UNIVERSAL
LIBRARY

OU_160643

UNIVERSAL
LIBRARY

Modern Technical Writing

Modern Technical Writing

THEODORE A. SHERMAN

Associate Professor of English
University of Idaho

ENGLEWOOD CLIFFS, N. J.
PRENTICE-HALL, INC.

Copyright 1955 by

PRENTICE-HALL, INC.

Englewood Cliffs, N. J.

All rights reserved. No part of this book may be reproduced in any form, by mimeograph or any other means, without permission in writing from the publishers.

First printing January, 1955
Second printing March, 1956

PRINTED IN THE UNITED STATES OF AMERICA

59878

Preface

In writing this book the author has tried to make the contents appropriate to a wide range of subjects so that any technical writer, regardless of his field of specialization, will find the help that he needs.

The book consists of three parts. The first deals with problems that arise in technical writing of every type. The second concentrates on reports. The third is a more extensive treatment of business correspondence than is customary in books on technical writing—a treatment that is desirable because letter writing is an important duty of most people in technical professions.

Thus the over-all plan is one in which the text proceeds from the general to the particular. Each part is written, however, in such a manner that a person who wants to study reports or letters first can do so without difficulty and can turn his attention to the earlier chapters whenever he desires. As a result of this treatment, the sections that concern technical writing in general are not buried in the discussion of reports, and the discussion of reports and letters is not interrupted by sections that apply to all technical writing, regardless of its form.

Because many writers have trouble with the fundamentals of English, an ample section on fundamentals is provided. It is added as a handbook, however, so that it will be more convenient for reference purposes and so that the regular chapters can be devoted to the special needs of technical writing rather than being burdened with material that concerns writing in general.

Exercises in the book are numerous and varied. These exercises cause the reader to encounter more problems than he is likely

to face in his writing assignments—problems that will probably confront him in the years that lie ahead. Also, these exercises make an excellent basis for group discussions. Writing assignments are suggested in sufficient number to permit a wide range of selection and to provide as much writing experience as time permits.

The specimens of various types of writing deal with many fields of subject matter. The specimen reports were kindly provided by industry, experiment stations, and government bureaus. Without exception, they are working-level reports—the kind that are written on the job. They are thus more useful than elaborate specimens for which the technical worker might have contributed information but which were put into their final form by a professional editorial staff.

The writer is greatly indebted to those who furnished these specimens and to many others without whose advice and cooperation the book could not have been written. The assistance of the following is gratefully acknowledged:

R. R. Raney, Garnet P. Phillips, and Edmund Lieberman of the International Harvester Company; E. J. Terhaar, F. M. Clinton, A. J. Davidson, and Wayne Criddle of the United States Bureau of Reclamation; H. A. Lott and George A. Davis of the Southern California Edison Company; William J. Long of the United States Steel Corporation; Jaque L. Hutchins of the Westinghouse Electric Corporation; The Caterpillar Tractor Company; William Chamberlin and H. E. Callahan of the General Electric Company; V. S. Casebolt and Rich Bakes of the Washington Water Power Company; T. R. Johnson of Purdue University; Dean Allen S. Janssen of the University of Idaho College of Engineering; Dr. L. C. Cady of the University of Idaho Research Council; and Professors J. W. Martin, C. O. Reiser, N. F. Hindle, C. C. Warnick, Joseph Newton, and Clayton Page of the University of Idaho.

T. A. S.

Contents

PART ONE: TECHNICAL WRITING IN GENERAL

1 INTRODUCTION 3

2 EFFECTIVE ORGANIZATION 9

The Process of Preparing an Outline 11

Checking an Outline for Errors . . . 12

General Suggestions 13

Avoidance of undesirable extremes: Classification: Parallel treatment of similar points: Sentence or topic outline: Logical allotment of space: Clearness in the outline

Final Check of an Outline 17

Exercises . 17

3 EFFECTIVE STYLE 21

Sentence Length 22

Avoidance of excessive length: Avoidance of primer style

Directness in Sentence Structure 24

Conciseness 24

Avoidance of repetition: Avoidance of trivial details: Avoidance of wordy phrases: Avoidance of needlessly complicated structure: Use of specific rather than general words: General looseness of style

Simplicity and Concreteness of Language 28

Avoidance of pompous language: Avoidance of needlessly technical vocabulary: Avoidance of hackneyed phraseology: Avoidance of vagueness

Exercises 30

4 MECHANICS 35

Manuscript Form 35

4 MECHANICS (*cont.*)

Technical Style 36
Use of figures or words for numbers: Numbers in ordinary style; Numbers in technical style: Use of abbreviations in technical style

Hyphenation 41

Documentation 42
Footnotes: Alphabetical list of references: Numerical list of references: Footnotes plus bibliography

Exercises and Assignments 50

5 SPECIAL PROBLEMS 55

Definitions 55
The sentence definition: The expanded definition: Point of view in a definition: General suggestions

Explanation of a Process 63
The introduction: The over-all picture: The explanation of successive steps: The conclusion

Technical Description . 69
Description of the object as a whole: Description of the functional parts: The conclusion: Adaptation to the reader and occasion: General suggestions

Summary or Abstract 76
Uses and importance of abstracts: How to write the abstract: The importance of accuracy: Specimen abstract

Technical Articles and Papers 78
Choice of subjects: Adapting the article to the periodical: Writing the article

Exercises and Assignments 83

6 TABLES AND FIGURES IN TECHNICAL WRITING 89

Tables 89

Figures 93
Bar charts: Graphs—curves: The pie diagram: Organization charts and flow sheets: Photographs: Diagrams and drawings

PART TWO: REPORTS

7 REPORTS—THEIR CONTENTS AND HOW THEY ARE WRITTEN . 111

General Discussion 111
Persons who may write reports: What reports are written about: The difference between professional and school reports

Procedure in Writing a Report 114
Analyzing the problem: Making a tentative plan for organizing the report: Gathering and analyzing the information: Sources of information; Analysis of information: Making the detailed outline: Planning the use of tables and figures: Writing the first draft: Revision into final form: Caring for final details

Qualities to Strive for in Reports . 127
Neatness: Interest: Omission of unnecessary material: Freedom from bias: Objectivity: Clearness and conciseness: Restraint: Impersonality and appropriate degree of formality: Self-sufficiency

Exercises . . . 134

8 NONFORMAL REPORTS—THEIR VARIATION IN FORM AND PURPOSE . 139

Reports Made by Filling in a Blank Form . . . 140
Reports in the Form of Letters 141
Reports in the Form of Memoranda 142
The Periodic Report 142
The Progress Report 143
The Laboratory Report 144
Reports That Fit into No Classification . . . 146
Examples of Nonformal Reports . . 147
Report made by filling in a form: Report in the form of a letter: Reports in the form of a memorandum: Periodic report: Periodic report of progress: Progress report: Laboratory reports

Exercises and Assignments . . . 180

9 FORMAL REPORTS 187

Definition and Uses 187

Component Parts 188
The title page: The letter of transmittal: The table of contents: The summary (or abstract): The introduction: The body of the report: Conclusions and recommendations: Visual materials—appendixes: The bibliography: Manuscript form and binding for formal reports: Manuscript form; Binding

Final Comment on Reports 210

Examples of Formal Reports . . 211
Bobbin fabrication: Lower cost canal lining

Assignments 254

PART THREE: BUSINESS CORRESPONDENCE

10 GENERAL PRINCIPLES OF BUSINESS CORRESPONDENCE 259

Correct Form in Business Letters 259
Identification of parts of the letter: Miscellaneous mechanical details: Stationery; Placement of the letter on the page; Spacing within the letter: System of indentation and punctuation: Form for individual parts of the letter: The heading; The inside address; The attention line; The subject line; The salutation; The complimentary close; The signature; Stenographic references—enclosures—postscripts; Additional pages: Abbreviation, capitalization, and figures: Abbreviation; Capitalization; Use of figures or words for numbers

The Substance of Letters . 273
Standards of appearance, correctness, and accuracy: Unity in business letters: Need of planning before writing: Arrangement of material in letters: Language in business letters: Paragraphs in business letters: Sentences in business letters: Tone: The "You Attitude": Good will in business letters: Beginnings of letters: Endings of letters: Summary on the substance of letters

Exercises 287

11 SPECIAL TYPES OF LETTER 293
Invitations 293
Letters Giving Instructions 296
Inquiries and Answers to Inquiries 298
Inquiries: Answers to inquiries
Complaints and Answers to Complaints 304
Complaints: Answers to complaints: Qualities common to all answers; Refusal to grant an adjustment; Letter granting an adjustment
Collection Letters 310
Letters Urging Action 314
Form Letters 318
Assignments 320

12 THE LETTER OF APPLICATION 327
Contents and Organization 327
The opening: The central section: Education; Experience; Personal information; References: The ending
Use of a Data Sheet 331
General Suggestions 332
Neatness: Analyzing the position applied for: The "You Attitude": Objectivity: Tone: Excessive use of "I": Discussion of salary expected: Making sure all questions are answered
Specimen Letters of Application 335
Assignment . 335

HANDBOOK OF FUNDAMENTALS

CORRECTNESS IN GRAMMAR 343
Case of nouns and pronouns: Agreement: Adjectives and adverbs
UNITY AND COHERENCE IN THE SENTENCE 354
Unity in the sentence: Fragment treated as a sentence; The comma splice: Coherence in the sentence
PUNCTUATION, CAPITALIZATION, ITALICS, AND ABBREVIATIONS 365
Punctuation: Capitalization: Italics: General rules for abbreviation

SPELLING 380
GLOSSARY OF USAGE 386
EXPLANATION OF GRAMMATICAL TERMS . 394

APPENDIX

A. S. A. ABBREVIATIONS FOR SCIENTIFIC AND ENGINEERING TERMS . . 405
HELPFUL PUBLICATIONS FOR TECHNICAL WRITERS 413
INDEX 417

I

TECHNICAL WRITING IN GENERAL

1

Introduction

In order to profit by a study of technical writing, it will be necessary, first of all, to develop a suitable attitude toward the subject. If you can bring yourself to accept the fact that skill in technical writing is a professional tool, ranking on a par with other skills and aptitudes necessary to a professional career—if you will study the subject with a real determination to profit by what it has to offer—you will have crossed the first and perhaps the hardest hurdle, and will have every reason to expect that the time you devote to the course will be time well spent.

No one who has been exposed to the comments of your future employers will question the value of writing ability in any of the technical professions. In an article entitled "How to Be an Employee," published in *Fortune*, Peter Drucker rates the ability to express ideas in words at the top of his list of requirements for success. The General Electric Company, in a pamphlet called *Why Study English?* states, "It pleases us to go on record as supporters of Mr. Drucker's statement," and refers to a meeting at which "representatives of all the major companies complained about the way their younger men were putting down their words —and their futures—on paper."

In the same vein, a government administrator comments in a personal letter, "Most writers do not realize the importance of doing a topnotch job." Also in a letter, an industrial executive remarks, "To rise to an executive position one must be able to present his ideas effectively, first on paper and then orally. If the

ideas are not well presented on paper, the chances are that he will never get a chance to present them orally."

A divisional head in a large rubber company comments, "In modern industry, an engineer must be able to sell his ideas and the project on which he works, just as a salesman does." Another executive writes, "Unless an engineering student can learn to write a good report, he might just as well reconcile himself to something a little better than a drafting job for the rest of his life."

Why do men in positions of authority consider skill in writing so important? The reason is clear to anyone familiar with the postgraduation demands made on a worker with technical training. In engineering, agriculture, forestry, bacteriology, mining, metallurgy, public health, or any other technical field, writing is necessary in connection with almost every stage of every important project. Before work is authorized or started, the possibilities of a project must be evaluated and stated and plans must be made in writing. When the project is under way, memoranda and letters must be exchanged as problems arise, and written reports must be made so that those in authority can learn how the work is progressing. When the project has been completed, the results must be recorded. Often, indeed, the only tangible result of a long and expensive project will be a written report; and if that report is botched up, the benefits of all the expenditure of time and energy may be jeopardized.

Since your writing will be important to your employers, it will also be important to you. Certainly it is one part of your work that is sure to reach the attention of your superiors—those who rank higher up as well as those immediately above you. If you write badly, not only will your weakness in writing be recorded against you, but your ability in other aspects of your work will be harder to perceive. On the other hand, if you write effectively, you will not only receive credit for being a good writer, but will also increase the likelihood that your proficiency in other lines will be recognized. Many a person first catches the attention of those upon whom promotion depends by means of well-written

reports; and unfortunately, many a person entering a technical profession finds progress more difficult because he had not realized, while a student, the need of learning to use the English language correctly and effectively.

Like other technical abilities, skill in technical writing is usually the result of conscientious effort. Unless you are lucky enough to possess unusual aptitude, you cannot expect to become an effective technical writer rapidly and easily. Only long experience and extensive practice will fully develop your potential as a writer.

Yet a course in technical writing, though only a beginning, can be a valuable start in the right direction if you try to profit by it as hard as you try to profit by your other courses. It can make you aware of the standards your future employers will expect you to meet. It can familiarize you with practical, tested writing procedures that you can use after graduation. It can give you a clearer picture of the manner in which writing fits into the total pattern of professional activity. It can reduce the likelihood that at the beginning of your professional work you will form undesirable habits which will harden until they become difficult to break. It can leave you a better writer than before; but even more important, it can lay a foundation for self-improvement in the future, so that your skill in technical writing, like your other professional skills, will steadily increase as your career continues.

So much for the reasons that technical writing is important Another question that may come to mind concerns the relationship of technical writing to writing in general.

Certainly the qualities cultivated in writing in general are important in technical writing also. As a technical writer, you will continue to work toward correctness in grammar, punctuation, and spelling; and whatever skill you have acquired in making your sentences and paragraphs effective will improve your technical writing. Sound organization, desirable in writing of any sort, is a matter of special concern; and the same might be said of clearness, simplicity, and directness of style. All in all, skill in technical writing is built upon the foundation of skill in writing

in general, and if your general writing is weak, your technical writing will not be effective until that weakness has been overcome.

Still, general writing ability does not in itself guarantee that your technical writing will be satisfactory. Technical writing is governed by a sense of values that other writing does not usually emphasize so strongly; it often calls for the use of special forms; and it requires familiarity with some special techniques that are not covered in general composition courses and are not needed by the average nontechnical writer.

Dealing as it so often does with the sciences, regular or applied, technical writing sets an unusually high value on objectivity, meticulous accuracy, and restraint. It is addressed to the reader's mind and makes little effort to appeal to his emotions. It is utilitarian in its purposes, and is usually intended for readers who already have, to some degree, a special interest in the subject matter. Consequently, though it places a high value on interest, it does not try so hard to be colorful and entertaining that it runs the risk of becoming flashy and superficial.

Among the characteristic forms in which technical writing appears are the bulletins and pamphlets issued by experiment stations and government bureaus, and the technical or semitechnical papers and articles read in meetings or published in technical periodicals. It is possible to produce many of these forms without studying them as separate types, but there is one form of technical writing—the report—which is particularly important and calls for special study. Though many technical writers may not be called upon to produce all the other forms listed, almost anyone who does any technical writing at all must write reports. Because of this fact and because reports vary so widely on different occasions, they are given special emphasis in this book.

As you work in any of the forms of technical writing mentioned, occasions when you will need to write a definition, explain a process, describe an object, or write an abstract will occur with

unusual frequency. Consequently, the problems that arise on each of these occasions will receive individual attention.

You will also find it necessary, in technical writing, to know how to use numbered lists, tables, and figures. You will need unusual familiarity with the conventions that govern abbreviations and the uses of figures or words for numbers, especially when the conventions of technical writing differ from those that govern writing in general. And further, since the soundness of technical writing must bear up under critical appraisal, you will need to master the process of documentation.

The treatment of technical writing in this book is divided into three parts. The first is devoted to matters that concern all technical writing, regardless of form. Because a piece of writing is planned before it is written, organization is chosen as the starting point. Next, suggestions are made about style. These are the first points covered because they deal with questions that arise oftener and earlier in the writing process than any other questions, except correctness in fundamentals, with which you will need to be concerned in technical writing. Thereafter the first part continues with chapters covering mechanical form, special problems, and the use of tables and figures.

The second part of the book is devoted solely to reports because, as has been pointed out, reports are written by everyone who engages in technical writing and because they pose so many special problems.

The third section of the text proper is devoted to business correspondence. Though letters may not always qualify as strictly technical writing, they assuredly comprise a substantial portion of the writing demanded of almost anyone in a technical profession, and therefore merit the attention they receive.

All in all, the material offered should provide the help you will need in order to develop a reasonable degree of skill as a technical writer—always assuming that you are not handicapped by weak general writing. (If you face such a handicap, the Handbook at the end of this book should be of assistance.) And as we

have seen, skill in technical writing is well worth acquiring because, if you do not possess it, you will find it harder to utilize any other technical proficiency you may have acquired. It would be an overstatement, perhaps, to say that success in a technical profession will be impossible if you cannot write effectively. It is no overstatement, however, to say that weakness in writing is a handicap that might well weaken your qualifications for many desirable positions, and that skill in writing is an asset which can make your professional advancement faster and easier.

2

Effective Organization

Roots, wood, bark and leaves singly perfect may be
But clapped hodge-podge together they don't make a tree.

James Russell Lowell was criticizing the poetry written by one of his contemporaries when he wrote these lines, but the quotation applies equally well to technical writing. It is not enough to state each of your facts and ideas so that it can be understood standing alone. If your technical writing is to be effective—if your facts and ideas are to function together to accomplish your purpose—your material must be well organized.

Unless a paper is extremely short and simple, good organization is likely to call for the preparation of an outline. Fundamentally, in making an outline you are merely planning your job of writing before doing it, as you would plan any other job, and setting down your plan in accordance with a simple set of conventions such as those illustrated in Figure 1.

To be sure, an outline may sometimes be used for other purposes than just as a plan for your own use. It might be submitted to the person who will eventually receive your completed paper so that he can decide whether you are on the right track; or it might be used as a source of topic headings in the completed paper. But an outline that is not an effective plan for use in writing is valueless for any other purpose, so the main emphasis in the present discussion will be on outlining as a method of organization.

If an outline is to function effectively, it should meet the following requirements:

It should cover the subject, as you have narrowed down your subject after carefully considering your purpose in writing.

Cutler Aluminum-Covered Buildings

I. Sizes available
   A. Available widths
   B. Available lengths
   C. Height for each width
      1. Height of side walls
      2. Height at center
II. Description
   A. The truss-free interiors
   B. The steel frame
   C. The walls and ends
      1. Structure of the corner sheets
      2. Structure of wall and end sheets
   D. Doors and windows available
   E. Structure of the roof
      1. The roofing sheets
      2. The ridge
      3. The roof ventilators
   F. Special adaptations possible
      1. Possibility of insulation
      2. Possibility of special fronts
         a. Masonry fronts
         b. Brick fronts
         c. Display windows
III. Suitability for varied uses
   A. Use for farm buildings
   B. Use for commercial purposes
      1. Use for display rooms
      2. Use for plant expansion
      3. Use for warehouses
      4. Miscellaneous uses
IV. The process of erection
   A. Time and equipment necessary for erection
   B. Laying the foundation
   C. Erecting the framework
   D. Assembling and erecting the ends and sides
   E. Possibility of subassembly

Figure 1. Specimen Outline Showing Correct Physical Form—This specimen illustrates a simple system of indentation and shows the proper symbols to precede four ranks of points. The spacing may be varied; either single spacing, double spacing, or a combination is possible.

It should be designed to accommodate the specific facts and ideas that you want to include in your paper.

It should give a sense of continuity—of organic unity—rather than being merely a collection of headings that are all related to the same subject.

It should lead to a paper that will perform its particular function as well as possible—which means that you must take into consideration not only the subject and the specific facts, but also the readers you are addressing and your purpose in addressing them.

THE PROCESS OF PREPARING AN OUTLINE

Knowing your aim is only the starting point when you prepare an outline. The next question is what procedure to follow in order to achieve the desired result. Before a procedure is suggested, however, one principle should be made clear: In order to make a satisfactory outline, you will first need to decide, in the main, what material you will use in the paper you are planning. If you disregard this principle, you will often find that your facts and ideas, when you gather them, will not fit into the organization you have decided upon. It is impossible to be sure of the best organization for your material until you know what that material is.

With this principle as a basis, the following procedure is suggested. It is equally appropriate whether you are planning to write an article, a report, or any other form of writing long enough to present problems of organization. It may not always make outlining easy, for there is no easy way to organize a complex mass of facts and ideas, but it is a systematic method that will reduce to a minimum the difficulty of producing good results.

1. Think about your subject and gather information about it if necessary. As you do so, jot down your facts and ideas in the form of rough notes. You may add or eliminate material later, but so far as possible your notes should cover the substance of your paper.

2. Study these notes and group together the material that belongs together. If necessary, postpone your final decision about doubtful points. Try to place all the material in no more than four or five main groups.

3. Taking into consideration both your subject as a whole

and your groups of material, decide upon the main points of your outline.

4. Holding in mind not only the logic of the subject but also the capacities and prejudices of your probable readers, arrange your main points in a suitable order.

5. Apply to the first main point the same treatment that you previously applied to the entire subject. Thus work out and arrange the highest rank of subpoints under your first main point.

6. Either apply the same treatment to the other main points or else continue working on the first main point until you have organized its contents as far as you deem necessary. At this stage, the speed with which your ideas mature on various portions of your subject will probably determine the order in which you bring various portions of your outline to completion.

The preceding method of outlining is intended as a general guide rather than as a rigid set of restrictions. There is no reason that you should not adapt your procedure to the way in which your ideas develop. Sometimes, for example, even before you jot down your rough notes, you will mentally form a tentative list of main points. Again, before you are sure of all your main points, you may form ideas on how to handle some of the material at lower levels. The actual focus of attention, however, should be directed first to the jotting down of notes which indicate the ground to be covered, and next to the formation of the full list of main points.

CHECKING AN OUTLINE FOR ERRORS

However carefully the first draft of an outline is made, errors in organization are likely to creep in. The first draft should therefore be checked over with the following points in mind:

1. There should never be a single main point. If there is, further examination will show that this single main point covers

the entire subject and hence is not a main *division* of the material, that some of the material placed under this main point does not belong there, or that the full subject has not been covered.

2. There should usually be no more than four or five main points. If an outline must be long, the increased length should result from the use of more subpoints rather than from an increase in the number of main points.

3. There should rarely be a single subpoint. That is, there should rarely be an A without a B or a 1 without a 2. The only justification of a single subpoint is the need of developing in a parallel manner two or more points that are closely related.

4. There should be no faulty subordination. That is, no subpoint should be placed under a main point where it does not belong.

5. There should be no faulty co-ordination. That is, no point should be shown as equal to another when it is logically subordinate.

6. There should be no overlapping among the main points or among subpoints of equal rank under the same main point.

GENERAL SUGGESTIONS

Avoidance of Undesirable Extremes

It is often necessary, in an outline, to balance between two extremes, either of which would be undesirable. It is undesirable, for example, to have too many different ranks of points. It is also undesirable to have a long string of subpoints of equal rank—perhaps eight or ten—under the same main point. Such a string of points might better be divided into two or three parts. Instead of naming ten advantages of some process in a single list, you might subdivide them into two or three different *kinds* of advantage, and name the specific advantages as points of a lower rank. Whether this would be an improvement, however, would depend on whether there were already so many ranks of points that it would be undesirable to add more.

Classification

The term *classification,* as used here, means the mere establishment of divisions. For example, an outline on erosion control in the United States might have four main points:

I. Erosion control in the East
II. Erosion control in the South
III. Erosion control in the Midwest
IV. Erosion control in the West

Each of these points might be subdivided thus:

A. Erosion control in the past
B. Erosion control in the present
C. Erosion control in the future

Some classification of this sort is often necessary and valuable, especially at the upper levels of organization. There is a real danger, however, that because it is so easy, classification will be carried too far. The outline that results is likely to contain many unnecessary headings but may fail, unless it becomes needlessly long and complicated, to include the headings that are really needed if an organization for the specific material of the paper is to be provided.

Parallel Treatment of Similar Points

Though the desire for parallelism should not lead you to jam any portion of your paper into an unsuitable organization, it is sound practice to organize similar points in a similar manner so far as the substance permits. Such a practice enables a reader to become familiar with the pattern and hence to read more efficiently.

When your outline as well as your finished paper is to be submitted to a reader, parallel wording as well as parallel organization becomes desirable. The main points should be phrased alike so far as possible, and the subpoints of equal rank falling under the same superior point should be phrased alike. This treatment is recommended not because arbitrary rules demand it but because it makes an outline easier to read.

The following examples show how an outline was improved by an application of the principle of parallelism:

Lack of Parallel Development

I. Building made of concrete blocks
   A. Original cost
   B. Upkeep and repair
   C. Suitability for use planned
      1. Sanitation
      2. Comfort of workers
   D. Durability

II. Building made of aluminum on a steel frame
   A. Sanitation
   B. Comfort of workers
   C. Financial considerations
      1. Original cost
      2. Upkeep and repair
      3. Durability

Parallel Development

I. Building made of concrete blocks
   A. Suitability for use planned
      1. Sanitation
      2. Comfort of workers
   B. Financial considerations
      1. Original cost
      2. Upkeep and repair
      3. Durability

II. Building made of aluminum on a steel frame
   A. Suitability for use planned
      1. Sanitation
      2. Comfort of workers
   B. Financial considerations
      1. Original cost
      2. Upkeep and repair
      3. Durability

Sentence or Topic Outline

In many discussions of outlining the distinction between the sentence and the topic outline is given considerable attention. Obviously, however, this distinction is unimportant unless an outline is to be scrutinized by someone other than the writer. Indeed, it is unlikely to be considered important anywhere at all except in the classroom. In many excellent outlines, some points are topics and others are sentences. Unless the points of an outline are to be used as topic headings, in which case they should all be topics, there is no reason for objecting to such a mixed form if the principle of parallelism, already discussed, is complied with.

Logical Allotment of Space

The space devoted to various points in an outline should be roughly proportionate to the space they will occupy in the paper to be written. Thus a reader can tell from the outline which points will comprise the bulk of the paper, and will not be misled as to what will be long and what will be short.

Clearness in the Outline

Unless you are to be the only person who will examine your outline, you should take special pains to make it clear. Each individual point should be impossible to misconstrue. In particular, every point should be phrased broadly enough to include the material it is intended to cover, but should not be so broad as to include more material than you intend to present. A heading such as *Internal combustion engines* would be unsuitable, for example, if only diesel engines were to be discussed.

Not only the individual points, but also the relationship among different points of an outline should be clear—especially the relationship between a main point and its subpoints. Suppose, for example, some point indicates the existence of a certain condition. There could be a question of whether its subpoints might be details, causes, results, or proof of that condition. An outline should leave no uncertainty about the answer to that question—

and the answer would not necessarily be the same for every subpoint.

FINAL CHECK OF AN OUTLINE

When you are approaching the completion of an outline, you can check your work by considering the following questions:

1. Does your outline have a desirable number of main points?
2. Do the main points, taken together, cover the subject? Do they really open the subject up? Will they lead to the most appropriate main divisions of material in view of the purpose of your paper and the readers you will be addressing?
3. Do the main points plus the points of lower rank provide for the inclusion of the detailed facts and ideas that you want to present?
4. So far as the substance permitted, have you used parallel organization where it might be expected?
5. Does your outline avoid mere classification when classification would serve no useful purpose?
6. If you have any single subpoints, can they be justified?
7. Have you avoided faulty subordination?
8. Have you avoided faulty co-ordination?
9. Have you avoided overlapping points?
10. Have you balanced properly between the desire to avoid long lists of equal points and the desire to avoid having points of too many ranks?
11. If your outline is to be examined by someone else, will it create an impression of clearness and continuity, and will it show with reasonable accuracy the relative amount of space that different points will occupy?

EXERCISES

EXERCISE 1

Following are fragments of outlines, each of which contains one or more weaknesses in organization. Point out in one or two sentences the weaknesses found in each example.

Since the specimens are only fragments, it may be assumed that in many instances the development was worked out more extensively in the original; but the portions that have been omitted would have no bearing on the weaknesses you are asked to identify.

(1)

A. Results of using 2,4–D
B. Percentage of weeds affected
   1. Part of weed most affected
   2. Percentage of weeds that recover
C. Advantages and disadvantages of using 2,4–D

(2)

A. Types of 2,4–D used
   1. Stage of growth at which applied
   2. Mixture of materials applied
   3. Rate and pressure of spraying
   4. Amount of 2,4–D applied
B. Precautions needed in using 2,4–D
   1. Protection of shrubbery
   2. Protection of flowers
   3. Limitations of 2,4–D

(3)

I. The possibility of reducing expenses
   A. Prevention of private use of company-owned cars
II. The possibility of increasing income
   A. Increasing sales in present territory
   B. Expansion into new territory

(4)

A. Requirements the adhesive must meet
   1. Types of adhesive
   2. Bonding methods

(5)

I. The Crane Canyon dam and reservoir
   A. Information about the damsite
      1. Suitability of the damsite
      2. Character of subsoil for a reservoir
      3. Cost of constructing the dam on this site
      4. Cost of preparing area for the reservoir

B. Information about water obtainable
   1. Minimum run-off available
   2. Probable loss from leakage and evaporation

II. The High Valley dam and reservoir
   A. Information about water obtainable
      1. Minimum run-off available
      2. Probable loss due to leakage and evaporation
   B. Suitability of site for dam and reservoir
   C. Costs
      1. Cost of constructing the dam on this site
      2. Cost of preparing area for the reservoir

(6)

I. Development of radio-frequency heating
   A. Methods of increasing heat of materials
   B. Use of high-frequency voltages
   C. Reasons for treating metals and nonmetals differently

(7)

II. General review of the industry during the year
   A. Unpredictable forces affecting the year's business
      1. The steel strike
   B. Domestic demand and production
      1. Demand
      2. Production
   C. Imports during the year
      1. The decline during the year
      2. Reasons for the decline

(8)

A. Results of developing the North Fork
   1. Immediate benefits
   2. Later benefits
   3. Flood protection
   4. Recreational benefits

B. Obstacles to development
   (*Subpoints omitted*)

(9)

I. Incandescent lighting
   A. Effectiveness of illumination
   B. Original cost
      1. Cost of materials
      2. Cost of installation

C. Operating expense
   1. Replacement of globes
   2. Cost of electricity

II. Fluorescent lighting
   A. Cost of materials
   B. Cost of installation
   C. Operating cost
      1. Replacement of fixtures
      2. Cost of electricity
   D. Effectiveness of illumination

(10)

This outline contained no main points except those shown. The subject of the paper was the gyrocompass.

I. The gyrocompass is a direction-finding instrument utilizing the principle of the gyroscope
   A. It requires a short time to stop oscillating
   B. It is so heavy there is only one on a ship

II. The gyrocompass often needs adjustment
   (*Subpoints omitted to save space*)

III. The gyrocompass is valuable in use
   (*Subpoints omitted to save space*)

EXERCISE 2

Make a brief outline (the total number of points to run from 12 to 20) on one or more of the following subjects. These outlines may be topic, sentence, or a combination, as directed by the instructor. They need not be "thought content" outlines unless the instructor requests that you make them so.

1. An outline for a description of a building with which you are familiar.
2. An outline for a comparison of two or more makes of automobile.
3. An outline for a discussion of the different careers open to one who graduates in the curriculum you are following.
4. An outline for a discussion of the requirements for success in the occupation in which you are expected to engage.

Other opportunities to apply the instructions about outlining will occur in connection with papers to be written later in the course.

3

Effective Style

When organization has been completed and actual writing begins, style becomes a major consideration. The complaints of those for whom technical students work after graduation show that improvement of style is an important objective. An effort to improve your style will carry you beyond the mere avoidance of errors in fundamentals. It will be an effort to make your writing not merely correct, but also effective.

Style is a subject to which many people have given little thought; but everyone has reacted to it, at least subconsciously, as a reader or listener. It involves among other things the difference between the folksy manner of a radio announcer and the grandiloquence of a politician; between the enthusiasm of a patent medicine advertisement and the restraint of an article in a medical journal; between the fervor of an attorney pleading his case and the analytical impersonality of a judge in his charge to the jury. In short, it concerns not what a writer says but how he says it.

In technical writing, to be sure, you will not often need to be concerned with the stylistic effects mentioned in the preceding paragraph. Rather, your style should mainly aim at clearness, directness, and conciseness. It should neither be so informal as to sound unprofessional, nor so excessively formal as to become stiff and pompous. It should lean toward restraint, for though a reasonable degree of enthusiasm is often an asset, an excess is likely to suggest bias. It should not aim at emotional intensity,

for the questions dealt with in technical writing are usually answered by the mind rather than the emotions.

In addition to these general considerations, there are several matters affecting style in technical writing that call for fuller discussion—sentence length, directness, conciseness, and the use of simple, concrete language.

SENTENCE LENGTH

Avoidance of Excessive Length

Though some long sentences are clear because their construction is simple, there are many cases when the use of shorter sentences could make some piece of writing clearer and easier to read. The following example shows how confusion was created by an effort to jam too much into a single sentence:

Cold work, proceeding by a complex process of slip, either alone or accompanied by twinning, within the grains or movement between the grains, always results in a distorted or disrupted crystalline structure, a marked increase in both hardness and strength, and a decrease in workability.

Note how clearness is improved by the use of two sentences:

Cold work always results in a distorted or disrupted crystalline structure, a marked increase in both hardness and strength, and a decrease in workability. This holds true whether the work proceeds only by the complex process of slip within and movement between the grains or whether the process of slip is accompanied by twinning.

Long sentences are not always so involved as the preceding example. Sometimes they are merely stringy. Stringy sentences may not be especially hard to read, but breaking them up will result in more satisfactory style. The following example was taken from a student's paper:

These figures for the pressure, temperature, and length of cooking time are not hard and fast, never-deviating figures, but are changed slightly from day to day, depending on reports from the testing room, where samplings of the corn are taken for testing to determine the best cooking procedures for the corn then being processed, because the grades change from field to field and the corn is not of the same consistency throughout the canning run. (One sentence, 76 words.)

To improve it may necessitate some rearrangement, but the effort of rearranging is justified. One improved version would run:

These figures for the pressure, temperature, and cooking time are not constant, for the grades of corn change from field to field and the consistency of the corn is not the same throughout the canning run. Consequently, samplings are taken to the testing room, where the best cooking procedures for each particular lot are determined. Thus it is possible to adjust the process of cooking so as to obtain the best results.

Avoidance of Primer Style

In the effort to avoid making your sentences too long you should not go to the other extreme and use "primer style," so-called for its resemblance to first grade readers. An excessive number of extremely short and simple sentences causes writing to become jerky and monotonous. Moreover, it does not necessarily result in clearness. Each sentence, it is true, may be clear; but the relationship of the ideas contained in the individual sentences is often hard to perceive. The primer style forces the reader to combine for himself the ideas that the writer should have combined for him. Also, it forces the repetition of words and thus destroys conciseness.

Note how, in reading the following examples, you are slowed up by being forced to come to a full stop too often.

Primer Style

1. These bacteria multiply rapidly. Their multiplication causes a pressure to be exerted against the sides of the can. The pressure builds up until it is at last extremely high. Finally it becomes so great that it bursts the can apart at the seam.

2. Various names have been proposed for the disease. Of these, "pole blight" has come to be accepted. This is because the disease is most destructive to pole-size trees. The only known suscept is western white pine. It is trees between the ages of 40 and 100 years that are attacked. These are the age classes that are already deficient when future cuttings are being planned on a sustained-yield basis.

More Mature Style

1. These bacteria multiply rapidly and thus cause, inside the can, a pressure that increases until it bursts the can apart at the seam.

2. Various names have been proposed for the disease, but "pole blight"

has become accepted because the disease is most destructive to pole-size trees. The only known suscept is the western white pine; and it is trees between the ages of 40 and 100 years that are attacked—the very age classes that are already deficient when future cuttings are planned on a sustained-yield basis.

To sum up the matter of sentence length and complexity: The best style is one that has variety. Some sentences should be short, some long, some medium. It is very easy, however, to fall into a habit of making all the sentences similar in length and type, and care is necessary to prevent such a pattern from forming.

DIRECTNESS IN SENTENCE STRUCTURE

Directness is highly valued in technical writing, not only for its own sake, but because it results in incidental benefits such as conciseness, clearness, and emphasis. No formula can be given for making writing direct; but if your style has ever been criticized as indirect, you may well ask yourself, whenever you find that you have written an involved sentence, "Just what is the message that I really want this sentence to convey?" Next, express the essential message with no preliminary frills and with no special effort to shade it gracefully into the surrounding material. Then and then only, provide the minimum of introductory or transitional material that is necessary for smoothness.

Note how the following sentences are made more direct.

INDIRECT: A recent article makes the statement that before 1950, Cuban reserves of manganese had been exploited almost to the point of depletion.

DIRECT: Before 1950, according to a recent article, Cuban reserves of manganese had been exploited almost to the point of depletion.

INDIRECT: Information was received by American importers to the effect that the exportation of manganese from Russia would be sharply curtailed.

DIRECT: American importers were informed that the exportation of manganese from Russia would be sharply curtailed.

CONCISENESS

One of the most important qualities in technical writing is conciseness. Though you may not always have time to go over

your work exhaustively in order to cut out words, you should know how to do so when time permits and the occasion justifies, and you should not overlook the desirability of writing concisely even when preparing a paper you will have little opportunity to revise.

You will need to exercise a certain amount of caution, however, as you revise for conciseness. Don't try so hard to cut out words that as a result you sacrifice clearness, proper application of emphasis, smoothness, naturalness, and precision.

If you are to write concisely, you will need to know the causes of wordiness. Among these are repetition of ideas, inclusion of trivial details, use of meaningless phrases and needlessly long connectives, needlessly complicated grammatical construction, and use of general words when specific words are available.

Avoidance of Repetition

Wordiness is often caused by unconscious repetition. *Spring of the year,* for example, is wordy when the meaning would be made clear by the single word *spring*. Similarly, *horizontal with the ground* and *neat-appearing to the eye* are repetitious because *horizonatal* means *parallel with the horizon* and nothing appears except to the eye.

Though the repetition in the preceding examples is poor style, there is no reason that all repetition must be frowned upon. Repetition, perhaps in different words, is sometimes justified for emphasis or clarification. However, it is an entirely different matter to repeat yourself for a purpose than to repeat yourself unconsciously.

Avoidance of Trivial Details

Inclusion of details that might be left to the imagination is another cause of wordiness. A sentence may tell us that the technician "picks up the flask and pours the mixture which it contains into the test tube." Unless the picking up of the flask is important, it would be sufficient to say that the technician "pours the mixture from the flask into the test tube," thus cutting 15

words down to 10. Again, a sentence may run, "The slides were put into an autoclave and sterilized." It would be sufficient if it said, "The slides were sterilized in an autoclave," for it is obvious that they could not be sterilized in an autoclave unless they were placed inside.

Avoidance of Wordy Phrases

The English language abounds in phrases that have little meaning but are occasionally necessary for smoothness. You should hold your use of such phrases to a minimum. Note how they can be eliminated in the following sentences.

Wordy Style

In *the case of* the copper veins, great enrichment was observed.
His failure resulted from *the fact that* he was inadequately prepared.
If there are developments *of a* favorable *nature,* work will be resumed.
The method *has proved itself to be* efficient.

Concise Style

In the copper veins, great enrichment was observed.
His failure resulted from inadequate preparation.
If there are favorable developments, work will be resumed.
The method has proved (or just *is*) efficient.

Also to be used sparingly are connective phrases that are identical in meaning with single words. Many a writer says *If developments are such that . . .* when just *if* would be sufficient. Other examples are *in the event that,* still another wordy way of saying *if,* and *due to the fact that,* often a wordy version of *because.*

Avoidance of Needlessly Complicated Structure

One of the most serious causes of wordiness is the use of needlessly complicated grammatical structure. In writing, as in anything else, the simplest construction that will produce the desired result is the best construction. This principle is illustrated in the examples below:

Wordy Style

1. He denied the charge in a vigorous manner.
2. Such a balance is an absolute necessity if any weighing that is exact is to be done.
3. The room had the following dimensions: It was 15 feet in length, 12 feet in width, and 9 feet in height.
4. The length of time the cans are cooked, the temperature at which they are cooked, and the pressure under which they are cooked are all controlled by electric clocks.

Concise Style

1. He denied the charge vigorously.
2. Such a balance is absolutely necesssary for exactness in weighing.
3. The room was 15 feet long, 12 feet wide, and 9 feet high.
4. When the cans of corn are cooked, the time, pressure, and temperature are all controlled by electric clocks.

Use of Specific Rather than General Words

Many times, writing becomes wordy because the writer uses a general word rather than one that is specific. He writes that two layers are *fastened together with glue* whereas he might write that they are *glued* together—eliminating the explanatory phrase by using a specific verb. Note also how in the following additional examples the use of a specific word permits the omission of explanatory material.

Wordy Style

The mixture *is heated* until it turns to a liquid.
The animal that has eaten this weed *walks* in a manner that indicates lack of co-ordination.

Concise Style

The mixture *is melted.*
The animal that has eaten this weed *staggers.*

General Looseness of Style

In addition to wordiness resulting from the causes mentioned, there are times when it results from mere looseness of style. Two specimens follow:

Wordy Style

The petroleum refineries far outdistanced their nearest competitors for the dubious honor of being the most unsafe industry for the life and limb of the worker.

The successful performance of some of the tasks requires the combined talents of a contortionist and a tight-rope walker.

Concise Style

Work in the petroleum refineries was far more dangerous than work in any other industry.

To perform some of the tasks requires great agility.

SIMPLICITY AND CONCRETENESS OF LANGUAGE

Simplicity as well as conciseness is essential to effectiveness in technical writing. Some writers are fortunate enough that it is natural for them to write simply and directly, but many others achieve simplicity only by conscious effort. Unfortunately, some of the worst offenders against simplicity are found among those who write with facility—those who can manipulate words so easily that they are unable to refrain from the temptation to do so.

Avoidance of Pompous Language

One of the main deviations from simplicity is the use of pompous, ostentatious language. This particular deviation is often the result of an effort to be impressive. However, it is generally agreed by authorities on style that the simplest language which will express an idea with precision and without violating the tone of the writing is the most desirable. It is better style to use *injures* or *damages* than *has a deleterious effect upon.* Similarly, *sticky* is better than *possessing adhesive properties,* and *The process of refining oil was changed* is better than *The process went through a metamorphosis.*

Avoidance of Needlessly Technical Vocabulary

Technical language has come into existence because it is sometimes needed for clear, effective communication. A single

technical word will frequently convey a message that otherwise would call for a long phrase or clause; and there are some subjects that it would be almost impossible to discuss without recourse to technical terminology. Yet though technical language may have its proper place in writing, it should not be used when it can be avoided. The purpose of writing is not just to get a message down on paper, but to get it into the mind of the reader. You cannot safely assume that everyone who reads technical writing possesses a technical vocabulary. Indeed, you must often assume the contrary. And even when you are writing solely for technically trained readers, it is best to avoid technical language when ordinary English will convey your message just as clearly, concisely, and accurately. It is poor style to use *impart thermal energy* to the substance when *heat* the substance would express the same idea. Needlessly technical language is more likely to characterize the work of a beginner who is afraid that simple language will not sound professional than the work of a veteran with skill in writing.

Avoidance of Hackneyed Phraseology

Still another necessity in the cultivation of effective style is the avoidance of trite, hackneyed phraseology. The terms to be avoided were originally fresh and imaginative; but they have been used so much that by now they numb the reader's mind rather than stimulate it, just as they now result from habit rather than from originality. Examples of trite phraseology are shown in the following list:

mother nature
last but not least
the dubious honor
veritable gold mine of information
at risk of life and limb
more honored in the breach than in the observance

Avoidance of Vagueness

Avoidance of vagueness, always a merit, is especially desirable in technical writing. Often, to be sure, vagueness is more than

just a matter of style. You may sometimes be tempted to write vaguely in a conscious or unconscious effort to conceal your lack of specific information. In this event it will be impossible to remedy your style until you obtain the missing facts. Yet it is also possible that you may often have sufficient information to be specific and merely neglect to use it. You may tell us, "*Small* samples are taken at frequent intervals," when you know the facts well enough to say "Samples *of 100 cc* are taken at *half-hour* intervals." Or you may write, "A *fairly large* piece of steel is placed in the machine" when it would be possible to write, "A *12-inch* piece of steel."

The word *quite*—as it appears in such phrases as *quite free from impurities, quite large,* or *quite a distance*—is a frequent sign of vagueness. Another phrase that is characteristic of vagueness is *a number of.* In technical writing it is better style to use "Five samples are taken," or "Ten samples are taken," or even "Five to ten samples are taken," than "A number of samples are taken." *A number of* could mean almost anything; consequently, it means almost nothing.

EXERCISES

EXERCISE 1

Each of the following sentences is excessively long, either because it is stringy or because it is involved. Break each sentence up as indicated. The order of material may be changed if necessary, and though your sentences should be concise, a slight increase in the total number of words may sometimes be unavoidable.

1. If a sufficiently thick layer of granular materials is applied, almost any soil can be satisfactorily used in a subgrade; but when the soil used for the subgrade is unsuitable in quality, the layers of granular material must be very thick, so anything that can be done to increase the bearing power of the soil foundation will allow a considerable reduction in the load-distributing layer and hence will greatly reduce the cost of road construction. (Break into three sentences.)

2. An answer to the question of whether soil can be compacted to such a degree that its future saturation will not greatly lower its bearing power is being sought in a study of the strength of soil samples compacted to

varying degrees of density and then allowed to absorb moisture. (Break into two sentences.)

3. None of the spark arresters originally available were entirely satisfactory, for those that had high efficiencies produced excessive back pressures that interfered with the efficiency of the engine, and on the other hand those that produced low back pressures were not efficient as spark arresters; but as a result of the work done to date, an arrester using a special tube has been designed and tested, and seems to have the advantage of being highly efficient and at the same time producing low back pressures. (Break into three sentences.)

4. To reduce the number of injuries every reasonable effort is made to guard all machines and equipment and to provide a safe, comfortable place to work; but guards on machinery can go only part of the way, and your alertness, your development of safe working habits, and your willingness to follow standard working procedures are a vital part of the safety program. (Break into three sentences.)

5. For young engineers entering the development departments the company provides a Communications Development Training Program which presents, during the normal work day, classroom instruction of graduate level in communications technology, accompanied initially by rotated work assignments, the purpose being to develop a well rounded background that can really be drawn upon in the solution of development problems. (Break into three sentences.)

EXERCISE 2

The following passages use primer style. Rewrite each, reducing the number of sentences as indicated. Minor changes in order may be made as necessitated by changes in sentence structure, but each revised version must be smooth, natural, and free from stringiness. The combining of sentences must be handled in such a manner that the division into sentences corresponds with the actual division of thoughts.

1. Forest fires destroy thousands of acres of timber annually. Most of these fires are started by careless motorists and campers. The motorist who carelessly flips a lighted cigaret or burning match from his car is responsible for starting many fires. These are usually discovered and quenched before much harm is done. The camper, on the other hand, often starts a fire in a remote region. This is a real menace. A fire started in remote regions may be discovered quickly. It takes a long time, however, to get men and equipment to the spot. This makes it probable that the fire will grow to be very large before it can be controlled. (Reduce to no more than four sentences.)

2. The water has a second serious defect. It forms a deposit in the water lines. In the mains, the deposit builds up at the rate of about one inch in twenty years. In the pipes, where the water flows slowly or in-

termittently, the rate of deposition is much greater. This is due to the fact that scale is actually flushed into the pipes from the mains. Clearing or replacing the pipes is a constant problem. One plumber must work at this job almost steadily. He is paid $2.50 per hour and works 40 hours a week. This means an expense of about $5,000 per year because of the hardness of the water. (Reduce to four or five sentences.)

3. It would be hard to estimate the cost of building a road network such as this. The plans would take long study and calculation. Likewise no exact figure for the new income could be given in advance. Such income would depend on the publicity given the project. It would also be dependent on the mineral wealth found. However, there would be a substantial net income as well as savings in resources. It seems likely that these would nearly offset the cost of constructing the roads. (Reduce to three sentences.)

EXERCISE 3

Rewrite the following examples so that they are stated concisely. Be sure, however, (1) that you do not eliminate any fact or idea unless it is too trivial to mention or is clearly implied by what remains, (2) that you do not alter meaning or emphasis, and (3) that you do not destroy smoothness and naturalness of style.

1. The exhibit that is located in the lobby is considered to be of unusual interest to anyone who is engaged in the study of the profession of engineering.

2. The new model is larger in size, lighter in weight, whiter in color, and more beautiful in appearance.

3. Their attitude was a result of the fact that they had not been given a full explanation of all the details of the plan.

4. The sides are then attached to the bottom by means of rivets.

5. In the event that prices rise higher within a period of three months, production will be resumed.

6. Each specimen is placed on the scales and weighed carefully.

7. It was said by the manager that the prospects are not such as to justify further expenditures.

8. When examined through a microscope, it was found to have four sides. All these sides were equal, and in each case the sides which were opposite to each other were parallel. Each angle amounted to 90 degrees.

9. After it had first pulled its own load through the mud with ease the cleated tractor was then brought back and fastened to the wheeled tractor's load. It pulled this load also to ground which was solid.

10. The device called the King tube is constructed in the form of a hollow cylinder so that when it is forced into the ground it cuts a core to the depth to which it is thrust. The tube is then removed from the ground, and the soil core sticks to the inside of it. The soil is then removed and placed in a container, in which it is taken to a laboratory.

In the laboratory, 100-gram portions are weighed out and put into milk bottles. Next, 100 cc of water is added to each bottle, and the bottles are placed in a shaking machine and shaken until a soil suspension is formed. After the soil is in suspension, the analyst removes the bottles from the machine and proceeds to add hydrochloric acid to each bottle, this acid being added in order to flocculate the suspended materials. (Cut to about 90 words.)

EXERCISE 4

Rewrite each of the following sentences, doing away with the needlessly technical or pompous expressions.

1. The vegetational aspects of the region were studied carefully.
2. The spray is applied by means of a manually operated pump.
3. There are many circumstances that will militate against successful operations.
4. The analyst increases the temperature of the mixture until it changes from a solid to a liquid.
5. As instructed, we will initiate activities in the wood-preservation project in March.
6. Among the experiments were several to determine whether spraying with DDT would have a deleterious effect upon wild life.
7. Better decolorization results may be obtained by refining the material before bleaching it.
8. One problem in using this method is the difficulty of preventing the hot water from passing into a gaseous condition instead of remaining a liquid.
9. A sound meter registers differences in volume of sound that are too small to perceive by auricular observation.
10. The acid is derived from the action of bacteria upon sugars and starches that remain in the mouth after the food has been ingested.

4

Mechanics

The present discussion of mechanics is limited to brief instructions on manuscript form, technical style, hyphenation, and documentation. Punctuation, capitalization, spelling, and other points that concern all writing are covered in the Handbook.

MANUSCRIPT FORM

Much of the time, technical writing does not demand any special manuscript form. In this event, the following instructions should prove sufficient.

1. Ordinary manuscript should be typed on one side of $8\frac{1}{2}$ by 11 inch white paper of good quality. Double spacing is usually preferable to single, though single spacing with double spacing between paragraphs is standard in letters and is often desirable in reports.

2. The margin at the top should be 2 to $2\frac{1}{2}$ inches on the first page and 1 inch on other pages. Other margins should be: left, 1 inch; right, $\frac{3}{4}$ of an inch or 1 inch; bottom, 1 inch. If a manuscript is to be bound at the side, the left margin should be increased by $\frac{1}{2}$ or $\frac{3}{4}$ of an inch. If it is to be bound at the top, the top margin should be increased to 2 inches.

3. The beginning of each paragraph should be indented five spaces.

4. Unless a separate title page is used, the title of a paper

should be placed on the first page, centered on the first line below the margin. It may consist entirely of capital letters or may be underlined and written "upper and lower case" (capital letters to begin each important word, small letters elsewhere). The title should be separated from the line that follows by a double or triple space.

5. If the name of an author accompanies the title, it should be centered a double space below the title and should be upper and lower case.

6. The page number is ordinarily placed in the upper right corner of each page except the first, from which it is omitted. If a paper is bound (not clipped) at the top, however, the page numbers should be at the center of the bottom margin.

7. Long quotations (75 words or more) should be single-spaced except for double spacing between paragraphs. Margins opposite such quotations should be increased by $\frac{1}{2}$ to $\frac{3}{4}$ of an inch on each side.

8. Ordinarily, manuscript should be fastened together by means of paper clips or not at all, and should not be folded. Occasionally, however, especially when it is placed in final, permanent form, it should be semipermanently fastened in a cover that opens at the side, or provided with backing paper and stapled together at the top.

9. Manuscript to be submitted for printing should never be fastened permanently. In such manuscript, figures should not be attached to the copy. Rather, the number of a figure should be written on its back and should be inserted in the manuscript at the point where the figure belongs.

TECHNICAL STYLE

In technical writing there is a strong tendency to deviate from what is customary elsewhere in two matters of form—the manner in which numbers are written and the use of abbreviations. The result of this deviation is usually referred to as technical style. In the present discussion, suggestions will be offered that should

make it easier to decide whether to use technical style on any particular occasion, and easier to use it correctly when you decide that its use would be appropriate.

Use of Figures or Words for Numbers

Numbers in ordinary style. Before the use of numbers in technical style can be explained, it is first necessary to recall the conventions that govern their use in ordinary writing. ***The basic rule in ordinary writing is:*** *If a number can be expressed in no more than two words, it should be written out. Otherwise, it should be expressed in figures.* (Examples: *four, seventeen, twenty-seven, one hundred, one thousand;* but *114, 1198, 14,456.*) There are many modifications to this rule, the most important of which follow:

Modifications

1. Figures are never used at the beginning of a sentence. A number in such a location must be written out, or else the sentence must be changed so that it does not open with a number.
2. All numbers in a series are written in the same form—preferably in figures if any number in the series is long enough to call for figures.
3. There are many special cases in which figures may or should be used regardless of the size of the number. These include degrees of latitude and longitude or of temperature, prices, scores, time of day, street numbers, dates, and tabular statistics.
4. For extremely large numbers, a mixed form is widely used, and is commendable because it is extremely easy to write correctly and to read accurately. (Examples: *50 billion, 125 million, 6.4 billion.*)

Numbers in technical style. Technical style differs from ordinary style in that numbers are not so likely to be written out as words. The main differences are as follows:

1. In technical style, 10 and all numbers above are expressed as figures. Any number below 10 is written out, however, except as mentioned below.
2. In technical style, a figure is used even for a number below 10 if the number precedes a unit of measurement. (Examples: *6 inches, 4 hours, 8 cubic yards;* but *six hoes, three stories, eight gusset plates,*

four arches.) This point becomes especially important when the unit of measurement is abbreviated.

3. In a passage where numbers are especially frequent, all numbers may be expressed as figures. (Example: *He used a crew of 3 carpenters, 1 plumber, 6 laborers, 1 foreman, and 1 timekeeper.*) This is particularly desirable when statistical information is being presented.

4. In a term that places one number immediately after another as part of the same phrase, one of the numbers is spelled out. (Examples: *7 six-inch timbers, two 7-man crews.*) It is preferable that the number to be spelled out shall be the one that in written form would be shortest; but if there are two such terms close together, the same form should be used for both.

5. Numbers that are merely approximations are often written out regardless of their size unless the result would be cumbersome. (Examples: *The company has enough timber to operate for twenty years. The building should stand for fifty years.*)

6. Sums of money are expressed in figures. (*$7.95, $5* or *5 dollars, $0.80* or perhaps *80 cents.*)

7. Technical style tends toward the use of decimals rather than ordinary fractions. In addition to other reasons, decimals are easier to write on a typewriter.

In a decimal fraction with a value less than one, a zero is placed before the decimal point (*0.719*). There are times, also, when it may be desirable to add a zero after the decimal point to show exactness (*6.840*).

8. Though technical writing tends to use decimal fractions, it should not use them to express information for which ordinary fractions are customary, nor should it use them when doing so would misrepresent the accuracy which had actually been achieved. For example, *2.375 inches* should not replace *2⅜ inches* when a measurement is not accurate to the thousandth of an inch.

The preceding rules do not contain the answer to every possible question, for if they did, they would be too long and complicated to be useful. Moreover, there are times when two rules may conflict with each other. Hence there are problems you will find it necessary to solve by using your own judgment. Most of the time, however, the rules that have been presented will make it possible to choose between figures and words with confidence that the form you decide upon will be acceptable.

Use of Abbreviations in Technical Style

As any reader may observe, abbreviations are used more frequently in technical writing than in writing in general—so frequently, in fact, that their use is clearly the result of a special set of conventions. If you are to decide intelligently, on any specific occasion, whether to follow these special conventions, you will need to know the underlying reason for their existence.

Abbreviations are justified not because they make the writer's work easier—though they may have that effect—but because they assist the reader. In technical writing, certain terms related to the field of discussion may be used over and over again. To write them out in full would waste time and space; but more important, it would make what is written harder to read. This is especially true when the terms in question are phrases rather than single words. It might sometimes be necessary, for example, to write *parts per million, feet per second, revolutions per minute,* or *board feet* eight or ten times in a single brief paragraph. Written out in full, these terms might occupy so much space that the remainder of the material would be overwhelmed. Yet each of these terms expresses only a single concept and would actually be clearer and more compact if expressed by a single symbol. Hence abbreviations that shorten such phrases to single symbols have come to be recognized and may be used when they serve a useful purpose.

If terms for which there are abbreviations do not appear often enough to be a problem, however, nothing is gained by abbreviating them. In fact, unless they come frequently, abbreviations are distracting and annoying; they look queer; they hinder rather than assist communication. Therefore it is advisable to refrain from using abbreviations called for by technical style unless terms that might be abbreviated are numerous.

When you decide, after considering the points mentioned, to abbreviate in accordance with technical style, you should use the following rules:

Rules for the Technical Style of Abbreviation

1. Unless it is extremely short, a term denoting a unit of measurement is abbreviated when it follows a figure. Examples of such terms are *inch, yard, pound, ounce, gallon, cubic yard, revolution per second, watt, board foot, horsepower.* Unless it follows a figure, however, none of these terms is abbreviated. One would write *63 ft, 2300 rpm, 435 ppm, 125 hp, 50 cc;* but "It is expressed in *horsepower,*" or "The measurement is converted into *cubic centimeters.*"

2. An abbreviation for a unit of measurement is aways shown as singular. You should use *lb,* not *lbs; bbl,* not *bbls, gal,* not *gals.*

3. A few extremely short terms denoting units of measurement are not abbreviated. Among these are day, mile, and acre. Since usage is not consistent, no exhaustive list can be given. Systematic personal observation is the only way to be sure about the customs in your own intended profession.

4. In many professions there are other terms, in addition to units of measurement, that are used with extreme frequency and consequently are abbreviated when it is reasonable to believe that the readers addressed will grasp the meaning instantly. Some examples are: *a-c* for *alternating-current* used as an adjective, *F.* and *C.* for *Fahrenheit* and *Centigrade, cp* for *chemically pure, el* for *elevation, emf* for *electromotive force.*

5. Even when you are using a technical style of abbreviation, there are many terms which you may abbreviate or not according to the dictates of your own judgment, provided you handle each term consistently.

6. The fact that technical style permits the use of abbreviations does not mean that it permits the use of arbitrary signs for words. You should write *8 in.,* not *8″; 12 by 15 ft,* not *12′ x 15′; per cent,* not *%.*

There are a few exceptions to this rule. It is correct to use the dollar sign, and in appropriate context the use of ¢ would be permissible. Degrees are another exception. Three forms are widely used to indicate degrees of temperature, as illustrated in *84° C, 84 C,* and *84 deg C.* (The same forms could be used for degrees Fahrenheit.) Degrees, minutes, and seconds of angles or degrees of latitude and longitude may be expressed by signs. It would be correct, for example, to write *21° 55′ 15″.* However, for the sake of convenience it seems desirable to avoid the sign for degrees because the other forms shown are easier to type.

7. Capitalization need not be affected by abbreviation. Abbreviations are not ordinarily capitalized unless the terms they stand for are capitalized.

8. In some professions, notably in engineering, it is customary to omit the period after many abbreviations. In deciding whether to use periods or omit them, you should follow the practice of books and magazines in your own field. Even in engineering, however, the period should be used if omitting it could cause confusion, as for example if it were omitted after the abbreviation for *inch*. Also, the period should always be used, even by engineers, after abbreviations that do not result from technical style but would be used in writing in general. (Examples: *a.m., p.m., c.o.d., B.C., Fig.,* and abbreviations used in footnotes and bibliographies, such as *ibid., op. cit., Vol., p.,* and *ff.*

9. One final rule about abbreviation will settle many questions: When in doubt, write the word out.

A general list of abbreviations may be found in *Webster's New Collegiate Dictionary*. A list of technical abbreviations sponsored by the American Standards Association is provided in the appendix of this book.

HYPHENATION

Terms that create problems of hyphenation occur with unusual frequency in writing that deals with technical subjects. Usage in hyphenation is far from uniform; and a full set of rules, such as the excellent rules in *Webster's New Collegiate Dictionary,* is necessarily long and complicated. Moreover, not even a knowledge of rules can prevent the frequent necessity of looking up an individual term. It should be possible, however, to solve a great many problems by using the following brief instructions:

1. A term that is formed by placing a prefix in front of a word is normally written as a solid. Such a term may be hyphenated, however, to permit internal capitalization (*pre-Cambrian*) or to clarify pronunciation or meaning (*reform, re-form; re-employ; re-anneal; intra-atomic*). *Self* is an exception to the general rule; when used as a prefix it is always set off by a hyphen (*self-sufficient*).

2. A compound adjective is usually hyphenated, at least when it precedes and directly modifies a noun (*time-consuming method, all-inclusive statement, 60-horsepower motor*). It is less likely to be

hyphenated if used as a predicate adjective. (*The job was half completed. The method was up to date.*) A chemical term is not ordinarily hyphenated even when used as a compound adjective.

3. Compound nouns are more likely to be written as separate words or as solids than to be hyphenated. A few special types that are hyphenated are exemplified by the following terms: *cave-in, motor-generator, weigher-in, I-beam, foot-pound.*

4. Compound verbs vary, but the type shown in the following sentences is hyphenated: *They double-tracked the railroad. They dry-cleaned the canvas.*

5. Usage in hyphenating compound adverbs varies widely, but a hyphen is always used in a compound adverb formed by adding *ly* to a hyphenated compound adjective (*half-heartedly, quick-wittedly*).

6. Regardless of other considerations, you should not use hyphens so that the result is unclear or illogical. (Undesirable: *mercuric chloride-activated compound, a 7 by 16-foot area.* Improved: *a compound activated by mercuric chloride, an area of 7 by 16 feet.*)

7. Many a question of hyphenation is best settled by a change in phraseology. Long, unwieldy compounds are poor style, and instead of trying to decide how to hyphenate them it is better to refrain from using them. (Undesirable: *internal-combustion-gasoline-engine cylinders, a piece of 1½-inch-inside-diameter pipe.* Better: *cylinders for internal-combustion gasoline engines, a piece of pipe with an inside diameter of 1½ inches.*)

8. It is important to remember that the same term may be hyphenated in one usage and not in another. (*The blast-furnace crew worked overtime,* but *A new blast furnace is under construction. The shutdown was unavoidable,* but *The plant is to be shut down. We plan to hard-surface the highway,* but *The highway has a hard surface.*)

DOCUMENTATION

As a technical writer you will often use information that you have obtained from printed sources. Consequently, you will need to acknowledge your indebtedness, partly as a matter of courtesy and honesty, and partly because you serve your readers' best interests by doing so. This acknowledgment of sources is referred to as documentation.

By acknowledging sources you may perform various functions: You may show the source of quotations or the authority for state-

ments that might arouse skepticism; you may indicate the extent of your study, and thus build confidence in your remarks; or you may show the reader where he can obtain additional information.

Four methods of documentation are common in technical writing: (1) The use of footnotes only; (2) the use of an alphabetical list of references (no footnotes and no citation of this list in the text); (3) the use of a numbered list of references, the entries in which are cited by number in the text; and (4) the use of footnotes plus a bibliography.

In choosing among these methods you should take into consideration both the function or functions you need to perform and the customs that prevail in your own particular field. The present discussion should assist you to select the system of documentation best suited to your needs on any specific occasion, and provide forms that you may follow in using any of the systems mentioned.

Footnotes

If you do not expect to cite sources very frequently and if your total indebtedness to references is not very great, footnotes alone will often be the most satisfactory system of documentation.

A footnote may be used for various purposes. Sometimes it is used merely to explain something in the text which will be clear to most readers but not to all; sometimes, to provide additional comments or facts that cannot be placed in the text without destroying continuity. These uses, however, are unrelated to documentation and may occur even in undocumented work. When you use a footnote for documentation, you should usually do so to perform one or more of the following functions: (1) identification of the source of a quotation; (2) acknowledgment of your indebtedness for certain facts or ideas; (3) citation of your authority for some statement of fact or opinion that you consider likely to arouse skepticism; and (4) indication of the source to which a reader may turn for additional information.

Footnotes should not be used unless they are needed. There is no reason to use a footnote in support of a statement which

your readers are unlikely to question or which they can easily verify without assistance.

Footnotes used for documentation should be numbered. Sometimes all the notes applying to each page are placed at the bottom of the page itself. In this event, some forms call for beginning with the number 1 for the first footnote on each page, and others call for use of a single sequence of numbers for all footnotes in a paper. Sometimes all footnotes applying to the entire paper are placed at the end; or perhaps all that apply to each section are placed at the end of that section. In this event a single sequence is used for numbering all the footnotes at any one location. Placing the footnotes on the pages to which they apply makes it easier for the reader to consult them. Placing them all in one location eases the work of the writer, and of the printer if manuscript is to be printed. Also, it permits the reader to see in one place all the references that have been cited.

The presence of each footnote is indicated by inserting its number in the text at the appropriate place. If the footnote identifies the source of a quotation, the number is placed at the end of the quotation. If the note applies to material that is not directly quoted, the number is placed at the end of the material which the note concerns. Some forms permit a writer to place this number in parentheses on line with the regular text, but more frequently the number is raised half a space above the line, thus: " . . . Using this system, it was possible to produce about 3,000,000 lumens of light."[2] As can be seen, the number identifying the footnote follows all other punctuation and is not preceded by a blank space.

Regardless of their location, footnotes are ordinarily separated from the text by a solid line beginning at the left margin and extending $1\frac{1}{2}$ inches (15 or 18 spaces) toward the center of the page. This line is a double space below the last line of text and a double space above the first footnote. A double space is left between two footnotes, but single spacing is used within the footnote itself.

The form of footnotes varies in minor respects, but most forms

are similar in general arrangement and contents. A footnote usually answers the following four questions, in the order indicated: (1) Who said it? (2) What was the title of the piece of writing in which he said it? (3) Where or by whom was this writing made available? (4) On what page or pages may the material cited be found? The following examples show footnotes citing various types of material. The form used is widely accepted. It is unlikely, however, that so many footnotes would be found on any single page; and if there were a bibliography, the footnotes referring to books would be cut down to merely the author, the title, and the page number.

Forms for Footnotes

1. Elmer B. Mode, *Elements of Statistics* (New York: Prentice-Hall, Inc., 1941), p. 50.
2. *Abbreviations for Use on Drawings,* Bulletin Z32.13-1946 (New York: American Standards Association, 1946), p. 12.
3. *Ibid.,* p. 14.
4. Fayette B. Shaw, "History of Commercial Banks," in *American Financial Institutions,* ed. Herbert V. Prochnow (New York: Prentice-Hall, Inc., 1951), pp. 10-12.
5. Mode, *op. cit.,* p. 43.
6. M. I. Mantell, "Subject Admission Requirements of Engineering Colleges," *The Journal of Engineering Education,* March 1953, pp. 405-406.
7. *The New York Times,* June 3, 1953, sec. 3, p. 6.
8. "Forests and Forestry," *Encyclopædia Britannica* (14th ed., 1949), Vol. IX, pp. 497-498.
9. D. V. Tom, *A Study of the Notch Sensitivity of Steels* (Master's thesis, University of Illinois, 1946), p. 14.

As mentioned earlier, the form of footnotes varies in detail. Different systems of punctuation are used. Some forms indicate the volume and issue of magazines, and some omit this information. Indentation is sometimes hanging rather than in paragraph form. Footnote numbers are sometimes raised half a space and set flush against the footnote rather than appearing as shown in the examples.

In many respects, however, usage is well established and should be complied with. When titles are presented, quotation

marks should be used for writings that are not separately printed (articles in magazines or in collective works), but the title of a book, magazine, or other independently printed reference should be underlined—the underline being the equivalent of italics in print. Since footnotes are not alphabetized, the name of an author is arranged in normal order and should be shown exactly as it appears in the original. A title, also, should appear exactly as in the original—at least when it is shown for the first time. After a reference has once been cited, however, it may be referred to by use of a shorter form. That is, a footnote referring to a book may be reduced to the name of the author, the title, and the page number; and the name of a periodical or organization, if long, may be sharply abbreviated.

A footnote need not repeat information already given in the text; so if an author's full name appears in the text, it may be omitted from the footnote. If only an author's last name appears in the text, however, the footnote should provide the full name. The question as to whether the name of an author or any other information belongs in the footnote or in the text is settled by applying the following principle: Whatever is actually part of the message belongs in the text; what is provided merely as documentation should be in the footnote.

Certain abbreviations are widely used in footnotes, the most common being *ibid.* and *op. cit.*, both of which occur among the preceding examples. *Ibid.* is the abbreviation for *ibidem,* Latin for "the same." *Op. cit.* is the abbreviation for *opere citato,* Latin for "work cited." The underlines for these and certain other abbreviations indicate that if printed, the letters would be italics because the terms are foreign. *Ibid.* without a page number indicates that a reference is exactly the same as that which immediately precedes. *Ibid.* followed by a page number indicates that the two references are the same except for the page. *Op. cit.*, which is preceded by the name of the author unless he was named in the text, is used when a reference has already been named but other references have intervened. Obviously, *op. cit.* cannot be used if more than one reference by the same author has

been named. In order to spare the reader the necessity of turning back to preceding pages, it is best to use *ibid.* and *op. cit.* only to refer to a reference on the same page.

Loc. cit. (Latin for *loco citato,* place cited) is sometimes used in much the same manner as *ibid.* but is less definite. *Passim* (Latin for here and there) is used to indicate that ideas have been gathered from various places in a reference, perhaps within a stated succession of pages. *Cf.* (Latin for *confer,* compare) is used just as *compare* might be used.

It seems desirable, however, in the interests of effective communication, to hold the use of a foreign language to a minimum; more and more technical writers are coming to the conviction that *ibid., op. cit.,* and *cf.* are the only Latin abbreviations that are really necessary.

Alphabetical List of References

Often, in technical writing, documentation is limited to an alphabetical list of references, headed either *References* or *Bibliography.* Such a list may include only the sources from which you drew specific information; it may be broadened to cover material that contributed to your general background; or it may even include references that would merely be helpful to a reader who wants additional information.

Obviously, a list of references not cited in the text conveys only a limited amount of information. It does not tell a reader where you obtained specific facts, but merely shows him whether you have examined a satisfactory number of authoritative, up-to-date references before writing. Still, the evidence that you consulted good authorities makes your statements more convincing; and the use of this system does not prevent your mentioning, in the text, the sources of specific facts when you think that such information is important. Whatever its limitations, the use of nothing more than a list of references is an extremely common method of documentation and therefore must be judged adequate to the needs of many occasions.

The form used for the individual entries in a bibliography or

list of references closely resembles the form used in footnotes. The main difference is that the last name of an author is placed first in order to facilitate alphabetical arrangement. When more than one title by the same author is listed, a solid line 1 or $1\frac{1}{2}$ inches long is often substituted for the author's name in the second and later entries. Titles are indicated as in footnotes: quotation marks for a title such as that of an article in a magazine or in a book, and an underline, the equivalent of italics, for the title of an independent publication. Two or more references by the same author are alphabetized on the basis of their titles.

Details may vary in different sets of instructions, but the following alphabetical list illustrates a form that is widely used and covers most types of entry.

REFERENCES

Brinton, Willard Cope, *Graphic Presentation.* New York: Brinton Associates, 1939.

Forbich, L. R., "Effect of Reagents on Heat Liberation Characteristics of Portland Cement." *Proceedings of the American Concrete Institute,* Vol. XXXVII, 1940.

Kinney, S. P., and E. W. Guernsey, *Occurrence, Distribution, and Significant Characteristics of Alkali Cyanides in the Iron Blast Furnace.* U.S. Bureau of Mines Technical Paper No. 390, 1926.

Ludwig, Norman C., "Effects of Sodium Chloride on Setting Properties of Oil Well Cements." *Oil and Gas Journal,* May 24, 1951.

———, *Retarded Cement and Method of Making.* U.S. Patent No. 2,429,211, 1949.

Nelson, R. T., Unpublished data from Geneva Works, Columbia-Geneva Division, United States Steel Corporation, Geneva, Utah.

Prochnow, Herbert V. (ed.), *American Financial Institutions.* New York: Prentice-Hall, Inc., 1951.

"River and River Engineering." *Encyclopædia Britannica,* 14th ed., Vol. XIX, 1949.

"Second Report on Refactory Metals." Iron and Steel Institute, Special Report No. 28, 1942.

Silcox, D. E., and R. B. Rule, "Cement for Oil Wells." *Oil Weekly,* July 29, 1935.

Numerical List of References

To make documentation more explicit without the use of footnotes, a numbered list of references is frequently used in place of

an alphabetical one. Thus a reference can be cited by inserting its number into the text. If this method of documentation is used, the list of references is limited to materials that are definitely cited, and the entries are arranged in the order in which they are first cited. The form of the individual entries is identical with the form used in an alphabetical list except that authors' names are usually arranged in the normal order. The following brief list should be a sufficient illustration of form.

REFERENCES

1. D. E. Silcox and R. B. Rule, "Cement for Oil Wells." *Oil Weekly*, July 28, 1935.
2. Norman C. Ludwig, "Effect of Sodium Chloride on Setting Properties of Oil Well Cements." *Oil and Gas Journal*, May 24, 1951.
3. Willard Brinton Cope, *Graphic Presentation*. New York: Brinton Associates, 1939.
4. Norman C. Ludwig, *Retarded Cement and Method of Making*. U.S. Patent No. 2,429,211, 1949.

To insert the number of a reference into the text of a paper, either of the following forms may be used:

The temperature loss rarely exceeded 2.9 deg. F. for 100 lb. of ore (7). This information . . .

Tests performed by L. V. Smith /2/ showed the form of the curves to be similar to the form previously reported for austenite steels.

A numbered list of references should not be confused with the use of footnotes at the end of a paper. When footnotes are used, each has a separate number even though it may refer to a reference that has been cited previously. When a numbered list of references is cited, however, each reference is listed only once, and the same number is used each time the reference is cited. Also, as can be seen in the examples, the page of the reference from which material has been drawn is not indicated when a numbered list of references is cited.

Like the alphabetical list of references, the list that is numbered and cited by number is used very widely, especially in writing that deals with agriculture. Thus it is apparently found satisfactory by a great many technical writers.

Footnotes Plus Bibliography

The most detailed system of documentation is that in which footnotes are supplemented by a bibliography. This system is used more frequently in scholarly work than in run-of-the-mill technical writing. It is suitable when references to sources are numerous and when a writer wishes not only to give the exact page number of every citation but also to show in one place all the references that he has consulted, regardless of whether he has cited them all specifically.

When footnotes are supplemented by a bibliography, their form is just as it would be if no bibliography were used except that a footnote referring to a book is cut down to the name of the author, the title, and, if necessary, the volume of the book, and the page number to which the citation refers. The form used for the bibliography is the same form that is used when there are no footnotes. Both footnote and bibliography forms have already been illustrated.

EXERCISES AND ASSIGNMENTS

EXERCISE 1

Following are sentences involving the use of numbers and abbreviations. Assume that they occur on occasions where technical style is desirable. Make the changes necessary for correctness in technical style. Do not make unnecessary corrections.

Note that although this exercise does not attempt to cover problems of hyphenation, some such problems inevitably present themselves as one considers usage in numbers and abbreviations. Make sure that hyphens are used correctly in your version even though none of the errors primarily concerns use of the hyphen.

1. The timbers were found to weigh 10.2 lbs per cu ft.
2. Wind stresses were computed for an 80-mile wind.
3. The inside posts were 12″ × 14″, and thus had ample strength.
4. The experiments were conducted on 22 40-acre tracts, distributed as shown in Figs. 4 and 5.
5. The furnace is large enough to provide .612 cu ft per sq ft of boiler surface.

6. The boat is equipped with a 10-hp motor.
7. A rapid change in strength occurs at 800 F.
8. The rate of movement of the bucket is 3-10 ft per sec.
9. The plant shown in the fig. was raised in soil containing 150 to 160 ppm of nitrate nitrogen.
10. Among the motors available are the following: one of 3 hp, one of 2 hp, and 3 of $1\frac{1}{2}$ hp.
11. A thickness of $\frac{3}{4}$ in will be adequate.
12. The attempt was made 4 times, but the excess still remained.
13. An increase of 21.5% in production immediately followed.
14. Roughly, the alloys weigh only about $\frac{1}{3}$ as much as an equal volume of steel or copper.
15. The highest loss of heat recorded was 11,905 btu.
16. The machine turns at a speed of 2500 RPM.
17. The mixture reached a temperature of 90 c.
18. The shop used a-c motors throughout, for the power supply consisted of alternating current.
19. The capacity of the plant in hp is 650.
20. It will be necessary to hire a crew of about 50 men.

EXERCISE 2

A. Most of the following sentences contain expressions that might lead a writer to feel that hyphenation was necessary or perhaps that the expression should be written as a single word. Rewrite, in correct form, each term that needs to be changed.

1. They used hit or miss methods.
2. They wore silk or rayon capes.
3. He was struck by a hit and run driver.
4. The water flowed through a 12 inch pipe.
5. He was employed in an explosives testing station.
6. The plane has a variable pitch propeller.
7. It is immersed in a sodium chloride mixture.
8. It had a broken water pump.
9. It needs an entire new water pump assembly.
10. We will make no load runs in the near future.
11. The power take off was often a cause of trouble.
12. It has a self regulating motor.
13. He studied ultra violet rays.
14. It is made of non conductive material.
15. He shows a co operative disposition.
16. He shows a non co operative disposition.
17. It is built of semi permanent material.
18. The carry over of wheat is larger than usual.
19. The water control structure must be rebuilt.
20. They used high frequency radio transmission.

21. They used very high frequency radio transmission.
22. They made very high grades in their studies.
23. They are using long handled shovels.
24. They are using long outmoded equipment.
25. It was a quickly absorbed poison.
26. We need to know the volume in ton miles.
27. The wet grinding equipment gave considerable trouble (*i.e.*, equipment for grinding wet material).
28. It is necessary to obtain a hollow spray nozzle (*i.e.*, a nozzle that makes the spray pattern hollow).
29. The canvas must be water proofed.
30. The nation will carry over more wheat than usual.

B. Improve each italicized expression in the following sentences either by inserting hyphens or by changing the construction.

1. A *steel quenching* tank was purchased (*i.e.*, steel is to be quenched in the tank).
2. It became rough at the *3.2 of a mile* point from the junction.
3. The highway department was testing out a *sodium chloride stabilized* road surface.
4. It can be done at any *plating and finishing of metals* shop.
5. The crew was laying a *hot plant mixed bituminous* surface.

EXERCISE 3

Following are ten statements presumed to be made in papers where the source of specific material is cited when citation is appropriate. Indicate the statements which in your opinion call for a citation.

1. Statistics show that the opportunity for advancement from the ranks of labor to a high position in large corporations is smaller now than before 1925.
2. The American Society for Quality Control recommends one year (9 quarter hours) of basic and applied, mathematically sound, statistical courses as the eventual goal for all engineers.
3. In 1953 approximately 50,000 bushels of weed seed will be present in the grain delivered to elevators in this region.
4. Thinning apples by spraying them while they are in bloom rather than by picking off the surplus apples later is a practice that for certain varieties increases the yield in alternate years by fifteen per cent.
5. The hardwood timber in the United States lies almost entirely in the eastern half of the nation.
6. Until 1948, no political convention had been televised on the spot except the Republican National Convention of 1940.
7. "The ascending spiral of labor and material costs has outdistanced the technological and operating economies in hydroelectric plants; and if the present high costs continue, the rates for power must also increase."

8. "Tires with neoprene tread and rubber carcass have . . . proved superior to tires made entirely of natural rubber."

9. The ultimate test will come when the students graduate and get into positions which test the ability that we have been attempting to develop.

10. A list of the corporations that have been participating in this program would read like "a Blue Book of the Industry." (In judging this item, consider only whether the fact that certain words *are quoted* calls for citation of source.)

EXERCISE 4.

A. Assume that you have written a paper which you are documenting by providing a numbered list of sources and citing them directly in the text, rather than by using footnotes. These sources are named in the list that follows, but the information is not placed in the proper form. Rewrite the list so that the form is correct.

1. A book named Hydrometallurgy of Base Metals, edited by George D. Van Arsdale and published in 1953 by McGraw-Hill Book Company, Inc. of New York.

2. An unsigned article entitled NBC Prepares for the Conventions published in the magazine Radio Age, in April, 1948.

3. An article entitled Catalytic Oxidation of Ascorbic Acid, by F. E. Huelin and I. M. Stephens, published in the magazine Nature in November, 1946.

4. An article entitled Reasons for Caution, by Edward Kaplan, published in Consumer's Research Bulletin in April 1948.

5. A book entitled Timber Products and Industries, by Nelson Courtlandt Brown, published by John Wiley and Sons, Inc., of New York in 1937.

6. An article by Arthur Roper entitled The Role of Agricultural Technology in Southern Social Change, published in the magazine Social Forces in October, 1946.

7. A book called Forest Products by Nelson Courtlandt Brown published by John Wiley and Sons, Inc., of New York in 1919.

8. A technical paper by J. V. Sturtevant entitled Percent Diversion Versus Measurement Limits, and identified as Technical Paper 117 of the United States Steel Corporation. It was written in 1952.

B. Assume that you have written a paper in which you do not cite the source of any specific material but which you wish to document by providing a list of references. Using the material provided for part A of this exercise, make a list of references (call it a bibliography if you prefer that term) suitably headed but not having numbers before the items and arranged as is suitable for an unnumbered list.

EXERCISE 5

Assume that you have written a paper which you are documenting only by means of footnotes. Assume also that you have occasion, on one page, to include in successive footnotes the material provided in the following list. (Actually, there would rarely be so many footnotes on one page.) Rewrite each item in the form that would be proper for a footnote.

1. The second edition of a book entitled Electrical Engineering published in 1953 by Prentice-Hall, Inc. of New York. The citation is to page 46. The book was written by K. V. Nelson.
2. An article entitled High Speed Photography by A. G. Hawkins and C. E. Balleisen published in a magazine called Machine Design in August, 1947. Reference is to page 119.
3. Another reference to exactly the same place as No. 2.
4. Another reference to exactly same source as No. 1, except that page is 113.
5. An unpublished address by N. W. Dougherty entitled Historical Background of Engineering Studies. The address was delivered at the annual meeting of the Southeastern Section of the American Society of Engineering Education in Baton Rouge, Louisiana on February 26, 1953.
6. A book entitled Theory of Games and Economic Behaviour and written by John Von Neumann and Oskar Morganstern. You found this book quoted in an article by Howard F. Emerson printed in the Journal of Engineering Education for April, 1953 and entitled A Mathematics Foundation for Industrial Engineers.
7. An article entitled Synthetic Rubber, published in March, 1942 in a magazine called the Journal of the Franklin Institute, written (the article) by E. R. Bridgewater. The citation is to page 77. The fact that Bridgewater was the author of the article is assumed in this instance to be mentioned in the text.

Note: Specific forms have not been given for the last three items. Make up forms that conform to the general principles governing arrangement of material in footnotes.

5

Special Problems

The special problems with which the present chapter deals are definitions, explanations of processes, technical descriptions, abstracts, and technical articles. None of these except the last is likely to be an independent, self-contained paper; yet each presents its own peculiar difficulties, and each is more likely to occur in technical writing than in writing in general.

DEFINITIONS

To understand the importance of definitions in technical material you need only recall the many occasions when an instructor or the author of some book you have studied has been forced to offer you one or more definitions before he could make any headway in discussing his subject. Like the instructor or author, you will often find, in your own technical writing, that you cannot avoid the use of some term the meaning of which must be clarified. Consequently, it will pay you to learn how to write a good sentence definition, and how to write an expanded definition when a sentence definition will not suffice.

The Sentence Definition

A definition that contains the bare minimum necessary to cover the meaning of a term is called a sentence definition. Usually it consists of a single sentence, but if a single sentence would be long, involved, and hard to read, two sentences are occasionally

used in spite of the name "sentence definition." Such a definition contains the term defined plus two other important parts—the genus and the differentia. The genus indicates a group or classification that includes the term in question, and the differentia discriminates between the term and whatever else the genus includes. These parts are seen in the definition of a microscope as "an optical instrument [genus] consisting of a lens or combination of lenses for making enlarged or magnified images of objects [differentia]."

The genus in a sentence definition must be chosen carefully. It must be accurate; and also, it should be as narrow as possible, so that there will be no need to overload the differentia with an excessive amount of information. (It was better, for example, to identify a microscope as an optical instrument than it would have been to identify it merely as an instrument.) The differentia should be adequate to discriminate clearly between the term defined and everything else that the genus might include.

A good sentence definition must be based on a clear understanding of the essential nature of the object for which the term stands. The definition of a pearl, for example, would need to emphasize the pearl's origin. Color, beauty, and value might also be mentioned; but unless the definition were based on the fact that a pearl is an abnormal growth within the shell of certain types of mollusk, it would be inadequate. Or again, the essential fact about the term *disease* is that it refers to the condition of whatever is affected rather than to the cause of that condition. A plant pathologist would consider it inaccurate to say, "This disease causes the plant to wilt." He would insist that the disease was the condition of the plant, not the cause of the condition.

The following sentence definitions may be studied as additional examples:

A forest region is an area, frequently covering portions of several states, within which the forests are the product of climatic differences whose controlling factors are the total annual amount of heat and the total annual rainfall.

Isothermal compression is the compression of a gas under such conditions that the heat generated by compression is removed as fast as it is

generated, so that the temperature of the gas does not change. The meaning may be seen in that *iso* is a combining form meaning *equal,* while *thermal* refers to heat.

The flash point of oil is the lowest temperature at which the mixture of oil vapor and air above the surface of the oil will flash up if ignited. The fire point is the lowest temperature at which the surface of the oil will catch fire and burn.

The Expanded Definition

Though a well-written sentence definition is logically complete. it often must be expanded if the reader is to realize all its implications, find answers to all the questions that may arise in his mind when he reads it, and see how it does or does not apply in specific cases. Sometimes it is expanded by means of additional definitions which make clear the meanings of the words in which it is expressed. Usually, however, it is expanded by one or more of the following methods: use of illustrative examples, comparison and contrast, listing of the component parts, and elimination.

Illustrative examples make a definition more concrete and sometimes, also, clarify its scope. For example, a definition of *parasite* might be expanded by mention of tape worms, sheep ticks, and other specific parasites each of which lives in or on some host from which it obtains food or shelter. The term *servomotor* might be made clearer by reference to the operation of a gyropilot or a gun-aiming apparatus. Illustrative examples are helpful in that they make a definition real. However, there is danger that the examples chosen will not be representative and hence will create a one-sided picture. For example, if all parasites listed were types that live inside the host, a reader might not long remember that the term *parasite* includes types that live outside, even though the sentence definition had been broad enough to include them.

Comparison or contrast is a useful method of expanding a sentence definition because it utilizes the knowledge that the reader already possesses. Also, it permits discrimination between the term defined and other terms with which that term might be confused. The full meaning and exact limitations of *contagious*

disease, for example, might not be realized until that term was compared with *infectious disease.*

A list of parts or divisions included by a term defined in a sentence definition will often help a reader to realize the full scope of the term. For example, a definition of *physics* might read, "Physics is the science that deals with those phenomena of matter involving no change of chemical composition." This is perhaps complete in itself, but it would be possible to help a reader by pointing out that under this definition physics includes the science of matter and motion, mechanics, heat, light, sound, electricity, and the branches of science devoted to radiation and atomic structure.

Defining a term by listing what the term includes should not be confused with analysis. When a term is analyzed, it is assumed that the reader knows what the *term* means but needs to be told what *its parts* are; but when parts are named for the sake of definition, the purpose of naming them is to enable the reader to see the meaning of the term itself.

Expanding a sentence definition by elimination is a process in which a writer clarifies our understanding of a term by pointing out what it might seem to include but does not. In defining *insanity,* for example, it might be necessary to mention that the condition called insanity does not include feeble-mindedness, imbecility, or any other condition consisting of mental deficiency as contrasted with mental derangement. Elimination can never by itself serve as a complete definition, for essentially, definition is a process of telling what someting is rather than what it is not. But by specifying some of the meanings that a term does not include, a definition makes it easier to see the limits beyond which the meaning of the term does not extend.

The foregoing methods of expanding a sentence definition may be used separately or in any combination. Any kind of material may be used, in fact, if it will help the reader to absorb and remember the sentence definition. The following example shows how a sentence definition has been made easier to grasp by being amplified.

The term cyclone, when used with precision, means a storm which may range from 50 to 900 miles in diameter and which is characterized by winds of 90 to 130 miles per hour that blow in a circle—counterclockwise in the northern hemisphere—around a calm center of low atmospheric pressure while the storm itself moves from 20 to 30 miles an hour. This definition of *cyclone* includes the terms *hurricane* and *typhoon* but not the term *tornado*. The term *hurricane* is properly applied to a cyclone of large extent and suggests the presence of rain, thunder, and lightning. The term *typhoon* is used to refer to a tropical cyclone in the regions of the Philippine Islands or the China Sea. A tornado, however, is not a cyclone. Though it consists of whirling winds, it is much smaller in diameter. It is characterized by a funnel-shaped cloud, the narrow bottom of which extends to or almost to the earth. Its winds reach a velocity that far exceeds the velocity of the winds in a cyclone. Though a tornado is often popularly referred to as a cyclone, it is a distinctly different phenomenon from what a meteorologist calls a cyclone, and results from different causes.

Point of View in a Definition

The meaning of many a term varies according to the context in which the term is used. When a lawyer uses the term *insanity* in the courtroom, he refers to legal insanity and intends to convey a meaning that is not usually in the mind of the average person who uses the term. If a psychologist were to define *normal human being,* his definition would differ from the one that would be offered by a physiologist or sociologist. Thus it is evident that the point of view from which a definition is written may affect its contents.

There is nothing objectionable about a definition written from a special point of view. It is important, however, that unless the context in which a definition is offered indicates the special point of view, the definition itself shall do so.

In technical writing, concerned as it is with specialized subject matter, the need of mentioning a special point of view occurs with unusual frequency. In particular, the difference between the scientific and the popular meaning of many terms should not be overlooked. A zoological definition of *insect,* for example, would include butterflies but not spiders; but to a layman the term would probably include spiders but not butterflies.

The popular meaning of words need not be treated with con-

descension. Ordinary people as well as scientists must use the English language. In technical work, however, precision is expected; so words that have exact scientific meanings should not be used or defined in a loose, casual manner. And when as a technical writer you address untrained readers, you should provide a scientific definition of any term that the reader might otherwise misunderstand.

The following specimen shows how a writer has recognized the obligation to define a term from a special point of view.

To a farmer, soil is the substance on the earth's surface that supports plant life, while to the geologist *soil* is an ambiguous term meaning the substance that supports life in addition to the material from which it was derived. To the engineer, however, the term has a broader meaning.

Earth or soil may be defined as *any unconsolidated material that can be excavated and handled with a pick and shovel.* Soils may include small boulders deposited by a glacier, the slick, greasy clays of the Mississippi Valley, beach sands, swamp slime, and even the tin cans, bed springs, cinders, and ashes of a typical city dump. Soils may be well-defined mixtures of a few specific minerals or heterogeneous mixtures of almost anything.[1]

Sometimes a point of view is so special that the definition which results is to some extent arbitrary. When government authorities, for example, establish grades of livestock and produce, each grade must be defined as exactly as possible. Though there may be a real difference between beef that is *prime* and beef which is merely *good,* the exact point where the distinction between the two grades is made is an arbitrary point. Similarly, to cite a long established example, the exact amount of alcohol a beverage may contain before it is legally considered intoxicating must be set arbitrarily.

Definitions that draw arbitrary lines are especially common in specifications that are written into contracts. Indeed, definitions are so important in specifications that a special section is often devoted to them. A typical example would be the definitions of *coarse aggregate* and *fine aggregate* that might be included in specifications in a contract that involved the pouring of concrete.

[1] George B. Sowers and George F. Sowers, *Introductory Soil Mechanics and Foundations* (New York: The Macmillan Company, 1951), p. 2.

Even an individual is sometimes justified in writing a definition that is to some extent arbitrary. If there is disagreement about the meaning of some term, a writer may define it arbitrarily —not with the intention of settling the general controversy but merely to let the reader know which of the possible meanings he has in mind when he uses the term.

The following definition, drawn from a set of specifications, is a good example of an arbitrary definition.

> Rock excavation includes all solid rock in place which cannot be removed until loosened by blasting, barring, or wedging, and all boulders or detached pieces of solid rock more than one-half cubic yard in volume. Solid rock under this class, as distinguished from soft or disintegrated rock under common excavation, which also requires blasting before removal, is defined as sound rock of such hardness and texture that it cannot be loosened or broken down by hand-drifting picks. No material, except boulders or detached pieces of solid rock, will be classified as rock excavation which is not actually loosened by blasting before removal, unless blasting is prohibited and barring, wedging, or similar methods are prescribed by written order of the contracting officer.

General Suggestions

Certain general suggestions may help you as you write your own definitions or as you check them over to be sure that they are satisfactory.

1. Make sure that a definition matches the term defined. That is, the definition of a noun must be expressed as a noun, that of a verb must be expressed as a verb, etc. Avoid such forms as "Cupellation is where gold or silver is refined . . ." Cupellation is not a place but a process and should be called a process.
2. Be sure that a definition includes everything that should be included. For example, if a bird were to be defined as a warm blooded animal that flies through the air, the definition would exclude the ostrich, which is a bird even though it does not fly.
3. Be sure that a definition excludes everything that should be excluded. The foregoing definition of *bird* did not exclude bats and hence was inadequate.
4. Do not ordinarily use, in a sentence definition, any word that comes from the same root as the term you are defining. (This rule will be modified in rule 5 that follows.) To define *fertility* as the

quality of being fertile does not increase the reader's knowledge one iota. (Though the dictionary may often seem to use a word deriving from the same root as the word defined, it does so only when it provides, near at hand, a definition that does not include the root word. The dictionary definition of *fertility,* for example, would closely follow a definition of *fertile* in which no word from the same root would have been used.)

5. In defining a term consisting of more than one word, concentrate your attention at the point where attention is needed. For example, in writing a definition of *soil physics* your main problem would probably be to show how soil physics differs from physics in general. You might assume that the reader would know the meaning of *physics,* and therefore might use that term in your definition. Obviously, however, if you felt unsafe in assuming that the reader would know the meaning of *physics,* you would define that term before attempting to define *soil physics.*

6. In writing a sentence definition, try to avoid language with which the reader is unlikely to be familiar. Recall, so as to avoid a similar offense, Dr. Samuel Johnson's famous and facetious definition of a *network* as "anything reticulated or decussated at equal distances with interstices between the intersections."

Note: In this connection, however, consider the definition of mumps as "a specific infectious febrile disorder characterized by a nonsuppurative inflammation of the parotid and sometimes other salivary glands." This definition would not increase a layman's knowledge of mumps. It would be better to tell him that mumps are "a contagious disease marked by inflammation and painful swelling of the salivary glands, especially the parotid, below and in front of the ear." To a doctor, however, the first definition would be satisfactory; and it must not be forgotten that a definition is sometimes written to pin down the meaning of a term more precisely than it can be pinned down with ordinary language.

Thus in writing a definition, as in writing anything else, you will need to consider the question, "Who will read this and why?" If a definition is written to enable a scientist to make a close discrimination in borderline cases, it may well be expressed in different language than would be used to give a layman a general understanding of the term.

7. In an expanded definition, be sure to point out how the term you are defining differs in meaning from any other term with which it might be confused. For example, if you were defining *toxin* you would probably need to discriminate between *toxin* and the more general term *poison,* and also, perhaps, between *toxin* and the more limited term *venom.* A sentence definition might take all the facts into consideration; but the expanded definition would be written so that all

the facts would not only be covered, but would actually reach the consciousness of the reader.

8. Do not forget that you can sometimes make a definition easier to grasp and remember if you mention the root or roots from which the term is derived. For example, *isobar* might be fixed in a reader's mind by a comment on the fact that it derives from *iso,* meaning equal, and *baros,* meaning weight and in this instance referring to the barometer.

EXPLANATION OF A PROCESS

You will often find it necessary in technical work to explain about some process. For example, you may have worked out some testing procedure and are expected to record it so that others can use it in the future. Or perhaps you will have observed a method used by some organization other than the one you work for, and will want to tell your own organization about it. Perhaps you will want to tell how you conducted an investigation so that your findings will be accepted as valid. Perhaps you will want to tell how some article is made or inspected so that a potential purchaser will have confidence in the product. In any of these and in numerous other circumstances, the ability to explain a process will be valuable.

As you can see from the uses mentioned, the explanation of a process is not a set of instructions. When you write instructions, you will presumably address the person who will perform the process, and your purpose will be to enable him to perform it properly. Possibly you will offer the instructions in the form of orders. The emphasis will be on the physical actions; and whether the reader really understands the process will be of importance only to the extent that such an understanding will make him more likely to follow directions.

The person who reads the explanation of a process, however, is likely to be an executive, a manager, or a supervisor rather than the worker who performs the process; and the explanation appears in a laboratory report, the report of a field visit, or perhaps a technical paper rather than in an instruction manual.

When you explain a process, you will usually find it desirable to follow a fairly well standardized pattern—a pattern that has become customary not because of arbitrary considerations but because it leads to explanations that are easy to understand. This pattern calls for an introduction; an over-all picture of the process, including a list of the main steps of which the process consists; an explanation of each of the steps listed; and a conclusion if a conclusion seems likely to be helpful.

The Introduction

Your introductions should be limited to information that the reader really needs; and it is unlikely that on any single occasion he will need information on all the points to be mentioned. This qualification should be held in mind as you read the following suggestions.

The introduction opens with a definition of the process and indicates why, where, when, and by whom the process is or was performed. It includes information on the materials, tools, and apparatus needed in performing the process; and if any important apparatus or materials are likely to be unfamiliar to the reader, it identifies them for his benefit. It tells, if necessary, whether the personnel who perform the process need special skills or training. Sometimes, too, it mentions special requirements about the time when the process must be performed, or special conditions that must exist, such as temperature, humidity, freedom from dust, or ventilation. And finally, it sometimes tells about preparations that must be made before the process is performed.

The Over-all Picture

The introduction is followed by any comment necessary about the process as a whole—for example, the theory on which it is based—and by a list of the main steps of which the process consists. An effort should be made to hold the main steps to five or six, for if they are too numerous it will be extremely hard for the reader to grasp and retain an over-all picture of the process. The main difference between the treatment of a long, complicated

process and a simple process is that the former is subdivided more extensively, rather than that it is organized into more main divisions.

The main divisions of the process should be named in chronological order so far as possible. They should be expressed in parallel form and may be numbered if numbering seems likely to be helpful, as it is sure to be if the number exceeds three.

When you divide a process into its separate steps, each of your steps should be based on the completion of some stage of the work rather than on some arbitrary principle such as place or time. It would be undesirable, for example, to say that a process consisted of two steps, work done in the field and work done in the laboratory, if some specific task were begun in the field and completed in the laboratory.

The Explanation of Successive Steps

After you have listed the main steps of a process, you should next take up these steps one by one and treat each of them somewhat as you treated the process as a whole. For each division, a definition is provided if needed, and the facts about time, conditions, apparatus, personnel, and preparations are made clear. Then, if necessary, the step is broken down into subdivisions.

When the process of dividing has gone far enough, attention is turned to what is really done when the process is performed. In telling what is done, you should emphasize the results that the acts performed are supposed to accomplish rather than the actions themselves. The effect of this emphasis may be seen by comparing the following examples:

> First, the form is filled with mix and then the mix is tamped with a half-inch rod 25 times, which leaves room for more mix. Again, and finally a third time, the process is repeated, the result being that all samples are compacted to the same degree.

> In order to compact all the samples to the same degree, each is tamped in the same manner. First, the form is filled with mix, and then the mix is tamped. . . .

The important fact, in the section from which these examples were drawn, was that the samples had to be uniformly compacted. The tamping was performed in a certain manner only because it produced that result. Yet in the first example, the result aimed at seemed added as an afterthought, and the reader was expected to follow through a series of actions the purpose of which had not been indicated. The difference between the two methods may seem small when observed in such brief specimens, but in a full paper it can mean the difference between clearness and confusion. An explanation of a process should not present long series of physical actions the purpose of which has not been made clear. Rather, as the reader reads about an action, he should know what that action is intended to accomplish; and when several successive actions are all performed in order to accomplish a single result, that result should be indicated at the beginning of the passage. Otherwise, the reader will soon be lost in a maze of details.

As your explanation progresses from step to step, you should keep the reader aware of his progress. When you take up a new step you should point out that you are doing so, using the phraseology and the numbers, if you used any, that you employed when you originally listed the steps. Special care is necessary when the steps do not follow one another in a regular, chronological order, as when two steps are performed at the same time by different people. By careful use of transitional material, however, you should be able to keep the reader oriented and constantly aware of the process as a whole and of where he stands at any moment as he reads about the process.

In the explanation of a process, as in any other writing, you will often find it important to decide how much detail is necessary. In this connection, there is no reason that all parts of a process must be covered in equal detail. Suppose that one step of a process consists of some test which the reader already understands or which is a recognized, standard procedure. It would probably be sufficient merely to say that this test is performed. Yet some other portion of the process might involve unusual

procedures that would call for detailed explanation. Thus, in regard to each portion of the process as well as in regard to the process as a whole, it is part of your job as writer to include the material that serves a purpose and to omit what can be omitted without loss.

The Conclusion

There are many occasions when the explanation of a process does not need a conclusion—especially when the process was performed on some specific occasion and is explained in a longer paper. However, when you feel that a conclusion is desirable, you need not hesitate to add one. Your conclusion might summarize the process, perhaps restating the main steps so that the reader's final impression will include the process as a whole rather than only one small part. It might evaluate the process or the results of the process. It might comment on why the process is important, or indicate how it fits into some larger process of which it is a part. But unless one or another of these types of material fits the occasion, your explanation should probably end with the final remarks about the last action performed.

The following explanation of a process is a typical specimen:

Fire assaying is a method that may be used to determine the amount of gold and silver in ore of any type. The following explanation, however, tells of its use when the ore is silicious.

The special equipment needed to perform this process includes a muffle furnace, cast iron "V" molds, an assortment of long-handled tongs, asbestos gloves, and a set of assay-ton weights. Supplies and reagents needed are fireclay crucibles, cupels, litharge (lead oxide), soda, borax glass, wheat flour, 6N. nitric acid, and distilled water.

The process is based on the fact that molten lead will dissolve gold and silver. It consists of four steps: (1) preparing and weighing the sample; (2) fusion—which consists of dissolving the gold and silver in the sample into molten lead and thus separating it from the remainder of the sample; (3) separation, that is, separating the gold and silver from the lead; and (4) weighing the gold and the silver.

In preparing the sample, the first step is to dry it and then grind it to a −100 mesh. Next, a sample consisting of one-half assay ton is weighed out on the gold balance. An assay ton is 29,166⅔ milligrams, which is the number of troy ounces in a short ton. By using this unit of weight, the

assayer simplifies his calculations, for the number of ounces of gold or silver in a half-ton of ore is the exact number of milligrams of gold or silver in his sample.

When the sample of one-half assay ton of ore has been weighed out, it is mixed in a 200-gram crucible with 2 grams of flour, 15 grams of soda, 60 grams of litharge, and 5 grams of borax glass. The flour must be weighed out but the other reagents may be measured with scoops that hold known weights of each reagent.

The next step, fusion, is accomplished by placing the crucible and its contents in the muffle furnace and subjecting them to a temperature of 1000 C for 15 to 20 minutes. During this period, the flour reduces the litharge to molten lead, which, as it settles to the bottom, dissolves the gold and silver in the sample. At the same time, the soda and borax glass react with the silica to form a slag with a melting point below 1000 C. When the fusion is completed, the crucible is removed from the furnace and its contents are poured into one of the "V" shaped molds, where the heavy lead, in which the gold and silver are dissolved, settles to the bottom and solidifies as a button.

It next becomes necessary to separate the gold and silver from the lead, which is done by a method called cupellation. A cupel—which is a bone ash cylinder 1½ inches high, 1½ inches in diameter and cupped on top—is placed in a furnace at 900 C and left there for half an hour so that it will reach furnace temperature. Then the assayer removes the cupel from the furnace, puts the lead button into the cupel, and places both in the furnace, leaving the door slightly ajar so that a draft of air passes over the lead. The oxygen in the air oxidizes the lead to litharge, part of which is absorbed by the cupel and the remainder of which is vaporized. The gold and silver do not oxidize but remain in the cupel in a sphere called a bead. The assayer knows when the lead has all been oxidized or absorbed because at that time the bead ceases to glow. Thereupon he removes the cupel with the bead from the furnace.

The final step, weighing, consists of weighing the bead, dissolving out the silver, and weighing the gold which remains. The weighing is performed in the ordinary manner. The silver is then removed by dissolving it in nitric acid, which does not affect the gold, and washing out the silver nitrate that results. The gold is then dried in a porcelain crucible over a Bunsen burner, and weighed when it cools. Since the sample was one-half assay ton, the number of ounces of gold per ton of ore is determined by multiplying the milligrams of gold by two. The weight of the silver is determined by subtracting the weight of gold from the original weight of the bead; and the amount of silver per ton in the ore is determined by multiplying the milligrams of silver by two.

One detail calls for further comment. Unless the amount of silver in the bead is at least twice the amount of gold, the two metals will not "part" when the bead is exposed to nitric acid. In this event, it is necessary to add silver so that the "parting" can be accomplished. This is done by

wrapping the bead in small pieces of lead containing a known quantity of silver. The bead, thus wrapped, is again cupeled as the lead button was cupeled. Thus the newly added lead is removed but the added silver, in known quantity, remains; and the increased silver content makes "parting" the gold and silver possible.

TECHNICAL DESCRIPTION

To understand how technical description differs from "literary" description, we need only imagine two descriptions of a room that has been ruined by fire. The literary description would enable us to imagine ourselves in the room—impressed by the fierceness of the fire that had wrought the damage, moved by the half-burned remains of personal belongings, startled to see the sky through a hole in the roof, conscious of the smell of wet, charred wood and the feeling of shattered plaster under foot. A technical description, however, would make no effort to create an imaginary experience nor to arouse our emotions. It would merely tell us, in an objective manner, the facts about the condition of floors, wall, ceiling, and contents—perhaps with the intention of enabling us to consider the need of repairs or to judge what might have been the cause of the fire.

A technical description is sometimes complete in itself, but it is more likely to appear as part of a longer paper. Such a description might deal with the damage done by an accident or a flood, or with the construction, facilities, and condition of a building. It might be written to help us to judge the possibilities of remodeling or to decide whether safe working conditions prevailed.

A technical description might also be written to tell us about some newly developed machine, some device that had been used in an investigation, or some piece of equipment the purchase of which was contemplated. The present discussion deals mainly with subjects of this latter type because such subjects will make the greatest demands on your skill as a writer.

The description of an object may concern the type of object in general or one particular example, but in either event, the basic method would be the same. Indeed, it is often best, in

describing some device in general, to base the description on a specific example.

The following technical description illustrates many of the points to be made in the remainder of the discussion:

The Sierra Portable Air Cooler

The Sierra portable air cooler, model Y, is a device for cooling and ventilating a room that does not exceed 2400 cubic feet in volume. It functions partly as an electric fan, but also draws air through a filter down which water is trickling, and cools the air by evaporating the water.

This air cooler is small and light enough to be portable. Its base is 17 inches square, though a grill on the front increases the total depth to 19 inches. Its height is 16 inches. At a point 13 inches from the bottom, each side turns toward the center, rising at a 45 degree angle, so that the total volume is reduced and the flat top is 9 inches wide and 17 inches deep instead of being equal in size to the bottom. Pressed aluminum has been used so far as possible in the construction, and thus the weight of the cooler has been held to 15 pounds. The cooler consists, in the main, of the pressed aluminum outer shell, the lower portion of which functions as a reservoir for the water; the motor and fan, which cause the circulation of air; and the water-evaporating system, which cools the air that is circulated.

The outer shell, as mentioned above, is 17 inches wide, 17 inches deep, and 16 inches high. It consists of the base and the shell itself. The base is made of heavier aluminum and serves as the reservoir. It consists of the square bottom and of sides that are 3 inches high. The upper section of the shell sets down into the base, and the two portions are riveted together. In this portion of the shell, the sides and top are an unbroken sheet of pressed aluminum. The back, however, is not covered by the shell, and the front contains an opening 12 inches in diameter into which is bolted a round meshed wire screen that protrudes 2 inches. This screen lets the air blown by the fan pass through but prevents the fan from being touched. An aluminum strip across the open back strengthens the structure, and a handle bolted to the top makes the cooler easy to carry.

The circulation of air is caused by the fan and motor. The fan, which is set close to the front opening, has three wide blades and is 12 inches in diameter. The motor is rated at 1/30 horsepower and operates on the ordinary 110-volt alternating-current lighting circuit. Its consumption of electricity is approximately that of a 75-watt light globe. Driven by this motor, the fan delivers 1140 cubic feet of air per minute. Both the motor and fan are supported by a sturdy cast-aluminum frame that is riveted to the base.

The water-evaporating system is the portion that cools the air. It consists mainly of a pump and of the evaporation screen. The pump is of

the impeller type and is driven by the same motor that drives the fan. It is set near the back of the reservoir. Water is carried from the reservoir to the evaporation screen by a ¼-inch rubber tube with aluminum connections at each end. The evaporation screen consists of a distributor —a V-shaped aluminum trough running from side to side near the top— and the screen itself, which consists of excelsior supported by light wire screen. It zigzags from the top to the bottom of the cooler, so that the surface down which the water trickles is larger than it would be otherwise. This evaporation screen almost entirely covers the back of the cooler, though it is set far enough forward to permit water to be poured into the reservoir at the back.

In action, the cooler functions as follows: The fan draws air in at the back of the cooler, through the excelsior grid screen and blows it out at the front. The pump delivers water to the top of the grid screen, where it trickles down to the reservoir for recirculation. Part of the water, however, evaporates in the air passing through, and thus cools the air. The cooled air is blown out the front of the cooler at the rate of 1140 cubic feet per minute and reduces the temperature in the room. Thus the air cooler can be used with good results on any occasion when the relative humidity is low enough to cause the water to evaporate.

Description of the Object as a Whole

Though most of the information in a technical description is likely to concern some single part of the object described, the opening section deals with the object as a whole. In this section, you should include any of the following materials that are needed: (1) a definition of the object to be described; (2) an explanation of the general manner in which it performs its functions; (3) a general description of the object—its size and shape, the material of which it is made if it is not made of too many materials, and possibly its color and finish; (4) a list of its major component parts, each being preferably a part which performs some particular function. Logic dictates that the first and fourth items in this list be the beginning and the ending items, but the order of the second and third might often be reversed.

Your definition of the object, if you decide that one is needed, will be sufficient if it merely explains what the reader might be doubtful about. For example, consider the definition, "A demagnetizer is a device for removing the magnetism from hardened tool-steel parts that have been held on a magnetic chuck

and thus have become permanently magnetized." The term *demagnetizer* has an obvious meaning, but the writer considered it necessary to indicate that a demagnetizer is used in a certain kind of work and for the purpose of demagnetizing a certain kind of object. His definition was adequate to the occasion, and performed a useful function. On the other hand, it would be pointless to write such a definition as, "An electric brake is a brake that is caused to function by electricity."

Sometimes the reader will know without being told what an object is used for, and sometimes the use of the object will be indicated in the definition. There are times, however, when the use of an object will not be apparent unless you make a point of stating it. Such might be the case, for example, if you were writing about a permeameter, a vane borer, or an autoclave. It will always be part of your job when you write a technical description to pass judgment on whether the use of an object needs to be told, and to include such information if you feel that the reader needs it.

The explanation in the opening section about how a device works may not need to be extensive, but if your reader is to understand a detailed description, he must not be left entirely in the dark about how the object performs its function. He would need to know that an autoclave sterilizes or cooks by means of superheated steam under pressure; that a centrifuge separates different materials by means of centrifugal force; or that the air brakes of a train function when the air pressure between different cars is lowered or released so that the compressed air stored below each car can enter the cylinders and apply the brakes. Even a minimum of such information can make all that follows far more intelligible.

When a person becomes familiar with some object by inspecting it personally, he notices the object in general before he notices the details. Consequently, it is desirable in a description to give the reader an over-all look at the object before presenting him with the information about its parts. That is, you should tell him early in the description about the shape and size of the object and

also, perhaps, about its finish, its color, and the material of which it consists.

Obviously, however, this information cannot be given about some objects because they are not sufficiently visible. For example, no one could effectively describe the appearance of the hydraulic-braking system of an automobile; and in this instance the appearance is unimportant anyway.

When a reader understands what an object is, what it is used for, how it functions, and perhaps what it looks like, he is ready for a list of its functional parts. This list should not be excessively long. Rather, it should consist of the main functional units, each of which may be broken down into *its* parts, if necessary, when the time comes to discuss it. For example, you might divide an electric washing machine of the nonautomatic type into the tub and gyrator, the wringer, the motor, and the frame. The smaller parts comprising each of these units would not be mentioned until later.

The items in a list of the main parts of an object may be numbered if numbering them seems likely to be helpful, and should be arranged in the order in which they are to be discussed. One possible arrangement would be the order in which the parts would be noticed by a person who was looking at the object. A second would be the order in which they perform their respective functions. This is usually the best order when the parts function in succession rather than simultaneously. A third possibility might be the order of decreasing importance, for it might be desirable to tell about the important portions of the object at once rather than delaying them while trivial matters are presented.

Description of the Functional Parts

When the main parts or divisions of an object are described, the treatment of each main part is somewhat the same as the treatment of the entire object. That is, it is defined if definition is needed. Its purpose and the general method by which it accomplishes this purpose are made clear. Its general characteristics

such as size, shape, and material are indicated. Its position in relation to the object as a whole and to the other main parts of the object is explained. And if it is complicated enough to merit such treatment, it is in turn broken down into its component parts, which are then discussed in the order in which they are listed. This continues until all the functional parts have been described in as much detail as seems necessary.

The Conclusion

Unless the object described is extremely simple, a brief conclusion will be desirable, so that the reader's final impression will not be limited to the last small detail. No single formula can be prescribed for the conclusion, but its general purpose will be to make the reader visualize the object as a whole, serving its purpose and functioning as it is intended to function. Often, if the object is one that performs some process, the best conclusion is to review one cycle of operation so that the reader can visualize the object in action.

Adaptation to the Reader and Occasion

The reader's knowledge and the demands of the occasion should affect both the contents and the language of a description. The fact that a description of some article is needed does not necessarily mean that all parts of the article must be described in equal detail. For example, electric motors are fairly well known and standardized, and if such a motor is part of a certain mechanism, it should be sufficient to tell the type, the power, and the kind of current it uses.

General Suggestions

1. A technical description, as we have seen, is intended to help the reader to understand an object as well as to picture its appearance. Thus it must include information about parts that may not be visible, and the emphasis is constantly directed to the manner in which the object functions.

2. In actual practice, a technical description is often accom-

panied by one or more figures. Instructions on the use of figures are given in Chapter 6, and it is possible that some assignments in the writing of descriptions may be postponed by the instructor until that chapter has been studied.

3. It is often possible to make a description clearer by comparing an object with something with which the reader is familiar. For example, by saying that an object had the approximate shape of an electric light globe with the socket end down, you might make shape and position clearer than you could ever make them by direct description. Comparison to the shape of letters is especially likely to be helpful as seen in the phrases *L-shaped, shaped like an H, somewhat resembling an inverted U,* or *having an S curve.*

4. In telling about size, try to avoid general words such as *large* and *small.* Their vagueness may be seen in the fact that a cupel, used in assaying, has been called a *small* cup; likewise a crucible, used in the steel industry, has been called a pot for melting a *small* amount of metal. Yet a cupel would hardly hold a teaspoonful of material, whereas a crucible might hold as much as 200 pounds of steel.

5. The positions of various parts of an object must be indicated with care unless the use of a figure makes the position of each part clear. Words such as *above, below, behind,* and *beside* must be used constantly. Information on position must include not only location but also information on such points as whether a cylinder is horizontal or vertical, or whether a hole in the center of a rod is parallel to the axis or across its diameter. Trivial facts should of course be omitted, but whatever is worth including should be expressed clearly.

6. The preceding discussion has dealt with objects that function actively. A technical description that deals with such a subject as the characteristics of a building or the condition of a piece of equipment is simpler but not essentially different. First it covers the subject in general and then breaks the subject into its main divisions, continuing this treatment until it provides all the information necessary.

SUMMARY OR ABSTRACT

A summary or abstract, as the terms are used in the present discussion, is a condensation of some longer piece of writing. Each term has other meanings also. The term *summary* is often used to identify a recapitulation, at the end of some piece of writing, which is actually part of the original. The term *abstract* is sometimes used to identify a statement, placed before some piece of writing but not part of it, which indicates the points to be covered but does not show what is said about any of those points. Nothing would be gained by a prolonged discussion of terminology. The point to be made clear is merely the meaning of *summary* or *abstract* in the present discussion—namely a condensed version of the actual contents of some other piece of writing.

Uses and Importance of Abstracts

As a technical writer you may have occasion to make abstracts (which term will be used throughout the discussion though *summary* would be equally appropriate) of your own writing or of writing done by others. For example, any report that is not extremely short will have an abstract; and except for the conclusions and recommendations, this abstract will probably be read more frequently than any other material the report contains. Indeed, some of those who see your reports may read nothing at all except the abstract, the conclusions, and the recommendations. Obviously, then, the ability to write a good abstract is one of the more important writing skills.

How to Write the Abstract

When you make an abstract of something you yourself have written, you will of course be dealing with familiar material; but when you write an abstract of some other person's material, your first step will be to become thoroughly familiar with the original.

You will need to master its organization and contents, and to discriminate between the main ideas and the supporting details or evidence. And as your mastery of the original increases, you should make notes that show which points you think it essential to include in your abstract.

Next, using your notes and also the original, you can write your rough draft. The notes will show which points must be included, and the original will supplement the information in the notes. The condensation is achieved by leaving out preliminaries, examples, details, illustrative incidents—everything except the main facts and ideas.

Your abstract should preserve the organization of the original. Also, so far as possible, you should preserve the approximate proportions of the full version so that you will give an accurate impression as to what points received most space. You may use the language of the full version without placing it in quotation marks, for you are not offering the abstract as original work. The point of view in your abstract should be that of the original. That is, your abstract seems to have been written by the person who wrote the original even if you are dealing with someone else's work, and seems to have been written at the same time that the original was written.

When your rough draft is completed you should polish it up until it reads as smoothly as possible without undue space being wasted on transitions. An abnormal effort should be made to avoid wordiness. Though it is hardly feasible to set absolute limits on length, an abstract should not often run more than ten or fifteen per cent of the length of the orginal.

The method suggested is not the method that might be used if the making of an abstract were approached too casually. Some writers try to produce an abstract by reading a paragraph and then condensing it, reading another and condensing it, and so on through the paper. It is hardly to be expected that such a procedure will produce good results. Unless you have written the full version yourself, you will find it extremely difficult to make a good abstract until you have your own notes to work from

The Importance of Accuracy

You will find it necessary, when you write an abstract, to take special pains in order to make your work accurate. Figures must be double-checked to avoid error. Facts and ideas must not be distorted in an effort to state them in fewer words. Great care is needed in the selection of facts for inclusion, for if its contents are unrepresentative, an abstract can be misleading even though it may contain no statement that was not in the original. In matters such as emphasis—in the implications as to what is important and what is less important—an abstract must give the same impression that the reader would receive if he read the full version.

Specimen Abstract

To see the relationship between a summary or abstract and full-length writing, you may compare the following abstract with the full version of the section you have just finished reading.

As used in this discussion, *summary* or *abstract* (which latter term will be settled upon for conciseness) means a condensation of some full-length piece of writing. Skill in writing abstracts is important because of the attention received by abstracts in reports.

Before you write an abstract you should be thoroughly familiar with the original and should prepare notes showing the points to be covered. Condensation is achieved by cutting out details and leaving only the main points that the details established.

An abstract should preserve the organization and proportions of the original. It may include direct quotation, and is written from the original point of view. It usually runs ten to fifteen per cent of the length of the original.

Clearness, conciseness, and accuracy are all-important. The abstract should be accurate not only as to specific facts, but also in the impression it creates as to what was emphasized in the original.

TECHNICAL ARTICLES AND PAPERS

Many students think of technical articles as a kind of writing done by someone else, and consider it unlikely that they themselves will have occasion to write articles. The chances that they

will do so, however—or at least the chances that a time will come when they might profit by doing so—are greater than it might appear. If we stop to think how many technical periodicals roll steadily from the presses, and if we remember that the contents in these periodicals are written by the students of a few years ago, we will realize that the students of today will be called upon to fill the columns of those same publications in the future. Writing for scientific and technical periodicals is definitely one of the methods by which a technical man can build a reputation among his colleagues and improve his chances for advancement.

The term *technical article* or *technical paper* is actually an oversimplification. An article may be technical in varying degrees. The essential distinction for the purposes of the present discussion is the difference between the article or the paper written by a man in a technical profession and the popular article, written by someone whose main occupation is writing and who makes no pretense of working in the field he writes about.

Choice of Subjects

The first essential in writing a technical or semitechnical article is to choose an appropriate subject. Although it would be a waste of time to classify subjects merely for the sake of classification, there is no better way to increase your resourcefulness than by becoming familiar with the types of subject that are actually being used in contemporary technical periodicals. Most articles belong to one of four types. These are: (1) the article that has a genuinely new subject; (2) the article which provides new information on a subject that has been written about before; (3) the article which concerns a subject made timely by some recent event; and (4) the article which has the purpose of establishing some special conviction on a question that may be either new or old.

Some articles of the first type are written to present information developed in research laboratories. Some give information about new processes or products that have been developed on the job rather than in the laboratory. Still others merely give

information about specific projects with which the writers have been associated, as for example the drilling of a new tunnel which created special difficulties, the opening of a new mineral deposit, or the outbreak of an unidentified tree or plant disease.

More numerous, however, are the articles of the second type—those that present new information on subjects which have been written about before. In every kind of technical activity, new information on old subjects is constantly being developed. Most of the new facts revealed in the numberless research laboratories all over the nation are related to subjects that have been familiar a long time. Each new problem that develops on a great construction job, and each ingenious method of solving such a specific problem can provide the basis for an article. New methods of performing old tasks and new developments on familiar processes or machines can be written about.

Extremely numerous, also, are the articles of the third type—those on subjects which may have been much written about but which are brought into the focus of attention by some new event. For example, in a year when tornadoes were especially frequent, many writers who understood these phenomena produced articles about them. Most of the information was not new, but a minimum of new ideas about an old subject was sufficient to motivate the articles when the subject of tornadoes was timely. Similarly, an outburst of articles is often produced by the enactment of new legislation in Washington, or by the announcement of an important decision by some regulatory board such as the Federal Communications Commission. Accordingly, when you are looking for a subject, you can do worse than scrutinize external developments affecting your area of interest. There is always a likelihood that one of them will revive interest in a subject that has recently been dormant.

The fourth type of article, that which aims at establishing some particular conviction, may concern either a new subject or an old one. It is obvious, however, that though the subject may be old, the conviction to be established must be either new or unusual. An article written to express an attitude that has been widely

expressed already, or to prove a point that no one will dispute, has no excuse for being written. If it expresses a new point of view, however, the article written to prove a conviction can be stimulating and valuable. Such an article is well worth writing, for every profession should unceasingly scrutinize the attitudes that it takes for granted if it hopes to keep pace with a changing world. The simplest method of thinking of such a subject is to ask yourself, "Do I agree with *every* attitude that is conventional in my profession? Do I have *any* ideas of my own?" Many a person has within himself the germ of an article if he would realize that it lies in the unorthodox remarks he makes in private conversations.

Adapting the Article to the Periodical

Even when, as a student, you write an article as a class assignment, you should proceed as if you intended to submit it for publication. Surely you will have publication in mind for any article you write after graduation; and accordingly, you should have in mind one or more periodicals for which your article might be suitable. Any experienced writer will tell you that it is futile to write an article first, and try to figure out later where to send it.

To adapt your article to a periodical you will need to examine the periodical thoroughly. Thus you can see what kind of readers you should address, and can make the length of your article, the style, and the language appropriate. The manner in which your article opens should be similar to that of others that the periodical has published; the same is true of the length of your paragraphs. To be sure, you cannot be expected to surrender your own sense of values—your own judgment as to what is accurate and important, but with this reservation you should follow the example of the free lance writer who "slants" his article to the periodical.

In this connection, it is best to forget about such magazines as *The Saturday Evening Post, Life*, and all others with immense and general circulation. These are not the outlets for which you would write in the practice of your profession. The authors who write for them are almost without exception professional writers

or big names. The writing you do in your profession, if aimed at publication, will be done for periodicals devoted to special interests and read by a special group of readers—or will perhaps consist of technical papers originally read at some meeting and then adapted for publication in the type of periodical mentioned. The present instructions are not intended to apply to writing for any publications except those that professional men read in an effort to keep abreast of developments in their professions.

Writing the Article

The actual process of writing an article is not essentially different from the process of writing in general. Consequently, no special instructions seem necessary except perhaps the reminder to apply what you have learned from the earlier chapters about organization, effectiveness of style, and all other points that have been covered.

It may be desirable to devise a title that will attract attention and an opening that will secure interest. Certainly you should try to secure interest by concreteness and vivid language. The article should contain few if any internal headings—at the most, no more than enough to indicate your main points. The headings that you see in many articles have been inserted by the editor mainly to break up formidable columns of type, and should not be confused with the complete, systematic topic headings that show the organization of a report or of a chapter in a book.

The question of illustrations calls for special consideration. The use of figures will be covered in more detail in Chapter 6, but it should be mentioned here that illustrations can be a fundamental part of a technical or semitechnical article. Accordingly, you should notice the extent to which illustrations are used in the articles printed in the periodical for which you are writing, and should bring your article into line with the periodical's customs.

If you utilize all these suggestions, and if you have a reasonable aptitude for writing, it is altogether possible that in later years you can produce articles that will be of value to your profession while at the same time you improve your professional

reputation, catch the attention of those whose good opinion is valuable, and thus further your own career.

Because it seems advisable that each student familiarize himself with articles in the magazines of his own field, no example of an article is presented.

EXERCISES AND ASSIGNMENTS

Exercises

EXERCISE 1

Indicate the genus under which you would place each of the following terms if you were defining it in a sentence definition. Take care to make your decision accurate.

calculus
welding
tomato
nylon
horsepower
photosynthesis

EXERCISE 2

It is often necessary, in a definition, to discriminate with special care between the term to be defined and one or more other terms. If you were defining the following terms, what other terms would call for this special discrimination? (Answer for 5.)

hail
fog
fruit
moth
oboe
sand
sleep (as a noun)
mass (as used in physics)
helicopter
chair

EXERCISE 3

Indicate the fault or faults you find in each of the following sentence definitions:

1. A bee is a flying insect which stings.
2. A bridge is a structure supported by piers or hanging from cables and built so as to make it possible to cross a river.
3. An outboard motor is an internal combustion engine used to propel a boat.
4. A lock is a device operated by a key or combination and used to prevent a door from being opened.
5. Welding is when metallic bodies are caused to unite by heating the

surfaces and allowing the metals to flow together, or by hammering or compressing the bodies.

6. Glue is a substance with which materials are glued together.

7. Water is an element each molecule of which is composed of two hydrogen atoms and one oxygen atom.

8. Hail is a form of snow consisting of small, roundish lumps of ice.

Note: A single definition need not include all the possible meanings of a term, but need only express one meaning satisfactorily. For example, a definition of *lock* would not need to include the term as in *lock of hair* or as in the *locks in a canal.* The definitions above, however, are faulty in that they do not express satisfactorily the single meanings they were intended to express, rather than in failing to express every meaning with which the term might be used.

EXERCISE 4

Write sentence definitions of five terms from the following list: Each definition need cover only one meaning of the term and may if necessary be from a special point of view.

plastic	battery	fertility
coal	triangulation	land economics
glass	transit	smelter
chlorophyll	alloy	soil mechanics
mineral	silviculture	refrigeration cycle
thermodynamics	dendrology	electrolysis
fault (geological)	cruise (as in cruising timber)	boiler efficiency
astigmatism	evolution	etching
diesel engine	immunity	friction
four-stroke cycle	allergy	
volt		

EXERCISE 5

The following explanation of a process is in many ways poorly written. As directed by the instructor, point out its faults or rewrite it.

Nitrate Nitrogen Determination

Nitrate nitrogen is a very important plant nutrient which is often the limiting factor in the growth of plants. For this reason it is often advisable to determine the quantity in the soil, so that if there is a deficiency, the amount needed can be added before a crop is planted.

The method used in nitrate nitrogen determination is comparatively simple, but a number of steps are involved in the process. Several 100-gram samples are taken at different points in the field to a depth of three feet by means of a device known as a king tube. This device is essentially a hollow cylinder which is thrust into the ground to cut a core of soil.

This core sticks to the inside of the tube when the tube is pulled up, and is taken to the laboratory for testing.

In the laboratory, 100 gram portions are weighed out and put into one quart milk bottles. To each sample, 100 cc of water is added, a stopper is put on each bottle, and the bottles are put in a shaking machine and shaken until a soil suspension is formed. Each bottle is then treated as follows: First, hydrochloric acid is added, which floculates the solution so that the soil particles settle to the bottom, leaving a clear liquid above. Twenty-five cc of this liquid is pipetted out, put into a beaker, and evaporated, leaving nitrate crystals in the bottom of the beaker. These crystals are dissolved with phenol-disulphonic acid, after which 50 cc of water is added to make the solution more dilute. Then, to neutralize the acid content of the solution, potassium hydroxide is added. The solution turns yellow as this is done, and the potassium hydroxide is added until the yellowness ceases to increase. Since the intensity of the yellow depends on the amount of nitrates in the solution, this characteristic is used in making the final determination.

The intensity of the yellow color is measured by use of a colorimeter, an instrument that permits matching the color of the unknown solution with that of solutions of known concentration. When by regulating the colorimeter the unknown solution is matched with a known solution, the amount of nitrate nitrogen in parts per million can be read from the calibration of the colorimeter.

After the nitrate nitrogen in all samples has been determined, the results are averaged; and if the average is smaller than desirable, a fertilizer that contains nitrogen can be added to the land from which the samples were taken.

Assignments

ASSIGNMENT 1

Write one or more expanded definitions of terms listed in Exercise 4, or of other terms if permitted by the instructor. Each definition should run from 200 to 500 words.

ASSIGNMENT 2

Write an explanation of one of the following processes, or of some other relatively simple process with which you are familiar. If you use a subject not on the list, make sure it is a process performed mainly by human actions rather than a natural process or one performed mainly by machinery that functions more or less automatically. The length of the explanation should run from 400 to 800 words.

The slump test for concrete
Laying out a field for contour cultivation
Solving one of the various transit problems used in surveying courses
Making some type of stake-out, as for a pipe line or a highway
Sieve analysis of aggregate for concrete
Some type of welding process
Brazing
Checking some type of equipment to determine cause of failure
Preparing a slide for a microscope
Thermal analysis of a metal or alloy
Producing a casting by pattern molding, using sand mold

ASSIGNMENT 3

Write a technical description of one of the following objects, or of some other relatively simple object with which you are familiar. Write from 400 to 800 words, adjusting the degree of detail so that your paper is a suitable length. Do not attempt to describe a complicated object. (It may be decided by the instructor to postpone this assignment until after the next chapter has been studied so that an illustration may be used in connection with the description.)

a bunsen burner
some welding tool
an oil stove or furnace
an electric toaster
an electric dishwasher
some specific type of circuit breaker
some type of musical instrument
a hydrometer
a thermocouple
a pitot tube
a device for spraying on paint
an auto pump
a fluorescent light tube
a jack hammer
an automobile battery
a flashlight
a cream separator
a hydraulic ram
some simple type of pump
some simple type of vise

ASSIGNMENT 4

Write an abstract of the following selection.

Metallurgy may be defined as the art and science of extracting metals from their ores and other metal-bearing products and adapting these metals for human utilization. The metal industry has grown to such proportions that it is the second largest enterprise in the world, being exceeded in importance only by agriculture. About five thousand separate metals and alloys are in commercial use at the present time, and new alloys are being developed constantly. The field of metallurgy has divided into a number of specialized branches, each of which has developed its own voluminous literature.

The importance of metals and metallurgy to modern civilization is self-evident. Without our metal products, we should still be living in the stone

age with caves and skin tents for dwelling places, crude wooden implements for tilling the soil, and stone hammers and axes for tools. Our modern civilization with its skyscrapers, automobiles, airplanes, refrigerators, radio sets, and ten thousand other devices with which we come in daily contact, would be impossible without the use of metals.

The metal industry was originally fairly simple. Undoubtedly the first metals to be used by man were those which he found in the native or metallic state, such as gold nuggets in stream gravels, native copper, or meteoric iron. The first smelting, or extraction of metal from a chemical compound, probably took place by accident rather than by design; some prehistoric man built a fire upon a metal-bearing outcrop and found a lump of metal in the ashes. Such experiences soon led to the construction of crude furnaces for smelting, and the art of metallurgy was born.

At first there was little distinction made between metals, but gradually man came to the realization that there were different kinds of metals—that copper, for example, was not a form of gold, nor lead a form of silver. Later he began to appreciate the fact that it was possible to have alloys of two or more metals and that these alloys had properties which differed from those of the pure metals. Until the fundamentals of chemistry had been discovered, metallurgy was purely an art; but, after it became possible to study the composition of metals and alloys and the chemical processes involved in extracting metals, the science of metallurgy began to take form. Today we speak of metallurgy as an art and a science, because, in spite of the great strides which have been taken by the physical sciences, metallurgy still contains some unexplained phenomena, still makes use of some rule-of-thumb methods, and still finds it necessary to employ artisans to do work which cannot be learned from scientific textbooks.[1]

ASSIGNMENT 5

Make an outline for a semitechnical or technical article. After the outline has been approved by the instructor, write the article. When you hand the outline and article to the instructor, you should indicate the periodical to which you feel the article might be submitted. Your choice and the nature of the article should result from a previously acquired familiarity with the periodical. The article should be a length that is approved by your instructor and is appropriate to the periodical you have in mind.

[1] Joseph Newton, *An Introduction to Metallurgy*, 2nd ed. (New York: John Wiley and Sons, Inc., 1947), p. 2.

6

Tables and Figures in Technical Writing

Many kinds of information—for example, statistical data or the shape, arrangement, and relative size of objects—are difficult to convey by use of words alone. In technical writing, the necessity for conveying these kinds of information arises with particular frequency. Hence it is important to know when and how to supplement words by using tables and figures.

TABLES

Of all the nonverbal devices, tables are used most frequently. Usually their function is to enable a reader to compare statistical information more easily. They may take considerable time to compile, and you may often be tempted to take the easy way out and work your statistics into the text, but there are times when it will be almost hopeless for the reader to grasp your information unless he receives it in tabular form.

Though tables usually consist of numerical data, ingenious writers use them to present other kinds of information also. A consumers' magazine uses them, for example, to present the facts about different makes of automobile. It names the different makes of car in the column headings, lists the feature being compared—such as brakes, visibility, steering mechanism—at the left, and indicates the facts about each car in the column under its name.

This enables a reader, with equal ease, to check up on all the features for any make of car covered or to compare each make to the others in any particular feature. This same type of table can be used for numberless other types of comparison—the characteristics, for example, of different kinds of apples; the identification of insects that damage crops and the measures for controlling them; the results of using different quantities of fluoride in water to reduce the decay of teeth.

As these suggestions indicate, tables can be used for so many purposes that a technical writer should always be on the alert for opportunities to use them. Also, he should realize that when the construction of a table seems extremely complicated, he can often serve his reader's best interests as well as his own by dividing the material into two or more simpler tables.

For your assistance in using tables, the following suggestions are offered, and examples are presented in Figures 2 and 3.

Suggestions for the Use of Tables

1. At the top of every table there should be a title—preceded by a number if more than one table is used. (This rule does not apply to a mere list.) Numbers of tables are sometimes Roman numerals but more frequently Arabic.

2. Unless a table is merely supplementary and is placed in an appendix, it should be referred to in the text so that the reader will know when to give it his attention. Reference to a table may be desirable even if the table is in an appendix.

3. Each table (unless tables are relegated to the appendix) should be placed where it is conveniently accessible at the proper moment. Ideally, a table should be placed shortly after the point where it is referred to—always on the same page if there is room for it. Under no circumstances should a table be placed very far in advance of the point where it is referred to or discussed.

4. The form of tables varies in detail as necessitated by the material to be presented. Figures 2 and 3 show forms that may be used or adapted as necessary.

5. Regardless of other details of form, each column should have a heading that shows accurately the nature of the contents below. When necessary, this heading should designate the units in which

Table 1. Lodgepole Pine Stumpage Prices (Non-Appraised Sales) on the Targhee National Forest

Size of Tree (diameter)	Approximate price per tree (cents)[a]			Approx. usable length (feet)
	Commercial Sales		Farm Sales	
	Green	Dead[b]		
4" to 6" d.b.h.	5.0	2.5	1.5	20-35
6" to 9" d.b.h.	20.0	10.0	3.0	35-50
9" to 12" d.b.h.[c]	50.0	25.0	8.0	50-70

[a]A small additional charge may be required for cooperative brush-disposal work.
[b]Dead timber no charge on farm sales
[c]d.b.h. is a diameter 4½ feet above the ground

Table I
Lodgepole Pine Stumpage Prices (Non-Appraised Sales) on the Targhee National Forest

Size of Tree (diameter)	Approximate price per tree (cents)[a]			Approx. usable length (feet)
	Commercial Sales		Farm Sales	
	Green	Dead[b]		
4" to 6" d.b.h.[c]	5.0	2.5	1.5	20-35
6" to 9" d.b.h.	20.0	10.0	3.0	35-50
9" to 12" d.b.h.	50.0	25.0	8.0	50-70

[a]A small additional charge may be required for cooperative brush-disposal work.
[b]Dead timber no charge on farm sales.
[c]d.b.h. is a diameter 4½ feet above ground.

Figure 2. Specimen Tables—The forms shown, unlike most forms seen in print, can be produced on a typewriter. They may be altered as necessary to accommodate different materials. The numbers at the left are not part of the tables but are added to clarify the vertical spacing. Additional forms and uses of tables should be observed in publications dealing with your intended profession.

Table 3. Physical Characteristics of Various Wall Constructions in Dairy Plants

Name	Thickness (inches)	Weight (lb per sq ft)	Impact Resistance	Abrasive Resistance	Sound Control	Fire Resistance (hrs)
Brick	8	80	good	good	poor	2-4
Concrete Block	8	54	good	good	poor	1-3
Pumice Block	8	35	fair	fair	fair	2-4
Face Tile	6	70	good	excel.	very poor	3
Poured Concrete	6	70	good	good	poor	2-4

Figure 3. Specimen Table Showing Tabular Presentation of Nonstatistical Information.

quantities below are expressed. If there is insufficient room to express the essential information in a column heading, part of it may be added to the table in notes, as described in Rule 10.

6. A table should indicate all the factors that affect the data it contains. (For example, the size of pipe used would affect data on the performance of a pump.)

7. Standard symbols and abbreviations may be used to save space.

8. Figures in columns are usually aligned to similar digits—which will ordinarily mean to the right digit.

9. Fractions should be expressed as decimals unless decimals are not customary for data on the subject concerned, or unless the use of decimals would misrepresent the degree of accuracy that was actually achieved.

10. When a note is needed to explain some part of a table, its presence is indicated by a lower case *letter* raised half a space above the line at the point where the note applies. The notes applying to a table come at the bottom of the table rather than at the bottom of the page, where they might be confused with ordinary footnotes.

11. A table should not break into the normal margins of the page. If necessary it may be placed so that it extends across the length of the page, with the top of the table coming at what would normally be the left side of the page.

12. No table should continue from one page to another unless continuation is unavoidable because the table is more than a page long. When such is the case *continued* or *ctd.* should be used at the

bottom of the first page to indicate that the table has not been completed and at the top of the second page to indicate that part of the table has preceded. Column headings must also be shown on the second page. If totals are to be indicated at the bottoms of columns, the subtotals should be shown at the bottom of the first page and at the top of the second page. The word *forward* should be used along with the subtotals, to show that they are not final totals.

13. A table drawn from a copyrighted source must be acknowledged, as one would acknowledge any other borrowed material. This may be done by naming the source in parentheses after or under the title, or by use of a footnote. If a footnote is used, its presence is indicated by a number raised half a space above the line. The number of the footnote may follow the *number* of the table if the latter is on a separate line, but follows the *title* of the table if the title and number are on the same line.

FIGURES

In the present discussion, all forms of illustrations are referred to as figures. Examination of technical books and magazines will justify this usage.

To the technical writer, figures are functional rather than ornamental. Though in other kinds of writing they are frequently used merely to arouse interest or improve the appearance of a page, in technical writing they serve primarily as a means of giving information. If they also happen to catch attention or make a page look more attractive, so much the better; but that is not the main reason for their use. On the rare occasions when a technical writer must use figures mainly for the purpose of arousing interest, he will disregard many of the rules for use of figures in technical writing.

Whatever types of figure one may use, the following suggestions should be helpful:

Suggestions for the Use of Figures

1. **Number and title.** Every figure should have a title, which should be preceded by an Arabic numeral if more than one figure is used. It is usually best to use a single sequence of numbers even when

figures differ in type. The number and title of a figure are normally placed underneath it unless they appear in a convenient location on the figure itself. So far as possible, the placement of the title for all figures of a single type (that is, all the curves, or all the photographs, etc.) should be alike. The lettering of the title should not be exceeded in size by any other lettering on the figure.

2. **The legend.** In addition to a title, a figure may have a legend if necessary. (The term *legend* refers to the additional lines, often in smaller type, that follow the title and explain the figure or identify its parts.)

3. **Spacing of the title and legend.** When the title is underneath the figure, there should be at least a double space between the figure and the title. The title, and the legend if one is used, should be closer, however, to the figure than to the text that follows, so that they will be clearly identified with the figure.

4. **Reference to the figure.** Every figure, unless it is purely supplementary and is placed in an appendix, should be mentioned in the text. (It *may* be referred to even if it is in an appendix.) The reference to the figure is placed in parentheses unless it is part of the sentence where it occurs. Note the following examples:

As can be seen in Fig. 4, the dimensions . . .

The arrangement of the equipment (See Fig. 5) is planned so as to . . .

5. **Placement of the figure in the text.** Any figure in the text should be placed, if possible, almost immediately after the point where it is first mentioned. Certainly it should not come very far ahead of that point, for if it does, the reader may either study it too soon or else, having passed it, may neglect to turn back to it. When possible, you should place a figure on the page where you discuss it.

6. **Partial lines of type.** If a figure is narrow enough to leave room for partial lines of type, the type should be on the left and the figure on the right. However, if two or more figures appear on one page, the layout may be designed in any manner that will be convenient and pleasant in appearance.

7. **Drawing the figure.** Full instructions for drawing figures are beyond the scope of the present discussion. It should be mentioned, however, that figures should be drawn in India ink, that they should be no larger than is necessary for clearness, and that each figure should be placed within a border line unless its own shape creates a natural border. The figure should not extend into the margins of the page.

8. **Self-sufficiency of the figure.** A figure should be self-sufficient,

so that the reader for whom it is intended may study it without being forced to consult the text. Every part of a figure that cannot be identified from its appearance should be labeled or else identified by use of a key. The key may appear on the figure or may be a legend under the title.

9. **Lettering on the figure.** The lettering on a figure should be placed, so far as possible, so that it can be read with the bottom of the figure down. Lettering that unavoidably runs at a right angle to the bottom of the figure should read with the right side of the figure down.

10. **Sidewise figure.** If a figure must be turned sidewise on the page, it should be drawn so that the bottom of the figure comes on what is normally the right side of the page. (This can sometimes cause lettering to appear upside down when the page is in normal position.)

11. **Acknowledgment of source.** If a figure is drawn from an outside source, the source must be acknowledged. The acknowledgment may be placed in parentheses after the title or after the legend if the legend is also drawn from the same source. Acknowledgment may also be made by means of a footnote.

12. **Mounting a photograph.** If a photograph or clipping is used as a figure, it should be mounted neatly, preferably by use of rubber cement, unless one is preparing copy for printing.

13. **Preparation of figures for printing.** If one is preparing copy for printing, figures must not be fastened to the pages of the manuscript. The figures and captions are separately prepared and numbered, and the manuscript is marked to show where the figures should be placed. The figures should be drawn larger than the size in which they will appear on a printed page—perhaps twice the size. Figures for offset reproduction should be drawn, usually, in the size that they will appear in the reproduction. The full planning of layouts for display printing is beyond the scope of the present instructions.

In the preceding instructions it is mentioned that a table or figure should be referred to in the text. This does not imply, however, that a mere mention is the only attention it receives. It is often desirable that the text should discuss either a table or a figure in considerable detail, so that the reader can understand it as easily as possible. The text may direct the reader's attention to the points that are most important, or may explain the table or figure in sufficient detail to make sure that its full significance and implications are not overlooked. One test of your skill as a

technical writer is the effectiveness with which you utilize the text to assist the tables and figures, as well as using figures to assist the text.

Thus far, all that has been said about figures applies to figures of every type. Some of the common types call for individual attention. Before they are discussed, however, it should be re-emphasized that no amount of discussion can eliminate the need for constant observation of the figures in technical books and magazines.

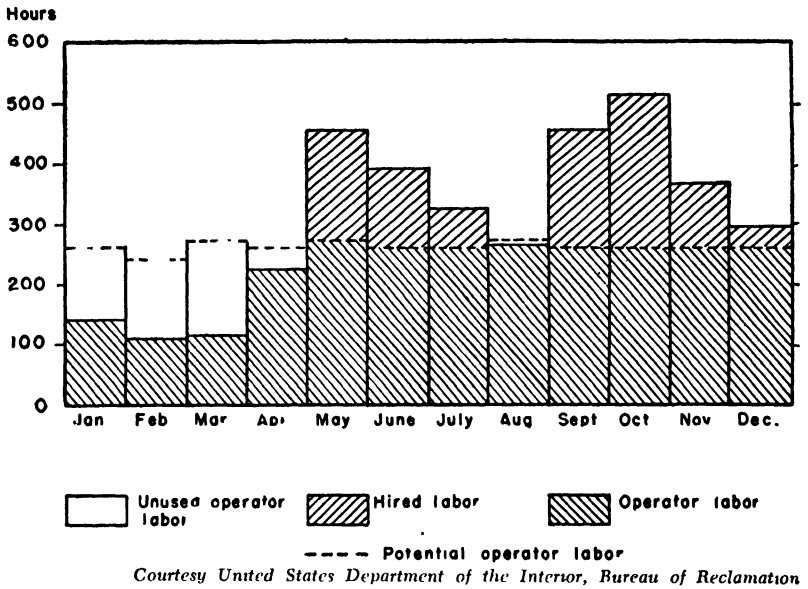
Bar Charts

One of the simplest and most useful types of figure is the bar chart, with which every reader is familiar. The information it presents is a type that might also be presented in a table. In fact you may often make out a table before making a bar chart or curve. The bar chart or curve may be preferable because it makes differences in quantity instantly and unavoidably *visual.* For example, a reader might see numbers such as 841,654 and 418,543 arranged in columns, along with several other numbers, and yet fail to become aware of the relative quantities until he had given the table exhaustive study. If such numbers were presented as bars, one of which would be more than twice as long as the other, the relative amounts would be visible and could hardly be escaped.

The bars in a bar chart are sometimes horizontal, sometimes vertical. They may be shaded differently in different portions of their length so as to permit comparison of parts as well as of the whole. For example, the different bars in a chart might represent the total expenditures of different divisions of some organization, and each bar might be shaded differently in different sections of its length so as to show what amount of the expenditures went for specific expenses such as wages, raw materials, power, and overhead.

Sometimes one sees such variations of the bar chart as the drawing of pictures to represent quantities. For example, the increase in the number of passengers carried by an airline might

be suggested by pictures of men, or the increase in the production of a metal by pictures of ingots. This pictorial treatment is used primarily when an effort is being made to popularize the material. It is intended to arouse interest as well as give information. Properly handled, it may be a useful device. Often, unfortunately, it is not properly handled. Instead of drawing, let us say, *three times as many* men to show that one airline carries



Courtesy United States Department of the Interior, Bureau of Reclamation

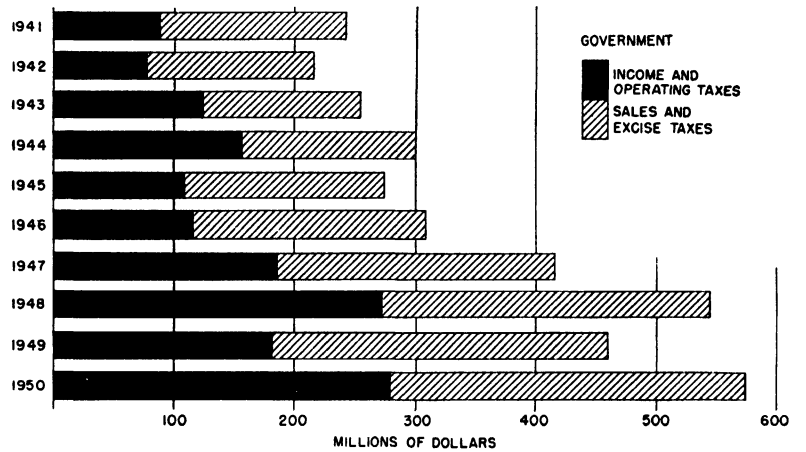
MONTHLY LABOR DISTRIBUTION ON A ONE-MAN SUMMER FIELD CROP FARM OF 50 ACRES.

Figure 4. Bar Chart with Vertical Bars.

three times as many passengers as another, a writer may draw one man for each line but make the second man three times as tall as the first. This is confusing, for in *area* the large man is *nine* times the size of the small man—and a reader forms only a vague or even erroneous impression until he studies the exact figures. Or when the ingots are used as illustrations, the writer may try to compare two quantities, one of which is twice the size of the other, by pictures of two ingots, the second being not only

twice as long but also twice as wide and twice as thick. The two pictures fail to convey any clear impression whatsoever of relative quantities, and even the blurred impression that they do create is likely to be inaccurate.

All in all, it is best to use ordinary bars or lines, so that no dimension varies except length, or else to show the variation of



PAYMENTS TO FEDERAL, STATE, AND LOCAL GOVERNMENTS. TAXES LEVIED ON THE COMPANY, PLUS TAXES COLLECTED BY THE COMPANY FOR THE GOVERNMENTAL UNITS.

Figure 5. Bar Chart with Horizontal Bars.

quantity by varying the number, not the size, of pictures. These methods are the most honest and accurate, and are also the clearest to the reader.

Figures 4 and 5 are characteristic bar charts.

Graphs—Curves

Like the bar chart, the graph or curve is a means of presenting data that might have been presented as a table. In fact it is hardly possible to construct a graph without having constructed a table first. The extra work that it takes to convert a table into a graph is often justified, however, by the fact that a graph makes it much easier for the reader to grasp the message.

Suppose you wished to show how the price of a commodity varied from month to month over a stretch of one or two years. To learn the low, the high, and the general trends from a table your reader would find it necessary to study the data at length. Yet all these points would be perceptible at a glance if the table were converted into a graph. If the data concerned three or four commodities, the use of curves would be even more advantageous. It would enable the reader to grasp the situation in a moment, whereas he would have to read and compare dozens of figures to get the desired information from a table.

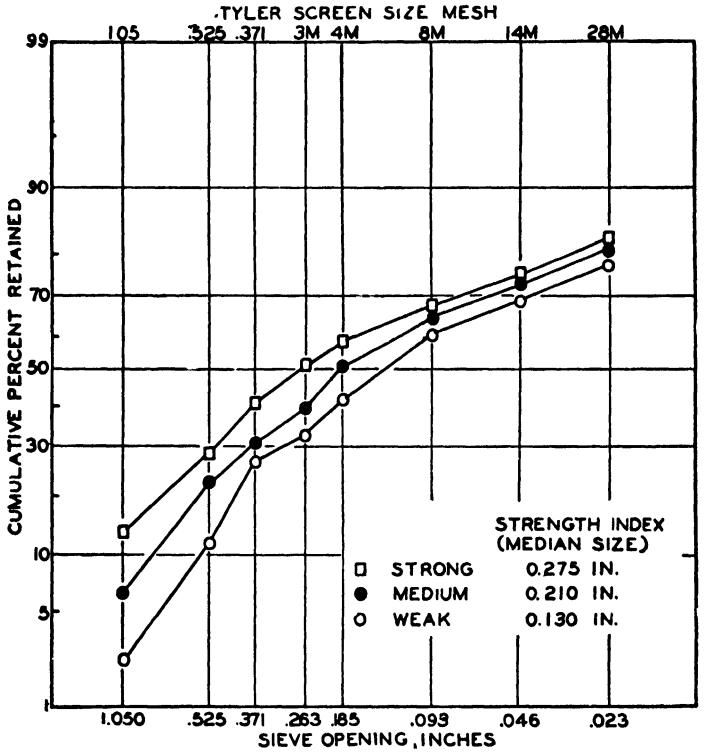
The graph or curve differs from a bar chart in that the graph always shows changes in two values. It shows how one varies as the other varies—for example, how employment increases or decreases as the year progresses. One of these elements is frequently the passage of time and the other is an amount or quantity. When this is the case, the passage of time is usually shown on the horizontal scale and the variation of quantity on the vertical scale.

As the instances described will indicate, a graph always has a horizontal and a vertical scale, the horizontal usually being used to indicate what might be called the independent variable, such as time, and the vertical to indicate the dependent variable. Full information about the scales must appear as part of the graph. The specimens shown illustrate the placement of this information. The vertical scale may be placed at the right as well as at the left if the graph is large enough to cause need for it there.

Sometimes more than one curve appears on the same graph. In this case, if there is room, each curve should be identified by a short title lettered above it. If room does not permit this lettering, a different kind of line may be used for each curve, and a key identifying the lines can be shown on some unused space on the face of the graph.

Finally, it should be pointed out that when you make a graph you should choose the scales, both vertical and horizontal, in such a manner that the impression this graph conveys is justified by the facts. When a line goes up or down at a sharp angle, a

reader gathers the impression that the rapidity of change is highly significant. If it climbs or falls at a slight angle, he interprets the change as insignificant. Yet the angle at which the line goes up or down is dependent on the scales selected. It therefore



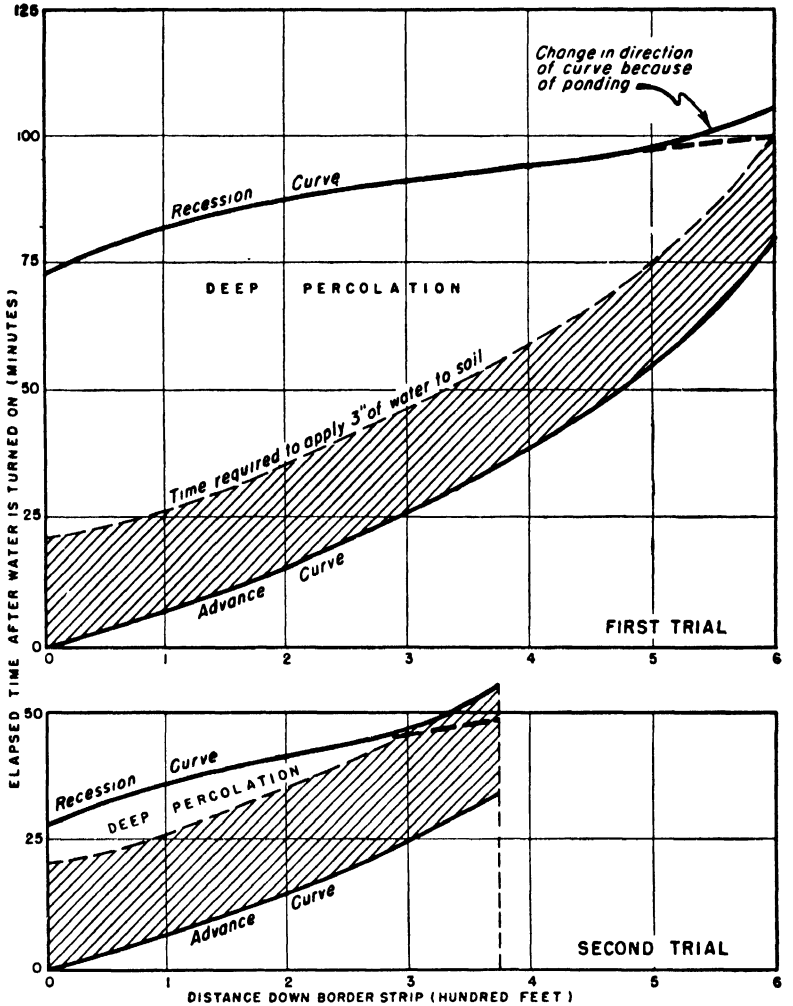
RESULTS OF SIEVE ANALYSIS OF THREE DIFFERENT SAMPLES OF SINTER AFTER TUMBLING FOR 200 REVOLUTIONS.*

Figure 6. Specimen Curve.

* E. C. Rudolph and D. J. Carney, *Quality Control of Blast Furnace Flue-Dust Sinter.* Reprinted by permission of the American Institute of Mining and Metallurgical Engineers

becomes a matter of mere honesty for a writer who makes a graph to work out his scales in such a manner that if a change is important the line climbs or drops at a sharp angle, and if the change is not important the line goes up or down slowly.

Figures 6 and 7 are examples of curves.



Light soil, Intake rate = 2.0" per hour, Slope = 0.5%, Width of strip = 20', Size of stream used = 1.5 cfs

$$\text{Unit Stream} = \frac{\text{Total stream}}{\text{Width of field in feet} \times \text{Length in hundred feet}} = \frac{1.5}{20 \times 6} = 0.0125 \text{ cfs}$$

Courtesy United States Department of Agriculture, Soil Conservation Service.

ADVANCE AND RECESSION CURVES FOR A TYPICAL BORDER-IRRIGATED STRIP.

Figure 7. Specimen Curve.

The "Pie" Diagram

Another widely used device is the "Pie" chart, consisting of a circle divided into segments. This form is used to make visual such information as relative percentages of a whole. For example, it might show what percentages of a corporation's income were allotted to various expenses, dividends, and capital gains. More than any other device it permits comparison of parts to each other and to the whole at the same time.

Like any other drawing, it should state amounts as well as illustrate them. These amounts should often be the actual quantities as well as the percentages.

One difficulty in making such a diagram is the problem of making the letters identifying the segments all run in the same direction. If there are too many segments and if they are too small, this difficulty may become insuperable and make it inadvisable to use the form.

A characteristic Pie diagram is illustrated in Figure 8.

Organization Charts and Flow Sheets

Unlike the figures discussed above, the organization chart and the flow sheet are not concerned with statistical information. The mere name of the organization chart shows what kind of information it presents—divisions of an organization by circles or rectangles, so arranged and connected by lines that authority, relationship, and responsibility are easily indicated. Such a chart is far more effective than words in presenting this information. Indeed, many a body has been induced to improve its own organization when an organization chart revealed confused or illogical relationships.

The flow sheet is very similar. Its typical use would be to indicate the method by which some process is carried out. The machines used are sometimes indicated by the conventional circles or rectangles, and sometimes by simplified drawings suggesting their actual appearance. The main difference between the flow sheet and the organization chart is that the flow sheet indicates ac-

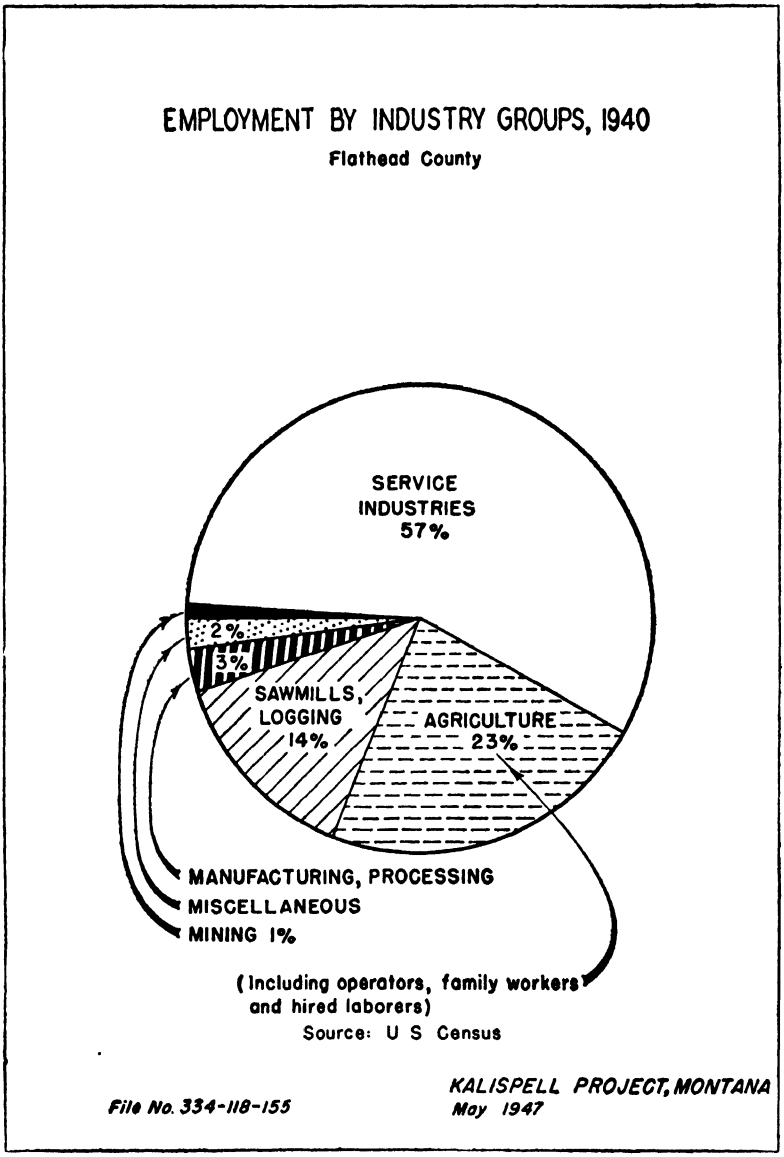
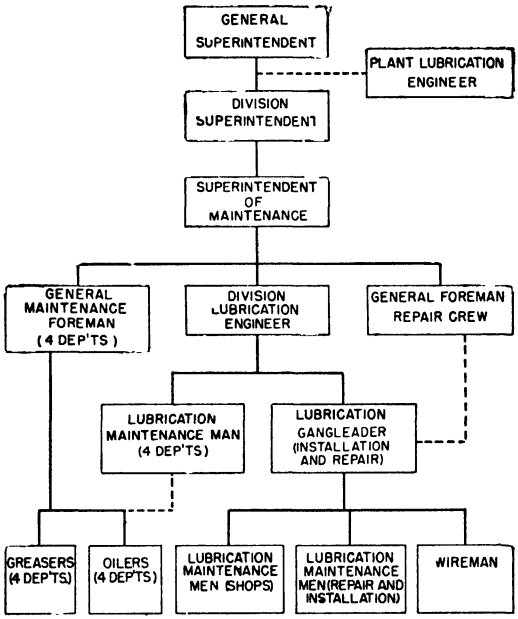


Figure 8. Specimen Pie Chart.

tual physical movement of materials. The direction of such movement is shown by arrows wherever necessary.

Figures 9 and 10 illustrate an organization chart and a flow sheet.



TYPICAL LUBRICATION ORGANIZATION CHART.*

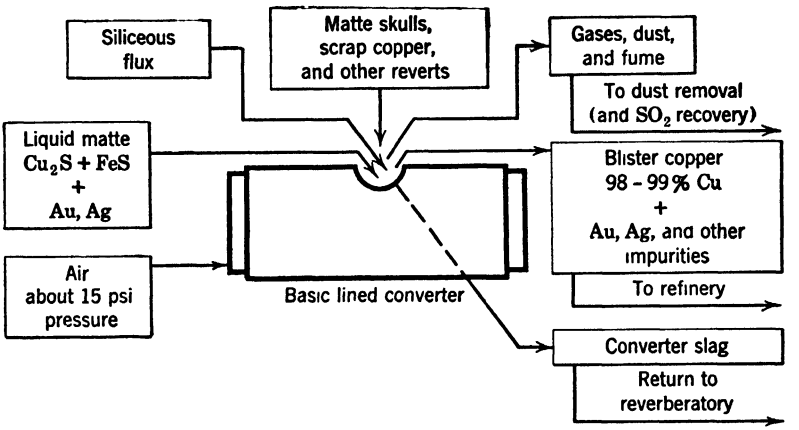
Figure 9. Specimen Organization Chart.

* R. R. Taylor, "The Functioning of a Lubrication Organization in Heavy Rolling Mills," *Iron and Steel Engineer*, January, 1953.

Photographs

In technical writing you may need to use photographs for either of two main purposes. The first is to assist verbal description. The second is to prove the truth of assertions. Photographs would be helpful, for example, in showing characteristic fractures of metal that might result from different causes, or in identification of insects or of plant diseases. They might also illustrate the condition of equipment that had not been maintained properly,

the breaks that had developed in a pavement or the lining of a canal, or the crowded condition of a factory. Sometimes, as suggested, the purpose of the photograph might be merely to give information; but often a photograph can be used to prove the truth of an assertion by letting the reader see for himself. For this latter purpose, it has no equal.



SCHEMATIC DIAGRAM SHOWING FLOW OF MATERIAL TO AND FROM A COPPER CONVERTER.*

Figure 10. Specimen Flow Sheet.

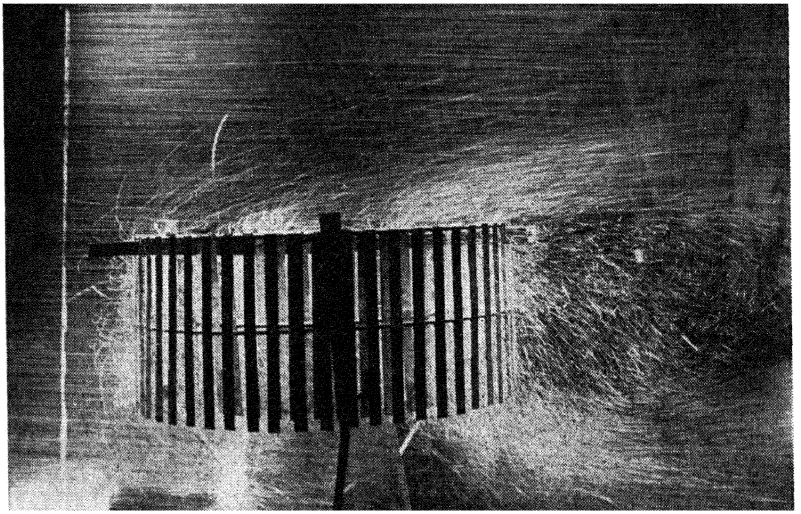
* Joseph Newton, *An Introduction to Metallurgy*, 2nd ed. (New York: John Wiley and Sons, 1947).

The photograph is limited, however, by the fact that it can show only the surface and that it may sometimes unavoidably present both significant and nonsignificant facts of appearance with equal emphasis.

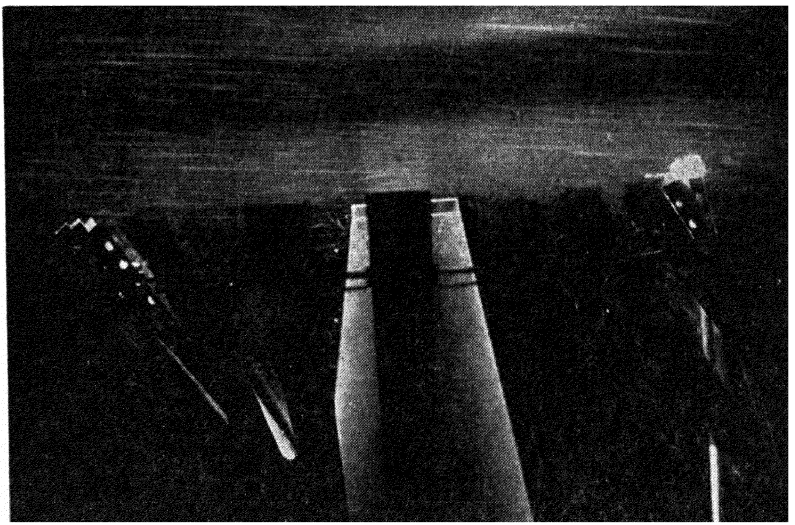
Figure 11 shows photographs used where no other form would fit.

Diagrams and Drawings

There are many occasions when diagrams and drawings can help to illustrate the text. For example, electrical wiring plans, schematic diagrams showing how any type of equipment operates, or drawings intended to illustrate actual appearance are constantly



A



B

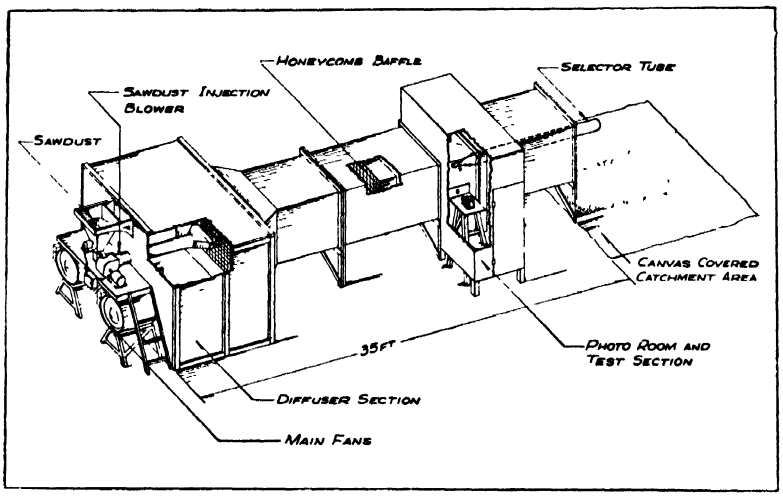
Courtesy of C. C. Warnick, University of Idaho Engineering Experiment Station.

AIR FLOW PATTERN AROUND SHIELDED PRECIPITATION GAGES. (A) SNOW-FENCE WINDSHIELD—UNSATISFACTORY. (B) MODIFIED ALTER II WINDSHIELD—MORE NEARLY SATISFACTORY.

Figure 11. Photographs Used as Figures.

used by those who write on technical subjects. The shape and relative location of objects as well as the manner in which equipment functions can often be shown better by a diagram than by any other method.

Useful as photographs are—and frequently they are the best method of illustration—there are times when drawings are better because they make it possible to illustrate the interior rather than



Courtesy of C. C. Warnick, University of Idaho Engineering Experiment Station.

SCHEMATIC DRAWING OF LOW-SPEED WIND TUNNEL USED TO STUDY MODEL PRECIPITATION GAGES UNDER SIMULATED SNOWSTORM CONDITIONS

Figure 12. Specimen Drawing.

just the surface of an object, to omit what is not significant, and to emphasize what is important. As you read the technical writing of others, you should make it a point to observe the manner in which drawings are used; and as you plan your own writing, you should constantly be on the alert for opportunities to make your work more effective by means of drawings.

A characteristic use of a drawing is seen in Figure 12.

II

REPORTS

7

Reports—Their Contents and How They Are Written

As it was pointed out in Chapter 1, the ability to write a good report is especially important to almost anyone who does any technical writing at all. Consequently, the second part of this book concentrates attention upon reports, applying what has been said about technical writing in general to the report-writing situation and taking up additional points that are of particular importance when reports are written. The present chapter bears upon reports in general, regardless of their type. The two chapters that follow examine reports of different types to show how they may vary in form and purpose.

GENERAL DISCUSSION

If you have looked over many reports, you have probably noticed that they differ widely in form, length, and many other respects. Probably you have asked yourself, "What is there about reports, since they differ so much from each other, that causes them to be considered a distinct species of writing?"

A report, it might be answered, is a written or oral communication in which information is given to a person or organization that has a right to expect such information. As this definition indicates, the common element in all reports—the fact that sets

them apart from other forms of writing such as articles or bulletins—is the element of *responsibility*.

Consider for a moment the first type of report that most of us encounter—the report made at a meeting of some organization by an officer or the chairman of a committee. Such a report may be impromptu or may have been written in advance for oral reading and insertion into the records, but in either event, it is made because the committee or officer is *responsible* to the organization. Thus in essence it is the same species of writing as a complicated technical report.

A technical report may be made to a single person, as when one man reports to his immediate boss on the job, or it may be printed and distributed by the thousand, as when the management of a great corporation reports to its stockholders. It may be short or long, simple or complicated. It may be expressed in any form whatsoever. Still, if it may be accurately called a report, the element of responsibility is there. Even if a report is actually printed for release to the general public, it is ostensibly written because one person or organization was entitled to the information it contains.

The importance of reports in the modern scheme of things is hard to overestimate. Reports are the means by which the executive utilizes the training of others. In any large organization—and this is an age of large organizations—they form the basis upon which many decisions of policy are based. They are one of the most important means by which information is exchanged; hence it is obvious that reports are as important as the exchange of information.

Persons Who May Write Reports

Anyone may have to produce a report—from the door-to-door salesman reporting to his boss on how many brushes he has given away, to the President of the United States, who reports to Congress annually on the state of the union. In industry, an employee may report to his immediate superior, the manager of a plant may report to the vice-president in charge of production, the vice-

president to the president, the president to the board of directors, and the board to the stockholders. Whether a person is engaged in scientific research, mining, agriculture, engineering, education, government, or general business administration, he will probably have to report to someone on his activities.

What Reports Are Written About

As we can see, it is hard to find any activity about which reports may not be written. A report written in business or in technical work, however, usually tells about what has happened as the writer has done his routine work, carried on a special project, or made an investigation in an effort to find the solution to a special problem. A report may tell of the conditions that prevail on a job that has been inspected. It may tell what was learned on a trip to inspect operations of other companies, or what has been found to be the cause that some part of a machine fails in service, and what shall be done to remedy the fault. It may tell whether a change in manufacturing methods seems advisable; whether to adopt some new process; whether the writer's company should manufacture a certain part or buy it. The types of subject are endless.

The Difference Between Professional and School Reports

As a student you have probably been asked to write reports for your classes. It it natural, therefore, to wonder about how these reports compare with reports you may write on the job after graduation.

Obviously, there are many qualities that lend merit either to a classroom report or to a report written for an employer. Yet there is one sharp difference between the two situations. In school, a student writes a report for his own good. He writes it because he needs to learn more about the subject, or perhaps because the mere process of obtaining and expressing the information is beneficial to him. It is unlikely, however, that he is presenting information that the reader needs.

On the job, however, the reader is all-important. This sets up

a test of merit that does not exist in the classroom. In the classroom, if a student not only covers all the ground assigned but adds some extras, he is likely to earn a higher grade. On the job, if a worker uses the time that the boss is paying for to gather and present information that is not actually needed—if he forces the reader to search out the essential information from a document that contains extras—he is likely to be told to rewrite the report and to weed out his material more carefully in the future.

Sometimes, in a class in report writing, an effort is made to simulate a situation in which the reader is not the instructor but some hypothetical employer or client. Such an effort is highly commendable. Inability to discriminate between what the reader needs and what he does not need is a common weakness among report writers, and an understanding of the difference between the school report and the report written on the job is an important step toward freedom from that weakness.

PROCEDURE IN WRITING A REPORT

Perhaps, as you look ahead to the time when you will be asked to write reports on the job, you feel uncertain as to just how you will go about the task. If so, you are probably more concerned than you need to be. Often, the situation in which you write a report will be so simple that it will present no problems except those that accompany every type of writing. Often, too, the situation will be purely routine and the procedure to follow will be obvious.

You will be most likely to encounter difficulty when called upon to write a report that is based on a special investigation of some specific problem. For such a report, or for any other report that seems to present difficulties, the following procedure is suggested:

1. Analyze the problem to determine what material the report must contain.
2. Make a rough, tentative plan or outline for presenting the material.

3. Gather the necessary information from appropriate sources, and analyze it to determine its significance.
4. Make a detailed outline.
5. Plan the figures or tables that will be used if such devices seem likely to be helpful.
6. Write the first draft.
7. Revise the first draft into final form.
8. Care for such final details as title page, letter of transmittal, final check of the manuscript, and binding.

Before details on these steps are given, it should be made clear that you do not need to consider this procedure as rigid, and may modify it as much as necessary. You might decide to use certain tables, for example, long before you could complete your detailed outline; or in a long report you might write up a first draft on some sections before you had obtained the information for others. In the main, however, the list shows the normal procedure, and it will come as close to being satisfactory as could be expected of any plan intended for general guidance rather than for a specific occasion.

Analyzing the Problem

Analyzing the problem will involve breaking it down into its component parts. Suppose a report is written to indicate which of three or four vicinities would be most suitable for a small pilot plant to be built by some processing company. Where to locate the plant would depend on the answers to many other questions, and it would be necessary to decide what those smaller questions might be. Regarding each vicinity it might be necessary to know, among other things, what sites were available, what railway and highway facilities were near each site, how far it would be necessary to transport raw materials, whether the necessary labor supply would be obtainable, and whether local zoning laws would create a problem.

These are only a few of the many probable questions, but it is apparent that until the main question is broken down into smaller questions it would not be possible to form a full picture of the information that the report should contain. Such an analysis will

usually be necessary for every report that calls for a special investigation.

Making a Tentative Plan for Organizing the Report

It is almost impossible to analyze a subject without forming a general idea of an outline, at least in its larger aspects. Your first efforts toward analysis will usually result in a limited number of main questions to be looked into, and further thought on each main question will show that it, in turn, involves a number of still smaller questions. In thinking of these questions you will be shaping main points and subpoints for an outline. Yet it is well to keep this plan general and tentative, for there is always a strong likelihood that as you gather the information, there will be unexpected developments. What seem at first to be minor points will grow larger in scale, whereas problems that look complex may prove simple. Thus the final decisions about the details of organization can best be made after much of the information has been gathered.

Gathering and Analyzing the Information

Sources of information. To discuss the process of gathering information it is first necessary to consider the various sources from which information to be used in reports might come. Because the purpose of a course in report writing is primarily to assist you after your graduation (as is true of other courses that make up your professional training), the discussion will deal mainly with the gathering of information by the man on the job rather than by a student in a report-writing class. Your peculiar problems as a student will be taken up, however, at the end of the discussion.

When reports are written on the job, the sources of information are usually obvious. It would be obvious, for example, that the information for a report on a newly adopted waste-treatment process would come from laboratory analysis of samples, or that a report on the results of a safety campaign would come from the company's records. Still, a list of the many possible sources might

be helpful. This list would include: published information, earlier reports and records of the organization for which the report is to be written, letters and questionnaires, personal interviews, personal observation or inspection, and tests or experiments.

Published material is often an important source of information. Before engaging in expensive, time-consuming laboratory work or other tests, you would do well to investigate the possibility that someone else has already done the work and published the results. This would involve checking over, often with the help of a reference librarian in a good library, the contents of books, periodicals, government bulletins, and printed publications of research bureaus or large corporations.

The reports that might have been written already for your own organization should not be neglected. Many large corporations keep extensive indexes of all reports, especially those that might interest more than one division, so that time and money will not be wasted by duplication of effort.

Another common method of obtaining information is correspondence. Sometimes this involves the sending of questionnaires, but for the technical worker a mere letter of inquiry is more frequently appropriate. Such letters are discussed in the section on letter writing. To a person on the job, the occasions when a letter is the best means of obtaining information will be so clearly apparent that there is no need to discuss them in detail.

In place of writing letters you may often find it better to get information by means of personal interviews. Such interviews are slower and more expensive than letters, but there are times when the flexibility of a personal conversation might bring out facts and ideas that would never emerge in an exchange of letters.

When the information needed for a report cannot be gathered from other people, personal observation is a possible method. A typical use of personal observation would be a visit to a factory to watch some process in operation, or a field trip by a manufacturer's agent to watch the performance of a leveling device for a harvester, newly designed by a private inventor. Personal inspection might be the method used in an attempt to determine

why accidents were frequent on a construction project, or what conditions might be causing an epidemic in some particular community.

Tests and experiments are a very common source of information. For example, tests would be used to determine whether certain flue gases contain valuable recoverable material. Experiments might be conducted in an effort to determine whether some new alloy could resist corrosion or whether a new method of treating wood would increase its resistance to rot. The tests and experiments utilized in many reports are often, though not always, performed in laboratories—for example, the X-ray examination of a newly designed metal part to study stresses and strains, or tests of water to see whether it is fit to drink. The list of possibilities is endless.

Not all the information in a single report need be obtained by the same method. On the contrary, there are many occasions when several types of source may be drawn upon. After a decision has been made as to what information is needed, the investigation is planned so that each part of the material can be obtained by the fastest and most efficient method.

As mentioned at the beginning of the discussion, the question of how and where to obtain information is different for a student in a class in report writing than for the man on the job. As a student you are unlikely, for example, to have access to earlier records of the organization you are presumably writing for, nor will you be in a position to do more than a minimum of field visiting, plant inspection, or tests and experiments. Therefore it may become necessary to reverse the normal procedure and try to develop subjects that permit the use of any information available.

You will probably have access to a library, but few reports for practical use grow from information obtained entirely from printed sources, and it will surely be desirable to look for subjects that lead to something more than mere reference papers. Such subjects may possibly be found in your experience on summer jobs; they may be found in other courses taken in school; they

may be found in the physical plant of your school—its heating plant, or its parking problems, or its needs for additions or alterations; or they may be found in the community where the school is located.

The conditions and opportunities in the many schools where students learn to write reports are so widely varied that the solution to the problem of where to obtain information will differ in different schools. Both you and your instructor may be forced to exercise ingenuity and imagination in seeking for a solution. Fundamentally, however—when the subject has been selected and the information gathered—it will usually be found that the list of sources used for reports written on the job will include most of the sources for reports written in class. And when you graduate and write reports on the job, you will usually have no trouble in deciding what source or what method to use in gathering information, even though the process of gathering it may not be easy.

Analysis of information. A report does not always consist solely of the statement of facts. Often you will find it necessary to analyze the facts, draw conclusions, and record the reasoning by which your conclusions were drawn. With such assistance the reader will reach a real understanding of the matter in far less time than he could do so unaided. Moreover, he will be much more likely to accept your conclusions—a result you will naturally desire—if the report not only tells the facts but also shows how they should be interpreted.

Making the Detailed Outline

As it has been mentioned, you will usually form a general, tentative plan for presenting your facts even before you gather them. Usually it will be necessary, however, to adapt this plan to the facts as they actually turn out, and to expand it into a detailed outline. In most respects, making an outline for a report is not essentially different from making an outline for any other purpose. True, there are times when you will be expected to arrange your material under a standard list of major headings;

yet you will still be forced to plan on how to present the material within each division, and there are innumerable occasions when you will be free to plan out the entire treatment. Therefore you should not neglect to use the good outlining techniques explained in Chapter 2.

In that chapter it was pointed out that making an outline really means organizing the material. As you organize material in a report, one consideration needs special emphasis: you should not concentrate so hard on the subject matter that you forget to consider the reader and the occasion. The subject matter can usually be organized in more than one manner; and which of the possible organizations is best depends on why the reader is reading—on what questions he is hoping to find answered.

This point is so vital that it calls for illustration. Assume that a report is attempting to show which of three methods should be adopted for some particular welding job. Roughly indicated, one method of organizing the facts would be:

Welding by method "A"
  How it is done
  What is good and bad about it
Welding by method "B"
  How it is done
  What is good and bad about it
Welding by method "C"
  How it is done
  What is good and bad about it
Reasons for choice of method "C"

This treatment would be undesirable for it would encourage you to tell about the different methods as if they were important in themselves. It would tempt you, also, to tell more about methods "A" and "B" than the reader would wish to hear, for the only facts the reader would care about would be those which proved that no mistake was made when the methods in question were discarded.

Suppose, however, that the following organization were used:

Superiority of method "C" over other methods
  Reasons method "A" is not suitable
  Reasons method "B" is not suitable
  Reasons method "C" would be suitable

So far as abstract logic is concerned, this latter organization is no better than the former. Judged, however, on the basis of meeting the reader's specific needs, the second is much superior. It throws emphasis on what is likely to be significant to the reader under the special circumstances, and reduces the likelihood that the report will include needless information about methods "A" and "B."

As a further illustration: suppose you were presenting the facts about current models of automobiles made by different manufacturers. You could organize the facts (1) so as to make it easy to learn all about each make of automobile, (2) so as to make it easy to compare the different parts of different makes, or (3) so as to make it easy to compare the merits of the different makes for certain specific uses (such as for a fleet of taxicabs, cars for traveling salesmen, or cars for use on a construction job in rugged country). In sketchy form the different organizations would be:

1. Make "A"
   - Engine
   - Body
   - Steering Mechanism
   - Etc.

   Make "B"
   - Engine
   - Etc.

2. The engines powering the different makes
   - The engine in make "A"
   - The engine in make "B"
   - Etc.

   The bodies of different makes
   - The body of make "A"
   - The body of make "B"
   - Etc.

   The steering mechanisms of the different makes
   - The steering mechanism of make "A"
   - The steering mechanism of make "B"
   - Etc.

3. Suitability for use in city traffic
   - Suitability of make "A"
   - Suitability of make "B"
   - Etc.

   Suitability for long highway trips
   - Suitability of make "A"
   - Suitability of make "B"
   - Etc.

   Suitability for use in rugged country
   - Suitability of make "A"
   - Suitability of make "B"
   - Etc.

Any of these plans would accommodate the facts, and all of them are logical; but really *good* organization means the creation of a pattern which, without violating logic, will apply the facts to the reader's specific needs. Before you could decide which of the patterns was best, you would need to ask yourself, "What are the questions to which the reader will be seeking answers?" Then you should use the organization which would make the answers to those particular questions easiest to find.

Planning the Use of Tables and Figures

If you find it desirable to use tables and figures in a report, you will need to decide whether to scatter them through the text, place them all at the end, or divide them between the two locations. It will usually be advisable to make your decision on this point before you write the text, for your decision will affect what you write. It is possible that you may actually draw up the tables and create the figures before you start to write, but situations develop so differently that it is impossible to generalize as to the best time for bringing the tables and figures into existence.

The use of tables and figures in a report is no different from their use in other technical writing. Therefore the discussion of this subject in Chapter 6 renders a detailed explanation at this point unnecessary.

Writing the First Draft

If the preliminary work has been done properly, the actual writing of a report is much the same process as writing any other

material and should not be abnormally difficult. A few special suggestions, however, might be of value.

The first of these concerns the problem of getting started. Many a writer finds it difficult to write the first few paragraphs or pages, yet feels that if he could just get his opening down on paper, the rest would come along without undue effort. If this is your state of mind, you may find it helpful to postpone work on the opening section and start writing any section that you feel ready to write. The opening can be supplied later.

If this is not feasible, the best procedure is simply to start writing without worrying about the quality of the result. As you warm up to your work, the quality will improve. Then you can go back and revise the opening, or discard it and write it over again.

There will be many times, of course, when you will not even consider writing the opening first because you will not expect to write the whole report at once. If a project leading to a report is long-extended, the information for the different sections of the report may become available at different times. In this event it is advisable to write up each section while the information is still fresh in mind. The opening section, under these circumstances, may be among the last to be written.

Whatever the circumstances under which you produce the first draft, you should push ahead, once you get under way, without worrying too much about minor details. If the flow of words is slowed down, it may be difficult to achieve continuity; so the attempt to achieve the niceties of style may well be postponed until later.

In writing a report you should be especially alert for the occasions when ordinary sentence-and-paragraph form is ineffective. Even if your tables and figures have already been planned, the use of a list which is set aside from the text is often helpful. Especially in conclusions or recommendations, a numbered list is desirable if the nature of the material permits. These sections are important enough to deserve special attention, and use of a numbered list makes them stand out and increases the likelihood that they will be clearly expressed.

A typical use of an unnumbered list (sometimes called an informal table) would be as follows:

. . The cost of labor for performing this job would be moderate, consisting of the following items:

Digging pole holes	$ 7.50
Hanging crossarms and insulators	9.20
Erection of poles	11.00
Digging anchor holes	24.00
Planting anchor plates	17.20
Stringing guy wires	21.30
	$90.20

The use of nontextual form may sometimes be carried even further. To show how this helps the reader, the same information is given below in two forms. Notice how much easier it is to grasp in the second form than in the first.

(a)

New sand costs $3.65 per ton, delivered and unloaded. If sand is reclaimed, the direct costs are $1.00 per ton. These costs consist of operating and maintenance labor plus fuel for drying the sand. The indirect costs, which include such expenses as repair parts, depreciation, and power, come to $0.25 per ton. Thus the total cost of reclaiming a ton of sand is $1.25, and the net saving per ton would amount to $2.40. It would be possible to reclaim 280 tons of sand per day, which would lead to a daily saving of $672. Assuming that there are 240 operating days per year, the annual saving would be $161,280.

(b)

Cost of new sand per ton (delivered and unloaded)		$3.65
Direct cost of reclaiming sand (operating and maintenance labor and fuel for drying)	$1.00	
Indirect costs (repair parts and depreciation)	0.25	
Total		1.25
Net saving per ton		2.40
Tons saved per day	280	
Net savings per day		$672.00
Annual savings per year (assuming 240 operating days per year)		$161,280.00

Sometimes these departures from textual form take extra time; but that is not always the case, for you will often have drawn up

your material in such a form before you even write the text, so that all you may need to do is to copy it as you already have it. Even when the extra work is necessary, the result justifies it. It is a fundamental fact in every job connected with writing that the writer must work harder so that the reader's work will be easier.

A final suggestion is to make liberal use of topic headings. Even in a report of only two or three pages, these headings open up the contents, thus making it easier for a reader to see what the report contains and to find what he is looking for. They have a fine psychological value in that they make the pages look less formidable. Their use involves little extra work if the report has been organized properly, for the points of the outline can be used as headings with no more effort than brief attention to expressing them as topics. And finally, the topic headings reduce the likelihood that you, the writer, will wander away from your subject.

Aside from taking extra trouble for the purposes mentioned, you should not let the fact that it is a report you are writing multiply your difficulties. Just write out your material as well as you know how to write it, realizing always that good writing in a report is in most respects similar to good writing elsewhere.

Revision into Final Form

After a first draft has had time to cool off, it should be revised or rewritten to any extent necessary. When possible, you should avoid revising your work until you can read it with a sense of freshness—as a reader, not as a writer. If you revise too soon, you will not be able to discriminate between what you have written and what you have only thought about. It is possible, however, to let the work cool off too long; and you should revise what you have written while the subject is still fresh enough in your mind so that you will notice omissions and errors.

The amount of revision may vary from minor changes in phraseology to the actual rewriting of sections or of the entire report. Sometimes a single revision will be sufficient, but on other occasions it may be necessary to work the material over three or four times. Time is usually a factor for a professional man, and

obviously the total amount of time expended must not be more than the project justifies.

The task of converting the first draft into final form makes it necessary to decide upon the manuscript form to be used for the finished product. There is no single manuscript form which must be followed in all reports. Sometimes a prescribed form must be used for some particular company, and sometimes in a particular type of report, such as those described in the next two chapters, one or another specific manuscript form is preferable; yet as you look over reports for different organizations, you will find that the forms are widely diverse. Therefore it may safely be said that lacking any specific instructions, you may use any manuscript form that would be suitable for other types of writing, only being sure that if the report is to be bound, the margin be increased at the left side or the top, as the case may be, so as to leave room for binding.

Caring for Final Details

When the report proper has been written and revised, there may still be some final details to care for. These may include the preparation of a title page, a summary or abstract, a table of contents, and a letter of transmittal.

If a title page is used, it should indicate, as a minimum, the subject of the report, the person to whom the report is submitted, the name of the writer, and the date. In large organizations you may also be expected to show the number of the report or of the project that the report concerns so that filing will be facilitated. All this information should be agreeably spaced.

The summary or abstract, table of contents, and letter of transmittal are specially characteristic of formal reports, and therefore will be discussed in Chapter 9, which deals with that subject.

One final task must always be performed: the close scrutiny of the entire report for errors in details. These could include errors in manuscript, in form, or even in such a simple matter as the order of the pages. Everyone dislikes to make this final check-up, but it is so easy for even conspicuous errors to pass unnoticed

that the final scrutiny is highly important. It should preferably be performed while the pages are still loose in order that correction of errors will be easier. When the report has been checked over carefully, it may be fastened together or bound in whatever manner seems suitable.

In closing, it should be re-emphasized that the steps discussed cannot always be taken exactly as listed. If a subject is complicated, you may push ahead faster on some steps than on others. Such simple considerations as weather might result in the completion of one section of a report while another section is still in the stage of rough plans. Yet the procedure is basically sound. Analyzing the problem, making rough plans for the treatment of the subject, gathering and analyzing the information needed, making the full outline, planning for figures and tables, writing the first draft, revising it as necessary, and doing the incidental jobs that cannot be done until the writing has been completed—such is the natural course of action. Though deviation may be necessary, you need not feel uncertain as to how to go about the job of writing a report if you will hold this plan of procedure in mind.

QUALITIES TO STRIVE FOR IN REPORTS

In the preceding discussion of the procedure to follow in writing a report and in earlier chapters, many of the qualities that make a report effective were indicated. Among these were accuracy; adaptation of contents, organization, and language to the needs and abilities of the reader; thoroughness; sound reasoning; and clearness and conciseness. Yet there are still other qualities that should not be neglected.

Neatness

As a report writer you should do everything possible to create from the outset the idea that your report is a high-caliber job, for a reader gathers an impression before he even starts reading, and first impressions are hard to overcome. Neatness is especially

important when the person who first receives a report must pass it along to someone else, for it reflects upon his own standards if slovenly standards are observed by those who work under him. All in all, a report that is good in other respects should not be forced to overcome the handicap of poor appearance, for it is hard to reconcile low standards in appearance with high standards in other respects.

Interest

Theoretically, a person who reads a report does so because its contents are of concern to him, and his interest may therefore be assumed. Actually, however, no report writer should neglect to make his report as interesting as possible. "Young men," writes one executive, "mistakenly assume that everyone who reads reports is as interested as the writer . . . The fact is that many men who are important to a project do not realize its importance, so the central idea must hit them quickly and hit them hard."

Those who read reports are busy men. Many problems are competing for their time. It is inevitable that the project which is presented in a dull manner will be less likely to get attention and action than one in which the interesting aspects are quickly brought out.

This does not mean that a report should be sensational in its bid for attention. The effort to attract attention should not and need not interfere with sound, logical organization. The assumption that the reader's interest stems primarily from the report's practical value to him is completely sound. What is necessary, then, is that the material shall be so organized and presented that the reader can see, quickly and easily, where his own concerns are involved. Your skill in bringing vital matters to immediate attention, yet at the same time making the organization of your reports logical and coherent, will do much to determine whether your reports arouse interest; and your mastery of effective style, a subject discussed in an earlier chapter, will do much to determine whether you can hold interest once you have aroused it.

Omission of Unnecessary Material

Coleridge once said that the art of writing consists largely in knowing what to leave in the inkwell. This comment truly applies to reports, for their effectiveness depends not only on including what should be included, but also on excluding everything that can be omitted without loss. If a report includes extraneous points or goes into excessive detail, it is hard for the reader to grasp and remember the facts of vital importance.

The difficulty of omitting irrelevant matter is increased by the fact that an investigation usually brings to light considerable information that is not needed. An inexperienced writer hates to see any facts go to waste, and hence is tempted to include everything.

A case in point was a report written to determine whether it would be advisable to poison grasshoppers on a certain tract of land, and to present a plan for poisoning them if it was found that doing so was justified. Along with the essential facts—the expense of poisoning, the damage that would be done to crops if no action were taken, the amount and kind of poison to use, the time and method for using the poison—the report contained nearly three pages on the life cycle of the grasshopper, including a detailed description of how it sheds its skin. None of this was needed except those facts which showed that the recommendations for poisoning were correct. The writer should not have let his own interest in grasshoppers tempt him to include information which was extraneous to the purpose of the report.

Freedom from Bias

A good report is free from bias. If it becomes apparent, when you write a report, that you have been too eager to reach a preconceived conclusion, your reader will lose confidence. Obviously you will sometimes have, at the beginning of a project, a strong expectation as to the probable outcome. Nevertheless, you should plan your investigation so that you do not overlook any evidence that might run counter to the conclusion you expect to reach, and

should present your findings in such a manner that the reader can see that you have been scrupulously fair. To be sure, an unbiased attitude may not be easy to achieve. It may be hard to force yourself to present evidence against a project that has aroused your enthusiasm. In the long run, however, no one in technical work will profit by giving way to prejudice or by permitting even the appearance of prejudice.

Objectivity

Closely related to freedom from bias is objectivity. Reasoning in a report should be done on the basis of concrete facts. The difference between a subjective and an objective approach may be seen if you will consider the question of whether those who work around electricity are likely or unlikely to take precautions against being shocked. It is possible to reason that such workers are intelligent; that they know electricity is dangerous; that they realize that one cannot avoid occasionally touching a wire one does not intend to touch; that it takes them only a few moments to pull a switch and cut off a current; that they are paid for their time and therefore lose nothing by taking precautions; and that therefore it is safe to assume they will do what is necessary to avoid needless risks. None of this, however, is objective. To approach the question objectively one would contact a reasonable number of electricians working on lines that usually carry power, and learn whether they had actually taken precautions against shock. The findings might be decidedly different from the conclusion reached by subjective methods.

Even on questions that seem to be matters of taste, it is possible to make a report objective by getting a cross section of many opinions. If the question were, for example, which of two methods of pasteurizing milk produced a product with better flavor, a single person's opinion might be subjective; but by having a substantial number of people taste the two products, it would be possible to obtain the objective fact that 70 per cent of those who had tried both preferred one over the other.

Clearness and Conciseness

When asked about the respects in which reports are most likely to need improvement, most readers name clearness and conciseness near the top of the list. Clearness, of course, is a result of many causes. Among those causes are adaptation to the reader and effectiveness of organization, which have already been discussed. Clearness is also promoted by proper use of topic headings and by introductory, transitional, and summarizing passages. That skillful construction of sentences also affects clearness is obvious. Less likely to be remembered, and surprisingly important, is the matter of paragraph construction. As you begin each paragraph, you should know what its topic is to be and should limit its contents to that topic. Also, you should not forget that by means of an easily identified topic sentence it is often possible to draw the details together and make it clear why they are placed in the same paragraph.

Conciseness, too, is important in view of the pressure under which those who read reports usually work. One government official, during World War II, instructed his staff that no one was to send him any report more than one page long. He did not have time, he insisted, to read more than one page about anything. His attitude seemed drastic, but there is no doubt that writing a long-winded report is one of the surest ways to create annoyance. The methods of achieving conciseness explained in Chapter 3 should always be utilized during the writing of a report.

Restraint

Proper restraint is an effective means of gaining confidence in your reports. Restraint is a matter of both substance and style. The overstatement that results from excessive enthusiasm is unlikely to carry conviction. Especially in the matter of drawing conclusions from evidence, a reserved, scientific attitude is needed. To realize how justified this caution may be, you need only recall the extravagant hopes raised with the discovery of new insecti-

cides, weed killers, and medicines, and the limitations of each discovery that appeared as time went on.

Restraint in style should lead you to avoid such words as *astonishing, tremendous, revolutionary, miraculous, shocking,* and *flagrant.* Often the best way to avoid such terms is to use specific facts. You would do well, for example, to avoid such an expression as *a tremendous increase* and say instead *a material increase* or *a substantial increase;* but it would be even more effective to say *a 75 per cent increase* and let the reader decide whether this percentage should be considered *tremendous* or *substantial.*

Impersonality and Appropriate Degree of Formality

In some of the simpler situations, especially when it is written in the form of a letter or memorandum, a report may be personal in style. Most of the time, however, impersonality is more appropriate because the facts are more important than the writer. If you write, "*I* tested the samples under varying conditions of temperature and humidity," the fact that you performed the tests personally seems to be considered significant; but if you write, "The samples were tested under varying conditions of temperature and humidity," you center attention on what was done rather than on who did it. Of course, if the fact that you performed the tests personally is important, that alters the situation. In that case, "I personally tested the samples . . ." or "The samples were personally tested by the writer under . . ." would be perfectly appropriate. Most of the time, however, impersonality is more likely to emphasize the facts that are really important.

Formality as well as personality must be considered. In many situations, where a report is of only temporary concern and is made to a person with whom you enjoy an informal relationship, formality would seem unnatural. However, if a report is likely to become a matter for future reference, or if it is likely to pass into the hands of others besides the immediate reader, it should not be too informal.

Colloquial (conversational) language, including shop jargon,

is usually inappropriate. In a report, a laboratory is a *laboratory*, not a lab. A *microphone* is not called a *mike*. A *telephone* is not a *phone*. One *telephones* to a person rather than *rings him up*. A procedure is *satisfactory* rather than *o.k.* One prefers *The action was premature,* or *The action was taken before the proper time* to *They jumped the gun;* and it is better to say that the reader *may be confident of the results* than that he may *bank on the results.*

Contractions are colloquial and are usually avoided. Often it is best even to go so far as to avoid the first person. In the report of a committee it might be more suitable to write, "The committee recommends that the association. . ." rather than "We recommend that you . . ."

A formal, impersonal style becomes especially desirable on the frequent occasions when different sections of a long report are written by different people. If everyone writes a personal, informal style, the style of individual sections may vary so much as to be incongruous; if everyone writes impersonally and with reasonable formality, there will be no perceptible difference in style as a reader passes from one section to another.

In avoiding excessive informality you should not go to the opposite extreme, however, and use a style that is pompous. Just write with enough dignity to suit the occasion. If you expect to hold a professional position, you will find it necessary to learn how to use language that is correct without letting your style become stiff and awkward.

Self-Sufficiency

A report should be self-sufficient. Many writers fail to achieve this quality because they do not realize the need of achieving it. Since the person whom they address in a report is usually the person who requested them to write it, they assume that he understands the full circumstances. It never occurs to them to tell to the reader facts that he may have originally told to them.

If you will use your imagination, however, you can see that a report should contain enough information to be intelligible even

to a person who knows little or nothing about the situation which caused the report to be written. The reader usually has more on his mind than the single report. There may be a considerable lapse of time between the date when you are asked to write a report and the date when you submit it, and many details may have been forgotten by the person who made the request. Also, your report may be read and set aside; but weeks, months, or even years later it may be taken up again and acted upon. And finally, the person who requested it may pass it along to someone who lacks his own familiarity with the subject.

In view of all this, a report should include enough information so that regardless of who reads it and regardless of the time and circumstances (for example when the reader is away from his offices and hence from his files) it can be read with full understanding.

EXERCISES

EXERCISE 1

Rewrite each of the following specimens so that the ideas it contains are expressed with the restraint that would be appropriate in a report. You may supply, if necessary, the objective facts that desirable changes would demand.

1. The cost of living skyrockets for the migrant workers when the greedy operators of campside stores victimize them by jacking up the price of food as high as the traffic will bear.
2. This sensational new method of extracting oil from the soy bean is made possible by revolutionary extraction machinery.
3. Though the orthodox power plant for a fair-sized city is as immovable as Mohammed's mountain, these floating stations can whip into a harbor and electrify a city with amazing rapidity.
4. If this method is adopted, tireless, flashing pistons will bring welcome relief to the aching backs of the workers.
5. Believing that dramatic showmanship could make the training program more understandable, we have used eye-arresting photographic slides.
6. Recently there has been an appalling reduction of the margin between output and peak capacity. To restore this margin will require tremendous expenditures and fantastic tonnages of steel and other materials.
7. Uncle Sam's snowmen gnaw through the roads' heavy, white blan-

kets with a rotary plow that chews up 2000 tons of snow per hour; and when the rotary bogs down, agile cats scramble to its assistance.

8. What happens to the parts of a car on the road is nothing compared to what happens in the torture chambers of a fatigue-testing laboratory, where fiendish instruments give the parts a beating to end all beatings.

9. Competition in this business is terrific. New discoveries are constant, and sales departments are kept hopping to find new markets in which to peddle the products that research scientists have dreamed up.

10. During this period, the industry was the target of vicious attacks by demagogic political mountebanks who were attempting to distract attention from their own efforts to prey upon the public.

EXERCISE 2

Rewrite each of the following specimens so that the language is suitable for a report which is written in a formally correct style rather than in a personal and informal manner. (There is no intention to imply that every expression you eliminate is wrong under all circumstances, but many an expression that is acceptable in an informal situation is undesirable in a formally written report.)

1. By giving the local manager the third degree we learned that he had bawled out the foremen until one of them finally blew his top.

2. The repair crew had to hoof it for three miles to reach the scene of the break, and when they finally arrived they fouled up the repair job.

3. On the basis of all the dope we could get, I'd say that you can't count on any improvement before spring.

4. Production will be held up until we can iron out the bugs in the newly designed machinery.

5. Some of the land-owners are getting set to hold us up for the privilege of crossing their land.

6. The Olson wax people have come up with a new method that looks like a sure thing to hit the jack pot.

7. We urged him to lay it on the line, but we figure that he has held out on us.

8. Every time the engine was revved up it conked out on us.

9. After the power line went down, it was four o'clock before we could get the juice turned on again.

10. What apparently got him down was that if he did what would please the brass, he had to listen to constant griping from his staff.

EXERCISE 3

One of the first necessities when you write a report that expresses the results of a special investigation will be to analyze the problem. As explained in the text, this means that you must figure out what questions the report must answer if it is to serve its purpose. Choose one of the subjects below, and draw up a list of questions to which

you think a report should contain answers. Break the large questions down into smaller ones which would need to be answered before the large questions could be answered. It will probably be desirable to make the subject more specific; that is, to limit it to some specific local situation that you know about or can learn about—for example, the abatement of the smoke nuisance caused by the heating plant in your own school.

1. Smoke abatement in your community or in some local factory or heating plant.
2. Choice of a method for treating the water used by some large establishment to remove its hardness or to improve it in some other manner.
3. The question of whether some manufacturer shall make a certain part for his product (for example, seat coverings for trucks or tractors) or hire it made. (Whether to hire some service performed or perform it could be used as an alternative to the subject based on manufacturing a product.)
4. The choice of a lighting system for street lights in some district with which you are familiar. (Lighting a new or remodeled gymnasium or baseball field would be equally suitable.)
5. The material to use for the construction of all or part of some building of a type with which you are familiar—for example, a dairy-processing plant.
6. The advisability of giving acoustical treatment to some building or some portion of a building with which you are familiar and in which noise is a problem.

EXERCISE 4

The purpose of this exercise is to encourage better organization by causing you to organize the same material in more than one manner. Once a person realizes that more than one organization is possible, he is less likely to use the first system that he thinks of, and more likely to work out the system which will make it easiest for the reader to find answers to the questions that the report is intended to answer.

The table below tells in simplified form the effect of mixing three different substances with soil for the purpose of improving the soil as a subgrade for highways. So far as the given facts permit (some factors that would affect the results are not given) make outlines for the following occasions:

1. An outline for a report that draws together the facts about each substance.
2. An outline for a report that emphasizes the results desired, and shows the effect of each substance if it is used in an attempt to produce each result.

3. An outline for a report that shows which substance or substances merit further testing and which should be dropped, and that provides reasons for the decisions.

EFFECTS OF MIXING OTHER SUBSTANCES WITH SILTY CLAY SOIL

Effect Desired	*Effect Caused by Using*		
	Portland Cement	Calcium Chloride	Dehydrated Lime
Greater ease of compaction	less ease	greater ease	less ease
Greater strength of soil	more strength	no effect	more strength
More resistance to capillary rise	more resistance	lower resistance	more resistance
More resistance to volume change when moisture content rises	more resistance	more resistance	more resistance

8

Nonformal Reports—Their Variation in Form and Purpose

The preceding chapter dealt with reports in general. It next becomes necessary to learn about how reports vary in form and purpose. It would be convenient if it were possible to establish a neat set of classifications into which every report would fit. This is done by some government bureaus and by some great corporations or divisions of such corporations which print their own manuals on report writing. These organizations work out their own types to suit their needs and identify these types by whatever names they consider appropriate. The present book, however, must be used by readers who will write reports for a wide range of employers. Therefore, though the terminology and the list of types are as near standard as varied usage permits, there will be no attempt to establish a rigid set of classifications comparable to a botanist's classification of plants. Rather, the discussion will merely attempt:

1. To give you a better understanding of the wide ramifications of reports in form and purpose.
2. To make the commonest type names familiar enough that if you are asked to write a report of a certain type and given no further guidance, you will know what is probably expected—and will also realize how much latitude you enjoy.

3. To encourage resourcefulness and self-confidence, so that if you are asked to write a report but are given no instructions as to the type wanted, you will decide upon the question of type and form with assurance.

In order that discussion and examples may be better integrated, "nonformal" and "formal" reports are discussed in separate chapters. The term *informal reports* is not used because "*in*formal" is an inaccurate description of a great many reports that do not contain all the divisions usually included in "formal" reports.

REPORTS MADE BY FILLING IN A BLANK FORM

Many reports are made by merely filling in the spaces on a blank form on which headings are already provided. This can happen when, in a particular organization, some activity becomes so routine that the information about it will always occupy approximately the same amount of space and will always be covered by the same headings.

Frequently the information filled in consists merely of figures. In this case making the report is not a problem of writing at all. Yet the blanks provided must sometimes be filled in with ordinary prose. On these occasions the printed forms are used to make sure that the organization of the reports will always be the same, to prevent the writer from overlooking any routine point which it is essential to consider, and to discourage any tendency to make the report too long. Such reports are good because those who read them always know exactly where to find what they are looking for. Their main limitation is their lack of flexibility. Sometimes flexibility is increased, however, by a section for comments.

Writing a report on a blank calls for no skill except the ability to observe accurately and to write clearly, accurately, and concisely. The style should be reasonably formal in a report that will become part of some organization's permanent records, but may be extremely informal in a report dealing with a matter of only temporary concern. A report made on a form appears on page 149.

REPORTS IN THE FORM OF LETTERS

There are many occasions when the natural form in which to make a report is a letter. No form except the memorandum is so widely used. Most of what you need to know about reports in the form of letters can be learned when letters are discussed later in the book, for ordinarily, the practices that make a letter good in other uses make it good when it serves as a report. The form is the same except, perhaps, that the use of a subject heading is more likely to be desirable when a letter is a report. In language, the letter serving as a report may not call for quite so much concern about tone, negative material, and good will, for the reader is likely to be in your own organization. However, if a letter is used in making a report to someone on the outside—a client rather than an employer—tone and good will are as important as in any other letter.

A letter can be used to report on almost any type of subject. Letters that serve as reports often run longer than the average business letter. Long or short, a report in the form of a letter should be just as carefully organized as any other piece of writing of comparable length and complexity. Such devices as topic sentences for paragraphs should not be neglected. Indeed, in a letter report of two or three pages, it may be desirable to use internal headings as in any other report.

Reports in the form of letters can vary widely in formality. When addressing a close associate, you might often be justified in making your style extremely informal. There are occasions, however, when your sense of fitness—your imagination in visualizing how the report will be used and whom it might eventually reach—should make it apparent that more dignity is indicated.

One final caution is needed regarding the use of the letter form for a report: If the subject is likely to be of permanent concern, the letter form is sometimes undesirable because it may cause the report to be filed along with ordinary correspondence rather than as part of the organization's permanent records.

REPORTS IN THE FORM OF MEMORANDA

In many ways a memorandum resembles a letter. Like the letter, it is one of the forms used most frequently. Like the letter, it is not usually used for a report that is long or one that calls for the use of formal tables, drawings, or any type of stiff or bulky materials. Like the letter, it may range from informal to formal in style, with the informal being more frequent.

The memorandum differs from the letter, however, in occasion and form. The letter is often used to report to someone outside the organization, or someone at a distance; the memorandum is strictly for use within the organization—for communication within a department or between departments, but always within the organization. Consequently, a memorandum may be unceremonious in style and may sacrifice niceties for conciseness. This does not mean that bluntness and tactlessness are to be condoned. Tact and diplomacy help to get results in dealings within an organization just as they do in outside contacts.

Originally the term "memorandum" implied something of a temporary nature. This is no longer true; yet there are times when a memorandum is written to make immediately available some information that will later be included in a longer, more formal report. Some of the largest corporations in the nation make this use of the memorandum.

For use in writing memoranda, printed forms are usually available. If no form is provided however, you should type certain information at the top of the first page, using the following form:

To: (name and if desirable the position of the receiver)
From: (name and if necessary the position of the writer)
Subject: Date:

THE PERIODIC REPORT

The types of report discussed thus far have been distinctive because of their form. A periodic report, however, is distinctive

because of its purpose. It is merely a report made as a matter of course at routine intervals, frequently but not solely for the purpose of keeping records. In its simplest form it may be made by filling in a printed blank—as when a weekly report is made on accidents, or production, or the percentage of production failing to pass inspection. It may also be made as a letter or a memorandum. From these simple forms it may range to the annual report of the board of directors to the stockholders of a great corporation —a long, elaborate, illustrated production printed and distributed by the thousand.

In any given situation the periodic report tends to settle into a fairly well established form because the points it must cover are usually similar on successive occasions. Consequently, unless you are the first person to fill a position, you will often be able to pattern your periodic reports after those written in the past. Thus the problem of organization, even in a long periodic report, may not be severe. It pays, however, to be always on the watch for special points that call for unusual treatment; and even when a report follows an established pattern, the difference between good and bad writing can affect its quality. And finally, you should not neglect to change the established form if you find that it can be improved in some way and if you are in a position to make changes.

THE PROGRESS REPORT

A progress report is just what the name indicates—a report on the progress of some project. It may take any form, from a simple letter or memorandum to a full scale formal or even printed report. Progress reports may sometimes be made at regular intervals, which would make them periodic reports as well as progress reports. On the other hand, they may be made merely when the progress on the project makes it seem fitting to report on what has been done—when, for example, some stage of the work has been completed. The distinctive fact about a progress report is that it deals with a venture which will eventually be completed.

In this respect, even when periodic, it differs from other periodic reports.

The very nature of progress reports affects their organization. In a broad way the reader of such a report always wants to know what has been done since he last received information, what is the present status of the project, what is now being done, and what are the plans and outlook for the future. Information on these points would properly include comment on any unexpected developments as well as any other facts that the reader would wish to know.

In a progress report on an investigation, it may be necessary to decide whether to include some or all the information that has already been obtained. The answer to this question varies with the occasion. If some aspects of the investigation are complete and the information would be useful, there is no reason to withhold it. If there is a chance, however, that the partial information would lead to hasty, and possibly erroneous conclusions, it might be well to hold back your findings until you can give all the information at the same time.

It has been mentioned that progress reports may fall naturally into a past, present, future pattern. This need not, however, be the main, over-all division of material. If the report deals with a complicated subject or with the progress on several projects, it is frequently advisable to base the main division of the report on subject matter, so that all the information on any one aspect of the subject will be together. The past, present, future pattern might still be applied to each separate section.

When it is necessary to write a series of progress reports on the same project, the organization of all of them should be as nearly parallel as the facts permit.

THE LABORATORY REPORT

One of the commonest purposes of a report is to give the result of work done in a laboratory. Sometimes this work consists of

merely running tests, the results of which are stated without reference to the reason the report was requested. On other occasions the report must not only tell the results of laboratory work, but must also apply them to some specific problem and even make recommendations as to action. In this latter case, the ordinary laboratory report forms may be discarded in favor of some other form more suitable to the specific occasion.

Most of the time, however, a laboratory report fits naturally into a form that has become fairly well standardized. Though there is some variation in different organizations, the following list covers most of the divisions a laboratory report is likely to contain:

Title Page, or merely the title
Object (often called Purpose)
Theory
Method (or Procedure)
Results
Discussion of Results
Conclusions
Appendix
Original Data

It is not always necessary to include all these divisions. Much of the time there will be no need to explain the theory; and if the method or procedure has become standardized, the section dealing with it may also be dispensed with. The results, of course, would always be given, though they might be expressed in some other form than words. There may or may not be reason to discuss the results; but even when such discussion is needed, it may be placed in the section "Results" rather than in a separate section.

Sometimes there will be no need for a section on conclusions, for the results themselves may be the only conclusions arrived at. The section on conclusions would be needed, however, when consideration of the results has led to convictions that go beyond the results themselves. For example, the results of a test of samples of a type of steel might consist of no more than the facts about its tensile strength and other qualities. Consideration of

those results might lead to a conviction as to whether the steel would be suitable for some prospective use.

The appendix need not be used unless it is deemed advisable to add materials omitted from the main report because they are too detailed, too technical, or too bulky to place earlier. As for "Original Data," much of the time the full data are included under "Results." If the full data seem needlessly detailed, however, the figures under "Results" may be reduced to mere averages and the full data placed at the end to permit verification, or else omitted.

The arrangement as well as the selection of points in a laboratory report may be varied. The order listed is logically sound, but for the convenience of the reader changes may be desirable. In particular, conclusions may sometimes be placed early in the report, perhaps following the statement of the purpose, for the conclusions are especially important and are likely to be what the reader wants to know at once. In fact, some of those whom a laboratory report reaches may read the conclusions and nothing else.

To sum up: If given a specific form you should follow it as closely as possible, for the reader will grasp the contents better if they are placed in a form with which he is familiar. If no particular form has been requested you may use the heads listed to the extent that you need them. The result will be standard in form so far as any general standard exists.

REPORTS THAT FIT INTO NO CLASSIFICATION

In addition to the types of report discussed, there are many varieties that fit into no special classification, especially as to form. They are not made on blanks; they are not letters, memoranda, or laboratory reports; and they do not contain all the parts usually found in formal reports—a type to be discussed in the next chapter. This often causes uneasiness to inexperienced writers, who often worry too much about form and too little about the reader's needs.

There is no reason to be unduly concerned if you are asked to write a report and none of the recognized types seems to fit the occasion. Merely gather the information that you believe to be needed, decide on the headings necessary to accommodate this information, and present the information under these headings in a simple, straight-forward manner. Whether the result can be classified as any particular type of report is inconsequential if you succeed in giving the reader the information he needs in a clear and easily understood manner.

EXAMPLES OF NONFORMAL REPORTS

The following reports are not offered as models. Moreover, though they include most of the types discussed, they are not intended to encourage you to draw sharp boundary lines between types. To draw such lines would be unrealistic.

The real purpose of including examples is in part to make the whole business of report writing more concrete. Further, it is probable that among the specimens you will find some devices that you can utilize in your own report writing, even though the reports in which they occur may not serve as patterns to follow in full. Perhaps the most important function of the examples, however, is to show how little regimentation exists in report writing. The more you have experience with reports, the more you will realize that good report writing is a matter of intelligent analysis of the reader's needs, effective organization, and clear, concise style rather than a matter of unthinking compliance with rigid specifications. Accordingly, you should feel encouraged to use your own judgment when you write reports.

As you study the examples, remember that no report writer ever achieves perfection; and consequently, be on the alert for alternative methods of presentation by which effectiveness might have been increased.

SPECIMEN NO. 1*

Report Made by Filling in a Form

The report on the opposite page was made by filling in a form. The style is informal, as fits the occasion. The purpose was to give information obtained on a field visit. Plant and field visits are the occasion of a great many reports, which may be written in various forms but are unlikely, whatever their form, to be very formal.

Note that the use of a form to fill in makes it very difficult for the writer to overlook any point that needs attention, and makes it certain that all reports of this type will be similarly organized. Thus the reader will always know exactly where to look for each kind of information.

* Courtesy of International Harvester Company.

FIELD REPORT

PROJECTS 10 & 11 -A184A, MOWER STANDARDIZATION

Date: April 3, 1951 Place of operation: C & M Ranch - Calexico, Cal.

Day's total hours in operation: Acres or Rods mowed (check which) x 700

Cumulative total incl.: 4/3/51 230 Hrs.

Machine used: QAMo 11 & 12 Mower on Super A #107 (11-A184A) Mounting. Trailer (10-A184A)

Field Conditions.

Early cutting - On the light side, but good. Not weedy.

Baling this hay.

Machine Action:

Operator thinks machine has less vibration; in fact he thinks so much of mower he is cutting hay on contract basis @ $.40 per acre, and cuts between 35 and 40 acres per day (12 hr. day). Mower pitman has thrown 2nd rivet from ball bearing end. That's all. Blocks have ceased to run. Tractor clock stopped at 170 hours. P.T.O. at 50 hours. This is no place for such delicate instruments. We'll get accurate hours and acreage because the operator gets paid for acres cut. Mower operating in 3rd gear. Shield under lower sheave bent toward sheave, but not touching sheave. Operator has "hung" rig four times on border.

Changes made, if any:

Hinge pin clevin broke loose from end of pipe (poor weld). Repaired by operator. Hinge pin worn so much at groove in 1-15/16 dragbar, that bar could not be held in proper position -- turned pin 180° around and wired for hardened pin.

Changes recommended, if any:

Comments:

The grey iron casting seems to be satisfactory as it didn't break when clevis became loose and allowed whole mower to fall to ground. Also, this casting held the whole weight of tractor while hung up on a border.

Signed: E. F. Huddle

SPECIMEN NO. 2*

Report in the Form of a Letter

The following report deals in letter form with the same field visit that occasioned the preceding specimen. The letter was written first, but the form report was also needed so that it might be filed with other, similar reports and thus could be used more easily later. The letter is more flexible than the form report, and might have been used to keep the receiver generally aware of the events of the trip as well as aware of facts about the machine observed.

The reader is obviously familiar with the precise subject from past experience. Even so, the letter would have identified the project and machine more definitely except that the form report was to follow and would serve as the permanent record.

The writer is on extremely familiar terms with the reader, to judge from the informality of his style. The formality of letter reports may vary as widely as the formality of letters in general.

* Courtesy of International Harvester Company.

Calexico, California
April 3, 1951

Advanced Engineering Department
McCormick Works
Chicago, Illinois

Attention: Mr. R. R. Raney, Chief Engineer

Dear Russ:

Ernie and I arrived here Sunday as per schedule and have followed the Super "A" mounted mower for two days.

This mower has been operated every day since it was started three weeks ago except Sundays. It now has twenty days of cutting behind it at an average of 35 acres per day.

The only mishap was that the clevis parted from the end of the support-pipe member where they were welded. Ernie recalls that these clevises were replaced, so welding onto a weld is not so good. The whole mower fell off, but did not damage anything, not even the grey iron casting.

In assembling the hinge pin back together, the operator twisted the head off the big bolt. This, you will recall, had the head welded to a piece of cold-rolled to make a bolt structure.

One rivet has let loose in the pitman at the fishplate end, in the wood. This was replaced. No pitmans have broken to date.

The clocks on this rig have both ceased to operate. This is not the place to use such delicate instruments. The clock for the tractor stopped at 170 hours and the P.T.O. clock stopped at 50 hours. To date the mower has operated 216 hours, and has cut 630 acres.

Will make a regular report when I return to Ontario tonight.

Hope you have received the third roll of film showing the mower in operation here in Calexico So much for now.

Very truly yours,

(signed) E. F Huddle

SPECIMEN NO. 3

Report in the Form of a Memorandum

The following report is written as a memorandum. The subject was one of immediate interest rather than of long range concern, as is often true of memoranda.

It presents information as to why a certain mechanism has failed to operate properly. Its information is, in general, arranged in a chronological and hence inductive order. It carries enough detail to make the case clear to any reader. If there should ever be reason to refer to it after the passage of considerable time, the record is complete enough to answer all questions.

TO: W. L. Chester, Manager
Engineering Department

FROM: H. C. Gustin

SUBJECT: Trouble at South Hills Steam Station DATE: Sept. 13, 1948
September 9, 1948

As requested by you, an investigation has been made of the trouble at South Hills Steam Station on September 9, 1948, when Unit 2 tripped on low vacuum.

At the time the trouble occurred, the Unit was carrying 70 mw and both circulators were being put on low speed in order to test operation of the unit under such conditions. During the previous week, when Unit 2 was operated for several hours with both circulators on low speed while a diver was inspecting tunnels, no operating difficulties were experienced.

Each circulator motor has three breakers: a low speed breaker, a high speed breaker and a truck switch. The truck switch is used to start and stop the circulator. Either the high speed or the low speed breaker is closed at all times, except for short intervals during a change of speed. In going from low speed to high speed the change-over is practically instantaneous, but in dropping back from high speed to low speed a timer relay is used to introduce a delay of about 9 seconds between the opening of the high speed breaker and the closing of the low speed switch in order to allow the circulator to slow down to approximately half speed

Mechanical trouble in the timer relay of Unit 2 East circulator motor appears to have been the primary cause of the trouble. A cotter pin had apparently not been properly inserted The following is the probable sequence of events:

(1) The Unit 2 West circulator was dropped back to low speed without incident.

(2) When the controls were operated to lower the speed of Unit 2 East circulator, the high speed breaker opened properly and the timer relay circuit was energized, but due to mechanical trouble, the timer relay did not complete the circuit to close the low speed breaker. This left the circulator motor de-energized (the high speed and the low speed breakers were both open) but with the trunk switch closed and the discharge valve open. The East circulator slowed, and probably started to rotate backwards, driven by the West circulator. When the low speed breaker pilot light remained dark, indicating that the low speed breaker had failed to close, the operator naturally assumed that the light was burned out.

Though topic headings are not always necessary in a memorandum, they are often helpful. Note that on this occasion the writer has used topic headings for conclusions and for recommendations. Thus he enables a reader who does not want to read the full details to discover the most important material with a minimum of effort.

(3) When the East circulator was left de-energized and diverting some flow from the West circulator, vacuum started to drop on the main unit. The throttle tripped at about 24 inches of vacuum.

(4) The proper and normal procedure was to put both circulators back on high speed in order to increase the flow through the condenser. Apparently an attempt was made to put the East circulator back on high speed. The high speed breaker closed, energizing the motor on the high speed drive at a time when the pump was probably turning backwards. The overcurrent relays operated to relay and lock out the trunk switch. The west circulator was returned to high speed without trouble.

(5) The Unit 2 East circulator low speed breaker was closed manually. After the timer relay was repaired, the high speed - low speed controls operated correctly.

Conclusions:

The trouble was caused by mechanical failure of the high-speed to low-speed timing relay in the Unit 2 East circulator motor circuit. All circulator equipment appears to have operated as would be expected with such a failure. There does not appear to be anything fundamentally wrong with this part of the circulator control circuit. The trouble may have been complicated by the tripping of the throttle at 24 inches of vacuum instead of the expected 20 inches.

Recommendation:

Investigation should be made of the possibility of removing the timing relays from the circuit. From the electrical standpoint there does not appear to be need for a time delay between the opening of the high speed breaker and the closing of the low speed switch. It is recognized that such a delay may be desirable, but not necessarily essential in order to prevent harmful reverse-torque mechanical stress in the pump parts.

H. C. Gustin
(Signed)

HCG:mh

CC: Ford and Carlson
John Williams
H. A. Scott
C. W Black

SPECIMEN NO. 4*

Report in the Form of a Memorandum

FLAME TREATMENT OF HAY

The following report, which deals with a visit to an experiment station by a representative of a commercial corporation, is essentially a memorandum but ends not only with a signature (to give it authority) but also with the complimentary close of a letter. This is a good example of the fact that professional men who write reports are not much concerned with academic distinctions about classification on the basis of form.

The report opens with characteristic introductory material—information as to the purpose of the report and the source of information. Thoroughness is evident when the writer tells with whom he talked, for this information would be desirable as the project was followed up later.

As one reads, it quickly becomes apparent that the method is strictly inductive. The first numbered list presents the facts and the second the conclusions. Placing this material in numbered lists helps to set off the findings from the incidental material in the report.

* Courtesy of International Harvester Company.

MC CORMICK WORKS

Chicago, Ill.

Department
District Office General Office
or Works

May 22, 1951

For Mr. J. R. Orelind
14th floor

Your Letter

Subject FLAME TREATMENT OF HAY
or File No.

On May 16, Mr. F. F. Huddle and I visited Purdue University for the purpose of obtaining factual information about the flame treatment of hay. We talked to Dr. H. J. Barre and Mr. Don Burrough of the Agricultural Engineering Department, and to Dr. F. W. Quackenbush and Mr. A. E. Purcell from the Department of Agricultural Chemistry.

The primary object of the work done at Purdue University has been to determine the effectiveness of flame treatment in preserving the carotene content of alfalfa hay. The effect on the moisture content or drying time was regarded as incidental by these investigators, but some observations were made in this direction, as a means of evaluating the practical possibilities of flame treatment. The major factual data disclosed during this conversation is as follows:

1. A high degree of heat applied in any manner for a short time will destroy the enzymes which are responsible for the destruction of carotene. This corresponds to the blanching process which is applied to fruits and vegetables before canning or freezing. The flame treatment was decided upon as being most practical, although good results were obtained in the laboratory by means of hot plates, infra-red rays or steam.

2. The carotene content is preserved fairly well for about twenty-four hours after treatment, but after this time, deterioration sets in quite rapidly. After forty-eight hours, the carotene content of flamed hay is no different than that of unflamed hay. Sunshine is a major deteriorating agent in field drying.

3. Flamed hay, lying out in the open field, is more vulnerable then unflamed hay because rain, at any time after flaming, bleaches out the flamed hay and results in a very inferior quality material.

4. Flamed hay is noticeably darker than unflamed hay.

5. The leaves of flamed hay dry much more rapidly than the leaves of unflamed hay.

6. The stems of flamed hay dry out at the same rate as stems of unflamed hay.

Several interesting questions may be considered in connection with the manner of presenting the material. After studying the report carefully, try to decide:

1. *Exactly* what problem was the writer's company concerned with when it sent him on this visit? Where does the first clear identification of this problem occur?
2. Does the difference between the company's problem and Purdue's problem stand out distinctly from the beginning? (The reader was presumably familiar with the situation, but try to consider the possibility of some other reader, or that of any reader a year or so later.)
3. In each list, which paragraphs are of primary interest to the writer's company and which are of incidental interest only? Do the facts and conclusions of primary interest stand out?
4. So far as the company's problem is concerned rather than Purdue's, are the conclusions about flame treatment of hay mainly positive or negative? Could the answer to this question be made easier to find?

After discussing these facts in relation to our problem of designing a machine for reducing the drying time of hay for field-baling, we came to the following conclusions:

1. The improved quality of hay obtained by flaming is achieved only at the risk that the hay may be severely damaged if rained upon in the drying period.

2. Flamed hay should be removed from the field and stored within twenty-four hours after treatment, if the carotene content is to be kept high. The Purdue people felt that a barn drying installation would be a very desirable auxiliary to flame treatment, to insure the success of the application.

3. Since the leaves of flamed hay dry so much more rapidly than the stems, the crushing process becomes an essential part of the total process, for it is only in this way that the stems can be made to dry any more rapidly than they now do in the case of unflamed hay.

4. It has been demonstrated that not only does crushed hay dry from 25% to 50% faster than uncrushed hay, but also that crushed hay which has been rained upon also dries out more rapidly than uncrushed hay which has been rained upon, and the damage to the feeding value is no more extensive. Crushing is therefore, a less hazardous process than flaming or crushing and flaming, and is therefore, more foolproof in the hands of the average operator.

The work at Purdue is being continued this summer. We will keep in touch with them and report any significant developments which take place.

Yours truly,

R. R. Raney
Chief Engineer
Advanced Engineering

SPECIMEN NO. 5*

Periodic Report

The following periodic report, an extremely simple type, was written at a branch operation of a large national corporation. It was sent to the division manager for his use in preparing one of his own reports. The same subject was covered in a much fuller version for certain other users. The purpose here is to keep the main office aware of the general activities of a single department of the branch for a single month.

As other examples of periodic reports show, such reports can vary in length and complexity and may cover either routine business or special projects.

A long, fancy annual report of a board of directors would also be a periodic report, but no example of such a report is included because most men in technical positions will never have to write one.

* Courtesy of General Electric Company.

EMPLOYEE AND COMMUNITY RELATIONS DIVISIONS

Training and Program Development Report for January, 1951

During the week of January 15 the Supervisor's 40-hour Training Program was presented, with 42 participating. A total of 80 supervisors, currently enrolled in PMS, will complete their conferences in February.

At the request of the "S" division the 17-subject 8-hour Non-Exempt Training Program was again presented with 30 employees in attendance.

A group of 36 Supervisors-in-Training attended a special meeting to discuss the spirit and intent of the GE-HAMTC Agreement.

Two issues of the Hanford Words SAGE were distributed during the month. Nine additional Handbooks were distributed to new supervisors A total of 158 employees were given Orientation during January.

The entire Training and Program Development Staff was trained by R. C. Holmquist in the company-wide program, "HOBSO." Three special senior-management meetings were held, at which time the appreciation version of HOBSO was presented.

SPECIMEN NO. 6*

Periodic Report of Progress

The following progress report was made on a prepared form, which causes the information to fall into a past, present, future pattern. Like many progress reports it is also a periodic report, for it is one of a series and a similar report is made monthly.

This report was made for a research agency that must keep track of a large number of projects. The agency itself publishes a monthly progress report which summarizes the contents of the reports on the individual projects. Use of a standard form to fill in makes it sure that all those who report on the various projects will use the same form. Flexibility is made possible, however, by the inclusion of a section for remarks.

* Courtesy of University of Idaho Research Council.

MONTHLY PROGRESS REPORT SPECIAL RESEARCH PROGRAM

Project No. 29 Peeling and Incising Machine for Fence Posts and Timbers

For the month of: March, 1952 Reported by: Henry F. Gauss

1. Progress during the month covered by this report:

Mr. Ravenscroft of the Penta Post Company inspected the machine. He was favorably impressed. His primary criticism was that the sap wood immediately under the bark was roughed up. He felt that a different type of brush could be found which might do a more satisfactory job.

The manufacturer of our present brush did not encourage us to think that such a brush could be made. However, we are in correspondence with another brush manufacturer who thinks that he can make a brush that will do the job. We have not as yet received final word from him.

2. Current Status:

Continuing.

3. Work scheduled for next month:

We are building a mechanism for feeding the machine positively, without depending on the angularity of the feed rollers. This device should be completed within the next month, after which we can determine whether it is the irregular feed that is causing our trouble.

Remarks:

Signed:

Date:

SPECIMEN NO. 7*

Progress Report

The following report is a progress report on a long-term project carried out under a university's special research program. It was printed for public distribution along with reports on other projects.

The contents of this report are worth study. Note that the four lines of investigation are indicated under the heading *Methods of Study*. Consider these questions·

1. What are the four lines of investigation? It was deemed important in this report to let the readers see how the whole problem was being attacked.
2. Does the section headed *Progress* follow an organization similar to that of the section under *Methods of Study?*
3. Do the transitional and introductory phrases and sentences bring out that parallelism sharply?
4. Is there any place where an informal table might make it easier to grasp the information presented?
5. If so, would the extra emphasis this table would give the point it covered make that point overshadow the rest of the report too greatly?

Note that though the headings used contain no words indicating a past, present, future pattern, the reader learns of what has been done, of what work is currently under way, and what plans are being made for the future.

* Courtesy of Engineering Experiment Station, University of Idaho.

PROJECT 4. HIGHWAY STABILIZATION

Earth roads fail because traffic wheel loads exceed the bearing power of the soil. To gain a stable surface, it is necessary to add layers of granular materials to provide load distribution to the subgrade soil. If a sufficiently thick layer is applied, almost any soil can be satisfactorily used in the subgrade. However, with poor subgrades as foundations for roads, the layers of costly granular materials must be very thick. Anything that can be done to increase the bearing power of the soil foundation will allow a material reduction in the necessary thickness of the load-distributing layer and hence will greatly reduce the cost of road construction.

Methods of Study

Several possible solutions to the problem of roadway stability may exist, and several avenues of investigation are suggested.

It is well known that increasing the density of a subgrade increases its bearing power. To what extent this solution is economically feasible is part of the current laboratory investigation.

If great densities can be economically obtained, can they be maintained, or will the weathering processes cause the soil to loosen up to some lesser density? The answer to this question will be sought during the coming months, but no results may be expected in much less than one or two years. This phase of the study will be based primarily on wetting and drying of compacted samples with very accurate measurements to detect changes in their volumes.

Can soil be compacted to such a degree that its future saturation will not greatly lower its bearing power? The answer to this question is being sought in a study of the strength of soil samples compacted to various degrees of density and then allowed to absorb moisture. Along with the answer to this question an answer is being sought to the question as to what the equilibrium condition of soil and moisture actually is. This latter question is being studied both in the field and in the laboratory.

It may be possible to change the properties of subgrade soils by the addition of certain admixtures. These admixtures may be used to waterproof the soil; that is, to eliminate its detrimental capillarity, increase its bearing power by acting as a cement, increase its ease of densification by lubrication, and in other ways improve the soil. In the laboratory several of the more promising of admixtures have been studied to determine their effects.

Progress

The studies to date have been confined to a silty clay soil. Other soil types will be investigated at a later date.

Laboratory tests to date, though not complete, have provided a considerable amount of data about densification. Although these data have not been completely analyzed at present, certain trends are indicated.

The resistance of soil to penetration, which is a measure of its bearing power, is markedly increased with increase in density. Soil compacted to present day standards for roads had a density of 106 pounds per cubic foot and a resistance to penetration of only about 200 pounds per square inch. The use of heavier equipment such as is in use on larger airport construction would yield increased densities up to 123 pounds per cubic foot and penetration resistance to about 1,000 pounds per square inch with a nominal period of application. This represents a major increase in stability. However, the same equipment, if used to gain the greatest density possible, could yield densities up to 130 pounds per cubic foot and penetration resistance to 4,000 pounds per square inch. This latter resistance is about 20 times as great as that normally being obtained in present road construction. It seems probable that the advent of heavier equipment might raise these values even higher. No maximum value of density has been obtained as yet.

Soil cannot be compacted to great densities without the use of heavy equipment. A 5½-pound tamping hammer dropped 300 times gave very nearly the same density as a 10-pound hammer dropped 25 times. On actual construction, time would not allow the use of the lighter roller to gain the given density.

Field studies indicate two facts of basic importance about soil moisture.

1. The moisture content in subgrades below asphaltic pavements did not have a material seasonal fluctuation. Moisture contents were as high in July as in December.
2. The amount of moisture in the subgrade varied inversely as the density. Around 90 per cent of the void spaces in the soil were filled with water at all times.

Studies with admixtures have also indicated some definite trends which warrant mention. Three admixtures, portland cement, calcium chloride, and hydrated lime, were used.

Of these additives, only calcium chloride was effective in increasing the ease of compaction for the soil. Portland cement and lime both acted to make the soil more difficult to compact. All additives acted to increase the strength of the soil, with lime and cement being most effective. Ten per cent of portland cement increased the strength to 10 times that of the plain soil. Two per cent of lime gave it almost three times the strength. Calcium chloride did not have an appreciable effect.

Portland cement and lime were effective in reducing the rate of capillary rise in the soil. Calcium chloride caused the rate to be materially increased. All additives caused the soil to be more resistant to volume

change under change in moisture content. They were about equal in this respect with the higher percentages being more effective.

The foregoing observations must be substantiated by further study and by further analysis of data on hand. The primary objective of the compaction study will not be obtained until the effects of greater compactive efforts have been investigated. Of the admixtures used so far, portland cement and lime seem worthy of further study.

Further Work

All phases of the study are to be actively pursued. Various materials, including an impermeable fabric, have been submitted for study. It is the intention to overlook no possibilities even though striving for a workable solution as rapidly as possible.

Of immediate interest, it is the intention to prepare a manual on the construction and maintenance of roads embodying the latest techniques and engineering knowledge. Field surveys of county roads indicate that such a manual could go far to help remedy some difficulties while the results of more detailed studies are forthcoming.

Liaison is being maintained with other organizations which are working along these lines. Current publications are being scanned to gain information bearing on the problem because in its many ramifications it probably will resist complete solution for many years.

SPECIMEN NO. 8*

Laboratory Report

ADHESIVES FOR LAMINATED PRESSBOARD

Note how the title page of the following laboratory report carries all the information needed to relate the report to the operations of the company.

In this report, the full data have been included, though that is not always done. The inductive method has been used. Many headings sometimes found in laboratory reports are not used; but as the discussion of laboratory reports stated, neither the arrangement nor the choice of headings in laboratory reports is identical for different users.

Observe the general organization: Purpose, Procedure, Comments, and Conclusions. Where do you find the Results? Would it be helpful to place them under a separate heading? Would it have been advisable to tell the anticipated benefits under *Purpose* and thus arouse interest?

Observe the organization in the different sections. When the results are stated, do they conform with the pattern established in *Procedure?* Do the paragraphs under *Comments* follow the pattern of the preceding sections? Note that the comments go beyond comments on the tests made, for the report applies the results of the tests to a specific problem, all factors of which are taken into consideration.

As you examine *Conclusions,* notice whether the organization of earlier sections is preserved, so as to have parallel organization throughout. The final statement under *Conclusions* is a recommendation. Would it have been helpful to have the term "recommendations" in a heading?

One element treated in *Comments* is not mentioned in *Conclusions.* What is it? Even though it might not affect the decision, might it have been advisable to mention it so that a reader who read only the conclusions would know it had not been overlooked?

Observe the style. Is it personal or impersonal?

* Courtesy of Westinghouse Electric Corporation.

WESTINGHOUSE

ELECTRIC & MANUFACTURING COMPANY

SHARON, PA.

Date: March 12, 1948

SHARON WORKS LABORATORY

Report No 70

Memo No

Subject: Adhesives for Laminated Pressboard

Copies to. Mr. J.G. Ford, Manager, Manufacturing Engineering--for file
Mr. W.G. James, Division Engineer, Power
Mr. R.L. Brown, Section Engineer

Budget or Order No. 6-SH-700373

Figuring Book No. Page

Confidential

Test Record Book No.

x General Company Distribution

File No. MP-500.1

APPROVALS --

(Signed)

J.G. Ford, Manager, Mfg. Engrg.

(Signed)

G.W. Minor Engineer

PURPOSE

To determine whether an adhesive other than treated paper M974-1 can be used for laminating pressboard used in oil-filled transformers.

PROCEDURE

Standard pressboard PDS 1581-1 was built up to a thickness of two inches according to P.S. SH-115348 by using the following materials: (1) treated paper M974-1; (2) Lepage's Dextrin glue #201, M6767-3; and (3) hide glue M2649. Pressboard beams 2" by 12" were then cut from each of the experimental plates of laminated material. This was to simulate the use of laminated pressboard as lead supports in power transformers.

The beams were then supported at each end (on a 12" span) and placed in the Tinius Olsen machine, where a measured load could be applied to the center of the beam The load was increased until failure of the beam occurred.

Small pieces of the laminated material (approximately 110 grams) were placed in 400 cc. of Wemco "C" oil at 90° C for one week. At the end of this time, the acidity of the oil was measured and compared with the acidity of a blank sample of oil under the same conditions.

The 60-cycle one-minute hold creep strength of the laminates was measured along the glue lines at distances of one and two inches. These tests were made in air on untreated samples and in oil after exposure to oil at 90° C for one week.

I. Breaking Load of Beams (in pounds)--12" Span

	Type of Adhesive		
Test No	974 Paper	201 Glue (M6767-3)	Hide Glue (M2649)
1	2340	1765	1040
2	2240	1955	950
3	2020	1895	1020
4	2500	1850	1030
Ave.	2275	1866	1010

II. Oil Acidity after One Week at 90° C--MgNaOH/gr. oil

	Pressboard Bonded with:		
Blank	974 Paper	201 Glue	Hide Glue
0.022	0.023	0.023	0.046

III. Creepage Strength along Glue Lines--60-Cycle one-Minute Hold

Sample	Air		Oil	
	1"	2"	1"	2"
Pressboard bonded with:				
974 Paper	16 KV	27 KV	16 KV	27 KV
201 Glue	16 KV	27 KV	16 KV	27 KV
Hide Glue	16 KV	27 KV	16 KV	27 KV

Remarks: Flash-over at electrodes before failure by creep

COMMENTS:

All of the pressboard beams failed parallel to the laminations at the values given above. Treated paper M974-1, which we are now using, gives a laminate which has a breaking load approximately 25 per cent greater than a laminate made with #201 glue (M6767-3). Hide glue gives the poorest bond of all the samples tested, since beams made with this adhesive fail at less than 50 per cent of the value of laminates made with treated paper.

There was no appreciable change in oil acidity as a result of exposure to pressboard bonded with treated paper or dextrin glue. However, an appreciable increase in acidity was evident after exposure to pressboard bonded with hide glue. The quantities of laminated pressboard which are used in our transformers are so small in comparison with the quantity of oil that this increase in acidity probably will not have any noticeable effect on the oil.

The actual creepage strength along the glue lines could not be measured because flash-over at the electrodes occurred before failure by creepage. An attempt was made to measure the creepage strength at a distance of six inches, but this value was not within the limits of the laboratory test outfit.

Treated paper M974-1 costs 25 cents per pound as compared with a cost of 5 cents per pound for dextrin glue M6767-3. This difference in cost will not be affected by the extra labor involved in coating the pressboard with this glue. It is estimated that a saving of approximately $1600 per year can be realized by using this dextrin glue if only labor and material costs are considered

In addition, we have found that pressboard laminated with dextrin glue does not require as long a cooling cycle after pressing as does pressboard laminated with treated paper. This factor in itself eliminates the need for large quantities of cooling water, and, as well, reduces delays in production which occur when laminated pressboard is made

The shop also believes that pressboard laminated with dextrin glue will be easier to cut and will reduce the cost of maintenance for saws This latter item is now considerable and can be attributed partly to the difficulty of cutting pressboard laminated with treated paper

The pressboard which we now get from our suppliers in thicknesses greater than $\frac{1}{4}$ inch is laminated by gluing the required number of plies to the desired thickness with dextrin glues It has been our experience that pressboard such as this is satisfactory in every way and has shown no tendency to delaminate

In view of these facts, it is recommended that dextrin glue be used instead of treated paper for laminating pressboard Although no specific tests were made in this investigation to determine the resistance of dextrin glue to Inerteen, we know from past experience that water-soluble dextrins such as the #201 covered herein are resistant to Inerteen. Process Specification SH-115348 will be revised in the near future to specify the use of this glue for laminated pressboard used in oil-and Inerteen-filled transformers

CONCLUSIONS

(1) Pressboard beams laminated with treated paper M974-1 have a breaking strength approximately 25 per cent greater than the strength of beams laminated with dextrin glue

(2) Pressboard beams laminated with dextrin glue M6767-3 have a breaking strength approximately 80 per cent greater than beams made with hide glue M2649

(3) The acidity of oil is not appreciably affected by the various adhesives covered in this report

(4) The creepage strength of the pressboard laminates is not affected by the various adhesives.

(5) Based on material costs, approximately $1600 per year can be saved by using dextrin glue for laminating pressboard. Additional savings can be realized in the time and amount of water needed for cooling and in maintenance of saws

(6) It is recommended that dextrin glue #201 (our M6767-3) be used in place of treated paper M974-1 for laminating press-board for oil-filled transformers

SPECIMEN NO. 9.*

Laboratory Report

THE SELF-PRIMING ABILITY AND CAPACITY OF THE 109876 PUMP

The following laboratory report is organized according to a system adopted as standard for the company in which it was written. The sections to be used as needed for this company are Title, Introduction, Conclusions, Summary of Results, Recommendations, Discussion, Description of Apparatus, Signature, and Appendix. This organization is designed to bring the end results of the laboratory work to the reader's attention quickly, in line with the conviction that such results are what is most important.

Page 1 was preceded by a title page (omitted) telling only the file number, the name of the project concerned, the number and title of this report, the job number, the order number, and the name of the job supervisor. This information was repeated and other information added as shown at the top of the first page. Note that a general title shows the project into which this report fits and that the title of this particular report is made extremely specific.

The Introduction orients the reader effectively, but in one minor respect might have smoother phraseology. Try to identify this point.

The Conclusions have been sharply limited to the findings on the major subject of investigation, though other facts are brought out elsewhere.

Questions to consider: Is the Summary of Results comprehensive enough? Does everything placed under that heading belong there? (Do not attempt to answer this or other questions until you have studied the report thoroughly.)

* Courtesy of the Caterpillar Tractor Company.

*

CATERPILLAR TRACTOR COMPANY RESEARCH DEPARTMENT

File No. 1S Reported by JOHN FLERTUS 11-16-48

Observed by R. A. RINDER AND JOHN FLERTUS 9-1-48 to 11-9-48

PERFORMANCE CHARACTERISTICS OF A CENTRIFUGAL SELF-PRIMING WATER PUMP

REPORT NO. 2.

THE SELF-PRIMING ABILITY AND CAPACITY OF THE 109876 PUMP

JOB NO. 6104-36A
ORDER NO. 93-1042
JOB SUPV. R. C. BROWN

INTRODUCTION:

Cooling requirements of our 4 3/4 inch bore engines have made necessary the design of a self-priming centrifugal water pump of increased capacity This was indicated in File 9517R. Report No. 1 under this file number has revealed changes that improve the priming ability of the pumps.

In order to incorporate these changes in the 109876 water pump, which is soon to be released for production, a check was made of the priming ability of this pump. This report covers the self-priming ability and capacity of the 109876 pump. The actual capacity was determined to provide verification of the original design calculations and to record the pump output for future reference.

CONCLUSIONS

1. The 109876 pump will prime faster than the original prove design 100351 pump throughout the speed range, if minor changes are made in the pump housing.

2. One of the major considerations in the design of a self-priming water pump housing should be to provide for the free discharge of air contained in the water system as the pump is started.

SUMMARY OF RESULTS

1. The priming speeds were slower than expected in the speed range of 1200 - 1400 rpm.

2. The suction lift of the pump was 7 3/4 feet and the inlet pipe length was 22 1/4 feet.

3. Pump impeller face clearance was 0.034 inches for this test.

The Recommendations have been made more definite by numbering them. Note that they cover points not covered in the Conclusions. This is due to the fact that the investigation not only answered the question which led to the report's being written, but also uncovered some other facts that called for action. The advisability of mentioning these other matters under Conclusions might be considered.

The paragraphs of the section headed Discussion were not numbered in the original, but numbers have been added to facilitate reference. Note how each of the earlier paragraphs under Discussion is related to some point under Recommendations. The writer of this report faced some difficult problems of organization, which lead to the following questions:

1. Which paragraphs under Discussion in addition to No. 1 relate to the original purpose of the investigation?
2. Which paragraphs deal with incidental findings?
3. Should paragraphs 3 and 4 be transposed?
4. What is the function of paragraph 5?
5. What later paragraphs perform functions similar to that of No. 5?
6. What changes in arrangement might be made to bring related material together?
7. Would the use of subheadings under Discussion help to bring related material together without losing the tie-in with Recommendations?
8. What subheads could you suggest to cover the material in Discussions?

Note the references on pages 2 and 3 to sheets at the end. CP519, though referred to, was not bound into the report. In view of this would it be helpful to say (Appendix) when reference is made to a sheet which *is* bound in?

This laboratory report gives full details about procedure. This was done because the procedure went beyond the making of routine tests.

*

RECOMMENDATIONS

1. Changes in the 109876 water-pump housing as shown on Layout CP519 should be made

2. For ease of assembly and disassembly, the use of a straight key for driving the impeller is urged, along with increased wrench clearance for the 119975 bearing mounting bolts.

3. A shoulder in the 119382 bearing should be added to provide a stop for the 119381 seal. This would prevent the seal from being pushed in far enough to block off the oil drain passage.

DISCUSSION

(1) The 109876 pump primed in faster times than were reported on File 95178 for the original prove design 100351 pump. However, in the speed range of 1200 - 1400 rpm the priming times were slower than expected Changes were made in the pump housing as shown on Layout CP519 to improve the priming performance in this range. The pump capacity agreed within 2 to 3 per cent of the calculated design values over the entire speed range

(2) When a 109876 pump was assembled for testing, it was found that installation of the impeller was difficult to perform with the 119354 seal plate assembly because of the use of a Woodruff key in the pump tapered shaft. With this type of key the seal plate had to be slipped over the key before the impeller was installed on the shaft. Alignment and engagement of the seal plate driving gears with the openings in the impeller was difficult and time consuming. Removal after the pump had been used and dirt deposits had accumulated around the gears caused damage to the seal plate since the plate must slip out of the impeller, and will not come off over the Woodruff key. The use of a straight key will eliminate this difficulty.

(3) The 119382 bearing has a counterbore of 2.000-1.998 in which a 119381 lip-type seal presses. It is possible to install this seal so that the oil drain passage would be blocked off. A shoulder to prevent pressing the seal in too far seems desirable

(4) As the clearance on the attaching bolts for the 119975 bearing is not sufficient for a socket wrench, an open end wrench must be used for installation and removal. Increasing the wrench clearance would result in faster and easier assembly and disassembly.

(5) After assembly the 109876 pump was mounted on the 15-hp dynamometer for the priming and capacity tests. Inlet and outlet piping of two-inch diameter was provided. The suction lift was 7 3/4 feet and the inlet pipe length was 22 1/4 feet. These dimensions serve as a comparative guide as to the volume of air the pump must handle during the priming process See Sheet B for this piping arrangement.

(6) In running the priming performance it was found that priming time in the 1200 - 1400 rpm speed range was not as good as was expected An observation window of Lucite was installed in the top of the pump-housing upper chamber to observe the priming water turbulence. It was found that with the pump running the upper chamber completely filled, except for an air cavity near the discharge volute. The elimination of this air pocket was attempted by using various baffles with limited success

Thoroughness was achieved by the inclusion of Paragraph 11.

Is there any information elsewhere in the report that might better be placed under Description of Apparatus?

The writer assists the reader by placing a list of "sheets" included just before the Appendix. Since there is no table of contents for the full report, this seems to be the best place for such a list. If the writer had used a table of contents, he would probably have listed the sheets in it or just after it; or perhaps he would have included only the heading *List of Sheets* in the table of contents, and placed the list itself where it now appears, just before the Appendix.

On a blank page of the original, following the page opposite, space was provided for readers to state their reactions to the report and to indicate any action taken as a result. Thus with little effort further developments were made easily available and part of the permanent record.

DISCUSSION (CON'T)

(7) The use of baffles changed the pump priming characteristics so that an improvement at 1200 - 1400 rpm resulted in slower priming at other speeds.

(8) With the removal of a capscrew holding the Lucite cover (permitting the entrapped air to escape) the pump primed well throughout the speed range. This indicated that the air in the system was not being discharged properly during the priming period.

(9) An auxiliary tank was mounted on top of the upper chamber. This provided a free air space above the level of the water during priming and allowed the air to escape through the outlet line. Performance comparable to that obtained by removing the capscrew resulted.

(10) The final modification of the pump housing to incorporate a means of eliminating the air pocket is shown on Layout CP519.

(11) The priming times as shown on Sheet C were obtained by measuring the time interval from the starting of the dynamometer until the water was discharged from the outlet pipe; thus the pump was penalized somewhat for the acceleration time of the dynamometer. The inlet piping was drained before each trial to eliminate extra water being trapped. The method used has been followed on all self-priming pump tests and provides a good comparison of the various units.

(12) The piping arrangement (see Sheet B) as used for the priming test was modified to include a three way valve and a weighing tank. While a pressure gauge is shown on the outlet of the pump a mercury manometer was used here until the outlet pressures became too large for the manometer.

(13) From the curves of head versus discharge shown on Sheet A, it will be seen that there is a rapid falling off of the head at the maximum water flow obtainable with this piping setup. Cavitation is responsible for this condition but since this is out of the pump's normal operating range no attempt was made to determine if the inlet piping were responsible.

(14) Pump impeller face clearance was 0.034 inches for this test.

DESCRIPTION OF APPARATUS

109876 Centrifugal Self Priming Pump
15 H.P. Electric Dynamometer No. 819
No. 236 Fairbanks Scale

(Signature)

SHEETS INCLUDED

A - Head vs. Discharge Curves
B - Piping Diagram
C - Priming Times at Various Speeds
D - Photograph of 109876 Self Priming Centrifugal Water Pump Housing

EXERCISES AND ASSIGNMENTS

Exercises

EXERCISE 1

Read the questions raised in connection with the report on the Flame Treatment of Hay (Specimen No. 4), and answer them, in writing or orally as directed by your instructor.

EXERCISE 2

Write a new version of the conclusions of the report on Flame Treatment of Hay, containing no more than 100 words and containing no explanatory details.

EXERCISE 3

Read the questions raised in connection with Specimen Report No. 7, the progress report on Highway Stabilization, and answer them, in writing or orally as directed by your instructor.

EXERCISE 4

Read the questions raised in connection with the specimen laboratory report about Adhesives for Laminated Pressboard, and answer them in writing or orally as directed by your instructor.

EXERCISE 5

Read the questions raised in connection with the specimen laboratory report about the Self-Priming Ability and Capacity of the 109876 Pump, and answer them orally or in writing as directed by the instructor

Assignments

A Note on Report Subjects:

There is so much variation in the conditions in different schools, and in the courses, training, and opportunities to gather information enjoyed by different groups of students, that when subjects on any list are used it will probably be necessary to take many liberties with them. Each subject is likely to need adaptation and sharper definition.

In adapting a subject you may need to broaden or narrow its scope. You may be forced to assume that the season is different from the season in which you actually write, or that some project recently undertaken in your school or community has not yet been undertaken. Or if a subject proves too large to cover in full, you may need to assume that you are conducting only a preliminary survey intended to show whether a subject should be investigated further or abandoned.

In defining a subject you would probably be forced to assume that you are writing the report for an employer or client rather than for a class assignment. Thus you would need to decide whom your report was presumably to be written for and why he needed it; to set up, that is, a hypothetical set of circumstances under which you are supposedly writing. In actual practice, of course, the information you would include would depend on the needs of the occasion. In the classroom, unavoidably, the hypothetical occasion must be shaped to enable you to utilize whatever information it is possible to obtain.

Many of the subjects suggested could plausibly be used for more than one type of report. There is therefore no reason that in writing any assignment you should not feel free to use a subject from the list suggested for some other assignment, broadening it or narrowing it as the occasion demands.

Since no list can include everything students may be qualified to write about, you may prefer to write about subjects not included in the lists provided. To develop a subject of your own, you should start out by canvassing your own resources. Review, mentally, all that you have learned on any job you have held; all that you know about any technical line of activity because perhaps some friend or relative pursues it; all that you have learned in any practical courses you have taken. Then try to create a hypothetical situation in which you can utilize that knowledge.

Regardless of the source of your subject, you should guard against making your reports too general, especially if some of your material must be drawn from printed references. Perhaps this point may be made clear by saying that in actual practice, a

report may use general information but usually applies it to a specific case. For example, general information about killing weeds by use of chemicals is so easily obtainable in print that no one would ever be asked to write a report to present it. But the weed conditions on a specific tract of land could not be found in print, so it is quite plausible that one might be asked to write a report on the conditions on that tract and on the measures necessary to control the weeds there. Or again, anyone could find general information about lighting systems, fluorescent included; so no one would request that a report be written merely on fluorescent lighting. But it is quite possible that a report might be requested on the advisability of using fluorescent lighting in some specific building which was to be modernized or remodeled. In this report, the general, printed information would be applied to the specific facts about the building—its construction and probable use.

All this should be taken into consideration as you choose subjects, for the wisdom of your choice of subject will strongly affect the merit of any report you write—an unfortunate condition that cannot be avoided in the classroom but will not exist when you are on the job. It is possible, of course, to write a poor report on a good subject; but it is impossible to write a good report on a poor subject, for a poorly chosen, unrealistic subject simply does not give you an opportunity to exercise many of the skills that make a report good.

ASSIGNMENT 1

Write a report in the form of a letter. A list of possible subjects is provided below. The specimen letters shown on pages 263 and 264 should give, for this one assignment, sufficient guidance as to letter form. Your letter report should be addressed to some person or organization that you think might logically request it. (Recall what has been mentioned about adapting and defining subjects, and change the one that you use in any way that seems desirable.)

It is suggested that this report should be from 400 to 600 words in length.

List of Subjects

1. A report on the inspection of a building on your campus or elsewhere to determine its general condition; or if you prefer, the adequacy and condition of its heating system, the presence or absence of fire hazards, the presence or absence of safety hazards, or its condition as regards lighting or sanitation.
2. A report on the conditions of some street, or road, or a section of streets which you can inspect easily.
3. A report on traffic conditions or parking conditions in some region to which you have easy access, with a view to determining whether improvements are necessary. This could be varied so as to make it concern the handling of traffic and parking at some type of public event such as football or basketball games.
4. A report on the condition of equipment, the need for new equipment, or the need for additional space in any laboratory, shop, farm, or other establishment with which you are familiar.
5. A report on the suitability of some particular site for a new service station, parking lot, city park, apartment house, dormitory or other college building, or shopping center—any type of establishment you are capable of writing about.
6. A report on the performance of any newly installed machine or other piece of equipment about which you have opportunity to learn the facts; or the unsatisfactory performance of some such piece of equipment and the reasons for the trouble.

ASSIGNMENT 2

Write a report in the form of a memorandum. The length should be from 400 to 800 words. The subjects suggested for letters should prove suitable, but if you prefer you may use a subject of your own choosing or from one of the lists provided for later assignments. Your subject will need definition and perhaps adaptation as was true of the subject for your report in the form of a letter.

ASSIGNMENT 3

Write a progress report, of a length to be specified by the instructor, on one of the following subjects or on some suitable subject of your own choice:

1. Some extended laboratory work you are doing or have done at some time in the past. (In the latter event, assume that the work has not yet been completed.)
2. The construction of some project such as a road, an air strip, a building, a heating plant—any such project with which you possess or can acquire sufficient familiarity.

3. The installation of new machinery or equipment in some college laboratory, shop, or other unit, or in some industrial establishment.

4. Some campaign, such as one to improve safety conditions or remove fire hazards in a particular plant consisting of one or more buildings. (The dormitories or fraternity houses in your own school might be investigated for fire hazards.)

5. Some campaign to secure better handling of machines or equipment in a specific industrial establishment or division thereof for the sake of safety or efficiency.

6. Your own progress on the task of conducting an investigation which will eventually lead to a full report, or your progress in handling some other type of problem—for example, carrying on a drive to raise funds, or obtaining new members in some organization.

ASSIGNMENT 4

Assume that you are an officer of some organization, or the chairman or secretary of some standing committee of an organization, and write the quarterly, semiannual, or annual report of your activities or those of your committee. The organization may be connected with your school—a social, professional, or honorary fraternity, for example, or a religious group, a gun club, a ski club, or any group that is active on the campus. As an alternative you might write a report of a similar nature for a school enterprise such as a magazine, newspaper, or yearbook, or for some nonschool organization with which you are familiar.

ASSIGNMENT 5

If your course of study includes or has included a laboratory course to supply you with subject matter, write a laboratory report on some test or experiment you have performed. This should be a report that calls for sufficient writing to constitute a *writing* assignment. It may of course contain tables and figures or may include forms that have been filled in, but should not be limited to such material.

ASSIGNMENT 6

As directed by your instructor, write one or more reports of unspecified form resulting from investigation of one of the following subjects, a subject from a different list, or a subject of your own choice. Like all other reports assigned, each of these reports should be defined by the setting up of a hypothetical situation in which your report is made to some person or organization that needs the information for its own purposes. If you choose a subject from one of the

lists provided, you may need to broaden or narrow its scope so that you can use the information obtainable and have the size of subject suitable to the length that the instructor stipulates.

1. The lighting system for some building under construction or being modernized—probably a building in the school you attend.
2. A lighting system for a baseball field, football field, gymnasium, or softball field in your campus or community; or a survey and recommendations for improving the outdoor lighting of your campus or of the streets in some section of your community.
3. An air conditioning system for some building such as those mentioned in Number 1.
4. The arrangement or rearrangement of equipment in a laboratory in your school. This could be varied so as to apply to an industrial establishment or branch of one, a dairy building—anything where your own interests and sources of information make a report of this sort feasible.
5. The selection of a heating system for use in a new building or to replace the plant formerly used in an old building.
6. An auxiliary power system to use in your school or in some such location as a hospital if an emergency should be created by an interruption of electric service. For example, experiments in some laboratory might be endangered if the interruption of electric service prevented the heating system from functioning.
7. The selection of a water-treatment system for some establishment such as a laundry, where hardness of water is a problem.
8. A report on the advisability of installing water heaters for the troughs supplying water to the milk cows on some dairy, and the choice of heaters if heating the water is found to be advisable.
9. A report on the advisability of installing a drying system so that hay can be dried in the mow on some specific farm.
10. The construction or reconstruction of a running track, baseball field, or football field for your school. This could include drainage and perhaps, in some regions, an automatic sprinkler system.
11. An investigation of whether it would be advisable to install an automatic sprinkler system on your school's campus rather than watering the campus by hoses, which causes a higher labor expense.
12. The selection of a refrigeration unit for a dairy, for some campus dormitory or other residence where meals are served, for a new supermarket, or for any other establishment that uses such a system.
13. An investigation of the causes of paint peeling off some building or buildings where that trouble exists, and the suggestion of remedies for the condition.
14. An investigation of the desirability of spraying paint rather than applying it by brushes on the exterior of buildings in your school when they need painting or repainting.
15. An investigation of the condition of some farm. (Presumably this

would be made for some person or organization contemplating the purchase of the farm—certainly for a person or organization other than a farmer who already owns and is farming the land.)

16. An investigation of the need for control of some insect or other cause of plant disease on some farm, and a program for control if control is found to be needed and practicable.

17. The possible need of a weed-control program on some tract of farm land and a program for such control if control is found to be needed.

18. The advisability of thinning apples on a certain orchard by spraying them rather than thinning them by hand.

19. The choice of a power system—electricity, diesel, or steam generated by burning wood waste—for a small saw mill.

20. The choice of make and model of automobiles to be purchased for use of the salesmen of some large company, or for some similar purpose. This could include, if you desire, suggestions for a systematic plan for trading in the cars for new ones after a certain period of usage in terms of time or mileage.

9

Formal Reports

DEFINITION AND USES

The term *formal report* is in a way misleading, for it suggests that all other reports are informal. On the contrary, their formality is a matter of degree, and a report may be quite formal in its manner and effect without having all the characteristics that would make it, according to most systems of nomenclature, a formal report.

Still, the term is commonly used and a writer should know what sort of product he will probably be expected to turn out when a formal report is asked for. The distinctive characteristics that the term implies, as gathered from a study of reports from many sources, are usually somewhat as follows:

1. A formal report will have a formal title page.
2. It will frequently be accompanied by a letter of transmittal.
3. Unless extremely short, it will have a table of contents.
4. A summary or abstract will precede the main body of the report.
5. It will contain, in special sections, certain characteristic introductory material.
6. Any conclusions or recommendations that are appropriate to the occasion will be placed in special sections under appropriate headings.
7. It will have internal topical headings, usually of more than one rank.

8. It will be formal in tone and impersonal in style.
9. It will contain visual devices such as tables and figures if such devices can increase its effectiveness.

The formal report can be used for varied purposes. It may be a periodic report, a progress report, a report on the completion of some project, or a report on the results of a special investigation. It may cover, in fact, any type of subject. Obviously, however, it is mainly used on occasions when formality is appropriate and when the report must be long enough to justify the somewhat complicated mechanism involved.

COMPONENT PARTS

Some of the parts that make the formal report a distinct type have been mentioned above. A full list of the parts that might be included, however, would be:

Title Page
Letter of Transmittal
Table of Contents
Summary (or Abstract)
Introduction
Body
Conclusions (and recommendations if called for)
Appendix
Bibliography, or list of references.

These parts have been listed in the order in which they frequently occur, but some organizations move conclusions and recommendations forward, as shown in the following variations:

Title Page
Letter of Transmittal
Table of Contents
Conclusions and Recommendations
Summary (or Abstract)
Introduction
Body
Appendix
Bibliography

Title Page
Letter of Transmittal
Table of Contents
Summary (or Abstract)
Conclusions and Recommendations
Introduction
Body
Appendix
Bibliography

Title Page
Letter of Transmittal
Table of Contents
Introduction
Conclusions and Recommendations
Summary (or Abstract)
Body
Appendix
Bibliography

Changes in the arrangement of the parts might affect their contents. For example, the summary will not cover the introduction when that section precedes it, but will cover the introduction if the latter has not yet been included. A writer's good judgment should enable him to adapt his treatment to the order he is following.

The discussion below will cover the parts in the order in which they were first listed. This does not mean that their arrangement in the report is the order in which you would write them. Only after the report is practically complete would you be able to prepare the title page, the letter of transmittal, the summary, and the final version of the table of contents.

The Title Page

The title page indicates (1) the subject of the report, expressed as explicitly as possible without becoming cumbersome, (2) the person to whom the report is made, (3) the person by whom the report is made, and (4) the date of the report. Also, in large or-

A REPORT ON

RECENT EXPERIMENTS IN THE RECOVERY

OF MANGANESE

to

THE NATIONAL STEEL COMPANY

by

Howard N. Tracy, Chief Metallurgist
Research and Development
Laboratory

January 15, 1953

Figure 13. Well-Designed Title Page for a Formal Report.

ganizations, it may bear the number assigned to the report and may indicate the project that the report concerns. All this material should be pleasingly arranged on the page.

The Letter of Transmittal

The letter of transmittal varies widely in length and contents. On many routine periodic reports it may consist of only one or two sentences, as for example: "I am sending you herewith a report on . . . for the year ending December 31, 19__." followed by such a complimentary close as "Respectfully submitted." At the other extreme is the letter of transmittal which actually replaces the summary and summarizes the contents of the report. This type may run several pages in length. (Such a long letter would precede only a report of considerable length.)

Most of the time the letter of transmittal is about the length of the average business letter. Its purpose is to say in effect, "Here is the report you asked for," just as one would make such a remark orally when handing in a report. It would ordinarily include a reference to the subject of the report, a mention if necessary of the scope and limitations, a mention of the reason the report was requested, and a reference to the means (letter, memorandum, or conversation) and date of authorization. Sometimes it might refer to the way in which the information was gathered.

Whether a letter of transmittal should indicate the findings of the report would depend on the occasion. There is probably no reason for withholding them if they are likely to be pleasing to the reader, but this information is merely incidental to the real purpose of the letter of transmittal. In general, the letter merely orients the reader to the situation, possibly makes an effort to arouse his interest, enables him to read the report with a feeling that he understands the situation, and mentions any other facts that one feels should be included. It may vary in formality to suit the occasion.

Following are two letters of transmittal of different types:

(1)

3006 Winchester Avenue
Twin Falls, Idaho
February 23, 195__

Mr. Walter J. Southdown, President
Southdown Livestock Company
Box 229
Hagerman, Idaho

Dear Mr. Southdown:

I have concluded the investigation authorized in your letter of January 8, as to whether your company should spray its own sheep by means of the new automatic sprayer, or whether it should have them sprayed, as in the past, by custom sprayers.

As requested, the investigation contains information on the relative cost of the two methods. Availability of the automatic sprayer has been checked upon. Only a minimum of attention is given, however, to the relative effectiveness of the two methods, for inquiry into that point was not requested in your letter.

Information was obtained from recent technical publications and from personal correspondence with the University of Idaho department of entomology. Dealers in stockmen's supplies, the U.S. Employment Service, and local custom sprayers also contributed information.

Attached is a report of my findings. I believe it will contain the facts you need in deciding upon your policy. I have enjoyed working on this project and shall be glad to be of assistance in the future—either by answering further questions or by helping you to get started with the spraying if you should decide to do it with your own equipment.

Very truly yours,

Kenneth O. Shepherd

The letter of transmittal above is an example of the use of such a letter to refresh the reader's mind as to what a report concerns, or to explain the situation to someone who might not be familiar with it. Note that the letter does not reveal the findings of the investigation which the report covers.

(2)

October 24, 1951

Mr. W. N. Bell
Vice-President

Attached is a report of a land use survey of White Beach District, the eighth district to be so surveyed. The estimates of future annual kilowatt-hour sales and district peak demand are based upon complete use of all

habitable land and present trends in the use of this district. However, this survey, when completed for all districts, will give an indication of where the greatest growth may be expected in the system and may be helpful in planning distribution and other facilities so that they can be made capable of serving the anticipated load when and if it develops.

The total area of White Beach District is 65.3 square miles of which 2.6 per cent is uninhabitable. Another 31.7 per cent, now unoccupied or used for agriculture, may be expected to develop further. Considerable industrial development is to be expected in the Alvarez area west of the Walker River. There is also room for more housing development between the present Fernwood Project and the San Carlos River. In 1950, total sales in the district were 686 million kwh with a district peak demand of 134.5 mva in December. If and when the district develops as described in the report, it is estimated that annual sales may reach 1,420 million kwh with a district peak demand of 278 mva, which represents an increase of 107 per cent over 1950 uses.

H. A. Scott
Executive Engineer

The letter of transmittal above is an example of the use of such a letter to replace a summary or abstract. It was accompanied by a report running three pages plus a map. The nature of the report was such that no conclusions or recommendations were called for. The report was made for a power company serving the district concerned.

The Table of Contents

The table of contents of a report is essentially the same as the table of contents of a book. It lists all the headings used in the report, and indicates the page number where each heading occurs. Unless the entire report is written in some particular form that always contains the same headings, the table of contents is developed from the outline, which will have been made when the report was originally planned, and altered where necessary as the work progressed. In effect, the table of contents is still an outline, for like an outline it shows the relationship of points by indentation. Occasionally it may have each point preceded by a number or a letter as in the outline, but usually such symbols are discarded entirely or reduced to Roman numerals before each point that represents a main division.

Each item in a table of contents is phrased as a topic (that is,

it is basically a noun plus modifiers) rather than as a sentence, partial sentence, adjective, infinitive phrase, or any other form. It is quite possible that many report writers do not limit themselves to this phraseology consciously, but if you study the internal headings actually used in reports or other technical writing, you will find that any other form than a *bona fide* topic is extremely rare. Other forms simply do not sound right to discriminating writers or readers.

Usually the list that covers the contents of a report indicates not only the topics of discussion, but also the titles of tables or figures. The tables and figures, however, are kept distinct from the topic headings. If all the tables and figures come after the body of the report, they may be included in the regular table of contents under some appropriate heading such as *Tables, Figures, Figures and Tables,* or *Appendix.* If some of these materials are scattered through the report, all such material should be listed separately under a heading similar in form to the heading for the regular table of contents. Thus a small page number never comes below a larger number in the regular table of contents.

You should increase your resourcefulness in the task of listing visual materials by constantly noticing the methods used in books. In the last analysis, the important point is that the table of contents should make it easy for the reader to see what a report contains, easy to understand how it is organized, and easy to find what he is looking for. Examples that follow show four full tables of contents. They also include portions of other tables of contents to show how the listing of visual material may vary.

Table of Contents for a Report on Pressure Testing and Valve Seating of "C.F.R." Motors

TABLE OF CONTENTS

Summary 1
Introduction 2
Purpose 2
Source of Information 2
Authorization 2

Conventional Valve-Testing Methods 3
Pressure Testing of Valves 4
Reasons for Testing Valves 4
Procedure in Pressure-Testing Valves 4
Standards Established for Pressure Tests 5
Erroneous Beliefs Exposed by Pressure Tests 6
Valve Seating 7
Valve Facing 8
Test Data 8
Conclusions 9
Recommendations 9

Note how the ample use of subheads makes clear the nature of the contents as well as guiding the reader to the location where specific points are discussed.

Table of Contents for a Report on the Completion of a Government Reclamation Project

CONTENTS *

Location Map
Chronology 1
Introduction 7
Construction Bids 7
Scope of Work 9
Plant and Equipment 9
Construction 10
Controls 10
Extra Work Order No. 1 10
Excavation 12
Reverse Filter 13
Reinforcement Steel 13
Concrete Control 13
Batching 14
Aggregate 14
Cement 14
Water 15
Air Entraining Agent 15
Concrete Mixes 15
Mixing 15
Forms 16

* Courtesy of United States Bureau of Reclamation.

Placing 17
Finishing 17
Curing 18
Radial Gates 18
General 18
Preparation for Painting 18
Painting 18
Gate Assembly 19
Electrical Installation 19
Hoists and Motors 19
Handrails 20
Backfill 20
Weather 21
Safety 22
Personnel 23
George B. Henly Construction Co. Inc. 23
Bureau of Reclamation 23
Labor 23
Wage Rates 24
Final Cost Analysis 25
Appendix No. 1
Plates 1-35 Photographs of Operations

Table of Contents for a Report on the Advisability of Treating the Water Supply at a State Hospital

TABLE OF CONTENTS

Abstract 1
Introduction 2
Purpose 2
Scope 2
Sources of Information 2
Authorization 3
Analysis of the Problem 3
Uses of the Water 3
Deposition in Water Lines 3
Corrosion of Equipment 4
Stains and "Red Water" 4
Taste and Odor 5
Treatment Required 5

Methods of Treating Water 6
Lime-Soda 6
Demineralization 7
Aeration and Filtration 7
Metaphosphate Treatment 8
Methods of Chlorination 8
Breakpoint Method 8
Excess Chlorine with Flushing . . . 9
Equipment and Process of Installation 9
Calgon Injection 10
Chlorine Injection 10
Bleeding Procedure 11
Costs and Estimates 11
Period of Construction 12
Results To Be Expected 12
Conclusions and Recommendations 13

Table of Contents for a Report on Two Proposed Routes for a Telephone Line

CONTENTS

Abstract 1
Introduction 2
Conclusions and Recommendations 3
The Anderson Ridge Route 4
Clearing Operations 5
Structures and Conductors 7
Maintenance Problems 9
Possible Disruption of Service 10
Property Easements 11
The Webster Gap Route 12
Clearing Operations 13
Structures and Conductors 14
Maintenance Problems 16
Possible Disruption of Service 17
Property Easements 19

EXHIBITS

Detailed Sheet on Construction Costs, Anderson Ridge Route . 8
Detailed Sheet on Construction Costs, Webster Gap Route . 15
Map Showing the Two Routes 20

Examples of Listing Visual Materials in the Table of Contents

As the visual material in a report varies, the method of listing it in or following the table of contents varies. Some of the possible methods are shown on the opposite page. The first two examples illustrate occasions on which all the visual materials are placed at the end of the report. The second two show the listing of such materials when they come within the body of the report.

The examples are not the only possible systems, but are offered to illustrate how the method of listing should be adapted to the nature of the material yet should not violate the conventions to which the reader has become accustomed. One of these conventions is that the list of visual materials is kept distinct from the list of topics discussed. A second is that the sequence of page numbers is never broken within any single list.

Terms that are not shown here—"Graphs" or "Photographs," for example—can be used if they will identify the nature of the material more completely than the terms used in the examples. The main consideration is simply to list the materials so that the reader can see what they are with a minimum of effort.

Each example begins with "Conclusions" or the equivalent in order to show the page number where the last section of ordinary discussion began.

Example 1. The material was all placed at the end. It was treated as an appendix, and a title page bearing the word "Appendix" was provided. Tables were numbered because there was more than one table. The graph and map were not numbered because each was the only example of its kind. It would have been permissible, however, to list them as Fig. 1 and Fig. 2. Any type of visual material except a table can be called a figure.

Example 2. Each different type of visual material has been treated as a separate appendix—a system that would become more desirable as the number of specimens of each type increased. Title pages to precede the separate appendixes have not been used. It would have been permissible to omit the term "Appendix" entirely and reduce the headings to merely "Tables" and "Figures."

Example 3. As the page numbers show, the visual materials have been placed within the body of the report. Hence a heading similar in form and equal in rank to the original heading "Table of Contents"

has been provided. In this example, tables were the only type of nonverbal material used.

Example 4. This example is like the one that precedes except that the report contained figures as well as tables; hence the change in the main title for the section. The title "Exhibits" could have been used instead of "Figures and Tables."

(Example 1)

Conclusions and Recommendations 12
Appendix 13
Table 1. Hydroelectric Plants in the Central Valley Power Service Area 14
Table 2. Fuel-Electric Generating Plants in the Central Valley Power Service Area 14
Graph Showing Power Requirements 15
Map of the Central Valley Power Service Area 16

(Example 2)

Conclusions 12
Appendix A—Tables
1. Comparison of Spoon Temperature Readings and Bath Temperature Readings 13
2. Tapping Temperature Range 14
Appendix B—Figures
1. Bath Immersion Pyrometer 15
2. Spoon Immersion Pyrometer 16
References 17

(Example 3)

Recommendations 14

TABLES

1. Natural Run-off of Central Valley Streams 4
2. Net Area of Irrigable Land and Area to Be Irrigated in Any Single Year 10

(Example 4)

Conclusions and Recommendations 12

FIGURES AND TABLES

Tables

1. Comparison of Spoon Temperature Readings and Bath Temperature Readings 3
2. Tapping Temperature Range 4

Figures

1. Bath Immersion Pyrometer 6
2. Spoon Immersion Pyrometer 9

The Summary (or Abstract)

However the parts of a formal report are arranged, one of the earliest is a summary or abstract. (When related to a report the terms are used with the same meaning. *Summary* seems to be used more frequently.) This section gives the contents of the report in condensed form. Its function is to permit a busy reader to avoid reading the report in full—a chore he may delegate to someone else. It may also enable a reader who has already read the report in full to refresh his mind about the contents without rereading it all the way through. Custom varies over whether it must cover the introduction and conclusions. If the summary follows these sections, it usually does not cover them. If it precedes the introduction and conclusions, however, it may cover their contents along with the other material.

The summary may run from five to fifteen per cent of the length of the full discussion. The percentage usually is found to be smaller as the report itself becomes longer. Instructions on how to write a summary have been given in Chapter 5.

The Introduction

All the sections discussed thus far have been mere preliminaries. Together they occupy no more than four or five pages. The report itself really begins with the introduction, which is written because the reader will have in mind certain questions: How did this report happen to be written? What function is it intended to perform? Where did the information come from? By whose request was it written? Until the reader knows the answers to such questions, he is not ready to receive the facts and discussion that the report contains.

There is no single form for the organization of this introductory material. One system is to use the general heading *Introduction* and then to place the facts under such specific subheadings as *Purpose* (or *Objective*), *Source of Information, Scope* (or *Limitations*), *Authorization,* and *Acknowledgments.* Another system is to use the heading *Introduction* without any subheadings. A third possibility is to dispense entirely with the heading *Introduc-*

tion and to use each specific subheading as a main heading. Yet regardless of the headings under which it is placed, the introductory information is the same. For convenience it will be discussed under the assumption that a main heading *Introduction* is used, plus the subheadings mentioned above.

Under the heading of *Purpose* or *Objective* the introduction explains as fully as necessary the conditions or events that created a need for the report, and indicates the function that the report is expected to perform.

The material under *Scope* or *Limitations* settles any possible doubt as to what the report covers and what it omits. This section may be omitted if the main title is so clear that no clarification is necessary, but often it is impossible to indicate the exact limits in the main title without making it cumbersome.

The discussion of *Source(s) of Information* answers the question of where and how the writer obtained his facts. It need not be included unless the question needs to be answered. Sometimes the facts on different aspects of the subject come from different sources. If so, this should be made clear. If some of the information comes from printed sources, they may be named in this section provided they are not more than three or four in number. If numerous, however, they should be named in footnotes or in a list of references.

The information under *Authorization* is extremely brief, merely telling who authorized the report, when, and how (letter, memorandum, personal conversation, or whatever other means). It is sometimes replaced by the inclusion, in a conspicuous place, of something such as a project number which would enable a reader to tell under what authority the work was done.

The introduction may include a section called *Acknowledgments* if it seems that acknowledgment of personal assistance—not to be confused with acknowledgment of printed sources of information—would be appropriate. Acknowledgments might be made, however, in the letter of transmittal if one is used. Occasionally one sees a section called *Acknowledgments* near the end of a report rather than in the introduction. Placed at the end, however, such a section usually consists of a list of earlier re-

ports or printed sources, and thus replaces a bibliography or list of references.

The total length of the introductory material should not be very great. One or two paragraphs on each point is usually enough. If a long discussion on any introductory point is necessary, it can be given an appropriate heading later in the report, and the coverage under *Introduction* can be omitted or reduced to a statement that the subject will be covered later in the report.

All in all, the formal introduction merely orients the reader. Sometimes there will also be a need for a general introduction that is actually part of the information-giving section of the report. If so, such material can be offered as the first main point after the formal introduction, being placed under such a heading as *General Discussion of . . .* , or *Earlier Background of . . .* , or *The General Problem of . . .* , or *Historical Review of . . .* Whenever there is a formal introduction, however, the ordinary introduction is identified by some other heading.

Some question may arise over why it is necessary to include the introductory material mentioned. The reader addressed is likely to be the person who authorized the report. Therefore, it may be reasoned, he will know already why the report is wanted, where and how the information was to be obtained, and what ground was to be covered. This is all true; yet the passage of time may cause many details to fade from the authorizer's memory. Also, the report may be passed on to other readers who are not familiar with the problem; or it may be filed and then taken up again months or years later. Therefore, the material in question is included so that the report will contain all the information any reader may need at any time, and thus will be self-sufficient.

Some of this information, it is true, may have been touched upon in the letter of transmittal; but there, it will have been barely mentioned rather than treated in full. The slight repetition is justified because there will be times when the letter of transmittal is read yet the report itself is set aside until later. Thus it will be of value to the reader to place a bare minimum of this orientational material in the letter even though the same ground is covered in more detail in the introduction.

Examples of introductory material may be seen in the longer reports included later in this chapter as well as in the following example.

INTRODUCTION

Purpose

The purpose of this report is to show some of the methods by which, in steel plants, the water supply may be conserved and the treatment costs and pollution loads may be reduced.

A typical steel plant consumes a tremendous quantity of water. Consequently, in a period when steel production is being increased, the water supply is a matter of great importance; and where water is not ample, conservation of the supply is essential. The quality as well as the quantity of water is important, moreover, for the different processes demand water of different qualities.

It is intended that the present study will increase the conservation of water after its initial usage, and thus lead to better use of the supply available.

Sources of Information

The information in this report came largely from the writer's personal familiarity with the steel industry, where he has worked on the problem of water conservation. Information has also been drawn from standard printed sources, as indicated by the list of references.

Authorization

This report was authorized by the Eastern Conference on Sewage and Industrial Wastes, in a letter from the chairman dated January 14, 1952.

The Body of the Report

After the introduction comes the body of the report, even though the heading *Body* is seldom used. This is the section that presents the real information and discussion except for information that may be relegated to tables and figures placed at the end.

Though it is usually the largest section of a report, no extended discussion of the body is necessary. The organization will have been decided upon when the outline was made, and the body merely covers the points listed in the outline. The merit of the result will depend on whether the writing possesses the qualities that make any writing good or bad, as well as the special qualities that are particularly desirable in reports. These are matters which

are not limited to formal reports, so they have been covered in preceding chapters.

Conclusions and Recommendations

Sometimes a formal report, because of the nature of the subject, will not need a section on *Conclusions and Recommendations.* When your report grows out of the investigation of a specific problem, however, it will usually need such a section. When you do include conclusions and recommendations, they should be the end result of all the facts and discussion the report contains. Thus the term "conclusions" is used with the meaning, "convictions arrived at on the basis of evidence" rather than, "the section that comes at the end." Logically, the conclusions come immediately after the body of the report. Sometimes, however, as has been mentioned earlier, logic is disregarded and they are moved to the beginning for the greater convenience of the reader. Regardless of where the conclusions are placed, they should grow out of the facts given elsewhere, and should include no new material.

Every statement that you make in the conclusions should be especially characterized by restraint. Overstatement is carefully avoided. When some of the evidence seems opposed to the conclusion, that fact should be conceded; and in explaining away this evidence the report should be scrupulously fair. If the evidence points toward some conclusion but does not definitely prove it, you should openly state that the evidence is not conclusive. There are times when you may express mere opinion, but you should frankly identify it as just an opinion. There is no surer way to lose the reader's confidence than to make statements in *Conclusions* that the facts do not warrant.

When conclusions are placed at the end, the considerations that justify them may be pointed out. When conclusions are placed at the beginning, however, no such support is offered. At either the beginning or the end, the conclusions should be numbered if the nature of the material permits.

Sometimes the organization of a report makes it natural to state, at the end of each major division, the conclusion reached

on the problem of that particular section. There is no reason this should not be done. Still, all the conclusions should also be drawn together in one special section. It would be inconvenient for the reader who wished to look over only the conclusions to hunt for them in several places.

Whether recommendations as well as conclusions should be included depends on the nature of the subject and on the instructions received. When recommendations are made, they should be closely keyed to the conclusions; and like the conclusions, they should be numbered whenever they are plural. The recommendations are a product of everything that precedes. The occasional tendency to regard *Recommendations* as a section consisting of a few helpful suggestions on incidental questions should be recognized as unsound. Rather, the recommendations are the focal point and the purpose of the entire report. An example of conclusions and recommendations follows, and further examples may be found among the specimens of reports.

CONCLUSIONS

The experiments on pressure testing of valves lead to the following conclusions:

1. Pressure testing makes it possible to achieve closer tolerances than can be achieved by conventional methods.
2. Refinement of technique was necessary to achieve these tolerances.
3. Equipment available at present makes pressure testing difficult, so efforts to obtain better equipment should be made if the method is adopted.
4. By achieving closer tolerances it should be possible to almost double the number of engine hours per run.

RECOMMENDATIONS

1. It is recommended that the pressure-testing method be adopted.
2. It is recommended that mechanics who will use the method be trained in its use, for even with training they will take some time to develop the skill necessary to make the method effective.
3. It is recommended that a continuing effort be made to improve the equipment used in pressure testing.

Visual Materials—Appendixes

Formal reports, like any technical writing, should often include tables and figures. Sometimes these tables and figures are scattered through the report, sometimes they are gathered together at the

end, and sometimes those of one type are given in the body and those of another type at the end. Scattering them through the report permits easier reference to them while reading and keys them more closely with the discussion. Placing them all at the end permits easier comparison of one table or figure with another, and gets the specially technical material out of the way of the reader who is not concerned with it. Also, placing such materials at the end is sometimes desirable because they would be physically awkward to handle if placed elsewhere. Unless you are following a prescribed set of instructions, you will need to settle on its own merits the question of whether to place all visual materials in the body, to place them all at the end, or to place some of them in each of the two locations. When tables and figures are concentrated at the end of the report they may be identified as the *Appendix*. If more than one type is used, they might be called *Appendixes* (or *Appendices*), being listed as *Appendix A, Appendix B,* and so on.

Full discussion of the use of tables and figures occurs in Chapter 6. Here, it need only be re-emphasized that, except in reports that are to be printed and widely distributed, the use of illustrations is functional rather than decorative. That is, illustrations are used because they give information effectively rather than merely to give the report an attractive appearance. If they also serve to stimulate interest, that is all to the good; but that is not their main purpose. As for the report that is elaborately printed for wide distribution—the average writer may provide some of the material it contains, but it is not a type for which he is likely to have final responsibility.

The Bibliography

When printed sources have been drawn upon extensively for information, a formal report should be documented. Any of the methods explained in Chapter 4 may be used for this purpose. Most of these methods include the use of a bibliography, or perhaps it may be called merely *References*. If such a list is used, it is normally the final part of the report, though it might on

occasion be placed ahead of some of the visual materials if the latter are stiff and bulky.

Manuscript Form and Binding for Formal Reports

Manuscript form. Unless you are requested to follow some other set of instructions on manuscript form, the following suggestions, which are as nearly standard as any other form, should be helpful.

The text may be double-spaced or may be single-spaced with double spaces between paragraphs. The margins are the same as those in any other manuscript except that an extra inch should be allowed for binding—either on the top or on the left side, as the case may be. Page numbers are placed in the center of the lower margin if the report is bound at the top. If it is bound at the side, they may be placed either in the center of the lower margin or in the upper right hand corner.

The topic headings on the pages of the report should be worded exactly as they are worded in the table of contents. This would be true, also, of the titles of tables and figures. The form and location of each topic heading shows its rank as main point, subpoint, or sub-subpoint. Further details may be observed on the specimen page, Figure 14.

Binding. A formal report should be bound permanently. Sometimes this is done at the top, and sometimes at the left side. If the report is bound at the top, there is usually no cover; but backing paper is used to protect the edges of the paper and to make the manuscript firmer and easier to handle. The backing paper is fastened at the top of the report—to the *front* rather than to the *back*. It is then folded up over the top and down the back so that the staples are covered. A one-inch strip of binding paper thus covers the top inch of the manuscript. This is an excellent method of binding any report up to 12 or 15 pages long provided the report does not contain any stiff, heavy materials such as photographs. If this method is used, the margin at the top of each page must be at least two inches.

Most reports that run more than 12 or 15 pages in length,

and many that are shorter, are bound on the left, often in covers made for this purpose. Binding at the side is better for even a very short report if any heavy exhibits such as photographs, maps, or blue prints are included. If a report is bound in a cover, the subject plus other desired information should be shown on the cover, even though the regular title page would be used inside.

The foregoing information on form and binding may be utilized to advantage as one writes many other types of material besides the formal report.

FIGURE 14.

Specimen Page of a Formal Report

On the page opposite, an acceptable manuscript form for formal reports is provided. Pagination is in the center of the bottom margin. The page bears three ranks of headings, the form for which is as follows:

Main Division: Centered and consisting entirely of capital letters. Underlined. No punctuation at the end. If it were not the first line on the page, it would be three or four spaces below the preceding line.

Subdivision: Beginning at the left margin a triple space below the preceding line and a double space above the line that follows. Capital letters used only for the first letter of each important word. Underlined. No punctuation at the end.

Sub-subdivision: Exactly like the form for subdivision except that it is followed by a period and that the text which follows begins on the same line rather than a double space below.

Other systems of headings may be used in place of the one illustrated; but whatever form is adopted, the main considerations are: (1) No headings of equal rank should be different in form. (2) No headings of unequal rank should be alike in form. (3) Headings of higher rank should always *look* more important than those of lower rank. Proper use of headings assists a reader to grasp the organization of the contents of the report.

FIELD COST-ACCOUNTING PROCEDURE

Labor costs should be channeled to the cost accountant by the foremen through the timekeeping department. Foremen will have to account for every hour of each man's time and to see that time cards are coded correctly. A foreman's report form similar to that shown in the appendix should be used, so that the foreman can summarize his crew's hours under the appropriate codes. Under "Remarks" peculiarities that might distort the cost picture should be explained. The foreman should also list equipment used in conjunction with his crew on the day's work and should code the operating hours for that equipment. The daily production of each crew should be stated in the proper units. In determining this information the foreman may need the assistance of the job engineer.

Since the timekeepers will handle all time cards it will be the responsibility of the timekeepers to provide the weekly labor breakdown for the field cost accountant, thus easing his load and eliminating one step in the processing of time cards. The cost accountant's job is to summarize all field costs and to present them to the home office, as well as to keep the superintendent and the foremen informed on production costs and progress.

Breakdown of Equipment-Operation Costs

Gas, Oil, and Maintenance. To determine the cost of operating equipment, the cost of fuel, oil, and repair and maintenance must be coordinated, totaled, and charged against the proper machines. Repair and maintenance for each piece of equipment will be shown on the shop-work orders and on the foremen's reports. Fuel and lubrication will be shown on the service tickets from the company's gas pumps. These expenses should be totaled weekly and should be included on the weekly summary sheet.

Rather than trying to charge the expense of operating each machine against the production of the machine for the same period, it is more practical to set up an hourly rental rate for each type of equipment. For example, when a report comes in showing that a dragline has worked four hours on a certain operation, the cost accountant can multiply the rate per hour by the number of hours and quickly arrive at the proper charges. These rates are based on direct costs as stated above, figured over a long period of time. In special instances where the accuracy is in doubt, the rates can be checked against the direct expenses as shown on the weekly summaries for the period in question. The change for a short-term error is more than counterbalanced by the long-term accuracy and by the greater ease in distribution of costs.

Figure 14. Specimen Manuscript Page from a Formal Report.

FINAL COMMENT ON REPORTS

Before the subject of reports is dismissed, certain final comments are called for.

The greatest obstacle in the way of writing good reports is often the state of mind of the writer. Until one has gained experience, he is especially likely to worry, when asked to write a report, because he cannot form a mental picture of the finished product. He is uncertain about what is expected. He is afraid he will betray ignorance of some obscure mysteries and rituals of report writing.

If this should ever be your state of mind, your worry is probably groundless. You are worrying over the wrong considerations. There is more danger that you will try to pattern your report after some inappropriate model than that you will betray ignorance of form; more danger that having been given a form to follow you will be afraid to alter it to suit the occasion; more danger that you will resort to a stiff and unnatural style merely because it is a report that you are writing.

In view of all this—if you are given a form, follow it intelligently rather than blindly. Whether you are given a form or not, make sure to include the necessary introductory material. In organization, always remember that the same facts can usually be organized by more than one plan, and make sure that the plan you adopt is the one that best meets the reader's needs. (Never let yourself stop thinking about that reader!) Use plenty of topic headings, but not so many that some of them serve no useful purpose. Tell the reader what you think he needs to know in a simple, natural manner. Apply the principles that make any piece of writing good, whether it is a report or not. Make a special effort to write with impartiality and restraint.

If you will do this, and if your basic writing ability is what it should be, you should be able to submit your reports to an employer with reasonable assurance that they will make a satisfactory impression.

EXAMPLES OF FORMAL REPORTS

These reports, like the examples of nonformal reports at the end of the preceding chapter, are offered for study and analysis rather than as models of form. They represent an application of the same general principles in different situations. Though they differ from each other in form, and though they differ from some of the forms given to illustrate portions of the formal report, their variation serves to indicate that usage is not uniform in actual practice.

Each is complete except for such material as drawings, maps, and photographs.

FORMAL REPORT NO. 1

Study of Bobbin Fabrication*

Except for the cover and illustrations, the following report is complete. The cover was a specially printed type that identified the company and division, and showed the project number and report title in smaller, typed letters. Though the report is formal it does not have a table of contents because the particular division of the corporation always uses headings chosen from the same list. It might be considered a laboratory report because of the nature of these headings and because it covers work done in laboratories.

The first page identifies the project and begins the summary, which in this report serves as a letter of transmittal. (You will observe that it is signed at the end.) The full list of parts in the report consists of: *Summary, Cost-Comparison Sheet, Origin, Object, History, "Data"* (see later comment), *Analysis of Data, Acknowledgment,* and *Bibliography,* plus illustrations and two supplementary reports. A question to consider is whether a table of contents showing subheads as well as main heads might be helpful in spite of the standardized form.

Because the summary comes first, it covers introductory material (*Origin, Object,* and *History*) as well as the body of the report.

* Courtesy of International Harvester Company.

MANUFACTURING RESEARCH DEPARTMENT

5225 S. Western Boulevard
Chicago 9, Ill.

Department
District Office
or Works

March 6, 1951

For Mr.

Your Letter

Subject or File No. Study of Bobbin Fabrication for the Twine Mill

Project #356-S

SUMMARY

For some time it has been the desire of the Fiber and Twine Division to be able to market a knotless, 20 pound ball of baler twine. The elimination of the knot is beneficial in that a special type of running knot is required in order for the twine to pass through the needle of a baler, which not only costs money to tie but also requires a certain amount of down time during the balling operation. A photograph of the type of knot employed is included as Figure 1 of this report. Before this desire could be realized, several problems had to be solved. One of the problems involved the designing of a bobbin which would hold approximately 20 pounds of baler twine and still not exceed a gross weight of 28 pounds. This project was established to solve the above problem.

As weight was of prime importance, the first phase of the investigation consisted of designing a bobbin to be made of a magnesium alloy. Due to the limited number of bobbins required, a sand cast design was considered to be most economical. The final design of the magnesium bobbin consisted of two identical sand castings jointed by inert arc welding and machined to the required dimensions. Several sample bobbins were supplied for test purposes. The average weight of a finished magnesium bobbin is approximately 6 pounds.

In addition to magnesium alloys, other materials were considered for use in the manufacture of a lightweight bobbin. Bobbins made of cast Aluminum exceeded the maximum weight limit. Laminated plastics were also considered and used in a proposed bobbin design. A bobbin was also designed using sheet aluminum. However, due to the success of the magnesium bobbin design as well as to other considerations, the plastic and sheet metal designs were dropped.

Although the prime object of designing a lightweight bobbin was to eliminate the knots currently existing in our baler twine, considerable economies will arise from the use of a bobbin having a 20-pound twine capacity. It is estimated that annual savings of $68,344. may be realized by using the larger, lightweight magnesium bobbin. These savings can be largely attributed to the elimination of the knot-tying operation as well as to a decrease in the number of doffing operations per shift. This latter condition also gives rise to an increase in the twine production per flyer.

This last paragraph of the summary gives the recommendations. Being thorough, the writer not only makes his recommendations concerning the immediate project, but also suggests a further study where a new possibility has become apparent.

Because of the effective unity of his paragraphs, the writer has so written his summary that a reader could read the first and last paragraphs and gain an understanding of the problem reported on and the solution arrived at. The intervening paragraphs cover the procedure, reasoning, and detailed facts that lead to the decisions made.

Compare the organization of the summary with the organization of the report that it covers.

Project # 356-S March 6, 1951

The bobbin design which was found most satisfactory was one made from two magnesium sand castings which are inert arc welded together to make a completed bobbin. It is recommended that this design as shown in Figure #2, attached, be used in the Company's twine mills for the production of baler twine. It is also recommended that it be considered for use in Binder Twine Production, where additional economies might be realized.

C. D. Evans, General Supervisor
of Welding Research

J. W. Armour, Manager
of Manufacturing Research.

cc: W. F. Elsholz, G. O.
W. B. Haley, McCormick Twine (3 copies)
J. C. Miles, Cima, France (Through Foreign Operations)
R. W. Simpson, Hamilton Works
P. O. Pippel, G. O.
Central Files
File

The sheet comparing costs gives full detail on how the savings referred to in the summary would be achieved. This saving, the report says, was not the main purpose of the investigation. Consider the reasons that might account for the cost sheet being placed here near the beginning—before all material except the summary, in fact—and whether it might have been desirable to place it near the end, where other supplementary materials are placed. Would its special interest justify its position?

The sheet itself is an interesting example of the thorough calculation that precedes conclusions on matters of cost.

COST COMPARISON

Present 8# Bobbins Versus Proposed 20# Bobbins
For 225 Ft. Baler Twine Operation at McCormick Twine Mills
(Project 356-S)

OCCUPATION	Man Power		EARNINGS Per Hr. Per Man		EARNINGS Total Per Hour		Est. Cost Reduction	
	Present	Proposed	Present	Proposed	Present	Proposed	Per Hour	Annually (1920 Hrs. Yearly)
Ballers	16	8	$1.325	$1.385	$21.20	$11.08		
Spinners	8	8	1.265	1.265	10.12	10.12		
Doffers	8	4	1.295	1.355	10.36	5.42		
Sacker Sealers	4	4	1.265	1.265	5.06	5.06		
Weigher Wrappers	4	4	1.295	1.295	5.18	5.18		
Janitor	1	1	1.295	1.295	1.295	1.295		
Blower	-	1	-	1.24	-	1.24		
Reconditioner	-	1	-	1.295	-	1.295		
Recond. & Blower	1	-	1.295	-	1.295	-		
Sliver Trucker	1	1	1.325	1 325	1.325	1.325		
Oiler	1	1	1.46	1.46	1.46	1.46		
Repair Man	1	1	1.51	1.51	1.51	1.51		
Spline Spinner	-	1	-	1.295	-	1.295		
Total:								
Per System - 1 Shift	45	35			$ 58.805	$ 46.28		
(*) 3 Systems - 1 Shift	135	105			$176.415	$138.84	$37.575	$72,144.
Vacation & Holiday Pay								2,000
Gross Total								$74,144.
Less: Added Depreciation & Personal Property Tax on New Equipment								5.800.
NET TOTAL								$68,344.

(*) 3 Systems (1 Shift) Constitutes Normal Operation.
NOTE: The above economy is contingent on bargaining with the union successfully on the proposed occupations and rates.

Prepared by _____
Accounting Department

Approved _____
Auditor

The original of the report was mimeographed. Note that the project number has been indicated at the upper right corner of each page to make the pages of the report easier to identify.

There is no heading *Introduction,* the introductory information having been placed under *Origin, Object,* and *History.* These sections permit a reader to orient himself to the project. Figure 1 is referred to at the end of the section on *History.* This is the first of several references to figures during the report.

The section called *Data* is reduced to a mere list of materials, mostly figures, all of which come at the end of the report, being too heavy to bind in among the pages of the text. These "data" include two reports made by other divisions which provided certain information needed. The result is a demonstration of the way in which a single report may call for the integration of work done by several agencies.

STUDY OF BOBBIN FABRICATION FOR THE TWINE MILL

ORIGIN

In April 1948, Mr. W. F. Elsholz, Manager of Manufacturing, Fiber and Twine Division presented the problem to Mr. J. W. Armour of welding a lightweight magnesium bobbin which they were currently attempting to develop. A project was established to assist them in this development.

OBJECT

To modify the present Hubbard Bobbin or design a new bobbin which would hold one full ball of baler twin (20 lbs) and not exceed a gross weight of 28 pounds.

HISTORY

Some time during the early part of 1947 McCormick Twine Mills, in cooperation with the Dow Chemical Company and Hubbard Spool, designed a lightweight all-metal bobbin, fabricated from magnesium. Several samples were made and tested. This original all-metal bobbin was made up of three parts: two sand castings for the flanges and a piece of extruded tubing for the hub. Considerable trouble was encountered in satisfactorily attaching the flanges to the hub. A thermosetting type of plastic cement was used in conjunction with long bolts but without apparent success.

The original reason for desiring a bobbin having a large capacity was to eliminate the knot which appeared one or more times in each 20-lb ball of baler twine. It would apparently be a tremendous advantage, from the sales standpoint, to be able to advertise a knotless, 20-lb. ball of twine, even though the present knot, if tied correctly, causes very little trouble in the field. (See Figure 1)

DATA

Figure 1 Knot As Tied in Baler Twine

Figure 2 Proposed Design - Old Design

Figure 3 Original Design of All-Metal Bobbin

Figure 4 First Design of Welded, All-Metal Bobbin

Figure 5 Bobbin Castings, Before and After Welding

Figure 6 Welding All-Metal Bobbin

Figure 7 Centrifugal-Testing Fixture

Most of the report, so far as it consists of words, falls under the heading *Analysis of Data,* which has several subheads. (Their being numbered is different from the usage in many corporations.) The integration of this section with the "data" is secured by reference to the appropriate figures immediately after some of the headings.

What plan seems to have been followed in the order in which the figures are arranged at the back of the report? (Their titles show their contents.) Is there any deviation from this plan?

What principle has been followed in the arrangement of subject matter under *Analysis of Data?* Notice how the reader is given enough facts to feel that he really understands the way in which the investigation developed.

Drawing #D-122 Casting Drawing, Proposed Bobbin Head Without Rim

Drawing #D-126 Machine and Welding Drawing, Proposed Bobbin Head Without Rim

Drawing #D-164 Proposed Rimless Plastic Bobbin Head With Die-Cast Drive

Drawing #D-165 Proposed Stamped Bobbin Head

Report, Metallurgical

Report, Dynamic Balance

ANALYSIS OF DATA

I Original Design of All-Metal Light Weight Bobbin (Fig. 3)

The original design of the all-metal bobbin consisted of three parts--two cast flanges and an extruded tube for the hub. A considerable amount of trouble was experienced in satisfactorily assembling these parts so that they would remain intact during service. A thermosetting type of resin was tried as a binder in conjunction with three long bolts passing through the two flanges and hub, but this did not prove satisfactory.

The first step taking in Manufacturing Research consisted of attempting to weld the flanges to the extruding tubing. As was expected, considerable weld cracking was experienced due to the location of the weld with respect to the flange. Magnesium is inherently quite susceptible to weld-metal cracking and therefore one would expect cracks to occur when a fusion weld is made in the center of a plate or flange This condition was approached when the original design was welded.

II. First Two-Piece Casting Design (Fig. 4)

The next step consisted of designing a bobbin with the weld located at a non-critical point. A consultation with personnel from a well-known aluminum-magnesium foundry indicated that it would be possible, and not too costly, to cast the bobbin in two identical parts. This would put the weld in the center of the hub, eliminating the restraint effect of the flange

A 15/16 in. wide flange was incorporated into this first design to approximate the design of the reinforced wooden bobbin then being used. Four catch plates were used in an attempt to provide a better balanced bobbin

Several sample bobbins of this design were made up for test Magnesium "C" alloy was used for these samples in three conditions: 1) As cast, 2) Heat Treated, 3) Heat Treated and Aged These three

Page 6 refers to further illustrations, one such reference being to Figure 2, which had not been mentioned previously, though Figures 3 and 4 had been mentioned. Apparently the writer felt that the order in which a reader would use the figures if he were studying them independently of the text did not coincide with the order in which he should refer to them from the text.

Notice how all the results have been concentrated by the informal table, which makes certain important facts easy to find and grasp. A report writer should always be on the alert for occasions when such devices may be of assistance to the reader.

A report should be thorough. This principle is illustrated where the writer includes the details about welding methods. Such information might be useful later and is therefore made a matter of record.

II. First Two-Piece Casting Design (Cont'd)

conditions were tried to determine whether or not the increase in tensile strength and/or hardness, as brought out by the heat treatments, would be beneficial In addition to these magnesium samples, several bobbins were made up using aluminum #220 alloy These aluminum bobbins proved to be too heavy (9-1/2 lbs.) so it was decided to confine our future work to magnesium bobbins The initial magnesium bobbins weighed approximately 7-1/2 lbs

III. Second Two-Piece Casting Design

The tests on the first series of magnesium bobbins, described above, indicated that two major improvements could be made: 1) eliminate the 15/16 in wide flange with supporting gussets, and 2) eliminate two catch plates Both of these changes contributed toward obtaining a lighter bobbin The drawings for this second and final bobbin will be found at the end of this report (D-122 and D-126) The material used for these bobbins was Magnesium "C" Alloy, as-cast

Figure 2 shows a comparison between the proposed welded-magnesium bobbin and the bobbin which was currently being used. The approximate weight of these two bobbins and their capacity is as follows:

	Old Design	Proposed Design
Approximate Weight of Bobbin (Empty)	6 lbs.	6 lbs
Approximate Weight of Baler Twine (Full)	12 lbs	20 lbs.
Approximate Gross Wt	18 lbs	26 lbs.

IV Welding the Two-Piece Casting Design

Figure 5 shows the two-piece casting design before and after welding As can be seen, some machining of the castings is required before welding. This is shown on Drawing #D-126. Internal reinforcement of the weld area was provided in the design to compensate for any loss in strength of the parent material due to the welding operation

The following are the conditions used for welding the two-piece magnesium bobbins:

Preheat Temperature: 100° - 125° F

Equipment.

1) Manual, water-cooled, Inert Arc Welding Torch
2) 200 Ampere AC Transformer Equipped with High Frequency Superimposed on 60-Cycle Welding Current

The general arrangement has been chronological, but not all the facts have been given by the chronological plan, some of them having been placed under the heading *Other Designs Considered.* Inclusion of this material is necessary for the sake of thoroughness. If these discarded designs had not been mentioned, the reader might wonder whether all the possibilities had been explored. Also, mention of them here might prevent waste of time later if someone thought that they might be worth investigating. The writer of this report has hit upon an excellent method of including everything needed without letting the facts about discarded designs clutter his account of the development of the design that was successful.

IV Welding the Two-Piece Casting Design (Cont'd)

Equipment (Cont'd)

3) Suitable Rotating Fixture

Filler Rod: Magnesium "C" Alloy, 1/8" and 3/16" diameter.

Welding Current: 130 Amperes

Inert Gas: Argon a/c 0.20 ft. 3/min.

Electrode: Tungsten, 1/8" diameter

Number of Passes and Filler Rod Size:

Total-3

1st. Pass - 1/8" Filler Rod
2nd. Pass - 3/16" Filler Rod
3rd. Pass - 3/16" Filler Rod

Welding Speed: Rotating Fixture set for 1.1 minutes per revolution (Total welding time per bobbin - 4.1 minutes).

Considerable weld porosity was initially encountered but preheating the castings was effective in eliminating this condition. Facilities were not available for preheating the large number of castings involved higher than 100°F to 125°F. It is recommended that for any further welding a preheat temperature of 200-250°F be employed.

During the investigation both Argon and Helium gases were tried but Argon proved the most satisfactory. In addition, both AC and DC current were used, but due to the ease of starting, and other reasons. AC was considered the most suitable.

Mechanical cleaning of the joint, prior to starting the weld, was found necessary. This mechanical cleaning was accomplished by using a standard welder's wire brush. In addition, it was found to be necessary to clean the weld deposit between passes.

V. Other Designs Considered

Three other methods of construction were considered during the investigation, namely: 1) plastic design (Drawing #D-164), 2) aluminum stamping design (Drawing #D-165), and 3) permanent-mold or die-cast design. Numbers (1) and (2) were not followed through

One principle often followed in reports is the placing of the material which is more technical in later portions of the report. This is done so that the executive will get what he needs from the earlier portions, which he reads first, and will not be forced to concern himself with technical details, which nevertheless must be included for other readers and for completeness. This caused the facts on tests to be placed near the end. Placing them at the end might also be justified by the fact that these particular tests were made as an assurance against weaknesses rather than as a means of finding whether the design had the positive qualities needed. Merely knowing that they had been made would be sufficient to reassure some of the possible readers that the designs were sound.

V Other Designs Considered (Cont'd)

to an ultimate design due to the successes of the two-piece welded design. Number (3) was discarded due to the initial tooling cost. If these bobbins were to be made and sold as a Harvester product, with relatively high annual requirements, then the permanent mold or die cast design would probably have proven the more satisfactory. However, the requirements were limited to one lot of approximately 2,600 bobbins, which would hardly justify high permanent mold or die costs.

VI Tests

1. Metallurgical Tests: In order to evaluate metallurgically the weld produced in the magnesium bobbin, specimens were submitted to the metallurgical section for tensile tests, micro-structure examination, and hardness tests. The results of these tests will be found at the end of this report

2. X-Ray Examination of Castings: All experimental castings were subjected to X-Ray examination prior to testing. Initially some porosity was encountered mainly around the catch-plate bosses; however, through the cooperation of the foundry, this porposity was substantially eliminated. In addition, representative samples of the 5,200 castings were X-Rayed to check on the quality being obtained at the foundry.

3. Centrifugal Testing: In order to determine the effect of high rotating speeds on the magnesium bobbin, 73 samples were subjected to a centrifugal test. A suitable fixture was built (Fig. 7) for rotating the bobbins at 5,200 rpm for two minutes. No excessive vibrations were encountered even when one sample was tested at 7,700 rpm. As the normal operating speed of the bobbins is 1,600 rpm, it was felt that a sufficient safety factor was present.

4. Balancing Tests: In order to further determine to what extent a representative sample of the experimental bobbins were out of balance, eight bobbins were sent to Melrose Park Works for a dynamic-balance check. A copy of the report of these tests will be found at the end of this report. A check of the bobbins showing the greater out-of-balance indicated the trouble was caused by a variation of the flange width at the periphery.

5. Stress Analysis of Weld Area. A determination of the internal stresses in the vicinity of the weld has been started but the results are not complete at this writing.

Discussion on savings has been withheld until the end because the possible savings were an incidental result rather than the original purpose of the study. The cost comparison sheet, however, was placed just after the summary. Would it be desirable to have it here in the section where the savings are discussed, or among the "data" at the end? The whole question of where to place the cost-comparison sheet is worth study.

The section *Acknowledgment* covers information of a type sometimes placed in a letter of transmittal or an introduction.

In what respects does the bibliography depart from the commonest forms of bibliography?

There is no section on conclusions or recommendations. Would it be desirable to have such a section at the end as well as to state the recommendations in the summary? Or might it perhaps be desirable to give the heading *Recommendations* to the last paragraph of the summary?

VII Discussion of Savings Involved

Although the initial purpose of this project was not based on the savings which might result from using a lightweight bobbin having a capacity of 20 lbs. of baler twine, a considerable saving was later indicated as being potentially feasible Generally this saving is based on two conditions as follows:

1. Fewer doffing operations required per shift
2. Elimination of the knot-tying operation during balling.

A savings-analysis sheet based on information obtained from McCormick Twine Mill and dated November 1, 1949, indicated that a potential annual economy of $68,344 exists, contingent on bargaining with the union successfully on the proposed occupations and rates

ACKNOWLEDGEMENT

Acknowledgement is due Mr. G. F Sturenfeldt and Mr. W B Haley, McCormick Twine Mills for their close cooperation, which played an important role in the successful completion of this project

BIBLIOGRAPHY

1. "Eliminating Cracking in Magnesium Arc Welds," WELDING JOURNAL RESEARCH SUPPLEMENT, pages 273 f · June 1948

2. "Arc Welding of Magnesium Alloys," Losse and Orban, WELDING JOURNAL. pages 598-607, December 1942

3. "Heliarc Welding of Magnesium," MODERN METALS, v 2, pages 17-18, March 1946

4. "Inert Arc Welding," Wyer, IRON AGE, v 158, pages 57-58, October 31, 1946

5. "Welding Magnesium," Moyle, WESTERN MACHINERY AND STEEL WORLD. v 37, pages 110,113,136,March 1946

6. "Inert Arc Welding," Puffer, STEEL, v 119, pages 80-82, 116, 119, November 18, 1946

7. "The Argon-Arc Process for Welding Magnesium and Aluminum Alloys and Stainless Steel," SHEET METAL INDUSTRY, v 23, pages 2405-2415, December 1946

8. "The Fabrication by Welding of Magnesium Alloys," C. R. Kemp, MODERN METALS, pages 31-35, August 1949

Prepared by:

R. C Becker

The photographs (Figures 1–7) and drawings in the original are omitted. They were placed between the bibliography and the two laboratory reports that follow and supplement the main report.

The first of these laboratory reports, shown opposite, gives no information except conclusions. Such sections as purpose, theory, and procedure or method are omitted because the tests were purely routine. Two micrographs, not included here, were used in the original.

MANUFACTURING RESEARCH DEPARTMENT

5225 S. Western Boulevard
Chicago 9, Ill.

Department Manufacturing
District Office Research Welding
or Works Department

For Mr. C. D. Evans

September 20, 1948

Your Letter

Subject or File No. EXPERIMENTAL MAGNESIUM BOBBIN
INTERIOR ORDER NO. Y-2060
ACCOUNT NO. 356-S

Attention: R. C. Becker

The results of our metallurgical examination on Sections of magnesium bobbin are as follows:

Tensile Strength:		
30,200	psi	)
25,400	"	) Base metal specimens
22,500	"	)
17,300	"	)
17,200	"	) Weld metal only specimens
29,700	"	)
21,900	"	)
31,300	"	) Overall specimens
26,400	"	)

Microstructure:

The microstructure is shown on the attached photomicrographs.

Hardness:

Hardness traverse is shown on attached sheet.

Signed: J. A. Halgren

Approved by:

M. E. McKinney
for A. S. Jameson

Copied 1-31-51/dn

The second of the two laboratory reports, shown opposite, illustrates the fact that forms for that type of report are not uniform. It is a laboratory report in that it tells of work done in a laboratory, but is written in the form of a memorandum and presents its information under headings adopted as standard by that particular organization. These headings are not the ones most widely used in laboratory reports; but by using them the organization achieves a result it desires, namely, having the laboratory reports organized in a manner like that of the main report.

INDUSTRIAL POWER ENGINEERING DEPARTMENT
Melrose Park Works

Office: Department 70 Date: May 26, 1949

To: Job Number. C-73

cc: J.W. Burley
L Niebling
File

SUBJECT:

Magnesium Bobbins for Manufacturing Research (Mfg. Research order #Q-31875).

OBJECT:

To check, dynamic balance of Twine Bobbins and record amount and angle of unbalance.

RESULTS:

Bobbin No.	Side	Angle	Oz.Ins.Heavy	Side	Angle	Oz.Ins.Heavy
2	X	65°C.	3.608	Y	55°C. C.	.879
3	X	150°C. C.	.518	Y	5°C. C.	1.584
16	X	2°C.	2.900	Y	78°C.	.830
21	X	120°C. C.	4.176	Y	30°C.	2.464
25	X	80°C.	.230	Y	65°C. C.	1.512
32	X	80°C.	1.755	Y	50°C. C.	2.171
55	X	145°C. C.	1.440	Y	70°C.	1.584
69	X	60°C.	.694	Y	45°C. C.	1.248

C. C. = Counterclockwise C. = Clockwise

REMARKS:

The angle of unbalance is figured from a line which would pass from the center of the bore through the center of the recess, which has the bobbin end side number stamped in it. Bobbins are marked with layout bluing where they are light in balance. 180° from marking is heavy point.

Signed: W. Flohr

Inspector: T. J. Hornsby

Copied 1-31-51/dn

FORMAL REPORT NO. 2

Canal Lining Test Section*

The following report would be considered formal. Even though the letter of transmittal was not bound into it, most of the other parts are present. It was written to give the results of an investigation. The investigation had been undertaken to obtain information for use as needed rather than for use on some specific occasion. Note that the general program under which the report was prepared is indicated in the heaviest letters on the title page. The title of the specific report follows in smaller letters. The subject is further identified by explanatory material below so that the exact subject and the nature of the report will be clear.

The report did not have a cover. Heavier, colored paper was used, however, for the title page and for a blank page at the end, so that these two pages served the purpose.

* Courtesy of United States Bureau of Reclamation.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Region I

LOWER-COST CANAL LINING PROGRAM

Experimental Precast Concrete Block

Canal Lining Test Section

Mile 13.6
"D" Line Canal
Payette Division
Boise Project, Idaho

Construction and Performance Report

Boise, Idaho

October, 1950

The report had the two-level table of contents shown opposite, indicating the divisions and their rank and arrangement.

Appendix A was a two-page statement of the specifications for the concrete blocks. Appendix B was a table showing climatic conditions. A large folded sheet bearing several diagrams and a small map that showed where the work had been done was bound into the report after Appendix B. A question to consider: Would it have been desirable to mention the folded sheet in the table of contents, and to show the reader, also, more about the nature of the material in the appendixes?

This report contained 15 photographs, placed between the introduction and the body of the report but not mentioned in the table of contents. (Their presence could hardly escape attention, for each was full page and they were necessarily on stiffer paper.) Each photograph was a right hand page. A left hand page opposite each explained it and bore several lines of comment. The pictures plus the comments covered the entire subject in the same order as the report. They might almost have substituted for the report except that specific information would have been difficult to find if it were presented only in such a manner. The photographs served to arouse interest as well as to give information, and made it easy to visualize the matters covered in the other portions of the report. They were so bulky, however, that it was rather difficult to find where the text continued after the interruption, and they did not promote continuity of reading. An alternative method would have been to place the photographs, as well as the present appendixes, at the end and refer to them at appropriate times during the text. This would have reduced the interest-getting value of the photographs, however, and would also have reduced continuity of reading.

CONTENTS

	Page
SUMMARY	1
CONCLUSIONS	2
INTRODUCTION	3
CANAL LOCATION AND DESCRIPTION	4
SEEPAGE CONDITIONS PRIOR TO LINING	4
DESCRIPTION OF LINED SECTION	4
PREPARATION OF SUBGRADE	4
PRECAST CONCRETE BLOCKS	5
General	5
Design	5
Composition, Mixing, Curing	6
Laying	6
Sealing	7
COSTS	7
PERFORMANCE	8
APPENDIX A	
APPENDIX B	

The summary is extremely thorough. It covers the introduction as well as the other sections, and it would greatly assist a reader to utilize the photographs.

After covering the introductory material, the summary tells about the investigation in chronological order. (Compare this with the order followed in the report itself.) The information obtained by the investigation is given just as it was obtained while the work was in progress.

SUMMARY

As an experiment in the Bureau of Reclamation's Soil and Moisture Conservation Program, and as a seepage control measure, a section of the "D" Line Canal, Payette Division, Boise Project, Idaho was lined with precast concrete blocks during March 1947. This section was lined to eliminate a seeped condition in the land immediately below the canal, and to conserve water. The section was 400-feet long, and contained 14,015 blocks which covered an area of approximately 1,400 square yards.

The installation was financed by the Soil and Moisture Conservation Program Fund The Project performed all of the work involved in preparing the subgrade and laying the blocks, for which it was reimbursed from the Fund.

The precast concrete blocks were furnished by the Concrete Construction Company of Boise, Idaho, under specifications prepared by the Branch of Design and Construction, Region I. Manufactured two at a time in a Besser Vibro-Pak Machine of "dry-mix" concrete, the blocks were 7-3/4 inches wide, 15-3/4 inches long, and 2-3/4 inches thick, with plain butt edges, and weighed approximately 27 pounds each. The blocks were manufactured at a cost of $0.14 each, and were trucked from the manufacturing plant to the placing site at a cost of $0.03 each, making the total cost delivered $0.17 per block.

Before the concrete blocks were laid, the subgrade was prepared by removing the berm on both banks, backfilling the undercut spots, and rounding the bottom of the canal. The blocks were laid in longitudinal rows with their long sides parallel to the center line of the canal, starting in the bottom and working up each slope. The transverse joints between blocks were staggered The joints were grouted with a grout mix of 1 part cement to 2 parts sand poured from a spout can. A six-inch thick, 24-inch deep cutoff wall was placed at each end of the lined section.

The blocks were laid without difficulty. Having plain butt edges, and being small in size, the blocks were well adapted to laying around curves. Furthermore, due to the plain butt edges, exacting subgrade preparation was not required

The surface of three small sections of the block lining was sealed for experimental purposes. Two of these sections were sealed with a diatafilled asphalt cement; the third section was sealed with a mixture of paraffin and diesel oil.

Some seepage loss from the lined section occurred throughout the first irrigation season due to the perviousness of the blocks. Thereafter, however, the seepage loss was eliminated, the surface of the blocks having been sealed with water-borne silt.

The total cost of the block lining in place was $3.05 per square yard, including the cost of subgrade preparation.

The block-lined section has performed satisfactorily over a period of three and one-half years, and is in excellent condition. The only noticeable defects are a few fine cracks.

In comparison with the *Summary, Conclusions* covers only the information obtained and the opinions arrived at on the basis of that information. There are no specific recommendations for action in any individual case because the purpose of the report does not call for them.

CONCLUSIONS

Precast concrete blocks with plain butt edges and Portland cement mortar joints may be used effectively as a canal lining material to eliminate seepage losses.

Having plain butt edges, these blocks possessed three distinct advantages over blocks cast with tongue and groove joint edges or lap joint edges. First, they were readily adaptable to manufacture by machine; second, they were easily laid around curves in the canal alightment, and third, they did not require exacting subgrade preparation prior to laying.

The blocks may be installed without skilled workmen or special equipment, except for a dragline operator and a dragline for preparing the subgrade, and, possibly, a concrete mixer for mixing the joint mortar.

Sealing the surface of the blocks with asphalt cement or other material was unnecessary, since the surface became sealed naturally through the deposit of water-borne silt.

At a cost of $3.05 per square yard, precast concrete block canal lining probably could not be considered as a low-cost type of canal lining, particularly on large-scale jobs where it would have to compete with cast-in-place linings placed by mechanized methods. This type of lining, however, should have some application and adaptability for use in farm ditches and other small lining installations

The *Introduction* indicates the exact subject, though it might do more to make clear the purpose of the experiment. The source of information is obvious and therefore is not mentioned. Likewise, no clarification as to scope is necessary. The facts concerning who did the work are provided since this information might be desired and yet does not belong in the body of the report. The final paragraph covers the question of authorization.

INTRODUCTION

This report describes the construction of a section of precast concrete block canal lining on the "D" Line Canal, Payette Division, Boise Project, Idaho, during March 1947.

Construction of the lined section was under the general supervision of Mr. Theodore Nelson, Irrigation Manager, Payette Division, Boise Project, Notus, Idaho. Project forces who performed all of the work involved were under the direction of Mr. Charles Maberry, foreman.

Techincal assistance for the installation was furnished by Mr. John V. Walter, Branch of Operation and Maintenance, Region I.

This report was prepared in accordance with Paragraph 10, Circular Letter No. 3398, and was written by R. J. Abbey, Branch of Design and Construction, Region I.

Though no such heading as *Body* is used, the body of the report begins on this page. The first three sections provide the facts that the reader should know before he reads about the work done. A section such as that entitled *Canal Location and Description* seems practically standard in reports made in the Bureau of Reclamation.

Note that under the heading *Description of the Lined Section* the reader's attention is directed to the drawing at the end of the report.

CANAL LOCATION AND DESCRIPTION

The experimental section is located approximately 4 miles north of Notus, Idaho, at Milepost 13.6 on the "D" Line Canal, Payette Division, Boise Project, Idaho.

The "D" Line Canal was constructed by the Bureau of Reclamation between the years 1938 and 1940 to irrigate approximately 13,000 acres of higher-lying land on the north side of the Boise River Valley, and was first operated during 1939. Originating at a division structure at the end of the Black Canyon Main Canal, the canal flows in a westerly direction for 39 miles to end approximately 7 miles north of Parma, Idaho At the head, the canal has a design capacity of 250 second-feet. Through the experimental section, the canal has the following design properties in the original earth section:

Base	10 0	Q	172
Side slopes	1½:1	r	2.94
Water depth	4 65	n	0225
A	78.94	s	00026
V	2 18		

SEEPAGE CONDITIONS PRIOR TO LINING

At the site of the experimental section, the canal contours along a sidehill through seamy, blocky hardpan. The bottom of the canal is covered with a layer of course sand. Water leaking through the sand and seamy hardpan was in sufficient quantity to cause a seeped condition in the land immediately below the canal. Installation of the machine-made block lining was intended to eliminate the seeped condition of the land as well as to conserve water

DESCRIPTION OF LINED SECTION

The lined section is 400 feet in length with a base width of 10 feet, a vertical height of 5.5 feet, and side slopes of 1½:1 In area, the section contains approximately 1400 square yards, and the lined perimeter averaged slightly over 31 feet. A curve in the canal alignment is included in the section.

The location of the lined section and a typical section are shown on the drawing at the back of this report.

PREPARATION OF SUBGRADE

When selected for lining, the section of canal at Milepost 13.6 was in comparatively good condition as to grade and alignment. However, the upper bank was undercut in several spots, and both the upper and lower bank had a projecting berm of soil and weed growth at the water surface line.

This page continues the explanation of the work done, which was started near the bottom of the preceding page. Chronological order was followed so far as possible in that the preparation of the canal section for the blocks comes first, followed by a description of the blocks. Logically and chronologically these points precede an explanation of the processes of laying and sealing.

To prepare the subgrade for the concrete block lining, the berm on both banks was removed, the undercut spots were backfilled, and the bottom of the canal was rounded. All of the above work was done with a 3/8-cubic yard Quick-May dragline. Following the dragline excavation, the slopes were hand-trimmed and the downstream cutoff trench excavated. Excavation of the upstream cutoff trench followed the laying of the last transverse row of blocks in the section.

PRECAST CONCRETE BLOCKS

General

The precast concrete blocks were furnished by the Concrete Construction Company of Boise, Idaho, under specifications prepared by the Branch of Design and Construction, Region I (See Appendix A). Using a Besser Vibro-Pak Machine and "dry-mix" concrete, the blocks were cast two at a time by the standard Besser process. With plain butt edges, the blocks were 7-3/4 inches wide, 15-3/4 inches long, 2-3/4 inches thick, and weighed approximately 27 pounds each. Fifteen thousand blocks were manufactured, of which 14,015 were placed in the lining. The Concrete Construction Company manufactured the blocks at a price of $0.14 per block, and trucked them from their plant in Boise to the placing site for $0.03 per block.

Design

The size of the blocks was more or less arbitrarily determined by the size of the standard molds used in the Besser machine. The mold used in casting the standard coping block is 2-3/4 inches by 7-3/4 inches by 15-3/4 inches. Since a thickness of 2-3/4 inches was adequate for a substantial lining, and since the other two dimensions were satisfactory, although perhaps smaller than desirable, this mold was used to cast the blocks for the lining.

The edges of the blocks were designed as plain butt edges to eliminate the shortcomings of blocks used in a section of precast block lining placed on the Roza Division of the Yakima Project in November and December 1946. Some of these latter blocks were cast with a tongue & groove joint edge, and some were cast with a lap joint edge Due to the special edges, manufacture of this type of block was not possible by machine methods with the plant equipment available; therefore, they were cast in individual molds and the surface finished by hand methods. During placing operations, it was found that a very exacting fine-grading of the subgrade was required to obtain a satisfactory fit at the joints with this type of block. Also, no method was found for laying the blocks around curves in the canal alignment. In contrast, the blocks used in the installation described in this report were adaptable to manufacture by machine methods. During placing operations, no requirement was found for fine-grading the subgrade to any degree of refinement, and there were no difficulties in laying the blocks around curves in the canal alignment.

Notice the main heading (on the preceding page) under which the sections on *Laying* and *Sealing* are placed. Is the kind of information given in these sections what one might expect under that particular main point? What variations in the use of topic headings might be substituted?

Composition, Mixing, Curing

The concrete in the blocks was composed of Type I cement, sand, 3/8-inch maximum size coarse aggregate, and sufficient water to hydrate the cement and impart some workability to the concrete Mix proportions of the concrete for approximately 7500 blocks were 1 part cement to 2.3 parts sand to 1.7 parts coarse aggregate, by weight, with a water-cement ratio of 0.34. These blocks were laid in the upstream half of the lined section. Mix proportions in the concrete for the remaining approximately 7500 blocks were 1 part cement to 4.3 parts sand to 3.7 parts coarse aggregate, by weight, with a water cement ratio of 0.43 These blocks were laid in the down-stream half of the lined section

The dry ingredients were mixed for 2½ to 3 minutes after which the water was added and mixing continued for another minute.

The yield from the first mix was 18 blocks per sack of cement; the yield from the second mix was 34 blocks per sack of cement

After casting, the blocks were steam cured for 48 hours and then removed to an outside storage yard.

The concrete in the blocks was highly pervious compared to normal concrete. A cupful of water poured over the surface of a block permeated the block immediately.

Laying

The blocks were laid in longitudinal rows with their long side parallel with the center line of the canal. The transverse joints between blocks were staggered from row to row. A 1/2-inch crack was left around each block in the bottom rows, the crack being filled later with a grout mix of 1 part cement to 2 parts sand poured from a spout can or bucket. On the slopes, the longitudinal joints were grouted by pouring the grout against the upper side of each row of blocks before the succeeding row was placed. The tranverse joints were grouted after the blocks were in place. After grouting, all of the joints were struck-off with a steel trowel.

Grout for the joints was mixed in a concrete mixer on the bank and chuted to a wheelbarrow in the bottom of the canal.

To anchor the lined section in the canal, six-inch wide, two-foot deep cast-in-place concrete cut-off wall was constructed at each end of the section.

A chute was used to transport the blocks from the top of the bank to the bottom of the canal, thus reducing the time and labor in handling the blocks and the foot traffic on the slopes. The blocks were soaked in water for approximately one minute on the bank before being sent to the bottom of the canal for placing and grouting. A one-minute soaking was sufficient to saturate the blocks due to their extreme perviousness.

The material under *Sealing* tells about the process only. The results of the sealing did not become apparent until later, so they are not expressed at this point. However, note the reference to the end of the report for additional information on sealing.

The discussion of costs is placed where it belongs chronologically and logically. If the reader wished to know about costs at once, however, he would find the facts summarized in the section *Conclusions.* If he wished to know the full details at once, the table of contents would show him where to look for them.

Note how thoroughness is achieved in the discussion that precedes the informal table. Certain facts are included in the discussion that would not fit into tabular form.

A small amount of hand-trimming on the slopes was necessary as the work progressed to insure a full bearing surface for each block.

A crew of 6 to 8 men worked 12 days laying and grouting the blocks, averaging 1170 blocks per day laid and grouted. The blocks were laid without difficulty, both on the tangents and on the curve. Having plain butt edges and being small in size, the blocks were well adapted to laying around curves, and refinements in subgrade preparation were unnecessary.

Sealing

As originally planned, the surface of the block lined section was to have been sealed with an asphalt seal-coat, since the machine-made blocks were highly permeable. However, due to the press of work and shortage of labor on the project at the time the lining was installed, this surface treatment was not done. Only three small sections were sealed as experiments. Two sections, one on the west slope, the other on the east slope, were primed with an RC-0 cutback and sealed with a diata-filled asphalt cement of 85-100 penetration. Both the RC-0 and the asphalt cement were broomed onto the surface. The diata-filled asphalt cement was mixed in the proportions of 77 % asphalt cement and 23 % diatomaceous earth, by weight. The third section was sealed with a mixture of paraffin and diesel oil (30 % paraffin and 70 % diesel oil, by weight) poured onto the surface and spread with a brush.

The location and size of the seal-coat test sections are shown on the drawing at the back of this report.

COSTS

The costs shown below were accurately kept, and will be, with slight variation, the costs attached to any installation of this type. Mass-produced in greater quantity, the cost of the blocks might be slightly reduced. However, the cost of the hand labor necessary, the equipment rental, and the cost of cement and sand for grout are more or less fixed. It is readily apparent, from the total cost of $3.05 per square yard shown below, that concrete block lining is not a low-cost canal lining. In this connection, it should also be pointed out again that this installation was made in 1947, when common labor was available for around $1.00 per hour.

	Labor	Materials	Equipment	Total
Preparation of subgrade	0.091		0.140	0.231
Blocks, including hauling		1.702		1.702
Grout	0.063	0.083	0.046	0.192
Cut-off walls	0.021	0.012	0.001	0.034
Transportation on job	0.063		0.041	0.104
Placing	0.385			0.385
Overhead (15% of total cost)	0 623	1.797	0.228	2.648
				.397
				3.045

The facts about performance have been withheld until this point so that they could all be drawn together in a single section. Since these facts would not be apparent until the end of the test, placing all the results at the end is not a violation of the chronological order. (In praising conformity to the chronological order once that order has been decided upon, there is no intention to imply that the chronological order is always advisable.)

The section on *Performance* is effective in that it contains first a general statement and then the specific details.

The report does not have nor need a "terminal conclusion," and the formal section on *Conclusions* has been moved ahead so that it might reach the reader earlier. Thus the facts about performance have been given immediately for the reader who wants only a minimum, but are covered in full detail in the logical place for the person who is reading the entire report.

PERFORMANCE

The performance of this installation has been entirely satisfactory over a period of three and one-half years. The only noticeable defects are a few fine cracks due either to expansion and contraction or settlement of the subgrade; otherwise, the lining is in excellent condition. The machine-made blocks being highly permeable at the time of manufacture, some seepage loss occurred through the lined section the first irrigation season. However, after four seasons' service, the blocks have been sealed naturally with water-borne silt to the extent that they are watertight

A rough field test of the permeability of the blocks was made after one season's service. The test consisted of pouring a full cup of water down the slope of three points within the lined section Over the first point, which was located within one of the asphalt-sealed sections, the water ran the full length of the slope to the bottom, as could be expected. Over the second point, which was located below the water-line on the blocks subject to sealing by silt, the water ran down the slope approximately 3-feet before it disappeared. Over the third point, which was located above the water-line on the blocks not subject to sealing by silt, the water disappeared as soon as it hit the surface of the blocks

A similar field test was made at the end of the fourth season's service, with identical results at the first point. Over the second point, however, most of the water ran the full length of the slope, indicating that the blocks had been effectively sealed with silt Over the third point, most of the water disappeared before it reached the blocks below the normal water-line

ASSIGNMENTS

Write a formal report on a subject of your own choosing, on a subject from the list below, or on a subject from one of the lists at the end of Chapter 8. This project, at the discretion of the instructor, should be divided into three stages as follows:

A. Review the note on choice of report subjects at the end of Chapter 8. Check thoroughly into the possibilities of any subject that you are considering to make sure that you can develop a plausible situation and that you can obtain the information you need. Make sure that the subject is not too large, and that the information your report contains is not information that the reader could obtain easily without a report being written. When the project is clear in your own mind, submit to the instructor for his approval and suggestions a paper in which you indicate:

1. The subject you have chosen, stated as explicitly as possible.
2. The name of the person or organization for which the report is presumed to be written.
3. The circumstances that cause the person or organization for whom you presumably write the report to want or need the information the report will contain.
4. The source or sources of information you will draw upon. (Do not settle upon your subject until you have made sure that the information you need is available.)
5. Any contrary-to-fact assumptions (assumption of a different season, or that some completed project has not been caried out) which you must make in order that your project can be undertaken.

B. Develop an outline for your report. Convert this into a table of contents, as near final form as possible, and submit it to the instructor. So far as possible, list not only the topics of discussion but also the titles of all tables and figures that you expect to use. (The discussion of *Table of Contents* earlier in the chapter covered the methods of listing such material.)

C. Write and submit the formal report.

Subjects

1. The possibility that a stream or lake needs protection from pollution by one or more industrial operations, and the measures that would accomplish that result.
2. The protection of a watershed from which some town derives its water supply.

3. The advisability of fluorination of the water supply of some small town with which you are familiar, and the recommendation of a system to use if fluorination seems advisable.

4. The best method of dressing the ore from some specific mine.

5. The condition of some mine that has not recently been operated, and an explanation of the work to be done before operations can be resumed.

6. Whether chemical control of the growth of brush or weeds along the right of way of some stretch of road or some branch of a railroad would be preferable to other means of control.

7. Methods of waterproofing walls for basements in some location where water presents a problem.

8. Whether an effort to control stable temperatures would increase milk production in a certain dairy herd sufficiently to be attempted.

9. What steps, if any, should be taken to control ventilation and humidity in a poultry house on some poultry farm.

10. The feasibility of installing a briquetting machine at some saw mill in order to utilize waste sawdust, and the selection of equipment if briquetting is recommended.

11. The feasibility of utilizing cull potatoes for the manufacture of industrial alcohol.

12. The feasibility of using a reverse-cycle refrigeration unit (heat pump) to heat an expensive lakeshore residence or some small industrial establishment near a lake or stream.

13. The advisability, in some specific project, of using such a material as sawdust for an admixture in the concrete.

14. The smoke problem caused by your school heating plant or by some other plant with which you are familiar—its seriousness and the abatement measures that might end the nuisance.

15. The possibility and advisability of using prestressed concrete in bridge construction. (This to be written for a contractor who undertakes such jobs.)

16. Whether the bleeder system of pillar working can be established and maintained in a coal mine.

17. Whether to use roof bolting instead of timbering in a mine.

18. The desirability of using steam-jet air conditioning in a cannery plant.

19. The treatment desirable for the water fed to boilers in some heating plant.

20. The possibility of using two-way radio to maintain contact with trucks making long hauls of logs so as to enable them to assist one another in case of trouble.

III

BUSINESS CORRESPONDENCE

10

General Principles of Business Correspondence

If you hold a position that calls for technical writing, it is almost certain that much of your writing will consist of business letters. Accordingly, the third section of this book is devoted to business correspondence.

To make it easier to visualize the finished product, attention is first centered on letter form. Next, the substance of letters in general is discussed. Thereafter, specific types of letters are considered in order to illustrate how the general principles of letter writing work out in a variety of characteristic situations.

CORRECT FORM IN BUSINESS LETTERS

The present discussion of letter form is not exhaustive, for a discussion that covered every possible question of form would occupy too much space and would make it harder to identify and remember the points that are essential. Books that go into more detail are listed in the bibliography; and if you expect to encounter unusual questions of form, you should have one of these books available. The information that follows, however, will answer most questions that arise in ordinary correspondence.

Identification of Parts of the Letter

In order to permit reference to the parts of the letter, they are listed as follows: (1) the heading (2) the inside address (3) the

salutation (4) the body (5) the complimentary close (6) the signature. Some of these terms are self-explanatory. It should be helpful, however, to identify the heading as the section that tells the address of the writer and the date; the inside address as the section telling whom the letter is addressed to; the salutation as the "Dear Sir" or its equivalent; the complimentary close as the "Very truly yours" or its equivalent; and the signature as the longhand signature of the writer plus the typed material that accompanies the longhand signature.

Miscellaneous Mechanical Details

Stationery. The stationery should be a good quality of unruled bond paper, preferably white, 8½ by 11 inches in dimensions. If the first page of a two page letter bears a printed letterhead, the second should match it in quality and color but should be blank. Some use is made of smaller stationery for extremely short letters, but paper of standard size is usually preferred even for short letters because of the greater convenience for filing.

Placement of the letter on the page. To place a letter on a page so that the margins are well balanced demands either long experience or careful planning. The result aimed at should be approximately as follows: (1) there should be more white space at the bottom than at the top unless the length of the letter and the size of the letterhead makes this impossible; (2) the side margins should be approximately equal, and should ordinarily be no larger than the bottom margin—often being smaller; (3) the body of the letter, regardless of the letter's length, should fall partly above and partly below the center of the page. A short letter will look better if slightly more than half the body is above the center of the page.

In spacing a letter it is helpful to remember that there are six lines of type to the inch, and either ten or twelve letters to the inch—usually twelve—in the line. Most writing averages about six letters to the word, including space between words. By utilizing these facts you can reduce the uncertainty about the space a letter will occupy.

When a letter is written on a blank sheet, the minimum margins all around are 1 inch, preferably 1½ inches, at the top and bottom. The maximum margin at the top is about 2½ inches, and at the sides is 2 inches. The space between the heading and the inside address may vary from a double space in the longest letters to six spaces in the shortest. In the shortest letters, the bottom margin is obviously controlled by the length of the letter.

When the stationery bears a printed letterhead, the point to consider when setting the top margin is the first line of the inside address. *In the shortest letters* this may be as much as 3½ inches (21 lines) below the top of the page. This would normally leave room for six or seven lines of the body of the letter above the center of the page. The side margins would of course be the maximum for such a short letter. *For the longest letters,* the inside address may begin only a double space below the date line, which would itself be only a double space below the bottom of the printed letterhead. For other letters than the longest, the date line would be placed (1) two spaces below the printed letterhead, or (2) half way between the letterhead and the inside address.

Spacing within the letter. The best procedure, normally, is to single-space within the paragraphs of all business letters and to double-space between paragraphs. The space between the heading and the inside address varies. There should be a double space, however, between any other two parts of the letter, namely (1) between the inside address and the salutation, (2) between the salutation and the body, (3) between the body and the complimentary close, and (4) between the complimentary close and the signature *if the first line of the signature is typed.* (Special considerations concerning spacing the signature will come later.)

System of Indentation and Punctuation

The system of identation most widely used in modern business letters is as follows: the heading (assuming the letter is on blank stationery) is blocked. That is, all lines begin the same distance

from the left side of the sheet. The inside address is blocked. That is, all lines begin at the left hand margin. The salutation also begins at the left margin. The beginning of each paragraph is indented either five or ten spaces. This is usually called the semiblock system.

The variation that occurs most frequently concerns the beginning of paragraphs, which sometimes are not indented. This deviation is entirely acceptable if the letter is single-spaced but not if it is double-spaced.

In the past, the indented system was widely used. That is, each line of the heading and of the inside address was indented more deeply than the preceding line. At present, however, the indented system seems old-fashioned.

The modern system of punctuating the heading and inside address is the open system. That is, no punctuation is used at the end of any line unless, of course, it is necessary to use a period after an abbreviation. The closed system of punctuation, which called for punctuation at the end of each line of the heading and inside address, is now considered obsolescent.

Figures 15 and 16 show business letters in correct form, well placed on the page.

Form for Individual Parts of the Letter

The heading. If the stationery does not bear a printed letterhead, the heading contains two to four lines, three being most common. The first line, plus the second if necessary, tells the local address from which the letter was written; the next line tells the town and state; and the last line tells the date. The name of the writer does not appear in a typewritten heading. The heading is placed in the upper right hand portion of the page. It may be placed so that its longest line ends at the right margin of the page, or it may begin slightly to the right of the center of the page, regardless of where this causes the lines to end. The heading would begin 1 inch to 2½ inches from the top of the page, the exact distance depending on the length of the letter.



THE WASHINGTON WATER POWER COMPANY

Pullman, Washington
August 25, 195-

Mr. C. C. Gearhardt
Route 4
LaCrosse, Washington

Dear Mr. Gearhardt:

You are undoubtedly aware of the several sprinkler irrigation installations that have recently been installed on farms in your area. I would like, however, to point out that your own farm is one that could greatly benefit from sprinkler irrigation.

An irrigated pasture will carry more than twice as many cattle and for twice as long as will your present pasture land. Four times as many pounds of beef per acre of pasture.

And remember this: while cattle are on pasture they are feeding themselves rather than having to be fed. This saving in labor is worth while.

Several irrigation wells in your area indicate that a satisfactory supply of underground water is available, and we have a three-phase power line close by which is capable of serving an electric pump of any size you might care to use. In addition, our irrigation rate is one of the lowest in the Northwest.

I would be very happy to discuss with you the application of irrigation to your farm. Enclosed is a postcard for your convenience in letting me know a date that would be to your liking.

Very truly yours,

Rich Bates
Farm Development Representative

Figure 15. Medium Length Letter, Correct in Form and Well-Placed on Letterhead.

1408 West Maple Street
Ogden, Utah
April 10, 19--

R and E Manufacturing Company
2353 Porter Street
San Francisco 7, California

Gentlemen:

I understand that you have published a pamphlet entitled Historical Notes on Surveying Instruments.

I should like very much to obtain a copy of this pamphlet. If no charge is made for copies, please send me one at your earliest convenience.

If it is necessary that I purchase a copy, please let me know the price so that I can order one as soon as possible.

Very truly yours,

Allen E. Wallace

Figure 16. Extremely Short Letter, Correct in Form and Well-Placed on Blank Page.

If a letter is written on stationery with a printed letterhead, the typed heading consists of the date line only. This may be placed half way between the bottom of the letterhead and the inside address, far enough to the right so that it extends to the right hand margin, or it may be centered and placed two spaces below the letterhead. A printed letterhead is often designed so as to provide a natural space for the date line.

Examples of Headings

1316 Twenty-seventh Street
Alameda, California
May 15, 195__

The Associated Engineers
University of Idaho
Moscow, Idaho
February 20, 195__

Abbreviation, capitalization, and use of figures are illustrated in the preceding headings; but since these are matters which apply to other parts of the letter also, they will be discussed later.

The inside address. The examples of inside addresses given below illustrate usage in the most common cases. As indicated, considerable flexibility is necessary to prevent some of the lines reaching an unwieldy length or to prevent the number of lines from becoming so great as to be awkward. Usually, however, three or four lines of reasonable length are sufficient.

When a letter is addressed to an individual, some title must always be used. To omit it is discourteous. The title *Mr.* is of course far the most common, but it may be replaced by *Doctor, Captain, Professor,* or any other term one might use before the person's name if one were actually speaking to him. The terms *Honorable* and *Reverend* are sometimes used in place of titles. *Honorable* is appropriate when one addresses an important governmental official. *Reverend* is appropriate when one addresses a clergyman. (Full coverage of all the possible forms appropriate for clergy of specific ranks or churches is beyond the scope of this treatment.) It is also correct to indicate the reader's degree, for example, Ph.D. and M.D., after the name rather than placing a title before the name. There should be no duplication, however. *Dr. Ralph Morgan, M.D.* would be incorrect.

Examples of Inside Addresses

Dr. D. M. Jones, President
The Central Medical Association
Olympic Building
South Bend, Iowa

Mr. Walter S. Stevens
Secretary of the Chamber of Commerce
Box 101
Helena, Montana

Dr. Frederick C. Moore
1415 West Bannock Street
Tulsa 12, Oklahoma

Dr. William C. Church
Professor of Mathematics
University of Kansas
Lawrence, Kansas

The Acme Machine Shop
Fourth and Main Streets
Salem 11, Illinois

Messrs. William Smith and H. R. Brown
1148 Main Street
Caldwell, Mississippi

Frederick C. Moore, M.D.
1415 West Bannock Street
Tulsa 12, Oklahoma

Professor William C. Church
Department of Mathematics
University of Kansas
Lawrence, Kansas

The following list, though it does not include every permissible form, is given to facilitate the addressing of letters to certain types of public official in a form that is sanctioned by good authority.

The Honorable Richard Russell
The United States Senate
Washington, D.C.

The Honorable Kenneth E. Johnston
The House of Representatives
Washington, D.C.

The Honorable W. Averell Harriman
Governor of New York
Albany, N.Y.

The Honorable Henry L. Talbot, Mayor
The City Hall
Lewiston, Kentucky

The attention line. An attention line is sometimes used in addition to the inside address. Thus, even in a letter addressed to an organization, one can indicate the name, the position, or both of the individual from whom the letter should receive attention. There are several places where such a line can be placed. The two places illustrated are probably the most common. Note that

the salutation matches the inside address in spite of the attention line.

The H. C. Capwell Company
Broadway and Twentieth Streets
Oakland, California

Attention of Mr. H. L. Klarnet

Gentlemen:

The H. C. Capwell Company
Broadway and Twentieth Streets
Oakland, California

Gentlemen: Attention of the Credit Manager

The subject line. Only a very small proportion of the business letters that go through the mails contain subject lines, for a good opening will identify the subject without a special line being necessary. Sometimes, however, a subject line is desirable, especially for such a purpose as to refer to a file number when you have been requested to do so. When a subject line is used, it is most frequently placed to the right of the salutation and on the same line or a double space below. When it is not on the same line as the salutation, it either may be centered or may conform to the style of paragraph indentation. Note the following illustration:

The Prudential Insurance Company
The Paulson Building
Spokane, Washington

Gentlemen: Subject: Policy No. 6,499,313

As you requested in your letter of July 23, I am sending you more complete information on . . .

The salutation. When a letter is addressed to an organization, the salutation should be *Gentlemen:* (or *Ladies:* if the organization is composed of women). *Dear Sirs* is out of date except on a letter addressed not to an organization but to more than one individual. The salutation should be followed, in a business letter, by a colon.

For letters to individuals, the following salutations, arranged in the order of decreasing formality, should be noted:

Sir: (too formal for most letters)
My dear Sir: (rather ceremonious)
Dear Sir: (very common)
My dear Mr. Jones: (often appropriate)
Dear Mr. Jones: (most widely used of all forms)

It is often desirable to replace *Mr.* by some other title, such as Doctor, Professor, Captain, Governor, or Mayor. It is more complimentary to refrain from using any abbreviation for a title, except *Mr.*, *Mrs.*, and *Dr.* The terms *Honorable* and *Reverend* are not titles, and though sometimes used in place of titles in the inside address, they should not be used in the salutation. Many other terms, such as *Superintendent,* for example, are sometimes erroneously used as titles. When there is doubt whether some particular term should be used as a title, it is advisable to refrain from using it.

As for the choice between the reader's name or *Dear Sir,* the old convention has been to use the name only when one knows the reader or has received a letter from him. In recent years this convention has been widely disregarded, for the whole tendency of business letters is to become less formal and more personal. To use *Dear Sir* may make a letter sound cold and remote. The modern trend is to use the reader's name unless his high rank or the occasion of the letter would cause informality to be in bad taste.

In a letter addressed to a woman, the question of whether to use the reader's name in the salutation is answered as it would be answered if she were a man. If the name is not used, the salutation is *Dear Madam.* There is a strong tendency, however, to avoid *Dear Madam* and use *Dear Mrs.* (or *Miss*) *Jones,* or *My dear Mrs. Jones.* In the last analysis, your own sense of appropriateness must determine your choice of salutations. There is no reason you may not even use the first name of a reader if you would use it in speaking to him personally and if there is no special reason informality would be unsuitable to the occasion.

The salutation must harmonize with the inside address. If a letter is addressed to an individual, the salutation must be to an individual. If the letter is addressed to an organization, the salu-

tation must be to an organization. As mentioned earlier, this holds true even when an "attention line" comes between the inside address and the salutation.

The complimentary close. The complimentary close is placed a double space below the final line of the body of the letter. It usually begins slightly to the left or slightly to the right of the center of the page.

The form used most frequently is *Very truly yours* (or *Yours very truly*). *Yours truly* is more formal and somewhat less friendly. *Sincerely yours* is an extremely common variation which is completely correct. Many discriminating writers, however, avoid wasting the extra assurance of sincerity on routine occasions, and reserve *Sincerely* for letters in which the emotional tone is more intense than usual. *Cordially yours* is a gracious form if one is doing the reader a favor or in a position to do him favors, but seems inappropriate in a letter soliciting a favor. *Respectfully yours* is used mainly when the reader's position entitles him to special respect or when one is formally submitting material to a person who outranks him in his own organization. It is too formal and too subservient for ordinary use. Participial endings—that is, *hoping, trusting,* and similar terms ending in *ing* are out of date. The best attitude is to regard *Very truly yours* as standard and to use it unless there is reason for deviation.

The signature. The place and contents of the signature are shown in the various examples. Whenever a letter purports to be personally written, the name of the person who wrote it must be signed in longhand even if the primary signature shows the letter to come from an organization. The name of the writer must always be typed, however, as well as signed in longhand.

In the examples that follow, the first indicates that the writer is acting merely as an individual; the second and third are alternate forms, both showing that the writer acts in behalf of an organization; the fourth shows the letter as being primarily from an organization, even though the name of the person who actually wrote the letter in behalf of the organization is also given. Note

that in Numbers 2 and 3 the organization is not named, the assumption being that it was named in the letterhead. Otherwise, the name of the organization would appear in the signature. In these examples, the complimentary close is shown above the signature in order to show the relative positions of these two parts of the letter.

(1)

Yours very truly,
John M. Jones (signed)
John M. Jones (typed)

(2)

Yours very truly,
John M. Jones (signed)
John M. Jones, Secretary

(3)

Yours very truly,
John M. Jones (signed)
John M. Jones (typed)
Production Manager

(4)

Very truly yours,
THE REED PAPER COMPANY
Robert L. Brown (signed)
Robert L. Brown
Sales Manager

Stenographic references; enclosures; postscripts. When a letter has been transcribed by a stenographer, her initials and those of the person who dictated the letter are placed at the left margin, either on line with the bottom of the signature or slightly lower. If enclosures are to be sent with the letter, that fact is indicated either one or two spaces below the initials mentioned. The following illustration indicates how these details work out in practice in one of the many acceptable forms.

We shall hope to receive your consent in the near future.

Very truly yours,
THE CENTRAL ELECTRICAL COMPANY
W. I. Bowers (signed)
W. I. Bowers (typed)

WIB/lc
Enclosures: 2

If a postscript is added, it is placed a double space below everything else in the letter. It is typed in the same form that has been used for the paragraphs in the body of the letter. It may or may not be preceded by *P.S.* Obviously, it should be short.

As used in modern business letters, a postscript is not a means of adding some statement which has been omitted by accident,

for letters should be written well enough that such accidents do not happen. Rather, a postscript is a device used to throw emphasis on some matter of special importance, or else to add something which it seems desirable to mention but which is not really related to the main message of the letter. Since such a device loses its effectiveness if overworked, postscripts should be used sparingly.

Additional pages. When a letter must run more than one page, the stationery used for extra pages should be exactly like that which is used for the first page except that it should bear no letterhead. The side margins should be the same as those on the first page. The top margin should be equal to the left margin. In order that the second and later pages can be identified, it is customary to indicate at the top of each page the person or organization to whom the letter is addressed, the page number, and the date. The first line of the body of the letter comes three or four lines lower. Several forms are used to give this reference information, one of the commonest being as follows.

Dr. Irvin B. Steadman 2 October 3, 195__

Abbreviation, Capitalization, and Figures

Abbreviation. In the body of a letter, the usage in abbreviation is the same as in any other writing. The style may be technical or nontechnical according to the nature of the material and the training of the reader.

In other parts of the letter than the body, the main point to remember is to refrain from over-abbreviating. The first rule is: In case of doubt, don't. Do not abbreviate the name of a person or organization unless the person or organization does so. Do not abbreviate months. Most organizations do not abbreviate the names of states (except that *N.Y.* and *D.C.* are customary), nor do they abbreviate such words as *Street* and *Avenue*. Most organizations write out such terms as *East* and *West* in addresses (2315 *West* Walnut Street). Some latitude is permissible if abbreviation is necessary to prevent a line being so long as to appear awkward. Yet even when taking advantage of this

latitude, you should use a consistent style in any given letter. That is, it would be wrong to abbreviate a term such as *Street* in the heading and write out a similar term in the inside address.

In the salutation, it is more courteous not to abbreviate any title except *Mr.*, *Mrs.*, and perhaps *Dr.* In the inside address, the terms *Honorable* and *Reverend* are sometimes seen abbreviated, but it is more courteous to write them out. The compliment that you imply by using one of these terms is cancelled when you attempt to save time by reducing the term to an abbreviation.

Capitalization. In the body of the letter, capitalization is the same as in any other writing. In other parts of the letter, the examples that have been given are a sufficient guide.

Use of figures or words for numbers. In the use of figures or words to express numbers, the body of a letter is no different from any other writing. One point however—namely the writing of dates, calls for comment. In the body of a letter as elsewhere the best form is as seen in the example, *June 17*. The year would be added if needed. You should not use such terms as *the seventeenth* or *the 17th* unless the month has already been named earlier in the body of the letter.

In other parts of the letter than the body, the best usage is as follows: A house number is written as figures. The number of a street is written out unless it consists of more than two words, in which case it is written in figures. Examples are: *Eighteenth* Avenue, *Forty-ninth* Street, but *114th* Street. (Some authorities permit the omission of the *th* when using figures, and write *114* Street.) It is permissible, also, to use figures for any street number if such a word as *East* or *North*, either written out or abbreviated, occurs between the number of the house and the number of the street.

Days of the month and years are always expressed in figures. It is wrong, however, to use a figure to indicate the name of the month. Correct: August 11, 1954. Wrong: 8/11/54. The form *11 August 1954* is not widely used in the United States except in the armed services.

THE SUBSTANCE OF LETTERS

Learning how to use correct form is no more than a starting point in the study of letter writing. The real opportunity to profit by such a study comes when attention is turned to the substance of letters.

To be sure, some letters deal with routine situations and call for no special qualities beyond the completeness, clearness, and accuracy that are essential to any type of writing. Yet even a routine letter is a personal contact; and in letters that are not matters of mere routine, the personal element becomes extremely important. This being true, it is well worth while to learn something about the attitudes and techniques which give letters the best chance of obtaining satisfactory results.

At the outset, we should realize the difference between a letter that is really good and one that merely is not bad. A letter that is merely acceptable is one that is correct in form, is free from serious errors in English or content, and does the obvious job without giving offense. A letter that is really good, however, is one *that exploits to the maximum, for the benefit of the writer or his organization, the contact which the letter represents.*

Standards of Appearance, Correctness, and Accuracy

First of all, it is important to realize that business letters must achieve high standards of neatness, correctness, and accuracy. You should make your letter neat for much the same reasons that you would try to present a neat personal appearance when meeting the reader personally. The appearance of a letter influences its reception, for the reader forms some sort of impression before he even starts to read. A messy-looking letter can create an impression of carelessness that lessens the reader's confidence in the accuracy of its contents. Rightly or wrongly, the reader may subconsciously assume that your standards in other matters are comparable to your standards in your letters.

Correctness involves both English and form. The use of bad

English in a letter is fully as damaging as bad English on any other occasion. Correctness in letter form should become so habitual as to be taken for granted.

Accuracy should include both the accurate interpretation of the letter you are answering, and accuracy in the information your own letter contains. A surprising amount of confusion and waste of time is caused by writers' failure to read carefully the letters they attempt to answer. Frequently, an additional exchange of letters is the result. And as for making sure that their own letters are accurate—that is a matter which demands more care than most writers realize. Especially such matters as dates, amounts, the numbers of orders or statements, and file numbers demand methodical checking. The present writer once knew of a confusion that lasted through two extra letters and finally had to be resolved by a long distance telephone call, all because a letter contained the word *not* when it was supposed to say *now*. Errors such as a reference to *Monday, May 18* when May 18 falls on a Tuesday provide another example of the need for closer attention to detail than that given by most writers.

Unity in Business Letters

There are frequent occasions when, on the same day, it may be necessary to take up two or three different matters with the same organization. This creates an impulse to take them up in the same letter. Such an impulse should usually be resisted. If the organization to which you write is very large, it is likely that the different matters will be handled by different people. Even if the same person handles them, discussion of more than one subject in a letter may create problems of filing and thus may cause trouble in locating your letter for future reference. Also, taking up different subjects in the same letter may cause one part of your message to be overlooked. The best procedure is to write a separate letter for every separate subject.

Modification of this advice may be appropriate when a letter covers several minor points on the same general subject—points

which will all be handled by the same person. An appropriate opening, stating definitely that there are several matters needing attention, can often make it feasible to handle them all in the same letter. In such a case it is usually advisable to number the points that need action so that each stands out distinctly.

Need of Planning before Writing

Unless a letter is to be extremely short, you should plan it before writing it. Your plan may be nothing more elaborate than rough notes, but it should at least indicate the points to be covered and the order in which you will cover them. As you make your notes, it will pay you to make sure that you have at hand all the facts you will need to include, so that you will not have to stop writing or dictating while you look up some bit of information.

The time used in making notes will be short and will be more than compensated for later because you will be able to forge ahead with assurance when you write. Also, planning in advance will usually improve the quality of your letter. It will ensure your putting related material in the same part of the letter; it will permit better arrangement than you could achieve while struggling with questions of phraseology; and it will permit you to concentrate on how to express each idea rather than being constantly preoccupied with the question of what you are going to say next.

It is true that as you gain experience and deal with situations that have become familiar, you will eventually be able to utilize in today's letter the planning that you have done on similar occasions in the past. Even so, it will usually be advisable to have in mind or on paper a check list of points to be covered; and it will also be advisable, before you write even a routine letter, to pause long enough to make sure that a routine letter will really cover the situation. Nothing is more annoying to your reader than to receive a letter that ignores some of the relevant facts.

Arrangement of Material in Letters

In writing a letter as in writing anything else you will need to be governed by two considerations as you plan the arrangement of the material—the subject matter and the reader. The logic of the substance may suggest one plan, but the limitations and peculiarities of the reader may suggest something different. Under these circumstances you will need to show real skill in reconciling the two possible treatments.

Whatever may be the message of a letter, there are two basic methods of arranging the material. These might be called "the order of saying *Yes*" and "the order of saying *No*." In any specific situation, one or the other should definitely be preferable.

When you are saying "yes" to a request, you should say it at once—sometimes even in the opening sentence. This is advisable because a reader who learns that his request has been granted is immediately put into a receptive state of mind for anything else it might be desirable to tell him. Perhaps he must be told that granting such requests cannot be made a regular policy, or that careful consideration was necessary before consent could be granted. Perhaps there is need to explain the circumstances that gave rise to the whole incident. All such material should be held back, however, until the affirmative answer has been given.

Some writers neglect this principle. They tell all the reasons that might justify a refusal before informing the reader that they are saying "yes." Thus they make the reader antagonistic, or at best secure only superficial attention to this material while the reader skims down the page looking for the definite answer. Moreover, by delaying the consent too long, they seem to give it grudgingly, and thus lose the good will that the consent might have gained. In view of all this, when you intend to say "yes," you should say it at once and say it graciously, then add any explanations that are necessary, and finally, bring the reader's attention back to the fact that his request has been granted.

When saying "no," however, you should not blurt it out at the

beginning, but should hold it back until you have given the reasons for the decision. Thus the decision seems to be the outgrowth of the facts rather than an arbitrary decision, made before the facts had been considered. If the "no" comes before the reasons, the reasons seem to have been scraped together to justify a decision that had been made at the outset. The proper method is to try to make the reader himself see that a negative answer is indicated by giving him the evidence and leading him to that answer gradually.

When you tell your decision, you should do so as tactfully as possible. Although no letter should be long-winded, the very fact that you have taken the pains to write a full explanation suggests that you have not rejected the request peremptorily.

Naturally, it is not possible to generate so much good will with a refusal as with a consent, but the arrangement advised above at least makes the best of the situation. A refusal that is tactful will create much less resentment than one that is tactless.

Not every letter, to be sure, forces you to grant or refuse a request, but the basic principle can be applied in almost every situation. That is: If your letter bears good news, let the reader know it at once; if the news is bad, break it gently; if it is partly good and partly bad, first tell the good news, then tell the bad news, and next direct the reader's attention toward whatever aspects of the situation are most cheerful.

Language in Business Letters

The first point to realize about the language to be used in business letters is that there is no special language for business letters. Many a person whose conversation is perfectly natural falls into an unnatural "jargon" as soon as he starts a business letter. Such persons call a letter "your esteemed favor." They use long, flowery expressions such as "I beg leave to inform you." They use wordy phrases such as "at an early date" for "soon" and "at the present time" for "now." They make excessive use of the passive voice, writing, for example, "Your letter has been received by us" and "It would be greatly appreciated by us" in-

stead of "We have received your letter" and "We should appreciate it." They use pomposities such as "It would be in accordance with our desires if . . ." for the simpler "We should like to have you . . ."

It is easy to form the habit of using this rubber-stamp phraseology. A good way to avoid it is to ask yourself, "Would I feel foolish if I talked this way in a personal conversation with the man to whom I am writing?" This is not to say that a letter should exactly duplicate the language of ordinary conversation, but it is certainly true that language which would sound pompous or unnatural in a conversation is bad style in a letter also.

A list containing additional examples of business letter jargon follows:

beg to advise, state, inform, acknowledge, etc.
contents duly noted (The fact that you are answering his letter implies that you have noted its contents.)
your letter of recent date (Refer to the date specifically; or if the date is not known and the situation does not justify looking it up, merely use "your recent letter.")
same (as in "Fill out the questionnaire and return *same* to us.")
party with the meaning of *person.* This use of "party" is appropriate only in legal documents.
favor us with
kindly for *please*
enclosed please find (Use *enclosed is,* or *A copy* (etc.) *is enclosed.*)
We wish to *take this opportunity* (unless the phrase has some meaning. If you were mentioning something incidentally when writing upon another subject, the phrase would have a meaning and be permissible, but most of the time it is entirely devoid of meaning.)

Paragraphs in Business Letters

Because most business letters are not themselves very long, their paragraphs tend to be short. The first and last paragraphs are often single sentences and are seldom more than two sentences long unless the sentences are abnormally short. The other paragraphs characteristically run from two to four or five sentences. Unless a letter is longer than average, it is unlikely to contain any paragraph in excess of 100 words. Single-

sentence paragraphs are permissible if they do not become too common, but you should not fall into the habit of beginning a new paragraph with every sentence. Unless most of the paragraphs are longer than one sentence, there is no value in paragraphing at all except the psychological value of making the letter look easier to read. As a matter of fact, most long or medium-length letters that contain too many one-sentence paragraphs are found on examination to be poorly organized.

Sentences in Business Letters

Sentences in business letters tend to be shorter than sentences in most writing. This results from the fact that many letters must be dictated, or written rapidly and mailed with little if any revision. Under these circumstances, long sentences are likely to become jumbled and to slow up the process of writing. You should not form the habit, however, of making all sentences so short that you write in the "primer style."

Tone

Few qualities, except clearness, completeness, and accuracy are so important in a business letter as the quality called tone. Tone concerns the impression that your letter creates in regard to your personal attitude. Everyone has heard the comment, "It wasn't so much what he said as the way he said it." In a letter, just as in a conversation, "the way in which you say it" is extremely important.

Roughly speaking there are three possible tones—neutral, negative, and positive. Neutral tone is the tone of a letter which by its manner neither gives offense nor creates a good effect, but is merely impersonal. The letter that is neutral in tone may not be really bad, but its writer has not fully exploited the opportunity that the situation gave him.

The term "negative tone" implies that in its *manner* the letter has an undesirable effect. Negative tone can result from many causes. One of these is merely choice of language. For example, "We have received your letter in which *you claim* that our ship-

ment was improperly packed," implies that the writer questions whether the statements of the reader are true. Even if such were the case it would be undesirable to make that fact apparent at the outset. It would be far better to open, "We have received your letter about the manner in which our shipment was packed," which is at least neutral.

Other characteristic negative terms are "you neglect," "you fail," "we are surprised," "your complaint," and "your error."

The negative tone may result, however, from other causes than the choice of words. It is a matter of basic outlook. It results from seeing the dark rather than the bright side of situations. One writer may write, "We have received your request. We regret to say that unfortunately we cannot comply with this request until . . ." Another and better writer will write, "We have received your request. We shall be glad to comply with it as soon as . . ." The difference is that one *sounds* like a refusal, the other *sounds* like a consent. One stresses the fact that the writer will *not* comply now; the other suggests that compliance *can be secured.*

Certain material may in its very nature be negative in effect. The senior applying for a position after graduation is using negative material if he writes, "This letter is from one of the many young men who are looking for work after graduation," for it is undesirable to remind the employer that many other applicants may also be available. One company wrote, "Now that it's fall, and you're getting warm clothes for the children and laying in your coal supply, hadn't you better make sure your automobile chains are in good condition?" This was negative material. It caused the reader to think of other expenses, to meet which he might try to economize by making his old chains serve. The applicant who wrote, "My experience *is limited* to nine months as assistant to . . ." used negative material, for he suggested that the reader interpret the facts unfavorably. He might have written "My qualifications have been increased by nine months experience as assistant to . . ." This encourages the reader to

think of what was learned during the nine months rather than of what has not yet been learned.

The nature of the positive tone has been brought out in the alternatives offered to the preceding negative examples. As these illustrations show, positive tone does not mean positive in the sense of "admitting of no doubt," but rather in the sense of "constructive" or "creative." The positive tone is achieved when the manner of writing and the choice of ideas has a desirable effect on the reader's acceptance of the message. A letter that is positive in tone is permeated with good will; it is optimistic; it looks for favorable possibilities. It has its parallel in the manner and attitude of the person who in a personal conversation is friendly, cheerful, encouraging, and tactful, the person who by his manner makes us *want* to agree with him.

The "You Attitude"

Almost every book on letter writing speaks of the "You Attitude." This phrase means merely that the writer attempts in every way possible to show that he has held the reader's interests in mind. A good example is seen in the letter written by a manufacturer refusing to accept an order from an individual consumer. This manufacturer might have offered as his reason the nuisance it would be to handle such small orders. Instead, he stressed the advantage to the purchaser in being able to see the various sizes and colors and to obtain products without delay, as he could do if he were served by a retail merchant.

This "You Attitude" can be achieved even in letters that would seem to offer little opportunity for it. For example, a letter written to collect back payments on a refrigerator purchased on the installment plan would have as its actual purpose the securing of the payment; yet the writer might indicate that he was writing because he did not want the reader to lose the refrigerator, as would happen if he did not make the payment; or he might stress how desirable it would be to the reader to protect his credit rating.

Good Will in Business Letters

Every letter is at least to some extent a good will letter. Making it so is one of the best ways to prevent negative material from getting in by accident. Also, making good will permeate your letters is a sensible precaution in that it may prevent remarks that inadvertently are offensive from doing damage.

If an unpleasant remark is made by accident in a personal conversation, you can notice the effect at once and can correct the slip you have made. Moreover, once said, the remark passes by at once. But when a letter gives offense, you have little opportunity to set the matter right. Moreover, the remark is there in black and white to be reread, rather than fading out at once. Consequently, it is necessary to take special precautions to prevent statements that are accidentally offensive. There is no better way to accomplish this than to make the spirit of good will so evident that the reader will realize an unfortunate remark could not have been meant as it sounded.

Furthermore, showing friendliness and good will in every letter pays off by making the reader *want* to see things as you see them. He is more reluctant to say "no" to someone who has been friendly than to someone who has been cold and indifferent.

Adopting this attitude is not being soft and emotional. Good will material is included because it helps the letter to get results. Hard-headed American business men are spending millions of dollars annually in a belief that good will is worth cultivating. It is often wise to leave out of a letter remarks that would be justified by the facts, because these remarks would destroy good will. The important point to remember is that you cannot assume the reader to be an impartial, fair-minded, unprejudiced judge. Therefore your manner and material should be determined not by what you might be *justified* in saying, but by what will obtain the result you desire. The satisfaction of "telling off" a reader who has been unreasonable is a luxury you cannot afford. Con-

stant attention to good will is not sentimentalism; it is merely common sense.

Beginnings of Letters[1]

All that has been said in the preceding discussion applies to the beginnings and endings of letters as well as to what lies between. Each of these parts, however, has special functions and demands special attention.

The beginning of a letter would usually consist of all the first paragraph, and sometimes of the earliest part of the second paragraph. The first paragraph should usually be short—often a single sentence and rarely more than two. Obviously it is a contact paragraph. It should perform all the following functions that the occasion calls for: (1) indicate the subject of the letter; (2) refer to the letter you are answering; (3) refer to your own previous letters on the same subject if the reader needs to hold any such letters in mind; (4) establish a satisfactory tone. Obviously, reference to other letters is not always necessary, but the first and last functions must always be performed by the opening.

To say that the opening of a letter must indicate the subject seems to be dwelling on the obvious, yet this obvious need is frequently overlooked. The person who is asking for an adjustment, for example, might begin his letter by telling of the occasion when something was purchased six months earlier. Before coming to the point—his request for a replacement—he might cover, chronologically, everything that had happened since the purchase. Or the person who writes an invitation to address some organization might tell about the organization for two or three

[1] This treatment deals primarily with the beginnings of run-of-the-mill letters, written in a brief time to send to a single reader. It makes no attempt to cover sales letters or other letters resembling them. Sales letters are usually written by specialists and are the result of long work and repeated revision. Frequently they have startling or at least colorful openings, designed to capture the attention of a reluctant reader. The occasions on which a technical man must write such letters are very infrequent, and the specialized job of writing them is beyond the scope of this treatment.

paragraphs before coming to the point that concerns the reader —that the latter is requested to give an address. Therefore it pays to remember: Start a letter in the present; make the subject and purpose clear at once; and above all, make sure that the reader can see how *he* is concerned with what he is reading.

When you are writing an answer to a letter you have received, you should identify that letter in your opening by subject and if necessary by date, and you should show that you have read it accurately. Such key facts as dates and amounts of money may well be restated, so that if any error has been made in the other person's letter it will be discovered at once. Most of the time, no such error will have been made; but if you engage in much correspondence, it is practically certain that there will be occasional errors to justify the precaution. The manner in which facts are restated should not be crude and obvious. It is poor writing to say, "I have received your letter of June 15. In this letter you say that you would like to have me make reservations for you for July 17, 18, and 19." Rather, let the facts seem to be mentioned incidentally, as for example, "Thanks for letting me know, in your letter of June 15, about your need of reservations for July 17, 18, and 19." Ostensibly, the sentence was written to say "Thank you." Actually, its purpose was to repeat the dates.

Mention of your own previous letters on a subject is advisable because the reader may have forgotten them and because your present letter may not reach the same person who read the earlier letters.

The establishment of tone is especially important. All that was said about good will applies with special force to the beginning. The reader's original impression influences his reaction to all that follows. If the tone of the beginning is offensive, it will be doubly hard for the material that follows to get a proper reception. Hence the opening should usually be friendly in tone, and should never under any circumstances be harsh or sarcastic.

At the very beginning you should try to get in step with the reader. Even if it will be necessary later to include material that takes issue with him, the opening should be an attempt to sug-

gest that you are not his opponent, trying to defeat him in an argument, but a person who has approached the subject with an open mind.

Even if a letter deals with a situation so serious that a display of warm friendliness would be obviously insincere, it is always possible to be completely courteous in the opening and to avoid any display of anger.

A thoughtless reaction to all this may be that it is a nuisance to have to make the opening of a letter friendly. Yet when you adopt a friendly or at least a courteous tone at the beginning, you are merely opening your letter as most people open a personal conversation.

Endings of Letters

The best method of ending a letter depends on whether you are attempting to secure some specific action. If not, the ending should be a final brief paragraph manifesting friendliness and good will. Here again, there is a parallel between a letter and a personal conversation. One usually tries to end even a business conversation in a friendly manner.

A typical letter not attempting to secure action would be one that was written to give the reader some information he had requested. You might well conclude such a letter by expressing hope that the information would be useful and that the reader's project would be successful. On the other hand, if you have been unable to provide the information asked for, it would still be possible to express a hope that the reader finds it elsewhere and that you can be of some service to him in the future.

If the purpose of a letter is to secure action, the action desired should be suggested by the ending. The suggestion should be as specific as the circumstances permit. The degree of urgency must of course depend on the circumstances. Sometimes the request for action may be in the form of a command: "Sign up today." Sometimes tact would make it advisable that the command be veiled: "To make sure that you receive the accommodations you desire, make your reservations today." Sometimes it must be

toned down still more: "We should appreciate it if you could let us know by April 1 the dates that you prefer." The degree of urgency must always be a matter of judgment. If you need immediate action when requesting a favor, it is especially important to be tactful. In such a case your letter is less likely to arouse resentment if it tells why immediate action is important. For example: "If you accept this invitation, we are anxious to give your address plenty of advance publicity. Therefore we hope you will let us know at your earliest convenience."

An ending aimed at securing action need not entirely neglect the element of good will. A skillful writer can usually phrase his request for action so that good will is apparent.

Whether a letter does or does not aim at action, one fundamental point about endings should never be overlooked: The ending of a letter should never dwell upon anything except what you wish the reader to go on thinking about. A reader tends to retain in his mind whatever he has read last. Suppose a letter ends by saying, "In closing, let me express once more my regret that, as originally written, my report did not contain all the information you needed." The reader's mind is thus focused on the fact that the original report was unsatisfactory. On the other hand, the letter might end, "In the new version I am now sending, I am sure you will find the full information that you will need as you proceed with the project." The reader's mind is thus directed to the merits of the new version rather than to the faults of the old. Although there are many occasions when a letter must express regret, what is said about regret should seldom be at the end, for the end should look forward and if possible should be optimistic.

Summary on the Substance of Letters

As we have seen, there is a great deal of difference between a letter that is merely adequate and one that is really good. Essentially, however, all that has been said grows out of one fact: In writing a letter, you are not just placing information on paper, but are talking to a *person*—a person with feelings and perhaps

with prejudices. Consequently, it is necessary to use in writing the methods that tactful people use in personal contacts.

In the chapter that follows, several types of letter are discussed. Most of what is said about any type, however, is just an application, in some special kind of situation, of the principles that apply every time any letter is written.

EXERCISES

EXERCISE 1

Make the corrections necessary to cause the following inside addresses, salutations, and complimentary closes to conform to the best usage. Do not make unnecessary corrections.

(1)

The Superior Grocery company
Fourth and Cedar Streets
Tacoma, Wash.

Attention of Henry Allen, President

Dear Mr. Allen:

Very truly yours,

(2)

John L. Shaw, Inc.,
4221 River Ave.
Portland, Oregon

Dear Mr. Shaw:

Very truly yours,

(3)

Mr. Walter Rogers, president
Missouri Meat Company
Box 776
Kansas City, Missouri

Gentlemen:

Yours very truly,

(4)

Dr. Lynn York, M.D.
Tower Building
Sacramento, California

My Dear Dr. York

Sincerely yours,

(5)

Hon. Frederick B. Redmond
The House of Representatives
Washington, D.C.

Dear Hon. Redmond,

Respectively yours,

(6)

Editor Evan R. Hawley
The Compass Magazine
718 Trent Ave.
Kansas City, Mo.

Dear Mr. Hawley;

Very truly yours

(7)

Albert A. Bergerson
121 14th Street
Dallas, Texas

Dear sir:

Yours truly,

(8)

Prof. Owen E. Felton
Dept. of Ag. Econ.
Southern Technical Institute
Biloxi, Mississippi

Dear Prof. Felton:

Very truly yours,

(9)

Harmon and Hensley, Incorporated
Box 1215
Nashville, Tennessee

Dear Sirs:

Very truly yours,

(10)

Mr. Jonathan Brady,
The Ace Foundry
Denver, Colorado

Dear Mr. Brady:

Very truly yours,

EXERCISE 2

Rearrange the following material in correct form for an inside address and an attention line if one is indicated. Supply an appropriate salutation for each.

1. Carl A. Troxell, an instructor in engineering drawing at the Oakland Technical Institute, Oakland, California.

2. The Consolidated Vultee Air Corporation, Daingerfield, Texas, Route 1. Ask attention of the manager of the Ordnance Aero-physics Laboratory.

3. The credit manager of the Pendleton Woolen Mills at Pendleton, Oregon.

4. The Jones and Laughlin Steel Corporation, located at Pittsburgh, postal zone 30, at the street address 3rd and Ross streets.

5. The Pacific Coast Division of the Owens-Corning Fiberglas Company, located in Santa Clara, California. The box number is 89.

6. The employment director of the Bell Telephone Laboratories, Inc., located in New York City, postal zone 14, at 463 West Street.

7. Clemson Agricultural College, Clemson, S.C. Ask attention of H. E. Glenn, Vice-Director of Research.

8. J. Carlisle MacDonald, of the United States Steel Corporation at 71 Broadway, New York 6, N.Y. Mr. MacDonald is assistant to the chairman.

EXERCISE 3

Many of the following sentences contain hackneyed business letter jargon. Rewrite each sentence that needs to have such language replaced by language that is more natural.

1. Your letter of recent date about use of glass for battery separators nas been received by us and its contents duly noted.

2. Please advise us of the title of your address as we are desirous of publicizing such address at an early date.

3. I beg leave to inform you that as per your request of recent date we will send our Mr. Jennings to inspect the faulty castings.

4. It will be in accordance with my wishes if you change your itinerary as suggested by yours of the 25th.

5. Enclosed please find a reprint of my article entitled, "A Five Year Plan for Increasing Oil Production."

6. We have read with interest your letter of March 14 suggesting a method of preventing the deterioration of apples during long periods of storage.

7. Assuring you of an earnest desire on our part to hasten this job as much as possible, we remain . . .

8. An early reply will be much appreciated by us.

9. If you will let us know a date that would suit your convenience, we shall be glad to have one of our representatives call upon you.

10. We have received your check for life membership in the society, and are enclosing herewith our receipt for same.

EXERCISE 4

Most of the following sentences from business letters are faulty because they are negative in language or idea or because, being ob-

viously beginnings or endings, they contain undesirable style or ideas for that portion of a letter. Write an improved version of each sentence that needs improvement. (If it is necessary to make up minor facts or to clarify interpretations in order to write a good version, you are free to do so.)

1. I was surprised to learn by your letter of June 19 that you claim my charge for investigating your lighting needs to be excessive.
2. In your letter of June 21 you have consented to address our meeting next month, but you have neglected to state which of the suggested subjects you will discuss.
3. I realize that you are a busy man, but I wonder whether you might be willing to address a meeting of this society on September 8.
4. Though questionnaires are sometimes a nuisance, I hope that the one enclosed won't be consigned to your waste basket.
5. We shall be glad to grant you the permission you have requested to go through our plant next Thursday, even though we ordinarily permit visitors only in groups and on conducted tours.
6. In regard to experience, mine has been limited, consisting of nine months as an inspector with D. H. Jones and Sons, Inc.
7. I regret to say that I cannot bid on this job unless I know how many drawings must be reduced in size and "stripped in" on the regular page.
8. I shall be glad to reduce our bid to the figure we had discussed previously if you will accept a later delivery date so that I shall not have to pay overtime wages in order to meet your deadline.
9. In conclusion let us say again that we greatly regret the delay and inconvenience our error in wiring the switchboard has caused you.
10. We hope that our refusal to comply with your request will not interfere with our pleasant relations in the future.

EXERCISE 5

Study the following letters, noticing the respects in which they might be improved in tone, in attitude, in organization, and in beginnings and endings. Try to determine, also, what might perhaps be added in each instance to make the letter really good.

Criticize or rewrite any letters designated by the instructor for such treatment.

Dear Mr. Smith:

Your letter of May 10, applying for work during the summer, when the university is not in session, has been received.

I regret to inform you that we have no position in which we can place you this summer. Due to a reduced number of orders, we are not increasing our staff.

Yours truly,

Dear Mr. Henderson:

I have before me your letter informing me that your son left his wristwatch in the dormitory room where he stayed during the recent one-week "camp" of the Future Farmers of America on this campus. In this letter you ask that I locate the wristwatch.

Before the boys checked out of their rooms, we did everything in our power to prevent losses such as this. The group leaders repeatedly urged the boys to look in all drawers, under beds—everywhere that objects might be left by accident. We do not feel, therefore, that we are to blame for this loss.

I have not heard of the finding of any wristwatch. The director of dormitories is now on vacation, and he is the one to whom it would probably be turned in if found in a dormitory room. When he returns, I shall contact him; and if the watch has been turned in to him, it will be returned to your son immediately. I feel, however, that if the watch is not recovered, it will be the boy's own fault he lost it, for no such loss could have occurred if the orders given by group leaders had been followed.

Very truly yours,

Officers of the Student Branches
on the October Itinerary
of President Hobson

Gentlemen: Subject: Title of President Hobson's address

President Hobson has just advised us that he has changed the title of his address to "The Role of Research in National Defense." Will you kindly announce it this way when sending information to the newspapers and otherwise announcing it.

It is important that we should have from you by October 10 at the latest a detailed schedule of the itinerary for President and Mrs. Hobson while they will be in your city. We should have the name of the person who will handle private automobile transportation where it is needed, and the name and telephone number of the person to be contacted upon the president's arrival in your city.

Since President Hobson has changed the subject of his address, he plans to dispense with the use of slides to illustrate it. It will not be necessary, therefore, for you to make the previously requested arrangements to have a projector and screen available.

I am enclosing herewith a biographical sketch of President Hobson and his career, which along with the information on the title of the address should be helpful in getting out publicity releases.

Thanking you for your attention to these details, I am

Very truly yours,

John Doe
Executive Secretary

Gentlemen:

We have just received your order for the offset printing of 500 copies of your Instruction Manual, along with the manuscript for same. We regret to inform you that we cannot accept this order at the price you have indicated.

The price, to be sure, is what we quoted you; but a price quotation by this or any other company is obviously made with the assumption that the offer will be accepted within a reasonable period of time. We do not feel that this has been done in the present instance. The price was quoted last February, but it is now September, and you have delayed almost seven months before sending the order.

During this period, the price of paper has increased on two different occasions, and we have been forced to grant one raise in pay to our employees. Our margin of profit is low enough that it does not permit us to absorb such increases in expenses.

We can accept this job for an additional 10 cents per copy, which will increase our charge from $250 to $300. This is a figure that we believe to be as good as any you can obtain.

We are anxious to do this job, and hope you can let us know as soon as possible whether we may go ahead with it. If our terms are not acceptable, however, please let us know and we shall return the copy of your manuscript.

Yours truly,

11

Special Types of Letter

The types of letter included in the present discussion have been selected with the probable needs of the technical writer in mind. Though not every letter can be classified as to type, it should be helpful to see how the general principles apply in a number of characteristic situations.

No effort has been made to have the list of types as extensive as possible. Some so-called types are so simple as to call for no special comment; and some, for example, credit letters, are not likely to be written by a technical writer. In this latter category belongs the sales letter, which the discussion does not cover. Certain sales letter techniques are explained, however, in the section on Letters Urging Action, which deals with the closest approach to a sales letter that most technical writers will be called upon to write.

INVITATIONS

Though invitations of a social nature are beyond the scope of the present discussion, there are many times when invitations are essentially business letters. Characteristically, an invitation might be written in behalf of a professional organization in an attempt to induce the reader to attend or to participate in a meeting, or to join in some other type of activity. Any person who belongs to an organization may sometime have the responsibility of writing an invitation in its behalf.

It would seem at first that invitations are so simple that there would be little to say on how to write them. It would seem that your invitation would be satisfactory if you would merely ask the reader to do what was desired and tell him the date, time, and place of the meeting or other function. Further consideration, however, shows that more can be done to make your invitation successful.

Assume, for example, that you must invite a speaker to address a meeting. You should indicate the purpose of your letter near the opening; yet the opening should also include something to catch the reader's attention—an expression of interest, for example, of something he has done which is perhaps the reason he has been singled out for the request. It flatters him to think that you really want *him* rather than merely wanting to fill out the program.

Your letter might be strengthened by mention of a few facts about the organization, the importance of the occasion, or the probable size of the crowd. In general, anything is appropriate that will show the organization and the occasion to be deserving of assistance.

If it is possible to make a subtle appeal to the reader's self-interest, you should do so. Many a speaker accepts an invitation partly because of the publicity and good will that result from his acceptance. Obviously, however, an appeal to self-interest should not be crude. You should maintain the attitude that the reader will be doing you a favor by accepting the invitation.

When all these points, or as many of them as seem appropriate, have been covered, the invitation should end by requesting action. The main difficulty in making this request is the problem of how to obtain an acceptance or a refusal promptly without seeming to rush the reader unduly. Perhaps the mildest way of requesting quick action is to use the phrase, "at your earliest convenience"—which the present writer maintains is not jargon because it is the simplest possible way of expressing the idea. Sometimes, however, you might find it necessary to ask for action by a specific date. In this event it is best to offer some

reason—for example, the need of preparing copy for a program. Whether urgency is necessary or not, you can make your ending pleasant by showing a desire to be hospitable—a desire to make the occasion enjoyable for the reader.

Though the preceding suggestions are appropriate, you should not make your letter excessively long. Usually, from two-thirds to three-quarters of a page is long enough. It is better to select the ideas that best suit the occasion rather than to try to use every device you can think of.

The following invitation illustrates the application of many of the principles explained:

Dear Dr. Peters:

Several members of our faculty who attended the meeting in March of the American Steel Institute have spoken with enthusiasm about your address on "The Exploration of New Ways." This is to extend to you a cordial invitation to speak at the annual banquet of the Associated Engineers of this university on the same or a similar subject.

The banquet is scheduled for May 25 at 7:00 P.M. It will be held in the Crystal Room of the Plaza Hotel in this city. We should expect, of course, to reimburse you for all expenses, including hotel accommodations, meals, travel, and incidentals.

The Associated Engineers is a student organization which includes most of the upper division students of engineering. Its banquet will be attended not only by these students but also by most of the members of the engineering faculty and by many prominent industrial leaders in the city. I am sure you would find this group an appreciative audience, and would meet at the banquet many people whose acquaintance would be enjoyable.

We surely hope you can accept this invitation, for we feel certain that you have valuable advice to offer us. On our part, we shall do everything possible to make your visit with us pleasant. It would be a pleasure, while you are here, to take you to look over some of the university's interesting research projects if you would care to see them.

We should also be glad to arrange hotel accommodations for you and to meet you at the train or airport if you could let us know when and where you would arrive in this city. Since we want to give your address wide advance publicity if you can arrange to speak to us, we hope you will let us hear from you at your earliest convenience whether you can come.

Sincerely yours,

John Jones, Secretary
The Associated Engineers

LETTERS GIVING INSTRUCTIONS

In a letter giving instructions, the first necessity is completeness. Though you will have to trust your own judgment as to how much detail to include you will find it necessary to think the subject through, visualize every contingency, and answer every question that really calls for an answer. Sometimes it may be necessary not only to give instructions but also to offer enough explanation of background that the reader will really understand the situation. Instructions are grasped more easily, remembered better, and carried out more intelligently if the reader is aware of reasons and purposes rather than being expected to follow orders blindly.

Explanatory matter should be kept distinct from the instructions so that the latter will not become blurred. When possible, you should clear away the explanations before giving the actual instructions. In any event, the manner of expressing the actual instructions should differ from the manner of expressing the explanation. The following example shows two ways in which a change of manner can be accomplished.

. . . To charge the expense of a machine against production for a short period would be extremely complicated. Therefore an hourly rental rate has been set up for each type of machine. It is to be applied as follows:

1. Keep an accurate record of the time a machine is used on each job that has a separate account number.
2. Charge the job account with the amount arrived at by applying the rental rate.
3. Charge the time lost for minor repairs and service to the job on which the machine is working.
4. Charge major repairs or overhaul against operating accounts 700 to 799.

OR

1. An accurate record shall be kept of the time the machine has been used on each job that has a separate account number.
2. The job account shall be charged with the amount arrived at by applying the rental rate.
3. Minor repairs and service shall be charged . . . etc.

In addition to making it easy to distinguish between explanatory information and actual instructions, you should employ every possible safeguard against haziness or ambiguity. As a famous Prussian general remarked, "Anything that can be misunderstood will be misunderstood."

When instructions can be arranged in a chronological order, such an order is usually effective. When the nature or complexity of the material makes a straight chronological order impracticable, the instructions should be organized as carefully as any other writing of comparable length. Related material should be drawn together, and points taken up in a well planned sequence. Numbering, underlining, extra indentation, internal headings—all such mechanical devices for achieving continuity and special emphasis are needed more frequently in instructions than in most other writing.

When you send a letter of instructions to a reader outside your own organization, good will is obviously important. When you send such a letter to your own subordinates or associates, the concern about good will need not be quite so great; yet even when you address subordinates, it is advisable to guard against unintentional brusqueness by adopting a pleasant tone throughout the letter.

The following form letter, sent to readers in the same company with the writer, makes a courteous effort to secure willing co-operation as well as giving instructions.

To the Superintendents of Branch Plants
National Implement Company

Dear Superintendents:

As you have been previously informed, a study is under way on the standardizing of procedures for writing our "one-page" report. This study has proceeded far enough that the Report Writing Department now asks you to have those who work in your division comply with the following instructions:

1. *Suggestions for Writing*

   a. Detailed technical information shall be held to a minimum. One-page reports shall include only general material such as reasons for the test, conclusions, test methods, and principal results.

b. If no major report is to be made later on the subject concerned, additional photographs and data may be filed with the original copy of the one-page report, and a note to that effect shall be made in the report itself.

2. *Illustrations and Curves*

a. When photographs are selected for reproduction on the back of one-page reports, care shall be taken to select clear prints, especially when reduction in size will be necessary. Four photographs is to be the maximum number reproduced on the back of the one-page report.

b. Curves are to be drawn on the back of the graph paper instead of on the side bearing the cross-section lines. (As many as six curves can be reproduced on the back of one report if this is done and if the explanatory lettering is sufficiently large.)

3. *Corrections*

After a report has been typed by the Report Writing Department on vellum, it will be returned to the writer for correction before being reproduced by the Ozalid process. When corrections are made, the following suggestions should be followed:

a. Corrections may be made either on the vellum sheet, on separate sheets, or on tissue overlay sheets.

b. If corrections are made on the vellum sheet, they must be made *very lightly*, and preferably in blue pencil since the camera does not photograph light blue. (Heavy pencil corrections, ink corrections, and especially corrections made with colored pencils are difficult or impossible to erase from the vellum sheet from which prints are made.)

We feel confident that if full cooperation can be secured in this effort to improve reports, your plant as well as all other divisions of the company will benefit. It will be greatly appreciated, therefore, if you will urge the personnel under your supervision to follow the methods recommended.

Very truly yours,

John Doe (signed)

John Doe
Head of the Report
Writing Department

INQUIRIES AND ANSWERS TO INQUIRIES

Inquiries

Whatever position you hold, you are likely to write inquiries. Sometimes you may be addressing a reader who can profit by

supplying information, or such an organization as a chamber of commerce or a governmental bureau. Under these circumstances there are no special difficulties. All that is necessary is to make the letter clear and courteous.

There are times, however, when you may need to send inquiries to those who are under no obligation to supply information and who will not profit by doing so except perhaps through the creation of good will. Most organizations at least answer inquiries as a matter of courtesy and good business. Whether their answers provide the information requested may depend in part on the skill with which the inquiry has been written. If your inquiry makes the receiver really want to answer, and if it makes the job of answering easy, its chances of success are greatly increased. If it is poorly written, however, it may draw an answer that is of little value. Therefore it pays to write your inquiry properly—to recognize the fact that you are asking a favor and to reduce the effort of answering to a minimum.

The resemblance of one inquiry to another is great enough that it is usually advisable to conform to a fairly standard pattern, consisting of the following elements:

1. An opening which makes it clear that the letter is a request for information and indicates the general subject to be asked about.
2. The reason the information is needed.
3. The reason, unless it is obvious, for sending the inquiry to the particular person or organization that you are addressing.
4. The actual questions to which answers are desired.
5. An expression of appreciation combined with a tactful suggestion of action. This should include an offer to return the favor if such an offer is plausible rather than just an empty gesture.

If it is possible to point out a way in which the receiver serves his own interest by providing the information requested, such a suggestion should obviously be worked in wherever it may be placed most smoothly.

To comment further on these steps: The first is necessary be-

cause every letter should indicate its purpose at once. Many writers, however, disregard this fact and launch into such an extended description of their own concerns that it is not made clear at the outset how the subject under discussion is related to the reader.

The second step is necessary because courtesy demands it. Although you should not be long-winded in telling why you need the information, it is not reasonable to ask the reader to use his time for your benefit unless you can assure him that your purpose is neither trivial nor contrary to his own interests.

The reason for the third step is obvious. Incidentally, in this portion of the letter you have an opportunity to insert a subtle compliment that may create good will and may make the reader want to be obliging.

The questions, however, are the heart of the letter. Both courtesy and self-interest make it advisable that your questions be worked out carefully. They should be well organized, so that those which deal with a single aspect of the subject are placed consecutively. Each question should be as brief as clarity permits. The answers called for should be brief facts or estimates rather than general discussions, for a general discussion is likely to be filled with so much hedging and qualification that it is hard to interpret.

If there are several questions, it is desirable to number them. When there is room, it may also be desirable to set the block of numbered questions apart by widening the side margins and placing each question on a separate line. Numbering the questions makes it easy for the reader to check up on what facts he must have in order to answer the letter. Also, the numbers make it almost impossible for him to overlook any question by accident. And finally, his answers are likely to follow the exact order of the questions—which is a great help if you are tabulating the answers from many persons.

Though a letter of inquiry should request information mainly by asking specific questions, it is often advisable, also, to give the reader an opportunity to add his own comments.

The ending of an inquiry should express appreciation and suggest action. Usually, this can be done in a single sentence. Neither directly nor by implication, however, should you say "Thank you in advance." To do so seems to imply that the reader is not free to decide for himself whether he will answer your questions. Suitable expressions of appreciation might be: "I shall greatly appreciate whatever information you may be able to send me," or: "Any attention you may give this request for information will be greatly appreciated." There is a real though subtle difference between these statements and such a statement as "Thank you in advance for answering these questions," or even "Thank you for this information."

The action requested should be made as easy as possible to perform. For example, you might suggest that the reader write the answers at the bottom of your letter, and usually you should enclose a stamped and self-addressed envelope.

Closely related to an inquiry is a questionnaire. In fact, a questionnaire is merely the result of removing the questions from the letter, placing them on a separate page, and providing room for answers. Unfortunately, though a questionnaire must be used when the questions are numerous, many people who answer straight inquiries disregard questionnaires. When, in spite of this, a questionnaire seems necessary, the letter that accompanies it should be merely a normal letter of inquiry without the questions. The page bearing the questions, however, should contain enough information to be answerable if separated from the letter.

Answers to Inquiries

If the response to an inquiry contains all or most of the information requested, it is one of the easier types of letter to write. When you write such a letter, your opening should indicate that the reader's request is being complied with, and of course should cover all the points that any opening should cover. Following the opening should come the information requested, so far as it can be provided. If part of the information cannot be provided, a statement to that effect comes next, accompanied by a suitable

expression of regret plus whatever explanation of reasons seems called for. The ending is usually an expression of good will; for example, a statement of your hope that the information will be helpful or that the reader's project will be successful—or perhaps an offer to provide additional information if such an offer seems fitting. When your letter providing information cannot bring any reward except good will, it should obviously concentrate on securing good will.

The preceding suggestions apply when you answer an inquiry from someone who is not a potential customer for goods or services. The answer to a potential customer is essentially a sales letter, which places it beyond the scope of the present discussion.

When you answer an inquiry but do not provide the information requested, the arrangement of your material should follow the pattern suggested for all refusals. (See pages 276-277.) Your opening should not indicate that the request is being refused. You should try to show that you would like to comply with the request. Then should come a statement of the reasons you cannot comply, followed by a tactful statement that the information requested cannot be provided. In stating your reasons, you do not need to be apologetic, but should avoid bluntness.

After the actual refusal, you should include a few more lines so that good will and your desire to help, rather than the refusal, will be the final impression. These added remarks could express your hope that the reader will find the needed information elsewhere, that his project in general will be successful, or that you can be of service in some other way in the future. Many times, when the exact questions received cannot be answered, you might be able to send printed enclosures or suggest other sources of information. Such material, whether useful or not, will keep the reader from feeling that you lacked a desire to be obliging. A well-written refusal can at least prevent the inquirer from feeling rebuffed.

The first of the following examples is a well-written inquiry. The second is a well-written letter sent in answer to an inquiry but not providing the specific information requested.

Inquiry

Gentlemen:

We have heard that an investigation now being made by the Oregon Forest Products Laboratory touches upon the use of alder wood for the manufacture of furniture. We are therefore hoping that you may be able to supply us with some information on that subject.

This information is needed because we have been considering opening a branch furniture factory in a new location but have hesitated to do so because of the doubtful supply of hard woods in the area under consideration. There are good stands of alder, however; and if these could be used, the feasibility of a branch factory would definitely be increased.

The specific questions to which we need answers are as follows:

1. Is alder wood easy or hard to season?
2. What seasoning temperatures are recommended?
3. How hard is it—in comparison, for example, with Western Hemlock?
4. How heavy is it (in comparison with other hardwoods or in pounds per cubic foot with moisture content indicated)?
5. Does it shrink or swell excessively when moisture content changes?
6. Can it be glued successfully if moderate care is taken?
7. Can it be stained to imitate mahogany, maple, or walnut?

Any additional information, or any printed material you think would be helpful, would be welcomed. In return, if we open an operation using alder, we shall always be glad to pass along any of our own findings. Meanwhile, we shall hope to receive, at your convenience, answers to any of our questions which you are in a position to answer.

Very truly yours,

Answer to Inquiry

Dear Mr. Ashby:

We have received your letter of April 14 inquiring about irrigation methods. The questions you raise are certainly questions that any irrigator needs to consider. Definite answers are difficult, however, because the answer to each of your questions depends on several facts about the land to be irrigated.

The maximum length of furrows, the best size of streams in a furrow, and the length of time it should take the water to get through a furrow can vary greatly. The answer, in each case, is affected by the slope of the land, the type of soil, the depth of soil, and consequently the importance or unimportance of guarding against erosion. Each area and each soil type constitutes a special problem, and a general recommendation is therefore impossible.

We believe, however, that you may be able to obtain assistance from

the Soil Conservation Service, which you would probably reach most conveniently through the office of the Bureau of Reclamation in Denver. Extensive studies have been made on the problem that concerns you, and I believe that the Soil Conservation Service might supply bulletins that explain how to figure out for yourself the best procedures to use on your own land.

We hope that this suggestion will be helpful and that you will feel free to call upon us in the future if there is any other way in which we can be of assistance.

Sincerely yours,

COMPLAINTS AND ANSWERS TO COMPLAINTS

Complaints

Perhaps the first point to remember in connection with letters of complaint is that although there is no other word by which we can refer to such letters, the very word *complaint* is disagreeable in its connotations and may well be considered taboo in the letters themselves.

A complaint should never be needlessly unpleasant. You will find this warning timely because the incidents that make it necessary to write a complaint are likely to make you feel irritated. With the reader at a distance, you may find the temptation to write a harsh letter difficult to resist—though you would probably be moderate if you were talking to the reader personally. Perhaps a harsh letter may even be justified; yet its harshness will usually anger the reader and render him incapable of passing fair judgment on the merits of your case.

All in all, you are not likely to gain anything by a display of irritation that you could not gain just as effectively without it and at the same time retain more good will. Hence a letter of complaint should as a minimum be completely courteous, and is often more effective if it is actually friendly in tone. Regardless of your personal feelings, you should address the reader as if you consider him a reasonable person—a person who wants to do what is fair. Thus your letter will seem intended merely to acquaint him with facts he would wish to know, just as you would presumably wish to know them if the case were reversed.

This does not mean that a complaint need be unduly apologetic. Indeed, it may of necessity be direct and extremely serious, but it should never be sarcastic and quarrelsome. Even when a situation is so aggravated as to make necessary a warning of drastic action, you should indicate that you would take the action with regret. By showing a desire to spare the reader the consequences of the action contemplated, you can achieve the "You Attitude."

When a complaint must contain a request for a specific adjustment, you assume that the reader accepts his moral and legal responsibilities, tell him the facts on which your request is based, and ask for settlement. It improves the tone of such a letter if you can work into it an expression of regret that the request for an adjustment is necessary. The conclusion of the letter should be a request for action.

The following letter of complaint is fairly typical:

Gentlemen:

Recently we received your shipment of ten large castings (1056 pounds) of crankshafts, the first shipment on the contract for fifty. In most respects these castings are satisfactory, but there are certain minor flaws that we wish to bring to your attention.

The first of these defects is a faintly apparent porosity on inside faces, always occurring at the same position. The second is the presence of faint, thin lines from ½ inch to 1 inch long, running in random directions. These, also, always occur at the same spot on the castings. Both types of flaw showed up during the process of machining.

We have also found that the molybdenum content of these shafts, as indicated by our own tests, does not coincide with the figures submitted by your laboratories.

In spite of these matters we are in general pleased with your performance on this contract, and we shall be able to use the shafts you have sent thus far. We believe, however, that you intend to have the shafts free from even minor flaws; and we hope that the other shafts in the order can be made so. Also, we shall have to insist on perfect castings on the other order we recently placed with you—an order for two new types of shaft.

We should therefore appreciate it if you would send one or more of your qualified men to examine the castings now in our possession. Such an examination, we feel, should help you to determine the cause of the flaws and to correct your casting procedures so as to make perfect work possible in the future.

Please let us know when we may expect a visit so that we can make sure the proper men on our own staff are free for consultation.

Very truly yours,

Answers to Complaints

When the answer to a request for an adjustment is routine, it may contain only three or four sentences expressing an appropriate degree of regret and informing the reader that the adjustment is being granted. There are occasions, however, when an adjustment must be refused, or else must be granted in a situation that is serious enough to call for a special effort to set matters right. It is these serious cases that the following discussion concerns.

Qualities common to all answers. When an answer to a complaint is not a matter of mere routine, the following general principles always apply, whether you grant or refuse a request:

1. The tone of such a letter should always be pleasant. Even when you are answering an angry, unreasonable letter, the luxury of writing an angry reply is not permissible. This is not to say that your letter must be subservient, but that it should refrain from personal unpleasantness and should make a calm, reasonable attempt to reach an understanding.

2. You should avoid the role of an opponent who is trying to defeat the reader in an argument. It is well to mention very near the opening some point on which you and the reader will agree.

3. Detailed restatement of the complaint refreshes the reader's memory about his original annoyance and revives his anger. Therefore, you should limit your restatement to the minimum necessary to show that you have read the complaint with proper care and understood it correctly.

4. Expressions of regret should be proportionate to the seriousness of the occasion. They should neither be so perfunctory as to suggest indifference, nor so excessive as to magnify a small matter into a large one.

5. Explanations should not be too long and involved, especially if a requested adjustment is being granted. To have them

so causes danger of seeming either unduly apologetic or unduly argumentative. The reader will presumably be more interested in what is to be done in the future than in a prolonged discussion of what lies in the past.

6. The end of the letter, especially, should be optimistic and forward-looking rather than reverting to the cause of the complaint.

Sometimes a complaint does not include a request for an adjustment. In this event, the preceding suggestions should be sufficient. Special consideration is necessary, however, for the letter in which an adjustment must be either granted or refused.

Refusal to grant an adjustment. A letter in which an adjustment is refused should contain the following parts in the order listed: (1) An acknowledgment of the complaint (though the word *complaint* is not used) and enough facts to show that it has been understood correctly. (2) An explanation of the facts and reasoning that lead to a negative answer. (3) The statement of refusal (though the word *refuse* is avoided). (4) An attempt to turn the reader's thoughts away from the complaint and point them toward the future.

Into the first or second of these parts should be woven whatever expressions of regret seem appropriate.

The most important characteristic of this plan is that the actual refusal is held back until the facts that justify it have been presented. By holding back the refusal you attempt to create an impression that the complaint was received by a person who was willing to consider it with an open mind and to grant the adjustment requested if such action seemed called for, but that full consideration of the facts showed that no adjustment was due. If you were to express the refusal first, and tell the reasons afterward, you would be very likely to create the impression that the reasons were hunted up to justify a decision that had already been made. Also, the statement of refusal would put the reader in a poor mood to read the explanation.

The decision, when expressed, should be stated tactfully; but the effort to be tactful should not be carried to such an extreme

as to be evasive. And once the decision has been stated, you assume that the reasons offered have been adequate and that the natural thing to do is to consider the subject closed and look to the future.

In building your case for a refusal, it is best to avoid repeating the reader's own misstatements for the express purpose of demonstrating that they are false or erroneous. It is best to overlook rather than point up the fact that your own statements are in direct contradiction to those of the reader. Your purpose is merely to justify your own decision rather than to shatter the reader's ego by proving him to be unreasonable, inconsistent, or untruthful. If you show up the weakness of the reader's case too devastatingly, he may be forced to grow angry merely as a subconscious escape from the low opinion he must otherwise hold of himself.

Some questions may arise over whether the method described will actually have the effect you might hope to achieve. It would be naive to hope for miracles. Even the best refusal will do less to give satisfaction than a well-written consent. At least, however, the method explained should hold resentment to a minimum.

Letter granting an adjustment. Sometimes you may need to grant an adjustment on an occasion that is important enough to call for more than a routine consent. In this event, the letter differs from a refusal in one important respect: The action being taken should be indicated extremely early in the letter. Thus the letter will contain: (1) An acknowledgment of the complaint (though the term *complaint* would not be used). (2) A statement that the request for an adjustment is being granted. (These two parts may be combined.) (3) Whatever expressions of regret are called for unless regret has already been expressed in the opening. (4) Whatever explanation seems necessary. (5) An attempt to turn the reader's thoughts away from the occasion for complaint and focus them toward the future.

This order is psychologically sound. The reader will listen to

explanations more understandingly after he has learned that the request has been granted.

When as a matter of policy you must grant an adjustment to which you do not feel the claimant is entitled, you should grant it graciously. Some writers will offer all the reasons that might justify a refusal before finally saying that an adjustment has been granted. By adopting this grudging, argumentative method, they sacrifice the good will that they are making the adjustment in order to retain. A letter will not have the desired effect if it shows the reader that though his request is being granted, he is considered unreasonable to have made it.

The first of the two letters that follow is a well-written refusal to make an adjustment. The second is an answer to a complaint in which no adjustment was asked but in which another type of action was requested.

Dear Dr. Hale

I was sorry to learn by your letter of August 5 of the damage done to your garden, and have made a careful investigation to see whether I might recommend to the city council that you be compensated for the damage.

Your letter mentions that the city weed-cutting crew not only cut down weeds along the sides of Cherry Street, but also cut down some shrubs at the edge of your garden. My investigation turned up the following additional facts.

Though Cherry Street has a paved surface only 30 feet wide, it was originally planned as a wider street, and the city property is actually a 60-foot strip. The property line of your lot is 30 feet from the center of the pavement rather than extending to the edge of the pavement. I find also that nothing was cut down farther than 25 feet from the center of the pavement. Thus if your shrubs were damaged, you must have inadvertently planted them beyond your property line, for no cutting was done except on city property.

In pointing this out I am not applauding the action of the weed cutters. I have reproved them for their bad judgment. Yet there would have been no damage if your garden had not extended onto city land, and therefore I cannot recommend to the council that you be compensated. I feel sure that even if I made such a recommendation they would not follow it.

I shall instruct the foreman of the crew to take special pains to protect your garden in the future. Meanwhile, I hope that the careful attention

given your letter indicates our desire to handle this matter fairly and to grant any claim where the city is legally liable.

Sincerely yours,

John Doe, City Engineer

Gentlemen:

Thanks for letting us know, in your letter of November 17, that the castings for crankshafts which we recently sent to you did not meet our usual high standards.

On November 24, if such a date is convenient for the members of your staff who are concerned, we will have two of our men visit your plant to look over the shafts that are faulty and to plan a procedure for determining the cause of the defects. From your description of these flaws, it would seem likely that the number and placement of the risers might have something to do with them.

This and every other likely cause will be considered when our men see the castings, and we will push the investigation vigorously until the cause has been determined and corrective measures have been taken.

We are glad you can use the castings delivered, and feel sure that the minor defects mentioned will not cause any trouble. You are right, however, in assuming that we want our castings to be free from even minor imperfections, and in letting us know that on this job our work was not perfect. You can count on our doing everything necessary to improve the remainder of the order and to make future orders free from flaws.

If there is any reason November 24 would not be a good time for our men to visit you, please let us know. Otherwise they will be there on that date.

Sincerely yours,

COLLECTION LETTERS

The present treatment of collection letters is based on the assumption that you may occasionally be forced to write a letter collecting money, but that you will not write collection letters as part of a daily routine in a collection department.

The first fact to realize when you write a collection letter is that you should not necessarily say everything you might be justified in saying. Rather, you should say only what you think will help you to get the desired result, and that result should include the retention of good will as well as the collection of money. This caution is needed because you are likely, when you write a collection letter, to feel annoyed that you are forced

to write it—perhaps justifiably annoyed. Nothing is gained, however, by a display of annoyance in the letter, and something may be lost. If you make the reader angry, his conscience is less likely to bother him about making you wait for your money. All in all, you should write a collection letter with full awareness that it will be read not by an unprejudiced judge but by a reader whose personal feelings are strongly involved and will influence his reaction to every statement you make.

When writing a collection letter, therefore, never cease asking yourself, "If *I* were to receive a letter making these remarks, would my reaction be the reaction I am trying to secure on the part of the reader?"

This is not to be construed, however, as urging you to write a letter that is apologetic or ingratiating.

In writing a collection letter you should not exert more pressure than previous letters justify. Too many people delay writing a collection letter longer than they should, and then try to compensate for their own delay by writing a harsh letter. Not only previous letters, but also future letters must be considered. As you write, you must ask yourself, "What will be my next step if this letter fails to bring payment?" Although your attitude should not be defeatist, it is nevertheless bad policy to drift into a position where you will be forced to choose between backing down on a threat and taking a drastic action you would prefer to avoid.

The earliest letters in any effort to collect money should be short and should seem to assume that mere oversight has caused delay in payment. Later letters should be somewhat longer and should not credit the delay to oversight when such an explanation is no longer plausible. Logically, if you credit the delay to oversight, you destroy your justification for including anything more than a mere reminder that the debt has not been paid.

The collection letter should not be an effort to prove that the reader has acted badly. Perhaps he has, but nothing is gained by proving it. Rather than trying to convince the reader that he is *un*fair and *un*reasonable, you should seem to credit him with

being reasonable and fair-minded (which will get him started to agreeing with you). Thus you may lead him to the conclusion that he should do what a fair-minded person does when he owes money—pay it. In urging him to pay, you are only urging him to do at once what he plans to do eventually anyway.

The collection letter should rarely consist of an appeal to sympathy. That is, it should not base its urgency on your own need for the money. Such an approach places the matter on a false basis. It suggests that the reader ask himself who needs the money most rather than who is legally entitled to it; and he is likely to decide, perhaps correctly, that he needs it worse than you do. The real justification for your collection letter is the fact that the reader owes the money and that payment is due.

An appeal to sympathy, if handled with tact, might be used, however, when the reader obviously operates on a larger scale than you do, or when you are trying to collect funds for the benefit of someone other than yourself—for example, money due on a pledge to a charitable organization.

The tone of a collection letter is extremely important. It should usually be friendly, and as a very minimum should be absolutely courteous. Certain tones are especially necessary to guard against—the scolding tone, and the tone of self-pity or self-righteousness.

One of the main considerations in avoiding bad tone is to guard against negative words and phrases. Such expressions as "You have *failed*," and "You have *neglected*" are examples. It would be negative to write, "You have *failed* to send payment and have *neglected* to offer any explanation of your *failure* to send a check." Rather, you should write, "We have not yet received payment, and have not been offered any explanation of the reason that payment has not been made." The second version makes the facts just as clear as the first, but does so without offensive terms.

The collection letter should observe the "You Attitude." If you, as the writer, assume as you should that the reader intends to pay his debts, you are not going against his interests in urging

him to do so. Except perhaps in the first letter and the last letter preceding legal action, you should encourage the reader to send at least an explanation of the reasons if he finds it impossible to pay. Thus you not only achieve the "You Attitude" but also may obtain useful information that will help you as you write later letters. Even in a final letter before definite action toward collection, you may still observe the "You Attitude." This final letter may be written, at least ostensibly, in order to give the reader a chance to avoid the lawsuit.

The ending of a collection letter should be a request for specific action. The action requested should be the logical conclusion to what has been said in the letter. It would be illogical, for example, to say in the letter that you feel sure the reason for payment is mere oversight and then at the end suggest that your reader send part payment and an explanation.

Following the principle that action should always be made as easy as possible, you should never neglect, somewhere in your letter or in an enclosed statement, to indicate the amount to be paid. If there is any question about the reader having stationery, stamps, and clerical help, it may be advisable to enclose a stamped and self-addressed envelope.

Collection letters may often observe what is known as "the principle of resale." That is, they remind the reader of the benefits he received when he incurred the debt. A person is less distressed at parting with his money if he is mindful of the fact that he has received good value for it.

Summing up the whole matter: a letter of collection is difficult to write because the basic situation tempts the reader to feel resentful and the writer to be tactless. Therefore, when you write one, you should make a special effort to put yourself in the reader's place and to imagine your own reactions if you were to receive a letter such as you are writing. You should never fail to ask yourself not "Are these remarks justified?" but "Will these remarks have the effect I am trying to get?" If you will do this, most of the possible blunders can be avoided.

The collection letter that follows urges payment quite strongly,

utilizes the appeal to fairness tactfully, and applies the principle of resale.

Gentlemen:

May I once more bring to your attention the fact that I have not yet received payment for my report to you on whether it would be feasible to open a branch packing house at Cedar Meadows? A statement showing the amount due is enclosed.

The report has now been in your possession for six weeks; and I have already sent one reminder, about three weeks ago, that payment for my services was due. No reply to this reminder has been received. I assume the report was satisfactory, for I have already offered to answer any further questions if you had them, and no questions have been sent to me.

I realize that this is an extremely busy season for a produce company, and that probably my previous request for payment has merely been overlooked. Yet as you may remember, when your need for the report was urgent I put forth unusual efforts to complete it rapidly. Since I did not keep you waiting for the report, I believe you will agree that I should not be kept waiting any longer for payment.

I am still willing, of course, to answer any further questions about my findings; but I believe that just as it stands, my report will enable you to open a new and profitable operation. I would therefore appreciate it a great deal if you would repay my efforts to finish this report promptly by sending me a check immediately.

Very truly yours,

LETTERS URGING ACTION

Many letters written for the purpose of urging action do not fit into any of the types discussed elsewhere. There are letters intended, for example, to urge the reader to contribute to some fund; to join a program for smoke or erosion control; or to join some organization. The writing of such letters may be demanded of men in any business or profession.

Letters of this type are much like the sales letter, which has such wide use in business. Therefore, though full treatment of the sales letter is not called for, it seems advisable to see how the general pattern of sales letters applies to letters aimed at securing action of any kind.

The basic plan of a sales letter involves four steps: (1) Attracting attention and securing interest. (2) Arousing desire. (3) Convincing the reader that the act he is urged to perform will satisfy that desire. (4) Securing action. The key words are *interest, desire, conviction,* and *action.* Though the lines that mark off one step from another need not be sharply drawn, the four functions must always be performed in any letter which attempts, under one cover, to do the whole job of selling. This is true whether the letter is selling merchandise or selling the desirability of some action that does not involve making a purchase.

To obtain interest it is best to get the letter under way with a minimum of the preliminaries that usually occur at the opening. The reader should immediately encounter something that he himself is concerned with rather than material that concerns the writer. If the opening can suggest that the reader's own welfare is involved, or the welfare of his organization, so much the better. One of the best openings for a letter of this type that the writer has encountered began with a statement that a certain specific man—identified as a negro share cropper—was condemned to death. The letter was an attempt by the Workers' Defense League to raise funds to use in preventing what it considered a miscarriage of justice. The plight of the single, specific man was more effective than abstract statements about the plight of the negro race. One of the poorest openings the writer has seen was in a letter by a social fraternity attempting to raise funds. It read: "It seems as though every time we write to the alumni we are asking for something." This showed that the writer himself was uncertain of the appropriateness of his request. Moreover, it put the reader on guard and warned him to steel himself to refuse. The writer should have aroused enthusiasm about the fraternity and its project before letting the reader realize that he was about to be asked for money.

To arouse desire, remember one fundamental point: The desire should be one that the reader already feels. Thus, you do not *create* desire. You merely fan an existing desire into

intensity, and then associate the action aimed at with the satisfaction of this desire. Technical writers can profit by seeing how advertisers use this principle. For example, a person may not desire an air-cooling system; but he does desire comfort, so his desire for comfort is exploited in a letter selling an air-cooler. A woman does not desire a certain soap, but does desire smooth hands—and the admiration they arouse; so the advertiser associates his soap with beautiful hands. Similarly, a man may not desire membership in an organization, but he does desire professional advancement; so it is the latter desire that you would utilize in persuading him to join. Or again—a company may not desire membership in a smoke-control organization; but it desires the good will of the community, and hence may be induced to join a control program not so much to obtain smoke control as to obtain good will. The starting point in arousing desire is to ask yourself, "What are some of the desires that the reader already feels?" and then, "How can I connect the idea I am trying to sell with one of those desires?"

This is not to urge you to attempt anything specious or fantastic. The connection you attempt to show should really exist. In fact, if the connection between the act you try to obtain and the desires the reader already feels is not genuine, the letter has little chance of success.

In arousing desire you do not emphasize every idea you can think of. You should make one single "appeal" dominate. Other possible appeals may be mentioned but should be kept subordinate. If a second letter is sent, a different appeal may be emphasized; but in any single letter, one incentive is emphasized and the others are kept in the background—visible, perhaps, but not conspicuous.

To secure conviction, simply use whatever evidence is best suited to the occasion. No generally appropriate methods can be suggested, as they have been suggested for attracting interest and arousing desire. Whatever the evidence you offer, you should carefully avoid an argumentative tone. The reader should not be

treated as an opponent who must be defeated in an argument. Rather, the effect should be that you and the reader are together following out certain facts to their logical conclusion.

In the effort to secure action, three points must be borne in mind: (1) The action suggested should be complete and specific. Rather than "Let us know your decision," you should write, "Check the enclosed card to indicate your decision." (2) The action should be made as easy as possible. For example, it may be desirable to supply an envelope or card that is already stamped and addressed, or perhaps you can supply blanks to fill in rather than forcing the reader to write a complete letter. (3) There should be an effort to make the action immediate, even if delay would do no harm. Once the reader starts postponing action, he is likely to go on doing so indefinitely, for his impulse to act is stronger at the moment he finishes reading the letter than it will be later when the contents of the letter have faded from his memory. Therefore it is well to offer some plausible reason he should act at once, preferably some benefit to him if he does so.

Certain final cautions are needed in regard to a letter aimed at action: First, the opening paragraph should be brief. This will make it look easy to read and will increase the chances that the receiver will start reading. If your action letter is a form letter, the hardest problem, quite often, is to induce the reader to read it at all. Second, the length of the letter needs careful consideration. If it is too long, a reader may not complete it—in fact may not even start it; but if it is too short, he finishes reading it before it has time to make any impression on him. Finally, you should not discuss the expense that you are asking the reader to incur until you have aroused his enthusiasm about the project concerned. Talking about expenses too early arouses the reader's defense mechanism and dampens his enthusiasm. Moreover, meeting the expense is action, and the effort to secure action always belongs at the end.

The following letter is an example of the letter urging action:

THE WASHINGTON WATER POWER COMPANY

Pullman, Washington

June 2, 1953

Electrical Contractors
Palouse Division

Gentlemen:

ALL ROADS LEAD TO COLFAX for a Meeting devoted *ENTIRELY* to the subject of *WIRING*.

Date—August 5, 1953
Time—8:00 P.M.
Place—Colfax Water Power Office

John C. Hewitt, Chief Electrical Inspector for the State of Washington, is coming over from Olympia. Mr. Hewitt will outline and explain proposed legislation affecting electrical wiring, which is being formulated and considered for the State of Washington.

Roy Crosby, Washington Water Power Meter Supervisor, will discuss the latest information on wiring requirements in connection with electric meter installations.

Both Mr. Hewitt and Mr. Crosby will be available to answer your *questions* and will welcome your *suggestions*. Also Mr. Lawrence Martini, Electrical Inspector from Kennewick, will be present.

This is the meeting designed to get all branches of the industry together, the Inspector—the Wireman—and the Utility. Anyone interested in wiring is welcome! How's to spread the word and fill up your cars for this meeting?

Sincerely yours,

V. S. Casebolt
Manager, Palouse Division

FORM LETTERS

Everyone is familiar with form letters. In most people's mail they outnumber the letters that are personally written. Yet they pose some problems in writing that do not come to mind when one merely reads them.

A form letter is a letter reproduced in quantity by such methods as mimeographing, printing, or automatic typewriter. Obviously it is less impressive than a personally written letter, for the reader immediately realizes that the message is of no more

concern to him than to many other people. This is a disadvantage it is frequently necessary to accept, however, when the same message must in fact be sent to many people and when the time and expense of individual letters would be prohibitive. Moreover, the disadvantage can be somewhat reduced by using a good grade of paper and by sending the form letter as first class mail in a sealed envelope. Sometimes, also, individual addresses and salutations can be inserted by typewriter, so that the effect is less impersonal. As any of these measures is considered, its expense must of course be taken into consideration.

Unless individual inside addresses and salutations are used, the first problem, when you write a form letter, arises in connection with these parts. Sometimes it is possible to improvise two or three lines to replace the inside address, as for example:

To the Officers and Advisors of
Student Chapters of
The American Society of Civil Engineering

Gentlemen:

More frequently, however, the inside address is omitted, and except for the heading, the letter begins with the salutation. This can be *Dear Sir* or *Gentlemen* unless the letter reaches both men and women. Sometimes, instead, you might use more specific salutations such as *Dear Purchasing Agent, Dear Subscriber, Dear Member, Dear Motor User*, or *Dear Friend*. These variations should be carefully considered, however, for they are in danger of seeming too coy. Still another device is to replace the salutation with such a line as: *To All Users of Drafting Instruments:* or *To All Users of Power Saws:*

The only other question of form arises in connection with the signature. Sometimes, in form letters, an effort is made to make the letter seem more personal by reproducing the writer's handwritten signature by mimeograph or in print. Often, however, the primary signature (that is, the first line below the complimentary close) is typed, usually capitalized throughout.

There is no real reason that the body of your form letter needs to differ from the body of individual letters, either in form or

content. However, since a form letter is not so likely to be dictated and sent without revision, you can often spend more time planning its layout. For example, you can emphasize a paragraph by widening the margins, or you can use the device of having the first paragraph end with three double-spaced periods in the middle of a sentence, and thus tease the reader into the second paragraph. Sometimes these eye-catching devices help to offset the disadvantage a form letter suffers in comparison with an individual letter.

The soundest way, however, to offset these disadvantages is to take more care with a form letter than it is possible to take with most individual letters. Having more opportunity to revise, and being free to write a form letter when you feel in the mood to do it justice, you can often produce a much better letter than you can dictate as part of the day's routine.

One more caution is needed: The message of a form letter must be so expressed that it is appropriate for *every* person who will receive it. For example, if some of the receivers are in universities and others in business, or if some have been members of an organization in preceding years and others are not yet members, the phraseology must be appropriate for either group. And if the letter is to be sent at different times of the year as need arises, it must avoid seasonal allusions.

The letter urging action is an example of a form letter (page 318), as are several other specimens through the chapter.

ASSIGNMENTS

1. As an officer or committee chairman of some organization, probably a student organization in your own school, it is your duty to secure a speaker at a meeting or banquet. Write to some person, real or imaginary, in a city within 100 miles asking him to be your speaker. Offer to re-imburse him for expenses, but do not offer payment for making the address. Suggest the subject or leave it to him as you see fit. Add any material that you think will strengthen your letter. Attempt to secure an early answer.

2. Write an invitation to send to important officials in your school and also, perhaps, to prominent men who are not connected with the school; invite them to attend some meeting or banquet such as the one mentioned in the preceding problem. (The question of whether they are to be your guests or are to pay for their own banquet tickets is necessarily left to your own judgment, for it would depend on the specific occasion.) Make a real effort to sell them on the idea of attending. This is to be, actually, a form letter, sent almost unchanged to all who receive it, but it is presumed that an individually typed copy will be sent to each recipient.

3. Assume that you are the recipient of the letter written for assignment 1 or 2, and that you are unable to accept the invitation. Write the letter declining it and telling the reason you must do so.

4. Write a letter of instructions presumably sent by the main office of some company to personnel who operate company automobiles. This letter should tell the receivers what to do about keeping records on the use of cars and on such matters as servicing and minor repairs.

5. Assume that the field men in some company with which you are connected have grown careless—or at least reports have been received that some of them have done so—in some process of inspection, testing, or securing samples to send to the laboratory for testing. Write a letter of instructions to all field men telling them just how the process is to be performed. Remember that the letter will unavoidably reach some men who have been using proper methods; and though you must attempt to improve the practices of those who are careless, you do not want to antagonize the others. Suggested activities about which to give instructions might include: field sampling, various field tests, mixing, batching, or curing of concrete; inspection of welding jobs; preparation of metal, wood, or masonry surfaces for painting; inspection of lumber to see whether it is the grade that it should be; moisture determination in soils; field testing of aggregate; or care and adjustment of any type of equipment.

6. Write a letter of instructions telling the receiver to conduct an investigation and submit a report on his findings. Make clear to him why the investigation is needed, what ground it must cover, and when the report is due. Tell him as much as the circumstances call for about the methods he is to use in obtaining information. If any instructions about expenses are necessary, they should be included.

7. Write an inquiry asking an organization that has been using some product, machine, or equipment about whether it is receiving satisfaction. You wish to know because your own organization is

contemplating purchase of the same product or equipment. Though you invite general comment, write an inquiry that includes several specific questions.

8. Rewrite the following poorly-written letter of inquiry:

Dear Professor Wilson:

I shall be very grateful if you will give me some information about the course in Technical Writing in your school. I should like to know, for example, during which year students take it, what curricula these students come from and whether the course is required for these students, or is optional.

In addition it would help to know the maximum number of classes any instructor teaches in the subject. What are considered the main objectives of the course, and how much writing does a student do? What is the maximum number of students in a class; and how great a percentage of the instructor's load is it considered if he teaches the maximum number of classes in this course?

The reason I ask this information is that I am requested by certain departments in this school to add such a course to our offerings in English here. I have felt you were one of the logical people of whom to make inquiries because members of the faculty here tell me that the course is strong in your school.

I should like to thank you in advance for the favor of answering these questions.

Very truly yours,

9. You are connected with a research agency that has been active in developing methods of preserving wood by "cold soaking." From a rancher there has come a letter asking how long to soak fence posts in order to obtain the best results at a minimum of expense. Write to him telling him that it is impossible for you to answer his question. The time to soak the posts is not uniform, being influenced by the species of tree, the season, how long the timber has been cut, how it has been prepared, and various other factors. There is, however, a simple method to treat timbers for most of the conditions likely to exist. A bulletin is being prepared which will make it easy for him to look up the answer to his present question and will provide other information on the subject. If he will write in three months, he may obtain a copy. If he will give you more information about the posts he wishes to treat now, you will try to make a recommendation.

10. Write an answer giving most or all of the information requested in Assignment 7.

11. Write an answer not giving the information requested in Assignment 7, and explaining reasons you cannot do so.

12. Assume that the company or school you represent had ordered

a printing job, after securing from the printer an estimate that the cost would be between $125 and $140. (This could be for the printing of brochures, programs for a meeting, or some such order.) The printer has submitted a bill for $162.50. Write a letter to him and ask that he either justify the increase or grant an adjustment.

13. Assume that the garage which does service and repair work for cars or trucks owned by your school or by a company for which you presumably work has grown careless. For example, it has neglected to check the battery water when it did lubrication jobs; has left off the cap after replacing brake fluid, etc. On repair jobs, it has done more work than authorized—for example, replacing spark plugs without authorization when a tune-up had been ordered, and replacing a whole exhaust pipe when a mere extension would have been sufficient. This has happened often enough to be a serious cause of dissatisfaction. Write a letter to the garage reviewing the situation and giving notice—though without needless unpleasantness—that continuation of such practices will mean a loss of your business.

14. Write a letter telling the manufacturer of some recently purchased piece of equipment that this equipment is not functioning properly. Ask that someone be sent to inspect it and remedy the defects.

15. Write an answer to the letter in Problem 12. The reason for the increased cost is that the copy did not reach the printer until four days later than it had been promised, with the result that he had been forced to pay overtime wages to get the work done by the deadline. Also, numerous changes were made in copy already set, necessitating resetting. This had been charged for, but the extra work this caused in the composing room had been absorbed without charge. Under the circumstances, you believe the bill to be justified.

16. The company for which you work operates several trucks. It has received a complaint from a citizen to the effect that its trucks regularly pass his home, which is on a small street in a residential district, traveling at excessive speeds and thus endangering children, stirring up dust, and making an annoying amount of noise. Answer his letter, and try to soothe his feelings. Tell him that since receiving his letter you have given suitable orders to all truck drivers. If the trouble continues, you would be glad to have enough details about specific offenses to determine the individual offender. It is not your policy to create a nuisance. Yet try to suggest that most of your drivers are probably driving properly most of the time.

17. You are associated with a company that lays concrete. Two years ago you installed a concrete sidewalk leading from the parking lot of some establishment to the rear entrance of one of its buildings.

A complaint has been made that this sidewalk has not held up properly. It has broken in several places, and in general is in bad condition. You are asked to do a repair job free of charge. Looking into the situation, you find that it has been customary to permit heavily loaded trucks to use this sidewalk to get closer to the building for loading and unloading. Neither the thickness of the concrete nor the preparation of the subgrade had been designed with such use in mind. The work had been done according to specifications, and checked by the owner's own staff as they deemed necessary during installation. The cause of the trouble was simply that the installation had not been planned to meet the use it has received. Refuse the adjustment, but express an interest in doing the repair job for suitable payment.

18. Assume that you represent some student activity in your school such as a newspaper, a magazine, or some group that prints a program for some activity and sells advertising space on it. The date is early May. Several advertisers have not yet paid their accounts, though the advertisements were published in February and statements were sent on March 1 and April 1. Write a letter—actually a form letter but separately typed for each receiver—attempting to collect the account. The approach should be that you are about to graduate. Next year, a new staff will conduct the activity. You wish to clean up all the business for your year—including both collections and the payment of bills, which you cannot pay until all collections have been made. Ask for payment within two weeks so that you can complete your responsibilities before June 1. Remember that those who advertise in student enterprises often take the attitude that they are practically making a donation, so try to avoid any remark that will lose the patronage the following year. Remember the principle of resale.

19. Write a letter urging students or student groups to pay their dues to some organization—the assumption being that the payments are 60 days overdue. As an alternative, try to collect money pledged in some school drive for funds but not yet paid.

20. Rewrite the following poorly written letter.

Dear Mr. Hays:

I regret the necessity of becoming a nuisance to you, but find that I must write to you again. On June 15, as you know, I brought a crew to your farm and spent two days spraying buildings for the purpose of insect control. I agreed then to wait until the middle of July for payment, so that you would have available the money from your strawberry crop.

On July 15 I sent you a statement. On August 1 I wrote a letter asking for payment. It is now August 23, and I have not heard from you. Is this your idea of the fair way to do business? I too have obligations to meet,

and I meet them when due. I have had to pay the crew, and have paid for the DDT used on your place. Your neglect in this matter has caused me considerable inconvenience.

I do not like to make threats; but I hope that you do something about this bill soon, so that I shall not be forced to resort to unpleasant measures.

Very truly yours,

21. Your school is assumed to have a special loan fund from which juniors and seniors in the curriculum you are following may borrow up to $200. Loans are to be paid back in quarterly installments, the first of which falls due one year after the borrower's graduation. A student who borrowed $200 made his first payment June 1, when it was due, but missed the second, which was due September 1. He was sent a statement September 15 and a brief form letter October 15. It is now November 22. He has not been heard from. Send him another letter, reminding him that another payment falls due on December 1 and suggesting that he make both payments at that time so as to bring his payments up to date. Urge, however, that if he cannot send both he should send at least one, along with a letter explaining why he is unable to keep to the schedule. An extension might be possible if there is good reason, but point out that the money is needed to help other students. The tone should be neither harsh nor whining. Try to keep good will without being unduly apologetic. It is suggested that this letter be from 175 to 225 words in length.

22. Write a form letter 250 to 300 words long in which you try to convince the readers to perform some action such as coming to a meeting for a cause of common interest, joining in some program such as weed control or control of a tree disease in the region or community, attempting to obtain some municipal improvement, or joining some organization. As an alternative you might solicit pledges or contributions to support some program or activity. The subject should be a matter of lively interest in your home or college community or in the profession for which you are training.

The date may be assumed to be different from the date on which you actually write the letter. Those who receive the letter should be people who have something in common, such as all being farmers, lumbermen, stockmen, engineers, sportsmen, people in organizations interested in public health, or parents. Supply an inside address that would be suitable for all who receive the letter rather than using an individual name and address. Unless the sort of group to which the letter is sent is clear from the letter itself, add a note giving this information to the instructor.

12

The Letter of Application

The letter of application is important enough to justify a special chapter. It is a type of letter that almost everyone must sometimes write, and no other letter can do more to affect the welfare of the writer. Even when a shortage of manpower makes employment easy to find, there is still competition for advancement; and the person who hopes to advance must often be able to present his qualifications effectively in writing.

The effectiveness of an application should be increased if the following suggestions are utilized.

CONTENTS AND ORGANIZATION

The Opening

Open your letter with a short paragraph indicating the position you are applying for and possibly telling where you learned that an opening existed. If necessary, identify yourself by mentioning, for example, that you are a graduating senior or by telling the position you hold at the time of writing. In general, let your opening paragraph establish contact and clear away preliminaries so that the reader can weigh the evidence of your fitness for the position with no unanswered questions in the back of his mind.

Try, in your opening, to catch the reader's interest by any means possible—by mention, perhaps, of some single outstanding qualification or by a single-sentence statement of your

particular combination of qualifications. This bid for interest can often indicate the pattern of the information that follows—the central portion of the letter being organized to prove what the opening statement claimed.

The Central Section

The central section, in which you present detailed evidence of your fitness for the position, should grow smoothly out of the opening. Though you should organize your evidence in whatever manner best fits your particular set of facts, the information will often fall naturally into sections on education, experience, personal information, and references. These sections need not be arranged in the order in which they are listed in the present discussion. The best arrangement in an application is one in which the strongest points are placed first. First impressions are important, and it is easier to convince a reader that you are a strong candidate at the beginning than it would be later, after the first sections of the letter had created the impression that your qualifications were ordinary.

Education. Mention as a minimum the higher educational institutions you have attended and the degrees you have earned or are about to earn. If you have an outstanding scholastic record, mention it. Do not hesitate to name your extra-curricular activities, for they can indicate desirable personal qualities and help to round out the picture of your character.

Let the amount of detail on your education be governed by the amount of other material you have to offer, the strength of your scholastic record, and the closeness with which your educational training resembles the work you would do on the job. Facts about education that one applicant should mention might well be omitted by an applicant whose other qualifications are stronger.

Experience. Give a complete record of your experience unless it is so extensive that you find it advisable to select only what is most significant—a condition that probably will not concern you until your career is well under way. Nothing is better evidence of

your fitness than experience in a job similar to the one for which you are applying; so if you have had such experience, mention it early. In regard to each job you list, let the reader know whom you worked for, where, when, what duties you performed, and possibly what you learned by performing these duties.

Do not feel that a job unlike the one you are applying for is unimportant. In almost any type of work you have had a chance to demonstrate good or bad personal qualities that will affect your value in any position you are applying for.

Personal information. As a minimum, tell your age, place of birth, weight, height, marital status, and health. It might be desirable also to mention freedom from physical handicaps, for omission of this information may make an employer suspicious. Do not hesitate to indicate your leisure interests, for they help to picture you as a person. Include facts about the background in which you were raised if this background is related to the field in which you are seeking employment.

References. You should usually name two to four references, preferably former employers or instructors. The exact number would depend on how many are necessary to confirm what you have said in your letter. Courtesy and self-interest make it advisable to secure the consent of anyone you name as a reference and to have the name and position of each reference absolutely correct.

Though the logical place to name references is late in the letter, do not hesitate to mention an especially important reference early—even in the opening paragraph. The name of an important person or of a reference whom the reader knows personally can be effective in arousing interest.

The Ending

Because the list of references does not make interesting reading, try to devise some means of giving your letter a lift at the end. No formula can be offered for doing this. Sometimes you might use a one-sentence summary of your qualifications. Again, you might refer to the time and sacrifices that have been in-

volved in your preparation for such a position as you apply for, and the effort you will consequently put forth to make good. The strong ending must obviously be developed out of whatever material your particular letter has included. It is not easy to write, but is well worth the effort of writing.

Though an attempt is made, at the ending, to intensify interest, the real function of the ending is to suggest action—sometimes the offer of a position but more frequently the offer of an interview. Therefore you should decide what action is likely and phrase your request accordingly. To make action easy, be sure to provide such information as your telephone number if a phone call is likely, or a change of address if one is imminent.

In suggesting action, carefully avoid negative suggestion. The sentence that runs, "*If* my qualifications are of interest I shall be glad to come for an interview" implies uncertainty in the writer's own evaluation of his qualifications. It would be better to write, "I shall appreciate your consideration of my qualifications, and shall be glad to come for an interview on any date you suggest," or, "I realize that before you fill this position you will want to talk with the applicant personally, so I should be glad to come for an interview at your convenience."

How urgent you can be in requesting action depends on the relative supply of jobs and applicants. Unless applicants are likely to be scarce, it is best to refrain from any attempt to hasten the employer's action except when there is a real reason for urgency. If it is really important that you secure an early decision, and if you are tactful, you might be able to speed matters along without giving offense. For example, no resentment should be aroused by such a statement as, "Since I shall be leaving town for one month on June 10, I should appreciate it if I might have an interview before then." Or if you wished to force the issue a little harder you might write, "I shall be making a trip to your city on May 31 and should appreciate it if you would suggest a time on that date when it would be convenient for you to see me." Most employers are normally considerate people. A reasonable request, tactfully made, is not likely to

arouse their resentment. But pressure must be applied with a great deal of tact or your effort to get an early answer may reduce the likelihood that the answer will be favorable.

USE OF A DATA SHEET

When you are forced for the sake of completeness to use so much material that your letter is in danger of becoming too long, you may find it advisable to use a data sheet. Such a sheet should not be used, however, when it would cause needless repetition or else would make the letter itself too scanty.

The data sheet is a complete picture of the facts, in tabular form. It should bear your name and address (future as well as present address if a change is imminent), and should indicate the position you are applying for. It should be dated, so that if it is temporarily filed but referred to later, the reader can tell when it was made out. It should contain the personal information that would otherwise be needed in the letter, and should give full information on education, experience, and references. More details can be placed in the data sheet than it is usually advisable to place in the letter itself.

There is no standard form for the data sheet, but it should be a tabulation rather than a discussion in sentences. The major headings are likely to be *Personal Information, Education, Experience,* and *References,* under which may be used any subheadings needed. To decide on the system of headings, jot down as rough notes all the facts to be covered, and then work out a plan of headings to cover them.

A data sheet should be made carefully or not at all. It should be as neat and accurate as the letter itself. It should be pleasantly spaced on the page—which usually means that you must plan a lay-out, make a rough draft, and then adjust the spacing to improve the appearance of the finished sheet. It is highly advisable to make a carbon copy of the finished version so that it will not be necessary to start from the beginning on some later occasion

A clear understanding of the relationship between the data sheet and the letter is important. The function of the data sheet is to free the letter from certain routine information that is necessary for completeness but that is uninteresting and may not be constructive evidence of your fitness for the job you are seeking. In the data sheet, you provide the full record. In the letter—assuming that there is a data sheet—you focus the reader's attention on the particular facts that are most important and bring out their full significance.

A data sheet cannot perform the functions of a letter; rather, it performs the functions of an application blank. (Incidentally, do not use a data sheet if you are submitting an application blank.) However completely the data sheet may present the facts, it remains for the letter to create a personal interest, for it is only in the letter that you seem to be talking to the reader personally.

GENERAL SUGGESTIONS

Neatness

Though neatness is important in every letter, it is especially important in an application. Your letter of application serves as an index of character. If it betrays carelessness, it suggests that carelessness is one of your personal qualities. If the reader sees that you tolerate low standards in any respect in your letter, he associates you with low standards and may wonder whether he can expect your standards to be high in the work you would do if he hired you. Moreover, it is highly unflattering to a reader to send him a letter that contains errors of any sort. It causes him to feel either that you did not regard the position as important—which reduces your desirability—or that you have been satisfied to offer an inferior performance on an important occasion. which brands you as a person with bad judgment.

Analyzing the Position Applied For

Try to work into your letter, subtly, not crudely, some indication that you have carefully considered the qualifications de-

manded by the position you apply for. Many a letter is less effective because the writer has thought only about himself and forgotten about the job. If you can convince your reader that you are sending an application only after matching up your own qualifications with the demands of the position that is open, he will listen with more interest to everything you tell him.

The "You Attitude"

Make it plain that you have been thinking about why your services would be valuable to the employer rather than about why you want the job. Your tastes, ambitions, and desires are irrelevant unless they increase your value to the employer. Sometimes they do increase your value. For example, your liking for a certain region might make it less likely you would resign in order to move away; or the fact that a position is in line with your long-range ambitions would make you work harder to give satisfaction. You should not waste space on such matters, however, unless you can show their connection with your probable performance on the job.

Objectivity

Keep your letter objective. Refrain from the temptation to make unsubstantiated statements to the effect that you are self-reliant, dependable, persevering, and the like. Such statements are just as likely to appear in the letters of applicants who have no justification for them as in the letters from writers who really possess the qualities in question. Unless you can establish your claims to abstract virtues by pointing to facts in the record, it is better not to claim them. Nothing will lose a reader's interest more rapidly than claims which you do not substantiate by objective evidence.

Tone

Achieving a satisfactory tone is usually a matter of balance. You should aim to appear self-confident but not conceited; obliging but not subservient; earnest but not stiff. To achieve a

good tone keep asking yourself, "If I were reading these statements instead of writing them, how would they affect me?"

Try to make your language sound natural. Do not be so eager to be impressive that you use pompous phrases such as *assiduous effort, earnest endeavor, intense determination,* and the like. Let the language in your application be the kind of language you would not feel embarrassed to use in a personal conversation.

A trained or highly gifted writer may sometimes aim at a special tone such as aggressive vigor, engaging frankness, or modest understatement: but unless you are unusually talented in writing, you will probably increase your chances of success by merely aiming at simplicity, naturalness, and freedom from affectation.

Excessive Use of "I"

Do not make your letter monotonous by using *I* at the beginning of every sentence; yet do not try so hard to avoid *I* that your style becomes involved and unnatural. Perhaps the best policy is to write the first draft of your application without worrying about how often you use *I;* and then, as you revise, to change the structure of a sentence here and there until the use of *I* is no longer conspicuous.

Discussion of Salary Expected

It is usually advisable to let the employer be the one who first brings up the question of salary. If you feel it necessary, however, to mention the salary that you expect, do so near the end of the letter rather than early. Until a potential employer is convinced that your services would be of value to him, he is not interested in what it will cost to secure them. Much of the time, of course, you will know whether a position pays an acceptable salary before you apply for it.

In any event, considerable tact is necessary if you attempt to tell a prospective employer what he must pay to obtain your services. You cannot convince him that you are good enough for the job by seeming preoccupied with the question of whether the job is good enough for you.

your having gained any experience you are likely to gain before graduation. Use your own judgment about whether to send a data sheet. Do not make unrealistic offers, such as an offer to travel farther for an interview than you would really be willing to travel under the circumstances.

HANDBOOK OF FUNDAMENTALS

CORRECTNESS IN GRAMMAR

Attention is directed in the following discussion to an extremely limited number of principles, the neglect of which leads to most of the grammatical errors. Definitions of the terms used may be found, if needed, on pages 394-402.

Case of Nouns and Pronouns

Nouns and pronouns may be nominative, possessive, or objective in case. Nouns are identical in nominative and objective cases, but change form when they become possessive. (See pages 374-375.) Pronouns vary in form more widely than nouns, as shown by the following list:

NOMINATIVE	POSSESSIVE	OBJECTIVE
I	my, mine	me
you	your, yours	you
he	his	him
she	her, hers	her
it	its	it
we	our, ours	us
they	their, theirs	them
who	whose	whom

All pronouns except those listed above and others derived from them are identical in nominative and objective cases and form the possessive, if at all, just as nouns form it.

The possessive forms *your, its,* and *whose* should not be confused with *you're* (you are), *it's* (it is), and *who's* (who is).

The three cases are used in accordance with the following rules:

1. The nominative case is used for the subject of a verb.

COMMON VIOLATIONS:

We shall hire *whomever* applies.

CORRECT: *whoever applies,* for the term is used as subject of *applies.* The entire clause that follows *hire* is the object of *hire,* rather than a single word being the object.

Us draftsmen need better light.

CORRECT: *We* draftsmen. *Us* and *draftsmen* are in apposition, both being used as subjects of *need.*

He is older than *me.*

CORRECT: . . . than *I.* The nominative form should be used, for the term in question is used as subject of the verb *am,* implied.

2. The nominative case is used for a subjective complement.

It is *I.* It was *we* workers who objected.

COMMON VIOLATIONS:

It was *him.*

CORRECT: It was *he.*

It was *me* whom you saw.

CORRECT: It was *I* . . . The term is used as subjective complement after *was,* and is modified by *whom you saw.*

Note: Though Rule 2 is valid in strictly formal writing, such forms as "It was *me*" or "This is *him*" are now widely accepted in informal writing and in conversation. The tendency to accept them is steadily increasing.

3. The possessive case is used to indicate possession.

This is *my* office. The *manager's* answer was brief.

When this rule is violated, the cause is usually an uncertainty over how the possessive case is formed. Information on this point is found in the material above and on pages 374-375.

4. The possessive case is used for a noun that precedes and modifies a gerund.

I agreed to *his* working overtime.

TYPICAL VIOLATION:

They objected to *him* altering the records.

His would be the correct form.

Note: When a pronoun—for example, *this* or *that*—has no possessive form, or when either a noun or a pronoun is separated from the gerund it modifies, Rule 4 is disregarded and the possessive is not used.

CORRECT: There is no record of *this* being done before.

CORRECT: The chance of *anyone* in the vicinity wanting the property is slight

5. If a noun or pronoun stands for something without life, the possessive case should if possible be avoided.

UNDESIRABLE: The *furnace's* grates; the *street's* surface.
PREFERRED: The grates *of the furnace;* the surface *of the street.*

Note: There are many exceptions to this avoidance of the possessive, especially when the noun in question involves time, as used in "an *hour's* work," or "a *day's* pay." Exceptions are also permissible to avoid awkward constructions.

6. The objective case is used for the object of a verb, verbal, or preposition.

DIRECT OBJECT OF VERB: The letter encouraged *him.*

INDIRECT OBJECT OF VERB: The letter gave *him* useful information.

OBJECT OF VERBAL: *Whom* do you intend to hire?

Whom is the object of the infinitive phrase *to hire.*

OBJECT OF VERBAL: Answering *him* was difficult.

Him is the object of the gerund *answering.*

OBJECT OF PREPOSITION: Three of *us* were chosen.

Us is the object of the preposition *of.*

COMMON VIOLATIONS:

They offered my partner and *I* a good contract.

Me would be correct, for the term is used as the indirect object of *offered.* This type of error results from excessive concern about avoiding *me* as a subject, as in "John and *me* are going." Uncertainty as to what form to use after *and* can be settled quickly by eliminating *and* along with the term that precedes it. "They offered *I* a contract" would obviously be wrong.

All of *we* draftsmen were questioned.

Us would be correct, for *us* along with *draftsmen,* is the object of the preposition *of.* The subject of the sentence is neither *we* nor *draftsmen,* but *all.*

He is a man *who,* in spite of his youth, we can trust.

The parenthetical phrase *in spite of his youth* obscures the fact that the objective *whom* rather than the nominative *who* is needed, for the term is the object of *trust.*

Who do you give the answer to?

Whom would be correct, for the term is used as the object of *to.*

Note: In informal writing and in conversation, there is a strong tendency to permit *who* at the beginning of a sentence despite the rules. In formal writing, however, it is still desirable to follow the rule.

7. The objective case is used for the subject or object of an infinitive.

We expect *him* to do well.

Him is the subject of the infinitive *to do*. The object of *expect* is not *him*, but the entire infinitive phrase, *him to do well*. This rule applies even when the infinitive is *to be*.

CORRECT: We knew *him* to be competent.
CORRECT: We knew it to be *him*.

VIOLATIONS:

Though the rule is included for the sake of completeness, and in order to remove uncertainty about usage with the infinitive *to be*, violations are too rare to permit illustration.

Agreement

Many of the most persistent errors in grammar result from failure to comply with rules of agreement. The rules that are violated usually concern: (1) agreement of verbs with their subjects, (2) agreement of pronouns with their antecedents, and (3) agreement of a demonstrative adjective with its object.

Agreement of Verb with Its Subject

A verb must agree with its subject in number, person, and gender.

Practically all of the violations of this rule consist of disagreement in number. Person and gender are therefore dismissed with no further comment. The rule involving agreement in number needs further development as follows:

1. A compound subject the parts of which are joined by *and* ordinarily takes a plural verb.

The time and the place *are* uncertain.

2. When a subject is compound in form but actually singular in meaning, it takes a singular verb.

The right and wrong of it *is* debatable.
Corned beef and cabbage *is* an appetizing food.

3. A compound subject the parts of which are connected by *or* ordinarily takes a singular verb when both parts are singular, and a

plural verb if both parts are plural. If one part is singular and the other plural, the verb agrees with the part that is nearer.

CORRECT: Either the oak or the elm *is* to be removed.
CORRECT: Either the chairs or the tables *are* to be refinished Monday.
CORRECT: Either the cow or the pigs *are* to be slaughtered.

4. The word *number,* numerical quantities, and fractions take either singular or plural verbs according to their meanings.

The number of complaints *has* been increasing.
A number of changes *have* been made.
Three days *is* a long wait.

Three days refers to a single period of time, even though *days* is plural in form.

Three days *have* passed since your letter was mailed.

Each day is conceived as a unit rather than merely as part of a single period of time.

5. A collective noun takes a singular verb when the group it refers to is regarded as a unit, but takes a plural verb when the statement concerns the members of the group as individuals.

The crowd *was* breaking up.
The crowd *were* going to their homes.

The committee *has* adjourned.
The committee *have* taken their seats.

Note: Though not strictly incorrect, the use of plural verb after a collective noun often sounds awkward, even though it is necessary because the noun must later be identified as the antecedent of a plural pronoun. Therefore, it is often a distinct improvement to change the sentence and thus eliminate the problem. For example: "The *people* in the crowd (rather than *the crowd*) were going to *their* homes."

6. Some nouns that are plural in form take singular verbs when singular in meaning—especially nouns ending in *ics.*

CORRECT: The *news is* encouraging. *Mathematics is* difficult. *Tactics wins* battles.
But: Our *tactics are* proving successful.

Note: For an excellent discussion of this subject, see the entry under *ics* in Webster's New Collegiate Dictionary.

7. Intervening words should not be allowed to interfere with the agreement of a verb with its subject. Many of the errors in agreement are caused by intervening words.

CORRECT: The body, in addition to the fenders and bumpers, *was* dented.

WRONG: The body, in addition to the fenders and bumpers, *were* dented.

No word except *body* is used as the subject.

8. A verb agrees with its subject in number, even though a predicate noun that follows may be different in number.

The border *was* shrubs of several species, carefully spaced.

Note: When an awkward-sounding sentence results from following this rule, it is advisable to change the structure of the sentence.

The border *was composed* of shrubs . . .

Agreement of Pronouns with Antecedent

The Rule. A pronoun should agree with its antecedent in person, number, and gender.

When a pronoun refers to a compound antecedent, the following additional rules apply:

1. If the antecedent consists of two or more nouns connected by *and,* the pronoun should be plural.

The tables and the chairs showed *their* age.

2. If the antecedent consists of two nouns connected by *or,* the pronoun should be singular if both nouns are singular, and plural if both nouns are plural. If the nouns differ in number, the pronoun should agree with the nearer.

You may pay the bill if the manager or the auditor will give *his* permission.

You may use either bolts or screws if *they* are large enough.

Either the bolts or the clamp must have been loose in *its* place.

Either the clamp or the bolts must have been loose in *their* places.

3. If the antecedent is two or more nouns connected by *nor,* the pronoun should be singular if both nouns are singular, but *plural if either noun is plural.*

Neither the manager nor the auditor gave *his* consent.

Neither the bolts nor the screws had fallen from *their* places.

Neither the employer nor the employees were willing to change *their* attitudes.

Neither the employees nor the employer were willing to change *their* attitudes.

The Errors. When a pronoun does not agree with its antecedent, the disagreement, almost always, is in number. The error does not

usually result from ignorance of the rule, but from uncertainty over whether the antecedent itself should be treated as singular or plural. Numerous though the errors are, a surprisingly large proportion of them occur when one of only three conditions exists. Any person who can master these three conditions will thenceforth have little trouble with the reference of pronouns. The conditions are: (1) The antecedent is a *collective* noun. (2) The antecedent is *a noun of common gender.* (3) The antecedent is not a noun but *an indefinite pronoun.*

1. Reference of a Pronoun to a Collective Noun: A collective noun is sometimes treated as singular and sometimes as plural. It is treated as singular when the statement where it appears applies to the group as a group, and plural when the statement applies to members of the group as individuals.

CORRECT: The board of directors makes *its* report.
CORRECT: The board of directors took *their* seats.

The errors occur when a writer treats a collective noun first as singular, then as plural—usually giving it a singular verb and then using a plural pronoun to refer to it.

WRONG: The orchestra *waits* with *their* instruments ready.
WRONG: The team *appears* wearing *their* new uniforms.
CORRECT: The orchestra *waits* with *its* instruments ready.
CORRECT: The team enters wearing new uniforms.
The error has been corrected by merely omitting the pronoun.
CORRECT: The members of the team enter wearing *their* new uniforms.

2. Reference of a Pronoun to a Noun with Common Gender: Writers sometimes make the error of using a plural pronoun because of uncertainty over whether to use a pronoun of the masculine or feminine gender—either of which is plausible—in referring to such a noun as *spectator, student, employee.* The correct form to use, in case of doubt, is the masculine—*he, him,* or *his.*

WRONG: A person should be able to rise above *their* environment.
CORRECT BUT STILTED: A person should be able to rise above *his or her* environment.
CORRECT: A person should be able to rise above *his* environment.

3. Reference of a Pronoun to an Indefinite Pronoun: Sometimes the antecedent of a pronoun is not a noun, but an indefinite pronoun. Most of the indefinite pronouns are included in the list below. Each word on the list is treated as singular, even though some of them are plural in meaning. Hence any pronoun referring to a word on the list should be singular in number.

INDEFINITE PRONOUNS

one	everyone	somebody
anyone	anybody	nobody
someone	everybody	each
no one		

When a pronoun disagrees in number with any of the words on the list above, the underlying cause is usually the writer's subconscious concern about gender. All the words on the list are common in gender. Hence, in an instinctive effort to achieve agreement in gender, writers use the plural *their,* which can be common gender, in order to avoid *he* or *she.*

This tendency is intensified by the fact that some of the words, for example *everyone,* are actually plural in meaning. Nevertheless, all the words listed are treated as singular (no one would think of writing "Everyone *are* here"), and should not be referred to by the plural *their.* Unless the feminine singular is known to be appropriate in the individual case, the masculine singular (*he, his,* or *him*) should be used. *His or her* is of course correct but is so stilted as to be undesirable.

WRONG: No one should neglect *their* responsibilities.
CORRECT: No one should neglect *his* responsibilities.

WRONG: Everyone should pay *their* bills promptly.
CORRECT: Everyone should pay *his* bills promptly.

WRONG: Each of those hired will be required to supply *their* own tools.
CORRECT: Each of those hired will be required to supply *his* own tools.

EXCEPTIONS:

The rules just explained apply to writing that is formal in style, and most people who are careful with their language follow them even when writing or speaking informally. There is a contemporary tendency, however, to relax the rules. Some of the more liberal modern authorities would regard it as correct to use *their* when the indefinite pronoun referred to is plural in meaning.

4. Agreement of Demonstrative Adjective with Its Object: A demonstrative adjective (*this, that, these, those*) should agree with the word it modifies.

WRONG: *These* kind of brakes may give trouble.
CORRECT: *This* kind.
WRONG: I could never make a neat diagram with *those* type of pens.
CORRECT: *that* type of pen.

Note: Errors such as those above are the only common violations of this rule. In each of the errors illustrated, the demonstrative adjective agrees with a closely related plural noun when it should agree with the singular noun that it actually modifies.

Adjectives and Adverbs

1. An adjective may modify a noun or pronoun directly (in which use it is called an attributive adjective) or as a predicate adjective. Used as a predicate adjective, it applies to a noun or pronoun by assistance of a verb.

The *old* building should be abandoned.

Attributive modifier. *Old* modifies *building.*

The building is *old.*

Predicate adjective. *Old* relates to *building* by assistance of the verb *is.*

2. An adverb is used to modify a verb, an adjective, or another adverb.

The snow had melted *rapidly,* so what might have been a *very* difficult trip was made *quite easily.*

Rapidly modifies the verb *melted; very* modifies the adjective *difficult; quite* modifies the adverb *easily*—which itself modifies the verb *was made.*

3. Use of an adjective instead of an adverb to modify a verb is usually a serious error—often so serious as to be considered illiterate.

WRONG: The car runs *good.*

The adjective *good* should not modify the verb *runs.*

CORRECT: The car runs *well.*

Well is correctly used as an adverb in the meaning here intended. In some meanings, *well* is also an adjective; but *good* is never correct as an adverb except in the phrase *as good as.*

WRONG: I can do it *easy.*
WRONG: I can do it *easier* than he can.
WRONG: Among all those who protested, he talked *angriest.*

CORRECT: I can do it *easily.*

Easily is the adverbial form of *easy.*

CORRECT: I can do it *more easily* than he can.
CORRECT: Among all those present, he talked *most angrily.*

Note: The error of using an adjective to modify a verb is especially persistent, as shown in the last two examples of errors, in the comparative and superlative degrees. (For discussion of degree, see Rule 7, below.)

4. Use of an adjective to modify another adjective or an adverb (as contrasted with an adverb modifying a verb, discussed in Rule 3) is not formally correct, but sometimes may pass as colloquial rather than being considered a serious error.

WRONG: The car was running *considerable* better.

Considerable is an adjective and should not modify the adjective *better.*

WRONG: The next day, I felt *some* better.

Some is an adjective, not an adverb. It should be replaced by the adverb *somewhat.*

WRONG: It was *real* nice of you.
CORRECT: *very.*

WRONG: It was made of *pretty* good material.
CORRECT: *rather* or *quite.*

WRONG: He was late *most* every morning.
CORRECT: *almost.*

Real, pretty, and *most* might be regarded as mere colloquialisms, but it would be better, except on an extremely informal occasion, to replace them when they are used as above by words that are recognized as adverbs. There is no way except familiarity with the specific word to determine what adjectives are considered merely colloquial rather than actually wrong when used as adverbs.

5. Adverbs are rarely misused for adjectives as direct modifiers, but use of an adverb when a predicate adjective is needed is an extremely common error. A predicate adjective follows the verb but does not modify the verb. Rather, it relates to the noun or pronoun used before the verb as a subject. This use should not be confused with the use of an adverb to modify the verb. A predicate adjective characteristically follows a "linking" verb such as *be, become, seem, appear, smell, feel, look, sound, taste.*

CORRECT: The glue is *sticky.*

Predicate adjective. *Sticky* refers to the noun *glue* rather than modifying the verb *is.*

CORRECT: The man looked *angry.*

Predicate adjective. *Angry* describes the man rather than changing or adding to the meaning of the verb *looked.*

CORRECT: The man looked *angrily* at the intruder.

Adverb modifying verb. *Looked,* in this sentence, has a different meaning. It is not used as a linking verb, but indicates an action. *Angrily* tells the manner in which the action was performed.

WRONG: The dinner smells *well.*

Well, except in the sense of healthy, is an adverb, not an adjective. An adjective is needed, however; for *smell* does not indicate an action and *well* tells a quality of the dinner rather than modifying *smells.*

CORRECT: The dinner smells *good.*
CORRECT: The dog smells *eagerly* at the bone.

Note the different meaning of *smells,* and note that *eagerly,* an adverb of manner, modifies *smells.*

CORRECT: The clerk felt *bad* about his error.

Predicate adjective.

CORRECT: The motor was running *badly.*

Adverb modifying verb.

Note: Those who make this type of error do so because they have been corrected for such errors as "The motor is running *bad,*" or "He reads *good.*" In an effort to avoid using an adjective when an adverb is needed, they are reluctant to use an adjective after a verb, even when an adjective is correct. One use of *badly,* however, calls for special comment: There is a strong tendency at present to accept such use as in "The clerk felt *badly* about his error" as correct despite the rule. *Bad,* of course, is also correct.

6. When the question of whether to use an adjective or an adverb has been answered, it may still be necessary to determine whether the particular word one wishes to use is an adjective, is an adverb, or may be used as either. Often, the adverbial form of a word may be distinguished from the adjective form because of the *ly* ending on the adverb, as in *strong, strongly; clever, cleverly; sure, surely.* The *ly* ending, however, is not a complete means of identification, for there are some adjectives that end in *ly* (*friendly, manly*) and many adverbs that do not end in *ly.* In case of doubt, it is advisable to consult a dictionary to see whether the word one wishes to use is listed as an adjective, an adverb, or both.

7. Most adjectives and adverbs may be positive, comparative, or superlative in degree. The change in degree is achieved by more than one method, as illustrated in the following examples:

ADJECTIVES

POSITIVE	COMPARATIVE	SUPERLATIVE
easy	easier	easiest
large	larger	largest
curious	more curious	most curious
good	better	best
bad	worse	worst

ADVERBS

POSITIVE	COMPARATIVE	SUPERLATIVE
slow or slowly	slower or more slowly	slowest
easily	more easily	most easily
quickly	more quickly	most quickly
well	better	best
badly	worse	worst

Note: Some terms, such as *perfect* and *unique,* cannot logically be used in the comparative or superlative degrees. *More prefect* is a contradiction in terms, as are *more unique, more empty,* etc. It would be logical, however, to use such expressions as *more nearly* perfect, unique, full, or empty.

The comparative rather than the superlative degree must be used to indicate comparison of two objects. The superlative degree is used when three or more objects are compared.

WRONG: His was the best drawing of the two drawings that were submitted.

CORRECT: His was the better drawing of the two that were submitted.

CORRECT: His was the best of the three drawings that were submitted.

UNITY AND COHERENCE IN THE SENTENCE

Unity in the Sentence

A sentence should be unified both in thought and in grammatical structure. A sentence may lack unity in thought either because of a failure to include all the material needed or because of the inclusion of extraneous material. The first of these two deviations usually results in the primer style (pages 23-24). The second may be guarded against by merely being alert to the question of whether all the material placed in the same sentence is actually part of the same

statement. There are many times, of course, when material may either be included in a sentence or divided into separate sentences as the writer desires.

When a sentence lacks unity of structure, it may be faulty in either of two respects: it may be a mere fragment because it lacks some of the elements necessary for grammatical completeness, or it may contain the error variously called the "comma splice," "comma blunder," or "comma fault."

Fragment Treated as a Sentence

A declarative sentence, to be complete grammatically, must contain a subject and a finite verb. Thus a participial or gerund phrase, a prepositional phrase, or a dependent clause is not a complete sentence, regardless of its length or complexity. Actually, it should not be necessary to subject a sentence to grammatical analysis in order to determine whether it is complete. A fragment may be distinguished from a complete sentence by the simple fact that it does not actually make a statement.

The error may usually be corrected by either of two methods: joining the fragment onto a sentence with which it is naturally connected, or changing it so that it may stand by itself as a complete sentence. The following examples show how fragments may be joined to other sentences or rewritten so that they are structurally complete.

FRAGMENT: The volume grew lower and lower. *Finally becoming so slight as to be inaudible.*

Participial phrase rather than sentence.

CORRECT: The volume grew lower and lower, finally becoming so slight as to be inaudible.

FRAGMENT: He was employed by the government for six years. *First in Washington, and later in New York.*

Prepositional phrases.

CORRECT: He was employed by the government for six years, first in Washington and later in New York.

FRAGMENT: The company was losing money steadily. *Although sales were as high as in previous years.*

Subordinate clause rather than independent clause.

CORRECT: The company was losing money steadily. The sales, however, were as high as in previous years.

FRAGMENT: Some of the expenses were increasing. *Overhead, for example, and the cost of raw materials.*

The italicized expression has no verb; it is used in apposition to *some.*

CORRECT: Some of the expenses were increasing. Overhead, for example, and the cost of raw materials were higher than before.

Note: Before the subject of fragments is dismissed, recognition should be made of the fact that skilled authors sometimes use incomplete sentences as a device to secure special effects. Dickens, for example, writes: "Dogs, indistinguishable in the mire. Horses scarcely better; splashed to their very blinkers." But this incompleteness was no accident. When a writer reaches the point where he is deliberately striving for special effects, he will long since have passed the time when he needs to concern himself with the fundamentals; and no one who passes judgment on writing will be likely to mistake the deliberate use of a fragment for the sake of style with the blunders of a bad writer. Until you are skillful enough that you never violate the rules of grammar accidentally, you should give up the idea of violating them on purpose to secure a special literary effect.

The Comma Splice

When a sentence contains two independent clauses, the punctuation between them must be a semicolon unless they are joined by a co-ordinating conjunction. Use of a comma instead of a semicolon on such an occasion is the error variously called comma splice, comma blunder, or comma error. It is more than a mere mistake in punctuation. It is a serious error in sentence structure—an indication that the writer does not know when he has completed a statement.

The only co-ordinating conjunctions are *and, but, for, or, nor,* and sometimes *so* and *yet.* These should be distinguished from conjunctive adverbs, such as *however, moreover, therefore, consequently, furthermore* and many others. A handy rule of thumb for avoiding the comma blunder is found in the fact that a conjunctive adverb may be buried within the clause which it introduces. Thus, if a connective word is one that might come elsewhere than between the clauses it connects, a semicolon rather than a comma is necessary. For example:

I have inspected it, *but* I shall be glad to inspect it again.

But could come only between the clauses.

I have inspected it; *however,* I shall be glad to inspect it again.

However might, if one desired, be placed after *glad* rather than at the beginning of its clause—which shows it to be a conjunctive adverb and indicates that a semicolon must be placed between the clauses.

There are various ways in which a comma blunder may be corrected. The simplest is to replace the comma by a semicolon or a period. Another possibility is to change the conjunctive adverb to a co-ordinating conjunction. Often, however, it is better to change one of the independent clauses to some other form.

Following is a comma splice, after which several possible corrections are indicated. The choice among the various correct forms would depend on what it was desired to emphasize.

COMMA SPLICE: We shall be forced to find a new route, the grades on the one suggested are too severe.

CORRECT: We shall be forced to find a new route; the grades on the one suggested are too severe.

Correction by change in punctuation.

CORRECT: We shall be forced to find a new route, for the grades on the one suggested are too severe.

Correction by using a co-ordinating conjunction.

CORRECT: The grades on the route suggested are so severe that we shall be forced to find a new route.

Correction by change in construction.

CORRECT: The severity of the grades on the route suggested make it necessary to find a new route.

Correction by change in construction.

Coherence in the Sentence

If writing is to be clear, every sentence must be coherent; that is, it must hang together. The relationship of every part to every other part and to the entire sentence must be unmistakable. To achieve this result it is necessary to consider the order of the parts, their structure, and the connectives that indicate their relationship. Lack of coherence often results from failure to apply the following detailed principles:

1. Similar parts of a sentence should be expressed in parallel form so far as their contents permit.

NOT PARALLEL: Wood was used for some of the parts, but others were made of metal.

PARALLEL: Wood was used for some of the parts, and metal for others.

NOT PARALLEL: Students in the night school learn auto mechanics, and are also taught drafting.

PARALLEL: Students in night school learn auto mechanics and drafting.

PARALLEL: Students in night school are taught auto mechanics and drafting.

(a) There should be no unnecessary change in the subject or voice. (Change in one frequently results in change in the other.)

NOT PARALLEL: While the mechanic was tuning the motor, the tires and battery were checked by his assistant.
PARALLEL: While the mechanic was tuning the motor, his assistant checked the tires and battery.

NOT PARALLEL: Washing the equipment was one of his duties, and he was also expected to keep the supply bins filled.
PARALLEL: Washing the equipment was one of his duties, and keeping the supply bins filled was another.
PARALLEL: He was expected to wash the equipment and to keep the supply bins filled.

(b) The elements of a series should be parallel in form.

WRONG: A technician must learn the *use, upkeep,* and *how to repair* equipment.
CORRECT: A technician must learn the *use, upkeep,* and *repair* of equipment.

WRONG: The machine is *simple, inexpensive,* and *repairing it is easy.*
CORRECT. The machine is *simple, inexpensive,* and *easy to repair.*

If an article (*a, an, the*) is used before any element in a series except the first (in which case it applies to all the elements), it must be used before every element.

WRONG: Information is needed about the length, the width, thickness, and weight of the sample.
CORRECT: Information is needed about the length, width, thickness, and weight of the sample.

When the elements of a series cannot be made parallel in form without the result becoming awkward, the phraseology should be changed so as to make it clear that a series is not intended.

WRONG: The chips are mixed with liquor and steam, fed into the apparatus, and the cooking process takes places as the mixture moves through the tubes.
CORRECT: After the chips are mixed with liquor and steam, they are fed into the apparatus, where the cooking process takes place as the mixture moves through the tubes.

(c) The elements that follow correlative conjunctions (*either . . . or, neither . . . nor,* etc.) should be parallel in form.

WRONG: It can either be shipped by freight or by express.
CORRECT: It can be shipped either by freight or by express.

LOGICAL: The power of the diesel is greater than that of the steam engine.
LOGICAL: The diesel engine is more powerful than the steam engine.

(b) Illogical use of *any* should be avoided.

ILLOGICAL: The first design was simpler than *any of the designs.*
LOGICAL: The first design was simpler than any of the later designs.

(c) If a comparison is not completely expressed, the words that are omitted must be clearly and unmistakably implied.

INCOMPLETE AND AMBIGUOUS: The manager trusts him *more than the superintendent.*
COMPLETE: The manager has more trust in him *than in the superintendent.*
COMPLETE: The manager trusts him *more than the superintendent does.*

INCOMPLETE: The highway is *as rough, if not rougher than* the side road.
COMPLETE BUT AWKWARD: The highway is *as rough as, if not rougher than,* the side road.
COMPLETE: The highway is as rough as the side road, if not rougher.

6. Use of mood and tense should reflect a consistent point of view.

INCONSISTENT USE OF TENSE: The production of grade "A" milk *required* the use of methods that *meet* official standards.
CONSISTENT: The production of grade "A" milk *requires* the use of methods that *meet* official standards.

INCONSISTENT IN MOOD: If you *would give* me an extension of time, I *shall* appreciate it.
CORRECT: If you *would give* me an extension of time, I *should* appreciate it.

INCONSISTENT IN MOOD: If the generated voltage *drops* below "E", current *would flow* through and help to rotate the armature.
CONSISTENT: If the generated voltage *drops* below "E", the current *will flow* through and help to rotate the armature.
CONSISTENT: If the generated voltage *were* to drop below "E", the current *would flow* through and help to rotate the armature.

7. Dangling participles and gerunds should be avoided. A participle is a verb form used as an adjective. A gerund is a verb form used as a noun. (See Definition of Grammatical Terms.) When a participial or gerund phrase comes at the beginning of a sentence, it should be followed immediately by some term indicating who performed the

action indicated, so that the action indicated by the participle or gerund will not be attributed to the wrong agent.

In respect to meaning, a dangling participle or gerund is undesirable because it is likely to be wrongly interpreted when first read. In respect to grammar, it is wrong because it is a modifying element with nothing to modify—whence the term *dangling*—and has no grammatical connection with the remainder of the sentence.

DANGLING PARTICIPLE: *Having thought the case over carefully,* my opinion was unlikely to be changed.

CORRECT: Having thought the case over carefully, *I* was not likely to change my opinion.

CORRECT: *Since I had thought the case over carefully,* I was not likely to change my opinion.

DANGLING PARTICIPLE: It can be built with either one or two doors, *depending on the wishes of the buyer.*

CORRECT: It can be built with either one or two doors, as the buyer wishes.

DANGLING GERUND: *By rotating the crystal,* the light is directed so that only the desired wave length is reflected back to the absorption cells.

CORRECT: By rotating the crystal, *one* directs the light so that only the desired wave length is reflected back to the absorption cells.

8. Dangling infinitives should be avoided.

DANGLING INFINITIVE: *To conduct the test properly,* the motor must run at a constant speed.

It sounds as if the motor were conducting the test.

CORRECT: To conduct the test properly, one must keep the motor running at a constant speed.

CORRECT: If the test is to be conducted properly, the motor must run at a constant speed.

9. When elliptical clauses or phrases are used, a sentence should be so constructed that the reader cannot infer the wrong idea. (An elliptical clause, phrase, or sentence is one from which something is omitted, being implied by what is expressed.)

CONFUSING ELLIPSIS: *While looking for a suitable location,* the truck broke down.

CORRECT: While *we were* looking for a suitable location, the truck broke down.

CONFUSING ELLIPSIS: When working on the barn, the problem of protecting the cattle hindered them.

CORRECT: When working on the barn they were hindered by the problem of protecting the cattle.

PUNCTUATION, CAPITALIZATION, ITALICS, AND ABBREVIATIONS

Punctuation

The main function of punctuation is to make writing clearer and easier to read. This function can best be performed by intelligent compliance with generally accepted rules. Though experienced writers usually comply with the rules almost unconsciously, even those who are most skillful find the rules helpful in doubtful cases.

It is true that usage in punctuation is not completely uniform. This lack of uniformity results mainly from the fact that the rules are broad enough to permit a writer, on many occasions, to exercise his judgment in deciding between alternatives either of which might be considered correct. It does not result from widespread disagreement about the rules themselves, nor from general disregard of the rules. Most of the rules are generally agreed upon by authorities, and the occasions when well educated writers definitely violate them are not frequent.

Three marks are especially important to anyone who has difficulty with punctuation: the period, the semicolon, and the comma. Even though familiarity with the other marks is desirable, you will find that if you can learn to use these three marks correctly—especially the comma—most of your problems with punctuation will be solved.

Finally, it should be emphasized that even though punctuation may be valuable, there is a limit to what it can accomplish. Punctuation is not a substitute for smooth, easy-flowing sentence structure. There are many times when a writer who is worried about how to punctuate a sentence should rewrite it rather than punctuating it, for the difficulty in punctuation may well result from the awkwardness with which the sentence is written.

The following rules are generally agreed upon for ordinary writing. They are not intended to cover footnotes, bibliographies, or the technical parts of letters. The punctuation of these special forms is illustrated where the forms themselves are discussed.

The Period

1. Periods are used at the ends of all sentences except those that are interrogative or exclamatory.

2. Periods are used after abbreviations.

a.m., a.d., Fig., *i.e.*, R.F.D., U.S.

EXCEPTIONS:

Many abbreviations made up of the first letters of words comprising the names of organizations are written without periods. (NATO, UNESCO, TVA, NAM, UNNRA.) Periods are often omitted, also, after abbreviations that are peculiar to technical style. In case of doubt as to whether a period is needed after any specific abbreviation, the list of abbreviations in a dictionary or the list published by the American Standards Association (pages 405-415) may be consulted. A special discussion of abbreviations in technical style, including the use or omission of periods, is found on pages 39-41.

3. To indicate the omission of words, three spaced periods are used. If the omission occurs at the end of a sentence, these would be in addition to the period used to mark the end of the sentence.

The survey . . . covered 174 of the 192 colleges now accredited in this field.

The Comma

The comma is used more than any other punctuation mark; in fact, it is probably used and misused more than all other marks combined. It is the main device by which the grouping of words, phrases, and clauses within the sentence is indicated, and hence it is of special importance.

1. A comma is ordinarily used between two independent clauses that are joined by a co-ordinating conjunction. The co-ordinating conjunctions are *and, but, for, or,* and *nor.* (*Yet* and *so,* also, are sometimes treated as co-ordinating conjunctions—*yet* in formal style and *so* in informal style.)

The trees had been damaged by fire, and the wild life had been destroyed.

The building is old, but it has been kept in good condition.

Note: When both clauses are extremely short and simple, the comma may be omitted.

It was damaged but it still is usable.

Note: If a comma is used *within* one or both of two independent clauses, the comma between them is usually replaced by a semicolon. (See Semicolon, Rule 5.)

2. An appositive or a term of direct address is set off by a comma or commas. (A single comma is used only when the element in question comes at the beginning or end of the sentence.)

The original factory, an old stone structure, still is standing.
Your answer, Mr. Smith, is satisfactory.

Note: No comma is used when a noun and its appositive are so closely related as to join in expressing a single idea.

The invasion was led by William the Conqueror.

3. An adverbial clause preceding its principal clause, or an adverbial phrase at the beginning of a clause, is usually set off by a comma.

After the achievement tests had been completed, the results were tabulated.
On all floors except the second and the fourth, the fire hazards have been removed.

Note: If an adverbial clause or phrase is extremely short, and if omission of the comma could not cause confusion, the comma may be omitted.

When he arrived he was admitted immediately.
During July the plant will be closed.

4. Independent elements, participial phrases, gerund phrases, and other such constructions at the beginning of a sentence are set off by commas.

No, the shipment has not yet arrived.
Worried by the complaints, we began an investigation.
The contract having been broken, no payment was due.

5. A conjunctive adverb (*however, moreover, therefore,* etc.) is set off by commas when it comes *within* the clause to which it applies. When it comes at the beginning of a clause, it may or may not be followed by a comma, but will always be preceded by a period or semicolon. (See Semicolon, Rule 2.)

His objection, therefore, was ignored.
I had heard the rumor before; consequently, I did not believe it.

6. Any mildly parenthetical element is enclosed in commas if it seems desirable to set it apart from the rest of the sentence. A writer is called upon to use his best judgment in applying this rule, for too many commas will make a sentence jerky and hard to read.

The newer strains, to be sure, will survive the blight.
The answer, when received, was unsatisfactory.
The central section, for example, was undamaged.
The frame, they insisted, was too light.

7. A term such as *namely* or *that is,* used to introduce an example or a list, is set apart from that example or list by a comma. (The

mark that precedes such an expression depends on the sentence structure.)

The usual crops—that is, wheat, peas, and alfalfa—are in good condition.

Three species of tree were observed, namely, pine, fir, and cedar.

8. Nonrestrictive clauses are set off by commas. Restrictive clauses, however, are not set off.

The south side, which had been exposed to the sun, was badly faded.
He moved to Arizona, where the climate was not so moist.

but

All motorists who drive recklessly should be fined heavily.
I have never been there when the legislature was in session.

Note: In the first two examples, the clauses introduced respectively by *which* and *where* merely add some additional facts. If they were omitted, the meaning of the remainder of the sentence would be unchanged. Hence they are nonrestrictive. The clauses introduced by *who* and *when* in the second pair of examples are restrictive. Each is used to limit—to *restrict*—the meaning of the main statement, which would be radically changed if the clause in question were omitted.

9. Items in a series are separated by commas.

Cattle, sheep, and hogs are now selling for higher prices.
New deposits have been found in Canada, in Africa, in Central America, and in Alaska.

Note: If a comma is used *within* any element in a series, semicolons rather than commas are usually used *between* the items.

Note: Opinions differ over whether to use a comma before a conjunction (*and* or *or*) that precedes the last item in a series. In technical and scientific periodicals and in material published by the United States government, use of the comma is predominant. In journalistic and popular publications usage is divided. In some sentences, a comma is essential for clearness because *and* or *or* is used within one of the items. For example:

The panels were painted red, green, yellow, and black and white

Without the comma after *yellow,* it would be impossible to know whether *black* belonged with *yellow* or with *white;* the meaning might be "yellow and black, and white." In view of this, it seems advisable to use the comma on all occasions rather than trying to remember to check each series to see whether a comma is needed for clearness.

10. Two or more adjectives preceding a noun are ordinarily separated by commas. The comma before the last adjective is omitted, however, if that adjective is so closely associated with the noun that the two seem to merge into a single thought unit.

A big, powerful truck is needed.
He has a modest, unassuming manner.
It was housed in a large wooden structure.
The watchman was a feeble old man.

11. A word or phrase that is placed in an abnormal position in a sentence should be set off by a comma or commas.

To a trained accountant, the problem would look easy.

12. A comma is sometimes used to indicate the omission of one or more words.

July will be devoted to writing; August, to revision.

13. A direct quotation is set off by a comma or commas.

"The tires are threadbare," he asserted, "and will blow out at any moment."
He asked me directly, "Will September delivery be acceptable?"

EXCEPTIONS:

A quotation that blends into the regular structure of the sentence is not set off by commas. A title in quotation marks is not set off by commas unless some other rule makes commas necessary.

The poet's prophecy about "airy navies grappling in the central blue" has become an unpleasant reality.
The rhythm of "The Raven" is very striking.

14. Commas are variously used to separate items in dates, places, and numbers as illustrated in the following examples.

IN DATES: Payment shall be made on September 15, 1956, at the main office of the company.
IN PLACES AND ADDRESSES: San Francisco, California, is an important shipping point.
The company is located at 70 Fifth Avenue, New York 11, New York.
TO SEPARATE ADJACENT SETS OF FIGURES: In 1950, 675 men were added to the pay roll.
BETWEEN THE DIGITS OF NUMBERS: 10,984. 234,617. 1,856,445.

The comma may be omitted in a number with only four digits unless the number occurs in a column containing numbers in which commas are used.

The Semicolon

The semicolon is an intermediate mark, less emphatic than a period but more emphatic than a comma. There are frequent occasions when a semicolon is correct but a period might have been used instead.

1. A semicolon is used between main clauses that are not joined by any connective.

Privately endowed schools must not be underestimated; they fill a genuine educational need.

2. A semicolon is used between main clauses connected by a conjunctive adverb rather than by a co-ordinating conjunction.

He had shown fine managerial ability; consequently his promotion was rapid.

Note: The co-ordinating conjunctions are *and, but, or, nor,* and *for.* Conjunctive adverbs are such words as *also, accordingly, consequently, furthermore, hence, however, indeed, moreover, nevertheless, otherwise, still, then, therefore, thus.*

3. A semicolon is used between main clauses when the second clause begins with an explanatory term such as *in fact, namely, for example, that is.*

All the costs have increased; for example, the cost of raw material has increased by 15 per cent.

Note: Rules 1, 2, and 3 might be summarized: A semicolon is normally the proper mark to use between independent clauses occurring in a single sentence except when the clauses are connected by a co-ordinating conjunction.

4. Even if independent clauses are connected by a co-ordinating conjunction, a semicolon may be used between them if it is desirable to set them apart more sharply than usual—for example, to set off one clause from two or more others to which it stands in contrast.

Its paint was damaged, its lights were broken, and its fenders were a complete loss; but the motor was in good condition.

5. Co-ordinate elements of any type, clauses or otherwise, are usually separated by semicolons if any of them contains commas.

Some economies, perhaps, may be possible; but however hard we try to hold down expenses, a considerable increase will be unavoidable.

The inspection was made by William Smith, representing the company; Walter Brosser, president of the union; and Boyd Anderson, inspector for the Bureau of Mines.

The Question Mark

1. A question mark is used at the end of a direct question, but not at the end of an indirect question.

Is the price level rising or falling?
He asked whether the price level was rising or falling.

2. A question mark is used at the end of any expression that asks a direct question, whether the form is interrogatory or not.

You claim the records have been altered?

3. A question mark is replaced by a period at the end of a "courtesy question," which is actually a request though it may be interrogatory in form.

Will you please send us this information as soon as possible.

4. A question mark, enclosed in parentheses, is used to express doubt.

Thomas Hooker, a founder of Connecticut, lived from 1586 (?) to 1647.

The Exclamation Point

An exclamation point is used after a word, phrase, or sentence to indicate intense feeling or forceful utterance. There are few occasions, however, to use an exclamation point in technical writing.

Ridiculous! The signature is forged!

The Colon

1. A colon is used before a long direct quotation that is being introduced formally.

John Stuart Mill expressed his doubts as follows:

2. A colon is used to introduce a formal enumeration—especially after *follows* or *the following.*

Bids were offered by the following contractors: Wilson and Taylor Construction Company, Toledo; Central Builders, Incorporated, Akron; Herman L. White and Company, Cleveland.

3. A colon is used between two phrases or clauses when the second is actually the equivalent of the first.

The method that they used had one unique advantage: it could be used by personnel who had received only one week of special training.

The Dash

1. A dash can be used before introductory words such as *namely, in fact,* and *that is,* and before abbreviations such as *i.e.* and *viz.,* to introduce an enumeration. (See also the Semicolon, Rule 3.)

It is superior in three respects—namely, economy of operation, safety, and comfort.

2. A dash can be used to set off an informal enumeration or a list of examples that are separated by commas.

Some of the accessories—the heater, the fog lights, and the bumper—are really necessities.

3. A dash is used after a list that is followed by a summarizing expression.

Colds, influenza, sore throats—all the winter ailments were prevalent

4. A pair of dashes may be used to set off interpolated material. In this use, dashes create sharper separation than commas but less sharp than parentheses.

Most of the additional cost—approximately 90 per cent—was passed on to the consumers.

5. A dash may be used to indicate incomplete or interrupted thought. (This use of the dash would be unlikely in technical writing.)

The reasons for our decision—but no, I'll not bore you with them.

Note: The dash is a mark to use when clear-cut rules make it correct. It should not be used haphazardly, merely because one is uncertain what mark would be appropriate. Unless one is writing dialogue or writing very informally, the use of dashes to show interruption of thought indicates lack of smoothness and continuity of style.

Note: In typewritten material, a dash is indicated by a double hyphen or by a single hyphen preceded and followed by a single space.

Quotation Marks

1. Quotation marks are used to enclose direct quotations.

"The modern automobile," he pointed out, "sells at about the same price per pound that is charged for beefsteak."

Note: If a quotation exceeds a paragraph in length, opening quotation marks are used at the beginning of each paragraph; closing quotation marks, however, are not used until the end of the quotation.

Note: Quotation marks are not used when the material quoted is set in smaller type or when it has wider margins than those of the regular text.

Note: Quotation marks are not used to enclose widely known proverbs, such as *Honesty is the best policy,* or other well-known quotations that the reader will recognize as quotations without assistance.

2. Quotation marks are used to enclose titles of short poems, articles, short stories—in general, the titles of writings that are not printed as independent publications.

The statistics come from an article entitled "Science and Public Relations."

3. Quotation marks are sometimes used to enclose the names of ships, trains, airplanes, etc., and to enclose words used as words. By some authorities, however, italics are preferred for such usage.

He had secured reservations on "the Portland Rose."
In the fourth paragraph, the word "unique" is used incorrectly.

4. Quotation marks are used to indicate words that are taken from the jargon of some special activity; words that are, in effect, borrowed from a vocabulary which differs from ordinary, formally correct English.

It is unwise to require too many "hardware" courses in a curriculum in electrical engineering.

Note: If such terms are used frequently enough to become obtrusive, one should assume he is writing in the special style of the activity concerned and omit the quotation marks, or should replace the terms in question by words in general usage.

5. A quotation within a quotation is indicated by single quotation marks.

The instructions say, "You are to write 'Rejected' on the top of every imperfect copy."

Quotation Marks in Relation to Other Punctuation

1. A period or a comma ordinarily precedes closing quotation marks, even though it might logically belong outside.

One of his poems, "Fuzzy Wuzzy," was especially popular.

2. A colon or a semicolon ordinarily follows closing quotation marks.

3. A question mark or exclamation point is placed inside the

closing quotation marks if it applies to the quotation, but outside if it applies to the sentence as a whole.

His exact words were, "Why was the gun concealed?"
Had he ever read "The Third Ingredient"?

The Apostrophe

1. An apostrophe is used in the formation of the possessive of nouns and indefinite pronouns. (Indefinite pronouns include such words as *one, everybody, everyone, nobody,* etc.) The detailed rules are as follows:

(a) Words, either singular or plural, that do not end with the sound of *s* form the possessive by adding *apostrophe* plus *s*.

the company's property	everybody's business
the manufacturer's guarantee	the men's wages
one's conscience	the children's safety

(b) Singular words ending with the sound of *s* form the possessive by adding *apostrophe* plus *s*.

Mr. Jones's desk	the horse's age
the boss's office	

EXCEPTION:

If the form created by following this rule would be difficult to pronounce, add *only the apostrophe*.

Moses' people. Not: Moses's people.

(c) Plural words ending with the sound of *s* form the possessive by adding only an *apostrophe*.

the companies' policies the workers' houses.

Note: For a detailed discussion, see *Webster's New Collegiate Dictionary*, pages 1202–1203.

2. An apostrophe is never used to form the possessive of a personal or relative pronoun. (The possessive of *it* is *its,* not *it's*. The possessive of *who* is *whose,* not *who's*. *It's* means *it is; who's* means *who is.*)

3. The apostrophe to show the possessive case is often omitted in a formal title. In using any title, the form to follow is the form that has official sanction.

The Teachers Retirement Act The Farmers Co-operative

4. A compound term such as *director of information* or *father-in-law* is made possessive by adding the *apostrophe* plus *s* or the *apostrophe* only, whichever is appropriate, to the last word.

Director of information's statement Father-in-law's tool chest

5. Joint possession is indicated by a change in the ending of only the last of two or more nouns.

Fred and Henry's office	Joint possession.
Fred's and Henry's offices	Each has separate office.

6. An apostrophe is used to indicate the omission of one or more letters in a contraction.

can't	o'clock	they'll
isn't	it's (it is)	I'll
you're	who's (who is)	

7. An *apostrophe* plus *s* is used to form the plural of words used as words, letters as letters, figures as figures, etc.

The sentence contains too many *and's*.
The *e's* could not be distinguished from the *i's*
The *8's* were blurred and looked like *3's*.

Note: There is a growing tendency to omit the apostrophe when clearness would not be reduced. It would be clear, for example, to write Bs, Cs, 8s. Often, however, the apostrophe is essential for clearness. Omitting it before adding *s* to *A*, to *U*, or to *I* would result in As, Us, and Is, which are identical with ordinary words.

Parentheses

1. Parentheses are used to set off a word, phrase, or clause that constitutes a definite interruption in continuity.

The store used "loss leaders" (articles priced below cost to attract customers) only on exceptional occasions.

Note: If material in parentheses is inserted into a sentence, no other punctuation precedes the opening of the parentheses. The closing of the parentheses should be followed by whatever punctuation would have been used if the sentence had been continued without interruption.

Brackets

1. Brackets are used to mark off material that is inserted into a quotation but not quoted.

"This year [1949] the outlook is less favorable."
"It is definitely established that he [Mr. Schenley] signed the contract."

Capitalization

1. The first word of a sentence or of a line of poetry is capitalized.

The air was smoky.

"A voice by the cedar tree
In the meadow, under the hall."

2. The first word of a quotation is ordinarily capitalized, but a capital letter is not used when the quotation merges into the grammar of the enclosing sentence.

His exact words were, "The request is refused."
He objected to "the capitalization of unrealized anticipations."

3. Proper nouns, their derivatives, and common nouns used as proper nouns are capitalized.

(a) Capitalize personal and geographical names, names of races, nations, languages, etc.

Henry A. Collins	Negro (before *race*)	The National Biscuit
American	Hudson River	Company
English	King County	Reed College
France	Lake Erie	

Note: Such words as river, lake, and college are always capitalized when they precede the word that indicates the specific river, lake, or college. Some magazines and most newspapers, however, do not capitalize them when they follow the word that indicates the specific river, etc. Many other such words—for example *mountain, street,* and *railroad,* are similarly treated.

Note: When these terms are preceded by two proper nouns, they are never capitalized.

The Mississippi and Missouri rivers.

(b) Capitalize the names of organizations, businesses, governmental bodies, etc.

Veterans of Foreign Wars The Builders Supply Company
The Federal Communications Commission

(c) Capitalize the days of the week, months, holidays.

Monday June Memorial Day

(d) Capitalize titles of books, magazines, articles, and other written materials. (The first word and each important word thereafter are capitalized. Such unimportant words as *a, an, the,* and conjunctions or prepositions shorter than five letters are not capitalized. The word *The* is capitalized if it appears as the

first word in the title of a book, but is not capitalized if used at the beginning of the title of a newspaper or magazine.)

Essentials of Microwaves — the *Saturday Review*
The World Almanac — *Science and Public Relations*

(e) Capitalize the title of a person if it precedes his name, but do not capitalize a title that follows a name unless it is a title of distinction.

Professor Page — Sergeant Keppler
Judge William E. White — Dr. Springer
President Eisenhower

Dwight D. Eisenhower, President of the United States
Felix Frankfurter, Associate Justice of the United States Supreme Court

but

Norman Page, professor of chemistry
William E. White, police judge
John Moore, president of the Rotary Club

Note: The illustrations above indicate capitalization in ordinary text. In the address of a letter or in most display printing, even the titles not shown in capitals would be capitalized.

(f) Capitalize words that are derived from the names of persons, places, or other proper names.

The crew lived in a Quonset hut.
The Plimsoll mark was visible.

Note: Eventually, the capitalization of such terms is usually discontinued, as in *sandwich*, and *boycott*. Since the discontinuation is gradual, there will always, at any given time, be many terms in which usage differs in different publications. A dictionary will contain guidance, but the dictionaries necessarily lag behind technical books and magazines in dropping off capitalization.

4. Nouns and pronouns referring to the Deity, and numerous other words with sacred significance are capitalized.

"Earth changes, but thy soul and God stand sure."
"So take and use Thy work."

5. The pronoun *I* and the interjection *O* (but not *oh* except at the beginning of a sentence or quotation) are capitalized.

6. In ordinary text, capitalization merely as a means of emphasis is poor form. Inexperienced writers tend to capitalize too frequently rather than too rarely. The following cautions, especially, should be observed:

(a) North, south, east, and west are capitalized only when they are used as proper nouns, that is, as the names of specific geographical regions. When these words indicate mere direction, they are not capitalized.

He lived in the South.
He lived south of the tracks.

(b) Such words as chemistry, psychology, and history are not capitalized except when they occur as part of a title—for example, the title of a specific university course.

Being interested in physics, he decided to take *The Physics of Sound.*

Italics

Italics (indicated in typing or longhand by an underline) show that words are used in some special manner and hence should be set off from the material in which they occur.

1. Italics are used for the titles of books, magazines, newspapers, bulletins, or other separately issued publications.

Basic Engineering Metallurgy
the *Chicago Tribune*
the *Farm Science Reporter*
The Business Letter in Modern Form
The American College Dictionary
Webster's New Collegiate Dictionary

Note: The word *A, An,* or *The* as the first word of the title of a book is italicized if the title actually includes it. These words, at the beginning of the titles of periodicals, are not italicized.

2. Italics are used for the titles of ships, trains, airplanes, works of art, etc. Some authorities, however, place such material in quotation marks.

the *Lusitania*
El Greco's *Cleansing of the Temple*
the *Twentieth Century Limited.*

3. Italics are used for words considered as words, phrases considered as phrases, and letters or numbers considered as letters or numbers.

The writer used *effect* incorrectly.
The phrase *in case of* is overworked.
The *i* looks like an *e,* and the *8* is so dim it looks like *3.*

Note: A letter used to indicate shape, as in "V-shaped" or "I-beam," is not italicized.

4. Foreign words or phrases are italicized, whether written out or abbreviated. (This rule covers Latin scientific names.) To determine whether some words are considered foreign or are accepted as English, it may be necessary to consult a dictionary.

ibid. *coup d'etat* *ipso facto* *de facto*

5. Italics are used to indicate special emphasis. Although formerly common, this use is currently frowned on and should be limited to occasions when the emphasis indicated is abnormal. Ordinarily, sentence structure rather than italics must be relied on to indicate emphasis of words.

Do you mean to tell me that you met *the* Walter Huston?
He definitely gave instructions that the deduction should *not* be made.

General Rules for Abbreviation

The following rules for abbreviation apply to ordinary writing only. The additional abbreviations needed when writing is technical in style, and the use of abbreviations in footnotes, bibliography, and technical parts of letters are discussed with those particular topics.

In ordinary writing, abbreviations should be used sparingly. Unless one of the following rules clearly calls for abbreviation, a word should be written out.

1. The universally known abbreviations *a.m.*, *p.m.*, *a.d.* and *b.c.*, are always used in place of the terms for which they stand.

2. The abbreviations *e.g.* (for example), *i.e.* (that is), and *viz.* (namely) may be used in informal material. In formal style, their English equivalents are preferable.

3. *Etc.* is so extremely informal that it should be avoided in regular text that is offered as finished writing.

4. In recent years, many abbreviations such as NATO, TVA, CIO, and UNESCO, have come to be accepted in any writing except that which is extremely formal because of the length of the names for which they stand. The form of any such abbreviation may be determined, if necessary, in an up-to-date dictionary.

5. The abbreviations *Mr.*, *Mrs.*, and *Dr.* are used preceding names. Such abbreviations as *Jr.*, *M.A.*, *Ph.D.*, *M.D.*, and *C.P.A.*, following names, are preferred to the full words or phrases for which they stand. In ordinary text, however, other titles than *Mr.*, *Mrs.*, and *Dr.* are in better form if written out, either before or after a name. Examples of these titles are *professor, captain, president, senator, governor, mayor*. Like these titles, the terms of respect *reverend* and

the honorable (these are not titles) should preferably be written out.

6. Such words as *figure* and *number* preceding a number may be abbreviated. (Fig. 3; No. 7)

7. Abbreviations are not used for the names of persons (*James, William, Robert* not *Jas., Wm., Robt.*).

8. Abbreviations are not used in ordinary text for the names of states or similar terms (except for *D.C.* and sometimes *N.Y.*); nor are they used in text for words such as *street, avenue, company, volume,* and *chapter.*

SPELLING

Among all the possible errors in English there are few that cause so much loss of face as is caused by errors in spelling. Mistakes in spelling are noticed and found annoying by readers who pass over other errors without noticing any except those that are most glaring. No person who expects to do technical, professional work can afford to shrug his shoulders, say "I never could learn to spell," and expect the world to indulge him in his ignorance.

The first necessity in overcoming weakness in spelling is the development of an adult attitude, the development of a determination not to go through life handicapped by a juvenile weakness. Once such an attitude is acquired, improvement may not be easy, but it is hardly so formidable a task as might be anticipated. Even a weak speller, if he keeps a list of the words that he misses, is usually surprised at its shortness. The frequency of his errors does not ordinarily result from his misspelling a long list of words, but from his repeatedly misspelling certain words that he uses frequently. Even a weak speller can often eliminate most of his errors by learning to spell no more than 40 or 50 words.

If you are weak in spelling, you should be able to make steady improvement if you will carry out the following instructions:

First: Check over your work carefully for the express purpose of correcting the errors that result from sheer carelessness rather than from ignorance.

Second: Keep a list of every word you miss, and have that list in front of you when you write. Your individual list will be more valuable than a list taken from a book. You will soon come to recognize any word on the list when you start to write it, and can check the way you spell it without taking time to consult a dictionary.

Third: Learn just a few rules—the ones that are violated most frequently.

Fourth: Give special attention to certain words that are misspelled

because of sloppy pronunciation, and to pairs of words that are confused because of their similarity.

The Rules

The following rules are not complete. Rather than covering everything, they represent an attempt to eliminate as much as possible, so that the rules that are most helpful will not be buried in the mass of rules and exceptions which would be necessary for completeness.

1. *ie* and *ei:*

When the pronunciation is long *e,* use *i* before *e* except after *c,* and use *e* before *i* after *c.* (When the pronunciation is not long *e,* the spelling is usually *ei;* but few words except those where the pronunciation is long *e* cause trouble.)

believe	receive	weigh
chief	conceit	neighbor
field	ceiling	foreign

EXCEPTIONS: either, neither, seize, leisure, weird, financier, species.

2. The effect of prefixes:

When a prefix is placed before a word, the spelling of the word itself remains unchanged. (This rule will solve many troublesome questions about double letters.)

dis + appoint = disappoint
dis + appear = disappear
dis + satisfied = dissatisfied
un + worried = unworried
un + noticed = unnoticed
grand + daughter = granddaughter

3. Treatment of final silent *e* when a suffix is added:

(a) When a suffix beginning with a consonant is added to a word ending in silent *e,* the *e* is retained.

hope + ful = hopeful
move + ment = movement
shame + less = shameless
like + ly = likely

EXCEPTIONS: *duly, truly, argument, awful.* Also, such words as *judgment, acknowledgment,* and *abridgment* drop the silent *e* in preferred forms.

(b) When a suffix beginning with a vowel is added to a word ending in silent *e,* the *e* is dropped. (This covers the spelling of hundreds of words to which *ing* may be added.)

hope + ing = hoping
move + ing = moving
locate + ion = location
quote + able = quotable
promote + ion = promotion
change + ing = changing

EXCEPTION: The letters *c* and *g* are always hard before *o* and *a* (*cat, coat, gave, go*). Hence a final silent *e* must sometimes be retained to keep the pronunciation of *c* or *g* soft.

enforce + able = enforceable courage + ous = courageous
change + able = changeable

EXCEPTIONS: *Mileage, saleable,* and *useable* are exceptions to the rule for dropping the silent *e*. Also, there are a few words such as *singeing* or *dyeing* in which the *e* is retained to prevent confusion with other words (*singing, dying*).

4. Doubling a final consonant:

When a suffix beginning with a vowel is added to a word ending in a consonant, the final consonant of the word is doubled under the following conditions: (a) The word must end in only one consonant, preceded by only one vowel. (b) The word must be accented on the last syllable. (This would include all one-syllable words.)

Final Consonant Doubled

occur + ed = occurred stop + ed = stopped
refer + ed = referred drag + ed = dragged
begin + ing = beginning lag + ing = lagging

EXCEPTIONS: gas + es = gases gas + eous = gaseous

Final Consonant Not Doubled

rent + ing = renting	Word ends in two consonants.
read + ing = reading	Two vowels precede the consonant.
offer + ed = offered	Accent not on last syllable.
refer + ence = reference	Accent shifted back to an earlier syllable.

Note: Though the rule just discussed seems somewhat complicated, its application may be greatly simplified, for the misspellings which may be corrected by applying the rule are almost exclusively the result of overlooking one portion of the rule—the portion referring to accent. Characteristic errors are *occured, begining, refered.* For purely functional purposes, the rule could be simplified to read: *If you are in doubt as to whether to double a final consonant when you add a suffix, notice where the accent lies. If it lies on the last syllable* (this obviously covers all words of one syllable) *double the final consonant. If it is not on the last syllable, do not double the final consonant.*

The cases where this would not apply will not cause trouble, for even the weakest spellers would spell words such as *needed* or *spend-*

ing correctly without even considering the question of doubling a final consonant.

5. Adding a suffix to a word ending in *y*.

(a) When a suffix is added to a word that ends in *y* preceded by a *consonant,* the *y* is changed to *i* unless the result would be double *i.*

worry + ed = worried
accompany + ment = accompaniment
pity + able = pitiable
mercy + ful = merciful
hurry + ed = hurried
worry + ing = worrying

EXCEPTIONS: There are several exceptions, including words such as *shyness, citylike, secretaryship.* None of the exceptions is likely to be misspelled, or even to occasion doubt. Hence the rule may be applied, in case of doubt, without danger of causing an error in spelling.

(b) When a suffix is added to a word that ends in *y* preceded by a *vowel,* the *y* remains unchanged.

joy + ful = joyful
annoy + ance = annoyance
assay + ed = assayed
employ + ment = employment

EXCEPTIONS: laid (from lay + ed); said (from say + ed); daily (from day + ly).

Note: The most valuable fact to remember about errors resulting from addition of suffixes to words ending in *y* is that practically all these errors result from a single cause: failure to change *y* to *i* when it should be changed. The section of the rule expressed in (a) should receive major attention.

6. Words ending in *ede* or *eed.*

Among the troublesome words ending in *ede* or *eed,* only three end in *eed,* namely *exceed, succeed,* and *proceed.* All the others end in *ede* —for example, *concede, recede, precede, supersede.* It is further worth noting, if one is doubtful whether *c* or *s* precedes the *ede,* that only one word, *supersede,* ends in *sede.* In all other words where the ending is *sede* or *cede,* the correct spelling is *cede.*

Pairs of Words That May Be Confused

Many misspellings result from confusion between the word desired and some other word that resembles it in spelling or pronunciation. Some of the words commonly confused are as follows:

accept, except
advice, advise
affect, effect
all ready, already
all together, altogether
brake, break
born, borne
breath, breathe
capital, capitol
cite, sight, site
choose, chose
coarse, course
complement, compliment
dual, duel
dyeing, dying
formally, formerly
forth, fourth
its, it's
lead, led
lightning, lightening
loose, lose
passed, past
personal, personnel
precedence, precedents
presence, presents
principal, principle
prophecy, prophesy
stationary, stationery
their, there, they're
to, too, two
whose, who's
your, you're

Words Misspelled Because of Pronunciation

Many words give trouble in spelling because they are mispronounced or pronounced carelessly. If the correct pronunciation of these words can be learned, the errors in spelling will be corrected automatically. Some of the most troublesome words of this sort are listed below:

accidentally (not accidently)
arctic (not artic)
athletics (not atheletics)
boundary (not boundry)
disastrous (not disasterous)
drought (not droughth)
height (not heighth)
hindrance (not hinderance)
incidentally (not incidently)
irrelevant (not irrevelant)
laboratory (not labratory)
mathematics (not mathmatics)
mischievous (not mischeevious)
performance (not preformance)
prescription (not perscription)
quantity (not quanity)
similar (not similiar)
sophomore (not sophmore)
temperament (not temperment)
temperature (not temperture)

Miscellaneous Spelling List

absence
accept
accidentally
accommodate
accumulate
acquaint
across
address
advice
aggravate
allotted
all right
already
amateur
analyze
annual
appearance
appropriate
argument
athletic
auxiliary
beginning
believe
beneficial

Miscellaneous Spelling List (continued)

benefited
calendar
ceiling
changeable
coarse
committee
comparative
comparison
competent
completely
conscience
conscious
continuous
controlled
course
criticism
criticize
cylinder
deferred
definite
dependent
descendant
description
desperate
develop
disappear
disappoint
dormitories
dual
duel
embarrass
emphasize
employees
environment
equipped
especially
exaggerate
exceed
excellent
except
exercise
exhaust
existence
familiar
feasible
finally
foreign
foremost
forth
forty
fourth
government
grievous
guarantee
height
hindrance
hypocrisy
immediately
independence
indispensable
interest
its
it's
laboratory
lead
led
leisure
liable
lightning
loose
lose
maintenance
manufacturer
mathematics
miniature
ninety
nineteen
ninth
noticeable
occasion
occurred
occurrence
omitted
optimistic
parallel
parliament
partner
perform
permissible
perseverance
personal
personnel
plane
plain
practically
precede
preferred
prejudice
principal
principle
procedure
proceed
quantity
quiet
quite
receipt
receive
recognizable
recommend
repetition
representative
reservoir
schedule
seize
separate
sergeant
similar
sincerely
sponsor
studying
therefore
thorough
tragedy
transferred
unnecessary
wherever

GLOSSARY OF USAGE

The following list includes many but far from all of the words and phrases that persistently trouble writers who have outgrown the glaring errors that characterize actual illiteracy.

The term *colloquial,* which will be used frequently, is used with the liberal meaning *informal* rather than being restricted to its original meaning of *conversational.*

Above. Use chiefly as an adverb or a preposition. As an adjective it has some acceptance in formal English but is sometimes considered objectionable. As a noun, it is acceptable only in legal writing.

UNDESIRABLE: We have checked the *above* list carefully.

BETTER: We have checked the *preceding* list carefully.

BETTER: We have carefully checked the list *above.* (Elliptical for *that is* above.)

Accept, Except. *Accept* means *to receive willingly. Except,* as a verb, means *to exclude.*

Affect, Effect. *Affect,* as a verb, means *to influence. Effect* as a verb means *to achieve or accomplish. Affect* is never correct as a noun (except in one highly technical usage in psychology). *Effect* as a noun means *result* and is essentially the noun form suggested by *affect* as a verb.

The weather *affected* their plans.
The attorneys *effected* a settlement of the suit.
The weather had no *effect* on their plans.

Already, All ready. *Already* means previously. *All ready* means *entirely prepared.*

Among, Between. *Among* is used in reference to more than two persons or objects. *Between* is used in reference to two only.

The profits were divided *among* the employees.
The profits were divided *between* the two partners.
The profits were divided *between* the company and the employees.

Amount, Number. *Amount* refers to quantity. *Number* refers to objects that can be counted.

The *amount* of beef in storage was increasing.
The *number* of cattle on the range was increasing.

And/or. Useful though this expression seems, it is frowned on by most authorities, including The American Standards Association.

UNDESIRABLE: It had been colored by the use of ammonium carbonate, and/or ammonium chloride.

BETTER: It had been colored by the use of ammonium carbonate, ammonium chloride, or both.

As. Often ambiguous when used to introduce a clause that might be introduced by *because* or *since.*

AMBIGUOUS: *As* the time of departure was drawing near, he became very nervous.

CLEAR: *Since* (or *because*) the time of departure was drawing near, he became very nervous.

As per. A bit of commercial jargon undesirable, in normal use, as a substitute for *in accordance with.*

UNDESIRABLE: The work was done as per instructions.

BETTER: The work was done in accordance with the instructions.

Bad, Badly. See discussion under *Adjectives and Adverbs,* page 353.

Balance. The word *balance,* except in connection with bookkeeping or accounting, should not be used for *remainder.*

WRONG: We will do the *balance* of the work next week.

CORRECT: Our *balance* in the bank account had decreased.

Because. Do not misuse *because* for *for. Because* should be used to introduce a clause that tells the cause of some result rather than a clause that merely tells the reason for a belief or knowledge.

WRONG: He has not been here today, *because* his tools are still in his locker.

CORRECT: He has not been here today, *for* his tools are in his locker.

CORRECT: He stayed away *because* he was ill.

Beside, Besides. *Beside* means *by the side of. Besides* means *in addition to, except, moreover.*

WRONG: *Beside* the reason mentioned, there are other reasons.

CORRECT: *Besides* the reason mentioned, there are other reasons.

But what, But that. The word *but* in these expressions is meaningless, has no grammatical function, and should be omitted in formal writing.

WRONG: We had no doubt *but what* (or *that*) he would be acquitted.

CORRECT: We had no doubt *that* he would be acquitted.

Can, May. *Can* indicates ability. *May* indicates permission. In recent years, however, the objections to using *can* for *may* have grown less vigorous.

Can't hardly, Can't scarcely. These terms are illogical just as a double negative is illogical. Taken literally, either of them would cause a statement to mean the exact opposite of what it was intended to mean.

WRONG: We *can't hardly* see it from here.
CORRECT: We *can hardly* see it from here.

Can't help but. An expression that cannot be defended from the grammatical standpoint and that is avoided by careful writers except in extremely informal use. It is a distortion of the extremely formal expression, *cannot but.*

WRONG: I *can't help but* agree with him.
CORRECT: I can't help agreeing with him.
CORRECT, BUT EXCESSIVELY FORMAL: I *cannot but* agree with him.

Considerable (as a noun or adverb). *Considerable* is an adjective. It should not be used as a noun or adverb. As a noun it is colloquial; as an adverb, illiterate.

WRONG: The company lost *considerable* during the first year
WRONG: We were influenced *considerable* by what he said.
CORRECT: The company lost *a considerable amount* of money during the first year.
CORRECT: We were influenced *considerably* by what he said

Continual, Continuous. *Continual* means *constantly recurring* (as in *continual* interruptions). *Continuous* means *without cessation* (as in the *continuous* roar of traffic).

Could of, Would of, Should of, etc. In all such expressions, *of* is misused for *have,* as the result of careless pronunciation in speech. The wrongness of these expressions is apparent when one realizes that they are comparable to "I *of* gone," etc.

Data, Phenomena, Strata. These forms are all plurals. Their singulars are *datum, phenomenon, stratum.* There is some tendency, recently, to use *data* as a singular when referring to a mass of facts considered as a whole; but most careful writers still restrict even *data* to use as a plural.

Differ from, Differ with. *Differ from* means *to be dissimilar. Differ with* means *to disagree.*

Apple trees *differ from* pines in appearance.
The manager *differed with* the president as to who should be promoted.

Different from, Different than. *Different from* is preferred.

Enable. *Enable* means to make able; to give ability to. It should not be used in such a sentence as, "This action *enables* the road to be paved," for the road is not given any new ability. It would be preferable to say, "This action enables the highway department to pave the road," or "This action makes it possible to pave the road."

Farther, Further. Careful writers prefer *farther* in reference to actual distance and *further* in reference to quantity or degree.

Fewer, Less. *Fewer* should be used when numbers are referred to; *less,* when quantity is referred to.

CORRECT: *Less* wheat was harvested this year than last; consequently *fewer* (not *less*) freight cars will be needed.

Good, Well. See *Adjective and Adverb,* pages 351-353.

Had ought. An undesirable form mistakenly substituted for *ought* or *should.*

WRONG: *He'd* (he had) *ought* to resign.
CORRECT: He *should* resign.
CORRECT: He *ought to* resign.

Had of. The *of* is meaningless, unnecessary, and wrong. Had is sufficient.

WRONG: I wish I *had of* learned the news earlier.
CORRECT: I wish I *had* learned the news earlier.

Hardly. See *Can't hardly.*

Have got. A redundant way of saying *have;* an undesirable substitute for *must.*

REDUNDANT: We *have got* many things to be thankful for.
UNDESIRABLE: *We've got* to reach the town before morning.
CORRECT: We *have* many things to be thankful for.
CORRECT: We *must* reach the town before morning.

If. Ambiguous and undesirable when used in place of *whether* because it does not imply *or not* with sufficient emphasis.

AMBIGUOUS: Let me know *if* you expect to visit us.
CLEAR: Let me know *whether* you expect to visit us.

Imply, Infer. *Imply* means, literally, *fold in.* A speaker or writer implies ideas. *Infer* means, literally, *carry in.* A listener or reader *infers* something which the speaker or writer has implied. It is inaccurate to say, "I *implied,* as I read your letter, that . . ." Similarly, it is wrong to say, "Did you mean to *infer,* by your remarks, that . . ."

Is when, Is where, Is because. *When, where,* and *because* can introduce only adverbial or adjective clauses. They should not be used to introduce noun clauses.

INCORRECT: Insolvency *is where* one cannot pay one's debts.
INCORRECT: Bankruptcy *is when* one's property is administered for the benefit of one's creditors.
INCORRECT: The reason for his absence *is because* he is ill.
CORRECT: Insolvency is a state *in which* one cannot pay one's debts.
CORRECT: Bankruptcy is a state *in which* one's property is administered for the benefit of one's creditors.
CORRECT: The cause of his absence is *that* he is ill. (or *is illness*)

Lie, Lay. *Lie* is an intransitive verb meaning *recline. Lay* is a transitive verb meaning to *place,* or *cause to lie.*

PRINCIPAL PARTS: lie, lay, have lain
lay, laid, have laid

CORRECT: He *lies* on the bed. (present)
CORRECT: He *lay* on the bed. (past)
CORRECT: He *has lain* on the bed all afternoon.
CORRECT: He *lays* the newspaper on the bed.
CORRECT: He *laid* the newspaper on the bed.
CORRECT: He *has laid* the newspaper on the bed.
WRONG: He *lays* on the bed.
WRONG: He *has laid* on the bed all afternoon.

Note: The confusion results because, primarily, the past tense of *lie* is identical with the present tense of *lay.* Some errors also result from the use of *laid* as the past tense or past participle of *lie.*

Like, As if. Careful writers do not use *like* as a conjunction, preferring *as if* or *as though. Like* is correct, however, as a preposition. In conversation, *like* as a conjunction slips into the language even of many literate people.

CORRECT: He looked *like* a man of forty.
CORRECT: He spoke *as if* (or *as though*) he had a cold.

Note: Being a preposition, *like* cannot introduce a clause; and the usual sign that the construction is a clause is the presence of the subject and verb. An easier way to tell whether *like* would be correct is to try using *as if* and to notice whether it sounds right. If it sounds right, use it. *As if* will never sound right in a sentence where it is wrong.

Most, Almost. These are two distinct words, with different meanings. Sometimes, however, *most* is used colloquially for *almost* as in "He made an error in *most* every copy." The simplest way to avoid

this error (or colloquialism if it be so interpreted) is to remember that *most* is never correct when *almost* would convey the desired meaning.

CORRECT: He made errors on *most* of the copies.
CORRECT: It was a *most* unfortunate statement.
COLLOQUIAL OR WRONG: *Most* everyone in the crowd saw the incident.

Of. Do not use *of* for *have* as in "He must *of* gone," for "He must *have* gone." This misuse of *of* occurs, also, after many other verbs—for example, *could of, should of, might of.* The error is a carry-over of careless pronunciation.

Per cent. This term (still preferred as two words but accepted as one) should not be loosely used for *portion* or *part.* Ordinarily, it should be used only following a number. It should not be used for *percentage.*

CORRECT: The company earned a ten *per cent* profit.
CORRECT: The *percentage* (*not per cent*) of profit increased.
WRONG: A large *per cent* of the meeting was wasted in arguments.

Practicable, Practical. *Practicable* is used to indicate that a method *can* be used or that a result *can* or *could* be accomplished. *Practical* goes farther. It indicates that whatever is being considered not only is a possibility but would actually give results that would justify action. For example, building a steam-powered automobile is *practicable* but has not proved to be *practical.*

CORRECT: The plan he suggested seems *practicable.*
CORRECT: Since he had a *practical* mind, he provided a *practical* solution to the problem.

Principal, Principle. *Principal* as an adjective means *main* or *chief,* and as a noun means *the main or controlling person,* as the *principal* of a school or one of the *principals* in a lawsuit. *Principle,* always a noun, means *fundamental truth, basic law.*

CORRECT: The *principal* reason for its failure was defective workmanship.
CORRECT: The *principles* of democracy must be preserved.

Rise, Raise. The distinction between *rise* and *raise* is essentially the same as the distinction between *lie* and *lay. Rise* is an intransitive verb. *Raise* is transitive.

PRINCIPAL PARTS: rise, rose, have risen
raise, raised, have raised

CORRECT: The prices *rise* when the supply becomes scarce.
CORRECT: The dealers *raise* the prices when the supply becomes scarce.

WRONG: The prices *raised* when the supply became scarce.
CORRECT: The prices *rose* when the supply became scarce.

Scarcely. See *Can't hardly, Can't scarcely.*

Seldom ever. Redundant; the full meaning is expressed by *seldom* alone.

Sit, Set. The distinction between *sit* and *set* is essentially the same as the distinction between *rise* and *raise,* and *lie* and *lay. Sit* is an intransitive verb. *Set* is transitive.

PRINCIPAL PARTS: sit, sat, have sat
set, set, have set

CORRECT: He *sits* at my desk, where he *sat* yesterday and where he *has sat* so many days before.
CORRECT: He *sets* the case on the desk, where yesterday he *set* it down so carelessly. He *has set* it there every time he came in the office.

Shall, Will. The careful discrimination between *shall* and *will* is not so common as in past times, and even literate writers frequently use *will* on some occasions when *shall* is called for by the rules. The main points to remember in order to make the traditional discriminations are as follows:

(a) To indicate simple future or expectation, *shall* is correct in the first person and *will* in the second and third persons.

I *shall* be a senior next year. He *will* spend August in Omaha.

(b) *Will* is correct in the first person, and *shall* in the second and third persons, to indicate determination or command.

I *will* do it in spite of your objections. You *shall* change your itinerary. They *shall* not pass.

(c) *Will* is used in all persons to express willingness.

I *will* go if no one else *will.*

Should, Would. Basically, the difference between *should* and *would* is the same as that between *shall* and *will.*

I *should* enjoy reading the book. He *would* enjoy reading the book, etc.

Should is used in all persons, however, in the sense of *ought to* or to express a condition.

I *should* give him credit for working overtime. He *should* give me credit for working overtime. If I *should* refuse, no one could blame me. If he *should refuse,* no one could blame him.

Similarly, *would* is used in all persons to indicate customary action.

It is also used whenever *should* would be misleading in that it would indicate *ought to.*

I *would* call on him every time I came to town. He *woula* never let me pay for my own dinner.

Some, Somewhat. *Some* should not be used as an adverb with the meaning of *a little.* The correct word for this use is *somewhat*

INCORRECT: I was feeling *some* better.
CORRECT: I was feeling *somewhat* better.

These kind. This expression is wrong. The plural *these* should not modify the singular *kind.*

Try and. This expression should not be substituted for *try to* in writing that makes any pretensions at precision. *Try and,* in a sentence such as "I will *try and* go," is just as illogical as "I *am able and* go" for "I *am able to* go."

Type. The common tendency among technical writers to use *type* as an adjective is not in conformity with the rules of good use. *Type* is a noun or verb, not an adjective. It cannot directly modify a noun unless, in a hyphenated term, it becomes part of a compound adjective.

INCORRECT: We installed the new *type* machines.
CORRECT: We installed the new *type of* machine.
CORRECT: The design calls for an *injector-type* condenser.

Very. It is not good idiom to use *very* to modify a past participle. Some word such as *much* or *well* should be used between *very* and the participle.

INCORRECT: The customers were *very pleasea.*
CORRECT: The customers were *very much* (or *very well*) *pleased.*

With. *With* should not be loosely used to establish some vague, undefinable thought relationship.

INCORRECT: *With* the plans completed, the president of the company went on a vacation.
CORRECT: The plans having been completed, (or, When the plans had been completed,) the president of the company went on a vacation.
INCORRECT: The production was increasing, *with* the prices holding steady.
CORRECT: The production was increasing, and the prices were holding steady.

While. Care must be taken to prevent *while* from being ambiguous

when it is used in the sense of *although,* and its use with this meaning is often regarded as improper.

AMBIGUOUS: *While* his work was heavy, he did it well.

AMBIGUOUS: The first floor was neat, *while* the second floor was cluttered.

CORRECT: *Although* his work was heavy, he did it well. (or: *As long as* his work was heavy, he did it well.)

CORRECT: The first floor was neat, *but* the second floor was cluttered.

EXPLANATION OF GRAMMATICAL TERMS

Absolute. An expression that is not grammatically connected with the sentence where it occurs; sometimes called a "nominative absolute."

The job being completed, the crew was laid off.

Adjective. A class of words used to modify (describe or limit) nouns or pronouns.

rough road, *this* year, *reasonable* profits.

Adjective clause. A clause used as an adjective to modify a noun or pronoun.

The tire *that blew out* was defective.

The clause *that blew out* modifies the noun *tire.*

Everyone *who came* enjoyed himself.

The clause *who came* modifies the pronoun *everyone.*

Adverb. A class of words used to modify verbs, adjectives, or other adverbs.

He drove *cautiously.*

Cautiously modifies the verb *drove.*

The problem is *very* hard.

Very modifies the adjective *hard.*

The frame was *very* strongly built.

Very modifies the adverb *strongly.*

Adverb clause. A clause used as an adverb to modify any part of speech that an adverb might modify, usually a verb.

If the cost is excessive, we shall cancel the project.

The clause modifies the verb *shall cancel.*

They will burn the slashings *when the weather grows damper.*

The clause modifies the verb *will burn.*

Agreement. The necessary correspondence between a subject and verb in person and number; between a pronoun and its antecedent in person, number, and gender; and between a demonstrative adjective (*this, these*) and the noun that it modifies, in number. (See pages 346-351.)

Antecedent. The noun to which a pronoun refers

After reading the *report* he returned *it.*

Report is the antecedent of *it.*

Appositive. A noun or other substantive placed next to some other noun, used in the same way grammatically, and referring to the same thing or person.

The main plant, *a four-story building,* stood at the edge of town.
It was discovered by the watchman, *a reliable employee.*

Article. Any of three words—*a, an,* and *the.*

Auxiliary. A word used as part of a verb to assist in indicating the tense, voice, mood, etc. of the main verb.

Are working, *have* answered, *must have* heard, *shall* or *will* arrive.

Clause. A grammatical unit containing a subject and a finite verb. At least one independent clause is necessary in any complete sentence. (Sometimes part of the clause may be implied rather than expressed, in which case it is called an elliptical clause.)

MAIN OR INDEPENDENT CLAUSE: one which makes an independent assertion.

SUBORDINATE OR DEPENDENT CLAUSE: one which is not self-sufficient, and which does not of itself make an assertion, but is used as part of a main clause. It is always used as a noun, adjective, or adverb.

INDEPENDENT CLAUSE: The sky is blue.

SUBORDINATE CLAUSE USED AS A NOUN: We heard *that the request was refused.*

SUBORDINATE CLAUSE USED AS AN ADJECTIVE: I know of a hotel *that will be satisfactory.*

SUBORDINATE CLAUSE USED AS AN ADVERB: Please close the door *when you leave.*

Comparison. The change of form in an adjective or adverb, indicative of change of degree, as in *good, better, best; long, longer, longest; easily, more easily, most easily.*

Complement. An element that ordinarily follows a verb and completes the assertion made by the verb about the subject. Types of complement are shown in the following examples:

DIRECT OBJECT: The farmer raised *wheat.*
INDIRECT OBJECT: The manager gave *him* a check.
PREDICATE ADJECTIVE AS SUBJECTIVE COMPLEMENT: The tractor is *old.*
PREDICATE ADJECTIVE AS OBJECTIVE COMPLEMENT: The news made him *happy.*
PREDICATE NOUN AS SUBJECTIVE COMPLEMENT: The tree is an *oak.*
OBJECTIVE COMPLEMENT: The president made John Jones the *manager.*

Complex Sentence. See *Sentence.*

Compound Sentence. See *Sentence*

Compound-Complex Sentence. See *Sentence.*

Conjunction. A word used to connect words, phrases, or clauses. Co-ordinating conjunctions are those which indicate that the elements they connect are equal in grammatical rank. Subordinating conjunctions are those used to connect subordinate clauses to main clauses.

CO-ORDINATING CONJUNCTIONS: *and, but, or, nor, for,* sometimes *yet* and *so.* See also *Correlative Conjunctions.*
SUBORDINATING CONJUNCTIONS: *after, as, because, since, when, where,* etc.

Conjunctive adverb. An adverb that functions also as a conjunction to join main clauses. (*also, however, moreover, consequently, furthermore,* etc.) Ability to discriminate between conjunctive adverbs and co-ordinating conjunctions is important as a means of avoiding the serious error known as the "comma splice." (See pages 356-357.)

Correlative conjunctions. Conjunctions used in pairs to join elements of equal rank.

Either . . . or, neither . . . nor, not only . . . but also, both . . . and

Ellipsis. The omission of words that are necessary for the grammatical completeness of the sentence, the words omitted being implied by what is expressed.

While (I was) working out of doors, I gained weight.
The new model is sturdier than the old (model is).
(You) Send me the answer promptly.

The subject of any imperative sentence is *you,* implied. Hence every imperative sentence is elliptical.

Expletive. The word *there* or *it,* used as the subject of a clause but having no meaning. The real subject often follows the verb when the sentence opens with an expletive.

There are several reasons for refusing.
It is certain that production will increase.
It is snowing. *It* is nine o'clock.

Gender. The status of a noun or pronoun as masculine (*man, waiter, he*), feminine (*woman, she, waitress*), neuter (*tree, house, it*), or common (*mouse, person, you*).

Gerund. A verb form used as a noun. A gerund plus its object is a gerund phrase.

Walking is good exercise.
Pruning a tree demands judgment. (gerund phrase)

Idiom. An expression that may not be justified by grammar or logic, but that is accepted as correct because of long and reputable custom. For example, in "*many a person . . .*" *many,* a plural, modifies *person,* a singular. The meaning is plural, but *person* is singular. Thus the expression is ungrammatical and illogical, but is accepted as correct without question. Or again: "That report *of yours* needs revision," is ungrammatical, for *yours,* a possessive, is the object of a preposition; yet the usage is accepted and "That report *of you*" would be unidiomatic. It is "good idiom" to say "I am able *to* go," but poor idiom to say "I can *to* go," though the expressions are grammatically identical. Idiom is especially important in connection with prepositions, the use of which frequently defies explanation.

Infinitive. The verb form used after *to.* (Sometimes, as in "I can go," the *to* is implied.) The infinitive form of a verb can be used as a noun, adjective, or adverb in addition to its use as a complementary infinitive, in which usage it completes the verb.

COMPLEMENTARY INFINITIVE. I hope *to be* there.

INFINITIVE AS A NOUN: *To err* is human.

To err is used as the subject of a verb, and hence used as a noun.

INFINITIVE AS AN ADJECTIVE: I have a confession *to make*

To make is used as an adjective, to modify *confession*

INFINITIVE AS AN ADVERB: They were eager *to accept.*

To accept is used as an adverb to modify *eager,* an adjective.

Inflection. Variation in the form of words to indicate change of number, gender, person, tense, or mood. Inflection of nouns is re-

ferred to as declension; inflection of verbs as conjugation; inflection of adjectives and adverbs as comparison.

Interjection. One of the parts of speech. A type of word at the beginning of a sentence or inserted into the sentence (whence *interjection—thrown in*) but not connected with the grammatical structure. Words such as oh, alas, and well (as an exclamation) are interjections.

Linking verb. A verb that expresses neither action nor condition, but merely establishes a connection between its subject and a noun, pronoun, or adjective in the predicate. A noun or pronoun following a linking verb is in the nominative case. The commonest linking verb is the verb *to be*. Other characteristic linking verbs are *become, appear, seem, smell* (in the sense of "possess an odor") *taste* (in the sense of "possess a flavor") and *feel* (as "experience a sensation.")

The seed *is* pure. The price *seems* right. The warmth *feels* good.

Modifier. A word is a modifier when it is used to limit or change the meaning of some other word, or of a phrase or clause. A phrase or a clause, as well as a word, can be a modifier.

WORD AS MODIFIER: His *slightly* embarrassed manner was amusing.

Slightly, an adverb modifies *embarrassed,* a participial adjective, which in turn modifies the noun *manner.*

PHRASES AND CLAUSES AS MODIFIERS: Construction *of the bridge* will be postponed *until the weather is warmer.*

Of the bridge, an adjective phrase, modifies *construction. Until . . warmer,* an adverb clause, modifies the verb, *will be postponed.*

Mood. The form, in a verb, that indicates how the action or condition expressed by the verb is conceived by the writer or speaker. In the statement of a fact or the asking of a question, the indicative mood is used. In giving a command, the imperative mood is used. In expressing doubt, wish, condition contrary to fact, etc. the subjunctive mood is used.

INDICATIVE: The rock *is* heavy. *Can* you *lift* it?
IMPERATIVE: *Examine* the surface carefully.
SUBJUNCTIVE: If I *were* you, I *should accept* the offer.
I wish he *were* not so young.

Nonrestrictive modifier. A modifier that merely gives information about the term modified rather than limiting or identifying it.

The roof, *which was very old,* was damaged by the wind.
His oldest son, *who was more experienced,* handled the case efficiently.

Noun. One of the parts of speech. A word used to name a person, place, thing, quality, etc.

John, Aristotle, engineer, Atlanta, wood, courage, etc.

Noun clause. A subordinate clause used, in a sentence, as if it were a noun.

I know *what you mean.*

Noun clause used as object of verb.

How he had escaped was a puzzling question.

Noun clause as subject of the verb *was.*

Object. The word, phrase, or clause identifying the person or thing that receives the action indicated by a transitive verb; the substantive referred to by a preposition.

DIRECT OBJECT OF A VERB: The company installed a *lathe.*
INDIRECT OBJECT OF A VERB: He offered *me* a bribe.

Bribe, the direct object, is the thing that was offered. *Me,* the indirect object, is the person to whom it was offered.

OBJECT OF PREPOSITION: He worked on a *farm.*

Farm is the object of *on.*

Participle. The form of a verb ending in *ing* or the form used after *have.* Participles can be used as adjectives.

A *barking* dog never bites. The *rejected* casting was returned to the factory.

Parts of speech. The classifications under which all words are classified. The eight parts of speech are nouns, pronouns, verbs, adjectives, adverbs, prepositions, conjunctions, and interjections. Each of these terms is defined in its proper alphabetical place in the present list of definitions.

A word qualifies as one or another part of speech only on the basis of its use in a sentence, and the same word may be used as more than one part of speech. Good usage, however, limits the permissible uses of most words. For example, it is possible to use *like* as a conjunction, but it is not good usage to do so. To determine whether it is correct to use a word as a certain part of speech, it is sometimes necessary to consult a dictionary.

Person. Some pronouns and all verbs vary in form to indicate whether they refer to the person speaking or writing (first person), the person addressed (second person), or the person spoken or written about (third person).

FIRST PERSON: *I am.* SECOND PERSON: *You are.* THIRD PERSON: *He is.*

Phrase. A group of related words which does not include a subject and predicate and is used as a single part of speech—adjective, adverb, verb, or noun. Phrases may be prepositional, participial, gerund, infinitive, or verb.

PREPOSITIONAL PHRASE: He discovered the address *of the owner.*

Adjective phrase, modifying the noun *address.*

PARTICIPIAL PHRASE: The fan *lying in the corner* is broken.
PARTICIPIAL PHRASES: *Entering the room,* I noticed that the fan *standing in the corner* was noisy.

Adjective phrases, modifying, respectively, *I* and *fan.*

GERUND PHRASE: *Pitching hay* is strenuous work. (noun)
INFINITIVE PHRASE: *To predict the results* is impossible. (noun)
VERB PHRASE: The method *has been found* successful.

Predicate. The portion of a clause consisting of the verb, its complements, and the modifiers of both. Except for interjections and absolute phrases, neither of which is frequent, the predicate consists of everything in the sentence except the subject.

Preposition. One of the parts of speech. A word used to introduce a noun or pronoun and establish its relationship to the sentence.

He will come *in* the morning *on* the plane *from* Chicago.

Principal parts. The three forms of a verb from which, by help of auxiliary verbs, the various tenses are mainly derived. These forms are the present infinitive, the past tense, and the past participle. (The past participle is the form used after *have.*)

PRESENT INFINITIVE	PAST TENSE	PAST PARTICIPLE
work	worked	worked
sing	sang	sung
begin	began	begun
catch	caught	caught

Pronoun. A word used in place of a noun. One of the parts of speech.

PERSONAL PRONOUNS: *I, you, he, she, it, they*
INTERROGATIVE PRONOUNS: *who, which, what*
RELATIVE PRONOUNS: *who, which, what*
DEMONSTRATIVE PRONOUNS: *this, that, these, those*
INDEFINITE PRONOUNS: *each, either, any, anyone, some, someone, one, no one, few, all, none,* etc.
RECIPROCAL PRONOUNS: *each other, one another*

REFLEXIVE PRONOUNS: *myself, yourself, himself,* etc.
INTENSIVE PRONOUNS: *myself, yourself, himself,* etc.

Relative clause. A clause, always dependent, introduced by a relative pronoun.

Restrictive modifier. A modifier that narrows, and thus restricts, the meaning of whatever it modifies.

All persons *who drive recklessly* should be arrested.
The cases *that were damaged* have been returned.

Sentence. A group of words expressing a complete thought and containing, either actually or by implication, a subject and a verb (predicate). A sentence may be simple, compound, complex, or compound-complex.

SIMPLE SENTENCE: The building is old.

A sentence may be simple even though the subject, the verb, or both are compound.

SIMPLE SENTENCE: Both industry and labor support the new ruling and condemn the old.

A compound sentence consists of two or more independent clauses.

COMPOUND SENTENCE: Sales were falling off, and inventories were increasing.

A complex sentence contains a single independent clause and one or more dependent clauses.

COMPLEX SENTENCE: The police recovered the property which had been lost.

A compound-complex sentence contains at least two independent clauses, hence being compound, and at least one dependent clause, hence being complex.

COMPOUND-COMPLEX SENTENCE: The wind was rising and the sky had clouded over when we finally reached the shelter.

Subject. The person or thing to or about which a verb makes an assertion, asks a question, or gives an order.

Substantive. A noun, or any word or group of words used as a noun. Any of the following, in addition to a noun, may be a substantive: pronoun, infinitive phrase, gerund, or noun clause. (See separate listing for each of these terms.)

Tense. The distinctive form in a verb that indicates time.

PRESENT TENSE: He reads
PAST TENSE: He has read
FUTURE TENSE: He will read
PRESENT PERFECT TENSE: He has read
PAST PERFECT TENSE: He had read
FUTURE PERFECT TENSE: He will have read

Tenses may be progressive or emphatic as well as the simple forms illustrated. Present progressive: I am reading etc. Present emphatic: I do read, etc.

Verb. A word or phrase that indicates action, being, or state of being. In a declarative sentence, the verb is the word or phrase that actually makes the assertion.

A transitive verb takes an object.

He *bought* the house.

An intransitive verb cannot take an object.

The sun *rises.*

Some verbs may be either transitive or intransitive.

TRANSITIVE: I *read* the letter. INTRANSITIVE: I *was reading.*

Verbal. A word or phrase derived from a verb but not making an assertion. Infinitives, gerunds, and participles (participles used in participial phrases or as adjectives) are the three types of verbals. Each is listed in its proper alphabetical location.

Voice. The form of a verb that shows whether the subject performs the action indicated (active voice) or has the action performed upon it (passive voice). Only transitive verbs can be in passive voice.

ACTIVE VOICE: The government *collected* the taxes.
PASSIVE VOICE: The taxes *were collected* by the government.

APPENDIX

APPENDIX

A.S.A. ABBREVIATIONS FOR SCIENTIFIC AND ENGINEERING TERMS [1]

In an effort to standardize abbreviations, the American Standards Association has designated a list that is now approved by the leading scientific and engineering societies. An introductory statement says: "These forms are recommended for readers whose familiarity with the terms used makes possible a maximum of abbreviations. For other classes of readers editors may wish to use less contracted combinations made up from this list. For example, the list gives the abbreviation of the term 'feet per second' as 'fps'. To some readers ft per sec will be more easily understood."

absolute	abs
acre	spell out
acre-foot	acre-ft
air horsepower	air hp
alternating current (as adjective)	a-c
ampere	amp
ampere-hour	amp-hr
amplitude, an elliptic function	am.
Angstrom unit	A
antilogarithm	antilog
atmosphere	atm
atomic weight	at. wt
average	avg
avoirdupois	advp
azimuth	az or *a*
barometer	bar.
barrel	bbl
Baumé	Bé
board feet (feet board measure)	fbm

[1] Extracted from American Standards Association, Abbreviations for Scientific and Engineering Terms (Z10.1–1941), with permission of The American Society of Mechanical Engineers.

boiler pressure	spell out
boiling point	bp
brake horsepower	bhp
brake horsepower-hour	bhp-hr
Brinell hardness number	Bhn
British thermal unit	Btu or B
bushel	bu
calorie	cal
candle	c
candle-hour	c-hr
candlepower	cp
cent	c or ¢
center to center	c to c
centigram	cg
centiliter	cl
centimeter	cm
centimeter-gram-second (system)	cgs
chemical	chem
chemically pure	cp
circular	cir
circular mils	cir mils
coefficient	coef
cologarithm	colog
concentrate	conc
conductivity	cond
constant	const
continental horsepower	cont hp
cord	cd
cosecant	csc
cosine	cos
cosine of the amplitude, an elliptic function	cn
cost, insurance, and freight	cif
cotangent	cot
coulomb	spell out
counter electromotive force	cemf
cubic	cu
cubic centimeter (liquid, meaning milliliter, ml)	cu cm, cm^3
cubic feet per minute	cfm
cubic feet per second	cfs
cubic foot	cu ft
cubic inch	cu in.

cubic meter	cu m or m^3
cubic micron	cu_μ or cu mu or μ^3
cubic millimeter	cu mm or mm^3
cubic yard	cu yd
current density	spell out
cycles per second	spell out or c
cylinder	cyl

day	spell out
decibel	db
degree	deg or °
degree centigrade	C
degree Fahrenheit	F
degree Kelvin	K
degree Réaumur	R
delta amplitude, an elliptic function	dn
diameter	diam
direct-current (as adjective)	d-c
dollar	$
dozen	doz
dram	dr

efficiency	eff
electric	elec
electromotive force	emf
elevation	el
equation	eq
external	ext

farad	spell out or f
feet board measure (board feet)	fbm
feet per minute	fpm
feet per second	fps
fluid	fl
foot	ft
foot-candle	ft-c
foot-Lambert	ft-L
foot-pound	ft-lb
foot-pound-second (system)	fps

foot-second (see cubic feet per second)	
franc	fr
free aboard ship	spell out
free alongside ship	spell out
free on board	fob
freezing point	fp
frequency	spell out
fusion point	fnp

gallon	gal
gallons per minute	gpm
gallons per second	gps
grain	spell out
gram	g
gram-calorie	g-cal
greatest common divisor	gcd

haversine	hav
hectare	ha
henry	h
high-pressure (adjective)	h-p
hogshead	hhd
horsepower	hp
horsepower-hour	hp-hr
hour	hr
hour (in astronomical tables)	h
hundred	C
hundredweight (112 lb)	cwt
hyperbolic cosine	cosh
hyperbolic sine	sinh
hyperbolic tangent	tanh

inch	in.
inch-pound	in-lb
inches per second	ips
indicated horsepower	ihp
indicated horsepower-hour	iph-hr
inside diameter	ID
intermediate-pressure (adjective)	i-p
internal	int

joule	j

kilocalorie	kcal
kilocycles per second	kc
kilogram	kg
kilogram-calorie	kg-cal
kilogram-meter	kg-m
kilograms per cubic meter	kg per cu m or kg/m^3
kilograms per second	kgps
kiloliter	kl
kilometer	km
kilometers per second	kmps
kilovolt	kv
kilovolt-ampere	kva
kilowatt	kw
kilowatthour	kwhr

Lambert	L
latitude	lat or φ
least common multiple	lcm
linear foot	lin ft
liquid	liq
lira	spell out
liter	l
logarithm (common)	log
logarithm (natural)	$\log_e$ or ln
longitude	long. or λ
low-pressure (as adjective)	l-p
lumen	l
lumen-hour	l-hour
lumens per watt	lpw

mass	spell out
mathematics (ical)	math
maximum	max
mean effective pressure	mep
mean horizontal candle-power	mhcp
megacycle	spell out
megohm	spell out

melting point	mp
meter	m
meter-kilogram	m-kg
mho	spell out
microampere	μa or mu a
microfarad	μf
microinch	μin.
micromicrofarad	μμf
micromicron	μμ or mu mu
micron	μ or mu
microvolt	μv
microwatt	μw or mu w
mile	spell out
miles per hour	mph
miles per hour per second	mphps
milliampere	ma
milligram	mg
millihenry	mh
millilambert	mL
milliliter	ml
millimeter	mm
millimicron	mμ or m mu
million	spell out
million gallons per day	mgd
millivolt	mv
minimum	min
minute	min
minute (angular measure)	′
minute (time) (in astronomical tables)	m
mole	spell out
molecular weight	mol. wt
month	spell out

National Electrical Code	NEC

ohm	spell out or Ω
ohm-centimeter	ohm-cm
ounce	oz
ounce-foot	oz-ft
ounce-inch	oz-in
outside diameter	OD

parts per million	ppm
peck	pk
penny (pence)	d
pennyweight	dwt
peso	spell out
pint	pt
potential	spell out
potential difference	spell out
pound	lb
pound-foot	lb-ft
pound-inch	lb-in
pound sterling	£
pounds per brake horse-power-hour	lb per bhp-hr
pounds per cubic foot	lb per cu ft
pounds per square foot	psf
pounds per square inch	psi
pounds per square inch absolute	psia
power factor	spell out or pf
quart	qt
radian	spell out
reactive kilovolt-ampere	kvar
reactive volt-ampere	var
revolutions per minute	rpm
revolutions per second	rps
rod	spell out
root mean square	rms
secant	sec
second	sec
second (angular)	″
second-foot (see cubic feet per second)	
second (time) (in astronomical tables)	s
shaft horsepower	shp
shilling	s
sine	sin
sine of the amplitude, an elliptic function	sn

specific gravity	sp gr
specific heat	sp ht
spherical candle power	scp
square	sq
square centimeter	sq cm or cm^2
square foot	sq ft
square inch	sq in.
square kilometer	sq km or km^2
square meter	sq m or m^2
square micron	sqμ or sq mu or μ^2
square millimeter	sq mm or mm^2
square root of mean square	rms
standard	std
stere	s

tangent	tan
temperature	temp
tensile strength	ts
thousand	M
thousand foot-pounds	kip-ft
thousand pound	kip
ton	spell out
ton-mile	spell out

versed sine	vers
volt	v
volt-ampere	va
volt-coulomb	spell out
watt	w
watthour	whr
watts per candle	wpc
week	spell out
weight	wt

yard	yd
year	yr

HELPFUL PUBLICATIONS FOR TECHNICAL WRITERS

Technical Writing and Reports

American Chemical Society, *Hints to Authors* (Bulletin 8). Washington, D.C., 1949.

American Institute of Electrical Engineers, *Information for Authors.* New York, 1948.

American Society of Mechanical Engineers, *Style Manual for Engineering Authors and Editors.* New York, 1939.

American Standards Association, *Abbreviations for Scientific and Engineering Terms* (Z10.1–1941). New York, 1941.

———, *Abbreviations for Use on Drawings* (32.13-1950). New York, 1950.

———, *Style Manual for American Standards* (PM 117). New York, 1949.

Brinton, Willard Cope, *Graphic Presentation.* New York: Brinton Associates, 1939.

Crouch, George W., and Robert L. Zetler, *A Guide to Technical Writing.* New York: Ronald Press Co., 1948.

Gaum, Carl G., Harold F. Graves, and Lyne S. S. Hoffman, *Report Writing,* 3rd ed. New York: Prentice-Hall, Inc., 1950.

Harbarger, Sada A., *et al., English for Engineers,* 4th ed. New York: McGraw-Hill Book Co., 1943.

Jones, W. Paul, *Writing Scientific Papers and Reports,* 2nd ed. Dubuque, Iowa: Wm. C. Brown Company, 1949.

Jordan, Richard C., and Marion J. Edwards, *Aids to Technical Writing.* Minneapolis: University of Minnesota Engineering Experiment Station, 1944.

Kerekes, Frank, and Robley Winfrey, *Report Preparation,* 2nd ed. Ames, Iowa: Iowa State College Press, 1951.

Mills, Gordon H., and John A. Walter, *Technical Writing.* New York: Rinehart and Company, Inc., 1954.

Modley, Rudolf, *How to Use Pictorial Statistics.* New York: Harper and Brothers, 1937.

Nelson, J. Raleigh, *Writing the Technical Report,* 3rd ed. New York: McGraw-Hill Book Co., 1952.

Oliver, Leslie M., *Technical Exposition.* New York: McGraw-Hill Book Co., 1940.

Rhodes, Fred H., *Technical Report Writing.* New York: McGraw-Hill Book Co., 1941.

Sypherd, W. O., Alvin M. Fountain, and Sharon Brown, *The Engineer's Manual of English*, rev. ed. Chicago: Scott, Foresman and Company, 1943.

Thomas, J. D., *Composition for Technical Students*. New York: Charles Scribner's Sons, 1949.

Ulman, Joseph N., Jr., *Technical Reporting*. New York: Henry Holt and Company, 1952.

Business Correspondence

Aurner, Robert Ray, *Effective English in Business*. Cincinnati: Southwestern Publishing Company, 1949.

Hotchkiss, George B. and E. J. Kilduff, *Advanced Business Correspondence*, 4th ed. New York: Harper and Brothers, 1947.

Frailey, Lester F., *Handbook of Business Letters*. New York: Prentice-Hall, Inc., 1948.

Parkhurst, Charles Chandler, *Babenroth's Modern Business Communication*. New York: Prentice-Hall, Inc., 1955.

Smart, Walter K. and Louis W. McKelvey, *Business Letters,* 3rd ed. New York: Harper and Brothers, 1950.

General English

Dean, Howard H., *Effective Communication*. New York, Prentice-Hall, Inc., 1953.

Leonard, Sterling A., *Current English Usage*. Chicago: The Inland Press (Published for the National Council of Teachers of English), 1932.

Leggett, Glenn, C. David Mead, and William Charvat, *Handbook for Writers*. New York: Prentice-Hall, Inc., 1951.

Perrin, Porter G., *Writer's Guide and Index to English,* 2nd ed. Chicago: Scott, Foresman and Company, 1950.

University of Chicago Press, *A Manual of Style,* Chicago, 1949.

U. S. Government Printing Office Style Manual. Washington, D.C., 1939.

Indexes

The Agricultural Index
The Art Index
Bibliography of Scientific and Industrial Reports
The Engineering Index
The Industrial Arts Index
International Index to Periodicals

The New York Times Index
Readers' Guide to Periodical Literature

Sources of General or Special Information

The Census Volumes (Department of Commerce, Bureau of Census)
- Agriculture
- Construction Industry
- Drainage of Agricultural Lands
- Irrigation of Agricultural Lands
- Manufacturers
- Retail Distributors
- Unemployment
- Wholesale Distribution

Encyclopedia Americana (1950)
Encyclopædia Britannica (1947)
Minerals Yearbook (Department of the Interior, Bureau of Mines)
The Statesman's Yearbook
Van Nostrand's Scientific Encyclopedia
U. S. Government Publications Monthly Catalog
The World Almanac

Index

A

Abbreviation:
  A.S.A., for scientific and engineering terms, 405-12
  letters, use in, 271-72
  rules for, 379-80
  technical style, use in, 39
    rules for, 40-41
Abstracts, 76-78
  accuracy, importance, 78
  example and assignment, 86-87
  formal reports, 200
  importance, 76
  specimen, 78
  uses, 76
  writing, 76-77
Accuracy, letters, 274
Acknowledgment of source, figures, 95
Action urged in letters, 314-18
Additional pages, letters, 271
Adjectives, 351-54
  agreement with its object, 350
Adjustment, letter:
  granting, 308-309, 310
  refusal to grant, 307-308, 309-10
Adverbs, 351-54
Agreement, rules, 346-51
  demonstrative adjective with its object, 350
  pronouns with antecedent, 348-50, 359-61
  verb with its subject, 346-48
American Standards Association, abbreviations for scientific and engineering terms, 405-12
Apostrophe, 374-75
Appearance, letters, 273
Appendixes, formal reports, 205-206
Application letters, 327-39
  answering all questions, 335
  assignment, 335-39
  central section, 328-29
    education, 328
    experience, 328-29
    personal information, 329
    references, 329
  contents, 327-31
  data sheet, use, 331-32
  ending, 329-31
  excessive use of "I," 334
  neatness, 332
  objectivity, 333
  opening, 327-28
  organization, 327-31
  position applied for, analyzing, 332-33
  salary expected, discussion, 334
  specimen letters, 335, 336-38
  tone, 333-34
  "you attitude," 333
Articles, technical, 78-83
  adapting to periodical, 81-82
  example and assignment, 87
  subjects, choice, 79-81
  writing, 82-83
Attention line, letters, 266-67

B

Bar charts, 96-98
Bias, freedom from, reports, 129-30
Bibliography:
  footnotes plus, 50
  formal reports, 206-207
Binding, formal reports, 207-208
Blank form, reports, 140
  exercise, 148-49

Body of the report, formal, 203-204
Brackets, 375

C

Capitalization, 376-78
  letters, use in, 272
Charts:
  bar, 96-98
  organization, 102, 104
  "Pie," 102, 103
Classification, outline, 14
Clearness, reports, 131
Coherence in the sentence, 357-64
  comparisons, 362-63
  connectives, 359
  gerunds, 363-64
  infinitives, dangling, 364
  modifiers, 361-62
  mood, 363
  parallel form, 357-58
  participles, dangling, 363-64
  pronoun agreement with antecedent, 348-50, 359-61
  tense, 363
Collection letters, 310-14
Colon, 371
Comma, 366-69
Comma splice, sentences, 356-57
Comparisons, sentence coherence, 362-63
Complaints, letters, 304-306
  answers to, 306-10
Complimentary close, letters, 260, 269
Conciseness, 24-28
  details, trivial, avoidance, 25-26
  looseness of style, avoidance, 27-28
  phrases, wordy, avoidance, 26
  repetition, avoidance, 25
  reports, 131
  structure, complicated, avoidance, 26-27
  words, specific, use, 27
Conclusions, formal reports, 204-205
Connectives, sentence coherence, 359
Contents:
  application letters, 327-31
  table of, formal reports, 193-99
    visual materials in, listing, 198-99
Correctness, letters, 273-74
Correspondence, *see* Letters
Curves, 98-101

D

Dash, 372
Data sheet, use, letter of application, 331-32
Definitions, 55-63
  examples and assignments, 83-84, 85
  expanded, 57-59
  point of view in, 59-61
  sentence, 55-57
  suggestions, general, 61-63
Description, technical, 69-75
  adaptation to reader and occasion, 74
  conclusion, 74
  example and assignment, 70-71, 86
  functional parts, 73-74
  object as a whole, 71-73
  suggestions, general, 74-75
Details, trivial, avoidance, 25-26
Diagrams, 105-107
Documentation, 42-50
  footnotes, 43-45
    bibliography plus, 50
    forms for, 45-47
  references:
    alphabetical list, 47-48
    numbered list, 48-49
Drawings, 105-107
Drucker, Peter, 3

E

Education, letter of application, 328
Enclosures, letter, 270-71
Errors, outline, checking for, 12-13
Exclamation mark, 371
Engineering terms, A.S.A. abbreviations for, 405-12
  flow sheets, 102-104, 105
  diagrams, 105-107
  drawing, 94
  drawings, 105-107
Expanded definition, 57-59
Experience, letter of application, 328-29

F

Figures, 93-107
bar charts, 96-98
curves, 98-101
formal reports, 205-206
graphs, 98-101
lettering on, 95
listing in table of contents, formal reports, 198-99
organization charts, 102, 104
photographs, 104-105, 106
mounting, 95
"Pie" diagram, 102, 103
placement in text, 94
preparation for printing, 95
reference to, 94
reports, planning use in, 122
self-sufficiency, 94-95
sidewise, 95
source of, acknowledgment, 95
use of, suggestions for, 93-96
Flow sheets, 102-104, 105
Footnotes, 43-45
bibliography plus, 50
forms for, 45-47
Formality, reports, 132-33
Formal reports, 187-255
appendixes, 205-206
assignments, 254-55
bibliography, 206-207
binding, 207-208
body, 203-204
comment on, 210
component parts, 188-209
conclusions, 204-205
contents, table, 193-99
visual materials in, listing, 198-99
definition, 187
examples, 211-33, 234-53
introduction, 200-203
letter of transmittal, 191-93
manuscript form, 207
recommendations, 204-205
specimen page, 208-209
summary or abstract, 200
title page, 189-91
uses, 187-88
visual materials, 205-206
Form letters, 318-20
Fragment treated as sentence, 355-56

G

Gerunds, sentence coherence, 363-64
Good will in business letters, 282-83
Grammar:
abbreviation, 379-80
adjectives, 351-54
demonstrative, agreement with its object, 350
adverbs, 351-54
agreement, 346-51
demonstrative adjective with its object, 350
pronouns with antecedent, 348-50, 359-61
verb with its subject, 346-48
capitalization, 376-78
complicated structure, avoidance, 26-27
correctness in, 343-54
nouns, case, 343-46
pronouns:
agreement with antecedent, 348-50
case, 343-46
punctuation, 365-75
sentence structure:
coherence in, 357-64
unity in, 354-57
terms, explanation, 394-402
usage, glossary, 386-94
verbs, agreement with subject, 346-48
Graphs, 98-101
bar, 96-98
"Pie," 102, 103

H

Heading, letter, 259, 262
Hyphenation, 41-42

I

Illustrations, *see* Figures
Impersonality, reports, 132-33
Indentation, letters, 261-62
Infinitives, dangling, sentence coherence, 364
Inquiries, letters, 298-301
answers to, 301-304
Inside address, letter, 259, 265-66

Instructions, letters giving, 296-98
Interest, reports, 128
Introduction, formal reports, 200-203
Invitations, 293-95
Italics, 378-79

L

Laboratory reports, 144-46
  examples, 168-73, 174-79
Language:
  letters, on, 277-78
  phraseology, hackneyed, avoidance, 29
  pompous, avoidance, 28
  simplicity and concreteness, 28-30
  vagueness, avoidance, 29-30
  vocabulary, needlessly technical, avoidance, 28-29
Legend, figures, 94
  spacing, 94
Lettering, figures, 95
Letters, business, 259-92, 293-325, 327-39
  abbreviation, use, 271-72
  accuracy in, 274
  action urged by, 314-18
  adjustment:
    granting, 308-309, 310
    refusal to grant, 307-308, 309-10
  appearance, standards, 273
  application, 327-39
    answering all questions, 335
    assignment, 335-39
    central section, 328-29
    contents, 327-31
    data sheet, use, 331-32
    ending, 329-31
    excessive use of "I," 334
    neatness, 332
    objectivity, 333
    opening, 327-28
    organization, 327-31
    position applied for, analyzing, 332-33
    salary expected, discussion, 334
    specimen letters, 335, 336-38
    tone, 333-34
    "you attitude," 333
  beginnings of, 283-85
  capitalization, use, 272
  collection, 310-14
  complaints, 304-306
    answers to, 306-10
  correct form in, 259-72
  correctness, 273-74
  endings of, 285-86
  exercises, 287-92
  form, 318-20
  good will in, 282-83
  indentation, 261-62
  inquiries, 298-301
    answers to, 301-304
  instructional, 296-98
  invitations, 293-95
  language in, 277-78
  material in, arrangement, 276-77
  mechanical details, 260-61
  numbers, use of figures or words for, 272
  paragraphs in, 278-79
  parts:
    additional pages, 271
    attention line, 266-67
    complimentary close, 260, 269
    enclosures, 270-71
    form for, 262-71
    heading, 259, 262
    identification, 259-60
    inside address, 259, 265-66
    postscripts, 270-71
    salutation, 260, 267-69
    signature, 260, 269-70
    stenographic references, 270-71
    subject line, 267
  placement on the page, 260-61
  planning before writing, need for, 275
  punctuation, 261-62
  reports in form of, 141
    exercise, 150-51
  sentences in, 279
  spacing within, 261
  special types, 293-325
    assignments, 320-25
  stationery, 260
  substance, 273-87
  tone, 279-81
  transmittal, formal reports, 191-93
  unity in, 274-75
  "you attitude" in, 281
Looseness of style, 27-28
Lowell, James Russell, 9

M

Manuscript form, 35-36
  formal reports, 207
Mechanics, 35-54
  documentation, 42-50
  exercises, 50-54
  footnotes, 43-45
    bibliography plus, 50
    forms for, 45-47
  hyphenation, 41-42
  manuscript form, 35-36
  references:
    alphabetical list, 47-48
    numbered list, 48-49
  technical style, 36-41
    abbreviations in, use, 39-41
    numbers in, 37-38
Memoranda, reports in form of, 142
  exercises, 152-55, 156-59
Modifiers, sentence coherence, 361-62
Mood, sentence coherence, 363

N

Neatness:
  application letter, 332
  reports, 127-28
Nonformal reports, 139-86
  blank form, 140
  examples, 147-79
  exercises and assignments, 180-86
  laboratory, 144-46
  letters, in form of, 141
  memoranda, in form of, 142
  periodic, 142-43
  progress, 143-44
  unclassified, 146-47
Nouns, case, 343-46
Numbers:
  figures, 93-94
  letters, use in, 272
  ordinary style, use in, 37
  technical style, use in, 37-38

O

Objectivity:
  application letter, 333
  reports, 130
Organization:
  application letters, 327-31
  effective, 9-20
Organization charts, 102, 104
Outline, 9-20
  classification, 14
  clearness in, 16-17
  errors, checking for, 12-13
  exercises, 17-20
  extremes, undesirable, avoidance, 13
  final check, 17
  parallel development, 14-15
    lack of, 15
  preparation, 11-12
  report, making detailed, 119-22
  requirements, 10-11
  sentence, 16
  space, allotment of, logical, 16
  topic, 16

P

Papers, technical, 78-83
  adapting to periodical, 81-82
  example and assignment, 87
  subjects, choice, 79-81
  writing, 82-83
Paragraphs, letters, 278-79
Parallel development, outline, 14-15
  lack of, 15
Parallel form, sentence structure, 357-58
Participles, dangling, sentence coherence, 363-64
Parts of the letter:
  additional pages, 271
  attention line, 266-67
  complimentary close, 260, 269
  enclosures, 270-71
  form for, 262-71
  heading, 259, 262
  identification, 259-60
  inside address, 259, 265-66
  postscripts, 270-71
  salutation, 260, 267-69
  signature, 260, 269-70
  stenographic references, 270-71
  subject line, 267
Parentheses, 375
Period, 365-66
Periodic reports, 142-43
  examples, 160-63
Personal information, letter of application, 329

Photographs, 104-105, 106
  mounting, 95
Phrases:
  hackneyed, avoidance, 29
  wordy, avoidance, 26
"Pie" diagram, 102, 103
Placement, letter on the page, 260-61
Pompous language, avoidance, 28
Postscripts, letters, 270-71
Process, explanation, 63-69
  conclusion, 67
  examples and assignments, 67-69, 84-85
  introduction, 64
  over-all picture, 64-65
  successive steps, 65-67
Progress reports, 143-44
  example, 164-67
Pronouns:
  agreement with antecedent, 348-50, 359-61
  case, 343-46
Punctuation, 365-75
  apostrophe, 374-75
  brackets, 375
  colon, 371
  comma, 366-69
  dash, 372
  exclamation mark, 371
  letters, 261-62
  parentheses, 375
  period, 365-66
  question mark, 371
  quotation marks, 372-73
    relation to other punctuation, 373-74
  semicolon, 370

Q

Question mark, 371
Quotation marks, 372-73
  relation to other punctuation, 373-74

R

Recommendations, formal reports, 204-205
References:
  alphabetical list, 47-48
  figures, 94
  numbered list, 48-49
  personal, letter of application, 329
  stenographic, letters, 270-71
Repetition, avoidance, 25
Reports, 111-37, 139-86, 187-255
  defined, 111
  formal, 187-255
    appendixes, 205-206
    assignments, 254-55
    bibliography, 206-207
    binding, 207-208
    body, 203-204
    comment on, 210
    component parts, 188-209
    conclusions, 204-205
    contents, table, 193-99
    definition, 187
    examples, 211-33, 234-53
    introduction, 200-203
    letter of transmittal, 191-93
    manuscript form, 207
    recommendations, 204-205
    specimen page, 208-209
    summary or abstract, 200
    title page, 189-91
    uses, 187-88
    visual materials, 205-206
  nonformal, 139-86
    blank form, 140
    examples, 147-79
    exercises and assignments, 180-86
    laboratory, 144-46
    letters, 141
    memoranda, 142
    periodic, 142-43
    progress, 143-44
    unclassified, 146-47
  persons who may write, 112-13
  professional and school, difference between, 113-14
  purpose, 113
  writing, procedure in, 114-34
    bias, freedom from, 129-30
    clearness, 131
    conciseness, 131
    exercises, 134-37
    figures, use of, planning, 122
    final details, caring for, 126-27
    final form, revision into, 125-26
    first draft, 122-25
    formality, 132-33

impersonality, 132-33
information for:
analysis, 119
sources, 116-19
interest, 128
neatness, 127-28
objectivity, 130
organizing, plan for, 116
outline, making detailed, 119-22
problem, analyzing, 115-16
restraint, 131-32
self-sufficiency, 133-34
tables, use of, planning, 122
unnecessary material, omission, 129
Restraint, reports, 131-32

S

Salutation, letters, 260, 267-69
Scientific terms, A.S.A. abbreviations for, 405-12
Self-sufficiency, reports, 133-34
Semicolon, 370
Sentence definition, 55-57
Sentence outline, 16
Sentences:
coherence in, 357-64
comparisons, 362-63
connectives, 359
gerunds, 363-64
infinitives, dangling, 364
modifiers, 361-62
mood, 363
parallel form, 357-58
participles, dangling, 363-64
pronoun agreement with antecedent, 348-50, 359-61
tense, 363
comma splice, 356-57
fragment treated as, 355-56
length, 22-24
excessive, avoidance, 22-23
primer style, avoidance, 23-24
letters, in, 279
structure, directness in, 24
unity in, 354-57
Signature, letters, 260, 269-70
Sources:
acknowledgment, figures, 95
information for report, 116-19
Spacing:
letter, within, 261
outline, allotment, 16
title and legend, figures, 94
Spelling, 380-85
list, miscellaneous, 384-85
pairs of words easily confused, 383-84
rules for, 381-83
words misspelled because of pronunciation, 384
Stationery, business letter, 260
Stenographic references, letters, 270-71
Style, 21-33
conciseness, 24-28
details, trivial, avoidance, 25-26
looseness, 27-28
phrases, wordy, avoidance, 26
repetition, avoidance, 25
structure, complicated, avoidance, 26-27
words, specific, use, 27
exercises, 30-33
language, simplicity and concreteness, 28-30
phraseology, hackneyed, avoidance, 29
pompous, avoidance, 28
vagueness, avoidance, 29-30
vocabulary, needlessly technical, avoidance, 28-29
numbers in, use, 37
sentence length, 22-24
excessive, avoidance, 22-23
primer style, avoidance, 23-24
sentence structure, directness in, 24
technical, 36-41
abbreviations in, use, 39-41
numbers in, 37-38
Subject line, letters, 267
Summary, *see* Abstract

T

Table of contents, formal reports, 193-99
visual materials in, listing, 198-99
Tables, 89-93
formal reports, 205-206
listing in table of contents, formal reports, 198-99

reports, planning use in, 122
specimen, 90, 91
use of, suggestions for, 90-93
Technical articles and papers, 78-83
adapting to periodical, 81-82
example and assignment, 87
subjects, choice, 79-81
writing, 82-83
Technical description, 69-75
adaptation to reader and occasion, 74
conclusion, 74
example and assignment, 70-71, 86
functional parts, 73-74
object as a whole, 71-73
suggestions, general, 74-75
Technical style, 36-41
abbreviations in, use, 39
rules for, 40-41
numbers in, 37
Tense, sentence coherence, 363
Title page, formal reports, 189-91
Titles, figures, 93-94
spacing, 94
Tone:
application letter, 333-34
business letters, 279-81
Topic outline, 16
Transmittal, letter of, formal reports, 191-93
Trivial details, avoidance, 25-26

U

Unclassified reports, 146-47
Unity:
business letters, 274-75
sentence, 354-57
Unnecessary material, omission, reports, 129
Usage, glossary, 385-94

V

Vagueness, avoidance, 29-30
Verbs, agreement with subject, 346-48
Visual materials, *see* Figures; Tables
Vocabulary, technical, avoidance of needlessly, 28-29

W

Words, specific, use, 27
Wordy phrases, avoidance, 26