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# THE PRINCIPLES OF MACHINE ACCOUNTING

# THE PRINCIPLES OF MACHINE ACCOUNTING

BY

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**An important development emerging from the proper use of machines is the magnitude of the ground which can be covered by reason of the speed and accuracy with which figures can be handled.**

**This practical work gives the reader a full understanding of machine application and of the adaptability of machine and method. This knowledge will enable him to advise his clients or his board of directors on the original installation of a mechanized system and on subsequent alterations arising from changing conditions. The book is divided into three portions (1) The actual accounting, (2) Analysis methods to suit varying conditions, and (3) The application of analysis methods and the machine recording of the results obtained when applied to costing.**

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# PREFACE

THE subject matter of this book has been presented in lecture form to the commercial students at Edinburgh University, the Heriot-Watt College, Edinburgh, and to the students of the Society of Accountants in Edinburgh and similar associations. It is therefore for the use of accountants that this book is primarily intended.

There is evidence that the increasing use of book-keeping machines has tended to cause a certain uneasiness among the more progressive members of the accounting profession. There is a suggestion of frustration when otherwise fully qualified accountants are faced with conditions which apply directly to their profession yet of which they have in many cases only a vague and sometimes inaccurate knowledge. The opportunities available for their enlightenment—the sales literature of the various machine manufacturers and the occasional visit to an exhibition —give no more satisfaction than a driving lesson would afford to a student of the internal combustion engine. The current literature on machine accounting too often demonstrates its impartiality as between one type of machine and another by attempting to deal with several makes to the confusion of the reader, while ignoring to his chagrin the basic accounting principles involved.

It would seem, therefore, that there is a need for a book which would set forth, not the operation or the features of particular makes of machines, for these may be superseded by the next model off the production line, but the accounting principles which underlie such operations and machine features. These principles cannot change while two and two make four.

The object of this book is to give the reader a greater understanding of machine application and of the adaptability of machine and method so that he may be able to advise his clients or his board of directors not only on the original installation of a mechanized system but on subsequent alterations arising from changing conditions.

The work has been treated in three portions:—

(1) The actual accounting, showing the more common methods of proof, their advantages and disadvantages with suggestions regarding the conditions most suitable to each method.
(2) Analysis methods to suit varying conditions.
(3) The application of analysis methods and the machine recording of the results obtained when applied to costing.

One important development emerging from the proper use of machines is the magnitude of the ground which can be covered by reason of the speed and accuracy with which figures can be handled. Thus the field of proof can be extended to include matters which, owing to the sheer volume of the figure work involved, had hitherto been left to chance or at best been made secure at a relatively high cost for labour in checking. The failure of the trial balance to disclose errors of posting to the wrong account may be quoted as an example. Under hand methods this weakness was accepted as unavoidable. Chapter VIII shows three methods of dealing with this difficulty. These are not the only methods but they serve to indicate the principle upon which the proof is based.

Again in the matter of analysis—the keynote of all accountancy—the machine has widened the field considerably. The columnar analysis book, so common under hand operation, is generally superseded even in very simple machine applications by one or more of the five basic methods discussed in Chapter XI.

In conclusion may I take the opportunity to express my gratitude and thanks to those who assisted in the preparation of this book by typing the manuscript and reading the proofs. I should also like to acknowledge my special indebtedness to Mr. T. Hunter Thomson, C.A., for the help, encouragement and advice which he so willingly gave.

J.C.L.

Edinburgh,
April, 1947.

CONTENTS

CHAPTER I

# THE PRINCIPLE OF PROOF

IRRESPECTIVE of whether a book-keeping system is operated by hand or by machine, the basic principle is always the same—every entry must be made twice to ensure accuracy.

In recognition of this principle, business transactions are recorded in two ways :—

(1) In the order in which events happen, i.e., chronologically in the Day Book.

(2) In the analysed or classified form in the Ledger.

The very names of these books give an indication of the character of the records which they contain. Thus, the chronological record is called the Day Book, implying order of time, while the classified record is called the Ledger, which word is reputed to be derived from the old Dutch word " Ligger," meaning position.

Neither of these records can be said to be more important than the other as far as proof goes, yet there is a growing tendency to regard the chronological record or Day Book as of less importance than the Ledger. In ensuring proof of accuracy, each record is as important as the other, since each should prove the accuracy of the other.

Owing to faulty design, however, it is not always the case that each record proves the accuracy of the other, and many book-keeping systems work on what might be called "chain progression," i.e., the information is copied from the original document (say the customer's order) to the Day Book, thence to the Ledger, from which the Statement of Account is finally copied.

It will be seen that, in such circumstances, if at any time the copying of the information should be faulty, the error would be carried forward from that point through all subsequent records. To eliminate as far as possible such errors of transcription is a simple matter of design in system. The aim should be to produce the two records—the chronological and the classified—from the original document. In addition to this, the preparation of both records should be as remote from each other as is possible. The final results of the two recordings should be compared.

As an illustration of this double record and the necessity for independent production, the practice common among accountants of adding

a column of figures in one direction and checking it in the other, may be cited. A further illustration of this point is the practice of checking a multiplication sum by reversing the multiplier and the multiplicand, or better still by dividing the product by the multiplier and obtaining the multiplicand as a result. One further method of proof which might here be mentioned is that of the schoolboy who compares the result of his multiplication sum with that obtained by a colleague. Agreement of results in such a case would also prove that each boy had done the correct sum. This last method illustrates the greatest independence in the production of the two records and is in principle the system generally adopted by banks which employ mechanical methods.

Reverting to the practice of adding a column of figures one way and reversing the order for checking purposes, a further development of this principle might here be mentioned. In order to secure greater independence of the double operation, it is better (contrary to the usual practice) to make the original summation downwards and the check summation upwards, for the following reason. In the checking operation, the eye will be at the top of the page when the final total of each column is being computed. Thus the decision has been made before the eye has had time to rest on the original computation, and the mind cannot therefore be misled by any suggestive influence which a wrong original summation might have.

From these simple illustrations, the following accounting principle may be drawn :—

*Where two results agree, both having been obtained by independent processes and having been derived from a common source, there is an assumption that the results are accurate.*

In other words, it is accepted by accountancy that the same mistake will not be made twice. The more independent the two computations can be made, the stronger becomes this assumption of accuracy.

The principle stated above is the basis of all accounting proof and will, throughout this book, be referred to as the "Principle of Proof."

This Principle of Proof applies as much to machine accounting as to hand methods ; there are, however, considerable variations between the two styles of accountancy in the methods of obtaining such proof. While all forms of proof must conform to the principle laid down, the benefits to be derived vary with the different applications and the machine features available.

These benefits may be stated under three main headings :—

(1) *Eliminating the human element.* The more advanced forms of proof afford fewer opportunities for error than others by transferring to the machine certain responsibilities previously carried by the operator.

(2) *Facilitating the discovery of such errors as cannot be eliminated by* (1). The extent to which errors are localized varies with the different forms of proof.

(3) *Increasing the speed of operation* either by permitting the omission of certain motions or by facilitating the physical handling of the machine or documents.

In the Chapters which follow, different forms of proof and certain machine features will be considered and the advantages examined.

CHAPTER II

## HAND *v.* MACHINE RECORDS

In many machine accounting systems, the Day Book consists of nothing more than copies of the invoices bound together. Such documents provide all the information necessary except the grand total of the documents. This figure is obtained by preparing on the machine a list of the amounts together with their aggregate. This list is called the "prelist," a term which is peculiar to machine accounting. The prelist provides the provisional total of the amount to be posted to the Ledger in respect of any particular batch of posting media. Once the prelist has been prepared, the entries are made in the Ledger, not from the prelist, but from the original documents from which the prelist was compiled. On completion of the posting operation, a "prooflist" is prepared. This is a list of the entries made in the Ledger in the course of the particular posting run under review, and if the work has been accurately executed the total thus obtained should confirm the total of the prelist.

In a comparison of hand and machine methods of posting it should be noted that with the former it is usual to post all the entries for a month before obtaining proof of their accuracy, whereas with the latter, each batch of postings (or posting run) is proved immediately on its conclusion.[1]

A further variation between hand and machine systems will be found in the form in which the accounts are kept. In hand book-keeping, the debit entries are made in order of date on one side of the Ledger and the credit entries are made in order of date on the other, the entries on both sides commencing each balancing period on the same line. At the end of the period, the two sides of each account are added and the balance struck. In machine work, all entries, whether debit or credit, usually follow one another in order of date and the balance of the account is struck after each entry.[2] The daily balance of each account is obtained by adding the amount of the current day's posting to the balance as it stood on the completion of the previous entry. This is called a Progressive Balance or Total-to-date. An example of a Progressive Balance is found in the records of an employee's weekly earnings which must now be kept for P.A.Y.E. purposes. In machine accounting, the previous

1 But see Line Proof, page 47, which is an exception.

2 Vertical or Straight Line Posting is an exception. See page 51.

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A

| Dr. | | | | | £ | s. | d. | | | | | | £ | s. | d. | Cr. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 19... | | | | | | | | 19... | | | | | | | | |
| Mar. | 1 | To Balance | b/d | | 20 | — | — | Mar. | 8 | By Cash | | 19 | 20 | — | — | |
| ,, | 3 | ,, Goods | | 124 | 10 | — | — | ,, | 31 | ,, Balance | | c/d | 35 | — | — | |
| ,, | 18 | ,, ,, | | 136 | 15 | — | — | | | | | | | | | |
| ,, | 25 | ,, ,, | | 151 | 10 | — | — | | | | | | | | | |
| | | | | | £55 | — | — | | | | | | £55 | — | — | |
| Apl | 1 | To Balance | b/d | | 35 | — | — | Apl | 7 | By Cash | | 28 | 35 | — | — | |
| ,, | 16 | ,, Goods | | 160 | 15 | — | — | ,, | 10 | ,, Returns | | 17 | 5 | — | — | |
| ,, | 26 | ,, ,, | | 165 | 110 | — | — | ,, | 30 | ,, Balance | | c/d | 120 | — | — | |
| | | | | | £160 | — | — | | | | | | £160 | — | — | |
| May | 1 | To Balance | b/d | | 120 | — | — | | | | | | | | | |

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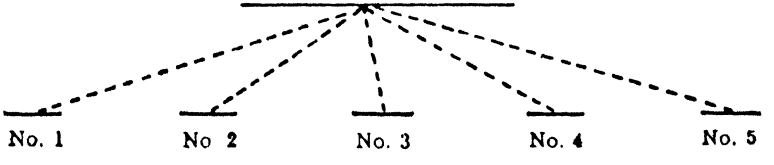
B

| OLD BALANCE | DATE | REFERENCE | | DEBIT | CREDIT | NEW BALANCE |
|---|---|---|---|---|---|---|
| | 1 Mar. | GDS | B/F | | | 20. 0 0 * |
| 20. 0. 0 | 3 Mar | GDS | 124 | 10. 0. 0 | | 30. 0. 0 * |
| 30. 0. 0 | 8 Mar | CSH | 19 | | 20. 0. 0 | 10. 0. 0 * |
| 10. 0. 0 | 18 Mar | GDS | 136 | 15. 0. 0 | | 25. 0. 0 * |
| 25. 0. 0 | 25 Mar | GDS | 151 | 10. 0. 0 | | 35. 0. 0 * |
| 35. 0. 0 | 7 Apl | CSH | 28 | | 35. 0. 0 | 0 * |
| 0 | 10 Apl | RET | 17 | | 5. 0. 0 | 5. 0. 0 CR |
| 5. 0. 0— | 16 Apl | GDS | 160 | 15. 0. 0 | | 10. 0. 0 * |
| 10. 0. 0 | 26 Apl | GDS | 165 | 110. 0. 0 | | 120. 0. 0 * |

CARRIAGE POSITIONS



balance (the balance before making the current entry) is sometimes called the Old Balance, while the balance obtained after the current entry has been made is called the New Balance.

Therefore the New Balance equals Old Balance plus or minus Posting. The act of bringing in the Old Balance is called "Picking up," and the Old Balance may sometimes be called the "Pick up."

The example on page 5 shows :—

(*a*) A handwritten form of Ledger account.

(*b*) The same entries as recorded by machine methods. Note how the balance of £20 on March 1st is "Picked up" on March 3rd, and so on with subsequent entries.

In hand posting, it is not uncommon to "call off" entries after they have been made, in an attempt to eliminate errors. The fact that, in spite of this check, errors remain undisclosed until the balancing period, is proof that such a form of check is by no means infallible. The checking of a month's postings is always a wearisome job, and after hours of "ticking" monotonously correct entries, operatives are liable to relax their vigilance and so run the risk of passing over the error. By the use of an adding machine, however, the number of items to be checked at the one time is reduced, as each posting run is checked separately. Figures of proved accuracy are thereby made available from which Control Accounts may be built up.

The adding and subtracting machine described in a later chapter, while lacking certain features essential to a Ledger posting machine, could be used very effectively as an adjunct to a pen-and-ink system to simplify the method of checking entries, to ensure accuracy and to provide up-to-date Control figures.

Taking a Sales Ledger as an example and assuming that copies of the invoices form the posting media, the procedure is as follows :—

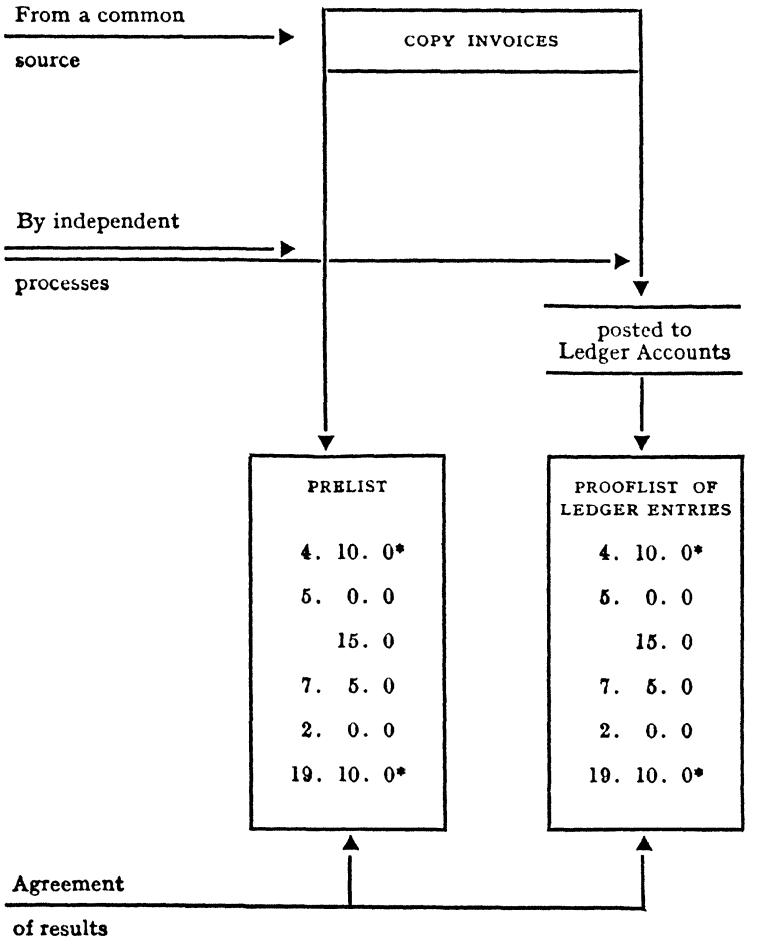
1. Add the media to form a prelist or provisional total of the amount to be posted to the Ledger. The prelist is usually printed on the tally roll, which is the name given to the narrow roll-paper commonly used in machine work.

2. Post the items to the Ledger by ordinary hand methods, except that as each entry is made, a book mark, such as a strip of thin cardboard long enough to protrude beyond the pages of the Ledger, is placed in each account after an entry.

3. On completion of the posting-run, the Ledger is opened at each of the accounts marked by a cardboard strip, and the entry (or entries where more than one marker appears in the same account) is listed by machine on the tally roll. This builds up the prooflist of the amounts actually posted to the Ledger. The agreement of the total

of the prelist (provisional total) with the total of the prooflist (confirmatory total) affords satisfactory proof of the accuracy of the posting.

CONTROL OF HAND WRITTEN LEDGER BY A SIMPLE ADDING MACHINE




The figure of £19 10s. would be carried to a Control Account.

The application may now be compared with the Principle of Proof.

| *Principle.* | *Application.* |
|---|---|
| "The agreement of two results." | The agreement of the total of the prelist with that of the prooflist. |
| "Obtained by independent processes." | (A) The prelist prepared from the original media, i.e., the copies of the invoice. |

| *Principle.* | *Application.* |
|---|---|
| | (B) The prooflist prepared from the Ledger entries. |
| "From a common source." | From the copies of the invoices. |
| | (A) To the prelist. |
| | (B) To the Ledger and thence to the prooflist. |

This is shown on the previous page in chart form.

Attention is drawn to the use of markers to distinguish the accounts to which entries have been made. This is a modified form of Benefit No. 3, i.e., "easing of the physical handling of documents." In this case the operator need locate the account once only—to make the entry. In the preparation of the prooflist, the markers make the second location of the active accounts easy. Note, however, on the other hand, that if no markers were used, the second independent location of the accounts would afford proof, within the scope of the Principle of Proof, that the amounts had been posted to the correct accounts. In other words, if an error had been made the prelist and prooflist would not agree, unless the operator twice selected the same wrong account.

In the event of disagreement between the totals, it is a simple matter to compare the prelist and the prooflist and so locate the error. This admittedly is a call-off check, but it may be observed that it is very much easier to compare two lists, each on a single piece of paper and having the items in the same order, than to compare figures posted to a Ledger, a method necessitating the turning up of successive accounts. There is, however, another very rapid method of making the comparison. Machine spacing is very accurate and regular, and if the two lists are placed one on top of the other, it will be found that the figures coincide. The lists may then be held up to a good light, when the shadowy effect of the entries which differ will be readily noticed. This is an example of Benefit No. 2, i.e., "facilitating the search for errors." It can be used very effectively in disclosing the fact that an item has been omitted.

A development of this check, discovered (possibly originally) by a girl of fifteen, consists of listing the amounts on the tally roll, printing the total and then turning back the tally roll and re-listing on top of the first impression. The second total, however, is printed below the first so that the two results can be compared. As a consequence :—

(1) If the two listings are identical the two totals will agree.

(2) In the event of error the totals will not agree and the error will usually be located by the failure of the two amounts to synchronize. Note, however, that there would be no double impression and therefore no location of errors such as mistaking £5 10s. for £5.

**Control.**

The prelist and prooflist having been found to agree, the total postings thus verified may now be carried to a Control Account.

**Credit Entries.**

Credit entries are proved in the same manner, i.e., by prelist and prooflist (the Cash Book itself would probably form a prelist). Credit Notes would be proved in the manner outlined for invoices, i.e., by prelisting, prooflisting and carrying the figure thus verified to the credit of the Control Account. The Control Account would be opened by posting to it the total outstanding in the Ledger. Thereafter, it would reflect in total the daily debit and credit entries made in the Ledger accounts. The balance of the Control Account would therefore be the total of all the Ledger balances, i.e., the total of "Sundry Debtors."

**Control Accounts.**

The day by day Control Account is a feature of machine accounting. As each batch of entries is made in detail to the various accounts, their sum is carried to a Control Account. Thus, in a properly constructed system, a Trial Balance is extracted merely to confirm a total which has already been provided by a Control Account.

**Purchase Ledger.**

Posting to the Purchase Ledger would be checked and controlled by the method described above for the Sales Ledger. A Control Account would be maintained which would provide the total of "Sundry Creditors."

**Active Accounts.**

Accounts in which entries are made during any particular posting run are called "active accounts." Attention is drawn to the term, which is widely used in machine accounting.

**Method of Proof.**

*Proof should be as comprehensive as possible.*

In framing a system of proof, the rule should be to make the prelist as early as possible and the prooflist as late as possible in the course of the accounting cycle. If the two extremes agree, then there is no need to check the intermediate steps. If possible the prelist for a Sales Ledger should be taken from the customers' orders. The final agreement with the prooflist would provide a check on the arithmetic of the invoicing.

Consider the following case :—

A retail shop provides a counter slip for each credit sale. These slips are copied into a Day Book ; the Day Book is posted to a Ledger; and the statements of account are copied from the Ledger.

It is by no means uncommon to find that—

(1) no summing is done until the entries are in the Day Book;

(2) a call-off check is made to prove that the Ledger is a true reflection of the Day Book ;

(3) similarly, the proof that the statements are a true reflection of the Ledger accounts is based on a call-off check.

Each successive step in the production of the statements of account is the subject of a special check, whereas, had a simple machine been available, a prelist of the counter slips which agreed with the prooflist of the statements of account, i.e., the agreement of the extremes, would have proved the accuracy of the whole cycle.

In order to enable the reader to visualize the method more clearly, the accounts in the above case have been treated as though there had been no balances brought forward and no cash or credit items. Such complications, however, do not introduce any new procedure ; they are merely variations on the original theme.

It should be observed that in the machine method it is taken for granted that each step is correctly carried out. Only when the final prooflist fails to agree with the prelist is recourse made to checking. Thus it may be said that using hand methods each step in the process is checked *lest* there should be an error, whereas in a properly installed machine job, checking is reserved for the cases where the proof shows that an error *has in fact been made.*

CHAPTER III

# THE ADDING AND PRINTING MACHINE

WITHIN the last half-century the adding machine has developed steadily and rapidly, and no doubt will continue to do so in the future, but the basic principles of the machine and its application do not alter. The types of machine vary both in construction and in operation, but, generally speaking, the figures which it is desired to add are set up or "indexed" as it is called, by depressing keys resembling those of a typewriter. In contrast, however, to the operation of a typewriter, a complete amount consisting of pounds, shillings and pence may be indexed before the printing mechanism is put in motion. After the indexing is completed, the machine is actuated either by pulling a handle or by touching a motor bar[1] controlling an electric motor. The mechanical working does not greatly concern the accountant, and it is sufficient to say that the operation of the motor causes the amount indexed to be printed on the paper and registered on toothed wheels, where it is retained. The indexing of further figures, followed by the operation of the motor, alters the wheels again, until at the end of the summation the indexing of the total key causes the machine to print the final figure registered on the wheels, which then return to zero. It is as if the figures indexed were wound on to the wheels by the adding operation and restored to zero by the operation of the total key. Subtraction is simply a reversal of the process ; the use of a subtracting control turns the wheels in the opposite direction, thus deducting instead of adding the amount. The name given to the complete set of adding and subtracting wheels is the *crossfooter.*

It is important that the student of machine accounting should understand clearly the more common results which are obtainable. These are described below as they would be found on a simple type of adding and subtracting machine. Note the asterisk or clear signal indicating that the adding wheels are at zero on commencement.

(1) **The Adding Control,** see Example No. 1, page 14.

*Operation :—*

Index the amount by depressing the appropriate keys.

Depress the adding motor bar, which prints the amount and records it in the wheels of the crossfooter.

[1] Throughout this book all the machines are assumed to be electrically operated. Most electric machines can be operated by hand also, should occasion arise.

Repeat these operations until all items have been dealt with.

Depress the total key, which prints the total of the items, marks it with an asterisk or other suitable symbol, and restores the mechanism to zero.

(2) **The Subtracting Control,** see Example No. 2, page 14.

*Operation :—*

Index the amount as before.

Depress the subtracting motor bar, which prints the amount with a minus symbol, after the right-hand figure. The amount is recorded *negatively* in the wheels of the crossfooter.

Repeat these operations until all items have been dealt with.

Depress the total key, which prints the total with the symbol CR at right-hand side, thus indicating a credit balance (or negative total).

(3) **The Non-Adding Control,** sometimes called **The Number Key,** see Example No. 3, page 14.

This motor bar prints the amounts but does not turn the wheels of the crossfooter and therefore does not add or subtract. It is used for the insertion of references such as invoice numbers or Day Book folios. The figures required are indexed on the pounds section of the keyboard.

As the normal layout of a machine is £. s. d., the machine would print ciphers in the shillings and pence columns after each number. Usually, however, the non-adding key is used in conjunction with another feature called the "cipher split," the function of which is to prevent the printing of the ciphers in the shillings and pence columns.

*Operation :—*

Index the number.

Depress the non-adding motor bar, which prints the figures but does not record them in the wheels of the crossfooter. If there is no cipher split, the number sign † opposite the item shows that it is not added. If there is a cipher split, then the absence of the ciphers would in itself indicate that the amounts were not added. Obviously there is no total.

In the example all the items shown are reference numbers and are therefore not added. The first item, having no cipher split, is illustrated with the number sign †, while the second and third items illustrate the alternative method of the combined use of non-adding and cipher split features.

(4) **The Non-Print Control,** see Examples Nos. 4 and 5, page 14.

As its name implies, this control does not print the items indexed, but nevertheless causes them to be added or subtracted in the crossfooter.

The printed total, positive or negative, is obtained by depressing the total key in the usual manner.

*Operation :—*

Index the item.

Index the non-print control.

Depress the adding (or subtracting) motor bar. The amount is registered in the wheels but nothing is printed.

Repeat these operations until all items have been dealt with.

Depress the total key. If the result is a positive amount, the total will be printed with the positive symbol. If it is a negative result, the negative symbol will replace the positive symbol. Examples Nos. 4 and 5 are simply repeats of Examples Nos. 1 and 2, except that the non-print control has been used.

(5) **The Total Key.** As already stated, this key prints the amount recorded on the wheels of the crossfooter, distinguishing between positive and negative amounts.

*Operation :—*

Depress the total key. The total recorded in the crossfooter wheels is printed and the wheels return to zero.

(6) **The Sub-Total Key,** see Example No. 6, page 14. The function of the sub-total key is similar to that of the total key, with one important exception—it does not restore the adding wheels to zero. Consequently sub-totals may be repeated an indefinite number of times. The sub-total may be described as a carry forward total in that it may be printed at the foot of one page and repeated at the top of the next.

The sub-totals are marked with the letter "S" to the right of the figures if positive or CR[1] if negative. In the example, a positive sub-total is printed after the third item and repeated before the fourth item. The figures are finally totalled by the use of the total key itself after the fifth item.

**To sum up, the six basic operations are :—**

Adding.
Subtracting.
Printing, without adding or subtracting.
Adding or subtracting, without printing.
Sub-totalling.
Totalling.

The controls may be used in any sequence. Example No. 7 shows the use of them all in one summation. For purposes of reference, the items have been numbered in italics.

[1] See footnote, page 14.

Example No 1.

```
                    *
    2.  0.  0
    4.  6.  1
    2.  0.  9

    8.  6. 10 *
```

Example No. 2.

```
                    *
    3. 10.  0—
    4.  0.  0—
    2.  5. 11—

    9. 15. 11 CR
```

Example No 3.

```
  104.  0.  0 †
  203.
1,234.
                    *
```

Example No. 4.

```
                    *
    8.  6. 10 *
```

Example No. 5.

```
                    *
    9. 15. 11 CR
```

Example No. 6.

```
                    *
    3.  0.  0          17.  3.  3 S
    4.  9.  1           4. 15.  3
    9. 14.  2               2.  9

   17.  3.  3 S        22.  1.  3 *
```

Example No. 7.

```
                    *
1.  1,014.                    9.   1. 10.  2 CR[1]
2.      2.  9.  6            10.   4.  4.  6
3.      1. 11.  4            11.   2. 14.  4 S
4.         19.  7—           12.
5.    104.  0.  0 †          13.       12.  6
6.      3.  1.  3 S          14  103.  6. 10 S
7.      4. 11.  5—           15. 103.  6. 10 S
8.      1. 10.  2 CR[1]      16. 103.  6. 10 *
```

Example No. 8.

*(*1*) 1,014. (*2*) 2. 9. 6 (*3*) 1. 11. 4 (*4*) 19. 7— (*5*) 104. 0. 0† (*6*) 3. 1. 3*

[1] The symbol of the negative Sub-Total illustrated is the same as that of the negative Total except that it is underlined.

1. Non-Add and cipher split.
2. Add.
3. Add.
4. Subtract.
5. Non-Add without cipher split.
6. Positive Sub-Total.
7. Subtract.
8. Negative Sub-Total.
9. Repeat or carry forward of Negative Sub-Total.
10. Add.
11. Positive Sub-Total.
12. Item of £100 inserted by use of non-print control.
13. Add.
14. Sub-Total.
15. Illustrates the ability of the Sub-Total Key to repeat indefinitely.
16. Total. The machine is now clear to begin next summation.

It will be observed from the examples that the different items appear one below the other. This vertical spacing, known as "listing," is automatically obtained from the machine operation. A slight adjustment will change this vertical spacing to horizontal spacing or "tabulating," which is used when it is desired to work across the paper instead of vertically. Example No. 8 shows in "tabulated" form some of the items already "listed" in Example No. 7.

**Error Key.** In addition to the various controls there is an error key which restores or cancels the keys indexed prior to printing. This enables the operator to alter a figure or description wrongly indexed.

**Repeat Key.** This key prevents the cancellation of an amount indexed even after the machine has been operated, i.e. the machine repeats indefinitely any amount indexed in conjunction with the repeat key.

CHAPTER IV

# LEDGER POSTING MACHINES

In the early days of machine book-keeping, accountants thought in terms of heavy bound books. The earlier machines were, therefore, so constructed that Ledgers were placed underneath the entire machine, which was then moved into the required position over the pages in much the same way as an overhead crane travels up and down an engineering shop while at the same time moving crosswise on traversing rails. After the adoption of the loose-leaf principle, the single page replaced the whole book. The page was moved about instead of the machine. The majority of machines now in use operate on the principle of bringing a loose-leaf Ledger account into position against a fixed printing mechanism.[1] This is accomplished by placing the single leaf Ledger account round the platen of the machine. Just as a sheet of paper in a typewriter carriage is moved along, so is the Ledger account tabulated. In the desired position, the movement of the carriage is checked by the "carriage stop." Each stop is known as a carriage position.

The specimen account B. on page 5 illustrates a very common ruling for a Sales Ledger. It is marked with five carriage positions, numbered from left to right.

When the carriage is in carriage position 1, the Ledger account is so placed that the printing mechanism is opposite the column headed "Pick Up of old balance" on the account.

In carriage position 2, the account has moved with the carriage until arrested by the second carriage stop and is now so placed that the printing mechanism is opposite the "Date" and "Reference" columns. This carriage movement continues with each successive operation of the machine, and the "Debit" column, the "Credit" column and the "Balance" column are each in turn brought to a stationary position opposite the printing mechanism.

An examination of the entries in the specimen account discloses that, with the exception of the date and the abbreviated descriptions,

[1] In cases where a large number of carbon copies is required, such as shipping invoices, the moveable machine can still be used with advantage on account of the force with which the type hits the paper. For the same reason, such machines are also useful where extra large type is required, as in typing the names of shareholders on Share Certificates.

e.g., GDS., DIS., etc., the account could have been prepared on the simple adding and subtracting machine described in Chapter III.

It follows, therefore, that the only additional features required to convert a straightforward adding and subtracting machine to a Ledger posting machine are :—

(1) 12 keys to print the months of the year.

(2) Keys to print the days of the month, i.e., up to 31.

(3) A sufficient number of keys to print the required abbreviations. Usually nine abbreviations will be found adequate.

A list of nine typical abbreviations is given, but special type bars can be made to suit special requirements.

GDS. for Goods.
CSH. ,, Cash.
DIS. ,, Discount.
BAL. ,, Balance.
RET. ,, Returns.
ALW. ,, Allowance.
J/E. ,, Journal Entry.
NET. ,, Nett.
CGE. ,, Carriage.

The date and description are printed by indexing the appropriate keys and depressing the motor bar in the usual way. This operation, of course, does not affect the wheels of the crossfooter; in other words, the date and description keys are permanently non-adding.

**Barrel or Rotary Date.** In cases where a considerable number of postings in a run bear the same date, the barrel or rotary date may be used as an alternative to the one operated from keys. The rotary date is simply a stamp on the lines of the ordinary rubber dating stamp. The bands of type, which rotate round a central barrel, are adjusted to the required position and the date as set up prints automatically. Such a dating feature does not require keys on the keyboard, and thus leaves room for more figures and so increases the figure capacity of the machine. On the other hand, the barrel date is not so easily changed as the keyboard type, hence the stipulation that a reasonable number of items should bear the same date.

**Ledger Posting Operation.** The features required for a simple Ledger posting machine having now been specified, the system and form of proof may be studied.

The formula for Ledger posting is :—

*Previous Balance (if any)* + *or* — *Posting* = *New Balance.*

Reverting to the specimen on page 5, it will be seen that to post the item on April 26th it is necessary to bring forward (or pick up) £10,

which was the amount of the previous balance at April 16th. The amount of the pick up may be made to "print" or "non-print," but in either case the amount will be recorded in the wheels of the crossfooter. In the illustration the pick up is printed and appears in Column 1, which is the first carriage position. The motor operation required to record the pick up also releases the carriage from carriage stop No. 1 and allows it to tabulate until further movement is arrested by carriage stop No. 2.

*Carriage Position No.* 2. In this position the date, abbreviated description and reference number are indexed and printed. The crossfooter is unaffected, i.e., the entry is non-additive, and the carriage tabulates to carriage stop No. 3.

*Carriage Position No.* 3. In this position the amount of the posting, £110, is indexed, printed and automatically added to the amount of the pick up which had previously been recorded on the wheels of the crossfooter. The carriage tabulates to position 5, passing over or "skipping" position 4, since there is no entry to be made in the credit column in this case.

*Carriage Position No.* 5. In this position, the total key is depressed, causing it to print the total of £120 in the "New Balance" column. The wheels of the crossfooter return to zero ready for the next entry.

INVOICES

Invoice No 123

THE SUPPLIER COY.

JOHN BROWN 12 Jan.

To SUNDRY GOODS 4. 0. 0

Invoice No. 124

THE SUPPLIER COY.

PETER WHITE 12 Jan.

To SUNDRY GOODS 6. 0. 0

ILLUSTRATION OF LEDGER PRIOR TO POSTING

Name—R. GREEN.

| OLD BAL. | DATE REF. | DEBIT | CREDIT | BALANCE |
|---|---|---|---|---|
| 12. 0. 0 | Oct. 6 1014 | 5. 0. 0 | | 12. 0. 0*<br>17. 0. 0* |

Name—PETER WHITE.

| OLD BAL | DATE REF | DEBIT | CREDIT | BALANCE |
|---|---|---|---|---|
| | | | | 17. 0. 0* |
| 17. 0. 0 | Jan. 9 95 | 3. 0. 0 | | 20. 0. 0* |
| 20. 0. 0 | Jan. 10 106 | 9. 0. 0 | | 29. 0. 0* |

Name—JOHN BROWN.

| OLD BAL. | DATE REF | DEBIT | CREDIT | BALANCE |
|---|---|---|---|---|
| | | | | 15. 0. 0* |
| 15. 0. 0 | Jan. 8 67 | 7. 0. 0 | | 22. 0. 0* |
| 22. 0. 0 | Jan. 9 90 | 5. 0. 0 | | 27. 0. 0* |
| 27. 0. 0 | Jan. 10 101 | 14. 0. 0 | | 41. 0. 0* |

Name—CONTROL A/C.

| OLD BAL. | DATE REF. | DEBIT | CREDIT | BALANCE |
|---|---|---|---|---|
| | | | | 49. 0. 0* |
| 49. 0. 0 | Jan. 8 | 7. 0. 0 | | 56. 0. 0* |
| 56. 0. 0 | Jan. 9 | 8. 0. 0 | | 64. 0. 0* |
| 64. 0. 0 | Jan. 10 | 23. 0. 0 | | 87. 0. 0* |

Balance of Control Account equals the sum of all the Ledger balances.

**The Human Element.** Note that the new balance of £120 is not necessarily correct. The operator might, for example, have indexed the pick up as £100 instead of £10, or have posted the debit as £10 instead of £110. The new balance of £120 is, however, a provisional total of the balance of the account as at 26th April, which, if confirmed, may be accepted as accurate in accordance with the Principle of Proof. The methods of obtaining this proof are varied. The particular form of proof chosen depends on the peculiarities of each case and the type of machine available.

**Long Run Proof.** In order to illustrate this form of proof a Sales Ledger, consisting of three personal accounts and a Control Account, is shown on page 19. The balance of the Control Account is, of course, the sum of the balances of the three personal accounts. Note that in machine book-keeping, the Control Account is not the reverse of the entries in the Ledger, i.e., debits to the personal accounts are usually debited in total to the Control Account.

On page 18 are the office copies of invoices Nos. 123 and 124, the amounts being £4 and £6 respectively.

It is required to post the entries to the accounts named on the posting media; to extend the new balances of the active accounts; to prove the accuracy of such new balances; and, finally, to make the necessary alteration in the Control Account balance.

**Operation.** The amounts of the posting media would be added to form a prelist. This provides the provisional total to be posted. The actual postings would be made from the copy invoices, the procedure being as follows:—

In John Brown's Account—

Position 1. Pick up the previous balance of £41. The amount may or may not be printed, but in either case it would be added in the crossfooter wheels.

Position 2. Date and Reference would be printed but not added.

Position 3. Debit of £4 would be printed on the account and added to the pick up already in the crossfooter.

Position 4. The Credit Column would be skipped.

Position 5. The total key would be depressed and the total of £45 would be printed in the New Balance column.

The crossfooter wheels would then return to zero.

Similarly, with Peter White's Account, the previous balance of £29 would be picked up, to which would be added the posting of £6, showing a New Balance of £35.

The posting run having been completed, a prooflist consisting of *all* the outstanding balances in the Ledger would be prepared.

## ILLUSTRATION OF THE LEDGER AFTER POSTING

Name—R. GREEN.

| OLD BAL | DATE REF. | DEBIT | CREDIT | BALANCE |
|---|---|---|---|---|
| | | | | 12. 0. 0* |
| 12. 0. 0 | Oct 6 1014 | 5. 0. 0 | | 17. 0. 0* |

Name—PETER WHITE.

| OLD BAL | DATE REF | DEBIT | CREDIT | BALANCE |
|---|---|---|---|---|
| | | | | 17. 0. 0* |
| 17. 0. 0 | Jan 9 95 | 3. 0. 0 | | 20. 0. 0* |
| 20. 0. 0 | Jan 10 106 | 9. 0. 0 | | 29. 0. 0* |
| 29. 0. 0 | Jan. 12 124 | 6. 0. 0 | | 35. 0. 0* |

Name—JOHN BROWN.

| OLD BAL | DATE REF. | DEBIT | CREDIT | BALANCE |
|---|---|---|---|---|
| | | | | 15. 0. 0* |
| 15. 0. 0 | Jan. 8 67 | 7. 0. 0 | | 22. 0. 0* |
| 22. 0. 0 | Jan. 9 90 | 5. 0. 0 | | 27. 0. 0* |
| 27. 0. 0 | Jan 10 101 | 14. 0. 0 | | 41. 0. 0* |
| 41. 0. 0 | Jan. 12 123 | 4. 0. 0 | | 45. 0. 0* |

Name—CONTROL A/C.

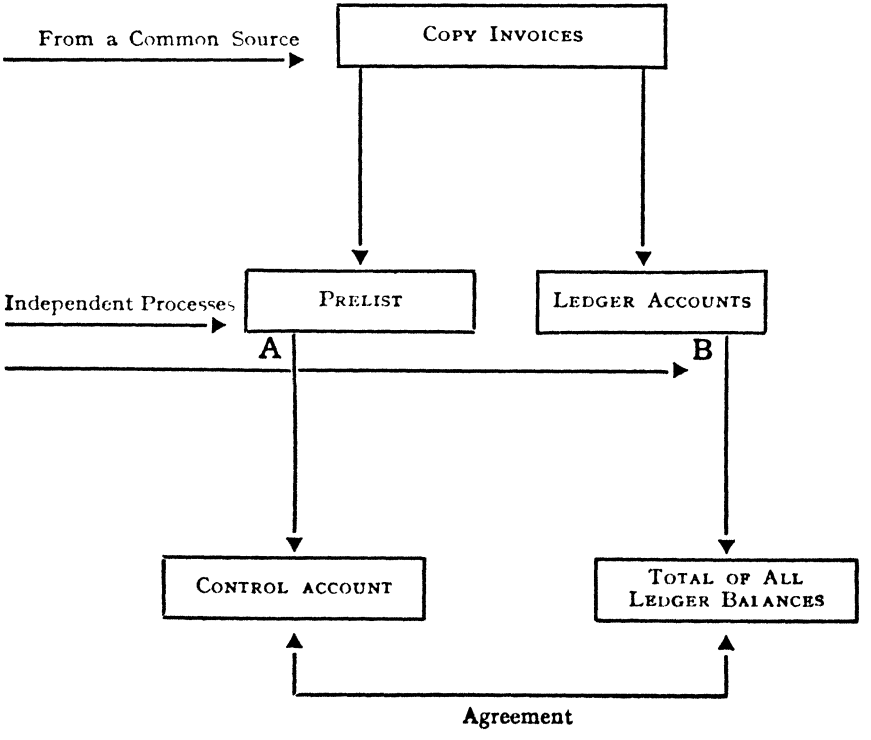
| OLD BAL. | DATE REF. | DEBIT | CREDIT | BALANCE |
|---|---|---|---|---|
| | | | | 49. 0. 0* |
| 49. 0. 0 | Jan. 8 | 7. 0. 0 | | 56. 0. 0* |
| 56. 0. 0 | Jan 9 | 8. 0. 0 | | 64. 0. 0* |
| 64. 0. 0 | Jan 10 | 23. 0. 0 | | 87. 0. 0* |
| 87. 0. 0 | Jan. 12 | 10. 0. 0 | | 97. 0. 0* |

The Control Account would now be posted. The procedure would be the same as that outlined for Personal Ledger Account posting. The amount of the debit would be the total of the prelist. The pick up of £87 plus the posting of £10 from the prelist would show a new Control total of £97. The agreement of the total of the prooflist with the new balance of the Control Account would be proof of the arithmetical accuracy of the entire work.

The name, "long run proof," arises from the fact that it entails the inclusion in the prooflist of the outstanding balances of *all* accounts whether active or inactive. Note that Green's balance was included in the prooflist although his account had not moved for three months.

The Ledger after the posting of the invoices is shown on page 21.

Long run proof in the ordinary personal Ledger as illustrated is not very common, by reason of the fact that it requires a high percentage of activity, but it is chosen first for illustration as being the most easily understood. It may be summarized as follows :—The balance of the entire Ledger before posting, i.e., the old balance of the Control Account, is known. To this balance the total of the prelist is added, thus providing a provisional total of the Ledger balances after posting. This



provisional total is confirmed by the total of the prooflist, which is obtained by listing from the Ledger the balances of all accounts after posting. The agreement of the total of the prooflist with the new total of the Control Account proves the accuracy of the figure work.

Given that :—

*Ledger balances before posting operation* = *Control Account balance before posting.*

the formula for Long Run Proof is :—

*Ledger balances plus* (*or minus*) *postings* = *Control Account plus* (*or minus*) *prelist.*

This is shown in chart form on the opposite page.

CHAPTER V

# OLD AND NEW BALANCE PROOF

In the example of long run proof in the previous chapter the Ledger contained three personal accounts, of which two were active during the posting run. With such a high activity the long run proof could be employed with advantage, but an activity of $66\frac{2}{3}$ per cent is comparatively rare in a Sales Ledger. If the activity rate is low it would be a waste of time to apply the long run proof, which obviously entails the listing for proof purposes of a preponderance of inactive accounts. As a general rule, therefore, the long run proof is not applied to cases where the activity falls below 50 per cent. In actual practice, however, it will be found that there are few borderline cases, the activity rate being generally either much below 50 per cent or very nearly 100 per cent.

In selecting a form of proof for a low activity Ledger, the choice would be governed chiefly by the peculiarities of the particular business and the features of the machine available for the work. Assuming that the work consisted of the normal Sales Ledger and that the machine was of the simple type described in Chapter II, a very common form would be that known as "Old and New Balance Proof." This proof is merely a limited application of the long run proof; limited in the sense that it deals with active accounts only.

In comparison with long run, the old and new balance proof suffers from a disability in that there is no figure available to show the total of the balances of active accounts before the start of the posting operation. The Control Account balance is unacceptable because it includes the balances of the inactive accounts. In the old and new balance proof, therefore, it is necessary to prepare two lists of the balances of the active accounts—the first consisting of the balances before posting (old balances) and the second consisting of the balances after posting (new balances). The difference between the total of the old balances and that of the new balances should equal the total of the posting media. The derivation of the name of this proof will now be apparent.

In making a choice between the long run proof and the old and new balance proof, where activity is the only guiding factor, the line of demarcation lies exactly half-way, as has already been stated. The reason for this is, of course, that as far as effort in proving is concerned there is no difference between listing all the new balances, as required by the

long run proof, and listing half the old balances plus half the new balances, as required by the old and new balance proof.

The formula for the old and new balance proof is :—

*New Balances of active accounts*[1] — *Old Balances of active accounts*[2] = *Prelist of Postings*

In the application of this proof the procedure is as follows :—

1. Prepare a prelist of the posting media, thus providing a provisional total of the figures which should be posted to the Ledger.

2. Post the individual amounts from the media to the personal accounts in the manner already described, i.e. pick up the previous balance (if any), add to it the amount of the posting and extend the new balance by printing the total which the machine will have accumulated.

3. Prepare a prooflist to discover the difference between
   (*a*) Old balances of active accounts, and
   (*b*) New balances of active accounts.

4. The agreement of the totals of the prelist and the prooflist proves that the entries have been made correctly in the Ledger. The total of the postings may then be carried to the Control Account.

As has already been shown, the preparation of a prooflist means in effect the extraction of two lists of balances—old and new. In actual practice the old and new balances of each account are entered on the same list. *The sign of the old balance is, however, changed,* i.e., plus becomes minus, and minus becomes plus. The resultant total is the difference between the old and new balances of the active accounts. The agreement of this total with that of the prelist is proof of the arithmetical accuracy of

1. The posting.
2. The prelist.
3. The prooflist.

Old and new balance proof might, therefore, be somewhat loosely summarized by saying that the prelist (what should be posted to the ledger) is confirmed by the prooflist (the total of the amounts actually posted to the Ledger).

The statement above that the prooflist is the total of the amounts posted to the Ledger is not strictly accurate. Correctly speaking the prooflist is a computation of the amount by which the balances of active accounts have been increased or decreased as a result of the entire posting operation. Now the "entire" operation included the picking up of the old balances as well as the posting of the entries. It follows, therefore, that if it is proved that the balances of the active accounts do in fact

[1] Balances after posting.
[2] Balances before posting.

reflect the alteration foreshadowed by the prelist, then not only were the postings made correctly but the old balances were correctly picked up. Thus the agreement of the totals of the prelist and prooflist proves that arithmetically :—

The entries were posted to the Ledger correctly.

The old balances were picked up correctly.

The new balances were extended correctly.

The prelist was extracted correctly.

The prooflist was extracted correctly.

It will considerably assist in the preparation of the prooflist if the active accounts are distinguished from the inactive accounts in some way. In Chapter II it was shown how the active accounts of the hand written Ledger were distinguished by cardboard markers. While not prohibiting the use of markers, loose-leaf Ledgers offer alternative and better methods of distinguishing the active accounts. They are :—

1. *Offsetting.*
2. *Pulling.*
3. *Stuffing.*

These constitute a combination of benefits 2 and 3. (See page 3).

**Offsetting.**

Usually the Ledger card is deeper than it is broad. Where such is the case any active accounts which it is desired to mark are not put back into the binder in the upright position which they occupied before posting, but are replaced on their sides. This has the effect of making them broader than the inactive accounts. Thus, on the conclusion of a posting run, all the active accounts are distinguishable by the fact that they are offset, i.e., they protrude beyond the inactive ones.

**Pulling.**

In "pulling," the active accounts are extracted from the Ledger, but instead of being returned to the Ledger after posting they are laid aside until the whole operation of posting and proving has been completed. They are thus clearly distinguishable at the time of the preparation of the prooflist.

**Stuffing.**

The actual posting documents are inserted as markers. They are retained in position after posting and thus serve to distinguish the active accounts until such time as the accuracy of the posting operation has been established.

It is not uncommon when either methods No. 2 or No. 3 are adopted to have the actual "pulling" or "stuffing" done by someone other than the Ledger-posting operator, usually a junior. By this means a check is established on the account selection within the principle of proof.

## SKELETON SALES LEDGER PRIOR TO POSTING

### ALEX SMITH, GLASGOW.

| OLD BAL. | DATE | REF. | DEBIT | CREDIT | BALANCE |
|---|---|---|---|---|---|
| | Jan. 1 | GDS 17 | 10. 0. 0 | | 10. 0. 0* |
| 10. 0. 0 | Jan. 3 | GDS 18 | 6. 10. 0 | | 16. 10. 0* |
| 16. 10. 0 | Jan. 5 | CSH 123 | | 1. 10. 0— | 15. 0. 0* |

### ROBERT SCOTT, LEITH.

| OLD BAL | DATE | REF. | DEBIT | CREDIT | BALANCE |
|---|---|---|---|---|---|
| | Jan 1 | GDS 14 | 9. 5. 0 | | 9. 5. 0* |
| 9. 5. 0 | Jan. 3 | GDS 15 | 1. 1. 0 | | 10. 6. 0* |
| 10. 6. 0 | Jan. 5 | CSH 122 | | 11. 0— | 9. 15. 0* |

### JOHN BROWN, ABERDEEN.

| OLD BAL. | DATE | REF. | DEBIT | CREDIT | BALANCE |
|---|---|---|---|---|---|
| | Jan 1 | GDS 11 | 5. 5. 0 | | 5. 5. 0* |
| 5. 5. 0 | Jan 3 | GDS 12 | 4. 0. 0 | | 9. 5. 0* |
| 9. 5. 0 | Jan. 5 | CSH 121 | | 10. 0— | 8. 15. 0* |

### CONTROL ACCOUNT.

| OLD BAL. | DATE | REF. | DEBIT | CREDIT | BALANCE |
|---|---|---|---|---|---|
| | | B/F | | | 78. 0. 0* |
| 78. 0. 0 | Jan. 1 | GDS | 47. 0. 0 | | 125. 0. 0* |
| 125. 0. 0 | Jan. 3 | GDS | 25. 0. 0 | | 150. 0. 0* |
| 150. 0. 0 | Jan. 5 | CSH | | 16. 10. 0— | 133. 10. 0* |

The junior's provisional selection of the account to be affected is confirmed by the machine operator who checks the junior's selection. The efficacy of this check depends entirely on the care exercised by the operator in the scrutiny of the junior's selection. As a checking method it is weak, because the second operator is open to be misled by the first selector's choice which is plainly visible.

On page 27 is shown a skeleton Sales Ledger of which three accounts are active during the posting run. It is assumed that there are more accounts in the Ledger, but only the active accounts need be considered.

It is required to post to the debit of the customers the following amounts :—

| | | | | |
|---|---|---|---|---|
| Jan. 7.—Brown | £2 | 5 | 0 |
| ,, 7.—Scott | 1 | 15 | 0 |
| ,, 7.—Smith | 4 | 5 | 0 |

and to prove the accuracy by old and new balance proof. It is assumed that carbon copies of the invoices are available to form the posting media. The balance of the Control Account at 5th January may be taken as correct, the difference (£100) between this figure and the sum of the balances of the three accounts illustrated being accounted for by the inactive accounts.

**Procedure.**

The copies of the invoices would be added to form a prelist, the total of which is £8 5s.

Brown's Ledger Account would be selected ; the previous balance of £8 15s. as at 5th January would be picked up in carriage position 1. The pick up is printed for purposes of illustration, but in practice it might not be printed. The date, particulars and reference number would be inserted in carriage position 2. The posting of £2 5s. would be entered in carriage position 3.

The credit column in position 4 would be passed over or "skipped." The total would be printed in position 5, restoring the wheels to zero.

The above operations would be repeated with Scott's account, picking up the old balance of £9 15s. and posting the amount of £1 15s. Similarly with Smith's account—pick up of £15, posting of £4 5s.

Assuming that "offsetting" had been chosen as the method of distinguishing the active accounts, the cards for Brown, Scott and Smith would be replaced in the Ledger lying on their sides.

**Proving.**

The prooflist would be prepared by listing the old and new balance of each of the offset, i.e., active accounts. The sign of all the old balances would be reversed in the list. The total thus obtained would be the

## SKELETON SALES LEDGER AFTER POSTING

### ALEX SMITH, GLASGOW.

| OLD BAL | DATE | REF | DEBIT | CREDIT | BALANCE |
|---|---|---|---|---|---|
| | Jan 1 | GDS 17 | 10. 0. 0 | | 10. 0. 0* |
| 10. 0. 0 | Jan 3 | GDS 18 | 6. 10. 0 | | 16. 10. 0* |
| 16. 10. 0 | Jan 5 | CSH 123 | | 1. 10. 0— | 15. 0. 0* |
| 15. 0. 0 | Jan. 7 | GDS 19 | 4. 5. 0 | | 19. 5. 0* |

### ROBERT SCOTT, LEITH.

| OLD BAL | DATE | REF | DEBIT | CREDIT | BALANCE |
|---|---|---|---|---|---|
| | Jan 1 | GDS 14 | 9 5 0 | | 9. 5. 0* |
| 9. 5. 0 | Jan 3 | GDS 15 | 1. 1. 0 | | 10. 6. 0* |
| 10. 6. 0 | Jan 5 | CSH 122 | | 11. 0— | 9. 15. 0* |
| 9. 15. 0 | Jan 7 | GDS 16 | 1. 15. 0 | | 11. 10. 0* |

### JOHN BROWN, ABERDEEN.

| OLD BAL | DATE | REF. | DEBIT | CREDIT | BALANCE |
|---|---|---|---|---|---|
| | Jan 1 | GDS 11 | 5. 5. 0 | | 5. 5. 0* |
| 5. 5. 0 | Jan. 3 | GDS 12 | 4. 0. 0 | | 9. 5. 0* |
| 9. 5. 0 | Jan 5 | CSH 121 | | 10. 0— | 8. 15. 0* |
| 8. 15. 0 | Jan. 7 | GDS 13 | 2. 5. 0 | | 11. 0. 0* |

### CONTROL A/C.

| OLD. BAL. | DATE | REF. | DEBIT | CREDIT | BALANCE |
|---|---|---|---|---|---|
| | | B/F. | | | 78. 0. 0* |
| 78. 0. 0 | Jan. 1 | GDS | 47. 0. 0 | | 125. 0. 0* |
| 125. 0. 0 | Jan. 3 | GDS | 25. 0. 0 | | 150. 0. 0* |
| 150. 0. 0 | Jan. 5 | CSH | | 16. 10. 0— | 133. 10. 0* |
| 133. 10. 0 | Jan 7 | GDS | 8. 5. 0 | | 141. 15. 0* |

net difference between the old and new balances of the active accounts and would be compared with the total of the prelist.

PRELIST

```
          *
 2.  5. 0
 1. 15. 0
 4.  5. 0

 8.  5. 0 *
```

PROOFLIST

```
          *
 8. 15. 0—
11.  0. 0
 9. 15. 0—
11. 10. 0
15.  0. 0—
19.  5. 0

 8.  5. 0 *
```

**Control Account.**

The required agreement having been obtained, the proved total of the postings would be entered in the Control Account. In making this entry, the procedure would be exactly the same as that adopted in posting the Personal Accounts, viz. :—

1. Pick up the old balance.
2. Enter the date and description.
3. Enter the total of the postings.
4. The new balance of the Control Account would be printed by the depression of the total key.

The illustrations on page 29 show the accounts after the posting; The prelist and prooflist are shown above.

**Types of Error.**

In machine posting, as illustrated above, error can arise only from certain definite sources. Errors fall into three broad classifications :—

1. *"Numerical" errors*, which arise through the operator's indexing the wrong key. For instance, a 5 instead of a 3.

2. *"Functional" errors*—errors which arise through the operator's using the wrong control key, e.g., operating the "subtraction" motor bar instead of the "add" motor bar.

3. Errors arising through posting to the *wrong account or to no account* or more than once to the correct account.

Classes 1 and 2 might both be styled arithmetical errors, and it is for this reason that the word "numerical" has been chosen for class 1, in order to provide a clear sub-division of the broader term "arithmetical error."

The errors are printed in BOLD type.

No. 1 type of error :—

| PRELIST | | PROOFLIST |
|---|---|---|
| * | | * |
| **2. 5** | | 8. 15. 0— |
| 1. 15. 0 | | 11. 0. 0 |
| | | 9. 15. 0— |
| 4. 5. 0 | | 11. 10. 0 |
| | | 15. 0. 0— |
| | | 19. 5. 0 |
| 6. 2 5 * | ◀— Difference £2 2 7 —▶ | 8. 5. 0 * |

JOHN BROWN, ABERDEEN

| OLD BAL | DATE | REF | DEBIT | CREDIT | BALANCE |
|---|---|---|---|---|---|
| | Jan 1 GDS | 11 | 5. 5 0 | | 5. 5 0* |
| 5. 5. 0 | Jan 3 GDS | 12 | 4. 0. 0 | | 9. 5. 0* |
| 9. 5. 0 | Jan 5 CSH | 121 | | 10. 0— | 8. 15. 0* |
| 8. 15. 0 | Jan. 7 GDS | 13 | 2. 5. 0 | | 11. 0. 0* |

No. 2 type of error .—

| PRELIST | | PROOFLIST |
|---|---|---|
| * | | * |
| 2. 5. 0 | | 8 15. 0— |
| | | 14. 0. 0 |
| 1. 15. 0 | | 9. 15. 0— |
| | | 11. 10. 0 |
| 4. 5. 0 | | 15. 0. 0— |
| | | 19. 5. 0 |
| 8. 5. 0 * | ◀— Difference £3 —▶ | 11. 5. 0 * |

JOHN BROWN, ABERDEEN.

| OLD BAL. | DATE | REF. | DEBIT | CREDIT | BALANCE |
|---|---|---|---|---|---|
| | Jan 1 GDS | 11 | 5. 5. 0 | | 5. 5. 0* |
| 5. 5. 0 | Jan 3 GDS | 12 | 4. 0. 0 | | 9. 5. 0* |
| 9. 5. 0 | Jan 5 CSH | 121 | | 10. 0— | 8. 15. 0* |
| 8. 15. 0 | Jan. 7 GDS | 13 | **5. 5. 0** | | 14. 0. 0* |

The errors are printed in BOLD type.

No. 3 type of error :—

| PRELIST | | PROOFLIST |
|---|---|---|
| * | | * |
| 2. 5. 0 | | 8. 15. 0— |
| 1. 15. 0 | | 83. 0. 0 |
| 4. 5. 0 | | 9. 15. 0— |
| 8. 5. 0 * | ◀— Difference £72 —▶ | 11. 10. 0 |
| | | 15. 0. 0— |
| | | 19. 5. 0 |
| | | 80. 5. 0 * |

JOHN BROWN, ABERDEEN.

| OLD BAL | DATE | REF | DEBIT | CREDIT | BALANCE |
|---|---|---|---|---|---|
| | Jan 1 GDS | 11 | 5. 5. 0 | | 5. 5. 0* |
| 5. 5. 0 | Jan 3 GDS | 12 | 4. 0. 0 | | 9. 5. 0* |
| 9. 5. 0 | Jan 5 CSH | 121 | | 10. 0— | 8. 15. 0* |
| 80. 15. 0 | Jan 7 GDS | 13 | 2. 5. 0 | | 83. 0. 0* |

No. 4 type of error .—

| PRELIST | | PROOFLIST |
|---|---|---|
| * | | * |
| 2. 5. 0 | | 8. 15. 0 |
| 1. 15. 0 | | 11. 0. 0 |
| 4. 5. 0 | | 9. 15. 0— |
| 8. 5. 0 * | ◀—Difference £17 10s —▶ | 11. 10. 0 |
| | | 15. 0. 0— |
| | | 19. 5. 0 |
| | | 25. 15. 0 * |

JOHN BROWN, ABERDEEN.

| OLD BAL. | DATE | REF. | DEBIT | CREDIT | BALANCE |
|---|---|---|---|---|---|
| | Jan. 1 GDS | 11 | 5. 5. 0 | | 5. 5. 0* |
| 5. 5. 0 | Jan. 3 GDS | 12 | 4. 0. 0 | | 9. 5. 0* |
| 9. 5. 0 | Jan 5 CSH | 121 | | 10. 0— | 8. 15. 0* |
| 8. 15. 0 | Jan. 7 GDS | 13 | 2. 5. 0 | | 11. 0. 0* |

The errors are printed in BOLD type.

No. 5 type of error :—

| PRELIST | | PROOFLIST |
|---|---|---|
| * | | * |
| 2. 5. 0 | | 8. 15. 0— |
| 1. 15. 0 | | **11. 0** |
| 4. 5. 0 | | 9. 15. 0— |
| 8. 5. 0 * | ◄ — Difference £10 9s. — ► | 11. 10. 0 |
| | | 15. 0. 0— |
| | | 19. 5. 0 |
| | | 2. 4. 0 CR |

JOHN BROWN, ABERDEEN.

| OLD BAL | DATE | REF | DEBIT | CREDIT | BALANCE |
|---|---|---|---|---|---|
| | Jan 1 GDS | 11 | 5. 5. 0 | | 5. 5. 0* |
| 5. 5. 0 | Jan 3 GDS | 12 | 4. 0. 0 | | 9. 5. 0* |
| 9. 5. 0 | Jan 5 CSH | 121 | | 10. 0— | 8. 15. 0* |
| 8. 15. 0 | Jan 7 GDS | 13 | 2. 5. 0 | | 11. 0. 0* |

Below is given a list of the types of error which could have been made in posting the items on page 28.

| | *Numerical* | *Functional* | *Wrong Account* |
|---|---|---|---|
| 1. Error in the prelist .. .. | Yes | Yes | No |
| 2. Error in posting .. .. | Yes | Yes | Yes |
| 3. Error in the picking up of the old balance during the posting | Yes | Yes | Yes |
| 4. Error in taking off the old balance during the preparation of the prooflist .. .. | Yes | Yes | Yes |
| 5. Error in taking of the new balance during the preparation of the prooflist .. .. | Yes | Yes | Yes |

With the exception of the errors of posting to the wrong account, any of the above errors would be disclosed by any of the forms of proof hitherto discussed. It may be mentioned here that proof of posting to the right account can be obtained, if desired, within the framework of the general principle of proof applied to the

other types of error, but its application will be dealt with in a later chapter.

The possibility of errors arising out of mechanical faults must not be overlooked. Experience has shown, however, that if a machine is well made, receives proper mechanical attention, and is scrapped at a reasonable age, the occasions on which it gives wrong results are rare; in fact, many machines go for years making hundreds of postings daily without a single arithmetical error arising from a mechanical cause. In many cases of mechanical trouble (although not all) the machine altogether ceases to function rather than produce inaccurate results. This cessation on the part of the machine (termed a "lock") makes mechanical attention imperative.

Brown's Account correctly posted is shown on page 29. On pages 31-33 are shown five illustrations of the same account. Each example contains one of the possible errors and its disclosure. Note that the prelist and prooflist include the figures of Scott's and Smith's Accounts.

**Type No. 1 Error.**

Numerical error in taking off prelist.

The amount of £2 5s. has been entered as 2s. 5d. in the prelist. Comparison of prelist and prooflist discloses difference of £2 2s. 7d.

**Type No. 2 Error.**

Numerical error in posting.

Jan. 7th, the posting of £2 5s. has been made £5 5s. Comparison of prelist and prooflist discloses difference of £3.

**Type No. 3 Error.**

Numerical error in picking up of the old balance during posting.

The balance as at Jan. 5th, £8 15s., has been picked up as £80 15s. on Jan. 7th. Comparison of prelist and prooflist discloses difference of £72.

**Type No. 4 Error.**

Functional error in taking off old balances in preparation of prooflist.

Instead of the subtracting motor bar, the adding motor bar has been used in taking off the old balance as at 5th Jan., £8 15s., in preparation of prooflist. Comparison of prelist and prooflist discloses difference of £17 10s.

**Type No. 5 Error.**

Numerical error in taking off new balances in preparation of prooflist.

New balance as at 7th Jan., £11, entered as 11s. Comparison of prelist and prooflist discloses difference of £10 9s. Note that the prooflist total is a negative amount.

Many machines have a locking device which prevents the use of the total or sub-total key whenever a negative total is in the machine. Such

totals can be printed only by the use of a special key which releases the lock. This ensures that the operator is made aware of the fact that the balance is negative. Many machines print credit or negative balances in red. Note that when carbon copies are taken, the colour of the carbon copy is, of course, constant, hence the special symbol CR. or — in addition to any change of colour of ink.

The posting to the Control Account is liable to all the numerical and functional errors except No. 1. To ensure absolute accuracy it is advisable to prove the posting of the final figure to the Control Account by comparing the difference between the old and new balance with the prelist total. The very fact that only one posting is involved might tend to make an operator careless through over confidence. Cases are not unknown in which operators have correctly entered posting runs of a thousand items and then made an error in the final operation of posting the total to the Control Account.

It may be mentioned here that in machine accounting it is comparatively rare for a posting run to consist of mixed debits and credits. Most machines have a device on the carriage which provides for the automatic skipping of the column not required. This makes it impossible for the operator to post an entry to the wrong side of an account.

CHAPTER VI

# CARRIAGE CONTROL

IN the closing paragraph of the previous chapter, it was mentioned that an automatic feature of the carriage could prevent the posting of a figure to the wrong side of an account. This feature, called carriage control, extends much further than this. In the machines hitherto discussed, it was left to the operator, by selection of the proper motor bar, to cause the machine to add, subtract, non-add or non-print in the different carriage positions. The carriage control feature relieves the operator of this responsibility and permits the substitution of one general motor bar for many. This general motor bar is merely a switch which controls the electric motor. This particular result obtained is governed by attachments to the carriage itself. With each tabulation these attachments depress the particular functional key or keys required. Reverting to the account on page 5 for example, the carriage would bring into operation the controls necessary to give the following results in the cycle of the debit posting :—

Carriage Position No. 1.—Add and print (or non-print) for pick up of old balance.

Carriage Position No. 2.—Print date, print reference number as indexed by operator, without adding and with cipher split.

Carriage Position No. 3.—Add and print the amount of the posting as indexed by the operator.

Carriage Position No. 4.—Skip credit column.

Carriage Position No. 5.—Operate total key. This key would be connected to a mechanism which would cause the carriage to return to position 1, ready for the next entry.

Not all machines automatically cause the total to print, but the same result may be obtained by the manual depression of the total key.

Thus the human element is more and more eliminated with each development of the machine. Once the cycle of operations is worked out the machine is built with the carriage control mechanism set to give the desired results *in so far as they are constant in each posting.* Thereafter the operator's only concern is such changing items as the actual amount of the pick up, the amount of the posting and the figures

of the reference number, etc. Whether the amount indexed in each particular column should be added or subtracted, non-added or non-printed, is automatically governed by the position of the carriage at the time the motor bar is touched. Thus the *carriage control eliminates all functional errors* as regards normal entries.

But all entries in a Ledger are not of the same pattern. The bulk of the postings in a Sales Ledger would entail the picking up of a previous debit balance, which would require an adding control. But there is the odd credit balance, which must be picked up by subtracting in order to throw out the correct new balance. In order to deal with both normal and abnormal entries, the carriage control, while set for the normal operation of the posting cycle, is under the control of the operator, who is able, by manipulation from the key-board, to override the automatic set up. Thus, if the normal function were to add the pick up, the carriage would, in the pick up position, automatically cause the machine to add. But by hand control from the keyboard, the operator is able to cancel this set up and so deal with the odd case of a negative pick up in the Sales Ledger. A simple illustration of this principle is found in the automatic control of traffic, which allows so many seconds North and South and so many East and West. This is the normal function, but if, for any particular reason, say a procession, the traffic were abnormal, it would be necessary to substitute the policeman's hand for the automatic traffic light.

With the introduction of carriage control, the field of operations for the machine was greatly enlarged for no matter how many complications were introduced into the operating cycle, the responsibilities of the operator, except for the occasional abnormal entry, *never went beyond the indexing of the correct amounts.* This simplification of the operator's job made it possible to have several sets of controls for one machine; for example, a set for each of the following :—

1. Sales Ledger.
2. Purchase Ledger.
3. Stores Ledger.
4. Cost Ledger.
5. Pay Roll.

Each set of controls, built as a separate assembly, can be attached and detached very speedily, and no matter how widely the mechanical operations vary as between one set up and another, the operator's job in each case consists only of indexing the correct keys and touching the motor bar.

In addition to increasing the number of different jobs with which each machine could deal, carriage control permitted the increase of the

ILLUSTRATION OF LISTING, WITH CROSSFOOTER AND ONE REGISTER

| | | | | |
|---|---|---|---|---|
| | | | * | |
| 4. | 10. | 6 | | |
| 5. | 9. | 1 | | |
| 2. | 0. | 4 | | |
| 11. | 19. | 11 | * | (Crossfooter Total) |
| 2. | 10. | 4 | | |
| 1. | 2. | 6 | | |
| | 3. | 4 | | |
| 3. | 16. | 2 | * | (Crossfooter Total) |
| 10. | 19. | 4 | | |
| 5. | 0. | 2 | | |
| 7. | 8. | 1 | | |
| 8. | 5. | 7 | | |
| 31. | 13. | 2 | * | (Crossfooter Total) |
| 47. | 9. | 3 | ± | Register Total |

The Register has "stored" the three crossfooter totals, i.e., £47. 9. 3 = £11. 19. 11 + £3. 16. 2 + £31. 13. 2.

number of controls within each job to an extent which might have caused confusion and error and would certainly have slowed down the operation, had their manipulation been left entirely to the operator. Of these further controls the register is probably the most important.

**The Register.**

*A register is a secondary set of adding wheels* which move either independently of, or in sympathy with, the wheels of the crossfooter. Usually a register does not have all the features of a crossfooter, nor does it require them, since its main function is to "store" figures supplied by the primary mechanism. It may be said that the crossfooter does the reasoning and the register does the remembering. The crossfooter and the register can each be totalled or sub-totalled independently of the other by indexing the proper keys. Distinctive symbols usually appear against the totals of each mechanism. Both the cross footer and the register are said to be active when, either by carriage or keyboard control, they are affected by the operation of the motor. Either or both can be rendered active or inactive by carriage control, and the operator can by keyboard manipulation, reverse the effect of such automatic control at will.

A straight listing of several amounts with crossfooter and register both active is shown above. Such a set up is called simultaneous addition. The crossfooter is totalled at intervals while the register is totalled once only, thus providing the grand total of the several totals provided by the crossfooter.

**The Use of Registers.** The maximum number of registers which can be obtained varies with the type of machine. The object of a register

is to increase the efficiency of the system. As stated in Chapter I, efficiency may be increased in three main ways.

It is now proposed to consider the application of progressively increasing numbers of registers to the various forms of proof which hitherto have been discussed on the basis of a machine with no register, i.e., a machine consisting of a crossfooter only.

Assuming that long run proof is in operation and that the machine on which posting is to be done consists of a crossfooter and one register, the procedure would be as follows :—

1. Pick up old balance. This amount would add in the wheels of the crossfooter.

2. Print (without adding) the date and reference number.

3. Enter the amount of the posting. This would print and would be added in the wheels of the crossfooter to the already existing old balance.

4. Print the total of the crossfooter with the register rendered active by carriage control. The effect of this last operation is to clear the wheels of the crossfooter and to transfer the amount to the register.

All the above functions would be automatically controlled by the carriage.

If this same cycle of operations is performed with each succeeding account, the total of the register on the conclusion of the posting run will be the sum of all the new balances of the active accounts. If to this figure the balances of the inactive accounts be added, the result would be a complete Trial Balance of the Ledger.

The addition of the balances of the inactive accounts to the figure in the register should present no great problem, since long run proof is applied only in cases where the percentage of activity is high.

It was stated on page 20 in which long run proof without a register was discussed, that "the posting run having been completed a proof list consisting of all the outstanding balances in the Ledger would be prepared. . . ." Without a register this entailed the listing *as a separate operation* of all the new balances of the Ledger. On a machine fitted with a register this can be obtained, as has been shown, by the mere listing of the inactive balances of the Ledger. Therefore, since the accumulation of the new balances of active accounts has now become a mechanical operation, error No. 5, on page 33, is eliminated in the long run proof, except in the case of inactive accounts.

**Direct Proof.** Where, by reason of the low percentage of activity of the Ledger, the long run proof is not practical, the old and new balance proof would probably be used. As discussed on page 24, the operation without a register entailed the listing of the old and the new balances

of the active accounts as a separate operation. The use of a register with the old and new balance proof makes such drastic changes in the form of proof that it is given a distinctive name—direct proof.

This proof, as will be seen from its study, is merely a variation of the old and new balance system. In the old and new balance proof no attempt was made to obtain the list of the old balances and the list of the new balances of active accounts, until the entire posting operation had been completed. With direct proof, however, the old balance is subtracted from the new balance at the time of the posting by what is called the second pick up of the old balance. At this point the register

DIRECT PROOF ON MACHINE WITH CROSSFOOTER AND ONE REGISTER

PROOFLIST
Jan 7

2. 5. 0 *
1. 15. 0 *
4. 5. 0 *
8. 5. 0 *

JOHN BROWN,

ABERDEEN.

| DATE | REF | DEBIT | CREDIT | BALANCE |
|---|---|---|---|---|
| Jan 1 GDS | 11 | 5. 5. 0 | | 5. 5. 0 S |
| Jan 3 GDS | 12 | 4. 0. 0 | | 9. 5. 0 S |
| Jan 5 CSH | 121 | | 10. 0— | 8. 15. 0 S |
| Jan 7 GDS | 13 | 2. 5. 0 | | 11. 0. 0 S |

PRELIST
Jan 7

2. 5. 0 *
1. 15. 0
4. 5. 0

8. 5. 0 *

The first and second readings of the pick ups are both entered non-print.

The prooflist is printed on the ordinary machine tape paper. Direct proof provides a prooflist which should be identical to the prelist.

Compare the above prooflist with that obtained under the Old and New Balance Proof as shown on page 30.

comes into operation to store the result of this subtraction. The procedure may be more clearly understood when it is pointed out that this operation is merely a version of the well-known catch—"Think of a number, add a stated figure to it, take away the number first thought of," etc., the result being of course the number stated. In the direct proof the old balance is picked up ; the posting is added to it ; the new balance is then printed in the Ledger account by use of the sub-total key, and the old balance is deducted from it. The result should be the amount of the posting. This figure is accumulated in the register so that at the end of the run the register supplies a figure which, if the work has been correctly done, is the total of all the postings. This figure is in actual fact not so much a total of the postings as the difference between the old and new balances of the active accounts—a figure which should, of course, equal the postings.

On page 29 an entry to John Brown's account is illustrated as it would appear if the old and new balance proof were applied. On page 40 the same entry is illustrated as it would appear if the direct proof were applied. The procedure would be as follows :—

1. Pick up (non print) the old balance of £8 15s. This amount adds in the wheels of the crossfooter and constitutes a *provisional total* of the old balance.

2. Enter the date, description and reference number. The adding mechanism would be rendered inactive by carriage control so that the adding wheels would be unaffected.

3. Enter the amount of the postings, £2 5s. This would add in the crossfooter.

4. Use the crossfooter *sub-total key* to print the new balance of £11. (Note that by the use of the sub-total key the amount of £11 *is retained* in the wheels of the mechanism).

5. *Deduct* (non print) the old balance of £8 15s. (In other words, change the sign of the old balance for the second pick up). This subtracts in the crossfooter and constitutes the *confirmatory total* of the old balance.

6. Clear the remainder of £2 5s. from the crossfooter wheels by the use of the crossfooter total key. The carriage control mechanism will be so set that this total will be accumulated in the register along with the corresponding amounts arising from subsequent postings.

Since the new balance is printed by the sub-total key and is, therefore, retained in the wheels of the machine, there can be no difference between the figure of the new balance and the figure from which the second pick up is subsequently deducted. Therefore, in the direct

proof the fifth type of error (see page 33) that of wrongly listing the new balances, is eliminated.

A further advantage (No. 2 on page 3) of the direct proof over the old and new balance proof is that in the event of a disagreement between the prelist and the prooflist a direct comparison can be made, whereas with the old and new balance proof the prooflist consists, not of a statement of the net differences between the old and new balances of each account, but of a list of these old and new balances, necessitating a subtraction sum, however simple, before the comparison with the prelist can be made. Compare the prooflist on page 30 with that on page 40.

CHAPTER VII

## MULTIPLE REGISTERS

IN the ordinary way there can be no improvement on the direct proof in the eliminating of errors, but apart from the question of proof there are other advantages which may be obtained by the use of additional registers.

**Three Register Proof.**

Three register proof is very common and is faster than direct proof for the reason that instead of subtracting the second pick up from the new balance and printing the total for purposes of accumulation in the register, the second pick up is itself accumulated in a register; the postings are accumulated in a second register and the new balances are accumulated in the remaining register. This means that the subtraction of the second pick ups from new balances is done *in total* at the *end* of the posting run instead of making a separate subtraction for each individual item posted. Therefore the benefit attached to the use of additional registers falls under heading 3 on page 3, since it increases the speed of operation by avoiding the necessity to press the total key after each second pick up.

On the conclusion of a posting run the following totals would be provided :—

Register 1.—The total of the amounts posted to the Ledger.

Register 2.—The total of the *new* balances of the active accounts. Each new balance is the result of the first pick up plus the posting.

Register 3.—The total of the second pick ups. This is an independent reading of the old balances.

As stated above, this proof goes no further than the direct proof in the elimination of error, but it does offer an advantage (No. 2 on page 3), because it is now possible in the event of error to state definitely :—

(1) either that the postings were correctly entered and that the error must be in the pick up ; or,

(2) that the pick ups were correct and any error must, therefore, be in the posting.

(3) that there is an error in both posting and pick ups.

If the error is in the posting, the total of register 1 will not agree with the prelist.

If the error is in the pick up, the difference between the totals of registers 2 and 3 will not agree with the prelist unless the same error has been made in picking up the old balance in the first and second pick ups. The second pick up constitutes the check on the first.

The reader is warned against falling into the trap of accumulating the first pick up. This is not unlike an attempt to lift oneself by the shoelaces, and recalls the story of the officer in charge of the midday signal gun who set his watch daily by the town clock, unaware that the clock was itself checked regularly by the signal gun.

Not only must the second pick up be made independently of the first, but every precaution should be taken to ensure that the first pick up should not influence the operator's mind when making the second pick up. In an earlier chapter the simple instance was given of checking upwards to prove the accuracy of a mental addition which had already been summed downwards. The same principle should apply in picking up old balances.

Some machines are so constructed that the operator cannot see the first pick up once the account is in the machine, and therefore (unless the amount is memorized) the independence of the second pick-up is assured.

**Front Feed Carriage.**

This device is very commonly (although by no means exclusively) used in conjunction with the three register proof.

A front feed carriage permits of the simultaneous production of two or more records which can be placed in the machine independently of one another. The principle is that a Journal sheet (sometimes called the proof sheet) is placed round the platen of the machine where it is held firmly. The carriage is so constructed that without disturbing this sheet other documents such as Ledger cards and/or statements can be superimposed. By placing a sheet of carbon paper over the Journal sheet it thus becomes possible to build on it a collated copy of the entries made on the superimposed documents. Thus at the end of a posting run there is made available on one sheet of paper a complete record of every entry made to the Ledger during the run. The register totals may be, and usually are, printed on the Journal sheet.

In dealing with the type of machine which had no front feed, it will be recalled that in order to provide ready reference in cases of need, all active accounts were distinguished by offsetting, pulling, or some such method. This indication of the active accounts remained operative until the accuracy of the work had been proved, the reason being that had a difference been revealed by the proving it would have become necessary to scrutinize each of the active accounts until the exact

## ILLUSTRATION OF THREE REGISTER PROOF

| 1st PICK UP | DATE | REF | DEBIT | CREDIT | BALANCE | 2nd PICK UP |
|---|---|---|---|---|---|---|
| 8. 15. 0 | Jan. 7 GDS | 13 | 2. 5. 0 | | 11. 0. 0* | 8. 15. 0 |
| 9. 15. 0 | Jan 7 GDS | 16 | 1. 15. 0 | | 11. 10. 0* | 9. 15. 0 |
| 15. 0. 0 | Jan 7 GDS | 19 | 4. 5. 0 | | 19. 5. 0* | 15. 0. 0 |
| | | | 8. 5. 0* | | 41. 15. 0* | 33. 10. 0* |
| | | | Register 1 total equals Prelist. | | Register 2 Total | Register 3 Total |
| | | | | | Difference between the totals of Registers 2 and 3 = Prelist. | |

Above is the Journal sheet which would be built up in posting the entries on page 28 to the accounts of Brown, Scott and Smith on a three register machine.

PRELIST

| |
|---|
| 2. 5. 0 * |
| 1. 15. 0 |
| 4. 5. 0 |
| 8. 5. 0 * |

| 1st PICK UP | DATE | REF | DEBIT | CREDIT | BALANCE | 2nd PICK UP |
|---|---|---|---|---|---|---|
| 80. 15. 0 | Jan 7 GDS | 13 | 2. 5. 0 | | 83. 0. 0* | 8. 15. 0 |
| 9. 15. 0 | Jan 7 GDS | 16 | 1. 15. 0 | | 11. 10. 0* | 9. 15. 0 |
| 15. 0. 0 | Jan. 7 GDS | 19 | 4. 5. 0 | | 19. 5. 0* | 15. 0. 0 |
| | | | 8. 5. 0* | | 113. 15. 0* | 33. 10. 0* |
| | | | Register 1 total equals prelist proving that the debit entries were correct. | | Register 2 total. | Register 3 total. |
| | | | | | The difference between the totals of Register 2 and Register 3 (£80 5s) exceeds the prelist total by the amount of the error (£72). | |

Above is the Journal sheet from the same entries as it would appear if Brown's pick up were entered as £80 15s. instead of £8 15s. See also page 32.

location of the error had been established. While such a scrutiny of the individual accounts would not take much time, it would take even less time to examine the collated copy of all the entries which a Journal sheet would provide.

The front feed feature, therefore, confers benefits of the type (2) (page 3) by facilitating the search for errors by means of a collated carbon copy of all entries, and of type (3) in that it permits an easier insertion and ejection of documents.

The most common application of the front feed carriage is the simultaneous production of Journal sheets (or proof sheets), Ledger accounts and statements. Another common application is the simultaneous production of payroll and employees' payslips.

A fourth register may be used to permit of the posting of mixed runs of debit and credit entries. Since the posting media is generally sorted to provide for separate runs of debits and credits this is not a common application. The set up would be as for three register proof except that two registers would be set to accumulate postings—one for debits and one for credits.

Additional registers may be applied when required.

See illustration of three register proof on page 45.

CHAPTER VIII

# OTHER FORMS OF PROOF

GENERALLY speaking, the proofs which have been dealt with up to this point are such as will meet ordinary Ledger posting requirements. Nothing can reduce beyond a fixed minimum the effort required to prove that the previous balance has been correctly picked up and that the correct amount has been posted to the account.

In addition to the general requirements of the average concern, however, there remains the problem of the business with peculiar requirements, or in the running of which peculiar conditions prevail. It is therefore proposed to examine in this chapter a few of the methods of proof which have particular application to special cases.

**Line Proof.**

In all methods of proof hitherto discussed the proof of accuracy has not been obtainable until the conclusion of the posting run. In most cases there is no necessity for an earlier proof. Conditions may be such, however, that unless an error is discovered immediately no action can be taken towards its proper rectification. A case in point is a Room Account in a hotel where it avails little to learn some hours after the departure of the guest that his bill was incorrect. In such a case it is important to have *immediate* notice of any error, for which purpose the line proof may be used.

The line proof is a development of the direct proof: the difference between the two forms lies in the fact that in the direct proof the old balance only is subtracted from the new balance, whereas in the line proof a second reading of the posting is also deducted. If an entry is correctly made, the wheels of the crossfooter should therefore be at zero, on the completion of each entry. If the wheels are not at zero, then the amount remaining in the crossfooter is the amount of the error, a search for which can be made immediately. Some machines have a feature which prevents the operation of the machine unless the crossfooter is clear (i.e., the wheels are at zero) in the final position. This feature may be made to work in conjunction with the paper release mechanism, with the result that unless a bill is correct the total key refuses to operate and the bill cannot be removed from the machine.

A further development of this use of the line proof permits a simple form of analysis to be made in conjunction with the ordinary ledger

posting operation. Instead of deducting the posting as one sum as described in the previous paragraph, it is deducted in two portions, each of which is applicable to one of the desired analysis headings. If the posting and the analysis are both correctly made, the result will be zero. Such an analysis should be confined to two headings only as, if it were to be extended to more than that number, the operation would be slow and might become unwieldy through the increase in the number of sources of error. Much would depend on the answer to the question : "When is the information required?" For instance, if the analysis were merely to build up monthly statistics it would be absurd to go beyond two headings ; in fact it would be improbable that the line proof analysis would be used at all in such circumstances.

On the other hand, analysis by the line proof, covering twenty headings, might in certain circumstances be advantageous. Take, say, the case of an auctioneer selling cattle for farmers. Certain expenses, such as transporting, shepherding, feeding, insuring, advertising, selling, etc., may have been incurred by the auctioneer on the seller's behalf. These all fall to be deducted from the cheque due to the farmer for the net proceeds of the sale. Sometimes a farmer pressed for time calls for his cheque immediately on the fall of the hammer. In such a case it is essential that evidence of the accuracy of the amount of the cheque should be immediately available, and the line proof would be one way of securing that accuracy. If the total key and paper release lock feature already described were used, the farmer's statement would automatically be retained in the machine pending the rectification of any error.

The system of line proof may also be applied when it is desired to check the accuracy of the information contained in the media. For instance, it is not uncommon to use a form of line proof in preparing gas and electricity bills. In the case of these bills the original information is obtained from the dials of the meters, the reading being entered directly into the inspector's meter book. No second reading of this figure can be obtained at the moment. The inspector also makes a mental calculation in which the previous meter reading is subtracted from the current one and the difference entered in his book. The new meter reading and he difference between the old and new reading are the inspector's computation and are subject to the human liability to err, a liability which is not decreased by the fact that the meters are not infrequently placed in dark cupboards and other places difficult of access.

The method of checking the readings by machine is as follows :—

The previous consumption as shown in the inspector's book is entered on the consumer's account and is *added* in the crossfooter.

The consumption to date as shown in the inspector's book is entered on the consumer's account and is *subtracted* in the crossfooter.

The difference, i.e., the consumption for the period *as shown in the inspector's book,* is entered on the consumer's account and is *added.*

If the inspector's subtraction in the meter book were correct, and if the figures were correctly indexed on the machine, the crossfooter wheels would now be at zero.

If the wheels are not at zero, then the amount remaining is the amount of error. Any error is immediately disclosed, thus permitting the job of folding the bills to follow closely on their preparation by machine. Note that up to this point there has been no check on the new meter reading, but the new meter reading of this period is the old reading of the next period when any inaccuracy will be adjusted unless the inspector continues to make a similar error in all subsequent readings.

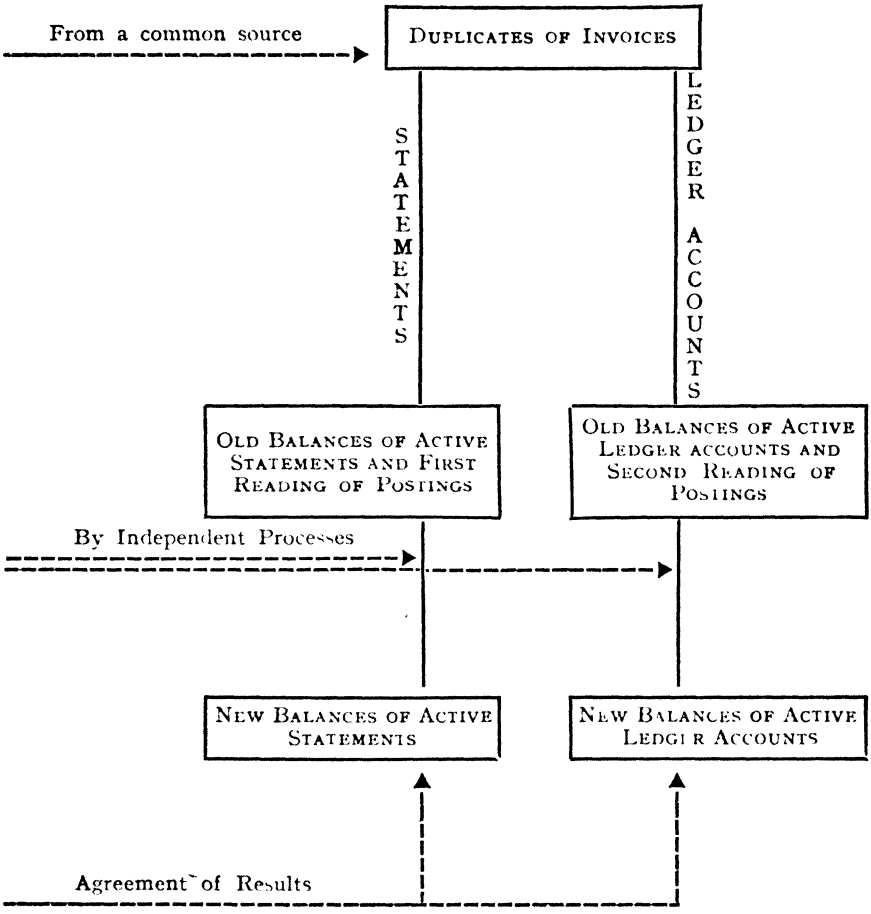
**Dual Run Proof.**

This is a form of proof which can be employed very effectively when suitable conditions prevail. Its application requires the production of two documents which each contain identical information. A very common example of this combination of documents is the production of a Ledger account and statement of account. The method is a variation of the long run proof and consists of posting the Ledger and accumulating the new balance of *active* accounts during the process. This accumulation may be made either by the use of a register or by a separate listing operation. The postings are then made to the *active* statements of accounts, during which operation the new balances are again accumulated or listed. The total of the new balances obtained from each of the posting operations should agree. Obviously, if an error is made in the posting during the Ledger run the proof totals will not agree unless a similar error is made during the statement run, and vice versa. Similarly, unless the old balances picked up are the same in each posting run the proof totals will again disagree. It follows, therefore, that the agreement of the proof totals proves that the entries were not only posted correctly arithmetically, but that the entry made in any particular account was also made in the relative statement.

Thus it is proved that the entries were posted to the correct accounts in the same way that arithmetical accuracy was proved. This proof is shown in chart form overleaf.

It should be observed that the proof figure provided by dual run is merely the total of the new balances of the active Ledger accounts. This figure is compared with the total of the new balances of the active statements of account. *There is no proved figure of the total postings*

CHART ILLUSTRATING THE DUAL RUN PROOF
AND PROOF OF POSTING TO THE CORRECT ACCOUNT.




which can be safely transferred to the Control Account. The total of the prelist by itself is unconfirmed. This difficulty may be overcome and a reliable control figure be obtained in three ways :—

(1) Two separate prelists may be made—one for the Ledger run and one for the Statement run.

(2) It may be necessary for statistical purposes to analyse the invoices, say, by travellers or districts. The preparation of such an analysis would be a virtual second summing of the prelist.

(3) The machine may be set to accumulate new balances in, say, the Statement run and new balances *plus postings* in the Ledger run. The proof formula would then be :—

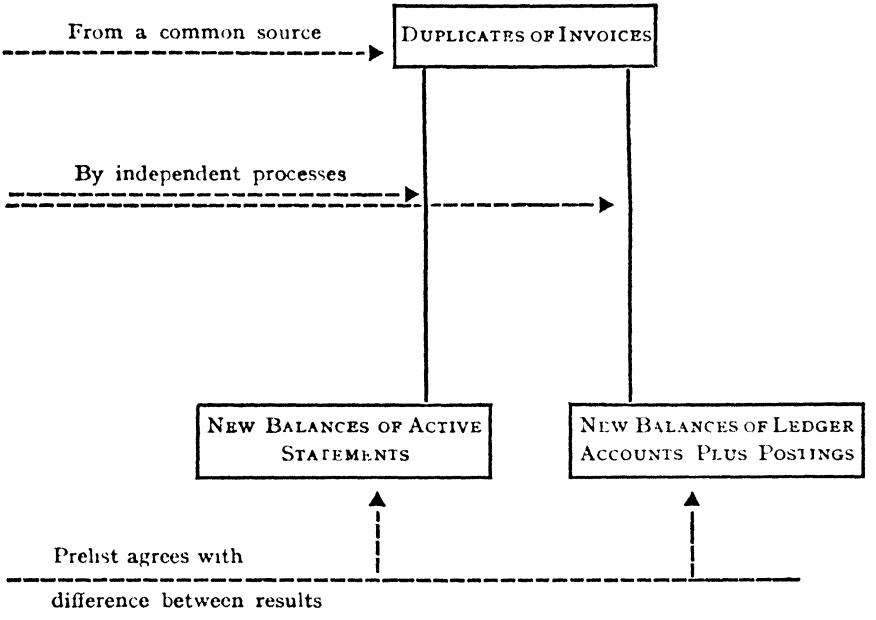
*New balances accumulated during Statement run + prelist = New balances + postings accumulated during Ledger run.*

Such agreement would prove the accuracy of the prelist.

Should an error be made in the prelist, the pick ups or the postings, the two proof totals would not agree. Note, however, that the proof merely indicates an error ; its location would fall upon the operator.

This form of dual run proof is shown below in chart form :—

CHART ILLUSTRATING THE DUAL RUN PROOF WITH PROOF OF TOTAL OF PRELIST FOR TRANSFER TO THE CONTROL ACCOUNT.




N.B.—Proof of proper account selection by the dual run method falls to the ground if an account wrongly selected should happen to have the same previous balance as the correct account. (See page 55).

**Straight Line Posting (also known as Vertical Posting).**

One of the advantages of machine posting is that the accounts are kept in a continuous state of balance, i.e., the balance to date is always available without its being necessary to add debits and credits and subtract out. To obtain this state of perpetual balance, as has been shown in previous chapters, it is necessary to pick up the old balance and to it add the current posting. Each account forms a continuous

chain of adding to-day's entry to yesterday's balance, and thus a total is obtained which may to-morrow be further increased by new postings.

It has been found from wide experience that in general the advantage of the continuous balance far outweighs the trouble involved in picking up the previous balance. Special instances may occur, however, in which there is little or no advantage to be obtained by keeping the accounts in continuous balance. Such cases are these in which *only one or two entries* take place in the accounting period, i.e., within the period covered by each rendering of a statement of account. In these circumstances it might be more advantageous to use the method of posting known as "straight line posting." If this method is used. the account is inserted into the machine, after which the date, reference number and posting are all indexed together. The operation of the machine causes the complete entry to be printed on the Ledger card and the amount of the posting retained in the crossfooter. This operation is continued with all subsequent postings, and at the end of the run the total in the crossfooter is the total of the amounts entered in the various accounts. In effect, the posting operation is nothing more than *a listing of the figures of the media*, a separate Ledger account being used for each item. The total thus obtained can then be compared with the total of the prelist and posted to the control account. Periodically the balance of each account is struck as in ordinary hand book-keeping.

**Paid and Unpaid Files.**

This is a very speedy method of keeping accounts, but it can be effectively used only where certain conditions obtain. There should be a very definite *control of credit*, and usually entries should be limited to one transaction within the accounting period. The seller must be prepared to cut off further supplies until previous transactions have been settled.

The paid and unpaid files are therefore used where the transactions consist of a debit which is cleared by a credit before further debits are raised. Examples of this may be found in the accounts of public utilities such as telephone, electricity and gas, where further supplies are cut off when accounts fall into arrear. The original request for payment is made out in duplicate ; the top copy is rendered to the consumer : the bottom copy is filed in an *unpaid file*. A control account of this file is maintained which shows the total of all the duplicate bills which the file contains. As the payments come in, the bills which have been settled are extracted from the unpaid file, dated by a rubber stamp, listed on a machine, and the total thu obtained compared with the amounts received as shown in the Cash Book for the period. The Control Account of the unpaid file is then reduced accordingly. The bills which

have been settled are now placed in a *paid file*, for which a Control Account is also maintained. Thus, at any time the following questions can be answered :—

(*a*) How much has been paid? See Paid File Control Account.

(*b*) When and by whom was it paid? See documents in Paid File.

(*c*) How much remains outstanding? See Unpaid File Control Account.

(*d*) By whom are outstanding amount due? See documents in Unpaid File.

It will be obvious that if accounts were allowed to fall into arrears without the stoppage of the supply of further goods or services, or if payments on account were accepted to any great extent, these files would become very difficult to control; but if the conditions required are even partially obtainable, it is a good plan to use the paid and unpaid file system so far as it can be applied, other methods being adopted for accounts that become complicated by reason of arrears or partial payment. Such accounts may be removed from the unpaid file (the Control Account being adjusted accordingly), and transferred to an ordinary Ledger account. The Control Account of the Ledger to which the transfer had been made would also require adjustment. The paid and unpaid file method is unsuitable in cases where a customer gives special instructions for invoicing and for the rendering of statements.

**Proof of Posting to the right Account.**

The methods of proving that postings have been made to the right account are all based on the same principle which applies to the ordinary arithmetical proofs—the agreement of two independent readings of basic facts. It is now proposed to examine the commoner forms of this proof.

The *Dual Run Proof*, which has already been discussed, is a very common method of proving that the correct account has been selected. This form of proof is much used by banks where errors of account selection may have serious consequences. For instance, if money lodged by "A" were credited in error to "B's" account and "A" drew a cheque which, as a consequence of the error, was dishonoured, then "A" might have a claim for damages against the bank. (*Rolin v. Steward* (1854), 23 L.J.C.P. 148).[1]

A second method of proving proper account selection is to have the folio number of the relative Ledger account entered on the back

[1] Note that Sir John R. Paget, in *Legal Decisions Affecting Bankers*, 1924, Vol. 3, p. 152, states that "recent cases go to show that, save in the case of a mercantile man or trader, where actual damage is presumed to have resulted from the dishonour of a business cheque, special damage must be proved before a plaintiff can recover substantial damages. The old idea that, under all circumstances and conditions, dishonour, unless justified, involved substantial compensation, must now be treated as exploded."

of the posting document and all such folios summed (provisional total). The folio numbers of the accounts to which the postings are actually made are also summed (confirmatory total). The agreement of the two totals thus obtained proves within the principle of proof that the proper accounts were selected. The reason for recording the folios on the back of the posting document is, of course, the now familiar one of rendering the first reading invisible at the time of making the second.

Proof of proper account selection can be attained by yet another method. The procedure is: mark on the *face* of the media the folio number of the account to which it is considered each particular posting should be made. In the Ledger accounts a special folio column is provided in which the folio number of each item *as shown on the posting document* is entered. If the account selection is correct, the special folio column will consist of a growing column of identical figures, among which any wrong number would usually be conspicuous.

The following illustration will make this method clear.

ANOTHER METHOD OF PROVING POSTING TO THE CORRECT ACCOUNT

PLANT UPKEEP

Steam Crane No. 14. Account No. 123

| FOLIO | DEBIT | CREDIT | BALANCE |
|---|---|---|---|
| 123 | 100. 0. 0 | | 100. 0. 0 |
| 123 | 20. 0. 0 | | 120. 0. 0 |
| 123 | 12. 0. 0 | | 132. 0. 0 |
| 927 | 4. 0. 0 | | 136. 0. 0 |
| 123 | 10. 0. 0 | | 146. 0. 0 |
| 123 | 15. 0. 0 | | 161. 0. 0 |

The folio 927 among the other numbers indicates an error of account selection.

N.B.—The folio entered in the special column *must be read from the posting document.* To read it from the account heading would be useless.

CHAPTER IX

## MULTIPLE SYSTEMS

IT sometimes happens that a business may have different classes of customers. In such cases it may be possible to divide the Ledger into sections. Each section would deal with one class of customer only and would have its own distinctive method of proof. This is quite common in large business, but it is not generally recognized that it is often possible to give the small business all the advantages of a variety of systems without creating complications or relaxing control. Consider the following actual example. A small coal merchant's office had three types of customer.

(1) Industrial.
(2) Domestic.
(3) A special club group.

The method of proof employed for (1) was the old and new balance proof.

With regard to (2) there had been trouble caused by the posting of entries to the wrong account ; an error which the ordinary Trial Balance did not disclose. It seemed, therefore, that this was an obvious case for the dual run proof. It so happened, however, that one large section of the domestic customers' Ledger consisted of a housing scheme in which the coal bunkers were of a standard pattern and size. Consequently, there was a number of accounts in which the balances were the same, the figures being the cost of filling the standard bunker at the current price of coal. This made the dual run proof unsuitable. (See page 51). This Ledger, therefore, was sub-divided into such customers as had standard-sized bunkers and those whose bunkers were of varying capacities. The standard-sized bunker accounts were proved by the old and new balance proof, while the accounts in connection with the non-standard bunkers only were proved by dual run, so that entries in this latter section of the Ledger were proved to have been posted to the proper accounts. The problem of mispostings in the case of the standard bunkers was still unsolved ; the ordinary dual run proof not being practicable, resort was made to the method described on page 53.

The procedure was as follows :—

One clerk entered on the back of the delivery notes the Ledger folio

of the account to which *in his estimation* the entries should be posted. These folios were summed (provisional total). The machine operator then posted the entries to the Ledger and summed the folios of the accounts to which they were posted, thus providing a confirmatory total. The agreement of the totals of the two totals proved, within the principle of proof, that the entries had been posted to the right account.

The club accounts (3) were in respect of the employees of a large concern. These accounts were guaranteed by the employers on the following conditions:—(*a*) that no more than a hundredweight of coal would be supplied at a time; (*b*) that a second supply would not be delivered until the first had been paid for. In consideration of these conditions a special price concession was granted. It was decided to keep this club Ledger on the paid and unpaid file system. The documents to be filed were the duplicate delivery notes extended at the current price. As new deliveries were made fresh documents were filed in the unpaid file, and with each payment the corresponding delivery note was removed from that file and placed on the paid file. A Control Account of the unpaid file was maintained. This account reflected in total all new deliveries (increases) and all cash received in payment (decreases). A Control Account of the paid file was also kept.

Not only can different forms of proof be applied to different sections of a complete system at one and the same time, but different forms of proof can be applied to the same section at different times to meet altered circumstances. For instance, a firm of wholesale provision merchants used the direct proof for the Sales Ledger. The statements of account were also maintained on the same principle, the routine of the work being so arranged as to ensure that statements of account, up to date, proved and balanced, were always ready for travellers setting out to call on customers in any given area. The accuracy of the account selection during the posting was proved by calling off from the media.

In 1943 the call on manpower for National Service so depleted the office staff that it became necessary to increase the machine posting speed. It was, therefore, decided to change the system of proof from direct to dual run proof. The effect of this change was an increase in the posting output of the machine, since the second pick up and the operation of depressing the total key was avoided, while the accuracy of account selection was proved as a result of the choice of the new form of proof. On the other hand, where an error occurred, the search under the new system of proof was more extended than would have been the case under the old form. Such was the degree of accuracy which the operator had attained that this disadvantage was largely discounted.

This illustrates the point that the skill and degree of training of an operator is a factor to be weighed in selecting a form of proof.

As has been shown so far in this chapter, systems may be considered as multiple with regard to type of customer and also with regard to period of time. A system may also be included in the multiple class with regard to types of machine.

**The Typewriter Accounting Machine.**

An accounting machine may have a typewriter attachment for use where narrative is required. Such a machine is called a typewriter accounting machine. Some machines of this type automatically compute totals, debit or credit, and print such totals on depression of the total key, while other machines merely indicate totals on dials after the manner of a motor car speedometer. With this latter type of machine the result of a computation is transferred to paper by the operator, thus introducing the risk of error to which all human operations are liable.

The fact that narrative is required does not always indicate that a typewriter accounting machine should be used. The reason is that the mechanism of an accounting machine is much more intricate than that of a typewriter, therefore the accounting section of a combined machine is more expensive than the typing section. Assuming for purposes of illustration that the cost of a typewriter accounting machine is divided 80 per cent. to the accounting section and 20 per cent. to the typing section, then, since the machine cannot type narrative and operate as an accounting machine simultaneously, it follows that 80 per cent. of the capital value of the machine is idle when typing is in progress; and further, since typing is slower than adding, it is highly probable that the accounting, or more expensive section of the machine, is idle for more than 50 per cent. of the time. Paradoxically, therefore, it would appear that a combined typewriter accounting machine should be used only when the amount of typing compared with the amount of figuring is small, but not small enough to be within the scope of standard abbreviations as described on page 17.

When much typing is required, it is generally possible to apply the system known as "dual billing." (Not to be confused with the dual run proof).

The principle of dual billing is that of the division of labour applied to machines. The figuring is done on a fast accounting machine after which the documents are passed to a typewriter on which the documents are completed.

One great advantage arising from the use of dual billing is that if the amount of typing is far is excess of the figuring, the number of

typewriters can be increased without necessitating a corresponding increase in the number of figuring machines.

The extent to which dual billing will prove advantageous depends mainly on the ratio of typing to figuring, but even with a moderate typing job the introduction of dual billing confers great benefits. It is, of course, important that the machines which are to work together should be fitted with the features best calculated to deal with the insertion, aligning and ejection of forms. Care must also be taken to ensure that the spacing of the machines is synchronized.

Consider the following case :—

A firm of house furnishers was obliged, for various reasons, to keep a fully detailed Ledger. Such was the nature of the business that one entry might involve ten to twenty lines of narrative. It was estimated that three typewriter accounting machines would be required to deal with the work. Dual billing was introduced, and two typewriters and one small Ledger posting machine were found to be adequate to handle the work. The cost of one typewriter accounting machine would have been greater than the total cost of the three machines which were installed.

CHAPTER X

# STATEMENTS

STATEMENTS of account may be divided into two classes :—

(1) Open item statements.

(2) Closed item statements.

**Open Item Statements.**

This class of statement shows only such items as are outstanding at the time the account is rendered. The statements prepared by hand methods almost invariably belong to this class. For the production of such statements the Ledger is built up during the month or whatever period may be most convenient and the items outstanding at the close of the period are simply copied on to the statement forms, showing the date of the transaction and possibly a reference such as an invoice number. If the sum of all the statements equals the balance of the Control Account, it may be accepted within the Principle of Proof that the figures in the Ledger have been accurately transferred to the statements and that the latter have been correctly summed.

*Open Item statements prepared by Machine.* If the statements are to be prepared mechanically the machine would print the date, reference numbers and amounts. The amounts would be entered with the adding and subtracting motor bars to provide a machine total in respect of each statement. If a register is available it would be set to accumulate the total of each statement and to provide automatically the grand total of all statements of account. This figure would be compared with the Control Account to establish the accuracy of the statements.

**Closed Item Statements.**

The closed item statement is just a copy of the customer's account in the supplier's Ledger for the period. Consequently it shows not only items still outstanding but also such items as were settled during the period, together with the relative squaring entry such as cash or credit note. The methods by which this copy may be obtained vary. The obvious way is by the use of a carbon sheet by which Ledger and statement can be produced simultaneously. There is a tendency to overrate the saving of time effected by the use of carbons for this particular purpose. Admittedly the use of a carbon permits the simultaneous production of two documents (Ledger and statement) in one operation, but this saving may be partially offset by the need to insert and withdraw

the carbon paper. This operation may be minimized by inserting the carbon paper at the beginning of the statement period and allowing it to remain in the Ledger until the statement is completed at the end of the period. In either case there still remains the question of alignment. A statement is a transitory document which appears at the beginning of, say, a calendar month and is sent to the customers at the end of the period. The Ledger, on the contrary, remains for all time, each new month commencing where the previous month left off. Consequently it may happen that while a particular entry may require to be made at the foot of a Ledger account, it may also be necessary, the date being the first of the month, to make the same entry on the first or top line of the relative statement of account. Careful aligning is required to produce a neat, evenly spaced combined Ledger and statement by means of a carbon paper. If the entries are crushed they will certainly look untidy and one entry may even be printed wholly or partially on top of a previous one. If, on the other hand, the operator allows an unnecessarily wide space between entries, the result would be an increase in the stationery bill. Even when the two documents have been aligned, care must be taken not to upset their relative positions in the process of inserting them into the machine. In this respect the front feed carriage (see page 44) is of great assistance—is in fact almost a necessity.

The above remarks must not be taken as a condemnation of the system of obtaining Ledger and statement by the use of carbon paper a method which is successfully employed in hundreds of installations. It is desired, however, to refute the assumption that a statement of account and the relative Ledger account can, by the mere insertion of a carbon sheet, be produced in no more time than would be taken to produce the Ledger account alone.

**Alternative Methods of Preparing Closed Item Statements.**

In addition to the dual run proof method, which has already been discussed, there are several other methods of producing statements by machine, from which a choice may be made. Some of the more common methods are considered below.

*Statement of Account with Old and New Balance Proof.* Using the old and new balance proof, the statements may be produced by the following operations :—

(1) Insert the statement of account into machine.
(2) Pick up the previous balance. Carriage position 1.
(3) Enter date and reference. ,, ,, 2.
(4) Enter amount of posting. ,, ,, 3.
(5) Print sub-total. ,, ,, 4.

(6) Withdraw statement form and insert the relative Ledger account.
(7) Print sub-total again. This is a repeat of the new balance as printed on the statement form. Carriage position 4.
(8) Return the carriage of the machine to the pick up position and print second pick up, using the subtract motor bar. Carriage position 1.
(9) Print date and reference. Carriage position 2.
(10) The amount now remaining in the machine is the difference between the old and the new balances. This amount is printed in the debit column by the use of the total key. Carriage position 3.

If the total printed in the debit column of the Ledger account agrees with the amount appearing in the posting medium, then proof of accuracy has been established within the Principle of Proof.

What is true of one entry is equally true of many entries. To extend this form of proof to cover any given number of transactions it is only required to substitute a prooflist consisting of all the totals printed in the debit columns of the various active accounts for the single total described above, and to compare the total thus obtained with a prelist of posting media.

Note that the old and new balance proof has really developed into a form of direct proof since the subtraction of the old balance has been made at the time of the posting of each entry instead of being made during the preparation of the prooflist. As a result the prooflist consists of a list of the differences between the old and the new balances of the active accounts.

*Closed Item Statement with Direct Proof.* It is but a step from the preparation of statements under the old and new balance methods to their preparation under the direct proof method. Actually there is no difference in principle between the two methods but usually the direct proof is associated with a machine having an accumulating register. This register would be active at the point where the final entry (the difference between the old and the new balance) is made. Consequently, on the conclusion of the posting run there is available in the register the total of the prooflist without the further listing which was required in the case of the old and new balance proof. The advantage of this is that the possibility of error in preparing the prooflist is avoided.

*Closed Item Statement with Three Register Proof.* Since three register proof is usually associated with a front-feed carriage the common method under this form of proof is to produce the statements and Ledger accounts simultaneously by means of carbon paper. As has already been shown, there are certain difficulties in the matter of alignment, insertion and

ejection of the related documents attaching to this method which are overcome by the special features of the front-feed carriage and the form of the stationery.

*Closed Item Statements by means of Repeat Printing Feature.* The repeat print feature is merely the mechanical equivalent of a carbon copy. Instead of creating two impressions simultaneously as by carbon methods, the two impressions are created one after the other by a mechanical operation. The first impression would be printed on the Ledger and automatically repeated on the statement or vice versa. The same would apply to dates, references and totals. As a result of this mechanical repeating, the Ledger accounts and statements contain the identical information in respect of the current period. Here again special devices are necessary to cover the fact that the entries may be required to occupy positions on the Ledger which differ from the positions which they must occupy on the statement.

CHAPTER XI

# ANALYSIS—THE FIVE BASIC METHODS

If an objective view be taken of book-keeping, it will be seen that the whole subject can be summed up in one word—*analysis.* The entire art of keeping records and proving their accuracy consists of *breaking up* masses of information, *reassembling* the figures in a new form, and establishing that the sum of the parts equals the whole, i.e., that the figures as reassembled equal the total of the original entries. The object of analysis is to draw together related facts and so present a comprehensive picture shorn of all irrelevancies. Thus, for example, John Brown's Ledger Account in the Sales Ledger is a collated picture of the sales to John Brown picked out of a mass of entries in the Day Book. Against these transactions are shown the corresponding cash entries selected from the Cash Book, the whole presenting the fact that John Brown still owes, say, £4 9s. 1d. in respect of two items of which the date and invoice numbers are available. The sum of all debit entries equals the total of the Day Book, and similarly the sum of the credit entries equals the total of the Cash Book. This process of breaking up and reassembling applies *in all fields of accountancy*—the sum of the individual dividend warrants equals the total of the dividend as shown in the Appropriation Account, the sum of the amounts of material charged to jobs equals the credit to the value of stores on hand, and so on.

In view of its widespread application, it is not surprising that the methods of breaking up and reassembling should be many and varied. A detailed study of all the methods and processes of analysis is beyond the scope of this work, but five main methods will be discussed, and these should form a useful foundation.

These five methods of analysis are :—

(1) The Columnar Method—a method in which each classification has a column ; usually a column for the total is provided also.

(2) The Sorting and Exhaust Method—sorting any unit documents and thereafter abstracting from the remainder the most active heading and repeating the process with all classifications until all have been dealt with.

(3) The Random Method—posting the items in the order in which they appear in the media.

(4) The Mechanical Accumulation Method—in which a separate machine register is used for each classification.

(5) The Unit Method—as its name implies—can be employed where the documents each refer to one classification only. Where such is the case, the documents can be sorted into bundles, each bundle representing an analysis heading.

Any of the above methods can be applied to any problem of analysis, but usually one particular method or combination of two or more methods will prove to be the most desirable in given circumstances. The selection of the particular method or combination of methods to be employed requires detailed knowledge of the particular case and a considerable knowledge of the five basic methods, their advantages and limitations.

In making a survey of a case, the answers to the following questions will be found useful in selecting the analysis method :—

(*a*) What final information is required?

(*b*) Is the final result alone required, or might a need for intermediate information arise?

(*c*) Does the information required consist of figures only, or is narrative desired?

(*d*) When is the information required and at what intervals (daily, weekly, monthly, quarterly, etc.)?

(*e*) In what form is the information required, that is, is it for internal use only, or must it be intelligible to persons outside the business?

(*f*) Is the basic information presented in unit form, compound form or a mixture of both? Can the basic form be altered at will?

(*g*) Does the required analysis contain many headings?

(*h*) Does the media from which the analysis is made refer, on average, to a few or to many of the headings?

(*i*) If the media refers, on the average, to many headings, is the high average caused by a small section of the media?

**The Columnar Method.**

This is a very common form of analysis. It involves a sheet with columnar rulings, having a printed heading for each section of the distribution. Sometimes the headings are at the side and the entries are made horizontally, and sometimes there is a combination of both vertical and horizontal methods. One disadvantage of the columnar method is that in many cases only one or two headings are required to deal with each entry, so that if there were ten columns, as many as eight might be left blank for each entry made. The waste of paper and storage space would be approximately in the ratio of four to one. Another disadvantage of this method is that it involves carrying forward and bringing forward many totals on each page. It is also inelastic in that

should a new heading be required it can be accommodated only at the expense of dropping an old one unless a new book be printed or resort made to interlining, possibly in different coloured inks. The main weakness or rather limitation of the columnar method, however, is that it *cannot be extended* beyond, say, twenty columns without giving rise to confusion through the multiplicity of lines. If too many columns are used, mistakes in the selection of columns might arise, a type of error which the ordinary arithmetical proof would not disclose.

**Sorting and Exhaust Method.**

The first operation under this method is to obtain a total or prelist of the media. Thereafter, all documents which affect one analysis heading only are dealt with. The documents—say copies of the sales invoices—are *sorted* into bundles, each bundle representing a heading. Each bundle is added, and thus a total under each analysis heading is procured. The remaining copy invoices (those which referred to more than one heading) are analysed by *exhaustion*. This process consists of leafing through the documents and abstracting the figures referring to one analysis heading and repeating this operation with each of the analysis headings in turn. The figures thus obtained would be added to the appropriate total which the sorting operation had already provided The grand total of all headings should agree with the total sales for the day, i.e., the prelist.

In the process of exhaustion the headings would be taken in order of activity, commencing with the most active. By this means the number of documents to be handled at each run would tend to decrease since a document would be discarded as soon as all the items had been dealt with. For example, if B department were considered the most active, then all the items for B department would be dealt with first. Then the items for A department (the next in order of activity) would be listed. Thereafter all documents which dealt with A and B departments only could be discarded from the bundle. When F department (the next in order of activity) had been listed, the documents to be discarded would be those dealing with

A and F
B and F
A, B and F.

And so on, discarding each document as the items were exhausted and so diminishing with each successive handling the bundle to be dealt with.

In very many cases the sorting and exhaust method of analysis can be successfully used as a substitute for the columnar Day Book. Usually the media consists of copies of the invoices. Such of the media as applied to one analysis heading only would be sorted into bundles,

each bundle representing a heading. A special bundle would be made of documents which applied to more than one analysis heading. This bundle would be analysed by the exhaust method.

The aggregate in respect of each analysis heading would be obtained, which figure would be carried to an analysis account bearing the appropriate heading. The previous figure on each analysis account would be picked up as part of the posting operation, thus providing a total to date in respect of each of the headings. A Control Account would be maintained which would be the aggregate of all analysis accounts.

**Random Method.**

This method might be used in posting a small Sales Day Book to the Ledger. The items are posted to the accounts in the order in which they are presented in the media. To be successful, random posting should be combined with a good indexing system. It is limited in its application when used entirely on its own, but can be combined with a modified system of sorting, e.g., by arranging the media in sections. It may also be combined with the exhaust method. For this purpose Ledgers are divided into sections. The Ledger-keeper for section No. 1 random posts the items which apply to his Ledger, marking off on the media the items so posted. The media is now passed to the Ledger-keeper for section No. 2, who posts and marks off all entries applicable to that Ledger. This process is continued until all the items have been posted.

**The Mechanical Accumulation Method.**

Machine analysis is merely the mechanical application of the columnar hand method. Instead of a column for each heading, however, a separate register in the machine accumulates the required totals. The analysis by machine register is, of course, limited by the number of registers available.

**Unit Method.**

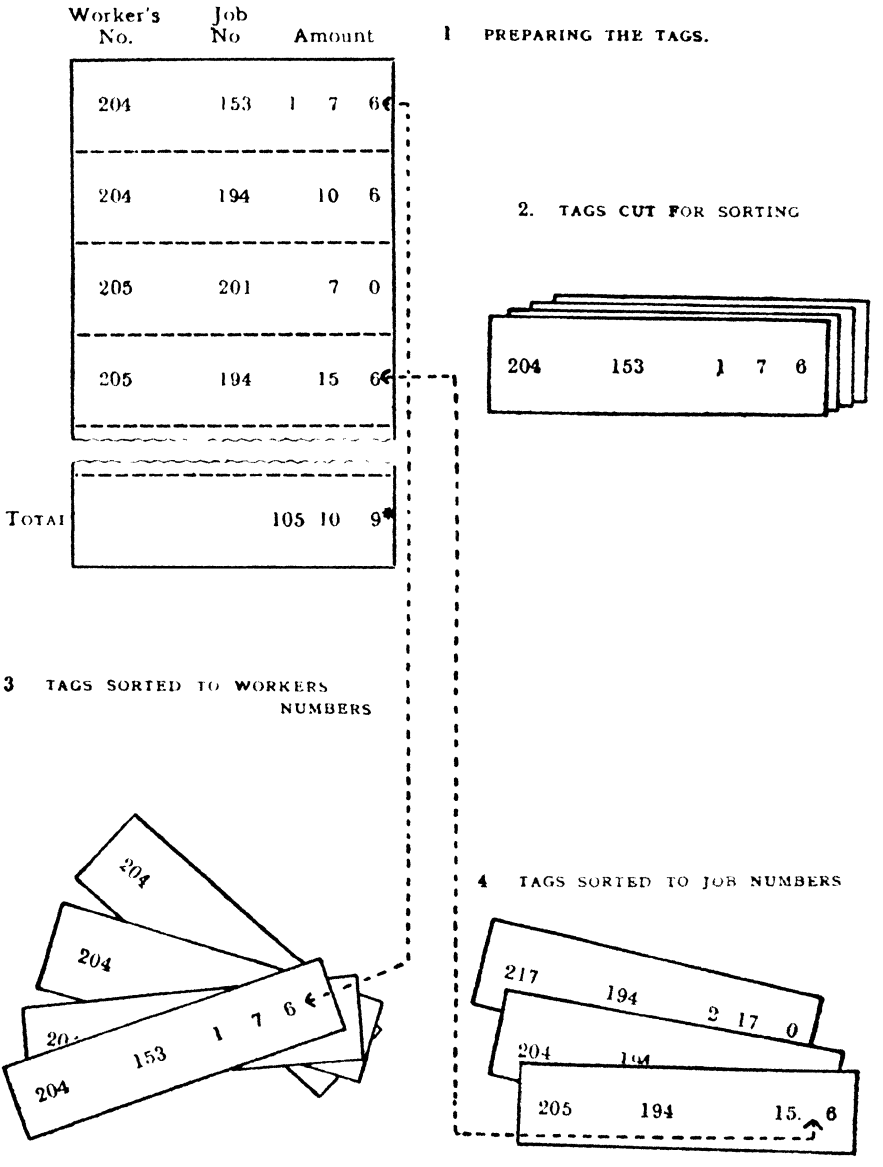
In the sorting and exhaust method, that part of the procedure covered by the term "sorting" can be applied only to documents which deal with a single heading. The remainder are analysed by exhaustion. There comes a stage, however, when the headings involved in each document are so numerous that the exhaustion method becomes unwieldy. In such cases, the analysis may be made by the process known as "tagging," which is the creation of a unit document for each entry in the media to be analysed.

The procedure, which is simple and very effective, is as follows :—

(1) Sum the media to be analysed. This *provides a prelist* for purposes of proof.

(2) Prepare on the machine tally roll a straight list of the essential figures. The total of this list should compare with the total of the prelist.

## THE STEPS IN TAGGING



(3) Separate the individual entries on the tally roll either by means of a guillotine or by tearing the tally roll, which would be specially perforated to suit the size of "tag" or ticket required. Sort the tickets in a sorting box in the required order and add them by sections on the machine. The grand total of all sections should agree with that of the prelist.

The information on each ticket might consist of Job No., Workers' No., and Amount. It may apply to more than one type of analysis but, in order to maintain its status as a unit document, it should not apply to more than one classification within each type. Thus a ticket made from a worker's time sheet might consist of a worker's check number, a shop number, a job number and an amount, but must not apply to more than one check number, shop number, job number or amount. Such tickets could be sorted into bundles, each bundle consisting of the tickets of a particular worker, which, when added, would be that worker's wage. The same tickets might then be reshuffled into bundles, each bundle representing a shop number, the sum of each bundle would be the wages chargeable to that particular shop. A further reshuffle of the tickets into bundles representing job numbers would provide the total wages expended on each particular job.

There is no limit to the number of types of analysis which can be represented on a ticket. While the ticket described above showed three types of analysis, it could have been elaborated further to show, for instance, the worker's trade classification, day or night shift, ordinary or overtime, time or piece work. The important point is that, while the number of types of analysis may be unlimited, only one classification within each type may be shown on one ticket.

See page 67 for an illustration of "tagging."

The uses of "tagging" extend beyond the limits of ordinary financial accounting and analysis. Consider the two applications of tagging which follow :—

*Production Control.* A factory printed Christmas Cards, the number of different designs ran into hundreds, each design had a distinctive number. The travellers submitted daily order sheets showing the number of each design sold, together with the distinctive line number. It was required to collate this information so that production could be kept in step with the orders received. It was decided to "tag" the travellers' order sheets.

*Procedure.* The total number (*not value*) of cards ordered each day was obtained by adding the figures on the travellers' order sheets. This constituted the *prelist.* Tickets were made on an adding machine, each ticket showing traveller's number, design number and number

of cards sold. The machine was set to add the number of cards sold, but not the travellers' number or the design number. The total number of cards sold thus obtained was compared with the total of the prelist. The tickets were then separated by guillotine[1] and sorted into bundles, each bundle representing a specific design. The number of cards ordered of any particular design was obtained by adding the tickets in the bundle bearing the corresponding design number. The agreement of the grand total of all section totals with the prelist total proved the accuracy of the work. An account was opened for each "Line Number." The number of cards printed was debited to the corresponding line number account and each account was credited with the number sold as shown by the "tagging" process. The balance of each account was the number remaining for sale, and formed a useful basis of the production programme.

*Collation of Employees' Earnings.* A concern employing a thousand men had been compelled, through pressure of work, to abandon the maintenance of Employees' Earnings Records. The Inland Revenue pressed for a return covering the period of twenty-six weeks. It was decided to use the tagging method of obtaining the total earnings of each employee. Tickets were made from the Gross Earnings column of the payroll showing date of pay week, worker's check No. and amount. This work was done in twenty-six sections, each section covering a pay week. The total of the tickets made for each week was compared with the total as shown on the payroll for the corresponding period.

After the tickets for all twenty-six weeks had been prepared and proved to be in agreement with the payroll they were separated by guillotine, sorted under the heading of check numbers, and the total earned by each employee was obtained by adding the tickets thus collated.

An arithmetical proof alone was not sufficient, since such a proof would not cover the case of a wrong check number being entered on a ticket, so affording tax relief to one employee at the expense of another. The check numbers on the payroll were therefore added to form a prelist, and the machine was set to accumulate, during the preparation of the tags, the check numbers as printed on them. The agreement of the two totals thus obtained proved the accuracy of the check numbers on the tickets. The adding of the consecutive numbers of the employees present each week was done on the negative plan, that is, the sum of the check numbers of the absentees was deducted from the sum of all the check numbers. Consecutive numbers are easily added if they

[1] In this particular case the machine was fitted with a guillotine which automatically cut the tags as they were made.

are considered as pairs. For example, the sum of the consecutive numbers 1 to 10 is 55 since it consists of the following pairs—

$$1 + 10 = 11$$
$$2 + 9 = 11$$
$$3 + 8 = 11$$
$$4 + 7 = 11$$
$$5 + 6 = 11$$

Five groups of 11 = 55.

When a unit system of analysis is employed, the processes involved are: (1) the preparation of the information in unit form where the original form is not unit, (2) the scattering of the units, and (3) the reassembling of the units in the new order.

*Preparation of Unit Documents.* This has already been dealt with under tagging.

*Scattering.* In the scattering of small units a *sorting box* is very often employed. This is a box divided into ten or possibly one hundred sections, not unlike the divisions of an egg-box, but of sufficient size to accommodate the particular documents to be handled. The sort is carried out in three stages: (1) to thousands, (2) each thousand to hundreds, and (3) each hundred to units.[1] Thus, if a ticket bearing the number 98,765, were being dealt with, the last three figures would be ignored in the first sort and the ticket would be placed in section 98. The tickets in each individual section would now be taken and sorted to the third figure, that is, the hundreds; taking the example again, this ticket would be placed in box 7. On the completion of this sorting operation the tickets in each individual section would be sorted to the last two figures, the sample ticket being placed in box 65. To reassemble the information in its new order the tickets in each section would be added. Thus, the total sum relative to each particular number would be obtained.

*Reassembling.* Closely allied to analysis is the building up or reassembling of the information in its new form. This may be done very effectively by the use of *shingled forms.* The name of "shingled forms" is derived from the fact that they overlap one another as do shingles on a roof. On these forms the particular headings required are printed, usually vertically, but sometimes horizontally. The figure derived from the analysis process (say, the total of a bundle of tags) is entered against the appropriate printed heading. When all the entries have been made on all the shingled forms, the latter are hung alongside one another on a board, overlapping in such a way that only the figures

[1] Sometimes this process is reversed and the sorting commences with the tens and units columns.

are visible. (See illustration below). A ruler or straightedge of some kind is then placed on the overlapped forms, and the figures thus underlined are cross added. As a result, the total in respect of all the forms and as applicable to each analysis heading is obtained. The total in respect of each heading is entered on a blank shingled form, which, when summed, provides the grand total of all the headings.

A simple illustration of shingled forms will be found in the practice, common among card players, of fanning out the cards in such a way as to show only sufficient to permit recognition. On the playing card there are only two analysis headings, value and suit; nevertheless, it differs in degree only with the most comprehensive shingled form.

**General Remarks.**

While the different analysis methods have here been dealt with separately, it should be observed that in practice there is no clean-cut division and the various methods very often merge into one another. For example, an analysis might in the first instance be broken up very broadly by the machine register method and divided further by the preparation of tickets (unit method). Again, the unit method and the exhaust method are very often combined. The choice of method

ILLUSTRATION OF SALES ANALYSIS BY TRAVELLER AND BY COMMODITY

| TRAVELLER NO 1 | | LER NO. 2. | LER NO 3 | LER NO. TOTAL |
|---|---|---|---|---|
| Butter | 1. 2. 6 | 1. 17. 9 | 15. 2 | 3. 15. 5* |
| Sugar | 15. 7 | 2. 18. 2 | 4. 1 | 3. 17. 10* |
| Tea | 2. 17. 1 | 1. 3. 1 | 17. 2 | 4. 17. 4* |
| Coffee | 1. 4. 6 | 1. 19. 8 | 18. 2 | 4. 2. 4* |
| Rice | 1. 0. 4 | 1. 1. 4 | 5. 5 | 2. 7. 1* |
| TOTAL | 7. 0. 0* | 9. 0. 0* | 3. 0. 0* | 19. 0. 0* |

The travellers' orders would be analysed by one or more of the methods discussed. The results would be transferred to the appropriate shingled form. These forms, when overlapped and hung on the board, may be added *vertically* to give the total sales by individual travellers and *cross* added to give the sales by commodity classification. These figures are then transferred to the appropriate permanent record.

must be based on practical experience and a careful study of the particular problem.

Regardless of the method or combination of methods by which an analysis is made, it only remains to carry to a permanent record the final figure resulting from the various processes. This permanent record

RECORDING THE INFORMATION ON THE TRAVELLERS' RECORDS

TRAVELLER'S ANALYSIS

TRAVELLER No 3

| PREVIOUS TOTAL | THIS WEEK | TOTAL TO DATE |
|---|---|---|
| 10. 0. 0 | 3. 0. 0 | 10. 0. 0*<br>13. 0. 0* |

TRAVELLER'S ANALYSIS

TRAVELLER No 2

| PREVIOUS TOTAL | THIS WEEK | TOTAL TO DATE |
|---|---|---|
| 12. 0. 0 | 9. 0. 0 | 12. 0. 0*<br>21. 0. 0* |

TRAVELLER'S ANALYSIS

TRAVELLER No 1

| PREVIOUS TOTAL | THIS WEEK | TOTAL TO DATE |
|---|---|---|
| 4. 0. 0 | 7. 0 0 | 4. 0. 0*<br>11. 0. 0* |

TRAVELLER'S ANALYSIS

CONTROL A/C

| PREVIOUS TOTAL | THIS WEEK | TOTAL TO DATE |
|---|---|---|
| 26. 0. 0 | 19. 0. 0 | 26. 0. 0*<br>45. 0. 0* |

Note the agreement of the totals of the Commodity and Travellers' Control Accounts. See page 73.

## RECORDING THE INFORMATION ON THE COMMODITY CARDS

COMMODITY ANALYSIS

RICE

| PREVIOUS TOTAL | THIS WEEK | TOTAL TO DATE |
|---|---|---|
| 5. 2. 6 | 2. 7. 1 | 5. 2. 6*<br>7. 9. 7* |

COMMODITY ANALYSIS

COFFEE

| PREVIOUS TOTAL | THIS WEEK | TOTAL TO DATE |
|---|---|---|
| 4. 7. 7 | 4. 2 4 | 4. 7. 7*<br>8. 9. 11* |

COMMODITY ANALYSIS

TEA

| PREVIOUS TOTAL | THIS WEEK | TOTAL TO DATE |
|---|---|---|
| 4. 16. 8 | 4. 17. 4 | 4. 16. 8*<br>9. 14. 0* |

COMMODITY ANALYSIS

SUGAR

| PREVIOUS TOTAL | THIS WEEK | TOTAL TO DATE |
|---|---|---|
| 3. 7. 9 | 3. 17. 10 | 3. 7. 9*<br>7. 5 7* |

COMMODITY ANALYSIS

BUTTER

| PREVIOUS TOTAL | THIS WEEK | TOTAL TO DATE |
|---|---|---|
| 8. 5. 6 | 3. 15. 5 | 8. 5. 6*<br>12. 0. 11* |

COMMODITY ANALYSIS

CONTROL A/C.

| PREVIOUS TOTAL | THIS WEEK | TOTAL TO DATE |
|---|---|---|
| 26. 0. 0 | 19. 0. 0 | 26. 0. 0*<br>45. 0. 0* |

usually consists of a Ledger card such as is commonly used in machine work. The procedure is the usual Ledger posting operation, and consists of picking up the previous balance and adding to it the figure derived from the analysis. A prelist would have been prepared, against which the accuracy of the posting would be checked. On the confirmation of its accuracy, the total of all postings, would be carried to an analysis Control Account. For example, if the job were to produce statistics showing the sales figure for each of a number of travellers, the copy invoices or other suitable media would be analysed accordingly, and the figure of each traveller's sales would be carried to an analysis account bearing his name: "Total of Sales by Mr. ——". The total in respect of all travellers would be carried to a "Sales by Travellers Control Account," which should agree with the financial side of the books, i.e., the particular Sales Day Book or section thereof which dealt with sales by travellers.

The examples on pages 72 and 73 show a two-way analysis of sales:—

(1) By travellers.
(2) By commodities.

The travellers' orders would be analysed by one or more of the methods discussed. The results would be transferred to the appropriate shingled form. These forms, when overlapped and hung on the board, may be added vertically to give the total sales by individual traveller and cross added to give the sales by commodity classification. These figures are then transferred to the appropriate permanent record.

**Production Sheets.**

The building up of the production sheets in a bakery affords an illustration of the use of shingled forms in an application quite apart from financial accounting.

The problem of what to bake and how many, is one which demands the daily attention of a bakery manager. Owing to the perishable nature of many bakery products, it is essential that a decision should be made promptly and executed immediately. There may be several retail branches who send in daily a list of their estimated requirements for the following day. Shingled forms afford a speedy and accurate way of arriving at the total requirements of *all* branches for each of many products. The shingled form is printed down the left-hand side with the names of all the common bakery products, with a space at the foot in which abnormal requests may be written. The right-hand side is left blank so that each branch can enter opposite each product the number required by that branch. At the bakery office the shingled forms are placed on a board and the number required for all branches in respect of each product is obtained by cross adding. To guide the

eye a ruler or straight-edge, as before described, is placed under each commodity in turn.

**Sterling Value.**

If the accounting system involves the charging of commodities to branches at selling price the retail values might also be entered on the shingled forms. The vertical summation of these figures provides the necessary debit in respect of each branch.

CHAPTER XII

# COST ANALYSIS AND COST RECORDING

ALL book-keeping is a matter of analysis and costing is no exception to this general rule. From the point of view of the mechanical production of cost records therefore, the whole subject is reduced to a process of selecting, firstly, the method or combination of methods of analysis; secondly, the system of transferring to a permanent record or cost account the information thus obtained; and finally, the proof method which, within the framework of the accepted Principle, establishes that the work is at least arithmetically correct. In certain cases it may be desirable that the proof be extended to include selection of account, while in other cases the proof may extend beyond financial figures and embrace units of time and/or material.

In previous chapters various methods of analysis were discussed, the reassembling of figures was considered and a number of forms of proof were studied. It now remains to apply these methods to the subject of costing.

For purposes of illustration, job costing, being one of the commonest types of costing in use, has been chosen. It should be noted, however, that the principles which are about to be discussed are applicable to all types of cost recording, the reason being, as already stated, that the whole subject is one of analysis.

Within certain margins cost figures should be controlled as regards accuracy as rigidly as, say, the Sales Ledger.

Information concerning cost consists of facts which no book entries can alter.

A quotation, estimate or tender is an expression of opinion. It is usually based on costs of previous jobs and therefore can be accurate only subject to the accuracy of the cost on which it is based and subject also to the accuracy of any adjustments required by changed conditions.

The price of a job is generally controlled by the estimate, and is therefore based in the last analysis on cost. Price need not be greater than the cost and may be less. In the latter event the amount by which it falls short should be clearly shown. The system of selling below cost may, from the point of view of policy, be justified, but the fact that a quotation for a job has been deliberately reduced should not affect the cost; any loss should be boldly shown. Cost is what it is, and book

entries, the object of which is to make the figures of the cost conform to the estimate for purposes of acquisition of praise, the avoidance of censure, or the maintenance of a bonus, can only be viewed by the cost accountant as a useless burying of the head in the sand.

The main elements of cost are material, wages and expenses. These elements may be further divided into :—

(1) Material charged directly to cost.

(2) Material charged to stores and subsequently to cost.

(3) Wages charged directly to cost.

(4) Expenses charged directly.

(5) Material, wages and expenses charged as a percentage of a direct charge, or according to the time spent on the job.

In the allocation of each of the above sub-divisions of the elements of cost, the object is to analyse the charges according to a pre-arranged plan and to collect the final results in the Cost Ledger in such a way as to provide a permanent record of the cost.

This breaking down and re-grouping can be considerably simplified by the use of an appropriate analysis method or combination of methods.

The machine's place in costing is to secure, at a minimum cost in time and effort, accurate information as fully as and minutely detailed as to provide an adequate guide to the financial and technical executives.

The advantages to be derived from such a wider analysis of facts and figures are being more and more recognized. A considerable time may elapse before the results become apparent, and sometimes the effects may seem remote. A case in point is that of an engineering concern which kept a number of small locomotives for carrying miscellaneous loads from one shop to another throughout the works. It was considered uneconomic to analyse by ordinary hand methods the expenses of running and maintaining these locomotives. The charges were, therefore, applied as a percentage on productive wages. A machine costing system was eventually installed which permitted a much more detailed and more direct charge to be made for the service. In consequence of this direct charge for the use of the locomotives, engineers speedily discovered that in many cases alternative methods were as good and were much less expensive. The net result was that several of the locomotives were found to be in excess of requirements and were disposed of.

The degree of accuracy which the records will attempt to achieve is a matter for the accountant to decide. Careful consideration should be given to the use which will be made of the final figure, and it should be borne in mind, particularly with regard to wages, that the original information will very often be furnished by a tradesman or an apprentice

who is not concerned, and cannot be expected to be concerned, with the accuracy of details. In one case, in which a new costing system had been introduced, one workman was heard to complain of difficulty in supplying the information required by his daily time sheet. He was reassured by a colleague, who informed him that the only point that mattered was that the hours worked should total 8½ each day. Another example of the general inaccuracy of time sheets as viewed from the cost angle is the classical case of the foreman who told his men (who had nothing to do) that the job they were on could now be considered closed because a new job had come in.

Just as a chain is no stronger than its weakest link, a final costing record cannot be any more accurate than the widest approximation in the chain of its production. It would seem, therefore, that in most cases absolute truth in costing records cannot be achieved since the basic information may not be strictly accurate. Therefore no useful object can be achieved by carrying subsequent calculations to minute fractions. Nevertheless, the accounting side of costing should not aggravate the position by widening the margin of approximation. Such information as *is* received in the Costing Department should be recorded consistently and uniformly, and accuracy should be established within the Principle of Proof.

It is now proposed to take the elements of cost and consider how each can be analysed, scattered, reassembled, and how the final information can be carried to a permanent record with adequate proof of accuracy.

CHAPTER XIII

# MATERIAL PURCHASES IN COSTING

**Analysis of Material Directly Purchased.**

The basic information in the case of material purchased for a specific job is contained in the supplier's invoices. These, with the co-operation of the Order Department may be obtained as unit documents, in which case the analysis would be made by sorting them into bundles, each bundle representing a job number. Such invoices as were not in unit form could probably be analysed by the exhaust method. There might be a few invoices (the railway carriage accounts, for instance) which, by reason of their compound nature, might require to be tagged. The tickets for this purpose would be very simple ; probably job number and amount. The information obtained from the various analysis operations would be amalgamated and the resultant figures would be posted to the appropriate Material Cost Accounts.

*Method of Proof.* The particular form of proof to be employed in the posting operation would be a matter for special consideration in each case. Generally speaking, the object would be to maintain the Material Cost Accounts in a state of perpetual balance. This would entail picking up the old balance and adding to it the amount of the posting just as was previously discussed in connection with the Sales Ledger.

The long run proof will very often be found suitable in establishing the accuracy of posting in the charging of direct material. It will be recalled that a high rate per cent of activity was a prerequisite of this form of proof. The number of accounts active is greatly influenced by the period of time covered by the documents which it is proposed to post to the Ledger. If, for instance, the invoices were analysed daily, then the activity of the Ledger accounts would be lower than if the invoices were allowed to accumulate for a week. The longer the period of accumulation, the greater will be the proportion of active accounts. Now the period of accumulation which can be allowed is in turn governed by the degree of urgency with which the final figures are required, therefore the suitability of the long run proof for the Material Cost Ledger depends largely upon the answer to the question, "When is the final information required?" If it is required immediately, a shorter period of accumulation would be necessary, the result of which would be a lowering of the proportion of active accounts.

If the circumstances are such as to preclude the use of the long run proof, then the old and new balance proof or any of its developments such as direct proof or three register proof may be employed, subject to the necessary number of registers being available on the machine. Such proofs are capable of dealing with any period of accumulation, however short.[1] At the other extreme, where sufficient time can be allowed to balance the accounts as and when required, the application of straight-line posting should not be overlooked.

With regard to the question, "When is the information required?" the shipbuilding and ship repairing industries illustrate its significance very effectively.

Building a ship is a lengthy process which may extend over years. The contract is based on carefully prepared plans and estimates. An interval, even of months, between the completion of the work and the production of the final cost might not matter very much.

In ship repairing, however, things may be very different, and speed in obtaining and proving cost figures may be essential. To take an extreme case as an example, suppose a foreign owner-skipper decides to take his ship off its usual course and make for the nearest port in order to have a small but necessary repair carried out. In this port he is an unknown foreigner. He desires the utmost speed in the execution of the repair, possibly with a view to catching a tide. Obviously, if the contractor had a speedy costing system it would be of great advantage in enabling the whole transaction to be settled out of hand. Such a job as a hurried repair is merely a variation of the case of the cattle auctioneer previously mentioned in connection with speed in proving accuracy. The parallel is even closer if the ship to be repaired were a trawler and if the skipper desired to meet the cost of the repair from the proceeds of the sale of the catch.

It is possible, therefore, that if a concern traded both as shipbuilders and ship repairers, two different systems of costing might be used. The method applied to the "Building" costs might consist of straight-line posting for a large number of very detailed entries, the actual summing of which might be done once a month, while the "Repairing" costs would consist of the broadest analysis and would be maintained in a state of continuous balance.

[1] Although not a costing matter, it may be of interest to point out here that in many banks with mechanized systems the day is broken up into periods called "batches," the last of which might cover thirty or even fifteen minutes. Each batch is "squared" individually, thus greatly easing the location of an error. One large Mail Order company works in periods of ten minutes.

CHAPTER XIV

# STORES RECORDS AND STORES COSTING

THE subject of the allocation of stores to the cost accounts is so closely allied with that of stores records that it is proposed to deal with the two operations in the same chapter.

In order to simplify both types of record by the avoidance of unnecessary detail, each item in the store is given a code number. These numbers are not allocated haphazard to the various items of stock but are graded and grouped in such a way that the code number of an article indicates the nature of the actual item which it represents. Thus the numbers 1 to 100 might be allocated to bolts and nuts; of these, all below 50 might represent gun-metal bolts and nuts, and above 50, mild steel bolts and nuts. The units column of the code number might be used to indicate size. A simple illustration of this method of numbering will be found in hotels where all rooms on the first floor may be numbered 100 followed by the actual room number, while those on the second and third floors carry the numbers 200 and 300 respectively. Thus, room 105 would be the fifth room on the first floor and 307 would be the seventh room on the third floor.

If the scales of the British weights and measures were strictly observed cumbersome fractions would result, and even if all fractions were decimalized it would be impossible to secure the requisite accuracy without carrying the calculations to large numbers of decimal places, thus not only making the figures unwieldy but increasing the chances of error. In order to overcome this, a unit system is used, by which method all measurements are made in terms of the smallest quantity of any commodity which is likely to be used. Thus, if six inches were the smallest length of an item likely to be required, then one foot would equal two units and one yard would equal six units respectively. Similarly, if a quarter of a pound were likely to be the minimum weight used of another article, then one pound would equal four units and a quarter of a hundredweight would equal one hundred and twelve units.

**Incoming Stores.**

The goods received into stores would be chargeable through the suppliers' invoices. The first step, therefore, would be to convert the items of such invoices to the agreed units and to mark each item with the appropriate code number. The procedure thereafter would depend

greatly on the circumstances and would be based on the principles of analysis discussed in previous chapters. Most probably the media would be of such a compound nature that some form of tagging would be the method chosen. Each ticket in the tagging operation would show the stock code number, the number of units and the sterling value. After the total of the sterling value and the number of units had been reconciled with the corresponding totals obtained from the suppliers' invoices, the tickets would be sorted into bundles of stock code numbers and a total would be obtained for each of these code numbers. These totals would be posted to the stock accounts, which would be kept (one for each commodity) in continuous balance as regards both quantity of units and sterling value. The operation would be the usual ledger-posting one of taking the old balance of quantity, adding to it the quantity posting and extending the quantity balance. Similarly, the old balance of sterling value would be brought forward, to this would be added the sterling posting, and the new balance of sterling value would be extended.

**Outgoing Stores.**

It is on the issues side of stock procedure that the records of quantity and value impinge upon cost records. In other words, what is credited to stock when it is taken out of store must be debited to some cost or expense account. Accordingly, the requisition upon which stores are issued should show :—

(1) The stock code number of the article required.

(2) The quantity of the article required, expressed in units or reduced to units.

(3) The sterling value of the issue.

(4) The job number or expense account to be debited.

*The Credit to Stock.* Given that the requisitions were in the unit form suggested above, the procedure for recording the issues from stock would be as follows :—

(1) A prelist of the quantities of units and their sterling value would be prepared.

(2) The requisitions would be sorted into bundles, each bundle representing a stock code number.

(3) The requisitions in each bundle would be summed, firstly in respect of quantity, and secondly in respect of sterling value. The aggregates would be compared with the totals of the prelist.

(4) Each Stores Account would be credited with the total issues of the particular item which it represented. The credit would, of course, be made in respect of both quantity and value.

The method of preparing the information for posting would be as outlined for receipts into stores except that no tagging would be required

since the requisitions themselves could be so constructed as to form unit documents.[1]

*Proof of Accuracy of Posting.* The method of proof with regard to the posting of receipts or issues would once again depend greatly on the period of time which could be allowed to elapse between each batch of postings to the store accounts. Unless the period were very lengthy, it is improbable that the number of accounts active would be sufficient to warrant the use of long run proof. It is more likely that the proof would take the form of old and new balance or one of its variations.

*The Stock Records Control Account.* Regardless of the form of proof selected, a Control Account would be maintained which would show the total of units and the total sterling value of the stock in hand. It should be noted that the total of units received into or issued from stock, has no material significance since it consists of a number of varying units of quantity such as ounces, pints, feet, pounds avoirdupois, etc. The quantity control figure is of accounting value, however, in that it provides a total against which the "Quantity Received" and "Quantity Issued" may be checked.

*Pricing of Issues.* It will be obvious that variations in price will upset the computation of the sterling value of stock in hand. This difficulty may be overcome by a system of averaging the price after each purchase. For example, if twenty articles are purchased at 1s. and ten are issued and later replaced by the purchase of an additional ten at 1s. 2d., then it would be necessary to adjust the issue price to an average by dividing the new sterling balance by twenty. In this case the new average price would be 1s. 1d., that is, £1 1s. 8d. divided by twenty.

*Proof of Posting to the Right Account.* Since the description of two items of stock might vary in, say, only one of many features, there is a danger of entries in a Stock Ledger being made in the wrong account. For instance, confusion might arise between items such as :—

$2\frac{1}{2}$-ins. x $\frac{7}{8}$-ins. mild steel hexagonal-headed bolts and nuts.

$2\frac{1}{2}$-ins. x $\frac{7}{8}$-ins. bright steel hexagonal-headed bolts and nuts.

Consequently, it is not uncommon to incorporate in the stores system a method of proving that the proper accounts have been debited or credited. A method commonly used in this connection is that of printing with each entry the item code number *as it appears on the posting medium.* (See page 54).

[1] The comparison between the purchase invoices, which form the media for posting receipts on the one hand, and requisitions, which form the media for posting issues on the other, illustrates the question on page 64, "Can the basic form of the information be altered at will?"

*The Charge to the Cost Ledger.* The unit requisitions which in the process of stock recording had been sorted in stock code number order would now be re-sorted into order of job number. The result will be that under any given job number the requisitions will not only be confined to those bearing that number but will be grouped by stock code numbers within each bundle. This makes it possible to telescope the entries so that instead of twice debiting a job number with one 2-inch valve, only one entry for two 2-inch valves would be necessary.

*Method of Proof.* In posting to the cost accounts, it is very probable that even with a short period between each batch of postings there would be sufficient activity to warrant the use of the long run proof, since most jobs in the Cost Ledger would be active. Much depends, however, upon the frequency with which finished jobs can be and are removed from the current Ledger (and, of course, from the Control Account). Again, the question, "When is the information required?" plays an important part in the selection of a form of proof.

CHAPTER XV

# WAGES

THE subject of wages may be regarded from three main aspects :—

(1) The compilation of the amounts of cash due to the individual employees and the building up of the totals from the various nominal accounts.

(2) The preparation of the personal records of employees—total of gross earnings to date and of income tax deductions.

(3) The keeping of the cost records.

The sources from which the above productions are prepared are :—

(1) The time-clock cards.

(2) The individual time sheets and statements of overtime showing how an employee has spent his time.

(3) Piece-work sheets, including bonus.

(4) The income tax tables for the time being in force.

In preparing the wages records, it goes without saying that a satisfactory proof of the accuracy of the recording will be established. This entails the reconciliation of the total wages paid out with the total allocated to the Cost Ledger. This means nothing more than an analysis of the payroll total of gross wages under the required headings and sub-headings, e.g., Job Numbers, Processes, Departments, etc. Control accounts set up at suitable points supply a broader picture of the position. Fundamentally, however, the whole process resolves itself into a choice of a suitable analysis method or combination of methods and the selection of a satisfactory method of proving the accuracy of the posting of the analysis results to the cost accounts.

As with the other elements of cost, a question having an important bearing on the choice of methods in analysing wages is, "When is the information required?"

In hand systems it will commonly be found that everything is concentrated on the working out of the net wages due to the employees. The totals for the nominal accounts—gross wages, income tax, charitable contributions, etc.—are obtained, not because such figures are urgently required, but because they are necessary to prove the accuracy or the internal additions and subtractions of the payroll. Generally, in a hand system the cost records are not dealt with until the wages have been paid out to the employees. There are exceptions to this even in a manual

system. In collieries, for instance, a handwritten payroll may contain detail in excess of that required to produce the net wages of the employees. This is an illustration of the importance of the question, "When is the information required?" Certain information in the hands of the colliery technical staff is very useful when the closing of a seam is under consideration. Since wages in a colliery form a large part (approximately 80 per cent) of the total cost of production, speed in obtaining analysis figures is an important objective even if its attainment should entail certain complications in the form of payroll.

**Employees' Personal Records.**

Formerly these records, whether prepared by hand or machine, were usually left until the rush of the pay day was over. P.A.Y.E. does not permit such a postponement, since the amount of income tax to be deducted from wages may vary each week with the amount of pay and must therefore be computed *before* the net wage can be ascertained.

Thus of the three aspects of wages—cash, personal records and costing, only the last can now be allowed to wait until the rush period is over. Although costing may be postponed in this way, it is usual under a machine system for the break-up for cost purposes to proceed concurrently with the work of the payroll. The point is one which depends on individual circumstances.

**Payroll : Machine Operation.**

The machine set-up for a payroll provides for the summing of the various awards in the crossfooter and for the subtraction of the various deductions. The total remaining in the crossfooter after these operations is the net wage for the particular employee to which the entry relates. Registers are set to accumulate such columns as are considered necessary. Sometimes a register will be set to accumulate two or three minor deductions, e.g., health and unemployment insurances, in one total with a consequent economy in the number of registers required. If a front feed carriage or its equivalent is used it will be possible, by means of a carbon paper, to prepare a duplicate of that part of the payroll which is of interest to the employee. Consequently, a pay slip becomes available by which the make-up of the net amount payable is intimated to each employee. This pay slip would be handed to the employee along with the cash. Sometimes the pay slip is prepared in duplicate, one copy (with a space for the signature) being handed to the employee before the pay-out. The employee is thus given an opportunity to examine the make-up of the amount of his pay and if satisfied as to its accuracy may subsequently exchange the signed pay slip for his pay packet or tin containing the cash and the second copy of the pay slip. By these

means each employee is enabled to raise any points of doubt before the pay-out, while the employer receives a signed receipt for the cash.

**Proof of Accuracy of Payroll.**

The main figures requiring checking in the preparation of the payroll are those of gross earnings. These figures in respect of each employee are taken from the time-clock card, piece-work ticket, etc.; therefore the total of the gross wages for all employees should be reconciled with the various awards as shown on the original documents. To make this reconciliation, the time-clock cards, etc., would (after extension) be listed to provide a first estimate of the gross wage total. The appropriate columns in the payroll would usually be automatically summed by the machine, and the aggregate of all the awards (a second estimate) would be compared with the first.

It should be noted that this proof merely covers the transfer of the gross earnings from the original documents to the payroll. The actual calculation of the wages—so many hours at a given rate—would require to be checked in the usual way by a second computation by either a calculating machine or mental methods.

**Personal Records : Machine Operation.**

Recent legislation has altered the routine of the preparation of the payroll by making it necessary to compute first of all the gross wage and then to consult tables to determine the amount of tax to be deducted under the "Pay as you earn" Scheme. It may be laid down as a general principle that this extra operation of computing the income tax to be deducted must be so organized that it does not interfere in any way with the smooth working of the wages routine. The record which by law must be kept consists of a continuous balance of the gross earnings together with a continuous balance of the tax deducted. In other words, the previous gross earnings must be picked up, to this figure must be added this week's earnings; the total remaining in the machine is the total gross earnings to date. At this point the tax tables for the appropriate code number must be consulted and the tax on the gross wages to date must be entered on the record card. From this figure the previous total of tax deducted will be subtracted, leaving in the machine the difference between the tax due and the tax deducted (i.e., the tax which falls to be deducted or refunded during the current week), which amount can now be printed by a touch of the total key if so desired. The amount of tax due to be deducted or refunded has, however, to be transferred to the pay slip.[1] In order to do this with absolute accuracy, the final total on the earnings record card may be printed by means of the sub-total

[1] Sometimes the envelope containing the pay acts as a pay slip and contains all the details, including the amount of tax deduction or refund.

key, and repeated as a total on the pay slip. Since this repetition of the totals is a mechanical operation, there can be no doubt that the figure of tax printed on the pay slip is the same as the tax printed on the record card.

**Proof of Accuracy of Employees' Personal Records.**

*Gross Earnings.* Obviously the number of employees present during any normal week will greatly exceed the number of absentees, therefore personal records are ideal for the application of the long run proof. The method of obtaining the proof is as follows :—Transfer the total of the gross earnings as obtained from the original media (i.e., time cards, etc.) to the Employees' Gross Earnings Control Account, bringing into the computation any previous balance of this account. The new balance of the Control Account should then equal the sum of the gross earnings of all employees. If the machine on which the records were prepared had a register it would be set to accumulate, during the process of posting the individual records, the new balances of the earnings, but if no register were available a Trial Balance would be prepared by a separate listing operation. Proof of accuracy within the Principle of Proof is provided by the agreement of the total of all gross earnings as obtained from the personal records with the new balance of the Control Account.

*Income Tax.* The proof as regards income tax records varies slightly from other forms of proof because there is no prelist against which postings and new balances can be proved. Each new balance is obtained from the appropriate table of tax due, and varies with the code number.

Reasonable proof of the accuracy of the deductions or refunds can be obtained by proving :—

(1) That the proper amount of tax due as shown on the table was entered on the employee's record, i.e., checking the reading of the table.

(2) That the amount of tax already collected was correctly subtracted from the total tax due.

*Checking the Reading of the Tables.* Short of doing the job twice there is no way of obtaining a reliable proof that the reading of the tables has been correctly recorded. Since, however, the tables are consulted anew each succeeding week, any error in reading or recording would tend to be adjusted subsequently as in the case of gas and electricity readings. Consequently no special check of this part of the work would be necessary except when there is no subsequent reading, such as :—

(1) On the termination of the employment.

(2) On the last week of the income tax period.

*Checking the Subtraction of Previous Deductions of Tax.* It is important that the amount of tax previously deducted from an employee should

be correctly subtracted from the figure of the total tax due according to the tables for the current week. The sum of all such previous collections in any given week should equal the balance of the Income Tax Collected Control Account for the previous week. All that is required therefore to provide reasonable proof of accuracy in respect of the income tax part of the employees' records is a list of the amounts brought forward in respect of previous collections. If the total of this list (which would include inactive records, i.e., absentees) agrees with the balance of the Income Tax Control Account as at the previous week, then the amounts of the various deductions and refunds are correct within the Principle of Proof subject to the table having been correctly interpreted and recorded. As has been shown, the adjustment of any errors of this type can usually be left to the compensating effect of subsequent readings.

*Immediate Proof of Readings.* When immediate proof is required, as in the instances of the termination of the employment or the termination of the tax period, it would be advisable to ensure accuracy by a second consultation of the tables.

**Inactive Personal Records.**

It will be recalled that the long run proof entailed the accumulation of *all* balances whether active or inactive, therefore, if that form of proof were applied to the personal records the balances in respect of absent employees must be included.

As time passed and employees terminated their contracts of employment, the proportion of inactive accounts would grow until they became a burden on the working of the proof. It would be necessary therefore to purge the records periodically by removing the accounts of such employees as were no longer on the payroll, care being taken to reduce the Control Accounts accordingly.

CHAPTER XVI

# WAGES COST RECORDS

In comparison with material the analysis of wages may be highly complicated. The methods of assessing the amount to be paid are many and varied, and one employee may receive awards of more than one type within the same pay period. Thus a man may be paid ordinary time, overtime at several different rates, an incentive award such as premium bonus, "dirty" money and even attendance money—the award for merely "standing by" in case he should be required. Nevertheless, in spite of the manifold awards, the problem remains one of analysis and can be solved by using the methods most suitable for breaking up the basic information and reassembling it in the required form. The information obtained as a result of this reassembling should then be carried to a permanent record by a method which furnishes reasonable proof of accuracy.

Usually the workers "clock in," and the clock card thus obtained supplies a control figure for the costing analysis. For example, if the clock card shows that a certain worker has been on the premises for 48 hours, then the time allocated in respect of that worker should total 48 hours. If the worker's wage is £5, then that amount should be charged to the cost records. The methods of obtaining the details vary. The worker himself may send in the allocation of time spent on the various jobs. This may be a dangerous practice where the cost records are in any way detailed; it is not the tradesman's job to enter into any nice discriminations which the Costing Department may have set up, and yet unless the allocation of wages conforms to the intentions of the management, the cost records lose much of their value.

Very often timekeepers (or time recorders) are employed to make the allocation. The timekeepers should have a certain technical knowledge if not skill, combined with an appreciation of the importance of their job. If a timekeeper is trained in his job from the technical as well as from the accounting angle, he can ensure that the basic information supplied to the Costing Department is not only arithmetically but technically accurate and is synchronized with the records of the Department. It then becomes the function of the department duly to record the information received and so present to the management up-to-date and reliable statistics.

One of the uses of cost records is to provide information regarding the past which may be used in assessing the future. Before a comparison of a given future period with the past can be made it is essential that either the conditions obtaining during both periods be identical or that they should be subjected to a properly gauged adjustment. Since rates of pay may vary considerably, and since overtime may be worked in one period and not in another, it is impossible to gain a reliable picture of a previous job from financial records alone. Therefore, to make a present use of past experience, it is an advantage to express the wages, not in cash alone, but in hours worked. This is very simply done in machine work by providing a separate register for the accumulation of hours. A double-balance account would be maintained in the Wages Cost Account showing the total-to-date in hours worked and wages paid. The machine set-up for this operation is similar to that used for quantity and value stores records.

Usually, overtime payments are effected by increasing the hours worked rather than by increasing the rate. In such cases the time clock recording will not agree with the inflated total of hours worked as shown by the payroll. Cost is what it is, and therefore the true hours worked with no fictitious "weighting," will be used for the cost records. The total hours worked can thus be compared with the time as shown by the clock card. The fictitious or "added" time may be included as an overhead charge on the grounds that it might be unfair to charge overtime to Job No. 123 because it was held over until Saturday afternoon in order to suit Job No. 122, which was completed on Saturday morning at ordinary rates. If, however, a job is effected at overtime rates at the request of a particular customer, then added time should be charged directly to the job but should be clearly distinguished from actual time, so that subsequent reference to the cost records will allow a true picture to be obtained.

**The Choice of Analysis Methods.**

The types of original document on which the analysis of wages is based vary. Examples of these original documents are : —

(1) A time-book for all workers (probably each book would deal with no more than one department). Such a book would show the time spent on all jobs by all workers in the particular department.

(2) Individual unit documents showing the time spent by each worker on each job.

(3) A time-sheet in respect of each worker showing the time spent by that particular worker on all jobs. This sheet might be ruled or even perforated in such a manner as to render easy its dissection into unit documents (see 2 above). The advantage of such a sheet is that in

the event of the disagreement of the totals the error can be more speedily traced to its source. The sheets are not dissected until the total of the cost allocation in respect of each worker is found to be in agreement with the total hours worked multiplied by his rate. In other words, there is a sectional reconciliation of financial and cost records, each worker representing a section. The methods of analysis will be chosen to suit the requirements and circumstances of individual jobs, but generally the examples of original documents listed above would be analysed in the following way :—

(1) By tagging the time-book, sorting the tags into job numbers and summing each bundle.

(2) By sorting the unit documents into job numbers and re-adding.

(3) By dissecting each man's time-sheet (after reconciliation with the total time worked) into individual tickets and proceeding thereafter as in (2) above. In order to make the work flow evenly, the time-sheets are sometimes in duplicate—No. 1 being for Monday, Wednesday and Friday, and No. 2 for the remaining days of the week.

The method of dealing with piece-work would follow on the lines suggested for time-work. No matter in what form the original information may be presented, its analysis should be within the range of the methods suggested for time-workers. Overtime would also be dealt with on the same principles.

CHAPTER XVII

# WAGES COST RECORDING

ONCE the allocation to the various sections of the cost records has been completed, there remains the straightforward job of posting the figures to the Cost Ledger.

The particular form of proof to be employed for the posting of the wages cost records will depend on the circumstances of each particular case, but in general it will be found that most jobs are active in each wage period, and it is probable that the long run proof will be found most suitable.

It is often necessary to make a further division of wages into trades to show (1) the wages in respect of each trade in each job, (2) the wages of each trade in all jobs. In this connection the shingled forms illustrated on page 71 can be very often successfully employed. The various trade classifications, Fitters, Turners, Riveters, Plumbers, Joiners, etc., would be printed down the left-hand side of these forms. As the bundles of wages tags were completed in respect of each job, further divisions within the job would be made by sorting the tags into bundles under trade headings. The total obtained by summing all the fitters would be entered each week on a shingled form bearing the particular job number and coloured, say, green. Each trade classification would be dealt with in similar fashion. Each month the green cards would be cross-summed and the monthly figure for each trade would be entered on a similar card coloured, say, white. The white form would carry the final figures for each job. Each quarter, half-year or year, the figures for the chosen period would be entered on a form coloured, say, buff. The grand total thus obtained would be the total wages in each trade in respect of all jobs completed during the period.

Since overheads are simply a section of the Cost Ledger, the methods of analysis as applied to the break-up of material, stores and wages to direct cost headings are equally applicable to the proportion of these elements of cost *which it has been decided* shall be treated as overhead.

The figure to be distributed by way of overheads having been obtained, its application to the various cost accounts is a subject for a further decision which will be materially affected by the nature of the product.

The decisions as to what is to be included as overheads and the method of the allocation concern accounting policy more than methods,

but once they have been made they should be carefully and consistently observed, since any alteration in the range of items to be included as overhead or any variation in the method of applying the overhead charge will affect the value of the cost records from the point of view of immediate comparison with the past and subsequent comparison with the future.

Regardless of the method selected for the distribution of overhead, the object of the machine system in this connection will be:—

(1) To provide the analysis figures, segregating overhead from direct charges and to prove the arithmetical accuracy of such analysis.

(2) To post the proper proportion of the overhead total to the Cost Ledger accounts.

(3) To accumulate the grand total of such allocations for comparison with the total of (1) above.

Assume for purposes of illustration that overheads are distributed as a percentage on wages and that it is to be applied weekly with the posting of the Cost Ledger. The first step would be to prepare a prelist of overheads based on the direct wages chargeable. The subsequent Ledger-posting procedure would depend upon the features of the machine available, but the object would be to obtain, either by register accumulation or by a separate listing operation, the total of overheads posted to the cost accounts. To establish accuracy this figure would be compared with the total of the prelist. A Control Account would be maintained which would show the total overhead charges absorbed to date in respect of all costs. This last figure would be considered periodically in conjunction with the total of all the overhead accounts in the Nominal Ledger and the overhead percentage figure would, if necessary, be adjusted for subsequent allocations.

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