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NEGROES PICKING COTTON

In the Southern States of North America.

Rambles among our Industries

COTTON AND THE SPINNER

BY

WILLIAM J. CLAXTON

Author of "Methodical Nature Study"

BLACKIE & SON LIMITED
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1913

RAMBLES AMONG OUR INDUSTRIES

There was a wise custom of the old trade guilds, the "wander-year", when the apprentice, having served his time, spent a year in wandering from one master to another before settling to his trade. The aim of the wander-year was to broaden the knowledge of the young tradesman and teach him the dignity of his craft. A like purpose has led the publishers to add to their "Rambler" Series a number of books dealing with the main industries of the country. It is well that boys and girls, before passing out into the busy life of the world, should learn something of the reality and something of the romance of the great industries by which that life is sustained.

The following pages trace the history of Cotton till it is ready for the loom. The weaver's art will be found described in another book of the series—"Wool and the Weaver."

CONTENTS

COLOURED ILLUSTRATIONS

COTTON AND THE SPINNER

CHAPTER I

Cotton and its Rivals

Once upon a time all the textiles met together to talk about themselves. There was Mistress Silk, the Queen of the Textiles, of whom you may read in another of the "Rambles among our Industries"; Fleecy Wool, recently arrived from distant Australia; Grandfather Flax, the oldest of all the textiles; Ropy Hemp, from which the cables are made; Coarse Jute, fresh from the marsh lands of India; Baby Ramie, the youngest of the textiles; and King Cotton—who was the first to speak.

"A mighty monarch am I," he said, "sought after by all and used by all. Look around your houses and see the articles made from me; examine your clothes and note how I protect your bodies.

Your beautiful lace curtains, with their wonderful patterns, are nearly all made of my thread; many of your tablecloths, also, were made from my fibre. When you lie down in bed at night, my sheets cover you, and my counterpane keeps you warm. Your flannelette shirtings and your cambric cloths all come from me; your corduroys and velveteens are made from my fibre too. How nice the girls look in their white cotton cloth dresses, or calicoes as they are called! Zephyrs, too, with their fancy designs, are indeed hard to beat. Go to distant India and you will see the natives almost entirely clad in my goods; travel to tropical Africa and, if the negroes be dressed at all, it will likely be with a cotton cloth girded around their loins. In all continents and in all countries am I used, but my home is most often in the hot parts of the earth. My white calico reflects the scorching rays of the sun and helps to keep the body cool. What looks nicer than the pure white cotton suits when they are worn for the first time?

"For many centuries my manufacture was almost entirely carried on in the home, but during the last hundred years and more I have been made in huge factories, where the whirr and lugg of the

mighty machines almost fill you with awe. In bygone times you could have entered hundreds of cottages and found the women and girls spinning my yarn and carding me, while their men folk were weaving me into a fabric. Have you not seen pictures of a woman at her spinning wheel? Later, great inventors arose, such as Hargreaves, Arkwright, and Crompton, who have done so much to make me a power in the land. Then the poor folk, seeing their home work taken away, rose up in their wrath and smashed many of my marvellous machines. But it was of no use. Henceforth iron wheels and metal rollers were to take the place of human hands. Giant Steam and 'Old King Coal' were my partners now; no longer was I to depend on the nimble fingers of the Lancashire lassie to twist my downy fibre into yarn.

A Lancashire Mill Girl

"Just glance for a moment at the busy centres of my industry. In Lancashire many of the people

The Centres of the Cotton Industry in England

work in my mills. The moist climate of their county is well suited to my manufacture, and their grand seaports and canals enable them to deliver my raw material as cheaply as possible. Listen to the patter of the wooden clogs down the busy streets of their huge towns. Follow the people and see them turn into mill after mill, all of them earning their living in my service, and making me a boon and a comfort to mankind.

"I am one of the most pushing of textiles. Perhaps you may not think that a good point. For hundreds of years flax was used in scores of light cloths; now I have quite taken its place. Even wool I am trying to displace by imitating her flannels in my flannelettes. In the hosiery

trade, too, my cotton stockings are slowly displacing those made of wool. The latest textile I am attacking is silk, and many think that my velveteens and beautiful plushes are just as good as the silk velvets and other products of the silk weaver How many times does a dishonest tradesman sell you a mercerized cotton cloth for one made of silk? Probably you are quite taken in by my beautiful lustre and pure colour. And then, my rich sateens! Are they not as pleasing to the eye as the finest satins?"

King Cotton was just going on to speak of his beautiful calico prints and his fine twills, all of which are so much used by the girls in the summertime. But we have heard quite enough of his boastings. Suppose we take a sea trip to distant America and find out how he grows. Let us join the negro cotton-pickers in one of the southern states of North America. Let us watch one of the big cotton mules at work. Stories of the great inventors in the cotton industry will be brought before us, and we shall see how the machine wreckers went about the country long ago smashing the jennies and mules. Truly King Cotton has a most romantic story to tell!

CHAPTER II

Homes of the Cotton Plant

Most of the textiles have very ancient history indeed. As far as we have been able to find out, Flax is the oldest of them all, closely followed by Silk. Wool seems to have appeared next, and some thousands of years later Cotton arrived, about the same time as Hemp.

The first information about cotton that we can trust is given by a great Greek historian who lived about four or five hundred years before Christ was born. "The wild trees of India", he says, "bear fleeces as their fruit, which are better than those of the sheep both in beauty and excellence; and the Indians use cloth made from this tree-wool." Now there is no doubt that by "fleeces" and "tree-wool" he refers to our modern cotton, for the white fibre of the cotton bell looks very woolly.

Soon after the death of St. Paul at Rome, a great work on Natural History was written by a Roman writer named Pliny. In this book Pliny tells us about the animals, plants, and trees

that grew in the world at that time, and this is what he says about cotton: "In Upper Egypt there grows a shrub . . . from which are made the stuffs we call *xylina.* It is small, and bears a fruit like the filbert, within which is a downy wool, which is spun into threads. There is nothing to be preferred to these stuffs for softness and whiteness; beautiful garments are made from them for the priests of Egypt."

For many hundreds of years there is a gap in the history of cotton. We learn that the manufacture of cotton was introduced into Spain in the year 930, or shortly after our Alfred the Great died. The first time this textile was made of use in England was in 1298. For what do you think cotton was first used in England? How did people light their houses in the olden times? Perhaps some of you have seen *cotton* candle wicks. It was thus as a light-bearer that cotton was first used in England.

About five hundred years ago cotton appears to have been first imported to this country, not from America, though, but from the south of Europe and Egypt. Columbus went on his great voyage and discovered the New World just over

four hundred years ago. Among other things which he noted on the West Indian Islands was the "wild cotton plant". Nearly thirty years afterwards another great explorer, Magellan, found the natives of Brazil lying on beds made of cotton down.

At this point we will leave the history of King Cotton, as we have now almost reached modern times. Do you not think, though, that we have said quite enough to show that the useful old king has a most wonderful history, and one of which, if he were human, he might well be proud?

No doubt you all know that the downy cotton fibre comes from a plant, and for this reason we speak of cotton as a *vegetable* fibre, while wool and silk are called *animal* fibres. The cotton plant belongs to the Mallow Family. Two or three species of these plants, such as the common mallow with its reddish-purple flowers, the dwarf mallow with its handsome heart-shaped leaves, and the musk mallow with its rather pleasant musky scent, are fairly common in this country.

From the picture of the cotton plants facing page 16, you will see that the flowers are of

different hues according to the plants on which they grow. The leaves are all lobed like those of our sycamore tree, and the calyx, or cup, holding the five-petalled flowers is made up of a number of teeth. The fruit of the flower is much like a pod, and when the pod is ripe it bursts, showing the lovely white fibre which we call "raw cotton", hiding the seeds embedded in it.

A Sprig of Cotton showing Flowers and Bolls

There are several different cotton plants, but only four are largely used in the trade. These are: (1) herbs, with soft stems; (2) trees, with woody stems; (3) plants that have hairs on the seeds; (4) the Barbados plant, or *barbadense*, because it is said to have had its origin in Barbados, one of the West India Islands, famous for its sugar and rum.

Taking them in their order, we find that herb-

cotton is an Asiatic plant, and it grows in most countries in Asia. Long before the American cottons were used, this fibre was being spun into yarn, but of late years the longer and softer fibres of the American cotton have displaced it in many factories. The principal homes of the Asiatic cotton are India and China; but herb cotton is also grown in Egypt, Turkey, and Cyprus. In some countries the plant grows to a height of nine feet—"Rather a tall herb," you will say—but the average height is about five feet. The Chinese grow this plant in nearly all parts of their country, but they seldom export any of the fibre.

Tree-cotton is found in South America, and it grows to a height of from twelve to fifteen feet. Perhaps that which grows in Brazil is best known; in that country there is a huge "cotton belt" over one hundred miles broad and several hundred miles long. You know what a large number of small fruit trees can be grown on a fair-sized English field; just imagine the number of cotton trees that will flourish on a belt of land larger than the whole of Great Britain. The tree will bear fruit for ten years, and as there are many pods on each tree, the Brazilian cotton farmer

should be able to make a good profit. You will see what the plant is like by looking at the bottom left-hand corner of the picture. That on the opposite side is a picture of the plant which we first described.

If a boy from Peru read the last paragraph, he would perhaps be jealous of his Brazilian neighbour, for the Peruvians state that the first home of the tree-cotton was in their country, where a large amount of it is still grown. Instead of having harsh and wiry fibres as the Brazilian cotton has, that of Peru is very woolly, and manufacturers often mix it with short wool fibres.

The third variety is grown in nearly all the southern states of North America, such as Kentucky, Alabama, North Carolina, South Carolina, Tennessee, Louisiana, and Georgia. Many of these names will be quite familiar to you, as some of the negro coon songs refer to them.

This cotton plant, containing the hairy seeds, grows about three feet high, and the fibre varies according to the state in which it is grown. That raised in Louisiana and Mississippi is generally looked upon as the best American cotton.

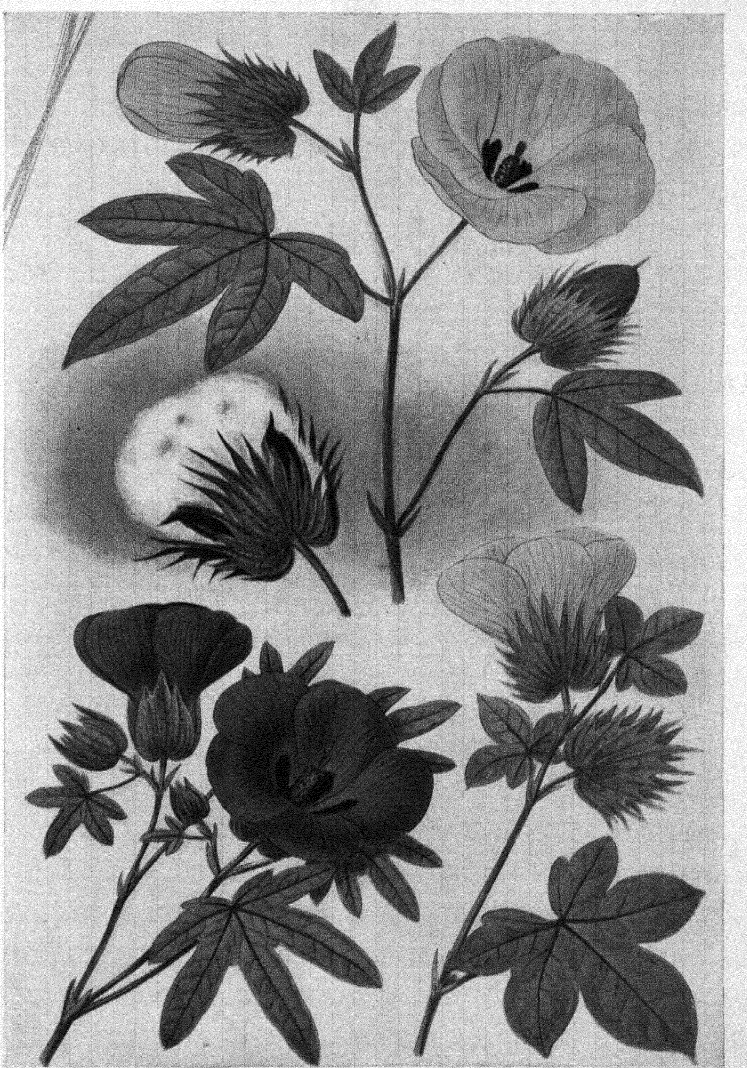
Barbados cotton or "Sea-island" cotton is the

most famous of all. You see the large yellow flowers, with one of the bursting pods, in the top of the picture. The plant grows from six to fifteen feet in height, according to the climate. It was originally grown on the West India Islands, but the cotton growers of Georgia and South Carolina introduced it into their estates. The fibres of the "Sea-island" cotton are of the very best quality, and all cotton-growing countries, such as Egypt, Turkey, and Persia, have tried to grow it, but they have been rather unsuccessful.

So we see that the chief cotton-growing countries of the world are the Southern United States, India, Brazil, Egypt, and China. China may be left out, as far as we are concerned, for the Chinese need all their cotton supply for their own use. The United States supply about two-thirds of the world's total.

There appears to be no reason why other countries should not grow cotton. All that this plant requires is a warm, sunny climate, not too dry, and it is said that it will thrive in almost any country for about two thousand miles on either side of the Equator.

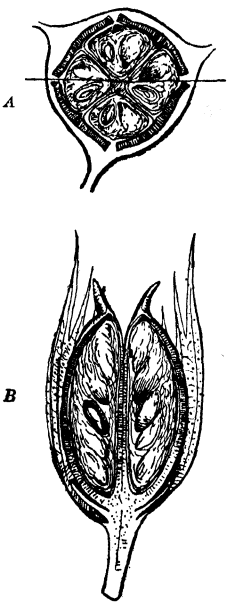
The rich American soils are much the best for



COTTON PLANTS

1. *Gossypium barbadense*, from which the "Sea Island Cotton" is obtained.
2. *Gossypium arboreum*, native to S. America, grows to a height of 15 ft.
3. *Gossypium herbaceum*, which grows in Asia.

producing the plant. In India there is a yield of only eighty pounds to the acre; in America, two hundred pounds an acre; so that if an Indian and American cotton grower each had a field of the same size, on an average the American farmer would have about two and a half times as much cotton from his field as the Indian.



Sections of Cotton Boll
A. Cross section.
B. Vertical section along the line A.

This is only what we might expect, because the soil of America is, to a large extent, rich "virgin" soil. It has not been worked nearly as long as the soil of most countries. The Sea-island cotton plant grows in rich marshy soil, and the fibre is much more silky and longer than that produced on poor soil. That enormous river, the Mississippi, spreads loamy mould for hundreds of miles around, and all the states through which this river and its large tributaries flow are famed for their fine, creamy cotton fibre. If we compare these rich soils with those of India, we can see that the

Americans are highly favoured by Nature. For many years, now, our American cousins have gone into the growing of cotton whole-heartedly. It would indeed be strange for an American to do otherwise. Other people have not made such a special study of the subject, and the trade has only been one of many. At first nearly all the fibre was sent to England to be manufactured, but of late years the Americans have built their own cotton mills, so that the time may not be far distant when they will need the whole of their raw cotton for their own mills. We in Britain are quite aware of this, and about ten years ago we formed the British Cotton Growing Association, one of the chief objects of which is to open up fresh cotton fields in other parts of the world, so that we should not be so dependent on America.

CHAPTER III

In the Cotton Fields

To-day we will go, in fancy, a journey right across the wide Atlantic Ocean to the Gulf of Mexico. As we enter the Gulf by the Florida Channel the sailors will probably point out the famous Gulf Stream, the course of which we may be able to trace by the deep blue colour of the water. We sail around the peninsula of Florida and keep along the Alabama coast until we come to New Orleans, a large town in the state of Louisiana, which stands on the left bank of the Mississippi.

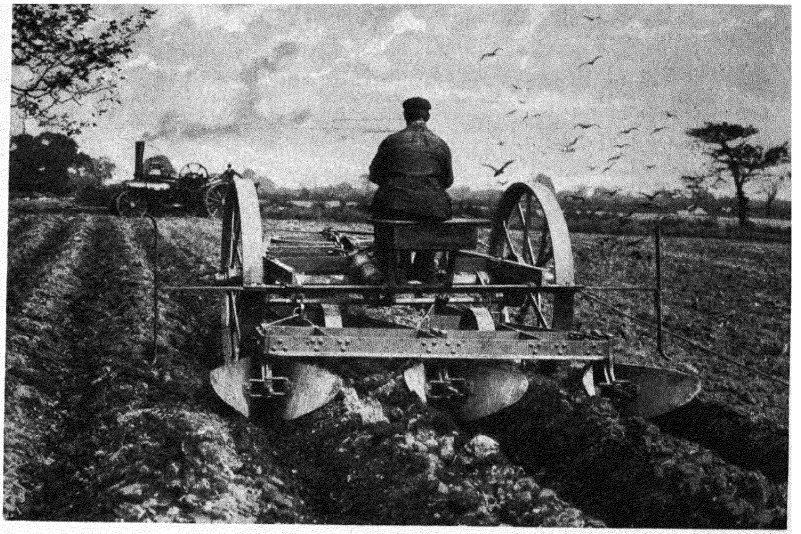
What a mighty river is the Mississippi! Beside it our little Thames, and Severn, and Clyde would look mere brooks. In the spring, terrible floods spread out for miles and miles around its banks on the low-lying lands, and in the rich soil brought down by the river, King Cotton has his cradle.

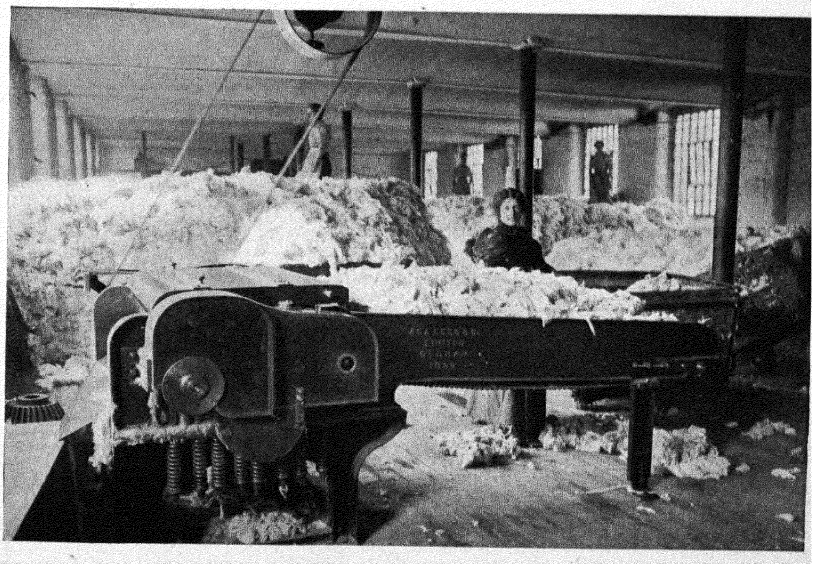
We shall probably see many ships lying near the wharves at New Orleans, and in these the bales of cotton will be loaded, ready for their

ocean journey to Liverpool and Manchester. Let us travel up to the north-west of the state of Mississippi, and here we shall find the soil made of loamy black mould. On this mould will be hundreds of cotton plantations, and fields where maize, bananas, and tobacco grow as well.

It is well that we should choose one of the southern states of North America for a visit to cotton-land, for, as we said in the last chapter, two-thirds of the world's supply of cotton comes from these states. True, we might have seen the home of the famous Sea-island cotton by stopping short at one of the West India Islands, or by landing at Georgia before we entered the Gulf, but our visit is to the huge cotton district in the famous river basin of one of the world's largest rivers. We should never think of going to India to see the plant grown in the best way, for our Indian fellow subjects do not go about their work of cotton-growing in such a skilful way as Americans, and they have not such up-to-date tools and machinery as those of our American cousins.

King Cotton does not appear to be very particular about the soil in which he grows, for almost any soil will suit him, if it is not barren rock or





At the top is shown a Steam Plough at work, throwing up the ridges of earth ready for sowing seed.
The lower picture shows the raw cotton from the bale breaker being mixed by machinery.

stony ground. Like the rest of plant life, he does best in a rich soil, but for his wellbeing his roots do not matter so much as his leaves, which take in plant food through the air.

Gathering Tree Cotton

Had we visited Mississippi in winter we should have seen the farmers having the land ploughed up very deeply. This would probably have been done by a steam plough, and then a heavy "cultivator" or harrow would have been drawn over the clods so as to break them up and let the air act on the soil. A gardener will tell you that this is the secret of all good gardening.

Early in March the fields are thrown up into ridges about two or three inches high. Long rows

are made right across the field, and manure is laid in the centre of the rows, after which the plough turns over the high ridges into the rows and covers up the manure. This takes only a few days to do. Then the seeds are sown. Boys who live in the country have seen a drill at work many times when the farmer is sowing wheat or barley. In the same way the cotton drill makes the holes in the ground and drops the seeds into them. In India, Egypt, and other countries the natives, as a rule, sow the seeds broadcast. To do this they carry a basket of seeds on one arm, take a handful out, and scatter them to the right and left as they walk along.

The rows are from three to five feet apart, and the seeds are planted from two to five feet from each other. In the warmer parts the sowing begins early in March, but in the cooler districts the farmers wait until the middle of April.

As the soil in this district is fairly rich, heavy crops of weeds spring up as well as young cotton plants. These must be uprooted with the hoe, and the plants must also be thinned out. On most plantations weeding is done by a machine which looks much like a harrow. This digs up

the plants and weeds and, at the same time, shovels the soil around the roots of the plants. Gardeners will tell you that plenty of boring all through the summer is of the greatest use to all growing plants, because the breaking up of the soil lets the air into the ground.

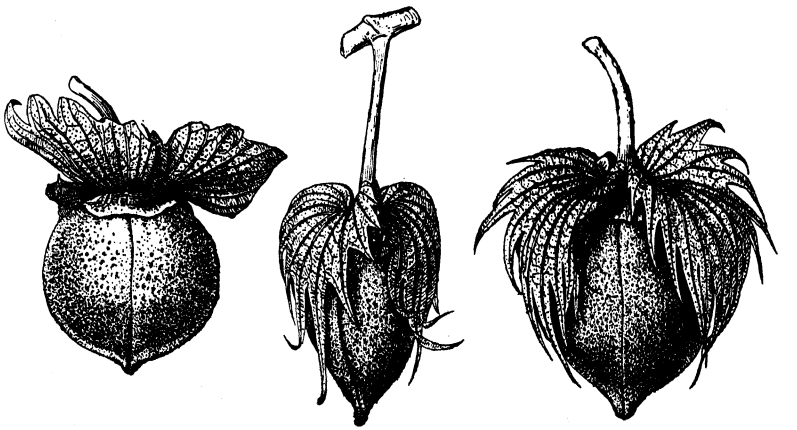
Look at the picture at the beginning of the book. Here you see the cotton harvest in full swing. Most of the workers are negroes or negresses. How different is their work now from what it was a hundred years ago. Up till 1865, a date which nearly all your grandparents will be able to remember, slavery existed in all the southern states of America, although all slaves in British colonies had been set free over thirty years before.

We will not describe the sad lot of the slaves. If you want an account of the kind of life they led you should read *Uncle Tom's Cabin.* Happily such a terrible state of things has long since passed away!

To judge by the looks of the little child in the front of the picture, these little negro boys and girls are quite happy in their work. What pretty headdress they wear! They need these

cloths, which are somewhat like an Indian's turban, to keep off the sun's rays.

The cotton fields have blazed with their yellow flowers all the last two months, and now the flowers have withered and the downy pods, or

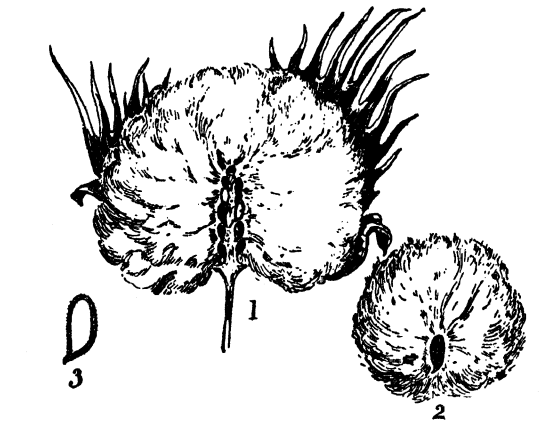


Various Forms of Cotton Bolls

cotton bolls as they are called, have taken their places. When the bolls are ripe they split open, and on each the beautiful white fibre springs out to the size of an orange. Thus the fields seem to have snowballs all over them, and when they are waved by the breeze it looks like a sea of white foam.

When August arrives the harvest begins, and

out into the fields troop men and women, and boys and girls, all eager for their work, for harvesttime comes but once a year, and they must earn money for a rainy day. There is no general rule as to how they work; some farmers prefer one method, and others another. In certain plantations each family of pickers has a space given it, and the whole field is split up into sections. In other cases, the pickers begin on one side of the field and work, side by side, across it. A "ganger" or overseer rides round on horseback and keeps a sharp eye on the pickers, as some of them may do their work carelessly.



Cotton Boll
1. Section of open cotton boll. 2. Single seed.
3. Section of seed (mag.).

In some cases a basket is carried on the left arm, but in most cases a bag is slung by a strap over the shoulder, and the picker has both hands free. The downy fibres are pulled cleanly from

the bolls, but many unripe ones are left to ripen. It is said that a quick picker can gather from 200 to 300 pounds of fibre a day, and when you think how very light the fibre is, you will understand what a great number of bolls the quick hands of the negroes must empty. In the front of the picture you see a large basket nearly full of fibre, and in the back a negro is struggling along with one quite full. He will have his basket weighed at the close of the day, and money will be paid him according to the weight of fibre he has picked.

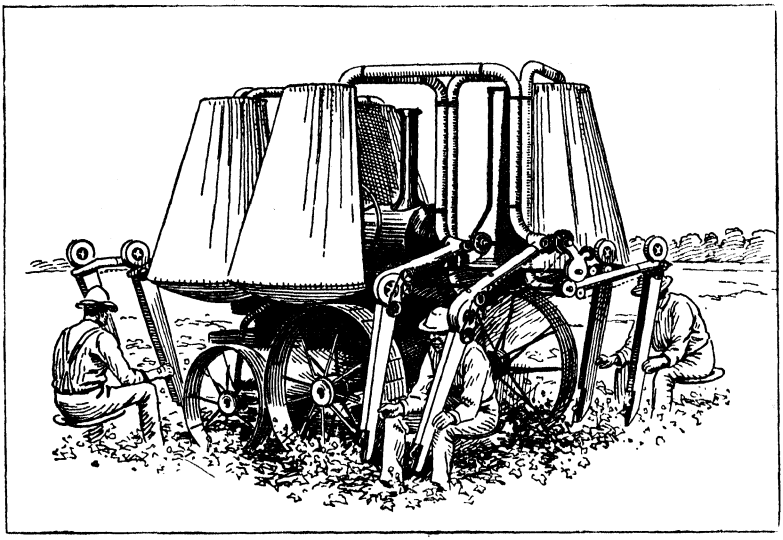
Would you like to spend a day in picking cotton on a Mississippi cotton plantation? The clear blue sky above you, with scarcely a cloud to be seen; the scorching rays of the summer sun making a heat haze all around; the fleecy tresses of the cotton bolls stretching for miles and miles as far as the eye can see; the gaily dressed negroes with their nimble fingers, and one sly eye glancing around to see if "de massa" is about; the little piccaninnies slung, maybe, over their mothers' backs, or left in charge of the little coons in some sheltered spot; such are some of the scenes which would probably meet your eyes. Perhaps the pickers would be humming coon songs or cracking

jokes, for negroes are fond of both, and nowadays they are on very good terms with their masters.

How different from the olden times! In those bad old times we could imagine our muslin frocks and calico sheets having their beginnings among the slashes of the cruel slave whips, and the moans and groans of the tortured slaves. Is not, then, the modern way of cotton picking better for us as well?

For a long time inventors have tried to make a machine which will pick cotton, but though machinery can be made to do almost anything, no one can give it brains with which to reason and think. We have seen that the pickers must leave the unripe bolls, and they must also be very careful not to pick any leaves with the fibre. Again, the bolls grow in all positions on the cotton plant, just as apples and plums do on the twigs of trees.

Mr. G. Lowry, an Irishman, has, however, made a cotton-picking machine which is driven by an engine. It is a four-sided frame, and at each corner a man sits who works a pair of arms beside him. The arms are double rods with toothed wheels at each end, around which run belts of



Lowry Cotton-picking Machine at Work

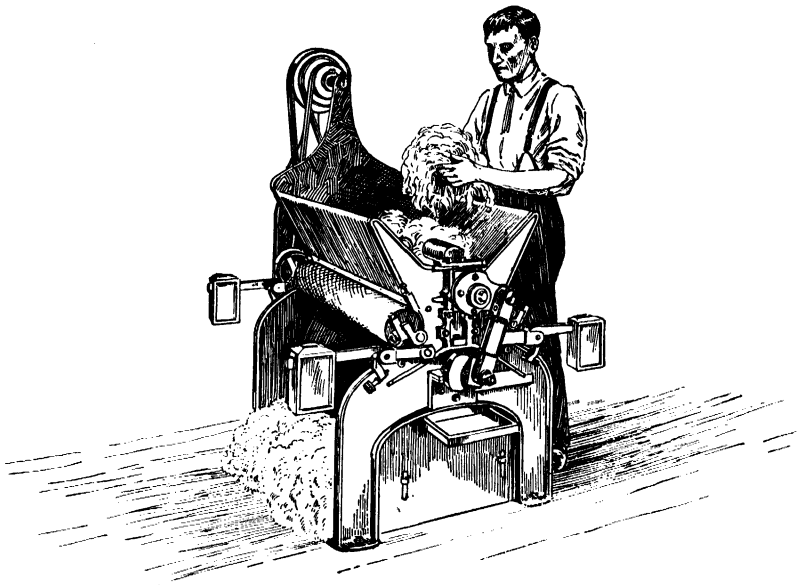
hooks. The man guides the arms on to the bolls, and the sharp hooks, revolving very rapidly, catch the fluffy fibre and sweep it out of the pod. As the hooks go round, carrying the fibre, brushes at the ends of the arms sweep it off into pipes, which convey the cotton into large bags carried at the sides of the machine. Though the work of picking is done quickly, yet the results are not as good as when done by hand, and the negro cotton pickers have not much to fear from their rival the picking machine.

After the downy fibre has been gathered, the farmers send it to the Gin House.

If you have seen a cotton boll, you may have noticed that the seeds are in the centre of the fibre. The seeds must be taken out of the fibre, and this is a very difficult task. We call the process of removing the seeds "ginning", and the machine which does this is known as the "cotton gin".

For many years all ginning was done by hand, but this method was very slow and costly. In 1793 Eli Whitney invented a cotton gin, which dragged the downy fibre by means of a number of sharp teeth through a narrow opening in the machine which was too narrow to let the seeds pass. This machine did not do very well, because it spoiled the fibre a great deal, and the teeth soon became clogged. Many improvements were made, such as fitting it with rounded teeth, fixing brushes over the teeth which swept the fibre away, and supplying a fan which blew away the dirt and other refuse.

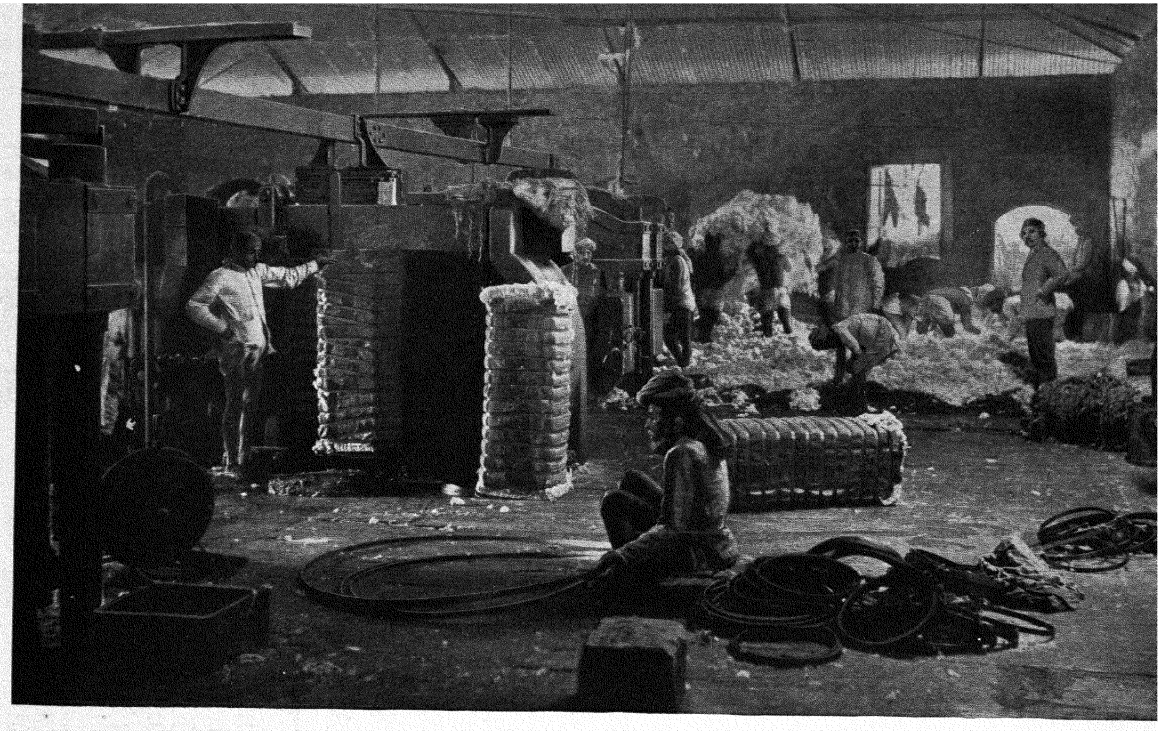
Of late years the Whitney Cotton Gin has been greatly improved by other inventors, but no inventor has yet been quite successful in



Removing the Seed
Ginning with a double-roller cotton gin. The seeds when pressed yield a valuable oil.

making a machine which will clean the delicate fibres but will not bruise them.

Another room in the gin house is generally set apart for making the cotton into bales ready for shipment. After the cotton has been ginned it is laid out to dry, and then it is placed in a press, which presses it into a solid bale and weighs it as well. The bale is covered with canvas, and then iron hoops are placed round it. As a rule, the bales are done up into bundles weighing four hun-



THE COTTON INDUSTRY IN INDIA

The natives are shown packing the cotton into bales by means of hydraulic presses, and binding them with iron bands ready for shipment to the cotton mills.

dred pounds. Thus you see a bale of cotton weighs about as much as four boys who weigh seven stones each, a weight which none of you could lift.

If we followed the bale in its travels we should see it taken by light carts or wagons down to the docks in the river, and then loaded by cranes into the hold of the huge vessel. Years ago it would almost certainly have gone to Liverpool; nowadays it is possible that the ship would be bound for one of the North American ports.

Over the sea King Cotton goes, snugly packed away in hundreds of bales, and the first stage of that muslin frock has been completed.

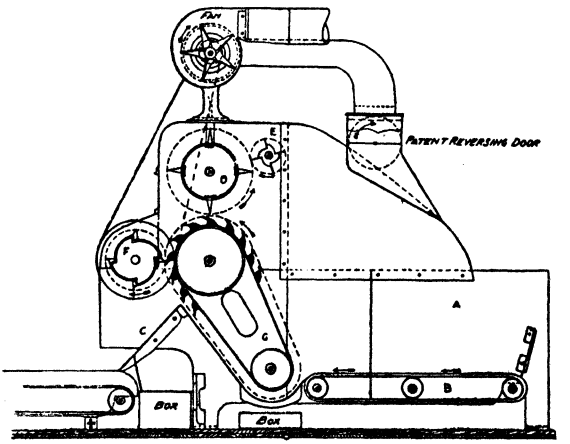


Diagram of a Bale Breaker

Arrows show the direction of cotton after it is placed on the moving belt B.

CHAPTER IV

Arrival at the Factory

We will suppose that the bale which we saw made up in distant Mississippi was bound for England. If this be the case, the ship will probably sail to Manchester by way of Liverpool and the famous Manchester Ship Canal. Years ago the vessel would have unloaded its cargo at Liverpool, which was then the port of Manchester, although the towns were thirty miles away from each other. Since the canal has been made, the cotton can be taken right into the vast docks at Manchester. The Ship Canal cost a huge sum of money to construct, but it is well repaying the merchants of the great cotton city.

Some of you may ask: "Why should Manchester and the other large Lancashire towns—such as Wigan, Bury, Burnley, Blackburn, Oldham, and Rochdale—be the centre of the cotton industry?"

There are two or three reasons. One is that the great Lancashire coalfield provides plenty of coal for the huge engines of the cotton mills, and as the coal is close at hand, the cost of carrying

it is small. But a more important reason is that the spinning of cotton can only be done well in a moist climate. Probably the air of Lancashire is better suited for spinning than that of any other

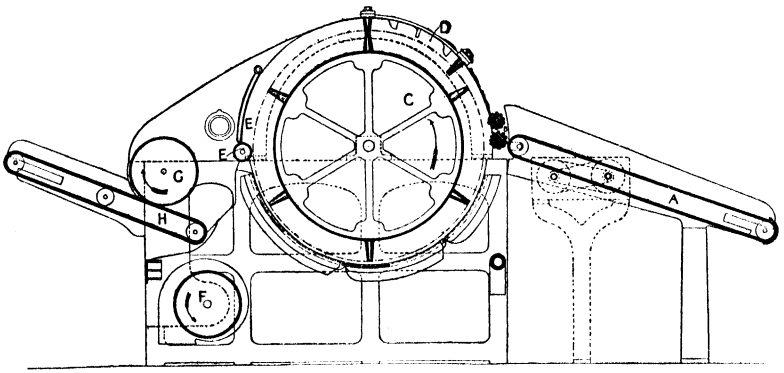


Diagram of Willow
The cotton is fed on to the travelling belt A, and after travelling over the spiked cylinder C is delivered by the travelling belt H.

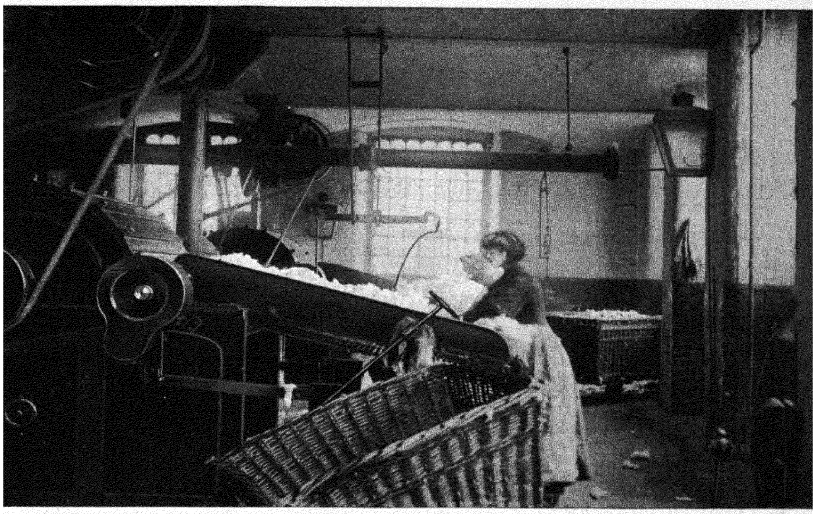
county, for Lancashire is not far from Seathwaite in Cumberland, the wettest place in the British Isles.

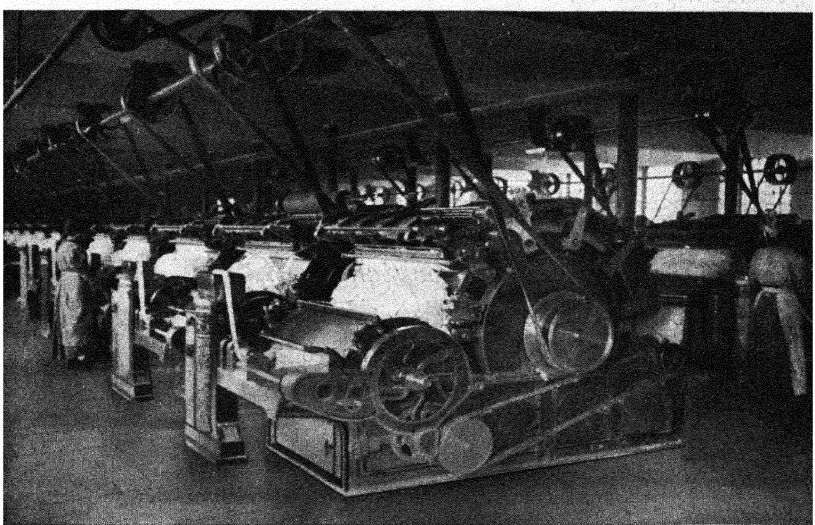
When the cotton has arrived at the docks, it is soon removed to one of the many cotton mills, and the cautious manufacturer first samples the bales. His trained eye and touch soon tell him the quality of the fibre in the different bales, and, to make quite sure, he often takes a small amount of fibre from each bale and has it spun and carded.

Soon the bales are sent to a room to be opened. We read in the last chapter that they were done up in iron hoops and sheets of canvas. Probably you would think that a labourer would unfasten the hoops and rip up the canvas by hand. In most factories this is not so, for the work of opening the bales is done by the Bale Breaker. This is a machine which not only opens the heavy bundles, but also combs out the matted lumps of fibre and fans away some of the dirt and rubbish.

The next thing done is the mixing. We have already seen that the fibres of the various cottons, such as tree-cotton and Sea-island cotton, are quite different in many ways. Some, like the costly Sea-island cotton, are very soft and fine; others, like the Egyptian and Indian cotton, have harsh and thick fibres. The manufacturer finds that blending these gives the best yarn. The "mixer" has the bales stacked along the side of a large room in layers, one above another, and he takes some cotton from one bale, arranges it in a layer on the floor, and then places another layer above this from a bale containing quite a different fibre. In some factories the mixing is done by machinery.

We have seen that the bales are made up, at





CLEANING THE COTTON

At the top are shown the machines (Openers) which loosen, clean, and roll the fibres into sheets. The Scutchers (lower picture) continue the rolling until the cotton is of uniform thickness.

present, of lumpy masses of fibre often mixed with leaves, dirt, dust, and other rubbish. Before the fibre can be carded it must be freed from dirt, the lumps must be laid out in smooth even layers, and the leaves and other rubbish removed. The machine which does a great deal of this necessary work is called the *Willow*. This is a heavy machine fitted with tearing teeth and a blowing fan. The teeth are fixed on a wheel, and as it goes round it tears the lumpy fibre to pieces, while the strong fan blows away clouds of dust. Many manufacturers do not like the willow. They say it is too rough with the fine fibres, and by tearing them so much does a great deal of damage to the softer kinds of cotton. So we find that in certain cotton mills an *Opener* is used instead of the willow.

The next curious machine the cotton has to pass through is called the *Scutcher*, and this machine, after further cleaning the fibres, forms them into a sheet. The very important thing which the scutcher does is to weigh the cotton. After the fibre has come from the opener, it is taken to a skilled workman who very carefully weighs it in scales and then spreads it out on the feeder of the machine. When it comes out at the other

end of the long scutcher it should be free from much of its dirt, dust, leaves, stalks, and any other refuse. It should also be formed in level sheets of an even thickness, length, breadth, and weight, ready for the carding-room.

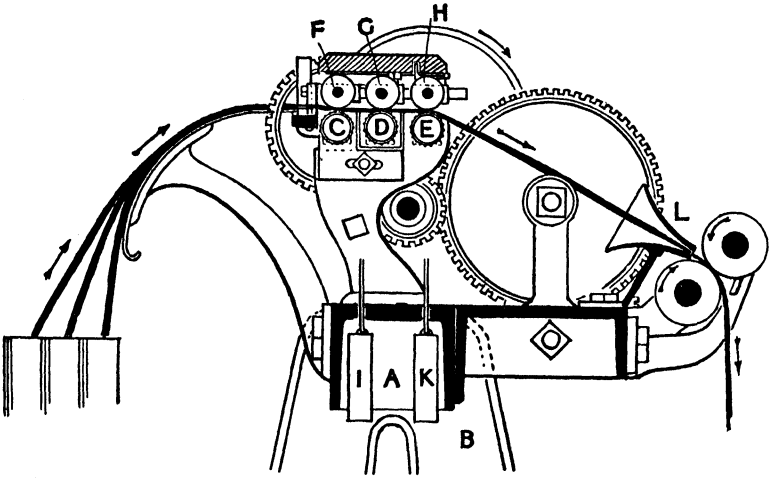
Suppose we follow King Cotton from the scutcher to the carding machine, and, before it enters the carder, let us take up a handful of fibre and closely examine it. We notice that, even though the cotton has been through two or three machines which cleanse it and draw it out into layers, yet there are still many defects in it. The spinner, whom we will shortly watch at work, must have every separate fibre clean and straight before he can make it into yarn. The fibres, as they leave the scutcher, are bent and twisted, and the object of the carding machine is to take away all these defects and make them into a soft rope or *sliver*, which is the beginning of all yarn.

As we read through the "Rambles among our Industries" we find that the different stages of manufacture blend into one another, so to speak. The machine partly opens and cleans the fibre, the next cleans it a little more; and so on. Through dozens of machines the raw stuff has

to pass; hundreds of hands work upon it. Sharp eyes watch the whirring, buzzing wheels of the restless machines, and deft fingers dodge in and out among the various materials.

A "card" was a handbrush with wire teeth used in the old days for combing out the fibres and laying them straight. It is no simple machine that does the work of carding nowadays. When the cotton is of known weight, and after it has been wound into a sheet on the roller of the scutcher, it is placed on the carder, then it is taken by wheel after wheel and roller after roller till it comes out at the other end with the fibres straightened and running side by side. The fibres should also be of equal length, because the short and broken cotton has been thrown out. It is a hard task to do this, and cotton is the most difficult of all the textiles to make into a perfect sliver, as the fibres are so very fine that it is quite impossible to separate them all.

In no part of his work has the cotton spinner made more progress than in the way he prepares the fibre for the spinning machine. Instead of the elaborate willowing and carding machines, the cotton workers of a century ago had to use their



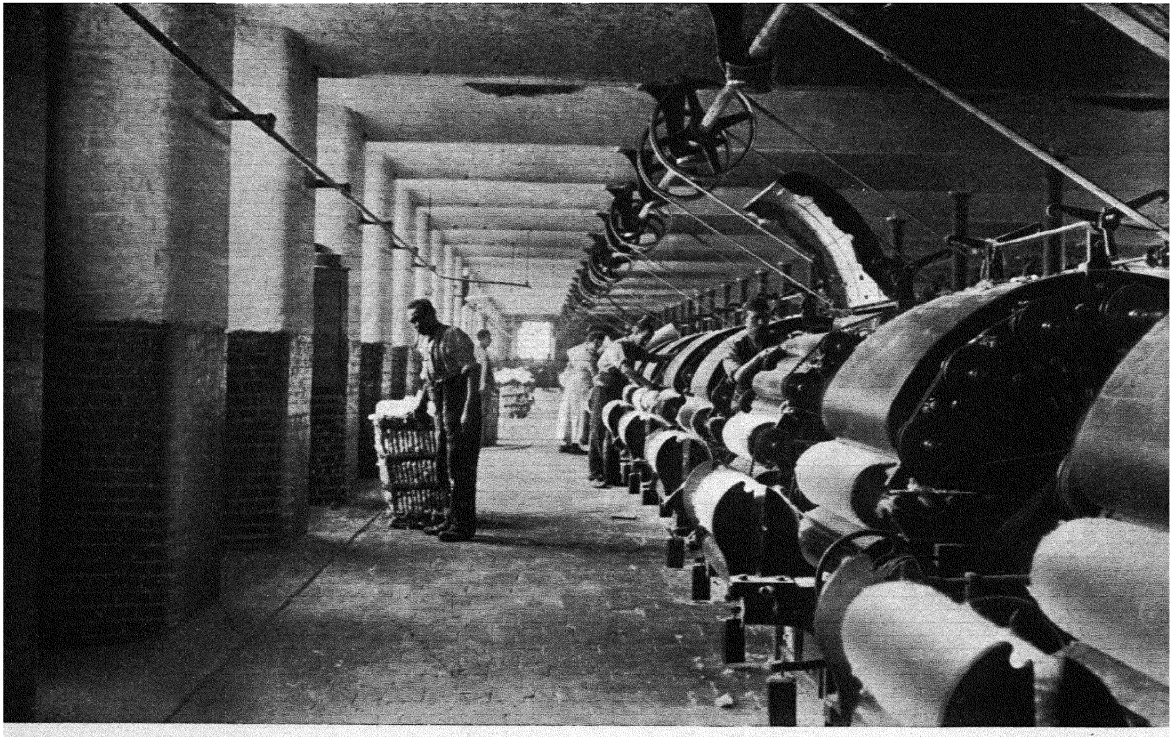
Cross Section showing Principal Working Parts of Arkwright's Drawing Frame

A. Roller beam, which is supported on the frame B of the machine. C, D, E. Fluted rollers, of which C is fixed; D and E are adjustable. F, G, H. Upper rollers, kept in contact with C D E by the weights I K. L. Funnel, receiving slivers from two adjacent sets of rollers.

hands in preparing the yarn. Willowing was done at home by the women and children. They simply opened and cleansed the fibres by placing them on a netted cord tightly slung on a wooden frame, and beating them with willow wands. Because willow wands were used, this was called "willowing". The cotton was then washed, and the wet mass of fibre was dried so that it matted together.

A good account of the early stages of the cotton manufacture is given in the *Life of Crompton.* Per-

haps you know that Crompton was one of the great inventors of the spinning machine. The following passage shows the kind of work a Lancashire lad had to do over a hundred years ago. This is what is said by George, the eldest son of the famous inventor: "I recollect that soon after I was able to walk I was employed in the cotton manufacture. My mother used to batt the cotton wool in a wire riddle. It was then put into a deep brown tub with a strong ley (boiling mixture) of soap and suds. My mother then tucked up my petticoats almost to my waist and put me into the tub to tread upon the cotton at the bottom. When a second riddleful was batted, I was lifted out, it was placed in the tub, and I again trod it down. This process was continued till the tub became so full that I could no longer safely stand in it, when a chair was placed beside it, and I held on by the back. When the tub was quite full, the soap suds were poured off, and each separate lump of cotton wool well squeezed to free it from moisture. They were then placed on the bread rack under the beams of the kitchen loft to dry. My mother and my grandfather carded the cotton wool by hand, taking one of the lumps at a time on



CARDING MACHINES

This shows the "Doffing" end of the carding machines, which by means of millions of tiny teeth comb the fibres and make them into slivers.

the simple hand cards. When carded they were put aside in separate parcels ready for spinning."

We have seen that when the cotton leaves the carding machine the fine teeth of the carder have drawn the fibres into parallel lines and produced a sliver of yarn. But still it is not ready for the spinner. The sliver is thick, and it has to be drawn into the finest of threads, which is a very difficult task indeed. For many years clever men, such as James Hargreaves, Richard Arkwright, and Samuel Crompton, puzzled their brains to make a machine which would draw the fibre into the length they needed, and at last a London druggist, Lewis Paul, invented a drawing frame. This was worked by rollers which drew out the raw mass of cotton into the proper fineness.

You will understand that if the soft rope of cotton, or sliver, be drawn out too much, it will become so thin that it will not hold together. Thus two or more slivers are often put together in the drawing frame, so that the strength of the rope is doubled. Sometimes six or eight slivers are put together in this way. This is called *doubling* the sliver.

CHAPTER V

Distaff, Spindle, and Whorl

"The loaded distaff in the left hand placed,
With spongy coils of snow-white wool was graced;
From these the right hand lengthy fibres drew,
Which into thread 'neath nimble fingers grew.
At intervals a gentle touch was given,
By which the twisting whorl was onward driven;
Then, when the sinking spindle reached the ground,
The new-made thread around the spire was wound,
Until the clasp within the wepping cleft
Held fast the newly finished length of weft."

—*Catullus* (translation).

We have now traced the cotton through all its stages up to the spinning of the thread, and it would be well for us to describe the spinner and his art.

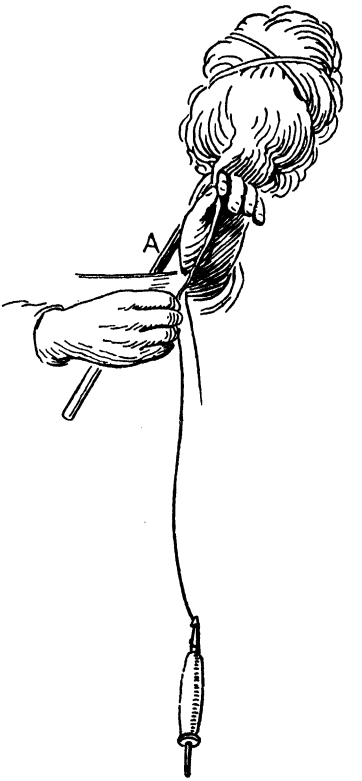
By spinning we mean the drawing and twisting of the fibre so that it is made into yarn. Though it is just a hundred and fifty years since the spinning jenny was invented, yet the art of spinning has been known for thousands of years.

Have any of my young readers who live in the country, and whose fathers may be farmers, or labourers on the land, ever heard their grandfathers speak of the way the sheaves were bound

up with straw bands in the harvest field? The harvestman would have a bundle of straw placed round his waist, and from this he would draw as many wheat stalks as he needed. The straws would be doubled round a stick which the man would give to a boy to hold by both ends before him. As the man twisted the straws he would twine in other straws to make the rope longer. The boy would twist the stick one way while the man turned the straws the other way, so that a double twist would be given to the rope at one and the same time. As the rope became longer, the man got farther and farther away from the boy. Now if we look closely at all these steps of rope-making we shall notice four stages, which are *turning*, *drawing*, *feeding*, and *spinning*, and these, with *doubling*, are the five acts of spinning carried out by the huge spinning machines.

When we watched the harvestman making his straw rope, we noticed that both his hands were free to twist the straws, because the boy held the stick on which the straws were doubled, and which, therefore, supported the rope. Now you know that the fine cotton fibres could not anyhow be wound around a thick stick as the long

straws were. They are not strong enough to have any pull given them, and they are far too short. Could not someone plan a machine which would do the same work as the stick held by the boy and the hands of the rope-maker? At last the *distaff* and *spindle* were thought out by the brains of some clever person. The word "distaff" means "bunch-stick", and the distaff was a stick the lower end of which was stuck through a band worn round the waist, and the upper end on which the prepared fibres were bunched.



Distaff and Spindle

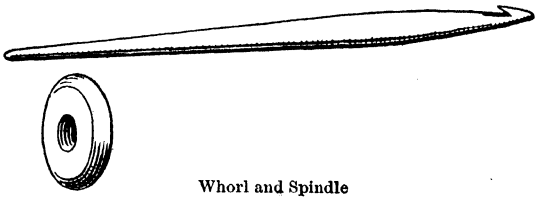
The earliest forms of spindles seem to have been stones shaped like a cone, and having a notch in the side by which the fibres could be caught. As soon as the spinner had drawn out a long enough thread, she would fasten it on the stone by the notch and let it hang

down by her side. She then gave the stone a twist with her fingers. The heavy stone would draw out the fibre and twist it into thread until it reached the ground, when the spinner would take it up and wind the thread upon it.

This, of course, was a very clumsy form of spindle, but now that they had hit on the idea, they did not take long to improve upon it. You know quite enough of the history of any invention to understand that it is the "first idea" which tells. People who follow can see the defects of the inventor's work and put them right, but this is much easier than thinking the problem out in the first case.

We soon find the clumsy stone spindle fashioned into a long slender article looking much like a crochet hook. In time the stone gave place to a wooden or bone spindle, but this was not heavy enough. Thus a heavy weight of clay or some other stuff was fixed to the end of it. After the clay had been turned round and round for hundreds and thousands of times it became smooth and rounded, especially as it had been worn by the spinner's hands. It was noticed that a round weight spun better than a square one, or one with

a number of points sticking out from it. This is what we might expect, because when the weight revolves it catches the air, and if there be corners or points, they act as small brakes on the motion. The weights were then made round, and were called *whorls*, and these were fixed on the ends of the spindles. The spinner now could work much



Whorl and Spindle

faster. She would quickly fix a length of thread on the improved spindle, give the whorl a little flick with her fingers which carried it right down to the ground, when another length of thread, a yard or so long, could be added to the reel.

In the little verse with which this chapter begins you have a capital description of spinning with the distaff, spindle, and whorl. For hundreds of years spinning was carried on in this way, and even in our most elaborate machines to-day we may trace some of the parts of these early tools. When knights of old rode to

battle or the tournament, their ladies stayed at home and amused themselves with the distaff and spindle; many of the poorer women and girls earned their living by these tools for many years. These simple devices were as common in most English homes as knitting needles and crochet hooks are to-day, and there were very few girls in the Middle Ages who did not know how to spin.

You must not, however, think that it is of cotton-spinning we have been talking. We have been tracing the gradual growth of the art of spinning. Cotton-spinning has only been carried on in England for about three hundred years, although long before this cotton had been spun in other countries. Wool and flax were the two fibres in greatest use in the Middle Ages, and in many places spinning schools were set up to teach this art to the girls or "spinsters' —a word we still use for an unmarried lady showing how common the work of spinning must once have been.

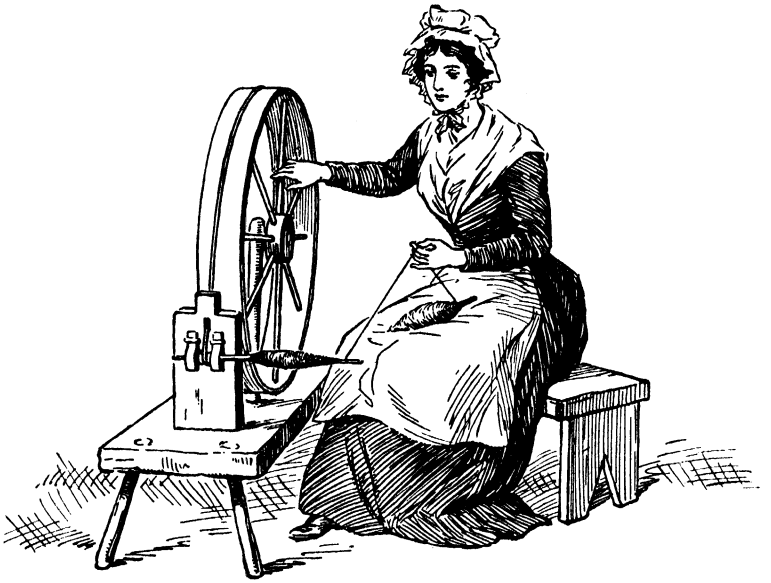
CHAPTER VI

The Spinning Wheel

We saw in the last chapter that for many centuries the only means of spinning the fibre into thread was by the distaff and spindle. Men in the Middle Ages were not such clever inventors as those of the present time.

While the spinners in the Netherlands, France, Italy, and Britain were content to use the distaff and spindle, the more quick-witted eastern nations, such as the Chinese and Hindoos, seem to have made early use of the wheel to turn the spindle. Instead of having the spindle hanging down by their side like the peg of a top spinning in the air, they fixed it, like the axle of a bicycle wheel, with the tapering ends running freely in bearings. Thus the spinner could get a much steadier motion of the spindle than by having it hang down, when it rocked from side to side and jerked the thread.

It is not quite certain who was the first to use this way of twirling the spindle. Whoever it was fixed some sticks in a round log, which stuck out round the log like the spokes of a



Early Spinning Wheel

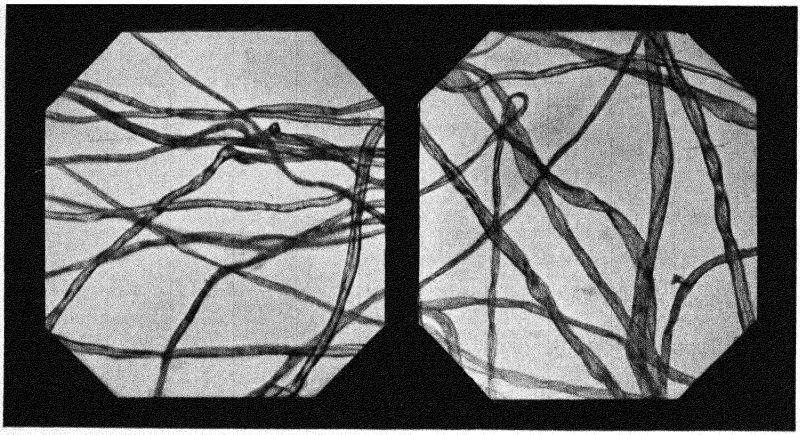
wheel. On the ends of the sticks he cut a deep notch, and on the whorl of the spindle he made a groove. Between them he stretched an endless cord. As the log was hung on bearings it would easily revolve, and by turning the circle of spokes round, the spinner could drive the spindle very quickly indeed.

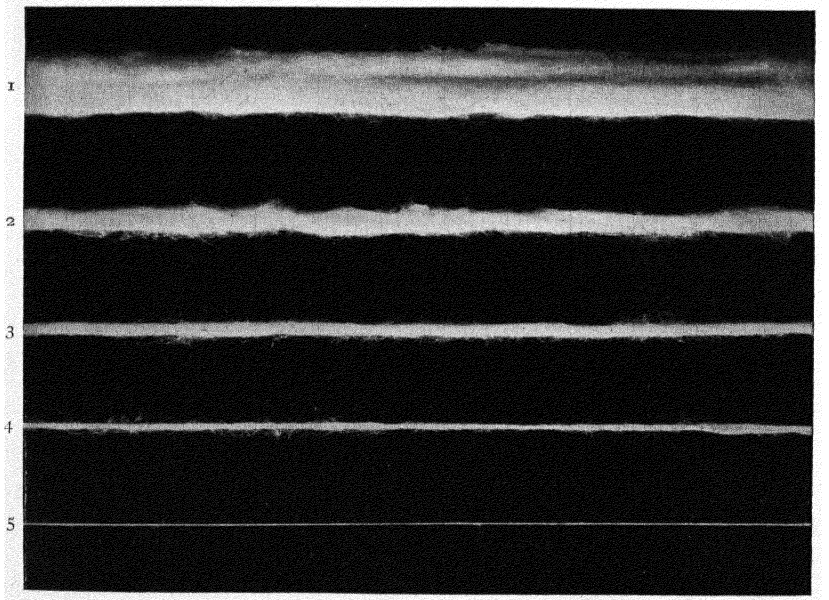
In the picture here given you can get a very good idea of these early spinning wheels, for of course the rough log with its spokes was soon formed into a wheel, and the spindle was fixed

to it in the manner which you see. You will notice a band round the wheel, which also passes round the end of the spindle, making it revolve. Which do you think revolves more rapidly—the big wheel or the smaller spindle? Compare them with the big flywheel of an engine which is connected by a strap with the smaller wheel on the drum of a threshing machine. The small wheel will turn round several times while the big one revolves once.

It is not certain when this idea was first brought into Western Europe, but we know that it had been used for thousands of years in the Far East. The wily Chinese knew well how to keep a secret, as we saw in our book about silk. They guarded the secrets of their inventions with their lives, and nearly everyone was loyal enough never to betray them to the hated foreigner. It was not until about six hundred years ago that anyone in Europe knew of the existence of this rough form of spinning wheel, and even when it became known, the distaff and spindle were in common use in our country for another four hundred years.

Gradually the new idea was used in Greece,





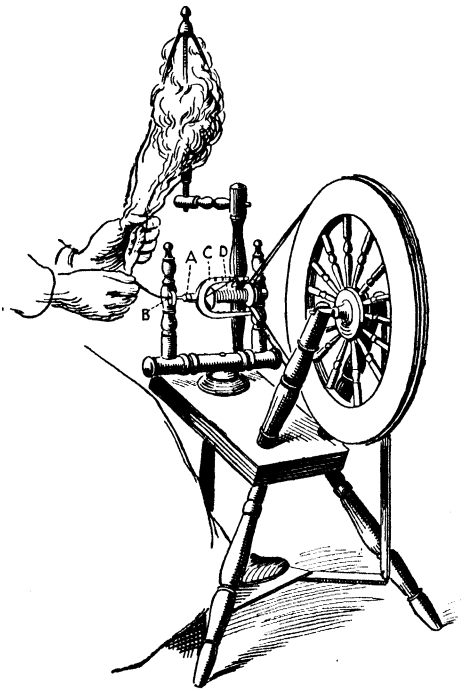
COTTON FROM FIBRE TO YARN

At the top are shown highly magnified views of Sea Island and Orleans Cotton Fibres. The lower picture illustrates the different stages in cotton spinning: 1. After Drawing. 2. After Slubbing. 3. After Intermediate Slubbing. 4. After Roving. 5. Spun Yarn.

from whence it travelled to Italy and Spain. It was a fashionable toy among royal ladies for many years, and the poorer classes, who were then very ignorant, first looked upon it as black magic. As time went on, there was a great demand for the yarn of flax and wool, and the spinning wheel was first used by the humbler folk in the Netherlands—the home of those clever weavers of whom you may read in *Silk and the Silk Worker.*

You have on the next page a picture of the early spinning wheel when it first appeared in Saxony. There is the big wheel, hung between posts which are fixed on a three-legged stool, and connected by an endless strap with the whorl of the spindle at the other end of the stool. At first the spinner held the prepared fibre in her lap; but it was soon found more handy to fix another post in the stool and arrange the wool on this, as you see in the picture. She picked out the number of fibres needed, and brought the ends within touch of the end of the spindle. With a smart glancing blow on the rim of the wheel she made it revolve, and the spindle was twirled round very rapidly, drawing out the fibres as it did so. Of

course the fibres would have been wound round the spindle had the spinner wished it; but her object was to twist them into thread, and by keeping them on the point of the spindle she caused them to twist, while she drew them out with her finger and thumb. When she had spun a length of thread she wound it round the spindle.



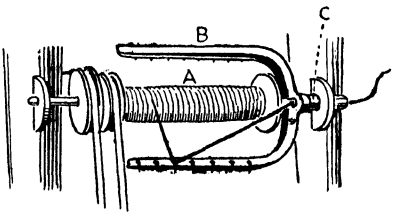
Early Saxony Spinning Wheel
A. Spindle. B. Eye of needle. C. Flyer. D. Bobbin.

Have you ever heard the romantic story of Christian Shaw and the "Bargarran Thread"? Some of you may have read a little book called *Scottish Industrial History*, which contains an account of this girl and the beginnings of the great thread industry for which Paisley is famous all over the world.

More than two hundred years ago there lived

near Paisley a Scotch "laird" named John Shaw, and he was the owner of a small estate called Bargarran. He had a daughter named Christian, whose health caused her great anxiety.

Had little Christian not been cured of her dreadful illness, the people of Paisley would have lost a good friend. When she grew up she became very fond of spinning the fibres of flax and wool, and she was extremely clever in making fine linen yarn. At last an idea came to her of twisting the yarn into much finer thread than was then made.



Saxony Spindle and Flyer
A. Bobbin. B. Flyer. C. Spindle.

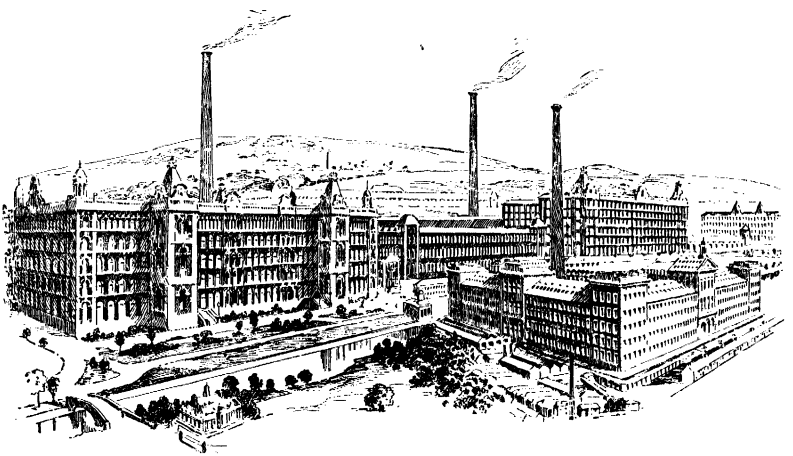
Her first attempt did not succeed very well. We are told that she had to do every part of the work with her own hands, even bleaching the flax fibres on a large slate in one of the windows of her house. "Try, try, try again" must have been Christian's motto, and success came to her at last, so that she was able to teach her sister and friends the new art of threadmaking. Lady Blantyre, one of Christian's friends, thought

highly of the thread, and carried a packet to Bath, where she sold it to some lacemakers. Soon afterwards Christian learned the secrets of the thread-makers of Holland through a member of her family who had been there. She made a special study of how to make and manage twining machines. Several of these machines were set up in the district round her home, and all the young women were eager to have one. In time Paisley became noted for its *Bargarran Thread,* and this well-known Scottish town has been famous for its thread ever since. "Paisley thread" is now known nearly all over the civilized world.

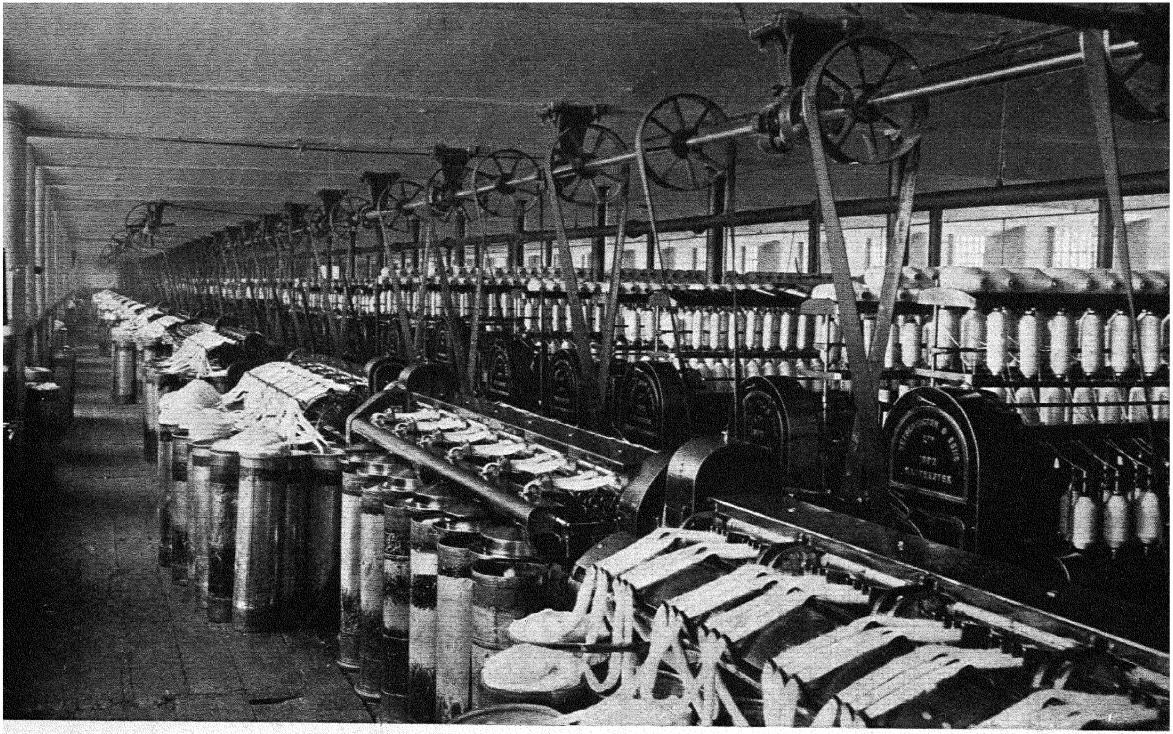
Now that the spinning of fine thread had become general, and more and more wool and linen yarn was needed, most of the Flemish weavers had spinning wheels in their houses. In time these "magical machines", as people called them, were found in most English homes. People, too, began to try to improve the wheel. They saw that it was a great advance on the oldfashioned distaff and spindle. Could they not, then, make an improvement even on this?

The secret of good reeling depended very much in the woman's fingers. As you have seen, the

fibre was rolled into the right thickness before being placed on the end of the spindle. The fingers were apt to become tired in time, and the woman lost her "grip" on the wool, so that the thread became slacker and slacker. So cotton-spinners began to think very deeply over the matter. We will study their inventions in the following chapters.



A Paisley Cotton Mill



DRAWING AND ROVING MACHINES

At the front are the Drawing Frames. Here the slivers are drawn out until the strands are uniform in thickness and the fibres nearly parallel. Behind the Drawing Frames are the Roving Frames, in which the cotton is wound on bobbins ready for spinning.

CHAPTER VII

James Hargreaves and the Spinning Jenny

About two hundred years ago a little boy was born at the village of Stanhill, near Blackburn, whose name was afterwards to be heard all over the world wherever the textile industry is carried on. This was James Hargreaves, who invented the famous spinning jenny.

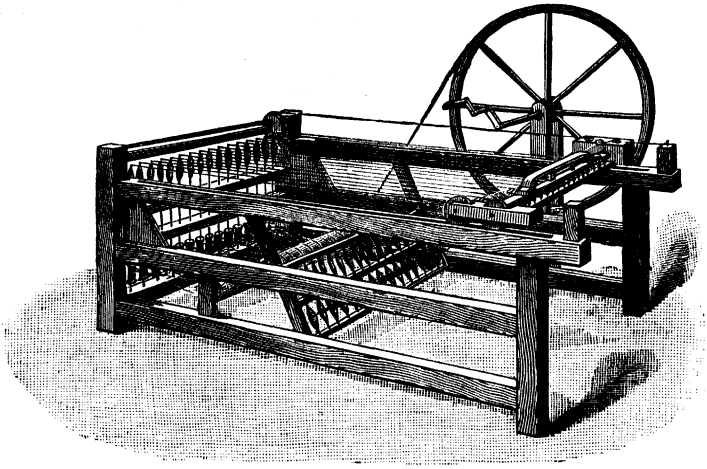
One would not have thought that he would ever become famous. His parents were poor working people who had a hard struggle to get a living, and, when he grew up and had a family of his own, his struggle was just as hard. Like most of the Lancashire weavers, Hargreaves depended on his wife Jenny to supply him with yarn, while he wove it into cloth. There were no large mills then, and nearly all the work of spinning and weaving was done in the cottages, after which the cloth was taken to the traders in the big towns.

One day, when Hargreaves was about forty years of age, he saw the following advertisement by the Society of Arts:—

> "For the best invention of a machine that will spin six threads of wool, flax, hemp, or cotton at one time, and that will require but one person to work and attend it (cheapness and simplicity in the construction will be considered part of its merits); for the best, fifty pounds; for the second best, twenty-five pounds."

The Society gave as its reason for offering this prize that the textile manufacturers found it very difficult when the spinners were out at harvest work—gleaning the corn, and so on—to get enough yarn to keep their weavers employed.

This advertisement no doubt set Hargreaves and many another Lancashire weaver thinking very deeply how to make a spinning machine that would do the work of several women at one time. The poor man was several times over brought almost to starvation, for he had a large family to keep, and his wife's time was taken up by household duties, so that he had to be spinner and weaver too. He scarcely earned enough to buy even the coarsest and cheapest food, and his heart was filled with despair. Many a long sleepless night was passed in thinking over the problem of making a machine which would spin several threads at once, but he seemed to get no nearer the mark. His wife sometimes found fault with



Hargreaves' Spinning Jenny

him for dreaming over his work. Somehow, when his brains were so busy with other things, his fingers did not handle the fibre very quickly, and the output of work at the end of the day gradually became less and less.

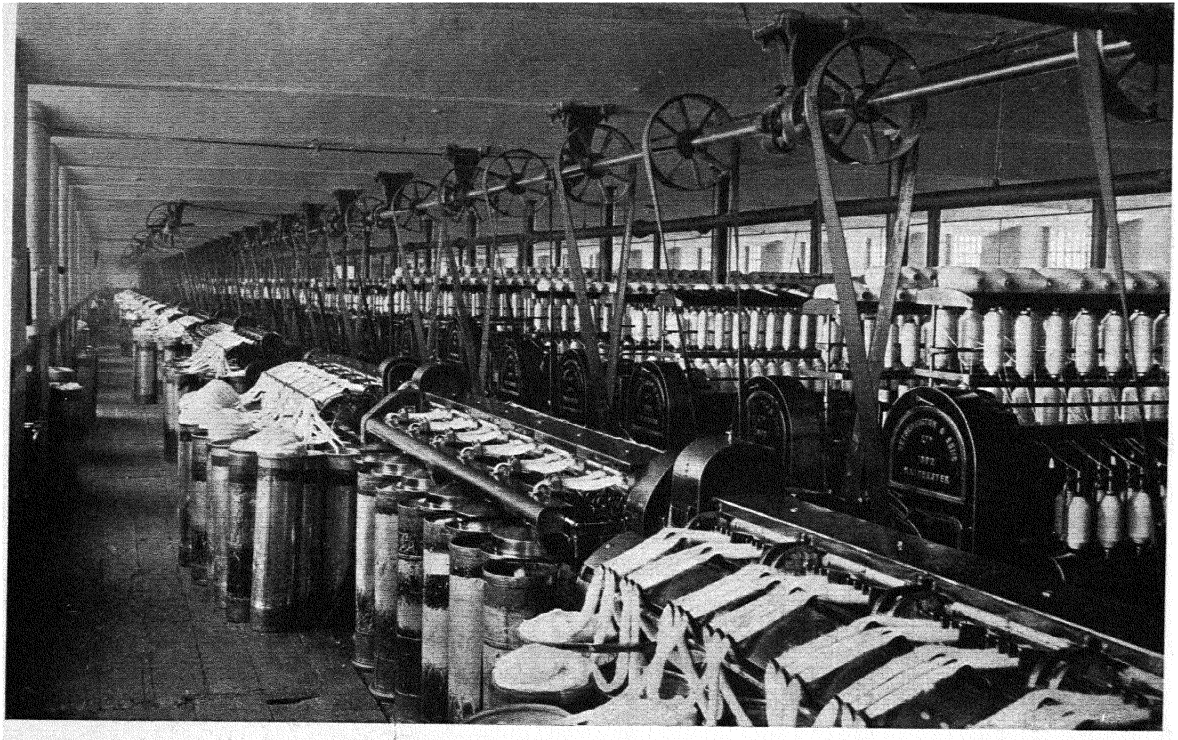
At last the end came. The spinning wheel, which for so long had just provided him with a living, was smashed. Two of his boys were having a game in the crowded little kitchen where he worked, when they knocked over the wheel and fled in terror from the room. Looking at the litter they had made, Hargreaves noticed that the spindle was spinning like a top upon the

floor. An idea at once came to him. Why not make a number of spindles and fasten them together so that they should all revolve in this way?

He was a very handy man with tools, and it did not take him long to put together a wooden stand, or creel, which would carry several spindles, place whorls on their ends, and fix them upright. On another stand he put roving spindles which would draw out the sliver into the right fineness for spinning, as we saw in Chapter Four. The stands were fixed in a frame, and on the top rails of the frame he put two crossbars, by which the rovings were drawn out and clasped ready for the spindles.

By this means he was able to spin eight threads at a time, and thus he could do the work of eight spinners, and work eight times as quickly as he formerly did. He called his new machine the Spinning Jenny, after his wife.

From this time the fortune of Hargreaves began to mend. He spun more thread than he was able to use himself, and in time he was able to supply many of the Blackburn manufacturers with yarn. For three or four years he kept his invention a great secret, and people began to wonder how it



DRAWING AND ROVING MACHINES

At the front are the Drawing Frames. Here the slivers are drawn out until the strands are uniform in thickness and the fibres nearly parallel. Behind the Drawing Frames are the Roving Frames, in which the cotton is wound on bobbins ready for spinning.

was that he could turn out all that yarn. They watched his house to find out if any assistants went to work. They stole round the windows at night to see if he were at work or in bed. Something out of the common was going on inside those walls, they were sure, for no single man could put out anything like that amount of yarn. At last they found the truth, and, mad with jealousy, they went one night to his house, smashed in the doors and windows, and utterly destroyed his beloved machine. Hargreaves indeed was lucky to escape unhurt himself, for the mob was quite beyond control, and they threatened his life if he made any more machines. The poor man was utterly ruined. He had no money to make other machines, even if he had courage enough to defy the mob. Some manufacturers, though, for whom he had worked, secretly employed him to make some more spinning jennies, and when he had saved sufficient money he removed to Nottingham, where he set up business for himself. You will be glad to hear that the persevering inventor had built up a very good business when he died at the age of fifty-eight, and his wife and children were well provided for.

There was one great change brought about by Hargreaves' invention, and that was that spinning, which up till then had nearly always been done by women and girls, was now carried on by men and boys. We have seen that for hundreds of years spinning had been looked upon as a woman's work, just as housekeeping is to-day. With the coming of machines this was changed, especially when the machines became heavier, so that only a man could work them.

The supply of yarn was also greatly increased, and we were able to send some of it out of the country. Before the invention of the jenny, we are told that it took three or four spinners to keep one weaver employed, and in a book called *History of the Cotton Trade* we read: "It was no uncommon thing for a weaver to walk three or four miles in a morning, and call on five or six spinners, before he could collect yarn to serve him for the remainder of the day; and when he wished to weave a piece in a shorter time than usual, a new ribbon or gown was necessary to make the spinner work more quickly".

CHAPTER VIII

The Barber Who Became an Inventor

"Where Derwent guides his dusky floods
Through vaulted mountains and a night of woods,
His ponderous oars to slender spindles turns,
And pours o'er massy wheels his foaming urns;
First with nice eye, emerging naiads cull
From leathery pods the vegetable wool;
With wiry teeth revolving cards release
The tangled knots and smooth the ravelled fleece;
Next moves the iron hand with fingers fine,
Combs the wide card, and forms the eternal line:
Slow with soft lips the whirling can acquires
The tender skeins, and wraps the rising spires;
With quickened pace successive rollers move,
And these retain, and those extend the rove:
Then fly the spokes, the rapid axles glow,
While slowly circumvolves the labouring wheel below."

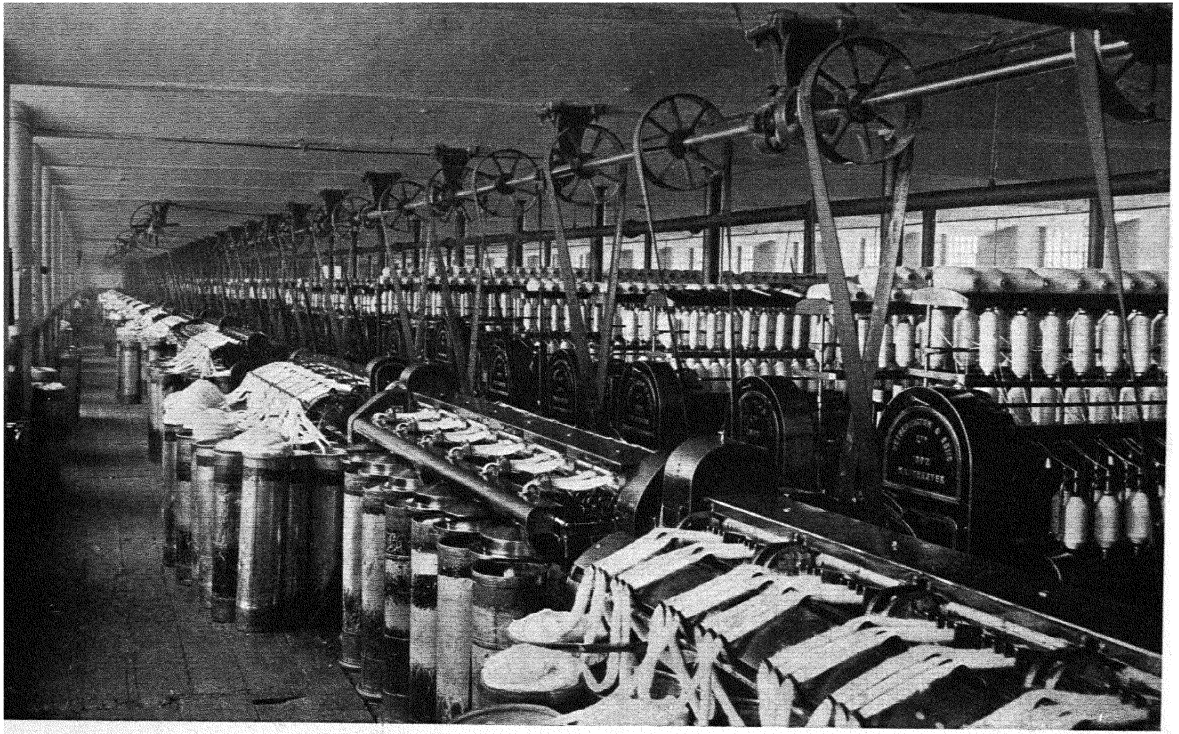
—*Erasmus Darwin.*

You may be sure that after James Hargreaves had shown what the spinning machine could do, the minds of most of the workers in the textile industry were bent on improving his jenny. There was one thing which Hargreaves' jenny did not do, and that was to take the place of the grip of the hand and the drawing of the arm. Spinners still had to use their hands and arms in drawing and twisting the rovings ready for the spindle much as they had done in the

old days when nothing but the distaff and spindle were used. The only improvement in his jenny was that by one grip and one draw a number of threads could be spun at the same time instead of only one, as in the older method.

At last one man solved the great problem, and he another poor and uneducated man too. His name was Richard Arkwright. Arkwright was a native of Preston, and he was born about two hundred years ago. His parents were very poor, and as he had twelve brothers and sisters, he had a very hard struggle to get even the coarsest food. You know that two hundred years ago children were not forced to attend school; indeed, there were only a few schools in the country for poor children, and even if their parents wished them to go to school, they could not afford the fees.

As soon as Richard grew up he was apprenticed to a barber, and could we have peeped into the dingy little shop where he served his time, we might have seen him lathering the customers and making himself as handy as possible. When his apprenticeship was finished he removed to Bolton, but as he was of rather a restless nature



DRAWING AND ROVING MACHINES

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he could not settle to a barber's life, and he wanted to be doing something where he could earn more money.

At that time the fashion among the upper classes was to wear enormous wigs. It is said that the wigmakers could not make the hair up nearly fast enough, as they were unable to get supplies of hair. Arkwright thought that he could earn more money by hairdealing than by giving his customers "a clean shave for a penny", as his sign stated, and so he started business as a hair merchant. In the village inns and on the carriers' carts the talk would often be about the latest inventions in the textile trade, and Arkwright, who always kept his ears well open, doubtless picked up many a hint as he travelled about.

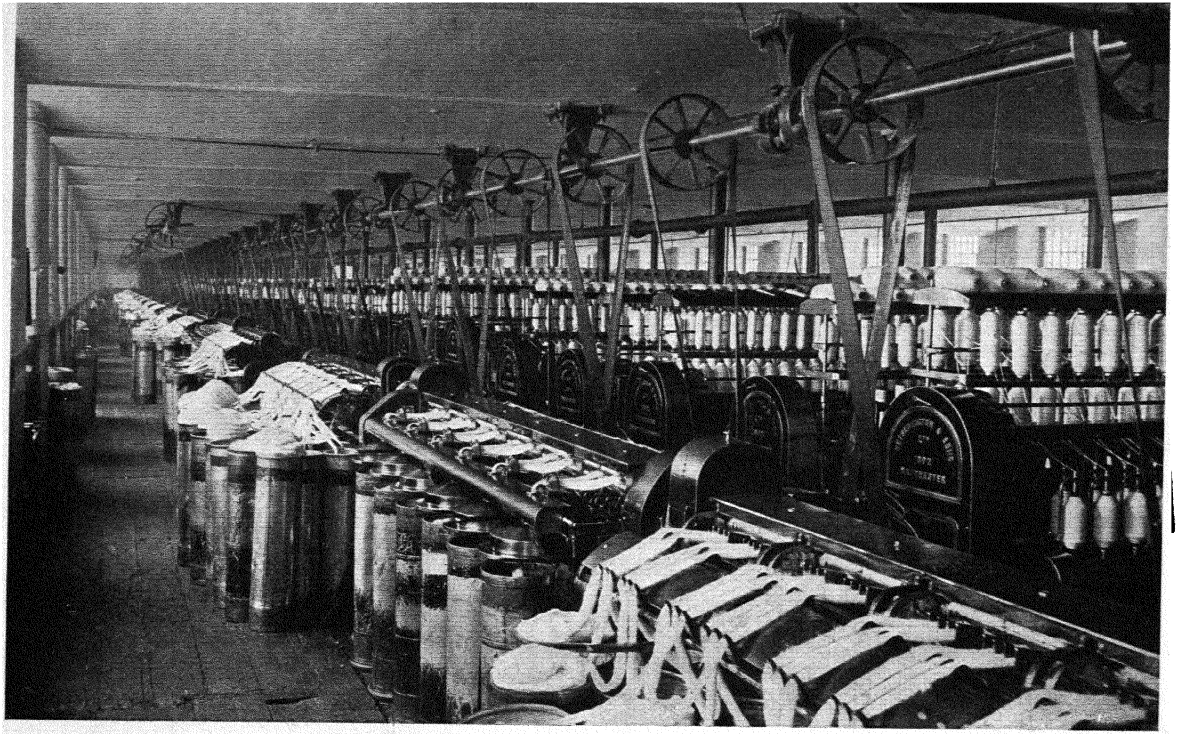
At last he settled down at Warrington and tried to make a cotton-spinning machine. He was rather clumsy with carpenter's tools, as he had seldom used them, and so he had to get other tradesmen, such as watchmakers, blacksmiths, and carpenters, to make different parts of his machine. After several attempts he invented a machine which would spin a finer or a

coarser thread than that of the spinning jenny, and he exhibited it in his native town.

He made several other machines, and his great aim was to produce a machine which could be used to carry through *all* the parts of the spinning process, such as drawing, twisting, and spinning, without any human aid except that of attending to the running of the machine.

Richard Arkwright

Like Hargreaves, he soon found that the people were very unfriendly to him, and he left his native county for Nottingham. Here he took a small workshop with another Preston man for partner; but their money was soon finished, and they were at a standstill. Arkwright knew how he could improve his spinning frame, and at last he applied to a rich inventor who had made a fortune out of stockings for funds to complete his plans. The money



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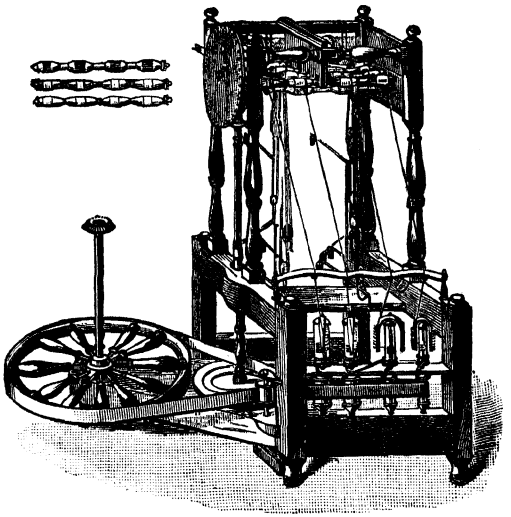
was given him, and before long he had made his invention almost perfect.

Perhaps you will understand how important Arkwright's invention was when you read that the frame would spin a great number of threads of any degree of fineness, with only one workman needed to feed it with cotton and join the threads when they happened to break. Instead, too, of the carding being done on a separate machine, and the sliver then worked up by the fingers for the spindle, he had four pairs of rollers fixed on the back of the frame. These rollers were driven at different paces—the slowest ones being at the back—so that the soft loose strip of carded cotton about which we read on page 44 was drawn out into a thread of the right hardness and thickness.

Soon Arkwright built a cotton mill, and made a very large frame which was worked by horses. This, though, was a rather expensive method, and he built a much larger factory on the banks of the Derwent at Cromford in Derbyshire. In this factory he placed a very large and heavy water frame, as he called it, because it was worked by a huge water wheel placed over the river.



Arkwright's Water Frame

Arkwright was not content even with this big machine. He could see many parts which were far from perfect. But with his water frame he could make yarn much faster and more cheaply than any of his Lancashire rivals; he was able to sell cheaper than they, so that he made great profits. You will be glad to learn that, in spite of the fact that others were allowed to copy his frame, Arkwright earned an immense fortune, and six years before his death he was knighted by George III.

CHAPTER IX

Samuel Crompton and His Mule

The last of the three great inventors of spinning machines was Samuel Crompton, who was born near Bolton in Lancashire in the year 1753.

Crompton was one of those boys who always want to pull to pieces toys and clocks and anything with wheels in it, to see how they are made and how they work. His father was a cloth-maker, and he lived on a small farm near Bolton. At first the family was fairly well off, and when Samuel was about five years old they moved to an old mansion in the district. Here they kept cows and poultry, farmed the land, and spent their spare time in carding, spinning, and weaving cotton and flax into cloth.

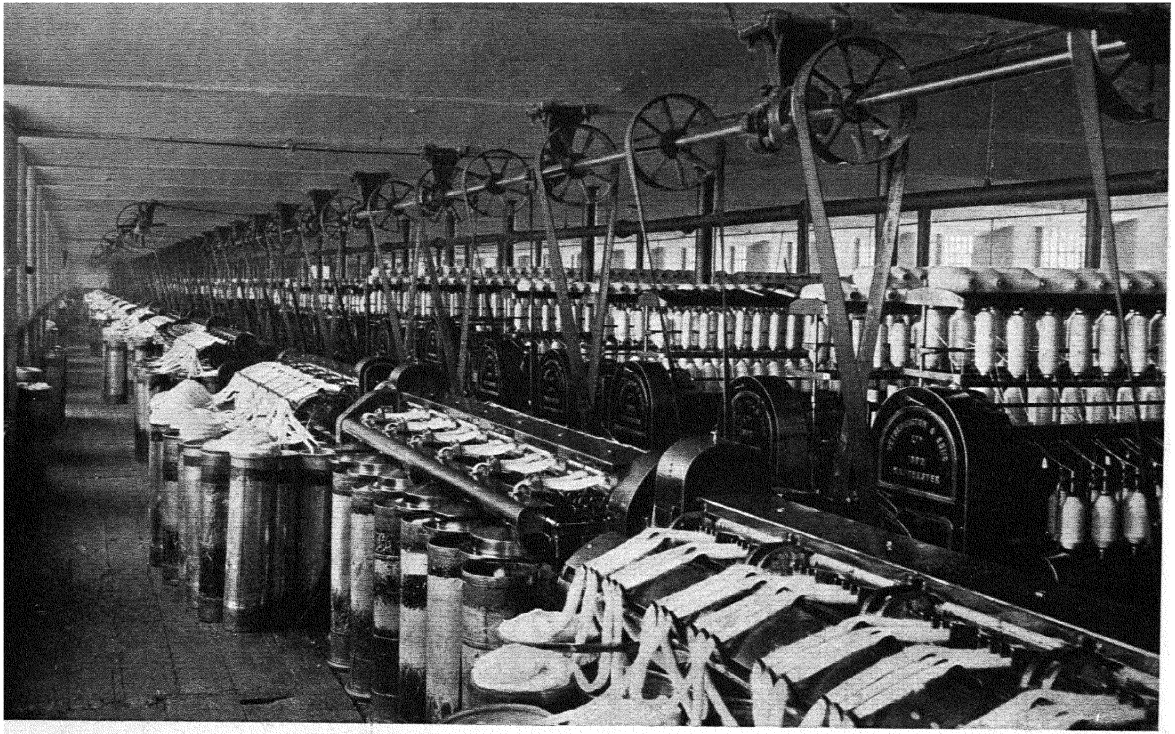
When the father died the widow and children were left poor, but the farm was kept on and the dairy looked after. The children began to work very early, and Samuel was soon able to manage his father's loom. When he was about sixteen years of age he had saved enough money to buy an eight-spindled spinning jenny like that made

by Hargreaves, and for five years he earned his living by spinning yarn on the jenny and weaving it into cloth.

Crompton had a great taste for music, and he soon learned to play the violin. In time he became noted in the district as a musician, and was engaged in the evenings in the orchestra at Bolton theatre, where he earned 1*s.* 6*d.* a night. Here he would see the gauzy, filmy dresses of the actresses and the gossamer draperies of the stage, and these, no doubt, gave him the idea of spinning the very fine threads needed for this class of cloth. For seven or eight years he gave up all his spare time in trying to make a spinning machine which would make threads of very fine quality.

Samuel Crompton

At the end of this time he had made such an improvement on the spinning jenny, that his yarns were in great demand by all the textile



DRAWING AND ROVING MACHINES

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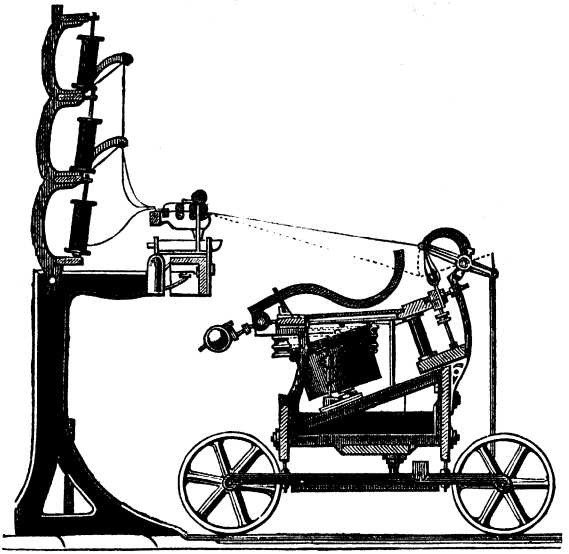
manufacturers. He called his new machine a "mule".

Many of you have no doubt seen that patient-looking animal called a mule about the streets, which seems to be half a horse and half an ass. The mule is said to unite the speed of the horse with the patience of the ass. In the same way Crompton's spinning mule combined the drawing rollers of Arkwright's water frame and the jenny of Hargreaves. So we see that "mule" was a very good name for the machine.

On the head of his mule Crompton fixed a bar for holding the bobbins containing the fine fibres of carded cotton. This is called a "creel". In front of the creel he placed two pairs of drawing rollers, and at some distance from these the spindles were mounted on a sliding stand called a "carriage". The spindles on the carriage could be moved to and fro. While the thread was being twisted, the spindles moved away from the rollers; and when the thread was wound, the spindles returned to the rollers.

Let us now see how our modern spinning machines are modelled on the early inventions. Some of you may have been over a cotton mill,



Crompton's Mule

where you will have seen one of these large machines at work. But however large the machine may be, however many bobbins of thread it can wind at once, yet it is really a number of mechanical spindles. There are many ways of fixing these spindles in the different frames, and there are many different sizes and shapes of spindles, but the spindle is the spinner's chief tool, just as it was hundreds of years ago.

There are five types in use at the present time, and the chief of these is the mule. Let us examine

a modern cotton mule, and trace some of the parts of Crompton's early machine.

In the picture here given you see at the back of the frame the roving creel. It is an iron frame, fitted with three rows of pegs, one above the other, and standing out from the frame are guides for leading the thread from the bobbins to the drawing rollers.

Near the bottom row of bobbins you can see some rollers. These are the drawing rollers, like those we noticed in Crompton's early mule. When the machine is at work, a man leads the thread from each bobbin down into a small wire hook fixed on a thread guide behind the back roller. When the soft roving passes into the grip of the back rollers, it is drawn out by the middle and front rollers, *which are made to revolve more quickly than those at the back.* On some cotton mules, when very fine thread is wanted, the front set of rollers revolves twelve times as quickly as those at the back. Thus the rovings are drawn or stretched.

On a sliding carriage before the rollers the shining row of spindles is arranged. The spindles move backwards and forwards to and from the rollers. When they come up to the front rollers,

the fine tips of the spindles on which the roving is spun take the threads from the rollers and move away again. So each spindle bears on its point a thread held tightly stretched.

When the carriage carrying the spindles retreats, it moves slightly faster than the front rollers revolve. The workmen call this the "gain", because the carriage gains in speed on the front roller. This "gain" stretches the yarn. By stretching the yarn thick places are drawn out, and it is of the same thickness all its length. All this time the spindles have been twisting the thread as they revolve very rapidly, and the twist is given by the very fine point of the spindle.

So if you compare the various parts of this modern mule with those of Crompton's simple-looking machine, you will find that both machines work on the same principle. There are the drawing rollers taking the soft rovings from the creel at the back. Then we find that the front rollers revolve much more quickly than those at the back, so that the thread is drawn. The spindles in both mules move backwards and forwards on a sliding carriage, taking the thread from the front rollers and twisting and drawing it into yarn.