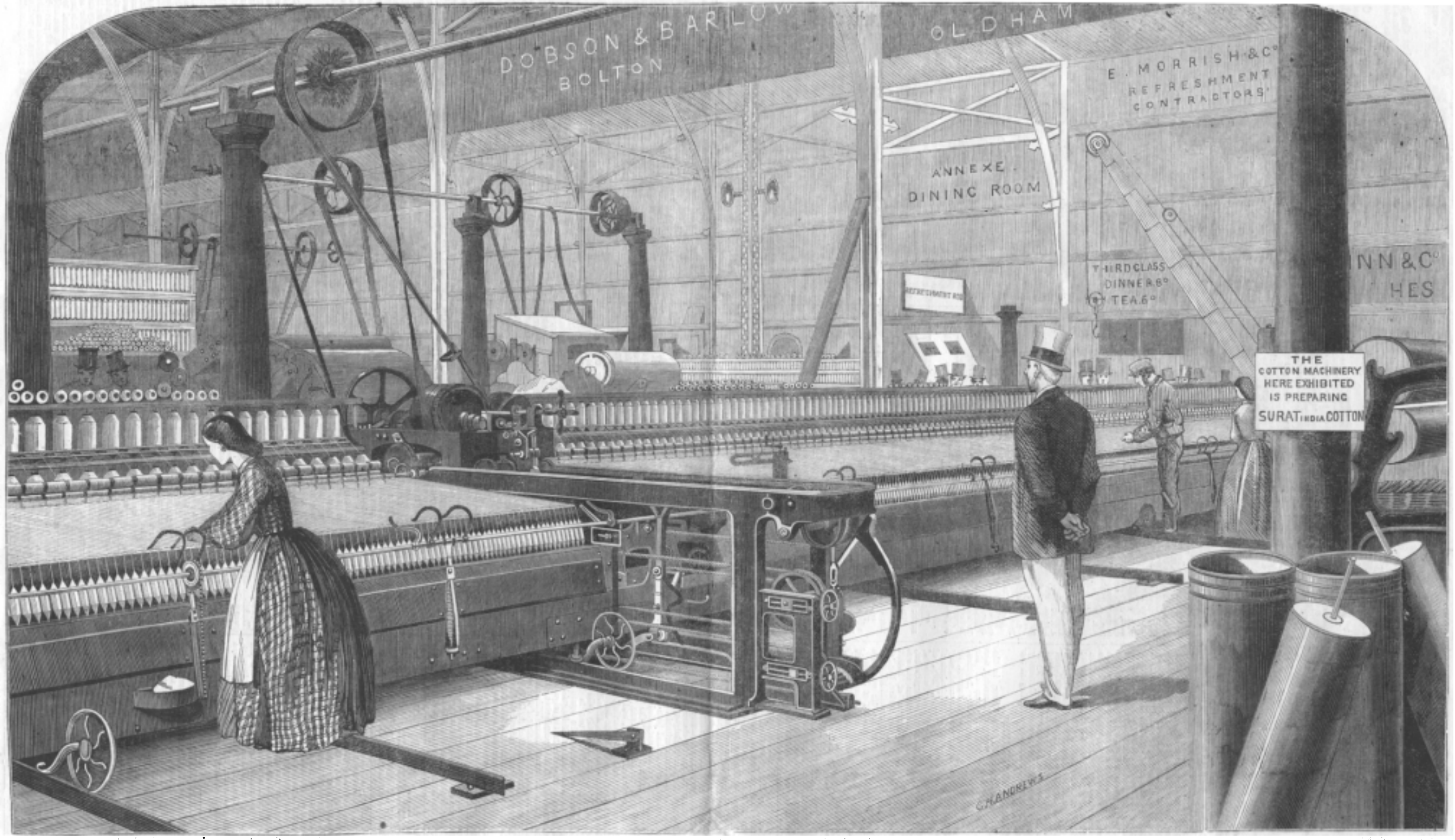


COTTON MANUFACTURE IN THE INTERNATIONAL EXHIBITION: PLATT'S SELF-ACTING MULE, OR COTTONSPINNING-MACHINE.

COTTON MANUFACTURE IN THE INTERNATIONAL EXHIBITION.

In all parts of the world cotton is the subject running most in men's minds at the present moment. At the mere mention of the word how quickly does the imagination carry us to the different quarters of the globe, and to the scenes taking place in them! In America we see two-thirds of a population bent upon the destruction of the other third, and their beautiful land disfigured by acts of horrible atrocity, noble cities destroyed by shot and shell, the generous gifts of the earth—the crops of sugar and cotton—given to the flames or the waves of the great ever-ebbing rivers, the soil remains untilled, the people have but one occupation, and that is to shed each other's blood. In England we know there are localities where want and misery reign paramount; the people suffer with meekness and resignation, battling bravely with the undeserved hardship that presses on them. In India men are busy, or should be, regulating the channels of rivers, irrigating lands, making roads, and providing for the future. The atrocious acts of one, the misery of another, and the rising energies of the third have a common origin; for the prosperity and happiness of the world seem to depend upon the facility with which it can possess itself of the white silky down inclosed in the pods of the cotton-bush.

The manufacture of cotton now becomes a subject deeply interesting to all classes, and we feel sure that we shall be consulting the wishes of our readers in devoting a considerable portion of our space to it. In the western annexe of the International Exhibition almost every description of machinery used in the production of cotton fabrics is exhibited. Instead of illustrating and describing these separately and in a disconnected manner, we purpose taking one series in the order in which they are employed. We have unusual facilities for doing this, as the firm of Platt Brothers, of Oldham, exhibit the entire range of machines, and on the premises pass the cotton through all its stages, from the condition in which it is plucked by the negro from the pod, until it is converted into cotton yarn. So complete an exhibition of machines is highly valuable in an educational point of view, and we shall endeavour to do our part to make it so by giving as clear and simple an explanation of it as we can.

In the diagram on page 170 is a sketch of the cotton-tree or bush, and the flower, leaves, and cotton-pod to a larger scale. As our present purpose is to explain the different processes the cotton passes through after it is gathered we need not enter into the question of cotton culture. We will therefore suppose the negroes have plucked the cotton, and the processes commence which are to eventually convert it into calico and the numerous other forms it assumes as necessary to the requirements of man.

THE GIN.

The first machine through which the cotton passes after it is plucked is the gin. The operation of ginning cotton is nearly always performed upon the plantation; the purpose of it is to separate the cotton fibre from its seed, pieces of the pod, sheath, or any other matter not cotton fibre that may be mixed up with it. The cotton-gin is a very ancient contrivance, invented originally in India, and is generally known now as the Churka gin, it being named after the place where it was originally used or invented. The machine represented in our

THE INTERNATIONAL EXHIBITION.

FIG. 1.

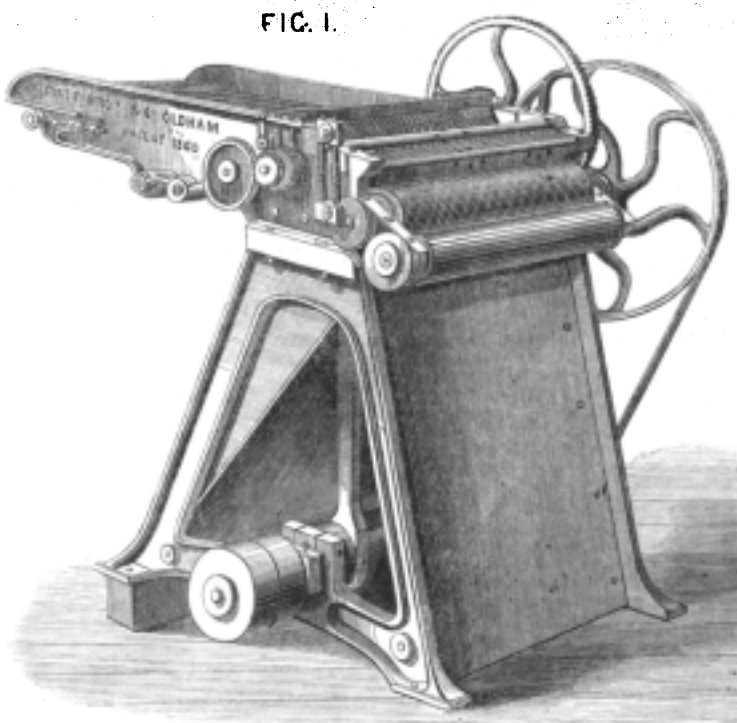


FIG. 4.

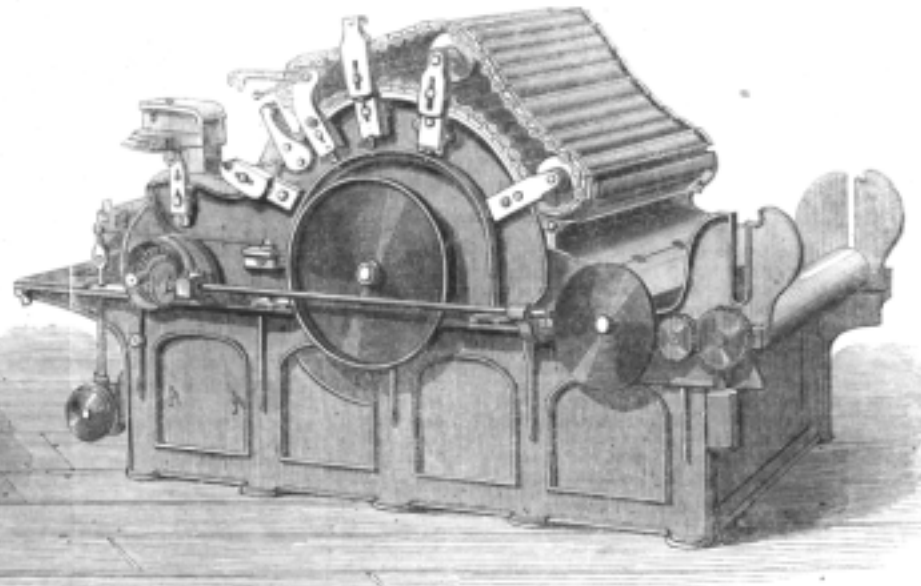


FIG. 6.

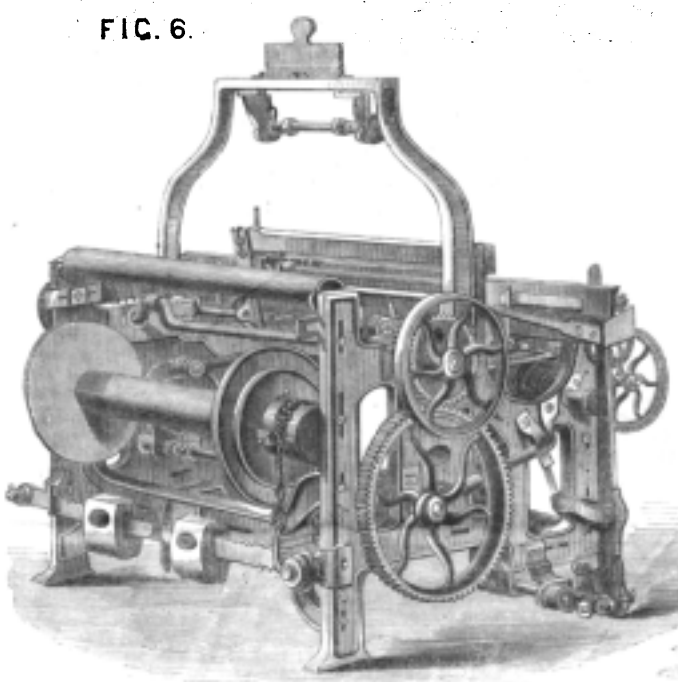


FIG. 5.

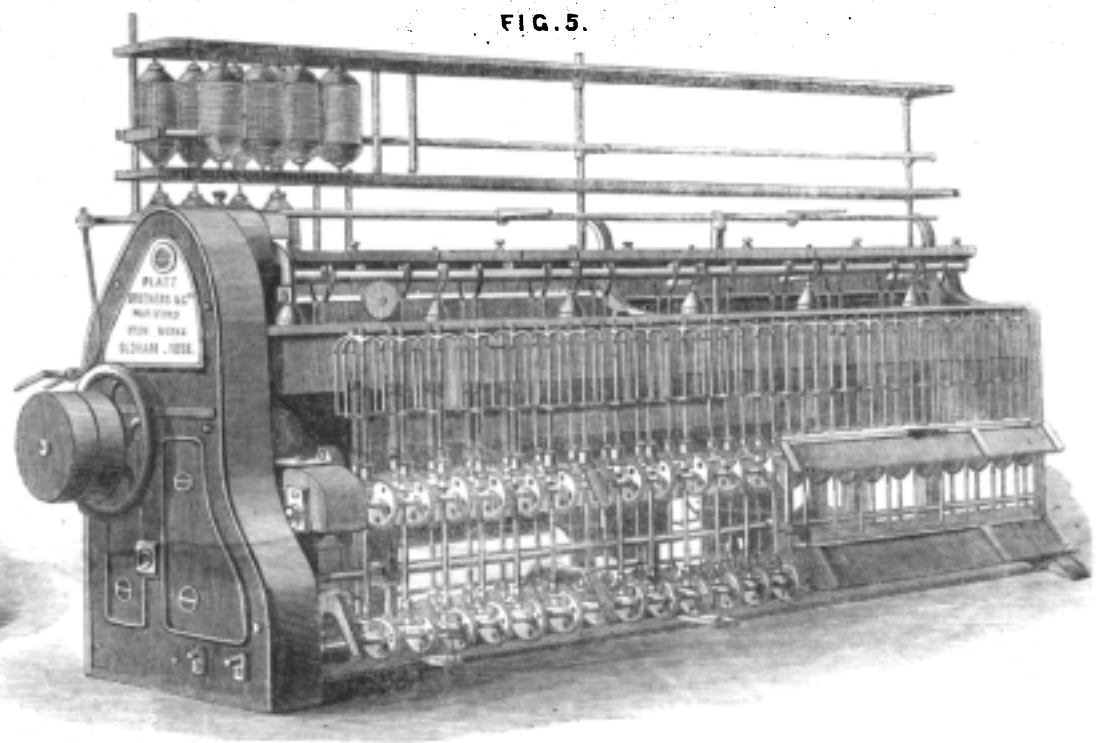


FIG. 3.

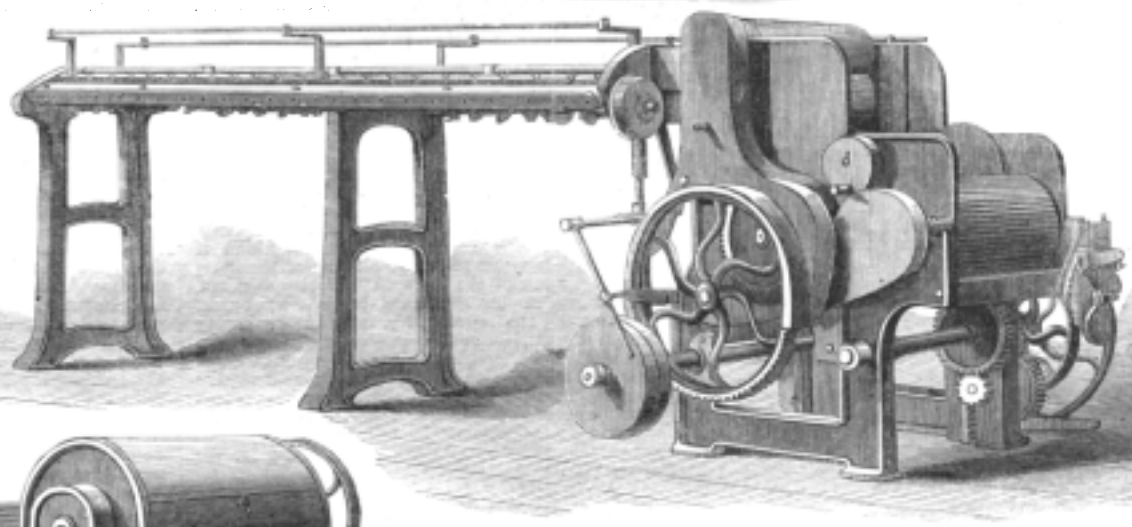
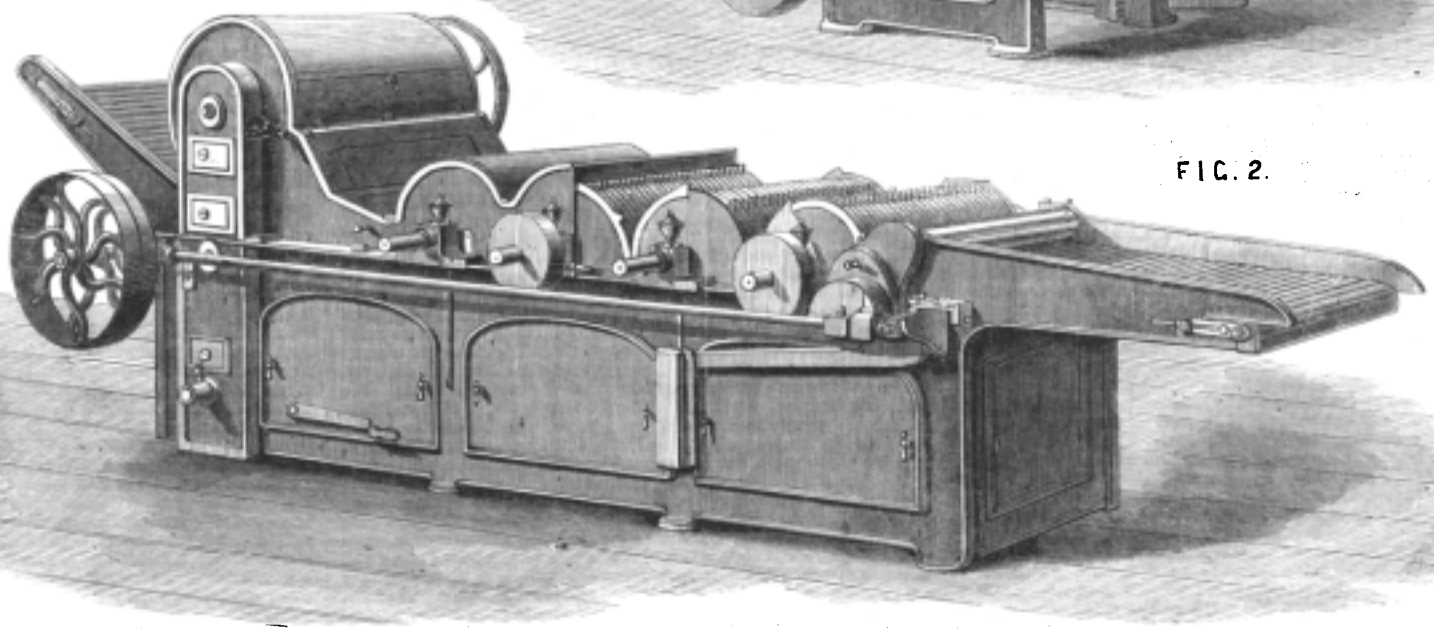


FIG. 2.



1. THE GIN. 2. THE COTTON-OPENER. 3. THE LAP-DOUBLER. 4. THE CARDING-ENGINE. 5. THE ROVING-MACHINE. 6. THE POWER-LOOM.

COTTON MANUFACTURE: MACHINERY OF PLATT BROTHERS, OLDHAM.

Engraving is called the Macarthy gin; it consists of a roller covered with leather about 5in. in diameter, having a number of small grooves cut spirally on its surface, and is made to revolve about 110 times in a minute. On the face of this roller is a thin steel plate acting against it with a slight pressure; it is also furnished with a wire grid, upon which the seed with the fibre attached is pushed by hand against the face of the roller, which, by means of the spiral grooves and the adhesive nature of the leather surface, draws the fibre under the steel plate until the seeds come in contact with its edge. While the fibres are thus held the seeds are pushed off by the edge of a bar which has a vertical vibratory motion, so as to pass the edge of the plate where the seed is held, and thus separate it from the fibre, which is carried forward and delivered by a fluted roller placed in front, which revolves in the same direction as the Macarthy roller; the spaces of the grid are adapted to the size of the seeds to be taken out. The improvements made in this machine are a travelling-lattice to facilitate the operation of feeding, the introduction of a spiked roller which travels faster than the other and separates the tufts of cotton in detail from the sheet spread on the lattice. From the spiked roller the tufts are transmitted to the other by a comb, which has a rotatory vibratory motion given to it through an elastic connecting-rod. There are also other minor improvements which we have not space to describe. The cotton, having been cleaned by means of the gin, is then packed by hydraulic pressure.

The bales of cotton having arrived at the premises of a manufacturer, a very important process has to be gone through, which can be done only by most experienced and skilful persons—that is the mixing the different bales of cotton in such a manner as to produce the particular character of material necessary for the purpose required. The contents of the assorted bales are spread out in layers, so as to form a stack, called a mixing. From the sides of this the cotton is carried to the machine called an opener. There are several descriptions of this machine; we have not space to enter into the detail of their working, but the object sought to be attained in all is to open the fibres of the cotton, which have become matted together, and to extract all impurities that may be in it, such as dried leaves, sand, &c., and to do this without damaging the fibre of the cotton.

THE CARDING-ENGINE.

The cotton, being thoroughly opened and freed from seed, dirt, and any foreign matter that may have got into it, requires now to be still further cleaned, and the fibres combed and separated to the greatest minuteness. This is done by passing the fleece through a series of machines called carding-engines; these are all modifications of one another, having one common object, which is to comb out, separate, and arrange in order every individual fibre of the cotton which passes through them. They are called carding-engines because they operate by means of cards, which are made by fixing staples of very fine wire, about half an inch long and a quarter of an inch wide, with a side bend in the middle of their length, into a strip of elastic cloth, composed of caoutchouc, united to a number of layers of cloth made from either linen, cotton, or wool, or a combination of these materials. These strips are about an inch and a half wide, and of lengths that will cover the cylinder upon which they are to be placed by being wound spirally upon its surface. These staples or teeth are made of varying strength of wire, and set in the cloth at pitches to suit the parts of the machine, as well as the kind of work they are intended for. They were formerly all set in leather; for wool-carding engines they are still so set. When the card is wound tight on the cylinders the crossed end of the staples are pressed to its surface, so that they can neither rise nor fall, but have an elastic firmness which keeps them to their work.

For manufacturing the finest description of yarns it is necessary that the cotton should be carded many times. The first engine used of this class is called the breaker carding-engine; it separates the fibre and extracts the dirt. The action of all carding-engines is similar in character: the cards cover a number of cylinders of different diameters, as brushes, the points of one set of cards almost touching the points of others. The card-rollers are placed in every variety of position, and revolve with different velocities, drawing out and combing the cotton fleece into the thinnest sheets of straightened fibre, which is removed from the last roller of the machine by a vibratory comb called a doffer. The sheet of cotton fibre when struck off the card-roller by the doffer is called a sliver, and is coiled into a can. From the first carding-engine the cotton passes to

THE LAP-DOUBLER.

This is one of the most beautiful in its action, and at the same time one of the simplest machines used in the manufacture of cotton. By this machine the slivers from the breaker carding-engine are formed into a fleece, and coiled into a lap to supply the finishing carding-machine. It operates as follows:—Two rows of tin cans, with the slivers coiled in them, are placed on each side of a feeding-table, which in plan forms the section of a cone. This table is furnished with two pairs of plain rollers of the entire length of it, and parallel to each of its sides; these rollers take the slivers from the cans and deliver them upon the surface of the table. As the slivers travel from the can to the table they pass through holes in a bar of iron to guide them over a curved plate, under which is a revolving shaft that carries a boss with three wings opposite each sliver. On the top edge of the curved plate is the fulcrum of a small two-ended lever; the lower end hangs under it, and is heavier, to give it a vertical direction, so as to cause it to fall in contact with one of the wings in the revolving shaft. The top ends of these levers project above the plate, and are pressed down by the slivers passing over them. While in that position the shaft is free to revolve, but should one of the slivers break or come to an end the lever falls, and the machine instantly stops. The pressure of the sliver upon the plate is as gentle as the touch of an infant's finger, yet so exquisitely perfect is the machine in its mechanical details that the removal of this minute pressure entirely changes the order of all its complication of wheelwork, rollers, and levers. The whole affair is brought to a standstill, and remains so until an attendant restores the continuity of the sliver by joining the broken ends or supplying a fresh coil. This delicate contrivance is necessary to maintain the supply of slivers perfect, or the fleece would not be uniform in thickness. The cans containing the coils are placed in a row on each side the table; one sliver from each can at the lower end of the table passes up the centre; the other slivers are supplied equally on each side. The whole move together towards the narrow end of the table, giving each other mutual assistance; but for this arrangement those which travel the entire length of the table would break. Messrs. Platt have introduced some improvements into the details of this machine, as well as generally improving its construction.

The cotton, having been perfectly cleaned, combed out, and brought in slivers—which are sheets of cotton fibre, and as yet have only assumed the form of ribbons—is subjected to the action of the drawing-frame, which doubles and still further draws them out, by acting thus:—A number of the ends of slivers, say six, are passed over guides, depressed by the weight of the sliver, through a series of four pairs of rollers, each pair travelling at different speeds; the difference in this case between the first and the fourth pair being about as 1 is to 6—that is to say, that the circumference of the fourth roller travels through a space six times greater than the circumference of the first pair, and, by so doing, elongates or draws the sliver thus passed to six times the original length, forming a single web, which is passed through a funnel to a pair of calender-rollers, through which it passes to a coiling-motion, which deposits it in a revolving-can, as previously described as attached to the carding-engine. The sliver thus deposited being doubled six times, and drawn and elongated six times, is, of course, precisely the same weight and thickness per yard as each of the slivers received by the back roller. The object sought by this is to equalise the quality of the cotton, and to make the slivers of uniform strength and texture by the combination. This process is repeated three times in this machine, and the amount of doubling and draught is equal in each case. The guides depressed by the sliver in passing to the back rollers act as stop-motions when the sliver breaks or runs out. From the drawing-frame the elongated ribbon of cotton passes to the slubbing-frame to be still further elongated. As in the last machine, the cotton again passes between sets of rollers revolving at different velocities, the speed of the first pair being to the speed of the last as 1 to 5; so that the sliver of cotton is increased in length five times in passing through them. In front of the rollers are two rows of spindles, which give, for the first time, a twisted character to the cotton. On the upper part of the spindle is placed the flyer, which is a crooked-shaped piece of steel, having two hollow legs. Threaded upon the spindles are wooden bobbins, about eleven inches long. The bobbins revolve as well as the spindles, but at a different rate, and from a separate movement of the machine. The cotton, now called slubbing, delivered by the rollers partially spun or twisted by the revolution of the spindles, passes through the hollow legs of the flyers, and is wound upon bobbins. Two of these bobbins are then filled into the creel of the intermediate frame. The slubbings are then doubled by passing the ends of two of them through another series of three pairs of rollers, and joining, drawing, twisting, and winding them upon bobbins, about nine inches long, which are revolving upon spindles in front of the delivery-rollers, as before. Two of these bobbins are then doubled in the creel of the roving-frame; the process of drawing, twisting, and winding is again repeated; and the cotton, now called a roving, is wound upon bobbins about eight inches long, ready for being spun in the mule and throstle. The twisting of the cotton, after being delivered by the rollers of these machines, is effected by the revolutions of the spindles. The slubbing or roving is passed through a hole on the top of and down one of the legs of the flyer to its finger, or presser, round which it is coiled and delivered to the bobbin. This presser hangs loosely upon the leg of the flyer, but is carried round by it at a uniform rate, causing a uniform pressure to be given to the bobbin through its weight and the resistance of the air on its circuit. As the bobbin is being wound it is caused to traverse up and down the spindle, so as to equally distribute the roving. The winding of the roving upon the bobbin is regulated by increasing or decreasing its speed according as the bobbin follows the flyer or the flyer follows the bobbin.

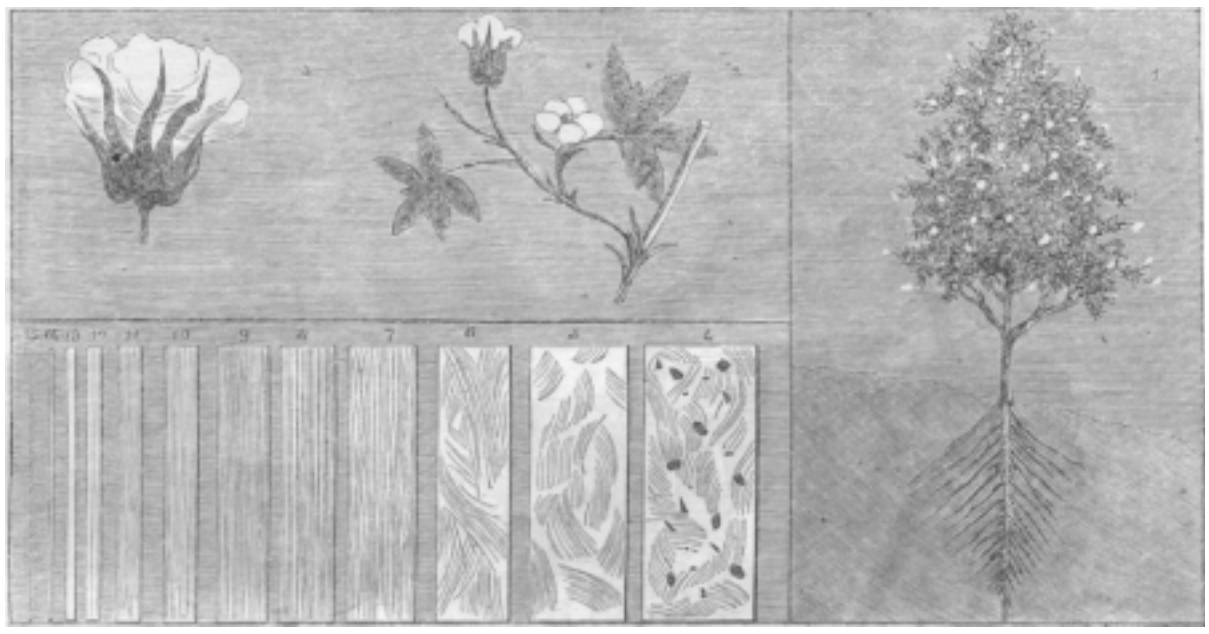
The next operation is carried on by what are called

SELF-ACTING MULES, OR SPINNING-MACHINES.

These machines are used for the purpose of converting the rovings from the last machines we have described into what is called cotton yarn, and winding it upon spindles in the form of cops by automatic means. Spindles are made in a variety of forms and sizes, but all have a certain general character. The spindle itself is a long round bar of steel of varying thicknesses, on some portion of the lower part of it is fixed a small pulley, called a wharve, by means of which a rapid rotatory motion is given to it; a long drum runs the whole length of the row of spindles at the back of them; small bands are placed round this drum and round the wharves of the spindles; the diameter of the drum is large as compared with the wharve of the spindle, consequently the revolutions of the drum give a high rate of velocity to it.

The spinning-machine is divided into two principal parts; one fixed, the other movable. The first comprises the creels for supporting the bobbins, the rollers for drawing or elongating the fibre, and the head-stock or framework which contains the movements necessary for effecting the changes required in the operation and communicating motion to the whole. The latter comprises the carriage which supports the spindles and the drum which imparts motion to them. This portion of the machine travels in and out from the rollers upon iron rails. As the yarn is being drawn out or wound upon the spindles it moves through a space of about sixty-three inches. The operation of spinning is thus:—As the fibres of the roving are being drawn and delivered by the rollers the carriage is caused to move from the rollers to its maximum extent: it then stops; the rollers and drawing-out motions are disengaged, but the twist motion is acting, the spindles continuing to revolve until the necessary amount of twist has been given to the yarn; the change is then made from the twist to the backing-off by causing the direction of the motions of the spindles to be reversed, and the yarn to be uncoiled a little, so as not to break by the depression of what is called the faller-wire upon it. The operation of winding the yarn then takes place: the carriage advances to the rollers, the length of yarn spun by the last drawing-out motion is wound upon the spindles, and the operation is complete. The different changes are effected by means of a cam-shaft in connection with the long lever which is acted upon by the traversing in and out of the carriage, the locking of the faller, and the revolution of the twist motion.

A great variety of improvements have been made by Messrs. Platt in the spinning-machines exhibited by them. They consist of an improved framework for the entire machine—a better method than that generally in use for driving the spindles; and a better form of carriage and arrangement, for its working with greater accuracy; also in the introduction of a governor or cop-regulator for adjusting the winding-on motion to the formation of the cop, which is perfectly automatic throughout.



COTTON IN ITS DIFFERENT STAGES.

Having now traced the cotton through the various processes necessary to convert it from raw unginned cotton into fine cotton yarn, it will perhaps fix the particular object of the different operations more clearly in the reader's mind if he turns to the accompanying Engraving. Under the sketches of the cotton-plant and cotton-pod (figs. 1, 2, 3) are a series of diagrams which are intended to indicate the different stages of the manufacture. Fig. 4 is the cotton containing seeds, dirt, and other matter; fig. 5 is the cotton after it has passed through the gin, the seeds and pieces of the sheath having been extracted; fig. 6 is the same material after having been subjected to the action of the cotton scutcher and opener, which separates the fibres by drawing apart those matted together and also effectually freeing it from dust; fig. 7 is the carded cotton, the fibres having been all brought to lay parallel with each other; in fig. 8 the carded cotton has been doubled and the parallelism of the fibres made still more perfect; in fig. 9 the ribbon of cotton becomes a roving, which is a quantity of cotton fibre perfectly cleaned, and every fibre laid straight in the direction of its length, in no way twisting or attaching itself to its neighbour. From this point to fig. 15 reduction of bulk is attained, and more or less twist given to it, until it becomes cotton yarn of any desired fineness. Thus there are four points attained in its manufacture—the first to free it from any kind of foreign matter, the second to secure perfect parallelism of the fibre, the third to secure uniformity in the roving by the lapping and doubling, and the fourth to draw out and twist it into yarn. The various processes which the cotton has passed through having brought it to the state of yarn, the next operation, called weaving, is to convert the yarn into cloth, or calico, which is the generic name for plain cotton fabric; but it requires some preparation ere it reaches the loom. First, it has to be carried to the winding-machine, which winds the yarn from the cop on to the spools or bobbins (warpers' "bobbins") for the purpose of beaming or warping; by the machine which winds the yarn from the warpers' bobbins on to beams for the sizing or dressing machine.

THE SIZING-MACHINE.

On page 165 we give an Illustration of this important machine, taken from one among the series of interesting machines exhibited by J. Harrison and Sons, of Blackburn. In this machine the yarn is passed from the warpers' beams through boiling size and over drying-cylinders, after which is is wound on the weaver's beam ready for weaving in the loom, which converts the prepared cotton yarn into cotton cloth.

THE LOOM.

This is a very ancient contrivance, and a plain hand calico-loom a very simple machine; but the power-loom and all descriptions of looms for weaving patterns in different material at the same time become very complicated in their details, and those not conversant with their operation and construction must find great difficulty in understanding them. The same elementary principles, however, exist in all, and, if these be understood, it is not difficult to comprehend the movements of the most elaborate. We will, therefore, endeavour to describe the simplest form of loom. The material or yarn to be converted into cloth is divided into two parts, the one called the warp the other the weft. The warp is a series of long lengths of yarn, wound side by side on a round beam. Each one of the threads of this warp is fastened to a fixed portion of the machine, at some distance from the rest of the warp on the beam; between these two points each thread of the warp passes—first, between vertical threads, called heddles or healds, and afterwards between vertical wires. The vertical threads are in pairs, and knotted above and below the threads of the warp. There are two sets of them, and they are so fitted up that they can be raised and lowered at the will of the weaver. When one set is raised, every alternate yarn of the warp is lifted up, and, as all the yarns are fixed in a line at the opposite end of the machine to where the warp-beam is placed, of course a space is opened by the heddles horizontally, one half the warp being above, the other below. Through this space a yarn is passed by means of a shuttle, which is a pointed oblong piece of boxwood, having an aperture in the centre, where a bobbin is placed having the weft wound upon it. The shuttle, having passed through the space formed by the action of the heddles, leaves a thread of weft behind it. The gears are then reversed; that which was uppermost becomes lowest, and the lowest is raised to the top. The effect of this is to reverse the position of the separate yarns of the warp by crossing them, which securely fastens the thread of weft between them. The heddles in their second motion form another space, through which another thread is passed by the shuttle in its reverse movement; each thread of weft is driven close up to that which preceded it by the vertical wires between which the threads of the warp are passed. This series of wires, called reeds, is fixed in a frame which is suspended from a portion of the upper part of the frame of the loom; it is pushed back with the left hand of the weaver, while the shuttle passes through the opening made by the lifting of the heddles, which latter operation the weaver effects with his feet. The shuttle having passed through the weaver draws the frame containing the reeds towards him, and strikes a smart blow against the completed edge of the cloth; this jams the weft up close. These operations are performed with great rapidity, both hands and feet being fully occupied, the feet to raise the heddles, the right hand to strike the shuttle with the weft through the opening in the warp, and the left to force the shreds of the weft together. The loom when worked by hand is a simple-looking machine; not so the power-loom, as in it there is not only the same parts to the loom, but also a number of mechanical contrivances to effect all the operations which are performed by the hands, arms, legs, and feet of the weaver; and the easiest motions of the parts of a human being always require very complicated machinery to imitate them. Power-looms have entirely superseded hand-weaving for ordinary cotton manufacture, the calico being now sold for the price formerly paid for the weaving only. A loom of the simple character we have described will be found in another part of the exhibition weaving velvet.

Thus far our description of the cotton manufacture applies to the production of the material called calico, a name which the material brought with it from India, it having been originally manufactured at a place called Calicut; but there are a great variety of other articles besides calico proper, manufactured under different names, in which cotton forms the whole or principal portion of the fabric. First, there is shirting, which is made from what used to be called water-twist; the yarn is twisted a little harder, the warp and weft are the same. Lining calico is an unbleached article, the use of which is implied by the name it bears; it is usually made of two-thirds Indian and one-third American cotton; it is manufactured extensively at Bristol and Hull. Printing cloths are calicoes made to receive patterns in colours on the surface by the process of block printing. This business was formerly principally located on the banks of the River Wandle, in Surrey, and the Cray, in Kent. The father of the late Sir Robert Peel is said to have worked and learned the art of printing calico at Crayford. Chintz is a cotton material similar to the ordinary printed cloths, but having its surface finished in a peculiar manner. Gingham is made of cotton chiefly from the East India market; the warp and weft alike, and both hard twisted; its chief peculiarity is that it is dyed in the yarn. Checked and striped calicoes are made with a fine warp and coarse weft, and consequently wear very badly. It is said that large quantities of these materials are supplied by contractors to the Army and Navy departments for shirts for soldiers and sailors, the contractors being bound to use an exceedingly fine and light warp of good material, but are allowed to put in a heavy weft of any rubbish they can procure. Muslins are a fine description of cotton goods, being always made of the finest Sea Island cotton. The Scotch muslins are the most celebrated; they are manufactured at Glasgow. The cotton yarns used for muslin are made to an almost fabulous degree of fineness; a single pound of one description, it is said, would reach from the Land's End to John o' Groat's House. The No. 300 formerly cost three guineas per pound, a pound being 160 miles in length. The females who work in the manufacture of this article are not allowed