TEXTILE MACHINERY AT THE PARIS EXHIBITION.

(*Continued from page* 588.)

The cotton fibre has now passed through the series of operations which fit it for the final process that will convert it into yarn. The last drawing operation has reduced it to the desired fineness, a much more extended twisting process will give it the necessary strength; the yarn has then to be rewound in such a way as to make it convenient for the various operations of weaving. Up to this stage, all the machines which were seen at the Exhibition were constructed on the same principle, and without any very great variations or modifications in detail, by the various manufacturers. But it is otherwise with the spinning frame. Messrs. Platt Brothers and Co. construct the self-acting winding mule; Messrs. Dobson and Barlow do so likewise; Messrs. Brooks and Doxey make the continuous ring machine; and the Société Alsacienne de Constructions Mécaniques also make the continuous frame on the Vimont-Bezin type. The self-acting mule, as it is made to-day, is certainly one of the most complicated and ingenious of machines. The whole of its functions, that is to say, drawing and twisting of the roving, and then the building of the yarn into a cop, is done by mechanical means. The self-acting machine being essentially a draw frame, has three pairs of draw rollers between which passes the cotton roving coming from the previous process. The bearings of the rollers are fixed to supports, which are bolted to a long beam of cast-iron E, Fig. 12; this beam is supported at frequent intervals by frames. The spindles upon which depend the operations of twisting and rewinding are mounted on a carriage, which can travel to and fro, approaching and receding from the drawing rollers. This carriage is mounted on wheels K L, and runs upon the rails M N. If we consider a thread held at one end by a pair of delivering rollers, and at the other by some point on the spindle B, which is inclined towards the rollers (see Fig. 12), if the spindle is made to revolve, the thread will be wound around it spirally until it reaches the top of the spindle; if the thread is properly stretched between the rollers and the top of the spindle, as this latter continues to revolve, it is evident that at each revolution the thread will slip off the top and will always remain in the same position; the thread will be obliged to turn around the top of the spindle, and for each revolution of the latter, that part of the thread comprised between the rollers and the point of the spindle will be twisted. The same thing will take place if the rollers, instead of being fixed, feed the thread forward while the spindle recedes bodily at a speed equal to that of the delivery; the twisting will commence near the spindle and be transmitted towards the rollers; whilst the latter feed the thread forward, the carriage travels back, always keeping the thread stretched at the same time the spindles are twisting it by their revolutions. When the carriage has travelled to the outer end of its stretch, it and the rollers are stopped; the spindle, however, continues to turn to complete the torsion. When this is completed, the spindles are stopped in their turn; the whole of these movements are included in the two periods which are automatically completed by the self-acting machine: first period, formation of the thread, outward movement of the carriage, commencement of the twist; second period, completion of this latter operation. The mechanism has now to wind up the twisted yarn upon the spindle. To accomplish this, the machine carries a thread-guiding device I, which is free to turn around an axis; to bring this guide, and also the yarn, to the point at which it will commence to rewind, it is necessary that the length of the yarn between the rollers and the spindles should be increased, and that the guide should fall, without, however, letting the threads go slack. In lowering the yarn guide the mechanism turns the spindle backwards in order to unwind a little of the yarn upon it, and it is only when this has been done that the carriage moves inwards and commences rewinding. This portion of the process is divided into two periods: rotating the spindle so as to unwind a small part of the thread, and starting the carriage forwards for rewinding. Every self-acting machine carries out these four processes, which are entirely distinct, and always follow one another in the same order. While the carriage runs out the spindles are driven by a double pulley V fixed to the motor shaft; the cord coming from this pulley transmits movement to the drum T, and as the distance between this pulley and V increases with the outward movement of the carriage, it is obvious that the driving cord must be adjustable to suit the movement. To this end it is passed over a certain number of transmission pulleys, and then over a pulley R mounted in the carriage in such a way that whatever might be the position of this latter, the cord is always properly stretched. Movement is thus transmitted to a horizontal shaft, running the whole length of the carriage, and called the spindle shaft; on this shaft are mounted tin rollers, which control the movement of the spindles by means of transmission bands.

The degree of twist given to the thread is carefully regulated; it depends on the number of the thread and the use to which it is to be put. Provision has to be made, therefore, to limit the amount of torsion, which depends on the number of turns of the rollers in relation to those of the spindles. When the driving shaft has made the requisite number of revolutions, it has to be stopped; this is effected by means of a wormwheel gearing into an endless screw, which, when it has made one revolution, stops the pulley V. By this means the amount of torsion can be accurately regulated. The horizontal travel of the carriage is controlled by means of a grooved pulley placed near the feeding rollers; at the other end of the frame is a transmission pulley, from which a cord passes to the carriage. As an exact degree of tension has to be maintained on the thread between the cylinders and the spindle, it is necessary that the movement of the carriage should be perfectly regulated and synchronised with the movement of the cylinders.

Fig. 12

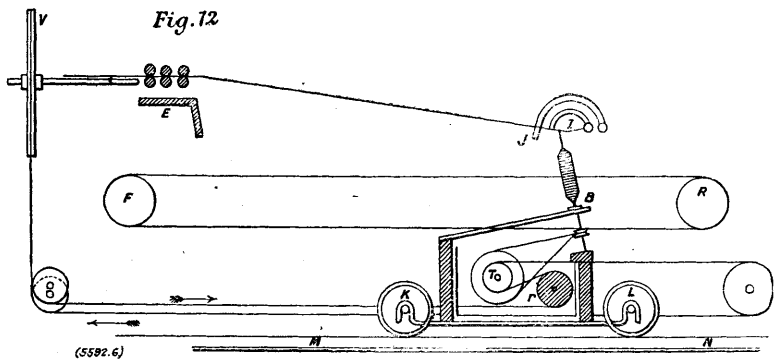

Fig. 13

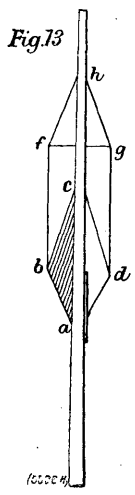

Fig. 14.

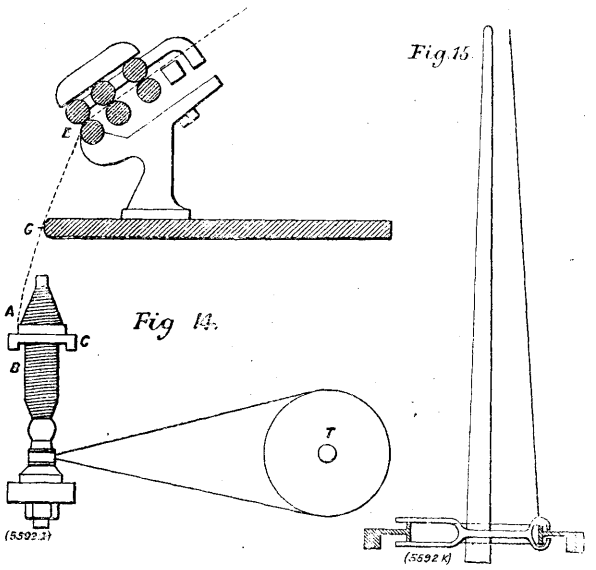

Fig. 15.

When the carriage has reached the outer end of its stretch, the cylinders and feed rollers are thrown out of gear by the carriage itself acting on a lever, which also has the effect of stopping the carriage. When the proper amount of torsion is obtained; the removal of the belt from the fast to the loose pulley throws the spindles out of gear. At this moment the operation of winding up the length of yarn into a cop commences; the spindles are turned in a reverse direction, and at the same time the yarn guide device comes into action. As soon as the moment arrives to commence rewinding, the spindles turn in the original direction and wind up the yarn on themselves, the proper formation of the cop being insured by the guide; at the same time the carriage travels back towards the feed rollers. In order to keep the threads properly stretched during the process of rewinding there is, in addition to the guide wire I, a second and somewhat similar guide J, a counterweight connected to which constantly tends to lift it; this second guide therefore keeps the thread constantly stretched. As soon as the carriage is run in, it shifts the belt from the loose to the fast pulley, and the operation is recommenced. The form given to the cops is a detail of great importance. A cylinder, conical shape, as in Fig. 13, is the best to satisfy all practical conditions, care being always taken not only to wind from the bottom to the top of the cop, but also from the top to the bottom; the latter forms a very open spiral, one or two turns being sufficient, whilst in winding from the bottom to the top the process is almost circular; in this way a very solid cop is produced. If we remember that the travel of the thread guide is subject to laws which we have just indicated; that the spindles which revolve at a uniform speed, during the running out of the carriage, have then to stop, make several revolutions in an opposite direction, and then resume their normal direction of rotation, but this time at a variable speed; it will be realised how much skill has been required to produce machinery filling all these conditions.

Messrs. Brooks and Doxey exhibit a ring spinning frame with 120 spindles for warp yarn. In this machine the bobbins B, Fig. 14, are carried on the spindles, which drive them at a uniform speed. The rail C has a vertical reciprocating motion and is formed of a flat cast-iron plate pierced with holes, the centres of which correspond exactly to those of the spindles. The diameter of these holes is greater than that of the filled bobbins; in them rings are fixed which are generally made of steel, highly polished, in order that the thread guide, or traveller, may slide with the smallest resistance. This traveller is a hook of steel wire, or copper, semi-circular in form, and the ends of which, folded at right angles, clip a projection on the ring; the travellers are made of various weights according to the fineness of the thread being spun. It will be seen that the thread drawn by the bobbin in its turn draws the traveller A, which produces the twisting of the thread between it and the guide G; but, though it is thus drawn, the traveller always lags behind on the bobbin, to insure the regular lay of the thread as it is produced. The same firm show a ring spinning frame, invented by Messrs. Gaunt and Ashworth, which builds a cop on the bare spindle. This we hope to illustrate later.

The ring frame exhibited by the Société Alsacienne de Constructions Mécaniques differs from that shown by Messrs. Brooks and Doxey, in the employment of a type of traveller called "curseur a traverse," invented by Messrs. Vimont and Bezin. Fig. 15 shows a ring fitted with such a traveller. By this arrangement the traveller is free to pivot around a point support O, which it takes on the ring on the one hand, while the other and forked end rests on another part of the ring. The thread, after having passed through the eye formed in the traveller at the first point of support O, runs through it, as shown in the sketch, to O 1 in the fork formed at the second point of support, before being wound on the bobbin. The tension of the thread thus arranged makes the traveller always rest against the bobbin, and it is thus drawn mechanically by the friction against its surface. In this way if the tension of the yarn increases at any moment during winding, the pressure of the traveller against the body increases, which also increases the friction which, for the moment, accelerates the movement of the traveller, and thus at each instant an automatic regulation is set up.

Such are the principles of the various cotton spinning machines which are shown at the Exhibition. If we wished to make a classification in order of merit, we should say that those machines which appear to us most carefully worked out in detail, and which are best arranged as a whole, are exhibited by English constructors. The German makers exhibit very admirable machines, which appear to work excellently, although their construction appears somewhat too light. The Swiss builders have made great progress during the last few years in details of construction, and hold a very close position with regard to their competitors. We should, therefore, classify the countries in the following order:

1. Great Britain.
2. Germany.
3. Switzerland.

We may now cast a rapid glance over the machines exhibited for wool spinning. and on this section we shall be much more brief, because only carding machines, self-acting frames, and spinning frames, similar in principle to those for cotton spinning, are exhibited. They are shown by the various constructors whose names have already been given. It is desirable, nevertheless, in order to understand the purpose of these machines to refer very briefly to the operations which precede the processes of spinning.

The first process to which the wool is subjected is that of washing, in order to free it from grease and other impurities. It is a curious thing, since the constitution of the wool fibres is naturally opposed to any nature of lay; and as these fibres cannot be transformed into regular threads, except by an infinite and successive series of sliding movements, it is necessary in spinning to replace by another oily substance—generally olive oil—the natural grease which has been washed out. This operation of saturating the oil is performed mechanically. This operation is followed by carding, in machines the principle of which is precisely the same as those for cotton, although the details differ considerably.

After having been carded, the drawing process commences in a machine called a gill box, a kind of draw frame of a special type. Like all the other machines of the same kind, it consists of a pair of feeding rollers, followed at a distance slightly greater than the length of the wool filaments, by a pair of draw rollers, driven somewhat faster than the first pair, and which produce, by the extension of the ribbon, the lay of the filaments one upon the other. Between the feeding and the drawing rollers the ribbon is guided by bars furnished with sharp points or gills, which give their name to the machine; these hold up the filament and prevent them from spreading under electrical and other influences produced by the friction. The bars are guided by screws, which give them a shifting movement a little greater than that which the feeding rollers impart to the ribbon. The drawing rollers are always, as in cotton industry, combined with doubling rollers. After passing through this process, the wool is wound upon bobbins. The removal of the oil with which the wool has been saturated follows this operation. This is simply a washing process, in which the ribbons are washed in one or two vats of hot water with soap, the surplus water is squeezed out by passing the yarn between two cast-iron cylinders clothed with an elastic woollen covering. After having been treated in this way, and the ribbons are dried by passing them over a series of copper drums heated by steam, the wool is then ready to be wound upon bobbins. If after this operation the wool passes to the drawing frame and thence, as in the cotton industry, to the spinning frames, of any class, it is carded wool.

If, on the other hand, before passing through the drawing frame it is treated in the combing machine, it becomes combed wool. The Exhibition affords examples of each of these classes of machines, sent by different manufacturers.

It should be observed here that in the series of operations the wool is only passed through one carding machine if it is to be combed and formed into combed yarn; whilst it is passed through three carding machines when it is not to be combed and is to be formed into carded wool. Of these three carding machines, the dimensions and arrangements of which are dissimilar, the first is called the breaker, the second the presser, and the third the finisher. The constructors, whose names we have already mentioned as exhibitors of carding machines, have shown several types of these series, into the details of which it is impossible, for want of space, to enter.

If now we would class the constructors in the same way as we have done those for cotton spinning machinery, we must assign the highest place for combed wool machinery to the French constructors and for carded wool machinery to the Belgians. The classification would therefore stand thus for the former class:

1. France.
2. Great Britain.
3. Austria.

And for the latter class we have:

1. Belgium.
2. France.

In a following article we shall consider the more important weaving machinery shown at the Exhibition.

(To be continued.)