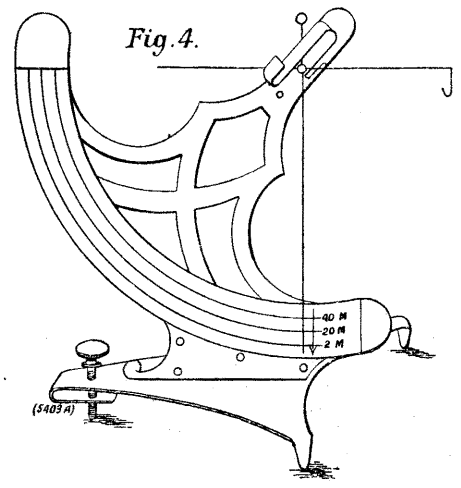
kilogramme, it will be sufficient to wind the sample twice around the gauge strip, which will represent a length of 2 metres. The length thus obtained is hung to the hook at the end of a light rod shown in the figure, and to which the long index needle is attached; the end of this needle is free to sweep over the face of the graduated arc of the apparatus, and the amount of its deflection can be read directly on the arc; the reading gives the desired number. As will be seen, three scales are inscribed on the arc, corresponding to three different lengths of yarn—40, 20, and 2 metres. If, on the other hand, it be desired to fix the count of a quantity of wound yarn, ten spools are taken

Fig. 4.



from the number, and from these enough yarn is drawn to wind four times around the gauge, giving 40 metres total length; when this combined 40 metres skein is hung on the arm of the device, the count desired is read off the 40-metre scale.

Among the most curious recording instruments exhibited is the "serigraphe," the invention of an American engineer, Mr. Serrell, who visited France many years ago, to study the textile treatment of silk, and who had the idea of utilising the elasticity and tenacity of the raw silk fibre, as a measure of its commercial value. In this apparatus, which is illustrated in Fig. 5, the silk fibre A, to be tested, coming from a spool, is wound round the roller B, which is a few centimetres in diameter, and the surface of which is covered with rubber, to prevent slipping; the fibre then passes over the small pulley C at the other end of the apparatus; this pulley is fast on a metallic pendulum G. The thread is then brought back and turned round the roller D which is fixed on the same spindle as the roller B; it also is covered with rubber, and its diameter is 50 per cent. larger than that of B. From the second roller the thread passes through a vibrator that distributes it uniformly round the spool E. The whole device—the two rollers, the vibrator, and the spool, are put in movement by a wheel and band beneath the table. Below the pendulum weight is a horizontal arm I, at one end of which is fastened the small pulley C, while at the other end is a vertical tube L that serves as a pencil holder. The point of this pencil is made to bear on a strip of paper graduated in millimetres, and which is placed round the drum M. A light transmission shaft N, with pinions and screw gear, connects the recording drum with the rest of the mechanism. The ratio of speeds is 1 to 5000, so that for each 5 metres of silk wound on the spool E, the recording drum M turns through 1 millimetre. The working of the apparatus will now be clear; the second roller having a diameter 50 per cent. greater than the first, the silk, in order to pass from one to the other, after turning round the pulley C, is stretched 50 per cent. The tension corresponding to this extension acts on the end of the pendulum, which is drawn from its vertical position more or less according to the tenacity of the silk. The pencil follows the movements of the pendulum, and is always in contact with the paper on the drum, the ordinates of which correspond to the sines of the angles of deviation of the pendulum, and the movements indicate the exact variations in the tenacity of the thread under a fixed percentage of extension. By raising or lowering the weight of the pendulum, the apparatus can be so regulated, that to a given tractive effort there shall correspond a known displacement of the pencil, for example, 1 millimetre movement shall represent 1 gramme of tractive effort. Although this highly ingenious device has not found a commercial adoption for the current testing of raw silk fibre, it has proved of great utility in the investigation of hidden faults. The inventor has, moreover, found a very useful application for it in silk-spinning, by making it automatic in its action. Certain additions, driven electrically, have been made, by which, when once regulated, it adds automatically the cocoons required to maintain the regularity of the silk thread; the operator has only to have a general supervision and to keep the basket serving the magazine filled with cocoons. It is said that silk spun by the Serrell system is weakened to a certain extent on account of the constant extension to which it is subjected, and that it does not possess so much elasticity as silk spun by hand; this allegation probably explains why this very ingenious system has not found a larger application, but it remains to be proved how far the objection is well-founded. M. Dusuzeau, of Lyons, shows an apparatus, the special object of which is to detect visible faults in silk thread, and which are due to "figure of eight" loops in which the silk-

Fig. 5.

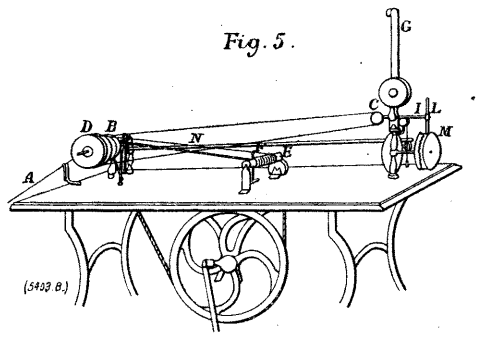
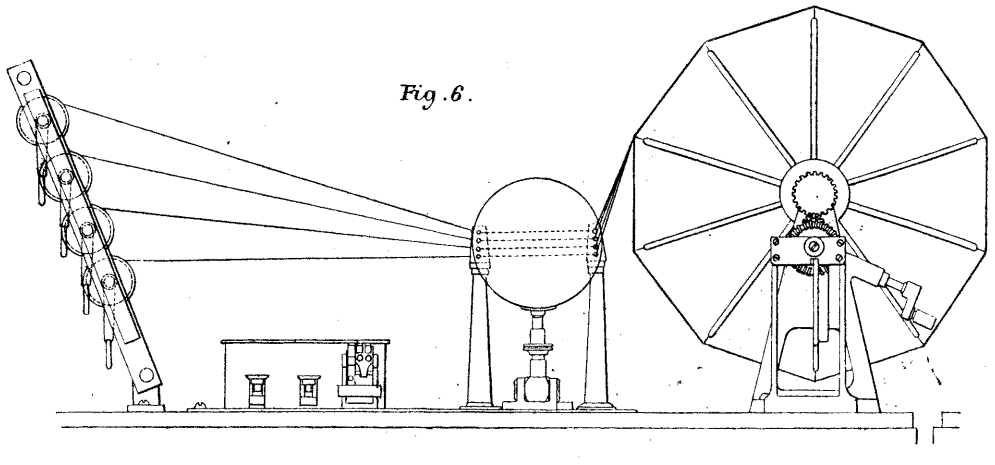


Fig. 6.



TEXTILE MACHINERY AT THE PARIS EXHIBITION.

(*Continued from page* 545.)

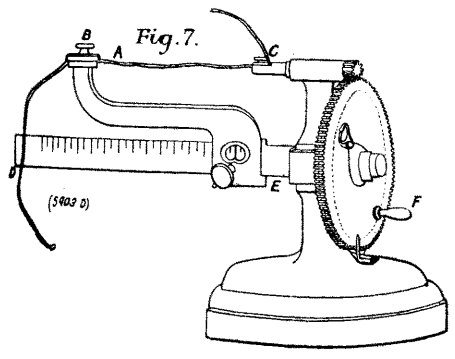
SEVERAL apparatus for recording the counts and physical qualities of yarns are shown in the Textile Gallery of the Paris Exhibition; of these the most representative may be described. MM. Piat et Cie., of Paris, exhibit a device illustrated in Fig. 4; the object of this is to show the count rapidly without the previous process of winding a given weight or length on a reel of fixed diameter; it is especially useful where only a short length of the thread to be tested, is available. The reel is replaced by a flat strip of wood 50 centimetres long, around which the thread is wound a certain number of times in order to obtain the measure desired. If, for example, it is a thread of combed wool that has to be tested, giving less than 50,000 metres per worm arranges the lining of the cocoon; these loops are much smaller in the inner than the outer parts of the cocoon, and being difficult to eliminate perfectly in the preliminary process, they are apt to reappear in the operation of spinning, sometimes separately, and often in small groups. The apparatus consists: 1. Of a frame of four or five bobbins (Fig. 6), on which the silk to be examined has been wound; these reels run freely on their frame,

the position or angle of which can be varied at will. 2. Of a winding reel made with ten sides, as shown in the diagram, and with grooves one decimetre apart; this receives the silk on its ten-sided perimeter, the development of which measures exactly 1 metre; to this is geared a revolution counter. 3. Of an achromatic lens placed in the centre of the apparatus on an adjustable stand that can be inclined when desired. On two supports behind the lens the four or five silk threads coming from their respective bobbins pass through a guide. The threads are kept parallel as they move, and are seen through the lens magnified three or four times, the enlargement being made more distinct by the use of a dark screen placed in a suitable position near the magnifying glass. 4. Of a defect counter made with three sections, and controlled by keys.

The apparatus is placed on a table, and, needless to say, should be worked with the best available light. Sitting opposite the lens, the operator turns the crank geared to the winder, with his right hand, thus drawing the silk off the frame containing the bobbins. The four or five threads from these are led through glass guides on the frame carrying the lens, behind which they pass parallel, and at distances from each other of 5 or 10 millimetres. The operator places three fingers of the left hand on the control keys. The first of these records very serious defects; the second and third, faults of a medium, or insignificant nature, respectively. The twofold operation of winding with one hand, and operating the keys with the other, is not found difficult or fatiguing. The defects, magnified as they are by the lens, can be easily seen without any great strain on the eyes, and the process is made easier from the fact that the operator can vary at will the speed with which he passes the threads behind the lens, and in very defective parts can stop altogether while he makes the record. As the perimeter of the winder is 1 metre, 500 revolutions, will have passed a length of 2000 metres (from four bobbins) beneath the inspection of the operator; and in all ordinary cases this length is sufficient as a test sample. If desired the count may then be obtained by weighing the wound thread.

Fig. 7 illustrates a device for making torsion tests of threads, and is the design of M. Paul

Fig. 7.

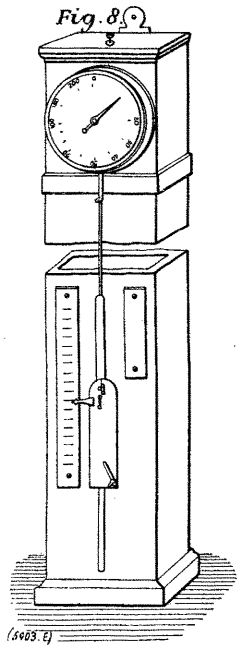


Sée, of Lille. It is intended for dealing only with short lengths. In the illustration, the thread A is held between two clips B and C, the distance between these being fixed by the scale D E. The crank F is then turned in the direction of the twist of the thread; the number of turns can be read off the indicator dial. The operation is much more delicate than might be supposed. If the filaments composing the sample being tested, have two or more ends twisted together, it is easy to separate them; but when the torsion of the filaments forming an end is to be measured, the operation is often very difficult, because the bundle of fibres held together only by torsion loses its cohesion when these bundles are untwisted, and they break under a very feeble strain. Tests of this nature should be conducted by two operators. Whilst one of these holds very delicately near the clips, one part of the bundle of fibres already untwisted, and separates them gradually, the other turns the crank very carefully, stopping at intervals. By this method the test is gradually completed, though with frequent failures.

Besides the apparatus designed for torsional tests, there are others for ascertaining the tenacity and elasticity of threads, physical qualities that play an important part in textile industries, and a knowledge of which is indeed absolutely necessary. It will be understood, for example, that a weaver would have the highest interest in knowing if the thread delivered to him was uniformly strong enough to withstand the strain accompanying the production of any particular tissue. Or, again, he wishes to know when the yarns have been dyed, to what extent, if any, the process has affected their physical qualities. On the other hand, the buyer naturally desires to know if the textiles he purchases possess the strength which he requires.

The apparatus used to test the tensile strength of threads, determines their elasticity at the same time; the latter term being applied incorrectly to the extension of the threads at the moment of rupture. There are quite a variety of devices for this purpose, based on different principles, but all have this point in common, that a part of the sample to be tested is held firm, and lightly stretched between two clips at a constant distance apart. By different means in the several apparatus, one of the points of support is withdrawn so as to increase the distance between the two, and so set up a strain in the sample. The moving support is connected with a recording dynamometer on which the strain exerted can be read by means of an index passing over the scale on the recorder. The strain is gradually increased until a rupture of the sample takes place; the results given at that moment are carefully recorded. The instruments of this class are, according to their special object, of very varying capacity, and are sometimes vertical, sometimes horizontal. In some the tractive effort is produced by a hand-turned crank; in others, when very small resistances are to be measured, a weight acting progressively, is employed. The recording dynamometer is operated either by a spring, or by a counterweighted lever; modern practice inclines generally to the latter type, because its action is invariable, while springs, either from wear or other causes, are apt to give unreliable readings. One of the most accurate instruments of this class to be seen in the Exhibition is that employed officially by the Chamber of Commerce of Lyons, and known as the "serimetre;" it is used for testing fine yarns, and especially silk threads. It is a vertical machine, and is illustrated in Fig. 8.

Fig. 8.



The tractive effort is obtained by a weight, the fall of which is checked by a clockwork regulator; the dynamometer is of the weighted lever type. Two screw studs are used to stretch the thread to be tested; the two points of attachment are 50 centimetres apart. A lever within the apparatus, acting as a brake, and moving around a horizontal axis, keeps the weight normally at rest. By means of a special arrangement of this lever, the weight is free to fall when the thread is stretched vertically, but it is stopped instantly when the thread breaks. As a rule, at least ten consecutive tests are made with the same sample, the mean of these being taken. The breaking strain, which is independent of the length of the thread, its weight being so insignificant, is recorded from the direct reading of the instrument, while the figure given for extension is doubled, in order to obtain the result for a metre. To this latter figure a correction must be added to compensate for the fall of the dynamometer lever. The results in extension to rupture furnished by silk threads are very variable. For some it ranges, according to the source of the fibre, the care used in spinning, the count, and hygrometric conditions, between 10 and 25 per cent. A variation of 20 per cent. may be considered quite satisfactory. As we have seen, the physical qualities of threads—hygrometric conditions, weight, regularity, torsion, tenacity, elasticity—are controlled in the textile industry by special and very varied apparatus. In another article we shall deal with instruments of a similar class, but adapted for testing tissues.

(*To be continued*)