TEXTILE MACHINERY AT THE PARIS EXHIBITION.

(*Continued from page 712, vol. lxix.*)

Our former articles* dealt with apparatus for testing yarns; we will now turn to those relating to tissues, before commencing the examination of the spinning and weaving machinery shown at the Paris Exhibition. In the first place, we must recall the fact that the dynamometrical testing of tissues has led to the general use of certain conventional methods. These relate (1) to the dimensions of the test pieces; (2) to the manner of fixing the specimens to test them; and (3) to the mean number of tests required for a practical result.

Following the custom of the officials of the Ministries of War and of Marine, who test the strength of cloth and of linen, it is usual to operate on strips of a width of 5 centimetres (2 in.). As to their length, the strips are cut according to the nature of the material, being greater for linen canvas, often called sail cloth, because it is subject to defects of which the consequences may be very serious, and being less great for the tissues of cotton and wool. Generally in tissues of linen and canvas a length of 40 centimetres (15¾ in.) is taken; with silk stuffs for flags a length of 30 centimetres (12 in.); for cloth and other tissues of wool, 11 centimetres; for cotton cloths 10 centimetres. The tests are made in the direction of the warp, and also in that of the weft.

The method of cutting varies according to the material. For cloth there is used the instrument shown in Fig. 1, in which are two blades A C, B D, connected to a handle P. These blades are slightly rounded and very sharp; they are about 2 centimetres wide and 5 centimetres apart. The piece of cloth being unrolled upon a wooden table, the tool is taken by the handle P, and is applied normally to the material in such a way as to put the blades parallel either to the weft or the warp, according to the way the test is to be made. If then the tool is slightly rocked, and at the same time pressed down firmly, there are produced two slits which are then joined by a scissor cut. It only remains then to raise with one hand the tongue-shaped piece thus detached, and to draw it back, at the same time that the stuff is held by the other hand upon the table, to cut easily a band of the desired length. Certain tissues other than cloths — for example, calicoes—lend themselves to this method of operation, but their number is very limited. Ordinarily, other means have to be employed, varying according to circumstances. If felt be under test, the contour of the band is first traced, and is then cut out either by aid of a ruler or by scissors. With cloth made on stocking frames, such as that used for jerseys, the lines are drawn in the direction of the stitches, and at right angles thereto.

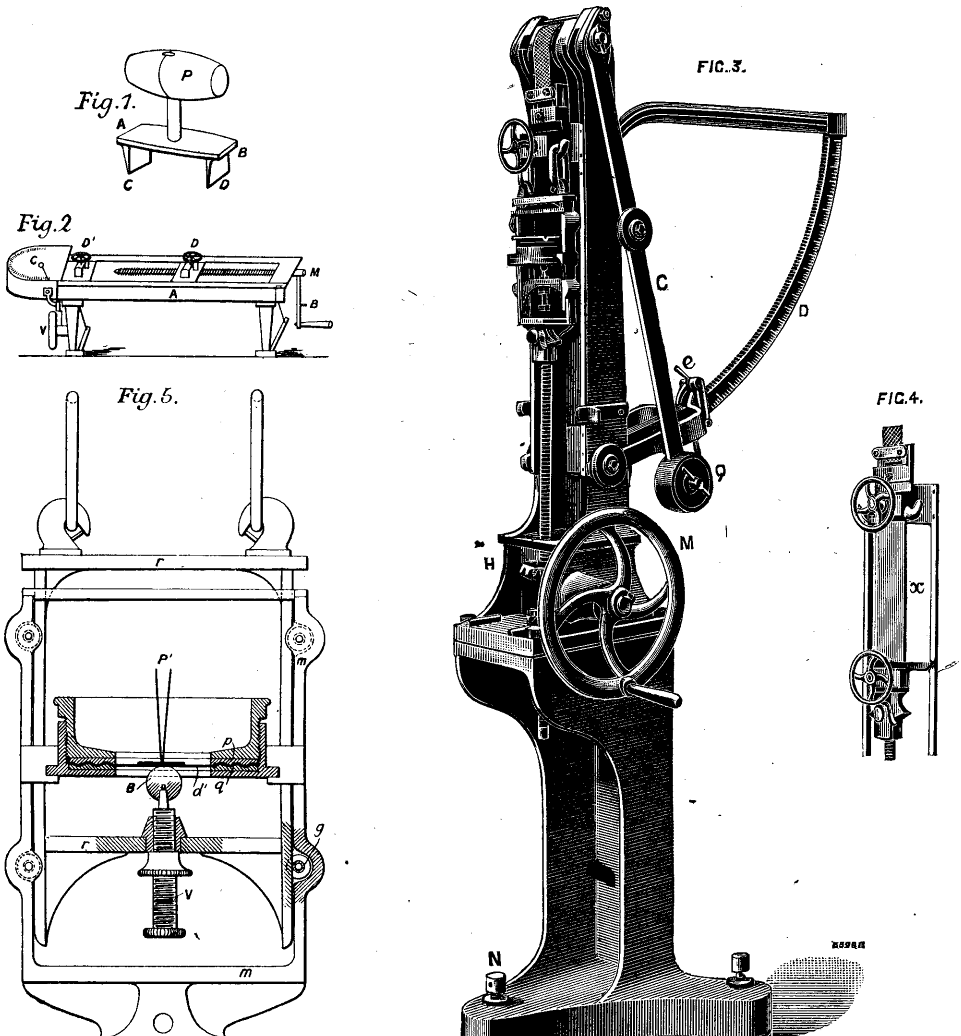

Fig. 1. Instrument for Cutting Test Strips. Fig. 2. Perreaux Dynamometer. Figs. 3 and 4. Dynamometer, Constructed by MM. Ollivier et Cie., Paris. Fig. 5. Persoz Dynamometer.

In the greater number of cases, and notably in regard to canvas and linen, there is first traced parallel to the direction of the tissue, a band of $5\frac{1}{2}$ to 7 centimetres in width, according as the threads are seen to be more or less coarse, or more or less sinuous. The band having been cut out, the two edges are ravelled out until the yarns withdrawn are all of the length of the band, then until its width is exactly reduced to the five centimetres desired. To demonstrate that this condition is fulfilled, one can employ a width gauge, which is applied to the band held vertically against the light. These preliminary operations require much care, and a considerable expenditure of time. In order to obtain reliable results, it is customary to make several tests in the direction both of the warp and of the weft, and to take the means. This is a useful precaution, because there may be considerable variations in a piece of cloth. This method is followed officially in Paris, when the public desires to make tests of this kind.

After this preliminary explanation, we will consider the principal apparatus of this kind to be seen at the Exhibition. One of the most noticeable is the Perreaux dynamometer, constructed by MM. Lefort et Duvau, of Paris. It is represented in Fig. 2, and has been adopted in France by the Ministers of War and of Marine, and also by the Governments of Sweden, the United States, and Japan. The principal part is a rectangle of cast iron A, in which work two sliding-blocks carrying screw clamps which take firm hold of the ends of the test strip. The rectangle is furnished with feet upon which it stands. At one extremity is the scale C, connected with a dynamometer spring, and at the other a screw provided with a handle M. By means of this screw the clamp D can be moved towards or from the clamp D^1. There is a divided rule by which the extensions of the test-piece can be measured. To prevent vibrations of the spring under the scale on the giving-way of the test-piece, and to insure the stability of the index, there is a ratchet wheel and pawl V, the former being geared to a rack. Consequently, when the test-piece breaks, the spring cannot rebound and injure the apparatus. The metric rule, which enables the extension and elasticity of the test-piece to be registered, slides upon the rectangle, and is carried by the clamp D^1, in order that the zero of the system may always correspond with the zero of the scale. If it were fixed, the lengthening of the dynametric spring under tension would disarrange the two zeros. In order to produce comparable results, the handle should always be turned at the rate of once per second. In returning the clamp to the starting point, a higher speed of revolution may be used, and to this end there is provided the peg B in the handle.

The employment of this instrument has led to the establishment of certain principles relative to the testing of tissues. It has been recognised that in linens and canvas the strength is the important point, while the extension is a secondary matter; hence it has been decided that for equal tractions the fabrics which stretch the most before rupture are superior to those which stretch less. It has also been found that after the same tests have been repeated a certain number of times, the cloths give to the dynamometer a considerable range of motion. These tissues, in spite of their good appearance, are made of inferior or defective materials, often badly spun or badly woven. In woollen cloths or stuffs, on the contrary, it is the elasticity which constitutes the principal point and the strength the secondary qualification. The tests show that when the wool has been altered by dying or bleaching, the disappearance in great part of the elasticity is accompanied by a corresponding reduction in strength. When wool is mixed with other textiles, such as linen or cotton, its nature is modified; it offers a resistance in a proportion equal to the quantity of foreign textile material it contains, and hence the elasticity, which is the test of good wool, being destroyed, the tissue must be judged from another standpoint.

The Perreaux dynamometer, which we have just described, has totally replaced in the French official trials the dynamometer invented by Commissioner Chevéfy. This latter was based on the employment of a counterweighted lever in conjunction with a cam, upon which was wound a chain that transmitted the pull to be registered.

Nevertheless, upon this principle there is based another dynamometer which is shown at the Exhibition by MM. Ollivier et Cie., of Paris, and which is illustrated by Fig. 3 annexed. It comprises a cast-iron table with levelling screws N, a vertical column H, carrying a long screw operated by bevel wheels, and a handwheel M. The head of the screw carries the lower clamp. At the rear side of the column is the graduated arc D, and upon it there slides a catch block carrying an index *e*, and moved by a counterweighted lever CQ. The position of this lever indicates the force brought to bear on the test specimen, the lever rising as the traction is increased. The extension of the specimen is read on a brass rule divided in half-centimetres. To use the apparatus, the operator fixes the extremities of the test band *x* (Fig. 4) firmly in the upper clamp, which is formed of two plates, with corresponding ribs and channels on their inner sides. The other extremity he puts in the lower clamp, taking care that the strip of stuff lies evenly; this is an

* The previous articles occurred on pages 543, 672, and 709 of our last volume.

important condition, if exact results are to be obtained. He then turns the handwheel to draw down the lower clamp. The pull is transmitted through the specimen to the cam, which raises the counterweighted lever over the graduated arc. At the moment of rupture the lever stops, the catch engages with a tooth of the sector, and the index marks in kilogrammes the effort exerted. To put the apparatus ready for another test, the operator turns the handwheel in the opposite direction, and then he lifts out the catch and returns the lever to its starting point. Each dynamometer is provided, for the purpose of verification, with an iron plate which can be attached by rods to the upper clamp. Upon this plate standard weights are put, and these, in combination with the weight of the plate and the rods, should correspond with the indications of the index *e*.

An apparatus for determining the resistance of tissues to perforation has been invented by M. Persoz, of Paris. This test is designed to realise mechanically, and in a way that can be registered, the trial practised daily by drapers and tailors, who holding a strip of cloth firmly stretched between the hands, press their thumbs against it in an endeavour to rupture it, and so to gain an idea of its strength. The method adopted in the machine consists, in principle, in holding firmly at its edges, upon a circular frame, between two rings *p q*, Fig. 5, like the membrane of a drum, a piece of the cloth to be tested. In the centre of the stretched surface there is applied the extremity of a rigid rod, which is pressed by a constantly increasing load until perforation takes place. The pressure exercised can be measured exactly in kilogrammes, and the deflection of the diaphragm in centimetres and fractions. The perforator ends in a cone, which is capped with a ball or sphere B of a determined diameter. A small device P^1, called a "planoscope," placed on the stuff to be tested before the operation is commenced, indicates by the opening of its two branches, the precise instant when the ball B begins to bear on the surface.

The apparatus comprises two slides *m r* moving easily upon one another, and can be used in conjunction with Ollivier's dynamometer. It can be used for many different materials, such as paper, cardboard, cloth, linen, felt, and leather, sheet metal, &c. It appears useful for testing articles which have to support rending strains, such as stuffs for clothes, sails, balloons, packing paper, &c.

We will conclude this brief review of the principal apparatus of precision for the textile trades by recounting the experiments—of which mention is made, at the Exhibition by Madame Vve. Michel-Alcan—made at the Conservatoire des Arts et Metiers, Paris, by MM. Alcan and Tresca upon the resistance of textile materials to friction. To this end they submitted cloths to the action of a brush, charged with powder, and operated by a handle. They determined by successive weighings the loss of weight due to the action of the brush after each 1000 strokes. The brush and the carriage on which it was fixed weighed together 26.7 kilogrammes (58.7 lb.), and the dimensions of the brush were 18 centimetres (7.1 in.) in the direction in which it moved, and 24 centimetres (9.4 in.) at right angles thereto. For each experiment the cloth was stretched upon a horizontal board by means of a slide exactly adjusted over a rectangular opening made in the plank. By this arrangement the entire surface of the cloth is left free, and its four edges are nipped between the walls of the opening, and those of the slide. The brush, driven by a reciprocating movement, acts only when moving in one direction, rising clear of the cloth on the back stroke. The experiments which have been made for purposes of comparison upon felts and ordinary cloth, show that the former bear twice as many strokes as the latter, without being more worn. The ordinary cloths were put completely out of service after less than 3000 strokes. The excess of thickness of the felted cloths, compared with the ordinary cloths, was the principal cause of their good wear. The same experimenters have also examined cloths from the point of view of permeability and absorption of water by capillarity. In these trials the ordinary cloths were shown to be more permeable, and to exercise a much more energetic capillary action than the felted cloths.

In comparing these results with those obtained in tests of resistance to traction, the authors arrived at the following conclusions:

1. By the process of felting, the fibres become incorporated in such a way as to form a whole of great strength, and of extraordinary power of resistance; but this effect is only obtained at the cost of flexibility and suppleness, which are important qualities in materials designed for conversion into garments. Woven material is therefore the best for this purpose; felted fabric, on the contrary, has the advantage when it has to be stretched or subjected to hard wear, either dry or wet.

2. Dyeing has an influence on the strength of the product. Other things being equal, a fabric made of natural wool—that is to say, wool which has not been subject to the action of tinctorial substances—will be stronger than a fabric which has been dyed; further, colours applied at a low temperature reduce the strength less than those which require the wool to be boiled more or less.

3. Uniformity of quality in two directions is more perfect the finer the material and the more equal the quantities of warp and weft.

(*To be continued.*)