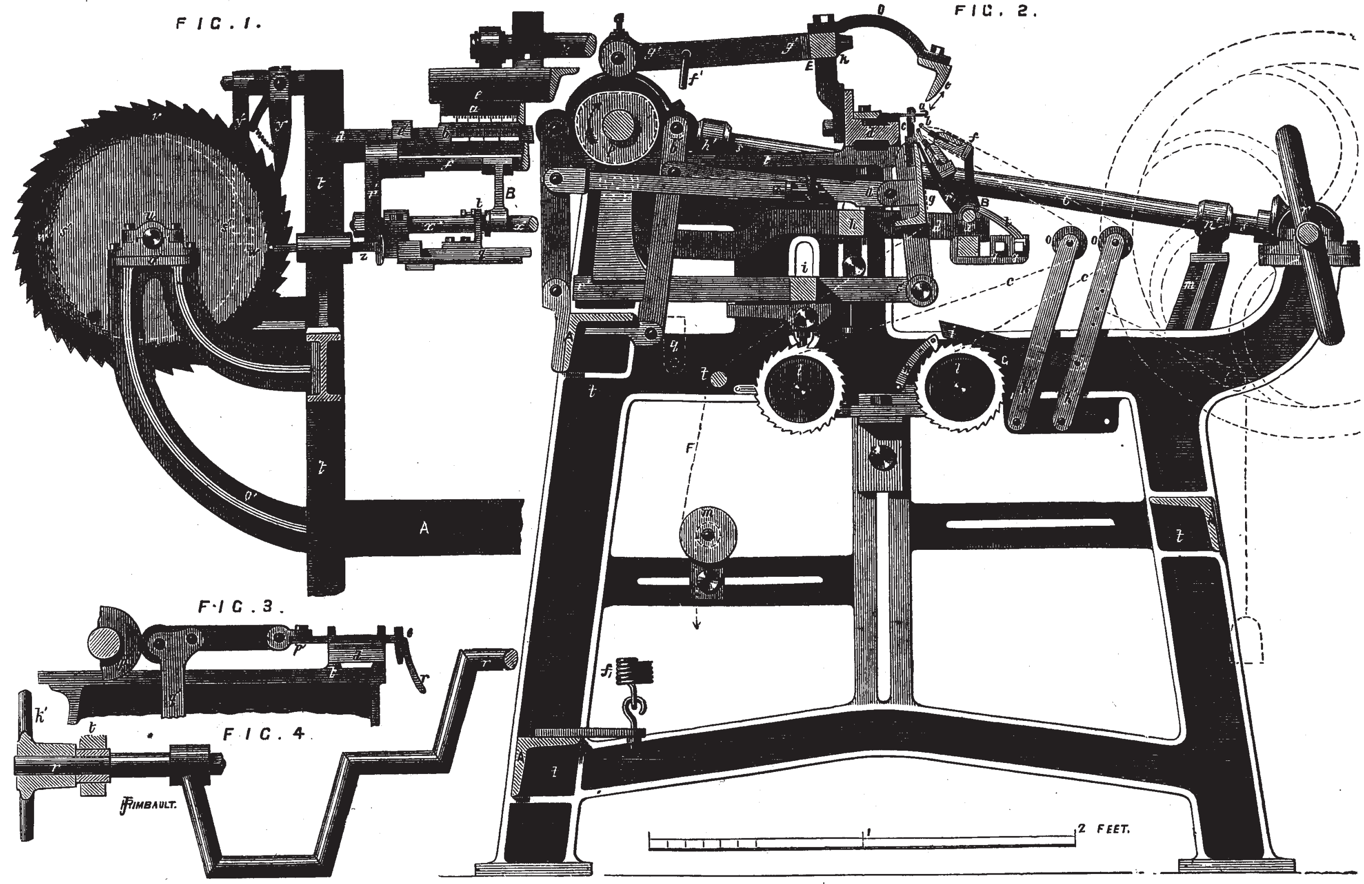
MECHANICAL KNITTING LOOM, AT THE VIENNA EXHIBITION.

CONSTRUCTED BY MR. ERNST SAUPE, OF LIMBACH.



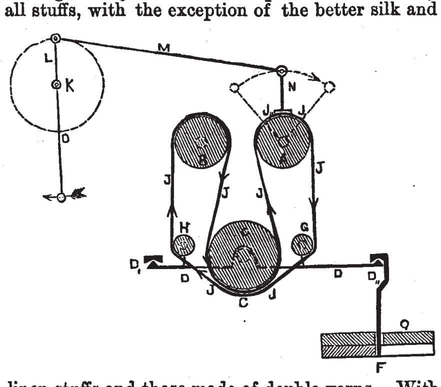
TEXTILE INDUSTRY AT THE VIENNA EXHIBITION.—No. XI.

By Dr. H. Grothe.

In order to complete our report on the weaving department at the Vienna Exhibition we shall have to make several additions to our former articles. Until now we have considered, strictly speaking, only such machines for the weaving process as are capable of producing in the ordinary way regular tissues by means of crossed threads; if, however, this rectangular crossing is made no longer the chief point, we get at once a great many new machines producing tissues, to which, in order to distinguish them from the class formerly described, various names are given, such, for instance, as knitted-work, net-lace, gauze (canvas), laces, points, girths, fringe-work &c. But if these tissues, after their production, are ornamented with figures produced by threads, we have to speak of stitching, tambour work, &c. We should not omit to mention, also, a number of appliances required to perform certain manipulations in the process of weaving or its products, and which have also partly to produce details for and of the loom, as, for instance, the reed-making machine, the braiding-machine, the machine for undoing healds, the machine for making the small rollers for winding up of the weft, &c. We have also to consider the apparatus for testing the strength of woven fabrics, and these latter machines we shall take first for our detailed descriptions.

We find at the Vienna Exhibition two machines of this kind, one of which is designed by Professor Otto Beylich, who calls it a "bristometer," whilst the other is built by M. Perreaux de L'Orne, of Paris; this latter apparatus represents the system which has now been used for some time by the Russian Government, as well as in France.

The testing of woven fabrics, that is to say, a preliminary and experimental definition of the strength or durability of cloths, has been very often tried, especially since the introduction of artificial wool and adulterations of all kinds, by which the fabric is not made to lose anything in appearance, but often 90 per cent. of its strength, as has been found by the present writer by the aid of instruments specially constructed for this purpose. The meaning of the word strength or durability, as applied to a woven fabric, is certainly relative, and can be fixed precisely only under certain circumstances. For each sample of stuff the strength has to be ascertained in the direction of the weft as well as in the direction of the warp, as the two differ generally as much as 25 per cent. for nearly all stuffs, with the exception of the better silk and



linen stuffs and those made of double yarns. With respect now to the adulterations mentioned above (which are, of course, permitted), and which cause the strength and durability of the woven stuffs to fall below the standard, as these adulterations themselves produce a great dissimilarity in the various parts of the fabric, large supplies of cloth should no longer remain untested. This has for some time been done by the Russian Government, and is now also done by the Prussian authorities. The Russian Government possesses already a considerable collection of these testing machines, amongst which we have found fourteen different systems, based on various principles, represented. Some of these machines prove the strength of the woven stuffs by pulling first in the direction of the warp, and second, in the direction of the weft and of the warp simultaneously, whilst other appliances test the strength of the material by friction and pull, in the same manner as it would be done by actual wear. To this latter system the new "bristometer" of Professor Beylich belongs, speaking, of course, with respect to mechanical influence only. This apparatus fulfils the following conditions:

1. The stuffs are submitted, by means of the apparatus, simultaneously, and in quick succession, to the same wear and tear as during actual use.
2. The wear and tear of the stuffs is produced by a succession of perfectly uniform actions, in which no other alterations of the occurring resistances take place than those produced by the wear and tear itself.
3. The apparatus counts the number of actions which take place until the wear and tear of the stuff has reached a certain point, or, for instance, until the stuff has been totally destroyed; this number represents the relative strength of the stuff.
4. The apparatus is, besides, arranged in such a manner that the forces of the various actions upon the stuff to be tested can be altered, and that independently of each other; whence it is possible to test the strength of each material in the manner most nearly corresponding to the kind of actual wear and tear it will have to undergo in practice.

This apparatus, a special suitable arrangement of which is shown in principle by the annexed sketch, consists of the rollers A, B, C, G, and H, over which a strip of the material J to be tested is passed in the manner indicated, and the ends of this strip being fastened down at J_1 and J_{11}. This strip J is stretched by a constant load produced partly directly by the weight of the roller C, and partly indirectly by means of the levers D and the weight Q, placed on the scale F. By means of a crank the roller A is put in rotation, the motion being transferred to the other rollers through the strip of material.

The principal action takes place between those two parts of the strip which pass over each other at the bottom of the roller C, and which, by moving in opposite directions, rub constantly against each other. These parts are, besides, submitted simultaneously to certain pressures and uniformly repeated bendings. The amount of friction depends upon the pressure of the outside part against the inside one, and upon the condition of the frictional surfaces. The pressure results from the load, and its amount depends upon the relative position of the lower rollers, which may be altered in such a manner that a pressure creating friction may be produced from a given maximum to almost *nil;* this pressure, however, remaining in the mean time constant as long as the load Q, and the relative position of the rollers, is not altered. The state of the frictional surfaces, moreover, does not undergo any alteration except that which is produced by the friction itself—that is to say, by the wear and tear that takes place. With the exception of the quick succession and uniformity of action, this process is analogous to that which takes place during the wearing of the cloth. This circumstance is of considerable importance on account of the necessity of producing a friction which is not liable to such alterations in amount as would occur if the cloth was caused to rub against some foreign body, the surface of which would undergo change by wear. Of course, the materials have to be tested under equal conditions—that is to say, the width of the strips, the weights and the relative position of the rollers have to be the same, and the amount of strength of any material is given by the number of revolutions or applications of strain which take place before the wear and tear reaches the desired or proposed state.

We consider this apparatus to be one of the best of all "bristometers" designed up to the present time, and we think that especially the idea of producing friction by two surfaces of the material to be tested, is a very ingenious one. In other apparatus of this kind, the friction is produced by rollers covered with cloth, by bars, or by grinding rollers. We may state here that Professor O. Beylich, of Munich, supplies the testing machines we have just described for Great Britain, Ireland, and America. The apparatus by M. Perreaux de L'Orne tests the material only by tension in the direction of the warp and weft, the sample of the material being fixed between cramps on two broad bars, one of which is fixed whilst the other is movable, like the slide of a lathe, by means of a screw. The material is thus stretched, and when the limit of strength of the stuff is reached, it will be torn asunder, whilst an indicator marks the amount of power required to effect rupture. We shall now direct our attention to the knitting machines.

Since Lamb invented the machines for knitting by arranging the needles in a straight line instead of a circle, the making of knitting machines has been considerably extended, and Lamb's simple arrangements did not remain without advantageous influence upon the construction of this kind of machines in general. Altogether, however, no new things of any importance are to be found at Vienna in this branch of industry. We find at first the machines on Lamb's system exhibited by the original works; next those by Mr. Conrad Maager, of Chemnitz, built on Bach and Grosser's patent system, by Messrs. Carbonnier and Co., of Paris; of Messrs. Brauer and Ludwig, of Chemnitz; of Messrs. Bach and Grosser themselves, and of Mr. F. Groebers, of Neufra, who has introduced some important improvements. Circular knitting machines for domestic use are exhibited by Messrs. Grimme, Natalis, and Co., of Brunswick, E. Buxtorf, of Troyes, and F. Groebers. Large circular looms and weaving machines are exhibited in the German department only, namely by MM. Fonquet and Franz, of Stuttgart, Stücklen and Terrot, of Stuttgart, G. Hilscher, of Chemnitz, and Brauer and Ludwig, of Chemnitz, whilst Messrs. May and Stahlknecht show photographs only of their machines. These exhibitors show various new constructions, circular machines for weaving stockings (system Faquin and system Fouquet), with French applications and English wheels, as well as English circular shawl-weaving machines, of the ordinary patent system. One of the most important of these looms is the mechanical knitting loom exhibited by M. Ernst Saupe, of Limbach, who builds these looms exclusively, and whose works may be said to be at present the best known in Germany. This loom, of which we give an illustration on the preceding page, consists of the frame t (Fig. 1) with the cross pieces A, to which is screwed the porcupine d with the needles a, fastened by molten lead. The main or eccentric shaft p receives its motion from the crankshaft r with the flywheel k (Figs. 2 and 4) by means of the cross shaft s, and it travels in the direction indicated by the arrow. The lifting wires c, which are fastened to pieces of lead of 1 in. width, are screwed to the sinker bar g, moved through the shaft i and the lever c by the eccentric shaft p. The machine or compass needles b are fastened in such a manner to the rulers f, (which are supported by means of the arms B of the so-called ruler shaft) that they are allowed to slide backwards and forwards.

The shaft x is moved by d, the shaft h, and the lever d_1. The rulers rest upon the arms r_1, which are also fastened to the shaft x, and which are moved forwards and backwards from p by means of the bar q_1, the arm e and the rod p_1, as shown in Fig. 3. The sinker bar g is connected with the main shaft p by the rods a_1 and b_1, the latter of which moves the bar g forwards, whilst the former draws it back again. The threads, either wool, cotton, or silk, pass from the beam l over the cross rollers o o, carried by the arms h_1, to the compass needles b; the arms h_1 are pulled back by weights suspended from cords, whence the threads are kept always in the necessary tension. According to the amount of this tension depending upon the weights, the stuff produced is more or less tight and strong. The presser bar e connected by the lever D with the shaft E, which is carried by the brackets k, is moved from the main shaft p by means of the lever g_1, up and down, whence the crooks of the needle a at the sinker bar are closed and pressed together. The knitted fabric passes over the roller l, and is wound up on the beam m. The ratchet G and the detent n prevent the continuous unwinding of the warp c c; this unwinding taking place only if, during the continuous working of the loom, the tension of the thread lifts the rollers o, and pulls the levers h^1 towards the needles, when the lever i disengages the detent n. As soon as the unwinding has taken place, however, the weights again pull back the rollers, when a spring presses n again quickly back into the teeth of G, stopping thus the revolving motion of the beam l, which moves generally one or two teeth only. Fig. 1 represents in a front view the knitting parts of the machine. With the description given above, and by reference to the illustration, the manipulations of this loom will be easily understood. The compass needles b and the bobbin needles a are arranged in two series; the arm of the series of compass needles B moves on x, and pushes against t, which is connected with the rod q, whence the latter touches z, which comes again in contact with the pattern wheels w and w^1, producing the alternate motion of the series of compass needles. These two wheels are fastened, together with the large spur-wheel v, to the shaft u, and the motion of this shaft is effected by the detents y and y^1, which move the spur-wheel v generally one tooth at a time. The dotted lines s s^1 show two wedge-like projections, which are used if, for the weaving of atlas, the compass needles have to be above the bobbin needles. The description given above explains all motions which are derived directly or indirectly from the eccentrics of the shaft p, and by means of which the fabric is produced. All parts of the loom repeat these motions between 50 and 60 times per minute, forming thus between 50 and 60 meshes.