TEXTILE MACHINERY AT THE PARIS EXHIBITION.

AT the present moment it is practically impossible to find any group of exhibits that fall within the scope of this journal, in a sufficiently complete condition to encourage the commencement of a critical and comparative examination. A very short time will alter the actual state of things, and then the difficulty will be to make anything like an exhaustive review of the vast number of technical exhibits. As we have already intimated, the building devoted to textile industries, was, at the date of opening, in a less backward condition than most others, and here, at all events, it is possible to commence a profitable examination.

The Textile Building promises to be one of the highest commercial interest of any on the Champ de Mars, for the industry to which it is devoted, not only in England and in France, but also in Germany, the United States, Belgium, and Austria, has assumed such great proportions in the export returns of each country, that machines and processes connected with it, become of greater international interest every year. Each year, too, the range of industries included in the word textile, becomes wider, until it comprises, not only yarns and simple tissues made from silk, cotton, flax, wool, and other materials, but also a large variety of products from fancy tissues of the most delicate fabrics, to the heaviest fishing nets; in addition, there are the numerous accessory industries, such as those of designing, dyeing, &c., so that it will be readily understood that an almost infinite variety of machinery is required to prepare for the manufacture of, and to produce, so great a multiplicity of goods.

So far as space and time permit, we propose to examine the manner in which this vast industry is illustrated by the machinery collected at Paris from many nations, and especially to dwell upon such useful novelties and original methods as are there represented. This examination will not have reference to the manufactured materials themselves, for that would carry us too far; it is, however, necessary to say a few words on the principal systems in use for defining the sizes of yarns, before proceeding to consider the apparatus that naturally calls first for attention, the devices exhibited for determining the values of yarns as well as of tissues of all kinds.

In that section of exhibits specially devoted to yarns, the first impression given is one of surprise that there should exist so many systems of counting, not only among different nations, but often in the same country. So great is the confusion created from this cause, that it has been determined to take advantage of the present Exhibition to hold an International Congress next autumn for the purpose of discussing the establishment of a standard system of count. This meeting is to be followed by an International Conference to consider the recommendations of the Congress, and various Chambers of Commerce consulted on the subject have intimated their approval, and desire to co-operate. A few words on the more important items in the programme of this Congress will therefore not be out of place.

Numbering of yarns—conveniently called "Numerotage" in French—is an operation, the object of which is to determine the thickness of a given thread, and the number or "count" is the figure that defines this thickness. In practice there are two methods for arriving at this result; the one is applied exclusively to silks, and allows the count to be determined according to the average weight of a silk skein of constant length. The other, applied to all other textile materials, is based on the length of thread required to give a constant weight. Thus the count defines the relation between the weight and the length of a thread.

The different systems chiefly in use may be very briefly examined, commencing with silk and with the French methods. According to a law dated June 13, 1866, the count of a silk yarn is represented by the average weight in grammes of a skein 500 metres long, the mean being established by testing 20 skeins of the same length. But the data thus established is of no practical interest to the manufacturer accustomed from time immemorial to consider the count of the silk only in deniers of a skein of 400 "aunes," from 475.5 to 476 metres long in round numbers. From this it has resulted that in the official records made in the French bureaux of tests, the weights of 20 skeins of 500 metres each, in grammes and fractions, are entered on the official forms, while in another column is shown the reduction of these weights into deniers (the denier is considered as equivalent to 0.05313 gramme). Then, after the mean number in deniers of the 500-metre skeins, the count corresponding to the old 476-metre skein is inserted; it is according to this last number that the fineness of a silk thread is commercially known in France. In order to convert the legal number into the commercial count expressed in deniers, for skeins of 500 and of 476 metres, the legal value has to be divided by 0.05313 gramme the value of the denier, or multiplied by 18.82. The result $D = 18.82 \times t$ corresponds to

the weight of the 500-metre skein, and the weight of the 476-metre skein is obtained by multiplying the preceding result by .952. From the foregoing it will be seen that to convert the old number in deniers d, and reciprocally, we have

$$d = .952 \times 18.82\, t$$

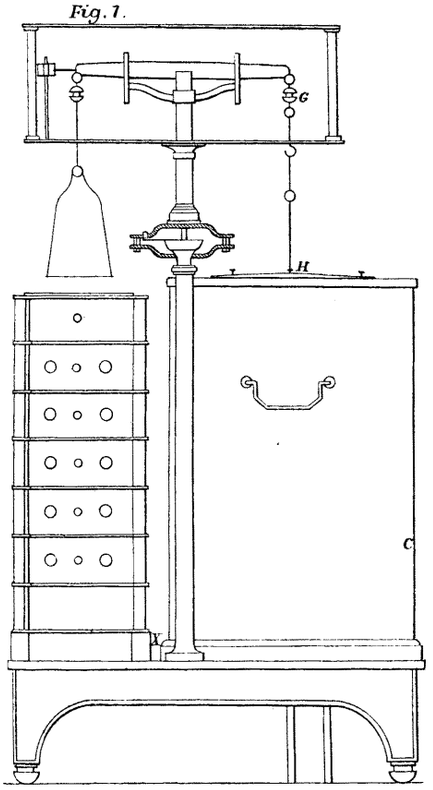
whence $$d = 17.92\, t$$

and $$t = .558\, d.$$

t being the legal "count."

Passing to materials other than silk, as already said, these are estimated by the length of thread required to produce a certain weight, or, speaking more generally, the number of skeins of a fixed length to make up a standard weight. But as both the weights and lengths are variable, much confusion has resulted, which it is hoped will be removed by the unification recommendations of the approaching Congress. Pending this very desirable result, the work of conversion from one method to another is of general practice, and is done on the following lines:

Fig. 1.



Assuming that in a first system the count of a yarn is N, and the bases of weight and length are P and L, that is to say that N skeins, L long produce the weight P, then if u represent the weight of the length unit of yarn

$$P = u\,L\,N,$$

whence $$u = \frac{P}{L\,N}.$$

In a second system we should also have for a given yarn

$$p = u'\,l\,n,$$

whence

$$u' = \frac{p}{l\,n}.$$

If it is assumed that in each case the value of yarn is the same, then

$$\frac{P}{L\,N} = \frac{p}{l\,n}.$$

From this can be deduced the value of one of the numbers when the other is known, as well as the bases of the two systems:

$$N = \frac{P\,l\,n}{p\,L}.$$

In the textile industry there are two principal systems of counting, the French and the English, for cotton yarns. In the former the count represents the number of 1000 metres in a ½ kilogramme; the perimeter of the spool on which the yarn is wound to form the skein, is 1.428 metres, that is to say, there are 70 turns per 100 metres. In the latter system, called the cotton scale, applying, however, not only to cotton, but to some classes of silk, as well as to carded wool and to mixtures of cotton and silk, the length of hank is 840 yards, and the number is represented by the number of hanks per pound; the perimeter of the spool is 1.5 yards. To convert the English into the French equivalent, or the reverse, the relation is:

$$\frac{F}{E} = \frac{500 \text{ gr.} \times 767.76 \text{ metres}}{453.6 \text{ gr.} \times 1000 \text{ metres}}$$

whence

$$F = 0.84685 \times E$$

and

$$E = 1.18113 \times F.$$

In hemp counts both the metric and the English systems are employed. In the former the weight of the parcel of hemp is uniformly fixed at 10 kilogrammes; the number of hanks subdivided into 10 skeins of 200 metres each, varies according to the count. Thus No. 1 containing five large or 50 small skeins, measures 10,000 metres; No. 2 containing 10 large or 100 small skeins, is 20,000 metres long; No. 3 containing 15 hanks, or 150 skeins, measures 30,000 metres and so on.

Fig. 2.

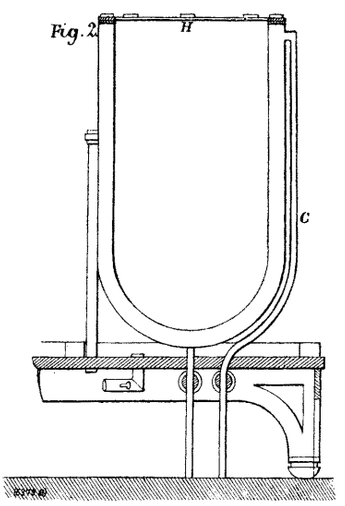
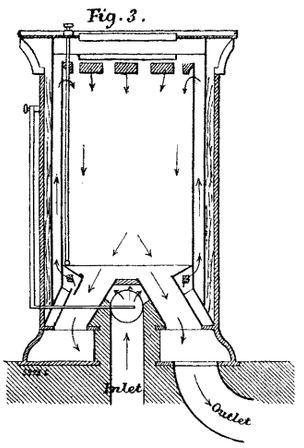


Fig. 3.



The system employed for linen thread is uniformly English; in this the thread is wound in skeins of 120 metres on a spool 2.5 yards in perimeter. Twelve such skeins form a hank, and 100 hanks make the standard parcel. In French equivalents the small skein contains 274 metres, the large skein or hank 3290 metres, and the parcel 329,000 metres. In this system the length is uniform, but the weight varies in an inverse proportion to the number; thus 100 skeins of No. 1 weigh 540 kilogrammes; the weight of No. 2 is one-half of this, or 270 kilogrammes; No. 3 is one-third, and so on. In order to ascertain the weight of a parcel the standard weight of a parcel No. 1 must be divided by the number of the packet being weighed; for example, 100 skeins of No. 12 weigh 540 ÷ 12 = 45 kilogrammes. The conversion of the kilogrammetric into the English numeration, or the reverse is as follows:

$$E = 1.666 \times K$$
$$K = 0.60746 \times E$$

In the wool standards distinction must be made between that of combed and that of carded wool. For the former two systems are in use, French and English. In fact, there are two French standards, the new and the old. The former expresses the number of thousand metres in 1 kilogramme; the latter—used in Germany as well as in France—indicates the number of skeins of 700, 710, 714, or 720 metres, according to different districts, per half kilogramme. A spool with a perimeter of 1.44 metres is used for winding the skein of 720 metres. The English system is known as the "worsted scale," and is employed either for plain, combed, or twisted wool yarn; it is represented by the number of small skeins of 560 yards in 1 lb. weight. To convert the kilogrammetric standard K equal to the number of thousand metres in a kilogramme, to the old French count the following constants are used, according to whether the small skein of 700, 710, 714, or 720 metres (F, F′, F″, F‴) is used in question:

$F = 0.7143 \times K$	$K = 1.40 \times F$
$F' = 0.7042 \times K$	$K = 1.42 \times F'$
$F'' = 0.7002 \times K$	$K = 1.428 \times F''$
$F''' = 0.6944 \times K$	$K = 1.44 \times F'''$

For the conversion of the kilogrammetric count K into English equivalents we have:

$$\frac{E}{K} = \frac{453.6 \text{ gr.} \times 1000 \text{ metres}}{1000 \text{ gr.} \times 512 \text{ metres}}$$

whence

$$E = 0.886 \times K$$

and

$$K = 1.128 \times E.$$

As examples, a yarn rating as 50,000 metres per kilogramme gives the English count of 44.3, and the English count 40 corresponds to a kilogrammetric length of 45,120 metres. Practically the English count 100 gives 113,000 metres (the exact length is 112,800 metres). For the conversion of the English number E into French numbers F, F′, F″, F‴, according to whether the lengths of skeins are 700, 710, 714, or 720 metres, the following constants are used:

$F = 0.806 \times E$	$E = 1.240 \times F$
$F' = 0.794 \times E$	$E = 1.258 \times F$
$F'' = 0.790 \times E$	$E = 1.265 \times F''$
$F''' = 0.783 \times E$	$E = 1.275 \times F'''$.

For the counts of carded wool, both the French and English systems are in use. The former as in the last case, depends on the number of thousand metres per kilogramme, but unfortunately old methods are also in vogue. Thus there is a special system largely followed at Elbœuf, where the unit of weight is the livre of 500 grammes and the unit of length is 3600 metres (3000 aunes). This constitutes the "current pound," and is the basis of the system; it is divided into quarters of 900 metres and into "sons" of 90 metres. The winding spool, the perimeter of which is 1.50 metres, is fitted with a counter, which strikes a bell at each sixtieth revolution; this marks the completion of each small skein of 90 metres. At Sedan there is in use a somewhat similar method, but less complicated, in which the standard is the number of skeins of 1256 aunes (about 1500 metres) contained in the pound of 500 grammes.

The English method conforms to that in use for cotton—that is to say, the count is fixed by the number of hanks of 840 yards in a pound. From this it results that the count 50 (English) of carded wool corresponds to No. 75 of combed wool. With the following constants the kilogrammetric number K is converted into the English numbers and reciprocally:

$$\frac{E}{K} = \frac{453.6 \text{ gr.} \times 1000 \text{ metres}}{1000 \text{ gr.} \times 767.76 \text{ metres}}$$

whence

$$E = 0.590 \times K,$$

and

$$K = 1.692 \times E.$$

Did space permit, the consideration of this interesting and complicated subject could be enlarged to fill a volume. The merest outline has been attempted in the foregoing paragraphs, with the twofold object of showing how necessary are the labours of the coming unification Congress, and how much ingenuity must have been expended in the devices for rapidly measuring counts, and determining the standards of various classes of yarns. Already the Textile Building of the Exhibition contains good examples of this detail in a great industry, and no doubt, as time goes on, those now in place will be supplemented by others. Thus, the Chamber of Commerce of Lyons exhibits models of the apparatus for testing the condition of silk yarn, and the amount of moisture it contains, that is used

in the public establishment of which the Lyons Chamber of Commerce has charge.

The leading feature of these apparatus consists of a series of stoves in which the samples of silk to be dried are suspended to the arm of a balance by a thread that passes through the cover of the stove. By this arrangement the weight of the silk can be ascertained at any moment, the process of drying watched and recorded, and the final weights taken, after dessication is complete, the hot-air supply being shut off at the moment of taking this last observation. The progress that has been made is illustrated by a series of reproductions, the first of which dates back to 1840; it is shown in the diagrams, Figs. 1 and 2, and consists of an inverted bell with double sides C, the top being furnished with a cover H. The samples of silk to be dried are suspended in the bell as shown, where they are subjected to a temperature a little above 100 deg. Cent., sufficient to expel all moisture and reduce the samples to a state of absolute dryness. In this condition the absolute weight is obtained by the balance, and the weight of the whole parcel is estimated from the sample. To this absolute weight a certain amount of water is added, corresponding to that which exists in commercial samples, and in this way the normal weight is obtained as a basis for regulating the conditions of manufacture. In this apparatus it will be seen from the section Fig. 2 that a pipe is introduced in the double side of the bell to receive and carry off the steam or moisture that is

liberated in the operation of drying. Another form is also exhibited elaborated from the elementary type, in 1853, by MM. Talabot and Perroz; Fig. 3, page 543, illustrates this form in which the heated air coming from a coke fire is led to the upper part of the receiver by a series of copper tubes, and is drawn out from the bottom through an opening connected with a chimney, the air passing through the sample on its way. In 1886 M. Testenoire, the present director of the Lyons establishment, introduced, with the co-operation of M. Robin, important improvements in the drying apparatus; he replaced the hot-air tubes with a sleeve, leaving an annular space in the bell, up which the hot air flowed in a larger volume, thus rendering the temperature more uniform, and the operation more rapid. The receiver was also encased in a non-conducting envelope, and a furnace was added in which coke or coal dust could be burned. This apparatus, which is exhibited, completes the series of these appliances that need be noticed. In another article we will consider other apparatus and instruments which are shown in the Building of Textile Industries, having for their object the regulating of textile threads and yarns, prior to their being made ready for the loom.

(*To be continued.*)