FABRIC ANALYSIS.

(Continued from July issue.)

Testing for Regularity.

To examine and compare the evenness of the yarn and its freedom from defects is best done by using what is known as a Yarn Examining Machine. The same consists of a board, (known as a mirror) black on both sides, or black on one side and white on the other, or of any color to contrast with the color of the yarn to be examined, so

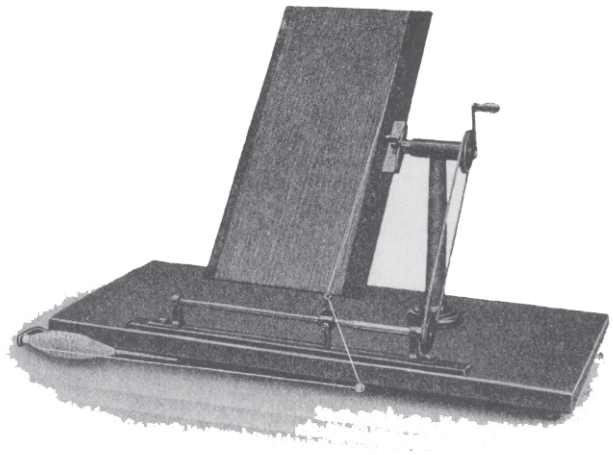

Fig. 78

as to clearly show up its defects. This board is secured to a clamp, the shaft of which is suitably rotated by gearing through a hand-wheel situated on the outside of the pillar carrying the shaft of the clamp. The threads to be tested are wound either from one or two cops or bobbins, as may be desired. The thread guides, which travel on a screw turned by a band from the hand-wheel, lay the yarn regularly on the surface of the board previously referred to, with a small space between the threads. The perfectly even distribution of the yarn enables any irregularities, such as knots or weak places, to be readily observed; also as the yarn from two cops or bobbins may be wound simultaneously, the external appearance of one yarn can then be compared with that of the other. The board, which may be of wood, cardboard or aluminum, is held in position on one side by the clamp and its thumb-screw, as previously referred to, and when filled, is taken out and another board put in its place, while the bracket carrying the thread guides is raised up and moved back to the starting point for another test. Defects of any kind in the yarn are thus readily exposed and the sample wound on the board may be held on file for future reference and comparison, spare boards being provided for this purpose.

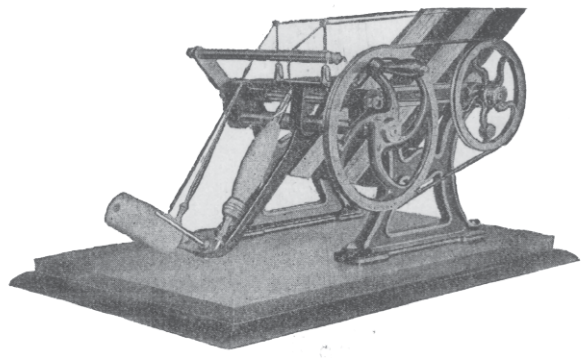

Fig. 79

Fig. 78 shows the Yarn Examining Machine, as handled by A. Suter, New York, in its perspective view, equipped with one bobbin for winding, and black or white velvet covered aluminium boards and the usual cardboard clamp. Machines equipped with winding from two bobbins are also furnished.

Fig. 79 shows the Yarn Inspector as built by Henry L. Scott & Co., with board in position. The yarn is shown wound from two cops or spools, and is laid evenly in parallel lines upon boards 17⅞ inches long by 8 inches wide.

These boards are held in either machine by a spring clamp and are instantly interchangeable. The machine is mounted upon a well-finished weathered oak base and designed with two solid iron side frames which support the mechanism. All metal parts are finished in black enamel and nickel plate, making these machines attractive as well as serviceable.

A simple method of performing this test when an apparatus is not available, consists of winding the threads round a board (which is notched at opposite extremities) at uniform intervals of about one-sixteenth of an inch, care being taken to always put equal tension on the yarn.

It should be remembered that although called a Yarn Examining Machine, it is not an examining machine, but a machine by the use of which the yarn may be placed in a position favorable for future examination.

There are two objections which may be raised to a too general use of the machine:

(1st) If the boards or cards are not limited, they may, when filled with yarn for observation, be placed aside for future examination, which may never occur.

(2nd) The quantity or length of yarn thereon available for inspection is not sufficient, and may be misleading. If the yarn on the boards be examined regularly and rigorously, the second objection holds not good.

For preference, therefore, the leas (portions of skeins or hanks, as the case may be) as wrapped for testing should be carefully examined before removal from the wrap reel; and perhaps after removal from the reel, by expanding the threads or rounds on an iron bar before weighing, and again examining for unevenness, slubs, snarls, snicks, neps, etc., etc. This expansion of the rounds will not affect the condition of the skeins so far as strength tests are concerned, and the same can be used for examination, counts and strength tests.

An apparatus for doing this work is shown in its perspective view in Fig. 80, the same being built by Chas. H. Knapp, Paterson, N. J. This apparatus is adjustable for handling different size skeins by pressing lever *a* towards handle *b*, of slide *c*, loosening in turn the grip of the latter on guide rod *d*, thus permitting the positioning of slide *c* either up or down on rod *d*, to suit the diameter of the skein (not shown) to be examined, and which is placed over rollers *e* and *f*. Slide *g*, operating on rod *d*, can be also adjusted (if needed) by means of tightening knob *h*. To make examination more quickly and at the same time more thorough, backboard (mirror) *i* is provided, being secured in its centre to rod *d*. The latter, and with it the apparatus, can be tipped in any position as required by the examiner and secured in that position by tightening knob *k*; the raising and lowering of the apparatus on the standard *l* is done by loosening and then tightening knob *m*.

If the yarn on examination is found to be passable, or up to the usual standard, no remark is made; if, however, the yarn should show any distinctive faults, the latter should be entered in the remarks column of a reference book. It is then at the option of the management of the mill to trace that fault in the yarn in its progress through its manufacture, and when the faults can be located. It is of advantage to thoroughly and carefully examine single yarns at this initial stage.

To Find Counts of Yarns by Comparison.

A common method of finding the counts by comparison consists of looping together a variable number of threads picked out from the sample and a given number of threads taken from a similar cloth of which the particulars are known. The ends of each series of threads is held between a finger and thumb, and twist is inserted by hand until both appear like solid threads, when it is possible for their thickness to be compared. Threads are added to or taken from the series of threads of which the counts are not known until the two sets appear to be equal in thickness. The counts are then in direct proportion to the respective number of threads used for the test. This method, though largely employed for low and medium counts, is not always satisfactory, and for fine counts is not reliable.

By means of the apparatus shown in Fig. 81 the threads can be twisted and their relative diameters afterwards compared with greater accuracy than is possible with the unaided eye. The apparatus has been specially designed for the

purpose of enabling threads drawn from small pieces of cloth to be minutely examined.

The lower portion of the apparatus consists of a movable stage, carrying two jaws *A* and *B*, which may be placed at any required distance apart (from ¾ to 3 inches) according to the length of thread to be tested. The two series of threads are looped over each other in the ordinary way, and the ends of one series are placed in the jaw *A*, and the ends of the other series in the jaw *B*. Tension is then put on the threads by placing a weight in one of the notched positions on the arm *C*, which is movably connected to rod carrying jaw *A*. By means of the hand wheel *D*, the jaw *B* is made to rotate until sufficient twist has been inserted to make each series of threads appear like a solid thread.

The upper part of the apparatus carries a miscroscope which is fitted with a micrometer scale, by means of which the diameter of a single thread (or of a group of threads) can be measured to the nearest millimetre (or to the nearest one-thousandth part of an inch) as required. By turning the hand wheel *E*, the stage carrying the jaws *A* and *B* is made to slide to the right or the left, so that any part of the thread between the two jaws can be brought under the field of vision of the microscope. The diameter of the known series of threads is first measured on the scale, then the hand wheel *E* is turned and the diameter of the other series is measured and compared with it.

The microscope has a magnifying power of from 60 to 100 diameters, so that small differences are easily detected.

As the threads (before twisting) are screwed up tightly in the jaws of the apparatus, it is more convenient to vary the number by breaking out threads in place of adding threads. For this reason, when first put into the jaw, the number of the threads of the unknown count should preferably be in excess of what is required.

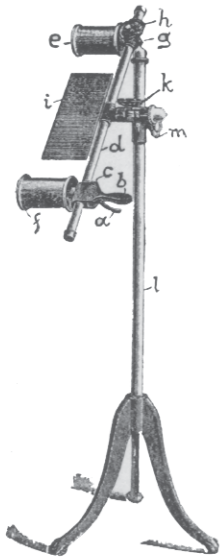

Fig. 80

Testing Diameters of Threads.

The same may vary, depending upon (*a*) more or less specific gravity of the raw material; (*b*) air contained; (*c*) the axial arrangement of the fibres and (*d*) the compression due to twist in spinning.

Measurements of the diameter of a thread are useful for indicating the evenness of the thread, which frequently varies up to 30 per cent; at the same time it indicates bulkiness of the thread.

The diameter of a thread is obtained by measuring, using a microscope and micrometer in connection with the procedure, by means of which the following standard rule has been accepted by the textile industry:

Square root taken of yards per lb. of yarn to be tested, minus 10 per cent for worsted, 7 per cent for silk and cotton, and 16 per cent for woolen.

Example: 2/50's cotton = 50 ÷ 2 = 25 × 840 = 21,000 yards per lb.

$\sqrt{21{,}000} = 144.9 - 10.1\ (7\%) = 134.8$

Answer: $\frac{1}{135}$ inch is the diameter of 2/50's cotton.

Example: 6 run woolen = 6 × 1600 = 9,600 yards per lb.

$\sqrt{9{,}600} = 97.97 - 15.67\ (16\%) = 82.30$

Answer: $\frac{1}{82}$ inch is the diameter of 6 run woolen.

Example: 22 cut woolen = 22 × 300 = 6,600 yards per lb.

$\sqrt{6{,}600} = 81.24 - 12.99\ (16\%) = 68.25$

Answer: $\frac{1}{68}$ inch is the diameter of 22 cut woolen.

Example: 2/32's worsted = 32 ÷ 2 = 16 × 560 = 8,960 yards per lb.

$\sqrt{8{,}960} = 94.6 - 9.4\ (10\%) = 85.2$

Answer: $\frac{1}{85}$ inch is the diameter of 2/32's worsted.

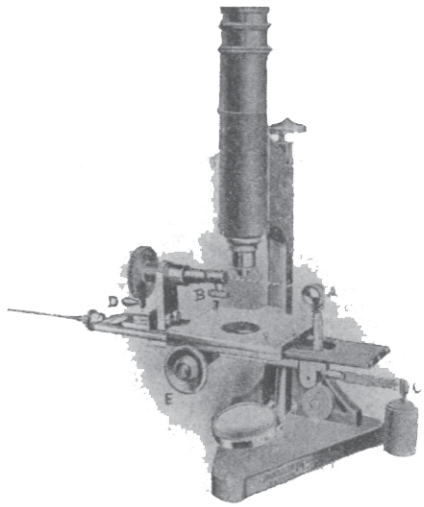

Fig. 81

Example: 40/3 spun silk = 40 × 840 = 33,600 yards per lb.

$\sqrt{33{,}600} = 183.3 - 12.8\ (7\%) = 170.5$

Answer: $\frac{1}{170}$ inch is the diameter of 40/3 spun silk.

Example: 4 dram silk = 64,000 yards per lb.

$\sqrt{64{,}000} = 252.9 - 10.1\ (4\%) = 242.8$

Answer: $\frac{1}{243}$ inch is the diameter of 4 dram silk.

The microscope, with which the machine for testing the diameter of threads is equipped, is mounted on a stand, which can be made to slide along the bed of the machine in a line with the thread, which passes between pegs on the table of the microscope.

By focussing, the thread can be made to come up sharp and clear on the black surface of the table (a slip of white paper being placed on the table for a dark-colored yarn) enabling the thread, magnified about 20 times, to be seen across a micrometer scale, by means of which it is possible to measure it to the one-thousandth part of an inch.

By sliding the microscope in a line with the thread, the effect of any of the previous tests, on any part of the thread, can be minutely observed.

Identification and Separation of Fibres.

For the purpose of testing textile fibres as to their identity, the micro-photograph is of great value, but if the question comes up to ascertain the proportion of cotton mixed with wool, cotton with silk, or some other mixtures, chemical analysis gives results of greater value and accuracy.

There is, however, one precaution to be taken which is frequently overlooked, and this is the necessity for checking the analysis by ascertaining the amount of the dissolving reagent or chemical which remains in the weighed fibre, and we must also take into account any loss that may have resulted from partial solution.

If a mixture of cotton and wool is under consideration, we should treat some weighed pure cotton with a caustic solution in exactly the same manner that the mixture is to be dealt with, noting the loss or gain in weight, estimating the ash, and making proper corrections for moisture.