FABRIC ANALYSIS.

(Continued from September issue.)

Grading of Yarns as to Size or Counts.

The diameter of yarns, technically known as their *count* or *number*, are based (with the exception of raw and artificial silks) upon the number of yards necessary to balance 1 lb. avoirdupois. The number of yards thus required vary for each raw material. The higher the count, the finer the yarn with reference to its diameter.

Cotton Yarns.

Cotton yarns have for their standard (hank) 840 yards, and are graded by the number of hanks 1 lb. contains. Consequently if 2 hanks (or 2 × 840 yards) = 1680 yards are necessary to balance 1 lb. we classify the same as number 2 cotton yarn. Continuing in this manner, always adding 840 for each successive number, gives us the yards the various counts or numbers of cotton yarns contain for 1 lb.

GRADING OF 2, 3 OR MORE-PLY YARNS.

In connection with 2-ply yarn, the number of yards required for 1 lb. is one-half the amount of that called for by the single thread.

Example: 20's cotton yarn (single) equals 16,800 yards per pound, while a 2-ply thread of 20's cotton, technically indicated as 2/20's cotton, requires only 8400 yards per pound, or is equal to the amount of yards called for in (single) 10's cotton.

If the yarn is more than 2-ply, divide the number of the single yarn by the number of ply, the result being the equivalent counts in a single thread. Thus 3/60's equals single 20's; 4/60's equals single 15's, etc.

ASCERTAINING WEIGHT IN OUNCES OF A GIVEN NUMBER OF YARNS OF A KNOWN COUNT.

Multiply the given yards by 16, and divide the result by the number of yards of the known count required to balance 1 lb.

Example: Find weight of 12,600 yards of 30's cotton yarn.
12,600 × 16 = 201,600
1 lb. 30's cotton yarn = 25,200 yards.
201,600 ÷ 25,200 = 8 oz. *Ans.*

Another rule is: Divide the given yards by the number of yards of the known count required to balance 1 oz. (being yards per lb. ÷ 16).

Example: Find the weight of 12,600 yards of 30's cotton yarn.
25,200 ÷ 16 = 1,575 yards 30's cotton yarn = 1 oz.
12,600 ÷ 1,575 = 8 oz. *Ans.*

ASCERTAINING WEIGHT IN POUNDS OF A GIVEN NUMBER OF YARDS OF A KNOWN COUNT.

Divide the given yards by the number of yards of the known count required to balance 1 lb.

Example: Find the weight of 1,260,000 yards of 30's cotton yarn.
30's cotton yarn = 25,200 yards to 1 lb.
1,260,000 ÷ 25,200 = 50 lbs. *Ans.*

TO FIND THE EQUIVALENT SIZE IN SINGLE YARN FOR 2 OR MORE-PLY YARN OF MINOR THREADS OF UNEQUAL COUNTS.

If the compound thread is composed of *two* minor threads of unequal counts, divide the product of the counts of the minor threads by their sum.

If the compound thread is composed of *three* minor threads of unequal counts, compound any two of the minor threads into one, and apply the previously given rule to this compound thread and the third minor thread not used before. In a similar way continue proceedings with 4 or more-ply yarns.

Example: Find equal counts in a single thread to a 3-ply yarn composed of 20's, 30's, and 50's.
$20 \times 30 = 600 \div 50\ (20 + 30) = 12$
$12 \times 50 = 600 \div 62\ (12 + 50) = 9\frac{21}{31}$ *Ans.*

A second rule for finding the equivalent counts for a yarn when three or more minor threads are twisted together is as follows: Divide one of the counts by itself, and by the others in succession, and afterwards by the sum of the quotients.

Example: Find equal counts in a single thread to a 3-ply yarn composed of 20's, 30's. and 50's.
$50 \div 50 = 1$
$50 \div 30 = 1\frac{2}{3}$
$50 \div 20 = 2\frac{1}{2}$

$5\frac{1}{6}$ and $50 \div 5\frac{1}{6} = 9\frac{21}{31}$ *Ans.* The same as before.

Woolen Yarns.

Run System.

Woolen yarns, with the exception of the mills in Philadelphia and vicinity are graded by *runs*, which have for their standard 1600 yards. Consequently 1 run yarn requires 1600 yards to 1 lb., 2 run yarn 3200 yards to 1 lb., etc., always adding 1600 yards for each successive run or number. In addition to using whole numbers only as in the case of cotton and worsted yarn, the run is divided into halves, quarters, and occasionally into eighths, hence, 200 yards equal $\frac{1}{8}$*th* run, 400 yards equal $\frac{1}{4}$*th* run, etc.

ASCERTAINING WEIGHT IN OUNCES OF A GIVEN NUMBER OF YARDS OF A KNOWN COUNT.

The run basis is convenient for textile calculations by reason of the standard number (1600) equaling 100 times the number of ounces that 1 lb. contains; thus by simply multiplying the size of the yarn given in run counts by 100, and dividing the result into the number of yards given (for which we have to find the weight) gives us as the result the weight expressed in ounces.

Example: Find the weight of 7200 yards of 4 run yarn.
4 × 100 = 400, and
7200 ÷ 400 = 18 oz. *Ans.*

ASCERTAINING WEIGHT IN POUNDS OF A GIVEN NUMBER OF YARDS OF A KNOWN COUNT.

Transfer result obtained in ounces into pounds or fractions thereof.

Example: Find the weight of 100,000 yards of $6\frac{1}{4}$ run yarn.
100,000 ÷ 625 = 160 oz. ÷ 16 = 10 lbs. *Ans.*

Cut System.

Woolen yarn is also graded by the *cut* system, of which 300 yards is the standard. Calculations are the same as those for cotton yarns, using 300 as standard in place of 840.

Worsted Yarns.

Worsted yarns have for their standard 560 yards to the hank, the number of hanks that balance 1 lb. indicating the number or the count by which it is graded. Calculations are the same as given for cotton yarns, with the difference of using 560 in place of 840 for the standard.

Silk Yarns.

True Silk.

Silk yarns are graded as to their count either by the *denier* or the *dram* system, the first being generally used as applying to raw silk, the other to indicate the size of thrown silk.

DENIER SYSTEM: The length of skein adopted for basis is 450 meters and the unit of weight $\frac{1}{2}$ decigram; thus the count is expressed by the number of $\frac{1}{2}$ decigrams that 450 meters silk weigh.
450 meters = 492.12 yards.
1 lb. = 453.6 grams.
1 gram = 20 deniers.
1 lb. = 9072 deniers.
1 denier = 492.12 yards.
9072 deniers = 4,464,513 yards.

DRAM SYSTEM: The length of the skein adopted for basis is 1000 yards and the unit of weight 1 dram, which equals 256,000 yards per lb. The count is expressed by the number of drams (and fractions of drams) that 1000 yards weigh.

Denier : Drams.
4,464,513 yards to 1 lb. in denier system
256,000 " " 1 " " dram "

Dividing the first number by the last number gives us 17.44 deniers equal to 1 dram.

Spun Silks.

Spun silks are calculated on the same basis as cotton (840 yards to one hank) the number of hanks 1 lb. requires indicating the count. In the calculation of cotton, woolen or worsted 2 or more-ply yarn, the custom is to consider the ply yarn correspondingly 2 or more times as heavy as the single yarn; thus doubled and twisted 40's (technically 2/40's cotton, equals single 20's cotton for calculations, etc. In the calculation of spun silk the single yarn equals the 2 or more-ply; thus single 40's, or 2 or more-ply 40's require the same number of hanks (40 hanks = 33,600 yards) to balance 1 lb. The technical indication of 2 or more-ply spun silk yarn is for this reason correspondingly reversed if compared to cotton, wool and worsted yarn, and where the numeral indicating the ply is put in front of the counts indicating the size of the minor threads (for example 2/40's) while in indicating spun silk this is reversed (for example 40/2's) *i.e.*, in the present example single 80's is doubled to 40's.

Artificial Silks.

The numbering of these yarns is done on the same basis as true silk, calculated by the legal denier (which is 450 meters = 0.05 grams) *i.e.*, 9,000 meters = 1 gram.

To Ascertain the Counts of Minor Threads of Union or Twist Yarns, or Fabrics.

This refers to test and calculations often required in the manufacture of fancy worsted fabric. Very often the combination of the two kinds of yarns is used in the warp, like for instance in some styles of Covert Cloth and where the warp is composed of a rather fine count of cotton yarn twisted over a heavier worsted thread. In the finishing process the fabric is then wool dyed, which will leave the cotton white, imparting to the fabric the characteristic mix, *i.e.*, salt and pepper effect, as we technically call it. In some other fancy effect fabrics the union of two threads, composed of different materials, may be done so as to produce a certain effect not possible to be duplicated otherwise. For instance, a fine count of a cotton thread may be twisted over a mohair yarn, the function of the cotton thread being to impart strength to the yarn during the weaving of the cloth. The mohair thread if used alone as a single thread would result in poor weaving, or possibly prevent weaving at all, on account of the long fibres protruding from the core of the thread clinging together in the formation of the shed and prevent the latter from opening properly for the passage of the shuttle. During the finishing process of the fabric these cotton threads are then carbonized (*i.e.*, chemically destroyed) leaving the lustrous mohair warp yarn intact, in turn imparting to the fabric the desired pleasing appearance.

Previous to taking up these calculations in connection with fabric structures it will be well to explain a

SHORTENING OF CALCULATIONS FOR WORSTED AND COTTON YARNS.

To shorten calculations use a *common multiple* or *constant number*, and which is **12.5** for worsted yarn and **8.33** for cotton yarn.

To ascertain worsted count by calculation, provided number of yards and weight in grains are known:

Multiply the common multiple 12.5 with number of yards of yarn you are testing and divide product by the number of grains said sample of yarn weighs.

Example: Length of yarn 28 yards; weight 10 grains. Then

12.5 (*c.m.*) × 28 ÷ 10 = 35.

Answer: The counts of the yarn is 35's single worsted (or 2/70's if dealing with a 2-ply yarn).

If dealing with a cotton yarn, the common multiple to use then will be 8.33.

Example: Solve previously given example considering the cotton yarn thread in this instance, and finally prove this calculation in connection with the first.

8.33 (*c.m.*) × 28 ÷ 10 = 23.32 + or practically single 23's to 24's cotton yarn (or 24's on the heavy side) is the count of the yarn.

Proof:

35's worsted (35 × 560) = 19,600 yards per lb.

23.33 cotton (23.33 × 840) = 19,597 + yards per lb. or what is the same length as the worsted yards.

To Ascertain the Count of Worsted and Cotton Components in Union Yarns.

Two ways for doing this are at our command, *viz:* (*a*) calculations only, and (*b*) chemical procedures in connection with calculations.

CALCULATIONS.

Unravel or untwist a definite length of the union thread and weigh the worsted and cotton minor threads separately.

Example: Suppose 10 yards of worsted and cotton yarn weigh 4.2 grains, what will the compound thread equal, expressed in worsted yarn counts.

12.5 × 10 = 125 ÷ 4.2 = 2/59.5's worsted.

Provided the worsted thread when untwisted weighs 2.8 grains and the cotton thread 1.4 grains, the count of either minor thread used is ascertained thus:

12.5 × 10 = 125 ÷ 2.8 = 44.6 count of worsted thread.

8.33 × 10 = 83.3 ÷ 1.4 = 59.5 count of cotton thread.

These counts are approximately (in practical work) equal to single 45's worsted and 60's cotton.

Considered as a 2-ply worsted thread, the same would equal

12.5 × 10 = 125 ÷ 4.2 = 29.76 or practically speaking a (29.76 × 2 = 59.52) 2/60's worsted thread. *Ans.*

Proof: Change cotton count to its equal in worsted, to make calculations possible.

60's cotton = 90's worsted.

Combining 90's and 45's worsted then gives us, by using rule "Multiply both counts and divide product by their sum," the following calculations:

90 × 45 = 4050

90 + 45 = 135 and

4050 ÷ 135 = 30's single or 2/60's worsted, *Ans.*, or the same as before.

CHEMICAL TESTS AND CALCULATIONS.

Dissolve the wool in a boiling solution of caustic soda or caustic potash. The count of the cotton thread may afterwards be calculated from the weight of the residue which is left on the completion of the process. The test is carried out in the following way:

Reel on a wrap reel a suitable length of the yarn to be tested and weigh it in grains.

If 60 yards weigh 25 grains, the count then will be equal to

12.5 × 60 = 750 ÷ 25 = 30's single or 2/60's worsted count.

To carry out this experiment accurately, it is necessary to obtain the absolute dry weight of the material, owing to the fact that cotton and worsted have varying properties for absorbing moisture. In consequence the standard regains for the amount of moisture permissible in these two materials are considerably different, being 8½ per cent for cotton, and 18¼ per cent for worsted. This means that 100 lbs. of absolutely dry material, when submitted to the atmosphere, will regain 8½ lbs. and 18¼ lbs. in weight respectively.

The absolutely dry weight is obtained by placing the sample in a conditioning oven and drying it until the weight remains constant for at least five minutes. The weight of the sample in its absolutely dry condition is now (for example) 21.75 grains.

A solution of 2½ per cent caustic soda, or 10 per cent caustic potash is then prepared, and the sample boiled therein until all the wool has been dissolved. The residue is next filtered and washed very thoroughly to remove any alkali from it, and is again placed in the conditioning oven until absolute dryness is obtained, after which the sample is again weighed; this (for example) equalling 7.5 grains. During the boiling of the material in the alkaline solution, there is a loss sustained by the cotton amounting to 2 per cent, which must be added to the residue, in turn giving us

7.5 grains + 2 per cent (7.5 × 102 ÷ 100) = 7.65 grains.

This weight (7.65 grains) represents the absolute dry weight of the cotton residue, so there must be added to it the standard regain of 8½ per cent, to bring the cotton into correct condition, and to enable the correct count to be obtained. Hence:

7.65 grains + 8.5 per cent (7.65 × 108.5 ÷ 100) = 8.3 grains, correct conditioned weight of the cotton residue.

The original length taken for the experiment was 60 yards, and therefore the length of the cotton thread forming the residue will also be 60 yards; then the count may be obtained by the following calculation:

8.33 (*c.m.*) × 60 = 499.8 and

499.8 ÷ 8.3 = 60.2 = single 60's cotton. *Ans.*

The count of the worsted yarn may be found by (*a*) deducting the weight of the residue from the original dry weight *i.e.*, 21.75 less 7.65 = 14.1 grains. To this weight must be added the standard regain of 18¼ per cent for worsted yarn, to bring the worsted into correct condition.

14.1 grains + 18.25 per cent (14.1 × 18.25 ÷ 100) = 16.67 grains.

This represents the correct conditioned weight of the worsted yarn. The length will be taken as 60 yards, and the count may be obtained as follows:

12.5 (*c.m.*) × 60 = 7500 ÷ 16.67 = 44.99 = single 45's worsted, *Ans.*

Proof: Determine the worsted count required to produce twisted with single 60's cotton a 2-ply thread equal in count to 2/60's worsted count. Proceed as before explained:

60's cotton = 90's worsted and 2/60's worsted = single 30's worsted.

90 × 30 = 2700 ÷ (90 — 30 =) 60 = 45's worsted.

The final result may then be checked by the following:

Question: What is the compound count expressed in worsted standard provided a single 60's cotton and 90's worsted are twisted together?

60's cotton = 90's worsted and following rule previously quoted we find:

90 × 45 = 4050 and

4050 ÷ (90 + 45 =) 135 = 30's single or 2/60's worsted, *Ans.*

Proceeding by explanations thus given, the compound value as to counts for any union or twist yarn can be readily ascertained.

(To be continued.)

A NOVEL CONSTRUCTION OF WOVEN TIRE FABRICS.

By John Skinner.

The same refers to a new fabric structure used in the manufacture of pneumatic rubber tires used on automobiles, motorcycles, bicycles, flying machines, etc.

To illustrate the construction of the new fabric the accompanying two illustrations are given and of which Fig. 1 is a view in perspective of a portion of the tire broken away in part to show its construction and embodying the new fabric structure; Fig. 2 is a plan view of a breadth of the new fabric.

The latter can be woven on any loom, using warp and filling in the usual way. The warp-threads used are of a rather low count of yarn, heavily twisted, and if so desired are impregnated with rubber or any other suitable compound. The filling, and which is of a rather high count of yarn, only interlaces with the warp-threads at the edge sections or portions of the strips so that the warp-threads form a sheet extending throughout the body of said tread portion of the tire, from one bead to the other. The edge sections or portions of the strip extend through the bead and are of sufficient width as to be readily embodied in the tire at the edge and as also to present a means by which the fabric may be readily handled in the manufacture of the tire, while maintaining the floating warp-threads in position. The strips are formed by severing the fabric along the medial lines of the interwoven warp-threads and fabric zones which extend at an angle of 45 deg. to the length of the fabric and thus the resulting strips are symmetrical and reversible.

With reference to fabric structure Fig. 2 numerals of reference indicate thus: 1 warp-threads, 2 picks, 3 interwoven portions of fabric formed in a diagonal direction (preferably at 45 deg. as shown) and 4 two selvages produced in the usual manner.

The filling threads extend throughout the width of the fabric and are cut away, *i. e.*, removed between the diagonal zones 3 if so desired. The dimensions of the fabric and the width and positions of the interwoven parts (zones) 3 of the fabric depends upon the particular requirement of the tire and may be varied as desired.

The distance between and normal to the medial lines 5 — 5 of the interwoven parts 3 of the fabric is to be equal to the width required for a strip of fabric to be embodied in the tire and the width of the entire breadth of fabric can be as great as desired, depending upon the length of the strips.

It will thus be seen that the fabric woven as described may be cut into strips by severance along the medial lines 5 of each zone. Each strip will then present interwoven edge sections with floating warp-threads extending between the sections.

Owing to the fact that the filling threads are of a relatively small diameter, the interwoven edge sections are in thickness not materially different from the intermediate sheet of warp-threads so that when two or more strips of the fabric are superimposed, the super-

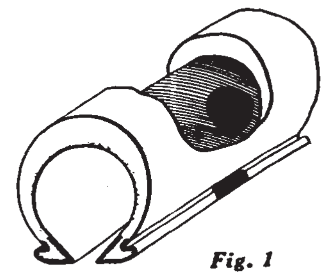

Fig. 1

imposed edge sections are not materially thicker than the superimposed medial portions of the floating warp-threads. This enables two or more strips of the fabric to be embedded in the tire without producing an undue thickness at the edge or bead portion of the tire.

When the strips of fabric are placed in the tire they are placed so that the floating warp-threads run and cross each other in opposite directions and with the angle of the warp-threads at 45 deg. they will cross each other at right angles, as shown in Fig. 1.

Great strength is secured in the fabric when it is embedded in or secured to the bead and a ready means is provided by the interwoven edge sections for the handling and positioning of the fabric during the manufacture of the tire. The sheets of floating warp-

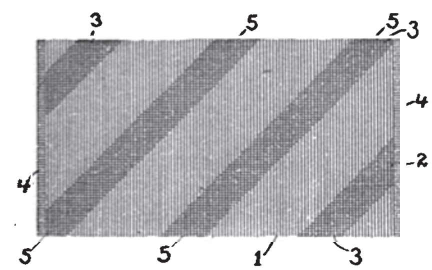

Fig. 2

threads extending diagonally through the body of the tire give a maximum of strength to the wall portion and since they are unconfined, do not detract from the flexibility or elasticity of the tire.

Shawls, the Fashion in Russia.

An interesting fashion that has become a feature in women's apparel in Russia is the wearing of bright-colored shawls, made usually of cotton, but sometimes of silk, with fringes at the ends. These shawls have for their background black, white, orange, red, or green, with picturesque flower patterns stamped on them, roses being the most common flower used for the purpose. The coloring of the floral figures as a rule is red, pink, or blue, with green for leaves and stems.

The shawls are comparatively long in proportion to their breadth, and resemble somewhat the women's shawls in vogue in Spanish countries.

It is understood that this shawl fashion has been adopted from the costumes worn by peasants in certain districts of Russia; the patterns are those long known to cottage peasant industries.