standard 12.5 used in the previous calculation and which will give us:

$$\frac{14.11 \times 4}{1.67} = 34\text{'s metric.}$$

It must be remembered that the counts obtained in this way from a sample of cloth are only approximate as there is a certain amount of loss during the scouring, bleaching, dyeing and finishing processes, which may or may not be compensated for by the curvature of the yarn (take-up) due to the shrinkage of the threads in crossing each other (weave) which causes the length of each thread to be greater in its yarn state than that of the finished cloth from which our sample for testing was taken. The increase in the length of the thread, noticeable when it is put under slight tension, enables a good estimate to be formed of the amount that the cloth has shrunk in weaving and finishing, and it is only by estimating and allowing for the loss due to finishing, etc., on the one hand, and the gain due to shrinkage in weaving and finishing on the other, that the actual counts can be obtained. No general rule can be laid down here, experience is the only guide. Preserving records of calculations of samples of cloth and yarn thus tested, will greatly simplify your labor by using them for comparison with new tests.

Changing Cotton "Yard System" to "Metric System" and Vice Versa.

The French system of numbering cotton yarns is based upon the metric system. The relation between fineness and weight or length for weight is exactly the same as in the English yard system (as used in this country, Great Britain, Germany and Switzerland) using a fixed weight and a variable length.

The fixed weight employed (in the metric system) is 500 grammes, and the number or count of the yarn is indicated by the number of hanks (each 1,000 metres long) required to weigh 500 grammes.

EXAMPLE: If 27,000 metres weigh 500 grammes, the resultant counts are 27's or 27 times the unit of length.

The French reel being made 1.428 metre in circumference, then:

1 round .... = 1.43 metres = 56¼ inches.
70 rounds = 1 lea (échevette) = 100 metres
700 rounds = 1 hank (échevaux) = 1000 metres

700 rounds × 1.43 metres gives only 999.60 metres length of yarn theoretically; in practice the superposition of the threads gives approximately the 1,000 metres.

The proportion existing between the "Yard" and the "Metric" system is:

Yard System:
768.08 m (840 yds.) weighing 453 grms. (1 lb.) = 1's cotton yarn by the yard system.
Metric System:
1000 m weighing 500 grms. = 1's cotton yarn calculated by the metric system.

$$\frac{1\text{'s Yard counts} \times 768.08 \times 500}{1000 \times 453 \times \text{Metric counts} (.0847)} =$$

$$\frac{\text{Yard counts}}{\text{Metric counts}} = \frac{1}{0.847}$$

RULE: (Using *constant* number 0.847)
Yard counts × 0.847 = Metric counts.
Metric counts ÷ 0.847 = Yard counts.

Another *constant* number sometimes used is 1.18, used inversely, thus:
Yard counts ÷ 1.18 = Metric counts.
Metric counts × 1.18 = Yard counts.

The former is the correct proportion and more accurate, on account of "closed" fraction resulting, as will be seen by using both *constant* numbers, with one example.

Using *constant* number 0.847
20 (Y. c.) × 0.847 = 16.94 (M. c.)
16.94 (M. c.) ÷ 0.847 = 20 (Y. c.)
Using *constant* number 1.18
20 (Y. c.) ÷ 1.18 = 16.94 + (M. c.)
16.94 (M. c.) × 1.18 = 19.98 + (Y. c.)

Artificial Silk Counts, Mercerized Cotton and Spun Silk Counts.

The discovery of artificial silks was made on the Continent in Europe, and consequently the numbering of these artificially produced yarns was originally calculated on the same basis as true silk *i. e.* on the Italian denier scale.

This system of numbering artificial silk yarns still holds good, with the result that in making comparisons with mercerized cotton and spun silk yarns, a great deal of confusion arises.

The standard hank used in the calculation of artificial silk yarn counts, according to the London Silk Conditioning House, is equal to 476 metres, approximately 520 yards, and the system of numbering is such that the weight in *deniers* of this length of yarn constitutes the count or number.

It will be understood from this that the coarser the yarn the higher its count will be an exact antithesis of cotton, woolen and worsted yarn numbering. Another debatable point is the equivalent weight of the Italian denier, since the latter varies in different districts. The London Silk Conditioning House gives the weight of a single denier as .001875 ounces or an equivalent of 533⅓ deniers in one ounce or 8533⅓ deniers to the pound avoirdupois.

From this data it will be easy to solve any problems involving the conversion of a denier count into a spun silk or cotton count or *vice versa*.

EXAMPLE. What is the equal in cotton as well as spun silk of 150's denier artificial silk?

Remembering that according to the London Silk Conditioning House, 150's denier indicates that a length of 520 yards of artificial silk weighs 150 deniers we can easily ascertain by proportion the yards per lb. and divide them by the cotton or spun silk standard 840.

EXAMPLE: Ascertain Yards of 150's deniers artificial silk, technically known as *fibre silk*.

520 : 150 : : x : 8533.33 = 29582.2 yards in one pound 150's denier artificial silk.

29582.2 ÷ 840 = 35.21. *Ans.* Practically 150's artificial silk equals single 35's cotton or spun silk or 2/70's cotton or 35/2's spun silk.

Calculations thus given result in the following
RULE: To convert a denier count into a single cotton or spun silk count, "Divide 5282.5 by the *denier* count given."
PROOF (of above example):
5282.5 ÷ 150 = 35.21. *Ans.*

This explains at the same time the ready conversion of cotton and spun silk yarn counts into fibre silk, *i. e.*, artificial silk counts using
RULE: Divide 5282.5 by the cotton or spun silk yarn count.
EXAMPLE: Convert 35.21's cotton or spun silk (as a proof of previous example given) into fibre silk count.
5282.5 ÷ 35.21 = 150's denier fibre silk count. *Ans.*

EXAMPLE: Convert 35's single cotton or fibre silk or 2/70's cotton or 70/2 fibre silk into the denier fibre silk count.
5282.5 ÷ 35 = 151 deniers, fibre silk count. *Ans.*

THE MANUFACTURE OF BEAVER OVERCOATINGS.
(*Continued from March issue.*)

(3) ARRANGEMENT OF WARP AND FILLING 2:1.

This arrangement comprises the most often used beaver weaves, resulting in what we may call a most perfect face and construction of a fabric, consistent with cost and production. If so desired, for the sake of cheapness of fabric, the use of a cotton back warp and a heavy count of back filling can be used, without deteriorating the face as well as construction of the cloth produced.

Fig. 17 illustrates such a beaver weave, having for its face the 3-harness warp effect twill (*a*) shown in *full* type; for its back the same weave (*b*), see *cross* type; for stitching the two plies the 3-harness filling effect twill (*c*) running in the reverse direction from that of face and back weave, see *dot* type.

Diagram *d*, is the complete double cloth, *i. e.*, beaver weave, repeating on 9 warp-threads and 9 picks. Crochet type used in presenting this weave has been selected to correspond to that used in connection with diagrams *a*, *b*, and *c* so as to simplify its method of construction to the reader. *Small dot* type in the complete weave *d* indicates the rule of any perfect double cloth structure, *viz:* "raise all the face warp

on every back pick." The stitching is done with the back warp into the face filling, according to rule governing perfect construction of regular double cloth.

Fig. 18 shows us the most extensively met with beaver weave, having for its face the 4-harness uneven sided broken twill, warp effect (a) see *full* type. For
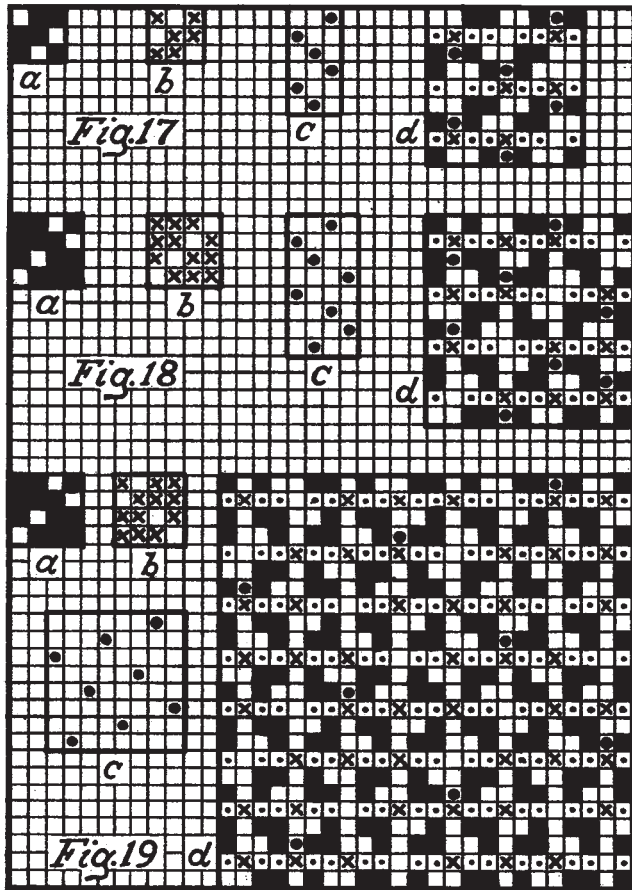
back weave the 4-harness straight twill, warp effect (b) see *cross* type, is used. For its stitching the 4 by 8 skip twill, filling effect, skipping filling ways, (c) see *dot* type, is used. d is the complete double cloth weave, *i. e.*, beaver weave, repeating on 12 warp-threads and 12 picks.

Crochet types in diagrams a, b, c and d are again selected to correspond. *Small dot* type in diagram d shows the raising of the back warp on every back pick.

This 4-harness broken twill, warp effect, is the weave for producing the body for a nice, close, full nap; the weave which comes nearest to the plain broadcloth weave, a weave which will show no twill effect whatever on the face of the fabric. In other words, this broken twill takes the place of the plain weave in connection with heavy-weight fabrics, and where the plain weave is more or less out of question to be used. On account of the importance of this broken twill as a weave for producing a perfect face, for face finished fabrics, two more examples of it are given in connection with weaves Figs. 19 and 20.

Fig. 19, a face weave, the 4-harness broken twill, warp effect. b back weave, the same as face weave. c stitching, the 8-harness satin, filling effect. d complete double cloth, *i. e.*, beaver weave, repeating on 24 by 24; constructed with crochet type to correspond with that used in diagrams a, b and c.

THE MANUFACTURE OF PAPER YARNS FOR TEXTILE PURPOSES.
Twisting Strips Into Weavable Yarn.
(Continued from March issue.)

The excessive ballooning of the thread during ring spinning was the reason for the invention of special machines for spinning this paper yarn, resulting in spinning machines in which no ballooning of the paper strip during twisting can take place, and where the yarn is wound in cross-shape, *i.e.*, to and fro on a bobbin spool, building itself up with strong ends on both sides. A working diagram of such a machine is shown in Fig. 7, and which will readily explain the procedure how the paper strip, as produced on a slitting and rewinding machine, after dampening, is twisted into paper yarn.

The paper-strip roll p produced on a slitting and rewinding machine is in turn placed upon a revolving disk t, from where the end of the paper strip is passed around roller i and in turn between a pair of guide rollers c, then to the pair of drawing rollers a and a', of which a is the driven roller and b the mate pressure roller, both working in unison. b is an endless driving band, *i.e.*, spindle band as we technically call it in connection with spinning machinery. Motion is imparted to this band b by threading it around a revolving tin cylinder (not shown) and when the motion of the latter, through band b, is transferred to spindle g and thus to the revolving disk t (as is secured to the spindle) with its contents on it, and which thus imparts the required twist, the yarn being for this purpose securely held by the bit of the two drawing rollers a and a' after which it is wound through the revolving carrier roller e onto ball s, which when filled with paper yarn is either stored or transferred direct to the spinning machine, as the case may require.

If so desired, the machine is equipped with a device for moistening the sliver at the moment when leaving the pair of guide rollers c, and thus just when the twisting starts.
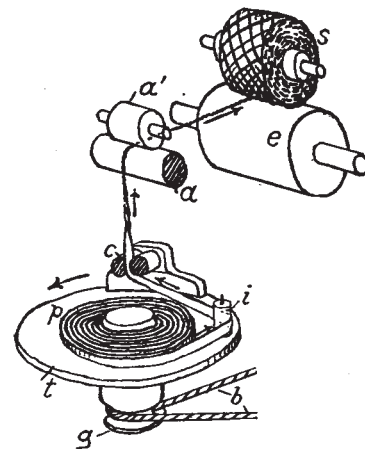

Fig. 7

Fig. 8 is a detail diagram (partly in section) of a portion of working diagram Fig. 7, showing revolving disk t and its whirl g in section, showing also the guide rollers c, as well as the twisting of the paper strip.

Disk t when revolving is automatically closed up by covering d, to prevent a premature drying of the