On pages 73, 74, 75, 120, 121 and 122 of Vol. IV, the reader will find a thorough description of the various processes for manufacturing silk practised.

Lately a new apparatus for producing in separate threads, artificial silk of the viscose class (see page 73, Vol. IV) obtained by treating cellulose with soda, sulfid of carbon and water, has come to our notice. The thread obtained by the new process, possesses a superior dye-absorbing power to that of viscose-thread obtained by former procedures.

The accompanying illustration, Fig. 1, is a diagrammatic view of the new apparatus, it being given in order to explain the process more readily to the reader.

The solution of cellulose (viscose) is contained in closed reservoir 1, from which it is forced up into compartment 5 by the pressure of compressed air admitted into reservoir 1 by a pipe 3. The pipe 2 conveys the viscose from the reservoir 1 to a draw-plate 4, which is immersed in a coagulating bath 5. The thread, as soon as it has become coagulated in the bath 5 passes successively into the baths 6, 7 and 8.

Bath 6 consists of water acidulated with 7% of sulfuric acid at a temperature of 158° F. The effect of this bath is to render the thread insoluble in water.

Bath 7 consists of water at the ordinary temperature, with intense circulation, and is intended for the washing of the thread.

Bath 8 contains water, ordinary soap, oil and soda, in order to completely neutralize the thread and prevent its adhering to the dryer.

Location of Apparatus. The viscose reservoirs 1 are installed in the basement of the mill, with a constant temperature, below the engine. About ten or fifteen draw-plates 4 are supplied by the same reservoir and it is thus possible to give the whole of the viscose pipes exactly the same form and approximately the same length. It is thus easy to obtain an equal rate of supply with the pipe full open for the whole of the draw-plates, the pressure and frictional resistances being themselves equal; moreover it is possible to control the temperature of the viscose up to the point where the pipes issue above the floor of the room, which is a great advantage in the spinning of artificial silk.

In its passage through the different baths, the thread is supported by power-driven, fluted rollers 9, the circumferential speed of which is exactly equal to the velocity of the run of the thread through the machine.

During the passage of the thread from one bath to another, the same rubs against a rubber sponge so as to remove any excess of liquid taken up and to cause it to fall back into the bath.

On leaving the bath 8 the thread passes over the dryer 10, around which it is made to travel several times.

The thread is rotated in an oblique direction (3 turns as a rule) around this cylinder 10, being guided in this operation by power driven shifter rollers 11, in order to give the thread a new position on the dryer at every revolution of the latter, in order to thus facilitate the drying of the thread. The shifter rollers 11 correspond in number to the revolutions made by the thread around the cylinder.

Fig. 2 is a front, and Fig. 3, a sectional view of the dryer. The dryer 10 is mounted to overhang on a pillar 13, and is provided with an interior heating device 14 through which steam is made to circulate.

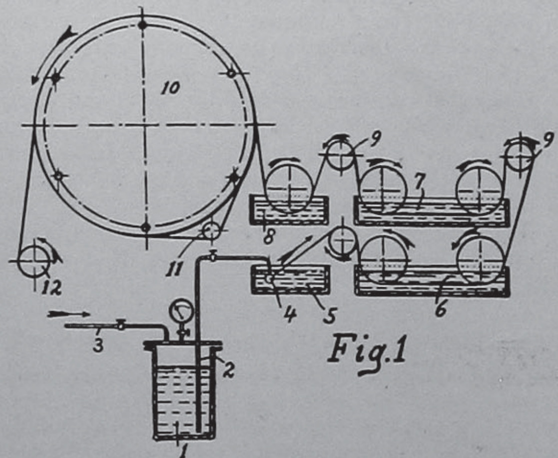


Fig.1

On finally leaving the dryer or dryers, provided more than one are used in the operation, the thread is wound on a bobbin 12 (see Fig. 1), the twisting and skeining being afterwards effected in the usual way.

As will be readily understood, several threads can be manufactured simultaneously on the same machine by means of the same arrangements keeping the individual threads separate.

The power driven, fluted rollers 9 are mounted to overhang at one end of their axis. One or more of the flutings of rollers 9 is or are prolonged beyond their front faces to form one or more projecting knobs, about $\frac{1}{6}$ inch high. The object of these knobs is to facilitate the process of starting.

The workman, holding the thread in his right hand, takes hold of it again with his left hand so as to follow approximately the rate at which it is being fed

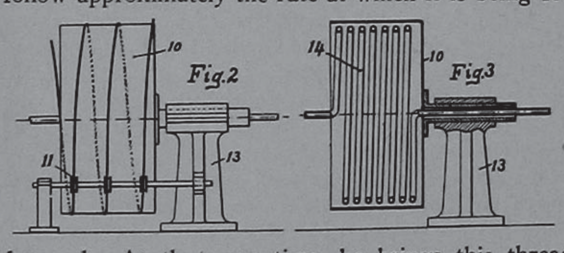


Fig.2 Fig.3

forward. At the same time, he brings this thread close to the roller 9 on which it has to run and without letting it go he causes it to be engaged by one of the knobs. The thread mounts at once of its own accord onto the flutings and the workman, always keeping the end in his hand continues to follow the thread as it is supplied, taking it up again and passing on to the following roller.

A workman of average skill is easily able in a short time to pass the end of the thread over the whole machine when running at a speed of 65 to 85 yards per minute.

PRACTICAL POINTS ON GIGGING.

(*Continued from page 165, Vol. IV, No. 6.*)

In making use of the teasel, two points must be kept in mind, *viz:* the mounting in the teasel slat, and the wear upon it after in use in the gig.

In the mounting of the teasels in the slats, which is a framework of iron, designed to hold the teasels in place and present a smooth, that is even, surface to the cloth to be worked upon, much effectiveness to the teasel is secured. They must be set in the slat so firmly that they will stand all the speed and working about which will be brought to bear upon them after they are on the cylinder of the gig. There must be no open spaces between them, and the teasels must be as much as possible of one quality.

Fig. 5 shows us such a teasel slat or frame drawn in outlines, a portion of the slat being shown filled with teasels.

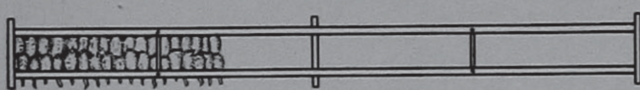


Fig. 5

Fig. 6

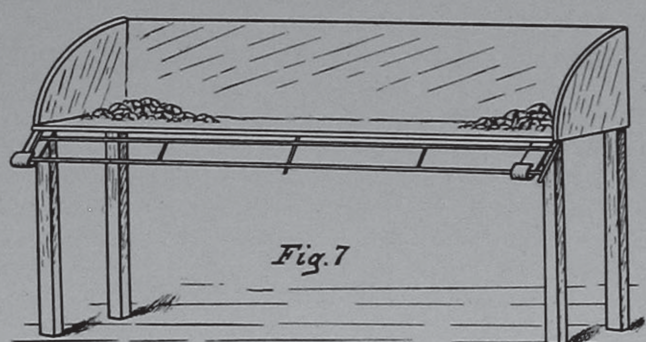


Fig. 7

Fig. 6 is a detail illustration of a portion of said slat, being drawn enlarged compared to Fig. 5, to show its shape more definite.

These slats are light, wrought-iron frames, the upper bar of which is of an arched shape, while its lower section is formed by two parallel bars having a space of about ½" between them. The space between the two bars in the slat is about 3½", cross stays being riveted about every 14 to 15 inches. The length of the slats depend on the width of the fabrics made by the mill, 56 inches being the average width of the bulk of our 6/4 wide woolen goods (inside the selvedge) met with; calling in turn for a teasel surface in the slat of about 58 inches or more. Packed tightly between the two bars, the teasels are held in their place in the slat, by their tops entering space in the concave top bar, while their stems pass between the double bars at the bottom.

Fig. 7 shows us a sketch of a teasel-setter's bench, the same having secured to it at its front two slanting brackets *a*, designed to hold the slat, the latter being shown in heavy lines. Standing or sitting before this bench, with a supply of proper sized teasel heads before him, the setter proceeds to fill the slat tightly packed with teasels presenting a solid, uniform, surface of hooked spines.

All the teasels must be set the same way—that is, with the hooks pointing in the same direction, as a raising action is only exerted when the heads act on the fabric from the stem end to the top. After the slat is filled, the stems as projecting from the lower bars, are then sliced off level with the slat by means of a long, sharp knife. It is not essential that each teasel stem should project between the bottom bars of the slat; one or two here and there are quite sufficient to bind the lot firm, into a mass.

Some finishers advocate moistening the teasels before they are mounted, so that they can be the more firmly and easily pressed into place. If such is made use of, the usual practice is to take a basket full of teasels at a time and steam them slightly, which will soften them and in turn make them easier to be handled. However it must be remembered that a teasel in a moist state is soft and therefore useless, again moisture will destroy its life, so that in order to make the slats thus mounted of any use, they will have to be quickly and thoroughly dried. This means a corresponding loss in time and labor before the teasel ever reaches the stage where it can do work, a fact certainly against this procedure of steaming or moistening teasels for the sake of setting them easily. Again when the fingers of the teasel setter are properly protected, teasels may be set in the dry state just as evenly as if they were moistened, and this more effectively. It may at the beginning take more time for him to set a certain number of slats, but that will be only a short while and then he will be just as expert at it as if setting moistened teasels. The teasels are then not injured and can be pressed together just as solid and just as even as if they were moist. Teasels mounted in the dry state are apt to stay in the frame longer than those mounted in the moist state.

Mounting teasels requires a good, quick eye, since it will not do to mount these teasels carelessly, they must be properly sorted first and afterwards still more or less selected as to size during setting or mounting the slats, since otherwise an uneven surface would result, and in consequence uneven and streaky work produced. Some shipments of teasels come to the mill with their stems cut off close, while others have stems 4 or 5" long left on, and which stems are then clipped down to about two inches in length, by a boy.

The proper selection, *i. e.,* buying of the proper size and quality of teasels is another important factor for good work at the process of gigging. There is no reason why the teasels should not be of a size to fit the slats. For instance why should we use a 2¼ or 2½ inch teasel with *buttons* to fill out with, when a teasel of about 1¾ inches would make a better slat and this with less trouble? It must be remembered that a 2½ inch teasel, as a rule, is more expensive than a 1¾ inch teasel, again that buttons, *i. e.,* small unripe teasels amount to nothing more or less than throwing away of good money for very poor material. Certainly growers and sellers of teasels must get rid of them, for they are of no use to them, neither of much use to anyone else. However, the price of these buttons is somewhat tempting to manufacturers, the same being as a rule so low, that it seems like a fair investment on their part to use them; but it should be remembered that these buttons or small teasels are not as well matured as the full grown ones, they being open and soft, and their usefulness in the actual process of gigging amounts to nothing; they simply fulfilling the purpose of holding the teasels which do the work in their proper place in the slats. If this purpose however is attained, by teasels which are effective in the process of gigging, certainly much less dead or useless material has to be handled. Again if the proper size teasel is bought by the mill, it must be remembered that it is not only easier for the teasel setter to mount the slats, but that every one of the teasels in such a slat will be of some decided usefulness, in turn reducing the cost of the teasels as well as the expenses in setting them in slats.

When set, the complement of slats for a gig is twenty-four, and which are then fitted and in turn belted down to the surface of the large cylinder or cylinders on the gig, to prevent any danger of the slats working loose, doing not only damage to the cloth and the machine, but at the same time on account of the great velocity of the gig cylinder becoming a point of danger to the operator of the machine, until the machine is stopped, as well as to persons working nearby.

(2) Tension.

With reference to this subject, we touch another vital point of gigging, one which requires most careful attention and manipulation on the part of the operator. It has always been one of the most important points to builders of gigs to construct a machine by means of which it is possible to be able to regulate to a nicety the tension of the cloth as it is stretched before the cylinder of the gig, in order to allow the machine to do its most effective work and at the same time bring about the best results in the finished fabric.

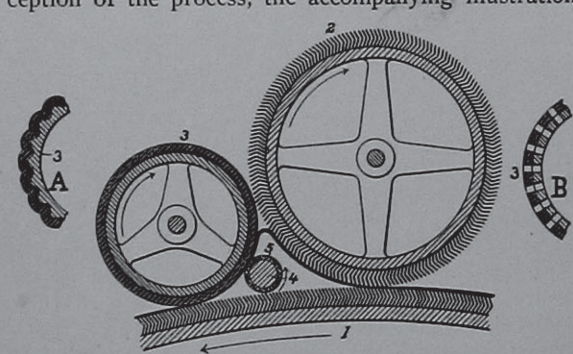
The difficulty however is one natural to the process, resting not so much with the construction of the machine as with that of the goods. If every piece that had to be gigged came to the machine in exactly the same condition as regards weight, stock and construction, then the matter of tension would be very simple indeed; however this is not the case, since fabrics vary so much in weight and construction, that an equal tension on two pieces which differ slightly in weight per yard would result in a perceptible alteration in the appearance of the face of the goods, and which difference would be heightened during the successively following finishing processes. Again differently constructed fabrics take in turn differently to gigging, and when the latter process must be always more or less regulated to suit the kind of cloth under operation. If, for example, the pieces of cloth under operation are made with a different number of picks to the inch, then the same amount of tension given to the fabric cannot possibly bring about similar results. For this reason it will be found an advantage to the operator to know enough about the construction of the goods to be gigged, in order to be able to regulate the tension so as to produce as nearly as possible uniform results to fabrics under operation. This, however, is no easy task, and can only be accomplished after considerable experience and skill on the part of the operator. This difference in tension as required for different fabrics, may not amount to much where the goods are heavy weights and do not require a great amount of work, but if the goods happen to be light weights and the gigging correspondingly light, the difference in tension required becomes then an important item.

(To be continued.)

A New Carding Arrangement.

The object, *i. e.*, advantage claimed for the new device, is to produce a smoother, evener and stronger yarn, especially so in connection with carpet yarns destined for plush or velvet (Wilton) carpets. The fibre being straighter, the yarn is more even, hence it is claimed, the pile stands up better in the fabric.

In order to be able to give the reader a clear conception of the process, the accompanying illustration



is given, showing a portion of the swift, a worker, a stripper and a tension roller. The usual number of these workers and strippers is used. Numeral of reference 1, indicates the swift, covered with the ordinary card clothing, and rotated in the present instance in the direction of the arrow. Arranged in regular order around this swift are the workers 2, also covered with card clothing, the teeth of which are opposed to the teeth of the swift. Adjacent to each of the workers 2, are the strippers 3, covered, in the present instance, with leather, insuring a smooth or comparatively smooth surface, *i. e.*, a surface that will support the web, in a continuous unbroken film. The workers and strippers rotate in the direction indicated by the arrows. As shown in the illustration, the web of the material under operation, in passing around the swift, is alternately caught up from the latter by the workers, and in turn removed from them by the strippers, to pass in turn onto the swift again.

The inventor of the new device claims that a comparatively smooth surfaced roller will act as a stripper, to remove the fleece from the workers and pass it onto the swift again. The strippers, being covered with leather, can be set very close to the swift, say $\frac{1}{64}$th part of an inch.

When the card is in operation, the surface of the strippers readily covers itself with grease or other foreign matter contained within the material under operation, causing complete contact of the grease covered stripper with the swift. The friction of the wire covered swift against the grease covered stripper, removes any excess of grease, thereby keeping the contact even and uniform. The fibre, by this close and even contact of the strippers and swift, is spread all over the latter in an even and uniform manner, thus allowing an equal portion of the stock or fibre to be taken, later on, by the doffer rings.

If so desired, the stripper may be fluted, as shown in diagram *A*, or have small holes bored into it, as shown in diagram *B*, thus further enhancing the stripping qualities.

The new arrangement enables us to use larger sized workers, thereby bringing a greater surface of the card clothing into contact with the stock between the swift and said workers, as the stock is not carried over the top of the workers in the manner common to the regular process of carding.

The object of the new process is to effect a drawing and straightening of the fibres as the web leaves the strippers. To do this, tension rollers 4 are arranged, and which rollers lie close in contact with the strippers 3, and being rotated in the proper direction, effect a drawing action between said rollers and the strippers while the fibres are being taken up again by the swift, causing the fibres to lengthen out and straighten, thereby removing from the finished slubbing, the twisted and confused appearance usually present. By having smooth or comparatively smooth surfaced rollers for the strippers, the drawing and straightening action of the carding process is enhanced and the fibre is not likely to be torn as with a roller having toothed clothing. The web, after it passes the last of the workers, is then transferred, by the usual devices, into the characteristic roving strands.

The rolls 4 may be of plain metal, or preferably they are covered with leather, as shown at 5, arrangements being provided to be able to adjust them toward and away from the strippers, in order to be able to regulate the amount of tension and drawing effect upon the fibres of the web.

A Direct Warper, that Traverses the Spool and not the Warp.

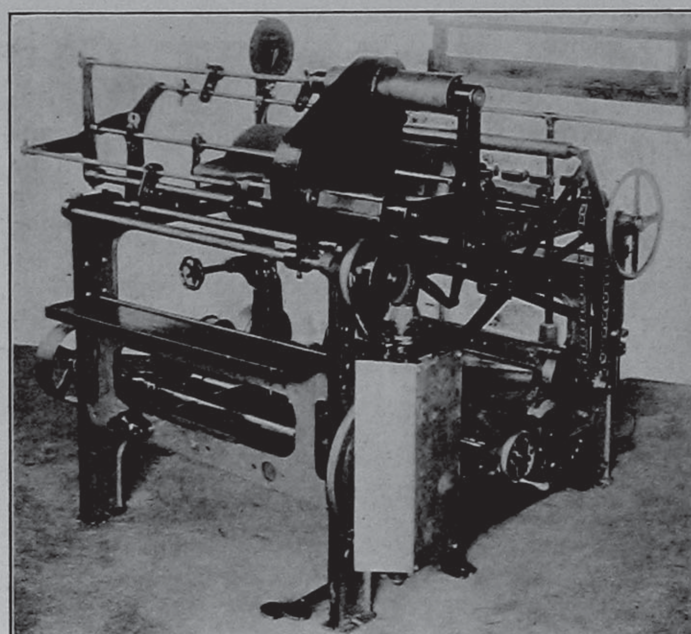
Ribbon Manufacturers will be glad to be made acquainted with the fact that such a Warper has just been perfected by Mr. Charles H. Knapp, of Paterson, N. J., the prominent Designer and Builder of Special Textile Machinery. This new Warper is shown in the accompanying illustration, in its perspective view.

There are two most prominent items which Mr. Knapp has aimed at in the construction of this direct warper, and this is improved quality as well as quantity of production.

The better *Wind* is obtained by the fact that the warp threads are held in the machine in one position, by a stationary porcelain guide, *i. e.*, the warp threads do not travers from end to end of the spool, as has been the case in warpers of former construction; the spool being made to travers, in the new warper, with the result that the outside situated threads of the warp, *i. e.*, its edges are not crossed and twisted, as has always been the case with former built warpers.

Giving the weaver better warps for his looms, more particular in connection with Narrow Ware Looms, and where any number of these warps are contained in one loom, will result in a better weaving of such warps, resulting in a more perfect fabric woven, as well as in a larger production per loom in a given time.

This travers of the spools referred to, is at the command of the operator, he being able, by a con-



veniently located hand-wheel, in front of the machine, and while the latter is in operation, to regulate a longer or shorter travers.

The speed of the travers, *i. e.*, the distance traversed in one revolution of the spool, is regulated by a hand wheel, located conveniently on the side (near the floor) of the machine, permitting said hand wheel to be operated during the running of the machine, *i. e.*, every motion of the warper can be regulated by the operator, while said warper is running, hence no time lost in making changes.

The starting and stopping of the warper, also the speed, (fast or slow) is controlled by two foot levers, one located at the front and the other at the back of the machine and a hand wheel at the side. Levers and hand wheel are so connected with each other that pressing the foot levers will control the machine in the same way as turning the hand wheel at the side will do. This gives the operatives free use of their hands, to piece up broken ends, etc. The speed of the machine, fast or slow, stop or start, is all under control of the foot levers.

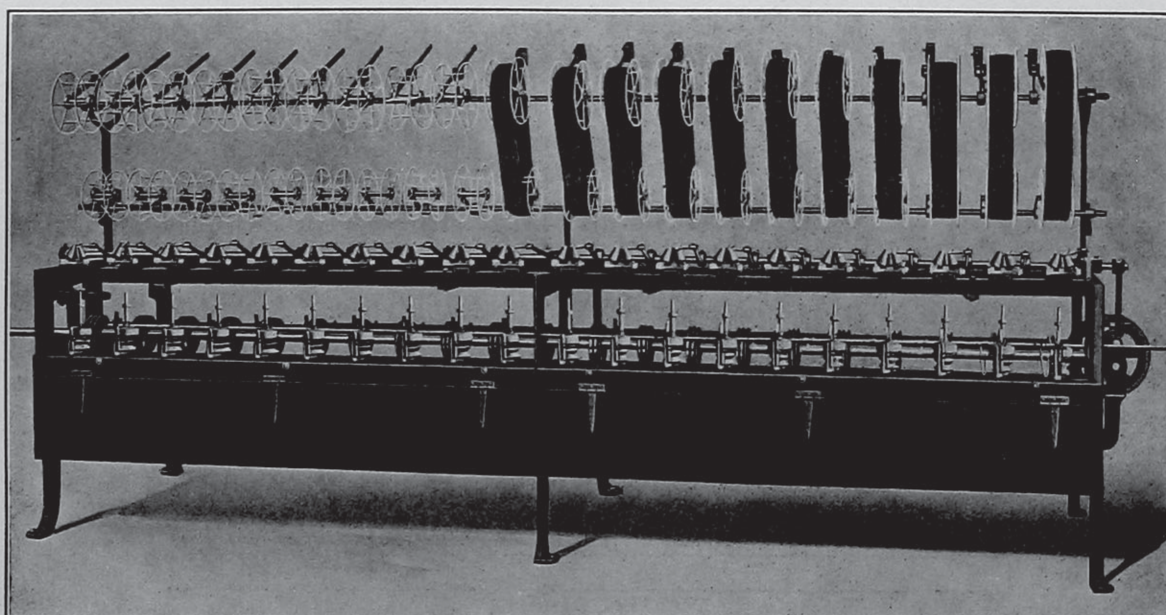
With reference to production, the machine will make four warps at one time on spools 8 inches long, 9 inch heads. On shorter spools, six and eight warps can be made at one time, facts which talk volumes for this new warper, without any further comment.

The Oswald Lever High Speed Cross Travers Quiller.

On pages 79 and 80, of the September issue of the Journal, the first description of this Winder in any Textile Journal was given. Since then, the Builders of it, The Oswald Lever Co., of Philadelphia, have kept on perfecting every detail of construction, applying at the same time, the Winder considerably to *net* silks, accomplishing in that line results which will astonish any Silk Throwster or Manufacturer, when he will be informed, for example, that in connection with 2 or 3-thread Japan Tram, the new machine with its *Lever Cross Travers* will wind sufficient filling on a filling holder, *i. e.,* Cop, to weave 72 inches of goods, when under the same conditions, *i. e.,* using the same number of picks, the same width of goods in reed, the same count of tram, and also the same size shuttle, the Quill with its straight travers, will only hold sufficient filling to weave 24 inches of goods.

Not only will this *Lever Cross Travers* permit of more filling (72:24=3 times as much) to be put on the filling holder, but at the same time less waste will be the result, since the *Lever Cross Travers* enables us to use up the Cop to the last inch of filling, without being compelled to put on any extra tension as is necessary when Quill runs down. Remember that the straight travers is not used with cops.

Being able to put 3-times as much Tram on the filling holder, besides resulting in an increase of production per loom, with its consequent less waste, at the same time will result in a considerable saving in freight charges between the Throwsters and the Weaving Plants. The tight wound Cops will take up little, if any more, space, than the Quills, with the result that a given size packing box will hold about 3-times as much Tram; and finally, the empty Cop has not to be returned to the Throwster, whereas the Quill has to.



WOOL SCOURING AND DRYING.

(*Continued from page 174, Vol. IV, No. 6*)

The "Stone" Dryer.

This dryer is constructed on a different line than any other wool dryer, presenting many features of advantage. Fig. 12 shows us a plan and Fig. 13 an elevation of the machine.

A description of the construction and working of this dryer is best given by quoting letters of references accompanying our illustrations, and of which *A* indicates a sheet steel cylinder, lagged with pine wood, forming the outer casing for the dryer, and being provided with angle iron runs for supporting the perforated steel table *B,* which is rotated by a pinion gear engaging rack under side of drying table. *C* are hot air chambers or boxes, containing steam coils. *D* is the self feed for feeding the stock to the machine. *E* is an exhaust fan for removing moisture, and *F* are three fans for circulating hot air. *G* are two fan pulleys for driving the three fans previously referred to. *H* is a blower for blowing stock from table, at *O,* after being dried. *I* is a cone pulley for driving the table, *J* a countershaft, and *K* a receiving friction pulley from main line. *P* indicates the blower pipe.

The operation of the machine is as follows: The stock is put into the self feed *D,* and by it is fed upon the perforated iron drying table *B,* which revolves slowly from right to left. The stock is subjected first to the action of the current of air from exhaust fan

E, which at once removes the excess of moisture through opening at the side of cylinder *A*. The stock,

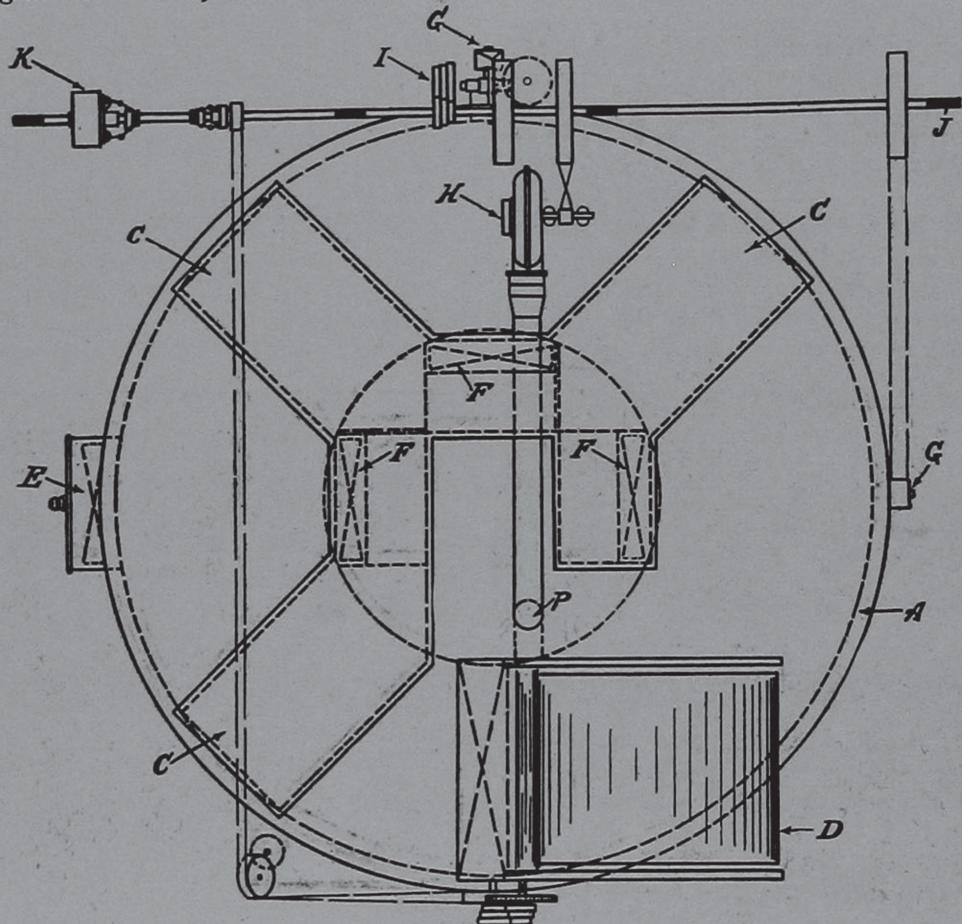


FIG. 11.

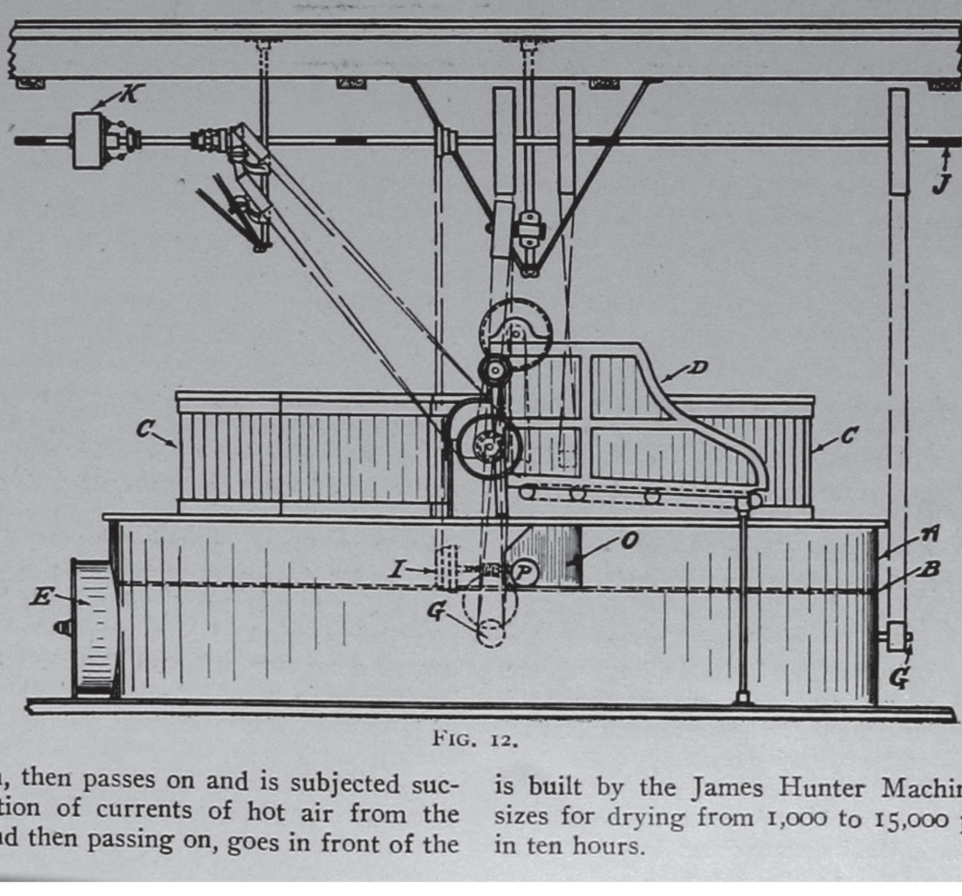


FIG. 12.

under operation, then passes on and is subjected successively to action of currents of hot air from the three fans *F*, and then passing on, goes in front of the blower pipe *P*, where it is ejected from the machine onto the floor, or into a proper receptacle. This dryer is built by the James Hunter Machine Company in sizes for drying from 1,000 to 15,000 pounds of wool in ten hours.

NOVELTIES IN DRESSGOODS.

FROM ABROAD.

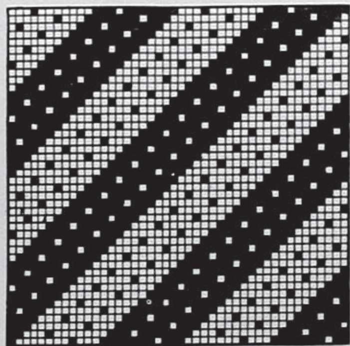


Fig. 1

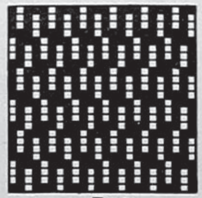


Fig. 2

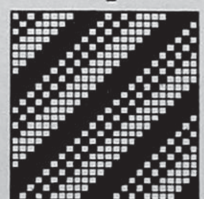


Fig. 3

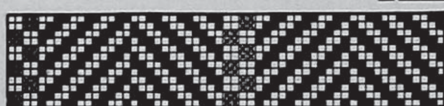


Fig. 4

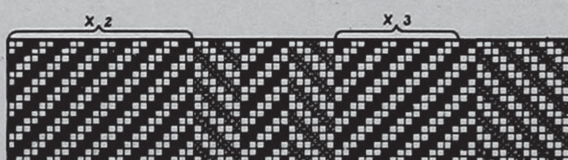


Fig. 5

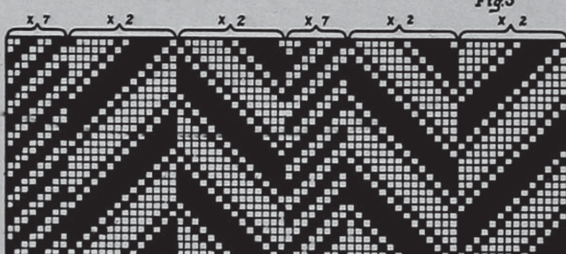


Fig. 6

Diagonal Dressgood. (2-COLOR EFFECT.)

Warp: 4450 ends, 2/64's worsted, light blue.
Weave: See **Fig. 1;** Repeat 22 by 22; 22-harness straight draw.
Reed: 21 @ 4 ends per dent; 84 ends per inch; 53″ wide in reed.
Dress: 10 Sections @ 445 ends.
Filling: 67 picks per inch, single 36's worsted, white.
Finish: Scour well, dry, shear, press, 48″ finished width.

Weave: See **Fig. 2;** Repeat 8 by 8; 8 or 16-harness straight draw.
Reed: 19½ @ 6 ends per dent; 117 ends per inch; 51″ wide in reed.
Dress: 1 end light shade.
1 end dark shade.

2 ends, repeat of pattern.
13 Sections @ 460 ends.
Filling: 65 picks per inch, arranged thus:
1 pick 36's worsted, light shade.
1 pick 24's cotton, dark shade.

2 picks in repeat of pattern.
Finish: Scour, dry, shear and press; 48″ finished width.

Cheviot Diagonal.

Warp: 2604 ends, 2/36's worsted, green mix cheviot.
Weave: See **Fig. 3;** Repeat 12 by 12; 12-harness straight draw.
Reed: 11½ @ 4 ends per dent; 46 ends per inch; 57″ wide in reed.
Filling: 45 picks per inch, 2/36's worsted, green mix cheviot.
Finish: Cheviot finish, full slightly, clear face on shear, 50 inches, finished width.

Gray Mix Dressgood. (STRIPE EFFECT.)

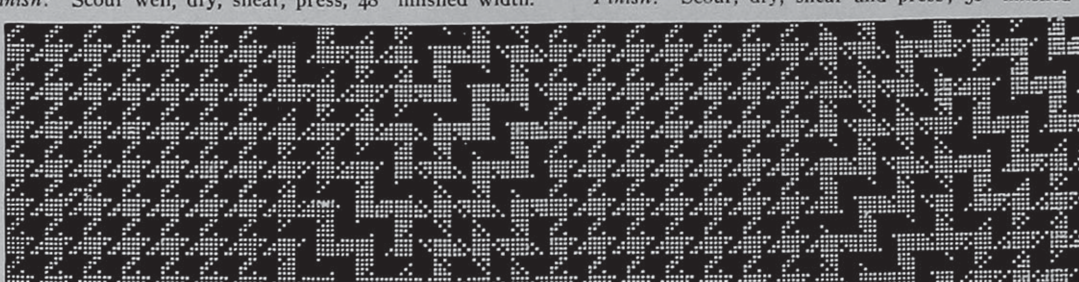
Warp: 4032 ends, 2/64's worsted.
Weave: See **Fig. 4;** Repeat 56 by 4; 8 or 12 or 16-harness fancy draw.
Reed: 21 @ 4 ends per dent; 84 ends per inch; 48″ wide in reed.
Dress: 2 ends, 2/64's worsted, dark gray mix.
2 " , " " , light gray mix.
24 " , " " , dark gray mix.
2 " , " " , light gray mix.
2 " , " " , dark gray mix.
24 " , " " , light gray mix.

56 ends in repeat of pattern.
9 Sections @ 448 ends; 8 patterns to one section.
Filling: 70 picks per inch, 36's worsted, light gray mix.
Finish: Scour well, dry, shear and press; 46″ finished width.

Fancy Worsted Suiting.

Warp: 4224 ends, 2/64's worsted.
Weave: See **Fig. 5;** Repeat 126 by 4; 8, 12 or 16-harness fancy draw.
Reed: 20 @ 4 ends per dent; 80 ends per inch; 52¾″ wide.
Dress: 48 ends, 2/64's worsted, white.
6 " , " " , light gray.
6 " , " " , white.
6 " , " " , light gray.
50 " , " " , white.
3 " , " " , light gray.
6 " , " " , white.
3 " , " " , light gray.

128 ends in repeat of pattern.
11 Sections @ 384 ends; 3 patterns to one section.
Filling: 72 picks per inch, 36's worsted cheviot, black.
Finish: Scour, dry, shear and press; 50″ finished width.



Color Effect for Fancy Diagonal Suiting (Check Effect) Fig. 6.

Half-Silk Dressgood.

(SPUN SILK, WORSTED AND COTTON, UNION.)

Warp: 5980 ends, 140/2 spun silk.

Fancy Diagonal Suiting. (CHECK EFFECT.)

Warp: 3520 ends, 2/64's worsted.
Weave: See **Fig. 6;** repeat 336 by 14; 18 or 22-harness fancy draw.

Reed: 16½ @ 4 ends per dent; 66 ends per inch; 53¼" wide in reed.

Dress: 4 ends, 2/64's worsted, light blue (delicate shade).
4 " , " " , medium blue.
—
8 ends in repeat of pattern.

8 Sections @ 440 ends; 55 patterns to one section.

Filling: 65 per inch, arranged thus:
4 picks 1/36's worsted, light blue (delicate shade).
4 " , " " , medium blue.
—
8 picks in repeat of pattern.

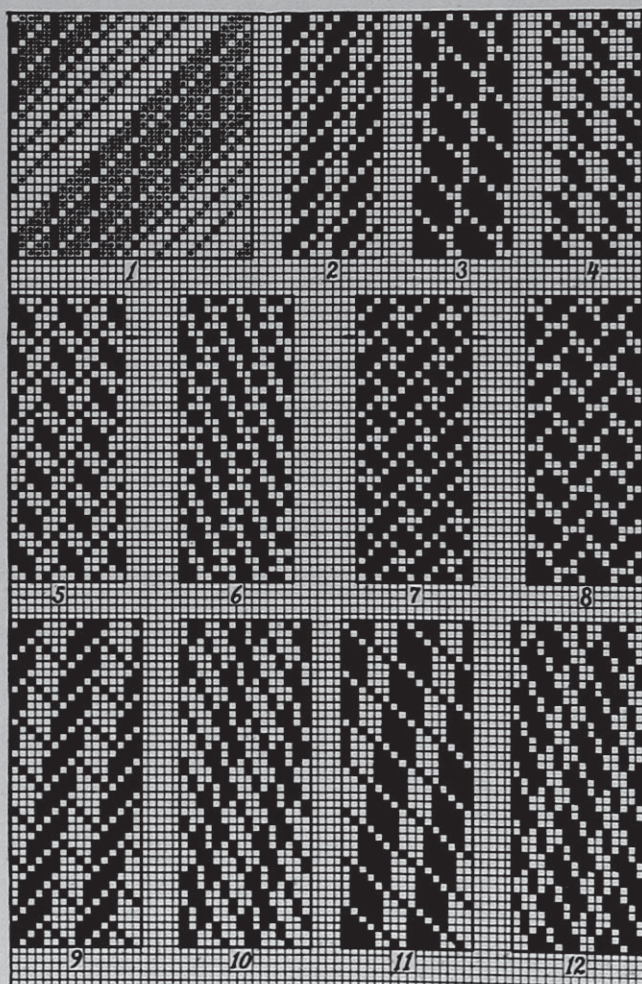
See special color effect given for this fabric structure.

Finish: Scour, dry, shear and press; 48" finished width.

DESIGNING AND FABRIC STRUCTURE FOR HARNESS WORK.

80° Steep Twills.

The same are another sub-division of our twill weaves, being obtained from our regular, *i. e.,* 45°



twills by means of drafting from any one of these regular twills, every 5th warp thread for the resulting 80 deg. steep twill, which on the point paper will show a much steeper twill effect than 75 deg. steep twills, as were shown and explained in the April issue of the Journal, that is provided the steep twill retains its diagonal effect. The latter, in many instances, is lost in the resulting 80 deg. steep twill, on account of the heavy grading, resulting in many instances in small well broken up granite effects, and where the foundation is only noticed upon closer inspection of the weave.

At the same time it must be remembered that the number of good weaves obtained by the present system of drafting steep twills, is not as numerous as is the case when drafting 63, 70 and 75 deg. twills.

Using only every 5th warp thread of the regular twill for the new steep twill, will indicate to us that with any foundation weave, which is evenly divisible by 5 only one-fifth of the number of harnesses is required for the 80 deg. steep twill, than is necessary for the foundation twill. In this way, a 30-harness regular twill will result in a 6-harness 80 deg. twill, for the fact that 30 divided by 5 equals 6.

Foundation twills whose repeat is not a multiple of 5, do not reduce with reference to harnesses required for its 80 deg. steep twill.

We will now explain the subject by means of a few practical examples, after which, as usual, we will give a few examples for the student to work out, in order to master the subject.

Fig. 1 is the $\frac{3}{5}\frac{1}{3}\frac{1}{3}\frac{1}{1}\frac{3}{1}\frac{3}{1}\frac{3}{1}$ 30-harness regular, *i. e.,* 45 deg. twill; the weave being shown in two kinds of crochet type, *i. e.,* every 5th warp thread of the twill is shown in *full* type, the remaining warp threads being shown in *dot* type.

Using warp threads 1, 6, 11, 16, 21 and 26, *i. e.,* warp threads shown in *full* type in diagram Fig. 1, consecutively in the construction of a new weave, results in weave Fig. 2, and which is the 80 deg. steep twill obtained from diagram Fig. 1, the steep twill Fig. 2 repeating on 6 warp threads and 30 picks; 2 repeats of the weave widthways being given.

Weave Fig. 3 shows us the 80 deg. steep twill obtained from its mate $\frac{5}{1}\frac{3}{5}\frac{3}{1}\frac{5}{1}\frac{5}{1}$ 30-harness regular twill, the steep twill repeating on 6 warp threads and 30 picks.

Weave Fig. 4 shows us another 80 deg. steep twill, the same having for its foundation the $\frac{8}{4}\frac{1}{5}\frac{1}{4}\frac{3}{1}\frac{}{1}\frac{1}{1}\frac{3}{1}\frac{1}{1}$ 30-harness regular twill.

Reading off in this way in our specimens of steep twills given in this lesson, the interlacing of the first warp threads with its picks, will always give us the reading off of the corresponding foundation twill, hence we will no longer quote foundations.

Weave Fig. 5 is an 80 deg. steep twill repeating on 6 warp threads and 30 picks, 5 picks more than the repeat of the weave being shown, in order to balance the appearance of the weaves on the plate.

Weave Fig. 6 is an 80 deg. steep twill repeating on 7 warp threads and 35 picks.

Weave Fig. 7 is an 80 deg. steep twill repeating on 6 warp threads and 30 picks, 5 picks more being given again, the same as was done in connection with weave Fig. 5.

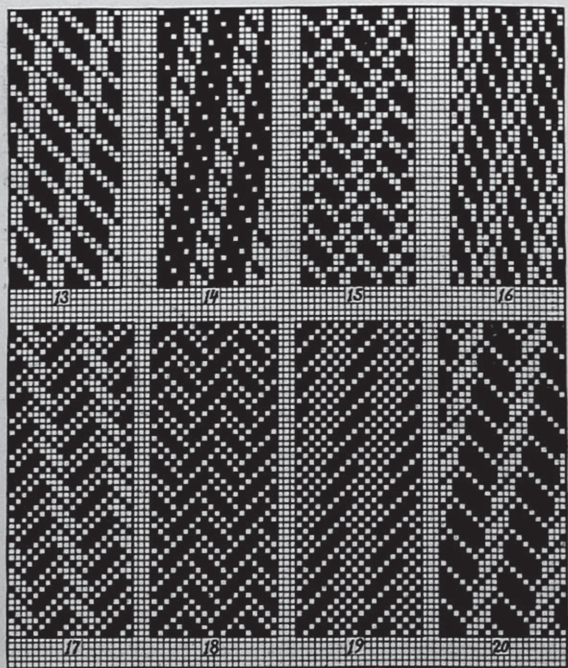
Weave Fig. 8 is an 80 deg. steep twill repeating on 7 warp threads and 35 picks.

Weaves Figs. 9, 10, 11 and 12 are four 80 deg. steep twills, each of them repeating on 8 warp threads and 40 picks.

Weaves Figs. 13, 14, 15 and 16 are four 80 deg. steep twills, repeating on 9 warp threads and 45 picks.

Weaves Figs. 17, 18, 19 and 20 are four 80 deg. steep twills, repeating on 10 warp threads and 50 picks.

From examples given, it will be readily seen by the reader that any number of these steep twills can be designed. To start him on original work, we herewith quote:



Questions:

Construct 80 deg. steep twills from the following seven regular twills:

$\frac{5\ 1\ 2\ 3\ 4}{5\ 4\ 3\ 2\ 1}$ 30-harness twill.

$\frac{4\ 5\ 4\ 1\ 1\ 1\ 1\ 1}{3\ 1\ 1\ 3\ 1\ 1\ 1\ 1}$ 30-harness twill.

$\frac{3\ 1\ 3\ 3\ 1\ 3\ 3\ 3}{1\ 3\ 4\ 3\ 1\ 1\ 1\ 1}$ 35-harness twill.

$\frac{3\ 1\ 2\ 1\ 1\ 2\ 1\ 2\ 1\ 3\ 1}{1\ 1\ 2\ 2\ 3\ 2\ 2\ 1\ 1\ 1\ 1}$ 35-harness twill.

$\frac{3\ 1\ 1\ 1\ 1\ 1\ 1\ 1\ 1\ 3\ 3\ 3}{1\ 3\ 1\ 3\ 1\ 3\ 1\ 3\ 1\ 1\ 1\ 1}$ 40-harness twill.

$\frac{5\ 1\ 1\ 1\ 5\ 5}{5\ 5\ 5\ 5\ 1\ 1}$ 40-harness twill.

$\frac{3\ 1\ 3\ 3\ 3\ 1\ 3\ 3\ 3}{1\ 3\ 3\ 3\ 3\ 1\ 1\ 1\ 1}$ 40-harness twill.

RIBBONS, TRIMMINGS, EDGINGS, ETC.

Velvet and Plush Fabrics.

(*Continued from page 178, Vol. IV, No. 6.*)

(c) Terry or Loop Pile Fabrics.

In these fabrics the pile is produced, *i. e.*, raised, without the aid of pile wires. They are woven on looms specially constructed for the manufacture of this class of fabrics.

In the manufacture of these fabrics, two systems of warp (on two beams) are necessary, one to carry the pile warp for the formation of the loop, and the other to carry the ground warp for forming the body of the fabric. Only one system of filling is used.

In the process of weaving these fabrics, the terry series of the warp is weighted looser than the lower or body series, or its warp beam arranged to let off the proper length of pile warp required at every third (the tight) pick, so as in either case to allow the loops to be formed on the surface of the fabric, by the lay swinging or being driven fully up to the fell of the cloth every third or fourth pick, the two or three previously inserted picks having been but partially beaten up. The three or four picks so interwoven, slide on the ground warp, which is let off with a more or less tight tension during the entire process of weaving.

The interlacing of the pile threads must correspond in the last pick of the preceding, and the first pick of the successively following filling section; either high, and when the loop will be driven on the face, or low, and when the loop will be driven on the back of the fabric.

Provided you want to change the position of the loops from face to back, at least four picks must be used at the change in the weave.

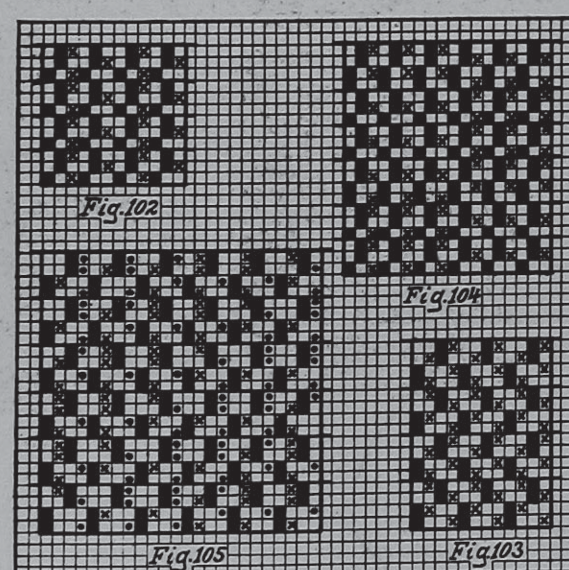
This system of pile weaving, in connection with Narrow Ware Fabrics, is used for trimmings for plush slippers, velvet and loop pile belts, etc.

Weave Fig. 102 is one of these systems of loop pile weaves, the arrangement of the filling being three picks to the section, *i. e.*, the loop. The arrangement of warp is two ends ground warp to alternate with one end pile warp. Warp threads 1, 2, 4 and 5, see *full* type, are the ground warp threads; warp threads 3 and 6, see *cross* type, are the pile warp threads.

Pile thread 3 forms a loop on the face of the fabric; pile thread 6 forming a loop on the back of the fabric.

Weave Fig. 103 shows us a loop pile weave, arranged with four picks to each section. The arrangement is one end ground warp (see *full* type), to alternate with one end pile warp (see *cross* type).

Every alternate pile warp thread, when driving up the picks, rests either on the face or on the back of the fabric.



Weave Fig. 104 shows us the pile warp threads (see *cross* type) interlaced after a check effect motive, the loops forming themselves according to the motive, either on the face or on back of the fabric. Three picks are used for each filling section, using four picks at the change of the effect.

Weave Fig. 105 shows us loop piles arranged in stripes, both sides being reversible. The pile threads are shown in our weave respectively by *cross* type, and *dot* type.

The heavy horizontal lines drawn in all four weaves thus quoted, show where the lay beats up close to the fell of the cloth, in order to form the characteristic loop either on the face or the back of the fabric, as was explained.

(To be continued.)

MOTIVES FOR STRIPES FOR HARNESS WORK.

(Continued from page 133, Vol. IV.)

In the accompanying plate of designs are given 28 new reproductions of stripes, suitable for all classes of Textile fabrics. They are a continuation of the

collections given in the November, January, February and May issues of the Journal, being furnished in the interest of the Designer for Figured Harness Work, Cotton, Worsted and Silk Dress Goods, Shirtings, Ribbons, Tapes, Edgings, etc., and where the harness capacity of the loom is limited.

The collection refers to designs for from 3 to 13 harnesses, for their execution on the loom. Explanations given on page 133, Vol. IV, refer also to this collection of motives.

142 of these designs for stripes for harness work have thus far been given.

THE MANUFACTURE OF OVERCOATINGS AND CLOAKINGS.

(Continued from page 182, Vol. IV, No. 6.)

B. Fur Cloth.

(2) Fur Cloth Weaves having Pile and Binder Picks.

A great many weaves which otherwise would be of little value for fur cloth fabrics, may be made use of, by adding special pile picks, which during gigging, supply the necessary fur covering. In former times, these weaves were in great demand; at present, their use is somewhat limited, for which reason only two examples, Figs. 36 and 37 are given.

Fig. 36 has for its binder picks, as shown by *dot* type, the plain weave. Every other pick is a pile pick, which interlaces for half the repeat with the plain weave, (see *full* type) and floats for the other half of the repeat on the face of the structure. This pick, while floating on the face of the fabric, at the process of gigging, produces the required fur covering. So as not to produce stripe effects on the face of the fabric, the floating of the pile picks is distributed after the 4-harness broken twill motive.

In Fig. 37, the weave for the ground picks is the 4-harness broken twill, warp effect. The motive for distributing the arrangement of the pile picks, and which interlace $\frac{1}{1}\frac{2}{1}\frac{1}{10}$ is again the 4-harness broken twill.

(3) Fur Cloth Weaves for Heavy Weight Fabrics.

If a certain weight of a fabric cannot be produced by means of single cloth weaves, we must then use the combination of a face and back filling. As a rule, only one system of warp is used, although two systems may be employed, if so desired.

In illustrations Figs. 38 to 59, the construction of some of the most frequently used weaves for such fabrics are given.

Weaves Figs. 38 to 47 have, for their foundation, either broken twills or satin weaves, filling effects.

The arrangement of the filling is one pick face to alternate with one pick back. The construction of these weaves has been thoroughly explained in *Technology of Textile Design*, on pages 105 to 108.

When designing these weaves, care must be taken to arrange the points of interlacing for the backing, as much as possible distanced, and at the same time evenly distributed, from the points of interlacing of the face filling. If dealing with foundation weaves, repeating on an uneven number of harnesses, this is easily accomplished; but if dealing with foundation weaves repeating on an even number of harnesses, the matter requires care and judgment, since a slight inclining towards one side is necessary.

By weaves of this kind, the float of the back pick corresponds to that of the face pick, in consequence of which the face and back of the fabric will look similar, provided one kind of filling for both picks is used, the principles of interlacing being identical for both the face and the back filling.

Weave Fig. 38 is the 4-harness broken twill, *i. e.*, the foundation for the fur cloth weave Fig. 39. For the face pick, filling effect is used, and for the back pick, warp effect, of said 4-harness broken twill.

In a similar manner we designed

Fur cloth weave Fig 41, from the 5-leaf satin, Fig. 40;

Fur cloth weave Fig 43, from the 6-leaf satin, Fig. 42;

Fur cloth weave, Fig 45, from the 7-leaf satin, Fig. 44; and

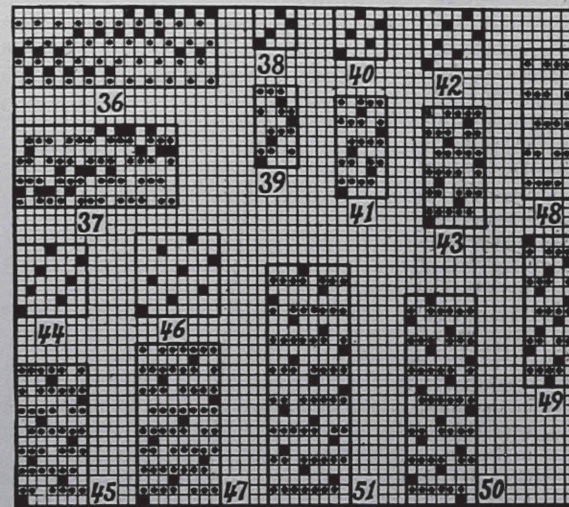
Fur cloth weave Fig 47, from the 8-leaf satin, Fig. 46.

Besides these fur cloth weaves, derived from broken twills and satins, we also can construct them from plain and fancy rib weaves, filling effects, used for face and back.

The next step for constructing new fur cloth weaves consists in changing the arrangement of face and back, to two picks face to alternate with one pick back.

How to construct these weaves is readily grasped by referring to weaves Figs. 48, 49, 50 and 51.

The first step is to put the back picks on the point paper, see Fig. 48; the weave used being the 5-leaf satin, warp effect. The next procedure is to select our face weave, and which must be a filling effect weave. Its selection is regulated by the weave used for the back; always taking care to distribute the points of interlacing as far away as possible, and as well distributed as is possible from the points of interlacing of the backing. Weave Fig. 49 is the fur cloth weave derived in this way from weave Fig. 48.



Weave Fig. 50 has for its foundation the 7-leaf satin, and

Weave Fig. 51 the 8-leaf satin.

(*To be continued.*)

DICTIONARY OF TECHNICAL TERMS RELATING TO THE TEXTILE INDUSTRY.

(*Continued from page 159, Vol. IV, No. 6.*)

Grassing:—One of the processes of retting, to which flax is subjected after removal from the steeping pool or retting dam. The object of spreading the stalks, called grassing, is, that by the action of the air and sun the drying process is completed as well as the fibres bleached. This process also renders the woody part (shove) short and brittle, and easily crushed and broken. About five or six days is the average time required for the process.

Gray or Grey:—Yarns or fabrics in an undyed or unbleached state; also such as are not scoured.
A term applied to the shades obtained by a mixture of white with black or some other dark color.

Gray Sour or Lime Sour:—An operation in calico bleaching consisting in washing the pieces in dilute hydrochloric acid, in which the insoluble lime soaps are decomposed, the lime removed, and other metallic oxides present dissolved, loosening at the same time the brown coloring matter.

Gray Washing:—In calico bleaching, the operation following singeing, consisting of washing the cloth in pure water for the purpose of wetting it out and rendering it more absorbent, also to remove some of the sizing of the warp.

Greasy Wool:—Wool, containing a great deal of yolk or suint, or wool fat.

Grege:—A trade name for raw silk.

Grenadin:—An impure commercial variety of fuchsin or magenta; a dyestuff.

Grenadine:—A dress material of cotton, silk or wool, or a combination. The goods are transparent, being sometimes produced in meshes or open work.

Grenadine Crepon:—A thin transparent material made entirely of wool, having a check-like pattern made of coarser threads or cords; used for women's summer dresses, etc.

Gres:—The saliva encasing the silk fibres for its protection. The amount present in raw silk being about 25 per cent. and upwards.

Griffe:—A series of horizontal bars cast in a reciprocating frame; being a part of the Jacquard machine placed there for raising and lowering the hooks and in turn the leashes of the Jacquard harness as connected to the latter.

Griffe Bars or Knives:—The bars of the griffe of a Jacquard machine.

Grille:—In lace, a background, consisting of bars or brides, crossing open spaces. The name is also given to the background itself.

Grisaille:—A fancy dress goods of French origin, woven on taffeta, having a printed cotton or silk warp and a worsted filling.

Grisette:—A gray woolen dress material characteristic of being worn by the working women of France.

Grist:—The Scotch term for *counts*.

Gros:—The French term for ribbed, *i. e.*, 2, 3, 4 or more picks in one shed of the taffeta weave; used in connection with silk fabrics, presenting on their face fine, medium or heavy ribs, designated in the market as Gros-grain, Gros d'Afrique, Gros d'Ecosse, Gros des Indes, Gros de Messina, Gros de Naples, Gros d'Orleans and Gros de Tours; the latter being the one presenting the most heavy corded surface, is made in black, and used for mourning purposes. Gros-grain is the finest of these corded silks, closely woven, to prevent the cords from standing out distinctly.

Ground:—That portion of a fabric, usually of a simple weave, which in connection with fancy structures serves as a base on which to display a figure.

Ground Warp:—In gauze weaving, the warp around which the whip threads twist.

In pile weaving, the warp which forms by interlacing with the filling the body structure.

Guanaco:—One of the native sheep of South America. Its wool is of the same nature and color as that of the Vicuna, but is shorter and coarser. When thoroughly scoured it is very fine and soft, and is employed in the manufacture of hats. It is also used for the manufacture of cloths for the covering of umbrellas.

Guipure:—A kind of lace in which the pattern or heavy parts are cut out of cambric, after which they are applied to an open part of stitch work.

A lace without a ground mesh, the pattern being held in place by connecting threads.

Gum, Sericin or Bast:—The gelatinous substance cementing the natural pair of brins into the bave or silk fibre (Fibroin) it being liberated from the silk thread after reeling by means of the boiling-off process, and in which silk yarn loses from 24 to 33 per cent.

Gums:—Gum Arabic, Gum Senegal, and Gum Tragacanth, are used occasionally in finishing cotton fabrics, in order to give stiffness and as a binding agent; but they cannot be used in quantities, owing to their liability to make the cloths sticky. They have a tendency to get sour, but this may be partially corrected by the addition of soda.

Gun Cotton:—Cotton which by steeping in a strong solution of nitro-sulphuric acid has become explosive.

Gunny:—A coarse heavy sacking of jute or hemp for wrapping cotton bales and for making bagging. It is manufactured to a great extent in Bengal, India; as well as Dundee, Scotland.

Gutta Percha:—The concrete juice of an evergreen saponaceous tree. Dichopsis (Isonandra) Gutta, common in the Malay peninsula and archipelago. It is used for a great variety of purposes, in insulating electric wires, in the manufacture of hose, belting and other flexible goods as a substitute for leather.

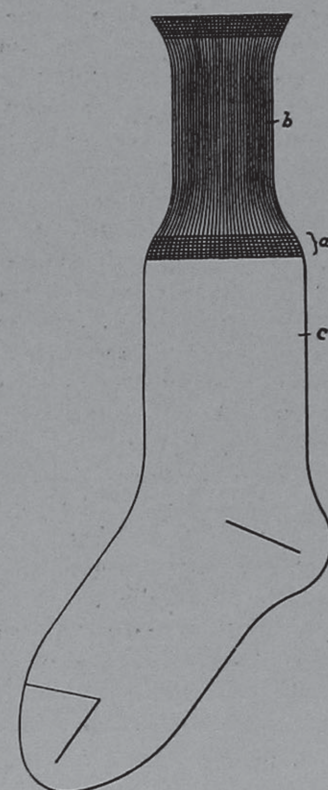
Guzzy:—A low grade of East Indian cotton cloth.

Gypsy Cloth:—A heavy napped cotton cloth used in the manufacture of negligee shirts, tennis and boating costumes, etc.

(To be continued.)

New Design for Hosiery.

The distinctive feature of the new design



(patented), is the ornamental band *a*, located at the junction of the ribbed top *b*, with the leg *c*.

Elastic Selvages for Knit Fabrics.

The sacks of some suspensory bandages are made of a knitted fabric strip provided at its side edges with elastic cords.

Such fabrics have heretofore been made in strips, knitted crosswise from one side edge to the other, each strip being about twenty-four inches long, as wide as the ordinary machine will knit. Ordinarily, about six cords are incorporated, side by side, in each side edge of the strip. When the machine starts to produce a strip, the stitches inclose the cord, which will form one edge thereof and then proceed in the usual way to inclose the other cords and make the intermediate part of the fabric and finally inclose five of the other cords, leaving a raw edge.

It has been customary to pick up by hand, each stitch of this raw edge with a needle threaded with one of the elastic cords which forms the outer edge of the strip, thereby finishing the strip and preventing the raw edge from running down. This, however, is a slow process.

The object aimed at in the formation of the new fabric structure, is to produce an elastic cord, inclosed therein at both side edges, by stitching in the knitting machine, and also to knit the fabric in strips of de-

sired width from end to end, instead of from side to side, and of any length required, thereby dispensing with the hand work heretofore necessary, and producing a fabric for this purpose with smooth and soft edges, which will not run down if the yarn should accidentally be broken.

The accompanying illustration is a plan view of a portion of a strip of the new fabric, showing the elastic cords somewhat extended, to show more plainly, their location.

The fabric is made with an elastic border 1 at each edge, said border comprising a plurality of elastic cords 2 arranged in parallel relation and inclosed by the stitching. The fabric, between the elastic borders, is made with a plain stitch section 3, adjacent to each of the elastic borders, and an intermediate rib stitch section 4. The elastic cords are covered with a rib stitch like the section 4.

A STUDY OF KNITTING.

(Continued from Vol. IV. No. 3.)

Automatic Sleevers.

While the Automatic Sleevers belong in the same class of knitting machinery as the Rib Top Machines, explained in the July, August and November issue, and its motions are similar, yet it differs from them in that it is a two feed machine, that is, two yarn carriers are used and consequently the cam outlines for the two sets of needles are different from those shown for the single feed Rib Top Machines.

Sleeves for underwear are the principal articles made on this machine, although it may be used for half hose tops if required, a greater production being obtained than with a regular Rib Top Machine, owing to the double feed.

With a single feed machine, one stitch is made for every revolution of the cylinder, whereas with a double feed machine, the needles make two stitches for every revolution of the cylinder. The two yarn carriers are placed opposite to each other on the cam cylinder. The dial plate cam, for operating the dial needles, is simply a condensed form of two cams from a single feed machine, the operating part of the single feed cam remaining unaltered while the part for the needle rest is replaced by another operating part of a single feed cam, although the needle rest is not entirely abandoned, but is greatly reduced.

The groove outline for a two feed dial cam is shown in the accompanying illustration Fig. 29. It will be noticed that there are two movable cams *A* and *B*, corresponding in their construction with each other, and which have the same outlines as that used on a single feed machine. Cam *A* will be used as the welt cam, and cam *B* as the tuck cam, both cams being operated from the pattern wheel.

The points 1 indicate the parts of the cam outline at which the needles are started to open, that is, begin to move outwardly. Points 2 are the portions which open the latches of the needles as they are operated upon, and push the stitches over the latches so that they rest on the needles behind said latches. Points 3 cast the stitches off of the needles, and thus close the latches of said needles, the yarn carriers having deposited yarn in the hooks of the needles when they were open. From points 4 to 1, the needles are at rest, the operations of the needles being the same as for the single feed, but it will be noticed, as was mentioned, that the needles rest only for a short space as compared to the single feed. The same cam rings *C, D, E* and *F*, on the outside of the cam groove, are used to keep the needles in their proper positions, as was explained in connection with the single feed in the July, August and November issue of the Journal.

With reference to the cylinder or vertical needles, the cylinder cam for operating them is also made to give two stitches in one revolution of the cylinder, or in other words, two single feed cylinder cams are made into one with a slight difference, which is that only one movable cam is provided for making the loose course stitch.

The stitches are made by the cylinder needles in the same relation to the dial stitches as explained in connection with the single feed in the July, August and November issue, that is, the stitches by the cylinder needles are made slightly in advance of those by the dial needles.

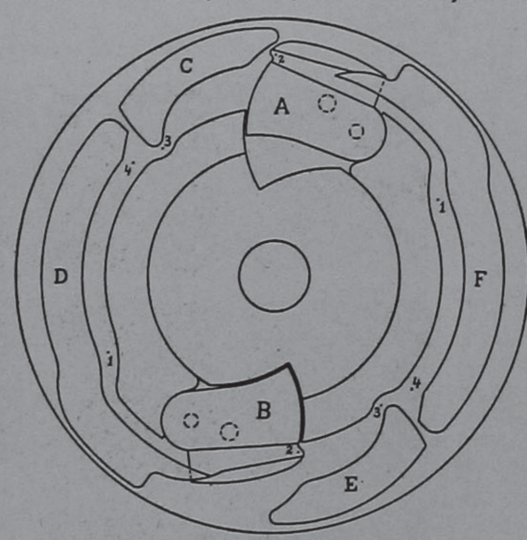


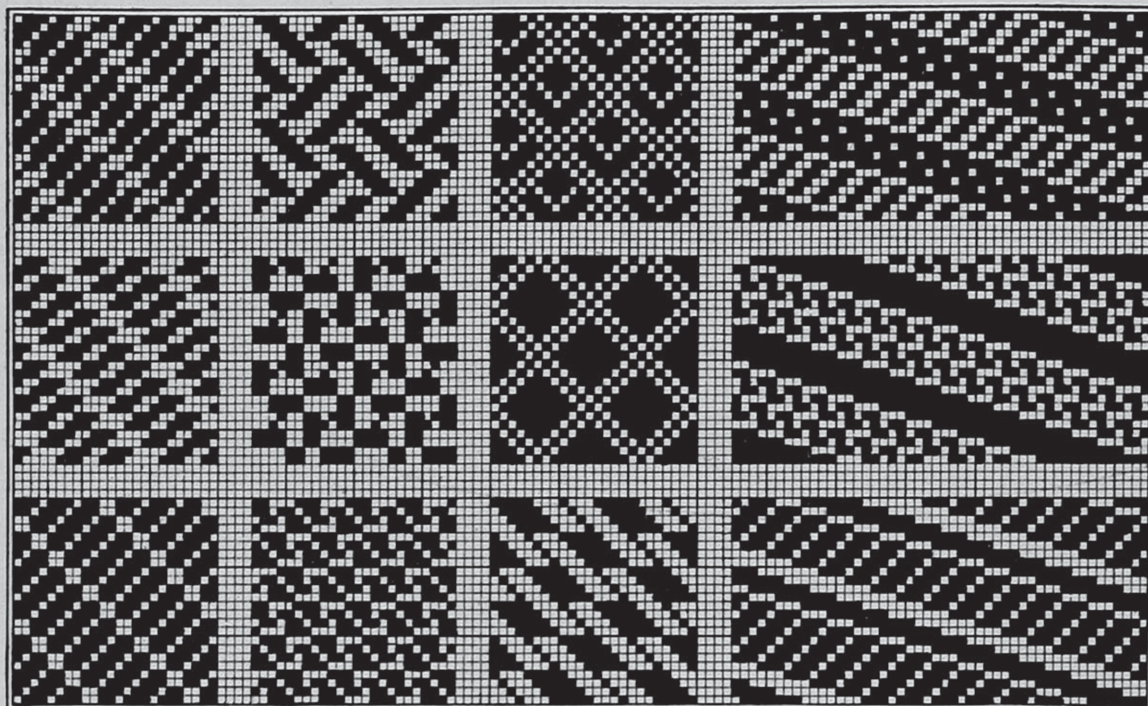
FIG. 29.

In making a sleeve on this machine, a welt is first made, then the plain rib stitch is knitted to make the lower end of the sleeve. After the plain stitch, the tuck stitch is made for the first portion of the upper part of the sleeve and then a looser tuck stitch is put in for the upper portion of the sleeve.

(To be continued.)

DICTIONARY OF WEAVES.*

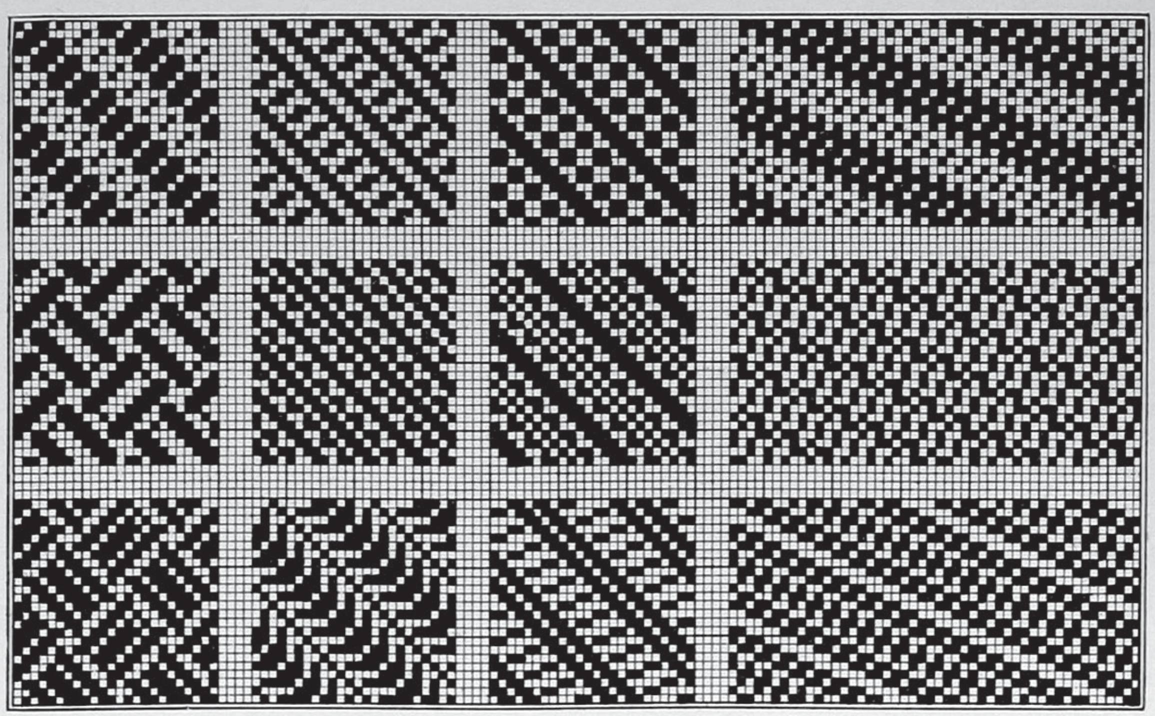
TWELVE HARNESS



12 X 36

12 X 12

TWELVE HARNESS



12 X 24

12 X 12

*Complete, this Dictionary will contain over TWENTY THOUSAND PRACTICAL WEAVES, taken from woven Fabrics. About One Thousand Five Hundred of them have thus far appeared, and can be obtained by ordering back numbers.

The Application of "Ciba and Cibanone Colors."

By H. Hollenweger-Mariano.

Whilst the ciba colors represent new members of the indigo or thioindigo group, the cibanone colors are derivatives of anthraquinone. The dyestuffs of the former class are suitable for the dyeing of vegetable and animal fibres, as well as the calico printing, whereas the cibanone colors only enter into consideration for the production of fast shades in cotton dyeing.

The dyeings produced with the different products in the hydrosulphite vat are especially distinguished by their brilliant shades and excellent properties of fastness.

Ciba Blue gives in cotton dyeing and calico printing pure blue shades, which are considerably brighter and much faster to washing, chemicking and light than those produced with indigo. In consequence of its greater affinity for the fibre, the darkest shades may be obtained by one dip.

Ciba blue may further be employed for the resist and discharge article as well as for yarn printing (chiné). On account of its superior properties of fastness, the dye is also of great interest in the manufacture of woollen articles fast to wearing, such as military cloth, etc.

Ciba Heliotrope produces on the various fibres mauve shades of great fastness; especially for calico printing, the product is very interesting as a substitute for the well-known alizarine violet, and it even excels the latter in many respects.

To the same series of colors there also belongs a dyestuff in which we possess the first vat green fast to chlorine, and which differs from the green vat dyes already known inasmuch as same can also be fixed on animal fibres.

Ciba Bordeaux, Red and Scarlet, are three homogeneous vat dyes which may be used in the same manner as the other ciba colors, and which permit of producing in dyeing and printing a whole range of shades from wine-red to the brightest scarlet. The shades obtained by these products also possess unexcelled properties of fastness.

The products already on the market under the name of ciba violets have, on account of their exceedingly beautiful shades and excellent properties of fastness, as well as for their simple method of application, already been favorably introduced in the different branches of the dyeing and printing trade. As regards their application, the same instructions may be followed as those indicated for the other ciba colors.

Cibanone Yellow and Orange are, on account of their remarkable fastness and brilliant shades, especially suitable for dyeing in combination with other vat colors. For instance, very bright and fast green shades on cotton may be obtained by mixing these two colors with ciba blue.

The Cibanone Browns are homogeneous products, and the fastest vat dyes to chemicking of all vat browns known at the present time, and are further distinguished by their bright and bloomy shades.

The most interesting products of the cibanone series are the two Cibanone Blacks, which represent the first black vat dyes. In comparison with colors employed hitherto in cotton dyeing, such as aniline black, logwood, or sulphur black, the cibanone blacks possess a splendid fastness to chemicking, a property which will prove most advantageous and important for many branches of the textile industry.

Ciba and Cibanone colors may be mixed with each other in cotton dyeing, thus enabling the production of a most varied collection of shades possessing an unattained fastness.

The Estimation of Indigo in Dyed Cotton.*

By Prof. Edmund Knecht, Ph.D.

The estimation of the amount of indigo present in a dyed yarn or fabric is of interest to the dyer from several points of view. As is well known, it is not possible, in indigo dyeing, to dye with a certain percentage of dyestuff, as is done with most other colors, the indigo dyer merely aiming at getting the desired shade, not being concerned with the actual percentage of indigo on the fibre. According as the fabric is dyed through, or is only surface dyed, it is manifest that the same shade may be obtained with different amounts of indigo, and this is one of the many points which might be studied with a rapid and reliable method of estimating the dyestuff on the fibre. But it is chiefly from the point of view of being able, especially in large works, to ascertain whether waste or loss of dyestuff is taking place which might be located and remedied that such a method would be of use.

That some importance is attached to the subject is shown by the fact that several methods have already been worked out with this object in view. One of the earliest of these was that suggested in 1886, by A. Renard, who extracted the indigo from the dyed fabric by means of hydrosulphite of soda, and precipitated the indigo from the solution by blowing air through. The same principle has been adopted by others, but the method is not satisfactory because it is necessary to extract several times to get all the indigo out, and the oxidation of the reduced liquor and the subsequent filtration require much time.

The nitrobenzene process of B. W. Gerland consists in extracting the weighed sample in a specially devised extractor with boiling nitrobenzene, but it does not seem to have been largely introduced, and according to his own statement it takes a considerable time to get the indigotine into a sufficiently pure state for weighing. The substitution of aniline oil for nitrobenzene in extracting indigo from dyed fabrics has been shown to bring about a not inconsiderable loss in dyestuff, and any method based on the use of this solvent is consequently of little value.

Extraction with glacial acetic acid, as suggested by Brylinski, and weighing the indigotine precipitated by pouring the acetic acid solution into water, is the method most generally adopted at the present time. I have recently had occasion to test the accuracy of the method, and though I find this highly satisfactory, the time required for extracting, especially in dark

*Paper read before the Society of Dyers and Colorists.

shades, is so great as to constitute a distinct drawback to the process.

Möhlau and Zimmermann's method consists in extracting the dyed fabric on a water bath with acetic acid containing some conc. sulphuric acid. A sulphate of indigotine is thus produced which dissolves in the acetic acid. By pouring the solution in the mixed acids into water the sulphate dissociates, and the indigotine comes out as a crystalline precipitate. A drawback to this method is that a correction has to be made, since the indigotine precipitated contains impurities from the cellulose.

The idea of dissolving the weighed sample of dyed cotton straight away in cold concentrated sulphuric acid, and then sulphonating with or without the further addition of fuming acid, has no doubt occurred to several interested in this question. That such a method cannot be employed, is however, at once evident when the experiment is tried, for although some of the indigotine is sulphonated and goes into solution, a very large proportion is destroyed, and with light shades I have on more than one occasion noticed that every trace of color was destroyed.

The new method which I wish to bring to your notice is based on two well-known facts, viz.,

(1) That cellulose readily and completely dissolves in sulphuric acid of 80 per cent. at from 95 deg. to 105 deg. F.; and

(2) That according to the patents of the Badische Anilin und Soda Fabrik, and of Geigy and Co., indigotine is also soluble in sulphuric acid of this strength, forming a sulphate which, when poured into water dissociates with separation of the whole of the indigotine as such. According to Binz and Kufferath this sulphate has the composition $C_{16}H_{10}N_2O_2 \cdot 2H_2SO_4$. If the precipitated indigotine is filtered off on a Gooch crucible through silica or asbestos, and dried, it can be sulphonated and then estimated by any of the ordinary volumetric processes.

In order to test the process, a quantity of pure crystallised indigotine was prepared which was shown by analysis to contain 99·5 per cent. of the dyestuff.

Five grammes cotton yarn and 0·2 grm. of this indigotine were then dissolved together in 80 per cent. H_2SO_4, and the estimation carried out as indicated before, the titration being done by titanous chloride. A sharp end reaction was obtained, and the amount of indigotine found was 0·1984 grm. in place of 0·1990.

The experiment was repeated with 5 grms. cotton and 0·2 grm. indigotine, giving 0·1979 grm. in place of 0·1990.

It was thus evident that in principle the method is correct, and sufficiently accurate for practical purposes. Although there is a slight loss this is somewhat less than that observed in Brylinski's acetic acid method tested with the same materials, but in either case the result would not be affected except in the second place of decimals.

The following is the *modus operandi* which we have hitherto adopted: Four grammes of the sample of dyed cloth are cut up into small pieces and placed in a porcelain beaker; 25cc. of sulphuric acid of 80% strength (148 deg. Tw.) are now added, and the whole is stirred slowly, the temperature being maintained at about 104 deg. F. In a very short time the cloth begins to dissolve, and after about ten minutes' stirring all has gone into solution. The contents of the beaker are now diluted to about 120cc. with water, and the precipitated indigotine is filtered off through a Gooch crucible containing sand and asbestos as the filtering medium. Diluting the acid solution is better than pouring it into water, since in the latter case the indigotine comes out in such a fine state of division that it is difficult to filter. The Gooch is then put in the oven to dry at 230 to 250 deg. F., and is then placed in a weighing bottle with a small amount of conc. H_2SO_4, when it is heated for an hour in a water oven. The sulphonated indigotine is then taken up with water, and titrated either by means of titanous chloride or by Rawson's permanganate process.

The method was tried against that of Brylinski on a medium shade of indigo dyed on bleached cloth, with the following results:

New method ($TiCl_3$ titration) .... 1·43%
Acetic acid method (gravimetric) . 1·48 "
Acetic acid method (titr. with $KMnO_4$ after sulphonating) .. 1·47 "

Since much of the indigo dyed material which comes into the market is either topped or bottomed with other dyestuffs, this circumstance must not be lost sight of in carrying out the test. The colors used for topping are usually either methyl violet or safranine, but these can easily be detected by means of acetic acid, and if present will remain in solution in the sulphuric acid on diluting with water.

Of colors used for bottoming, manganese bronze is the only one likely to give trouble, for if it is present I find that it destroys, during the first operation, a considerable proportion of the indigotine contained in the fibre. If on testing the ash of the fabric with nitre and fusion mixture it is found to be present, it must be removed before proceeding further by treatment with bisulphite and acid.

The sulphide colors which are at present largely used for bottoming indigo do not appear to give any trouble when the final titration is effected with $TiCl_3$, being apparently destroyed either by the first or second treatment with sulphuric acid. In one experiment which was carried out 2·5grms. cloth dyed with Eclipse Brown were dissolved along with 0·2grm. crystallised indigotine in 80% H_2SO_4, and further treated as described before. On titrating, 98·9% of the indigotine taken was accounted for. Pyrogene Brown, Thion Yellow 2 G, Immedial Brown used up no $TiCl_3$. Katigen Indigo (1grm.) used up a very small amount, but not sufficient to influence the result beyond the second place of decimals.

Analysis of Commercial Indigos: A method similar to the one which I have just described was suggested some twelve years ago by B. W. Gerland. The acid which he used in the first treatment was, however, somewhat weaker, while the temperature was

(*Continued on page xii.*)

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