from the boards by the rotary motion of said brushes. In order to carry the dust and dirt away from the machine and avoid fouling the air, a hood 22 is provided, which is arranged to inclose the space between the feed rolls, and from this hood extends a pipe 23 to convey the dust to a convenient point of exit.

A STUDY OF KNITTING.

(*Continued from page 29.*)

The Rib Top Machine.

These cylinder needles, as was intimated, receive a vertical movement, in order to perform the knitting operation, said movement being obtained by means of a cam groove, placed on the cam cylinder which revolves about the needle cylinder, the cylinder needles having projecting shanks near the bottom of their lengths, which run in the cam groove. The cam cylinder is attached to the cylinder needle cam ring, which receives a positive rotation, and through this ring the cam cylinder and also the dial cap, containing the dial cam, are given a rotary movement.

A development of the cylinder needle cam is shown in Fig. 23, that is, the groove is shown in one plane, whereas in the machine it is circular, the two ends shown, forming a continuous groove on the cam cylinder.

Referring to the illustration to explain the method of operating the cylinder needles for knitting, 1 indicates the point which starts the needle upwardly to open the latch of said needle, the stitch in the hook in this instance acting to open the latch in the same manner as with the dial needles. When the point 2 acts upon the needle, said needle goes to its highest point with the latch open and the stitch resting just below the latch on the needle. Before the needle starts down again, the yarn carrier has deposited the yarn on the projecting dial needles, so that the cylinder needle in coming down catches the yarn in its hook to form a new stitch when the stitch in back of the latch closes said latch and is cast off.

Point 3 indicates the part of the cam for casting off the stitch by bringing the needle to its lowest position. This movement of the needle corresponds to the inward movement of the dial needle, that is, the stitch below the latch, when the needle goes down, slides over the latch, thus closing it and then slides entirely off of the needle. From point 3 to point 4 the needles rise to a resting position, attained at point 4, and in which position they remain without the aid of a top guard until arriving again at point 1, thus completing the cycle of operation for one stitch.

THE LOOSE OR SLACK COURSE is made in the fabric by means of these cylinder needles. A slack course is simply a long stitch and is obtained through the cam *A*. This cam is made vertically movable and is operated from the pattern wheel as will be explained later. By moving it downward, a longer stitch is obtained, because the needles are drawn down farther and consequently take more yarn. After the long stitch is made, the cam *A* is raised to its normal position and the plain stitch is again made. The cams *B* and *C* are used as guards to prevent the needles from flying upwardly and opening the latch, and consequently losing a stitch, when they should be partly down with the latch closed.

It may be mentioned that the dial plate cam is set so that the point 2 leads the point 2 of the cylinder cam a short distance. This is necessary in order that the cylinder needles shall descend slightly in advance of the dial needles drawing inwardly, in order that said cylinder needles may catch the yarn as resting on the projecting dial needles before it is drawn inwardly by said dial needles.

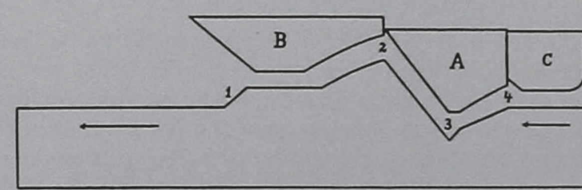


FIG. 23.

PATTERN WHEEL. This wheel, as its name indicates, is used to produce the pattern, that is, to put the welts and slack courses in their proper positions in the half hose tops. Fig. 24 is a side view of a pattern wheel with operating levers, said wheel being driven by the ratchet teeth on its circumference, as will be subsequently explained. The figure also shows the pattern chain cylinder which is positively driven from a wire-point clothed wheel in contact with the moving fabric as the latter is being drawn down by the take-up motion. There are three rows of screw holes around the pattern wheel, the holes being made radially over each other and receive screws according to the pattern desired. These screws actuate a vertically movable bob pin through levers, which in turn actuate the movable cams on the dial plate and on the cylinder cam through lever connections. By placing a screw in hole No. 1, a loose course is made by moving the cam *A*, Fig. 23, on the cylinder cam lower, so as to get a corresponding movement of the cylinder needles. A screw in hole No. 2 of the pattern wheel will bring both cams to their normal positions and thus produce plain work. No screws in any of the three holes will make the tuck stitch for the welt, that is, the movable dial cam will go in half way and cause the double stitch.

A screw in hole No. 3 will cause the dial needles to remain at rest, that is, in an inward position, so that they will lose the necessary stitch for the welt.

(*To be continued.*)

THE FASTNESS OF DYESTUFFS.

In most cases, where the fastness of a dyestuff is an important item to a mill, it is best, by the boss dyer, to first make tests, in a small way, that will closely imitate the conditions of actual practice. The method of determining the fastness of dyestuffs consists, in putting a dyed sample through the various operations and conditions it must withstand, the most important of them being *fastness to washing, fulling, and light.*

Goods are often washed or fulled with soap and soda, which makes it necessary to have colors that are fast to alkalies.

Fastness to acids is often an important consideration where dyed cotton is to be subjected to cross-dyeing, and for wool colors, when the goods have to be carbonized after dyeing.

Materials that are to be worn next to the skin demand colors that are not affected by the organic acids in the perspiration.

Fastness to stoving (that is, the action of sulphurus acid gas) is a frequent requirement, and also the fastness to steaming and hot pressing operations used in finishing.

FASTNESS TO LIGHT: This determination is best made by exposure of the sample under glass to the direct rays of the sun, thus getting the maximum effect in the shortest time. One part of the dyeing is usually protected so that a comparison with the original dyeing can be readily made. The samples for this test are prepared as follows: The material to be tested is wound around cardboard conveniently three inches wide, and one half is then covered with black paper. The whole is then exposed to light test in a specially constructed testing frame, which should be ventilated, as the excessive heat often generated by the sun's rays would otherwise affect the dyeings. The length of the exposure depends upon the requirements, and should be about twice as long in winter as in summer. Indigo samples make a good standard for light test comparisons.

FASTNESS TO WASHING: It is often required that a given dyeing shall not bleed into white cotton or wool when washed, and such tests are generally made comparatively as follows: The same number of strands and the same length of the types to be tested are braided with equal quantities of wool and bleached cotton. For each test the same amount of washing solution is used at the same temperature, and the quality of the soap used plays an important part. Free alkali in the soap—and especially caustic alkali—will cause most colors to bleed, and any bleeding will be at once noticed on the bleached material in contact with the sample being tested.

FASTNESS TO ACIDS: A 5grm. skein of the sample is boiled for one hour in the assistants usually used for the dyeing of the acid colors on wool—that is, 4 per cent. sulphuric acid and 10 per cent. Glauber's salt, made up to forty times the weight of the goods; or for 10grms. one would use 4cc. sulphuric acid, and 10cc. Glauber's salt made up to 400cc. with water. A skein of undyed cotton and one of undyed wool are boiled in the same bath. After one hour's boiling the sample which is being tested is thoroughly rinsed and dried. There should be no appreciable alteration in the shade or intensity if the dyeing is to be considered fast to acids.

FASTNESS TO CROSS-DYEING: There are two tests that should be made to determine the fastness to cross-dyeing: first, to show the resistance to dyeing with acid colors; and second, to determine the fastness when cross-dyed with the after-chromed colors. The dyed sample to be tested and 10grms. of wool are placed in the same bath in which the wool is to be dyed with, for example, Naphthol Black B. The Naphthol Black B is then dyed according to the usual formula on to the wool. This color is one of the best to use in making this test, as it leaves the cotton undyed, and the effect of the cross-dyeing on the sample can be more readily determined. After the bath appears to be exhausted the dyeing should be continued for ten minutes, which will ensure the cotton being unstained by the Naphthol Black B. An excellent color to use to determine the resistance where after-chroming comes into consideration is Anthracene Chrome Blue R. The sample to be tested, together with 10grms. of wool, is dyed with 2½ per cent. Anthracene Chrome Blue R in the usual manner, and when the bath is exhausted it should be brought down to 60° to 70° C., and the required amount of potassium bichromate added, a quantity equal to two-thirds of the dyestuff used. Re-heat slowly to the boil and after-chrome for one-half to three-quarters of an hour. If fast to cross-dyeing and after-chroming, the shades should not be too appreciably changed during the above processes.

FASTNESS TO CHLORINE: The number of dyeings that withstand chlorine is limited. The test is carried out as follows: Make up a solution of calcium hypochlorite by grinding one part bleaching powder with one part water, diluting with ten parts water and filtering. By adding water to the filtered solution adjust it to stand at 1° Tw. Immerse the sample in this solution for twenty-four hours together with some grey cotton. Rinse and acidify with a 2 per cent. solution of hypochloric acid. Note if the grey cotton has been bleached, and if so, note whether the sample to be tested has been in any way changed.

FASTNESS TO PERSPIRATION, HOT PRESSING, STEAMING, CROCKING (*i. e.*, rubbing off), are determined by obvious methods that need no special mention.

FASTNESS TO STOVING: For this purpose the sample or samples may be placed in the stoving chamber while a lot is being bleached, and the effects noted. Before placing in the stoving chamber, it is best to wet out the samples in a 1 per cent. solution of soap, and wringing out, but without rinsing, submit to the action of the sulphurous acid.

FASTNESS TO FULLING is only satisfactorily determined by submitting the dyed fabric to the action of the fulling mill.

IDENTIFYING DYESTUFFS IN THE POWDER FORM: There have been many elaborate tables prepared showing the various reactions the various dyes will give with reagents. The reagents used for this purpose are as follows:

Water	Distilled.
Alcohol	Absolute.
Ether	Chemically pure.
Benzine	"
Sulphuric acid	"
Sulphuric acid (dilute) 100grms. C.P. acid per litre.	
Hydrochloric acid 100grms. C.P. acid per litre.	
Nitric acid Chemically pure conc.	
Sodium Hydrate	1.10 sp. gr.
Ammonia hydrate	0.09 "
Sodium carbonate	1.10 "

Sodium acetate ....1.10 sp. gr.
Magnesium acetate ....1.10 "
Calcium acetate ....1.10 "
Barium acetate ....1.10 "
Lead acetate ....1.10 "
Tannin solution (100grms. tannic acid per 500cc. dissolved and added to 100grms. $NAC_2H_3O_2$ in 500cc. water).
Alum ....1.20 sp. gr.
Potassium dichromate ....1.20 "
Mercuric chloride ....1.20 "
Ferric chloride ....1.10 "
Stannous chloride ....1.10 "
Calcium hypochlorite $1\frac{1}{2}°$ Tw. freshly prepared.
Acetic acid ....1.06 sp. gr.

If the color is in the solid or powder form, it is dissolved in 1000 times its weight of water. In the case of paste colors a larger quantity is taken, according to the percentage of dry dye they contain. If the coloring matter is soluble, either entirely or nearly so, the solution is filtered so that in the event of any precipitation taking place later it may be noted. The dry color itself is only taken when determining the solubility of the dye in alcohol, ether, or benzine, and in the noting of the action of concentrated sulphuric acid.

When making these solubility tests about $\frac{1}{10}$grm. of the color is taken and 20cc. of the solvent. The mixture is well shaken in a test tube, boiled, and filtered. When concentrated sulphuric acid is taken, $\frac{1}{10}$grm. or less of the dry color is treated, and without heating the color of the resulting solution is noted. A portion of the solution is then poured into another test tube containing cold water, and the effect noted—for example, when precipitation ensues, what color is produced, etc. The rest of the acid solution is heated to the boiling point, and note is taken of any changes in the liquid. The solution is then allowed to cool, and is diluted by pouring into cold water.

When testing with other acids, alkalies, and salts, equal parts of the color solution and reagent are mixed in a test tube. One-half of the resulting mixture is allowed to stand in the cold, and the remainder is heated to the boiling point and is then filtered. For reducing with zinc dust and acid or alkalies, 20cc. of the color solution are mixed with 5grms. zinc dust, then about 20cc. of the solution of the acid or alkali are added, and after well shaking the mixture is boiled until decolorized. The solution is then filtered, and it is noted whether the solution turns color on exposure to the air. A table should be prepared, setting forth the reactions that the color under examination gives, and this can be compared with the published tables of color reactions or with a table prepared individually of the color reactions of the various dyestuffs of the same general class. The general class of the dye under examination can be generally determined by a few trial dyeings. Prepare dyebaths as follows:

(No. 1) 20 per cent. Glauber's salt and 2 per cent. soda.

(No. 2) 20 per cent. Glauber's salt and 4 per cent. sulphuric acid.

(No. 3) 2 per cent. acetic acid and 2 per cent. alum.

(No. 4) 1 per cent. acetic acid only.

Use 1 per cent. of the color in each case.

Proceed to dye from bath No. 1 with cotton, assuming the color to be substantive. Bath No. 2 is for acid colors, and for the test use a skein of wool. In bath No. 3 use 4, as used for mordanted wool, assuming the dye to be a chrome of alizarin color. Test 1grm. of the dyestuff with a bit of zinc and hydrochloric acid. If a sulphur color, hydrogen sulphide will be evolved, which can be confirmed by its action on filter paper moistened with lead acetate.

Dyed fibres present a very complex problem to determine just what product was used in obtaining the result. When compound shades have been produced it is not possible, with any degree of accuracy, to determine the products used, but as a general rule the kind or class of the dyestuff used can be determined, and the following tests are applied in determining this:

General tests for the detection of the kind and class of colors on dyed fibres.

Basic Colors: Boil the pattern with a small amount of alcohol in a small beaker or test-tube. The basic color will be dissolved off from the fibre. The alcoholic solution is filtered off and the alochol evaporated. The residue is re-dissolved in hot water, and cotton mordanted with tannin and antimony is dyed in the resulting solution. If the same amount of cotton is used as was originally taken it will become approximately the same shade as the sample under examination.

Substantive Colors: Boil two to five grammes of the dyed pattern in ammonium hydroxide for five minutes. The substantive color will be stripped to a large extent. Evaporate off the ammonia from the filtered solution and add a little soap solution. Place a piece of white cotton in this solution and boil, when it will become dyed the same color as the original pattern. A color that has been diazotized and developed will strip to a slight extent, but will not dye the white cotton. The same is true of colors after-treated with metallic salts, and of those coupled with diazotized paranitranilin.

Paranitraniline Red and Similar Colors Produced Direct on the Fibre: These colors are characterized by the fact that they volatize under proper conditions. The pattern to be tested is wrapped between white, bleached cotton cloth, and is then ironed with a hot iron. The pattern will be volatilized and transferred to the white cotton.

Azo and Substantive Colors on Wool: These colors may be recognized by the fact that they may be readily discharged by boiling with stannous chloride and hydrochloric acid. If it is an azo color chromed, then chromium may be detected as follows: The sample is burned in a platinum dish until all organic matter has been consumed. The ash is then mixed with five times its bulk of chemically pure sodium and potassium carbonates, and fused. The fused mass, on cooling, is dissolved in water, filtered, and the filtrate treated with an excess of acetic acid. The acetic acid solution is then boiled until all carbon dioxide is removed, the solution concentrated, and a few drops of lead acetate solution added. A bright yellow precipitate of lead chromate results if chromium was on the original sample.

Substantive colors on wool may be distinguished by the test previously given for the substantive colors of cotton.

Alizarin Colors: True alizarin colors do not discharge with tin crystals and hydrochloric acid. The mordant used is detected by methods of qualitative analysis; the chrome as before, an iron mordant, by dissolving (any residue left on the filter paper when the solution of the fused mass is filtered) with concentrated hydrochloric acid, and after diluting precipitating Prussian Blue with a solution of potassium ferricyanide; an aluminum mordant by precipitation; the characteristic aluminum hydroxide as follows: Part of the filtrate used for the detection of chrome is acidified with hydrochloric acid, and ammonia added cautiously until the reaction is barely alkaline. Any aluminum present will be precipitated as the hydroxide, which gives a characteristic flocculent precipitate.

Turkey-red or Alizarin Red: Turkey-red cannot be decolorized by boiling with a solution of tin crystals and hydrochloric acid. When Turkey-red is boiled with a solution of titanous chloride it changes at once to a maroon shade. This is quite characteristic, as the other reds are decolorized by the above.

Logwood Black: Boil the pattern with a little dilute nitric acid, when the familiar logwood red reaction will be given.

Indigo: The best test for indigo is the very characteristic spot given with nitric acid. Another means of identification is through the fact that indigo may be sublimed off the fibre by gentle heating. Place a sample of indigo-dyed goods in a test tube and heat gently. The indigo will condense on the upper cooler parts of the tube.

Chrome Yellow: This yellow may be distinguished by the fact that boiling with acids does not affect it, and boiling with soap decolorizes it. Also, by the determination of the lead and chrome.

Catechu Brown: This dye is distinguishable by its exceeding fastness. It is not affected by acids nor alkalies, nor can it be discharged with tin crystals and hydrochloric acid.

Sulphur Colors: These colors are distinguished by their fastness and by the fact that hydrogen sulphide is evolved when a sample is boiled with tin crystals and hydrochloric acid. Place a portion of the dyeing to be tested in a test tube and add a few cubic centimetres of hydrochloric acid and 1cc. of stannous chloride solution. The gas given off is tested with filter paper that has been moistened with a solution of lead acetate. A trace of hydrogen sulphide evolved will discolor the lead acetate paper and indicate a sulphur color.—Canadian Textile Journal.

Washing Woolen Yarn previously to dyeing. Ammonia has the advantage for washing white woolen yarns as a preliminary to dyeing. If the yarn is soaked in weak ammonia over night, it will be found that there is a great saving in the cost of cleaning said woolen yarn previously to dyeing, since the subsequent treatment with soap requires much less soap, much less heat, and much less time, than when the ammonia treatment is omitted.

FULLING.

The Process and Modern Machinery.

Fulling has for its object to shrink the woven fabric, either its width or length, or both ways, at the same time putting the fabric in such a condition to permit the successively following wet and dry finishing processes to be properly performed. Fulling adds strength to the fabric, loosens any superfluous dyestuff matter, etc., adhering to the fibres, as well as all oil, grease, etc., added to the wool to permit carding and spinning, size added to the warp yarn for economical weaving, etc. This loss in weight of the fabric, as well as any further loss to the cloth during scouring, gigging, napping, shearing or any other finishing process, must be carefully taken in consideration by the superintendent when planning the construction, *i. e.,* lay out of a new range of fabrics for the loom. At the same time he must take into consideration any proportional gain in weight per yard of cloth, provided the same is to be shrunk lengthways (less yards in finished piece as compared to length of fabric from loom).

Mistakes made then will be the cause of lots of trouble and disappointment to the fuller and in turn loss to the manufacturer. For this reason, the superintendent of a woolen mill must have a thorough practical knowledge of the fulling process, including soap and water questions, the construction of the fulling mill, as well as that of the nature and properties of the kind of wool, or any by-products, he is to use in the construction of a fabric, twist of the yarns, ends per inch in warp and filling, the character (arrangement of interlacing) of the weave, as well as the final finish and handle of the fabric required when ready for the market, *i. e.,* the after-processes the fabric is subjected to following fulling.

It might be well to mention that in connection with heavily felted fabrics, there is a limit to fulling, *i. e.,* to the felting or shrinking action of the wool fibre and that when this point is reached, no amount of running the cloth in the fulling mill will shrink it any more—you can wear out the fabric by running it in the mill, but no more shrinking, a feature many a superintendent has experienced to his sorrow, although as a rule but once, for it certainly was a tough lesson, not soon forgotten. For example, consider 56 inch Kersey, to stop felting say at 60 inches, or any similar case. The 4 inches over, in example quoted, are a detriment, and from a business point of view will be considered as no gain by the clothier, again, the fabric is $\frac{1}{16}$ too light in weight; for example, only $22\frac{1}{2}$ oz. per yard (considered at 56 inches wide) in place of a required 24 oz. weight for the 56 inch wide fabric, and which is sure to be a loss to the manufacturer, possibly no demand for such a light weight Kersey.

Fulling itself dates back to the ancient times when treating the cloth for the purpose of cleansing or whitening, with the feet, in tubs containing water in which some alkaline substance (to take the place of our soap) had been dissolved. From this procedure no doubt dates our olden time process of fulling by means of the *Hammer or Beater fulling mill,* also called *Falling Stocks,* now obsolete; the *Kicker Mill* being an improvement to it, and to which kind of

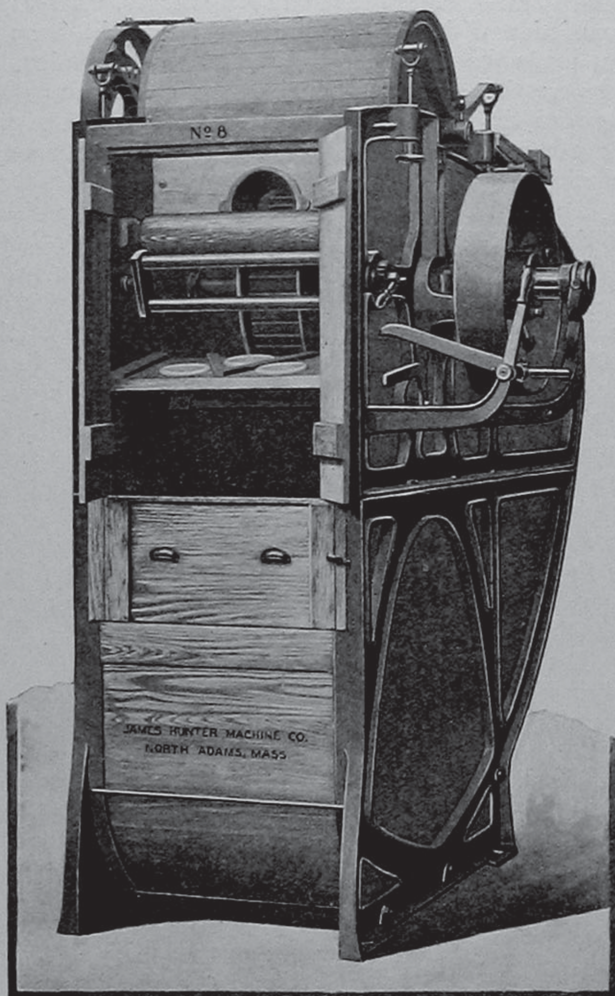


FIG. 1.

fulling mill we will refer to later on, since the same has advantages over our rotary mill, again there are disadvantages, and considered all around the *Hunter Rotary Fulling Mill* is acknowledged to-day the standard fulling mill in the market.

The Principle of Fulling is based upon the felting properties of the wool fibre and which is called into action by bringing an alternating pressure to bear on the moist fabric (heat and moisture). The most important agency is moisture. Wetting the fabric with water, and running it in a fulling mill would certainly felt the cloth, but it would be too slow a process and on account of that in many cases disastrous to the fabric, hence out of question. The proper, *i. e.,* customary way to apply the moisture required for felting is by means of a good soap solution, which exerts a softening influence upon the fibre. The constituents of the soap employed vary according to the type of fabric under treatment. Fabrics containing colored yarns naturally have to be more carefully treated and handled than those which are fulled in a natural condition.

Some soaps contain alkali which certainly has a tendency to aid felting, however, using a neutral soap, although the process is somewhat slower, will produce more satisfactory results in the final finished fabric. We will come back to this all important soap question later in a special chapter.

The Hunter Rotary Fulling Mill. Before, we mentioned that the next agency required for fulling is pressure; that this is accomplished by the action of the fulling mill, and finally that the most often met with machine in this line is the Hunter Rotary Fulling Mill. For this reason we will next give a description of the construction and operation of this machine, which as will be readily understood, is built in different sizes to suit the capacity of the various woolen and worsted mills; again, some slight modifications may be made, or ordered, to suit the whims of a certain manufacturer; however, considered in a general principle of construction, they are identical.

Fig. 1 is a perspective view of such a fulling mill, with right hand drive, with top door opened to show the interior construction of the machine. It shows what the builders term, their Style 8 mill, claimed especially adapted for worsteds and dress goods as well as felts, or in other words, a fulling mill suitable for any woolen or worsted mill. The illustration shows a one compartment mill, larger plants ordering them, however, to be built with two compartments, with a consequent saving in the cost of the machinery as well as floor space, a wooden partition separating the two machines.

Fig. 2 is a diagrammatical view of another style of their fulling mills, shown in perspective with part of the sides of the machine shown broken out, in order to reveal the run of the cloth through the machine, showing at the same time the construction and operation of the working parts of the machine. This illustration shows a two compartment machine.

In our descriptive matter we will refer to one compartment only, the reader readily understanding that

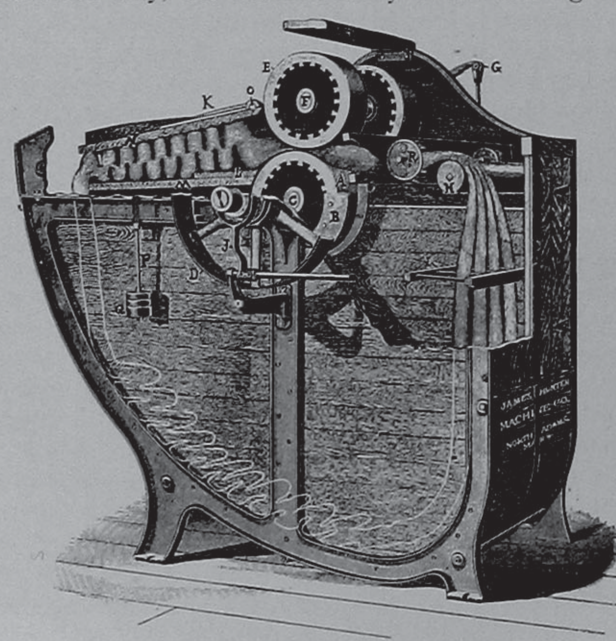


FIG. 2.

the second compartment (if used) is nothing else but a duplicate of the one described.

Examining our illustration, we see that the most prominent device is a pair of heavy rolls, one on top of the other, the lower one *A* being provided with a heavy flange *B* (shown partly broken away to show run of cloth between the rolls). At the same time its shaft *C* is the driving shaft for the machine, belt power being applied to it by means of driving pulley *D* situated just outside of the side frame of the machine. The top roll *E*, mounted firmly on a shaft *F*, has no flanges since it runs inside the flanges of the lower roll *A*. At the opposite side from the driving end, shafts *C* and *F* are provided each with a gear, both being alike and meshing with each other so that as a result, both rolls will turn at a uniform speed, in turn preventing any unnecessary friction to the fabric. These two gears (the driven and the driver) are incased in an iron casing, to prevent accidents.

The journals, holding shaft *F* for the top roll are placed slidably in a guide way in the framing of the machine, so as to permit raising or lowering of said top roll, sufficiently to accommodate for the varying amount of fabric structure run at one time between rolls *A* and *E*, which naturally will separate more with heavy fabrics, than if dealing with lighter weight structures. These rolls vary in size in the various makes of fulling mills, however, about 8″ face by 18″ dia. is a fair average of their dimensions. The face of the rolls is generally of wood, hard rubber or bronze, while the rest is of iron, very few all iron rolls being used. The average speed at which these rolls are run is 115 rev. per minute. (In some makes of fulling mills the flange on the lower roll is omitted.)

As the weight of the top roll is insufficient to exert sufficient pressure upon the cloth under operation, elliptic springs *G* are used to increase this pressure. They are secured on the journal boxes (one on each side of the machine) of shaft *F* and can be drawn down to any desired pressure by means of rods threaded on one end and passing through a hole in the frame or in an extension cast on the frame of the machine. The aim of the fuller should be to put as much cloth as possible between these rolls, since this will act as a cushion, and the pressure will thus be more effective.

As will be readily understood, two pieces at the least are run side by side in a two compartment mill. Always try and select pieces of the same range of goods and of as even a length as possible for running at one time in the mill, in order that they full up as near as possible alike. If putting pieces of an uneven length in a mill—say one 40 another 48 yards long, it certainly will require more time for fulling the latter, thus when the 40 yard piece is fulled up and taken out of the mill, the 48 yard piece must be kept running, causing one side of the mill to run empty while the other piece is still running which will cause excess pounding, detrimental to any kind of a machine. After threading the goods in the mill, their ends are sewed together, an endless string thus being made of each fabric and which then is continually moving through the mill.

The sewing together of the ends of the fabric or fabrics, after they are put into the mill must be carefully done, making the seam firm and smooth, whether made by hand or by machine. In connection with hand stitches, take small and even stitches, whereas in connection with machine seams, see that the seam is not made too deep into the cloth and thus bulky, in turn creating a pounding each time such a seam passes between the rolls. Have the protruding ends of the seam turned inside, for this will greatly help smooth running.

To keep the cloth running in the proper position in the mill, guide rolls *H* and a guide frame *I* are placed there, the latter in some instances being made to act as a stop motion, provided the run of the cloth gets, for one reason or the other, snarled up at the bottom of the mill, and thus causes a knot to form, which on account of being too large to pass through its ring in the guide plank, will lift the latter and thus cause outside arm *J*, through proper lever connections, to disconnect the clutch and stop the running of the machine, in turn preventing the cloth from being worn tender in places, or causing holes to be made, as would be the case if the run of the cloth was arrested and the rolls kept on turning, and consequently acting continually on one place of the fabric.

The pressure thus exerted by the rolls upon the fabric is, however, only in one direction, and which is laterally, for which reason the fabric if only exposed to this pressure would shrink only widthways, the strain put upon the fabric while being pulled along by the rolls through guide ring and up from the bottom of the mill, having a tendency to rather stretch the fabric lengthways than shrink it. Thus means had to be provided in the construction of the fulling mill to counteract this tendency, and simultaneously exert sufficient pressure to cause the fabric to also shrink in its length when so required, and which is accomplished by providing a device known as the *crimping box, trap* or *clapper K* to the mill. This contrivance is placed directly back of the rolls, and in such a position that the fabric will have to pass through this box-like affair before allowed to drop to the bottom of the mill. The side pieces of this crimping box are made to fit snugly to the rolls. The bottom of this box is about five inches lower than the top of the lower roll *A*. On the end of the box, nearest to the pair of rolls, is a shoe *L*, made of bronze, and which is securely fastened to the bottom board *M* of the crimping box, which is made of 1½ inch plank and is securely supported in the framing of the machine. These crimping boxes vary in length in the different makes of fulling mills, however, they should not be allowed to fall below 18 inches in length. The top *N* of the box is firmly fastened to a shaft *O*, which extends to the outside of the fulling mill, and is also supplied with an arm, which is fastened so as to stand in the same direction as the top of the box. This cover is made to fit inside of the box, being of a shape to permit its easy working up or down. To the end of the outside arm is fixed a rod *P*, which hangs down, being arranged to allow weights *Q* to be attached to it. The pressure required to lift the top of the box must thus be strong enough to also lift this arm with whatever weights are attached to it, and by this means, additional pressure besides the weight of the top *N* of the box is brought to bear upon the fabric. At the same time, by means of changing the weights *Q*, the pressure required is regulated. The goods, after being pushed into the box *K*, by the rolls, accumulate, *i. e.*, crimp until the pressure is sufficient to raise the top *N* of the box, and thus allow the goods to drop again to the bottom of the mill, the goods being thus shrunk in length according to requirements.

R is what is known as a stretching device, the same consisting of two smooth (bronze) rods held in two (bronze) discs, the fabrics to be fulled passing in their run to the rollers between said rods, as clearly shown in the illustration. The discs are mounted on shafts, one end of which projects outside of the mill and can be turned and locked in that position. The rods then will hold back the cloth in its travel to the rolls, thus imparting more or less tension to the fabric, accordingly to the position given to the rods of the stretcher. This device is mainly used in connection with lighter weight fabrics, in order to hold them out in their length.

It will be noticed that these Hunter Fulling Mills are provided with the clutch drive, as compared with tight and loose pulleys, as are used in some other makes of fulling mills. This clutch drive has the advantage that it is much more sensitive when the knock off lever works, and besides works quicker. With the tight and loose pulleys there must be a strain on the goods when they catch up until the belt has been removed from the tight to the loose pulley, while with the friction clutch it throws out immediately, thereby releasing all strain on the goods. Further, the constant shifting of the belt from tight to loose pulley and vice versa wears the edges of the belt, and as soon as the edges of the belt are worn, it does not travel true and you not only lose a portion of the power, but the belt soon gives out. With the friction pulley the belt always travels practically true with nothing to wear its edges, therefore you get the maximum life of the belt.

Heat. The third agency necessary for fulling is heat, which generates itself by the friction the fabric is subjected to during the process, *i. e.*, the running of the mill. This heat is required for the process, however, care must be exercised that the heat in the mill does not become too excessive, since this will weaken the fibres, dull or bleed fancy colors, for which reason we find some fulling mills provided inside with thermometers, although the bulk of our fullers trust the feeling of their hands to distinguish a fabric running too warm, *i. e.*, overheated, and when then the doors of the mill must be opened to let out this surplus heat—about 85° F. is a good average, possibly 90° F. a limit—again there are some classes of colors very sensitive to heat, and which consequently must be treated at a lower temperature according to fastness of color to fulling.

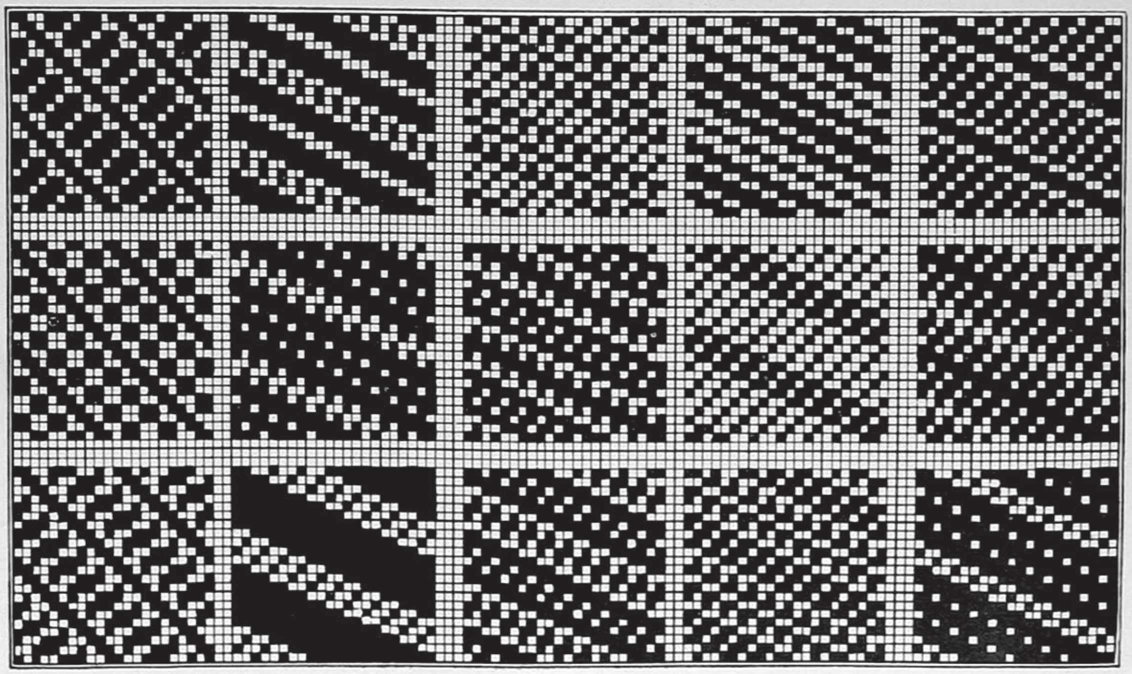
When pieces heat above the required point, moisture will evaporate so much quicker, for which reason the goods must be regularly examined by the fuller to see that they do not run too dry, *i. e.*, chafe, adding off and on a little fresh soap to keep moisture and heat where they belong. If it should occur, either through carelessness or otherwise, that too much soap has been applied to the fabric, then the best remedy is to run at once, and quickly, a dry fabric in the mill, and which will absorb any surplus of soap from the fabric under operation, though it must be clearly understood that without sufficient soap and heat, goods will not felt—shrinking may be got without felting, but this is not proper fulling.

Soap. The selection of the proper soap and its application forms a most important item to the process of fulling. Besides exerting a softening influence upon the fibre, it at the same time is the means for removing the emulsion given to the wool stock in the picking room to be able to card the wool and spin the roving into yarn. Again, it will keep the goods from chafing and wearing off too much during the fulling process. The requirement, for a good fulling soap is a hard soap which is free from caustic, *i. e.*, is neutral, for caustic, if present to any extent in the hard soap, is sure to injure the colors more or less, if not the fibre, and once the color has been injured, it is impossible to remedy the injury. The strength of this soap for fulling purposes depends upon the fabric handled, the same, however, must possess sufficient body to turn out the grease from the fabric, and hold it in such a state that, to all appearance, it might be scraped off the cloth any time, throughout the process. If the soap is not heavy or has not sufficient alkali to start the grease, dirt, etc., in the cloth, cloudiness and dullness of colors are sure to result. If the fulling soap fails to raise the grease in the fabric, *i. e.*, raises it only partly, portions of the grease remaining unsaponified, this is not only a serious detriment to the fulling, but at the same time, the heat generated during the process, will have a tendency to set this grease, and which then is much more difficult to remove in the scouring of the goods. For fabrics with extra bright colors, and which naturally have been more carefully handled from the fibre to the woven cloth (cleaner all around), use a good neutral soap liquor, lukewarm, pour slowly on the fabric, not too much at a time, the weight of the goods determining this point, using about one pound hard neutral soap to a gallon of water, and about 9 gallons of this prepared soap liquor to about 45 lbs. of goods. In solid colors, a very small quantity of alkali might be judiciously used, if any difficulty found in forcing out the grease, dirt, etc., but the proper way is to only help to loosen the grease and dirt by means of it, the fulling not to commence until the grease and dirt in the fabric become loose. One pound of good soap used in this manner will do more towards getting the goods clean than double or more the amount used later on in the washing machine, by preventing the dirt from being first felted into the cloth structure, making it hard to get rid of in washing afterwards. Thin alkali soaps, if used, will run the dirty grease and dyestuffs through and through the fabric, staining the structure and causing the colors to become dead. There will be found a vast difference

(*Continued on page viii.*)

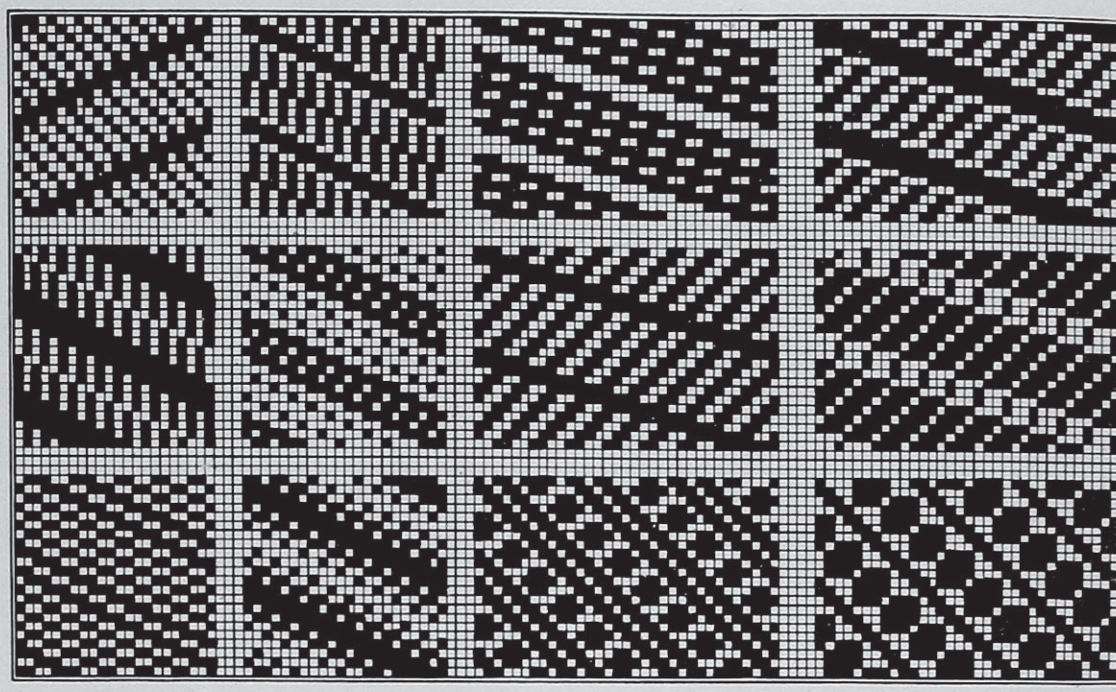
DICTIONARY OF WEAVES.

ELEVEN HARNESS



11 × 22

ELEVEN HARNESS



11 × 22 and 11 × 33

good supply of soda alkali, previous to fulling, the time required for the latter operation will be reduced nearly one-third. Again, if shoddy is extensively used, as it generally is in these low grade woolens, then the washing before fulling will in many instances give the fabric the appearance of all wool cloth, pretty nearly covering the adulterant; however, the shoddy in this instance has got to be in the right condition, that is, if it is carbonized, as it usually is, it must be washed free of sulphuric acid, since where this free acid is present, and the goods are brought in contact with a soda alkali, the tendency is for the formation of a combination upon the surface of the fibres, which will act injuriously in connection with the fulling, since it is insoluble in water unless the water is considerably heated.

(*To be continued*)

American Cotton Goods in Australia.

In an interview with one of the largest merchants in Hobart, Tasmania, proprietor of a large department store and a man who has traveled extensively in the United States, he mentioned that in his opinion the only reason why American cotton textiles are not sold in Australia more than the textiles produced in other countries is because reputable American houses have never seen fit to send their expert sales agents to properly explain the special advantages of their goods. There are probably at least 100 special representatives of English houses, with expert knowledge of cotton textiles, who are traveling through Australia at the present time, giving every important town a visit two or three times a year, an affair not done by one American house. American cotton manufacturers intrust their business to general agents at Sydney and Melbourne, who handle almost any goods they think they can sell, from a patent medicine to a bedstead. Many of them have done so well with certain American goods, like agricultural machinery and boots and shoes, that they think they are able to be agents for almost anything that is American, and so undertake business to which they can not give proper time and attention.

If you inquire of one of these agents about any particular line, say of American calicoes, he may be able to tell you that the reputation of the house which sells them is good, but is quite incompetent to explain in what way, if any, the line of goods you ask him about excels. Australians are pretty conservative about what they buy, and it takes some convincing explanation to induce them to purchase American calicoes when they are accustomed to other kinds. I have discovered for myself, the merchant claims, that American calicoes are purer and wear longer than calicoes produced elsewhere, and if the fact were only known generally that while American calicoes are lighter, generally speaking, than other kinds, yet they are more durable, American manufacturers would become in supreme command of this market. In my own establishment, he further mentioned, the sale of American calicoes is constantly increasing, and it only requires a little more educating for all persons to want them. Those he sells are invoiced to him from 12 cents to 40 cents per yard; the best demand being for those invoiced at from 15 to 20 cents per yard.

American cotton bed sheetings are also meeting with a steadily increasing sale in Australia, they being also favored by the low rate of duty, of 5 per cent. American denims, which sell in Australia from 14 to 24 cents per yard, have long outdistanced in their sale the denims of other countries, and it now seems to be generally admitted in Australia that it is impossible for other countries to compete with the United States in this trade. They also pay only 5 per cent ad valorem. The Tasmanian workingman seldom buys any other kind. American denims are being more and more used in Tasmania as clothing for boys, as they not only look well, but stand a great deal of hard usage, moreover are cheap. However it must be remembered by our manufacturers that only the cloth should be exported, as the duty on made-up goods is 35 per cent, *i. e.*, prohibitive. One large use American cotton sheetings is put to in Tasmania is as a substitute for wall paper or plasterings in many houses back in the country.

American cotton underwear has so far very little sale in Australia; what possibilities there are in this direction it is hard to say, as no particular effort has ever been made to exploit them. In sending samples of underwear, our manufacturers should bear in mind that the cheapest grades would sell best, also that Tasmania has its winter when the United States has its summer, and that samples, say for the winter trade, should be sent at least six months ahead, the winter demand beginning in April.

MILL NEWS

Philadelphia. Andrew Michie, manufacturer of hair cloth, is running until 9 o'clock every evening.

The John Mawson Hair Cloth Co., at Kensington and Glenwood Aves., have increased their equipment by fifteen new looms and five more will be added in a short time. All the looms are running 60 hours a week.

The Delwood Mill, A. J. Gordon & Co., have removed from Hancock and Somerset Sts., to the Andrews Mill on Adams Ave. and Leiper St. They occupy the floors formerly used by the Royle & Pilkington Co.

R. J. Lawson will retire from the retail clothing business and devote his entire time to his cloth weaving establishment in Frankford.

Greaves Brothers, manufacturers of dress goods, after a period of depression, are operating again a large part of their plant.

Scranton, Pa. The Wyoming Yarn Company have incorporated, and will build a yarn mercerizing and silk dyeing plant. A site for the plant, which will be erected this summer, has been secured. The capital stock is $75,000.

Dover, Del. The Post & Sheldon Corporation, a silk manufacturing company of Paterson, N. J., have sold their Delaware plant, which has not been in operation for some time.

William A. Lush has arranged for the building of a mill at Fairview, to be known as the William Lush Silk Mill. It will be 125x45 feet, one story, and of brick construction. The building and equipment will represent an outlay of about $30,000. It is expected that the mill will be running early in the fall.

Pottsville, Pa. The Tilt Silk Mill, employing 600 hands, have resumed again operations in full.

Ariel, Pa. The Ariel Knitting Co. has incorporated with a capital stock of $15,000.

Williamstown, Pa. The Unrivaled Hosiery Mills have incorporated with a capital stock of $15,000.

Utica, N. Y. After having been idle for the last two months the Capron Mill annex, in this city, who employ nearly 200 hands, have started their mills again on full time.

Cohoes, N. Y. The knitting mill of the Himes Underwear Company at Northside, and the Pacific Hosiery Mill, in which work has been suspended or materially curtailed for some time, have again gone on full time.

Watervliet, N. Y. The Roy Woolen Company has incorporated with a capital of $75,000. The new company will manufacture woolen and worsted goods.

Chadwick, N. Y. The stockholders

of the Utica-Willowvale Bleachery voted to increase their capital stock from $250,000 to $375,000, to provide funds for extensive improvements to the construction of the plant.

Mays Landing, N. J. Improvements involving an expenditure of about $100,000 will be made to the Wood Cotton Mills. In place of the present looms, 500 automatic looms will be installed.

Paterson, N. J. It is reported that a new cotton weaving plant is to be erected by H. E. Danner, of Boston. The erection of a weave shed on a site bounded by Fourth avenue, the Susquehanna Railroad and River street, is contemplated.

Uxbridge, Mass. Taft & Landry have completed their sample loom which was invented by Mr. Louis Landry, one of the most expert loom-fixers in this locality. The new loom, it is claimed, has an improved picker stick arrangement designed to increase the production of weaving cloth 25 per cent over the present looms in use in mills.

Fall River, Mass. Joseph T. Leach, who has been overseer of carding at the Cornell Mills, has been appointed Superintendent of the Arkwright Mills to succeed Charles C. Pierson, who is retiring.

The Troy Cotton & Woolen Mfg. Co. paid a regular quarterly dividend of 6 per cent on August 1.

The Bourne Mills paid its semi-annual profit-sharing dividend to its operatives. Each operative regularly employed received about two-fifths of a full week's pay. The total amount paid out was about $2,200. The directors have decided to continue the dividend another six months.

The following regular quarterly dividends have been declared since our last issue:—The Union Cotton Manufacturing Co., 1½ per cent; Sagamore Manufacturing Co., 2 per cent; Laurel Lake Mills, 2 per cent, and an extra of 1 per cent; Luther Mfg. Co., 1½ per cent; Arkwright Mills, 1½ per cent; Barnard Mfg. Co., 1½ per cent; Chace Mills, 2 per cent; Davis Mills, 1½ per cent; Flint Mills, 1½ per cent; King Phillip Mills, 1½ per cent; Merchants Mfg. Co., 1½ per cent; Mechanics' Mills, 1½ per cent; Shove Mills, 1½ per cent, and Weetamoe Mills, 1½ per cent.

Lawrence, Mass. Walworth Bros., manufacturers of ladies' and men's wear, are running day and night. About 200 hands are employed.

Lowell, Mass. The Lawrence Hosiery Mill has again resumed work on full time.

Salem, Mass. The Naumkeag cotton mills have resumed full time.

Pittsfield, Mass. The W. E. Tillotson Mfg. Company are running their weave room full time. The yarn making department runs day and night.

The Airdale Mills Co. is getting all its looms running again.

Boston, Mass. Eugene N. Foss will soon announce his plans for the establishment of a big cotton mill in East Boston. The land has been purchased and the plans of the building have been completed. It will be the only cotton mill in the State in the immediate vicinity of Boston.

Woonsocket, R. I. The new weave rooms of the Hamlet Textile Company are completed and 100 looms for weaving silk will be installed at once. The plant when finished, including their present equipment of 370 broad silk looms, will be the sixth largest of its kind in America. The chief articles manufactured are *peau de cygne, peau de soie*, high grade *liberty satin*, neckwear and cotton back satin.

Pawtucket, R. I. D. Goff & Sons, manufacturers of braid, have started to blast out a channel in the Pawtucket River in order to obtain a better water supply for their mill.

South Manchester, Conn. The two large ribbon factories, which are being built for the Cheny Brothers Co., manufacturers of silk, are nearing completion. It is the intention of the company to transfer to here, the work now turned out by their Hartford plant, which gives employment to between 200 and 300 operatives.

Norwich, Conn. The plants of the United States Finishing Company and the Shetucket Company, manufacturers of denims, ticking and striped goods, have resumed operations.

Winsted, Conn. The factories of the Winsted Silk Company and Winsted Hosiery Company have again resumed full time operations.

Willimantic, Conn. Business in the silk line, of the kind done by the Chaffee Company, has had a change for the better, and the plant will now revert to its former running schedule, full time.

Augusta, Me. The Edwards Cotton Mills have resumed again full time in all departments, with full pay. The mills have been running on half-time since the 1st of March, and employ about 1,200 hands.

Topsham, Me. Dr. H. Q. Mariner and C. B. Maxfield have formed a company to be known as the Maxmarlan Knitting Mill, and have leased a building, 50 by 100 feet. They are expected to begin operations in the fall on men's hose.

Bangor, Me. The contract for the construction of the new woolen mill of Mayo & Son, at Foxcroft, has been awarded to the Eastern Concrete Company of Boston. The building will be completed in November.

Manchester, N. H. The Amoskeag Manufacturing Company paid a dividend of $6 per share of the company's stock, on August 1, to stockholders of record of July 20.

The Elliott Manufacturing Company paid its usual semi-annual dividend of 5 per cent on August 1.

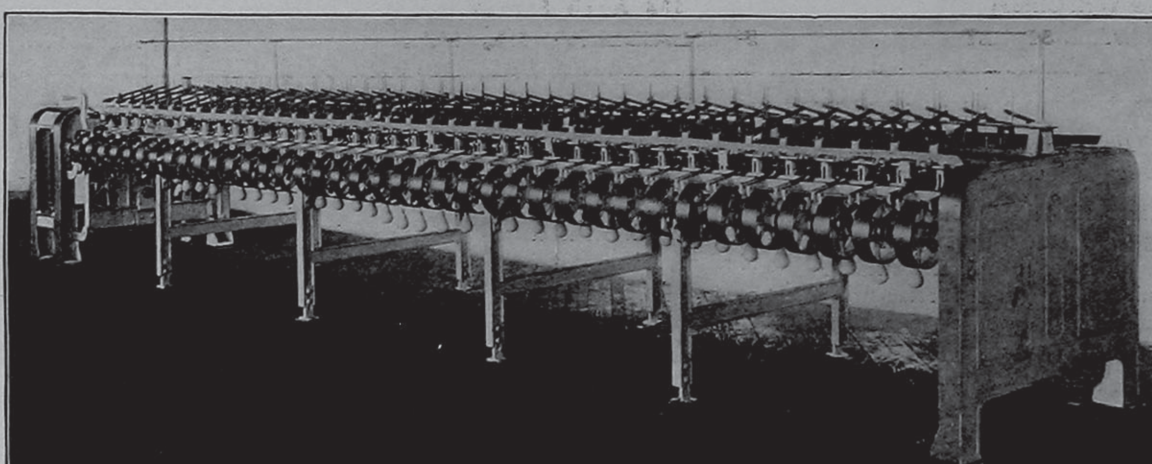
Baltimore, Md. The six mills of the United States Cotton Duck Company have resumed operations after having been closed for two weeks, during which the machinery was thoroughly overhauled.

The Mount Vernon mills, Nos. 1 and 3, which are also owned by the company, did not close down for the usual midsummer overhauling.

The United States Cotton Duck Company has recently received a fair-sized order from the Government for cotton duck and other material manufactured by the company, and it is on this order that the mills are now working.

East Durham, N. C. The Durham Cotton Manufacturing Company is expending about $50,000 for improvements and installations of new machinery. This plant has 25,767 spindles and 820 narrow looms.

Rockingham, N. C. The Roberdel Manufacturing Company, manufacturers of ginghams and heavy plaids, have increased their capital stock from $200,000



to $500,000. Their equipment consists of 14,000 ring spindles and 604 looms.

Lincolnton, N. C. The Eureka Manufacturing Company has completed the erection of its building and installed 1,020 mule spindles, with accompanying apparatus, for manufacturing low counts of cotton yarn.

Lexington, S. C. The Rickard Knitting Company is the name of the new company recently organized with a capital stock of $10,000. The building is located near the Lexington Manufacturing Company's plant.

M'Coll, S. C. The annual statement of the president of the Marlboro Cotton Mills show a net gain of 13¼ per cent on the capital stock for the past year, notwithstanding the heavy losses caused by the panic in the sale of products.

Newberry, S. C. The Ashley Manufacturing Company, which recently manufactured some silk hosiery as an experiment, will, it is claimed, add this product to their output.

Dalton, Ga. The Cherokee Mills are constructing buildings to accommodate about 10,000 spindles and 300 looms for manufacturing cotton towels and blankets.

Memphis, Tenn. President Hightower, of the Mississippi division of the Farmers' Union, states that it is practically settled that cotton bagging will be used for wrapping all cotton in Mississippi this season. He says that a movement is under way whereby practically the entire belt will discard the use of jute.

Two new cotton concerns have been incorporated to deal in and manufacture cotton in this city. They are the Martin-Phillips Company, with a capital stock of $100,000; and the C. M. Cole Cotton Company, with a capital stock of $25,000.

Huntsville, Ala. The Abingdon Cotton Mills, which have been idle for several months, are at work again, giving employment to 400 people. It is understood that other mills will be started by the middle of the month, the demand for cotton goods having picked up lately.

Fort Payne, Ala. Fifty additional knitting machines and auxiliary machinery are included in the plans of the Davis Hosiery Mills of Chattanooga, Tenn., for their local plant.

Oshkosh, Wis. The Waite Grass Matting Company has incorporated with a capital stock of $150,000. The company will manufacture mattings and carpets.

EXPLANATIONS FOR THE CHART OF WEAVES ON

"Textile Designing Simplified."

The object of this chart is to show how easy weaves for all classes of Textile Fabrics can be constructed; it will be a search light in the misty matters in the field of designing Textile Fabrics. Keep this chart of weaves for reference. Millions of new weaves can be obtained by it.

All weaves for Textile Fabrics have their foundation in Plain Twills and Satins.

PLAIN.—This weave and its sub divisions are explained on the chart in the top row by 16 weaves, the sub-divisions covering common, fancy and figured Rib and Basket weaves.

TWILLS.—The foundation of constructing regular (45°) twills is shown by rows 2 and 3 with twenty six weaves, covering twill weaves all the way from 3 harness up to 13 harness. The sub divisions of twills are quoted next on the chart, being Broken twills, Skip twills, Corkscrews, Double twills, Drafting twills, Curved twills, Combination twills warp drafting Combination twills filling drafting, 63° twills, 70° twills, Wide wale twills, Entwining twills, Checker-board twills, Pointed twills, Fancy twills, thus covering every sub division of twill weaves possible to be made.

SATINS are next shown, giving also their sub divisions, viz: Double satins and Granites.

HOW TO PUT A BACK FILLING ON single cloth is shown below the satins by two examples, and at its right hand is quoted the principle of

HOW TO PUT A BACK WARP ON single cloth.

On the bottom line are given the four steps for:—

THE CONSTRUCTION OF DOUBLE CLOTH, 2 @ 1; and above the same one example, with the arrangement 1 @ 1.

THREE PLY CLOTH is shown by one example.

HOW TO BACK SINGLE CLOTH WITH ITS OWN WARP is shown by two examples.

WEAVES FOR SPECIAL FABRICS are quoted: Tricots (warp, filling and Jersey effects), Rib fabrics, Honeycombs, Imitation Gauze, Velveteen, Corduroy, Chinchillas, Quilts, Plush, Double-plush, Tapestry, Crape, Terry, Worsted coating stitching, Hucks, and Bedford cords

HOW TO WORK THIS CHART OF WEAVES.

CAPITAL LETTERS of references refer to the plain weave and its sub-divisions.

SMALL LETTERS of references refer to twills and their sub-divisions.

NUMERALS of references refer to satins and their sub-divisions.

Example.—How to ascertain the construction of the weave at the right hand top corner of the chart; being the figured rib weave marked C C'? These two letters of reference mean that said figured rib weave is nothing else but the combination of the 2-harness 6 picks common rib weave warp effect C, and the 6 harness 2 picks common rib weave filling effect C'.

Example.—The letter of reference *c*, underneath the first broken twill indicates that the same is obtained from the $\frac{1}{3}$ 4 harness twill *c*, (third weave on the second row); in other words, letter of references below each weave of any of the various sub divisions refer always to the corresponding foundation weave.

Example.—Twills *q*, and *o*, are the foundation for the eight combination twills filling drafting, said common twills are drafted 1 @ 1, the different designs being obtained by means of different starting.

Example.—The wide wale twill *t' w'*, has for its foundation the 63° twills, marked also respectively *t'* and *w'*, the latter two weaves have again for their foundation respectively the common twills marked *t* and *w*.

Example.—Granites marked 8 have for their foundation the 8-leaf satin, such as marked 12 the 12-leaf satin.

Example.—Backed by filling *e* 8, means the common $\frac{2}{2}$ 4-harness twill *e*, (fifth weave on second row) and the 8-leaf satin is used in the construction of this weave.

Example.—The complete design of double cloth, marked *e* 8 A, means that the common $\frac{2}{2}$ 4-harness twill (*e*), the common plain (A) and the 8-leaf satin (8) are used in the construction.

Example.—Rib fabric A, indicates that the plain weave forms the foundation.

It will be easy to substitute different foundations in constructing weaves for heavy weights.

In reference to single cloth weaves we only want to indicate that by following rules shown in the chart, millions of new weaves can be made up from it.

Keep this chart on hand for reference. Only 144 weaves are given, yet they will guide you to make millions of new weaves.