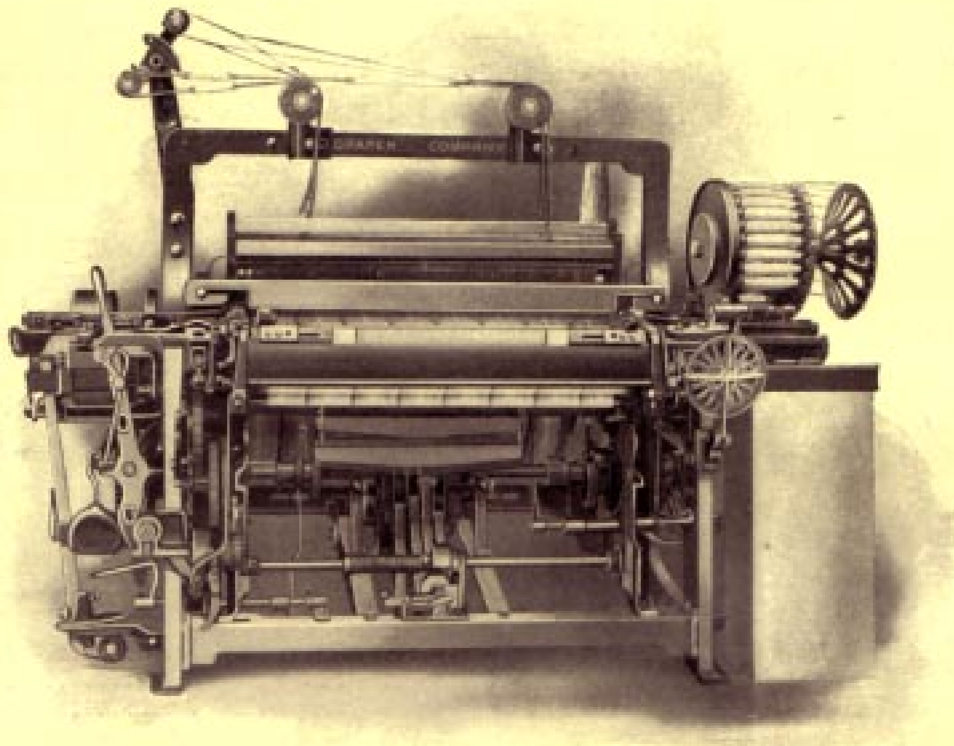
Vol. I NOVEMBER, 1907 No. 2

Posselt's Textile Journal

A Monthly Journal of the Textile Industries

Table of Contents

E. A. Posselt, Publisher, 2028 Berks St., Philadelphia, Pa.
European Agents: Sampson Low, Marston & Co., Ltd., 100 Southwark Street, London, S. E.



This is the Well Known E Model

NORTHROP LOOM

IN ITS LATEST REVISED CONSTRUCTION

If interested in this or any other models
of automatic filling-changing looms,
write to

DRAPER COMPANY,
HOPEDALE, - MASSACHUSETTS

Southern Agent **J. D. CLOUDMAN,** 40 South Forsyth St., ATLANTA, GA.

POSSELT'S TEXTILE JOURNAL

A PRACTICAL AND
EDUCATIONAL JOURNAL

DEVOTED TO

THE TEXTILE INDUSTRIES.

2028 BERKS STREET,
PHILADELPHIA, PA.

Posselt's Textile Journal

Vol. I. November, 1907. No. 2.

THE JOURNAL'S TEXTILE SCHOOL.

JACQUARD DESIGNING.

Lesson 2.

In our former lesson we mentioned that the finish of the fabric itself plays an all important item in connection with the design. For example, let us consider, in opposition of fabric structures previously referred to, a napped fabric, may it be a cotton or woolen flannel, blanket, shawl, etc., and when it will be readily seen that in connection with these napped fabrics, the face (as well as the back) of the cloth is covered with a pile, completely concealing the threads as well as their interlacing; a feature positively compelling the student to only use a bold and heavy figure, *i. e.,* plenty of ground between the figures as well as their details, remembering at the same time that we have only the difference between figure and ground for designing at our disposal, *i. e.,* we cannot rely to any great extent on any change in weave, to produce certain effects in some parts of the figure, since, as mentioned before, the interlacing of the threads is completely covered by the nap. A blending of the two colors, in portions of the design, will be the only change in effects at our disposal.

Fig. 4 shows us a fabric sketch of such a napped face fabric structure, *i. e.,* a woolen shawl, and which will clearly show the bold massing of figure and ground necessary.

The commercial standard is certainly the prime factor which influences the manufacturer, and in turn the designer, in the production of new styles, fabric structures, as well as the design; for the fact that the commission merchant or dealer practically dictates this point, he in turn being guided by the taste and inclination of his customers, *i. e.,* the buyer, the consumer of the goods, and for which reason, a dealer, and in turn a commission merchant will only order such styles, designs or goods, which experience will teach him to sell. However, there is always a chance for the manufacturer or the designer to make slight changes in the interest of the design and fabric, without offending the taste of the buyer, in fact, some careful suggestions on their part, and as incorporated with the design, actually may meet with the approval of the customer.

To prove this point to the student, we may mention that nobody can have helped but noticed the improvement in designs, coloring, as well as fabric structures in the market during the last 25 years, *i. e.,* since the training given to textile students by the various textile schools in operation since then, has been felt in the market; it being the reason why the designs in every new season, considered all around, are superior to the one passed.

This will also explain that the designs of better grades of fabrics are continually reproduced the next season in cheaper grades of fabrics; it being the reason why designs in expensive silk fabrics, and which require the height of artistic training on the part of the designer, are the next season frequently reproduced in the best grades of cotton fabrics, seeing them very likely the next season in cheaper grades of cottons. It is the reason, why designs of axminster carpets and which naturally require any amount of skill on the part of the designer, are in turn the next season imitated either in brussels or tapestry carpets; again, the fact. that well taking styles in brussels carpets will surely find their way in tapestry as well as ingrain

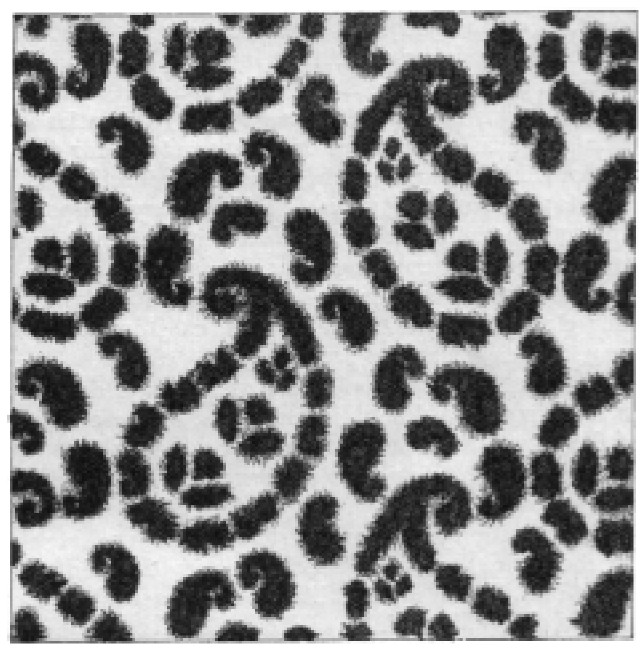


Fig. 4

carpets, will indicate that the whole affair, no doubt, is governed by the idea of the customer of imitating the fabrics used in the passed season by the wealthier class, and which class of people naturally have a stronger feeling for style and taste, a feature which, however, is only an advantage to the general product of the market, bringing without trouble, taste in the design to all classes of figured textile fabrics.

In the same way, it must be remembered that fashion to a great extent is set abroad, in connection with imported goods, and when it must be remembered that technical training abroad is of a great deal longer standing than here, technical schools abroad having been started as far back as the '50's, in the past century, all over Europe.

One of the greatest enemies, as we might say, to the designer certainly may be found in the commission merchant, or more so the retail merchant, *i. e.,* the man who cannot distinguish a good design from a poor one, although he possibly may be able to distinguish a better grade from a lower grade of fabrics he is selling, and when it will be found hard for the manufacturer or his commission merchant to convince him of the additional expense in producing good designs, and which either should command a better price, or anyway drive poorer designs out of the market. This, however, is not the case, as anybody can readily convince himself in connection with any retail store and where good as well as poor designs are offered, *i. e.*, have to bring the same price, the merchant himself either having no taste at all, or not the time to trouble with it, again the whole affair may be left by him in the hands of an incompetent man whose only object is to sell, never taking into consideration that pleasing a customer will bring him back to the store.

Selection of proper design. With reference to the selection of design, care must be exercised in this direction, for the fact that not every design or figure is suitable for every kind of fabric, whether within the compass of the jacquard machine or not. In other words, the designer must take into consideration the practical use the fabric is put to, as well as the different conditions the fabric is seen by. By the latter we mean, for example, designs or figures suitable for dress goods will be naturally out of place in connection with carpets; again designs used for drapery purposes, like curtains, must be of a different nature than such as used for floor coverings, for the fact that when in use, the fabric is seen under different conditions; hence each class of fabrics, more or less, calls for its own range of designs and figures.

A most important point for guiding the designer in planning for a design, is the size, *i. e.*, the compass of the jacquard machine at his disposal, as well as the method of the tie-up of the harness, and for which reason, any jacquard designer should be well acquainted with the various systems of tie-ups in use for the various makes of fabrics he may come in contact with. The student will for this reason find the articles on "how to tie up a jacquard harness" in the editor's work "The Jacquard Machine Analyzed and Explained" of the greatest of value in this study.

Considering the affair, *i. e.*, the design, filling ways in the loom, the designer is practically unlimited with reference to repeat of the pattern, whereas in the direction of the warp, he is governed by the capacity of the jacquard machine as well as the texture of the jacquard harness.

A minor importance in both cases is the amount of take-up of the fabric between its set in the loom and that of its finished state. No solid rule with reference to this contraction can be given, for the fact that the same varies with each different class of fabric structure, depending on kind and counts of yarn used, texture of warp and filling, the weave employed, in all its varieties, for ground as well as figure of fabric, and finally the finish. In the latter case we must take in consideration, that, other things being equal, a woolen or worsted fabric will take up more than a cotton or silk structure, again that a structure composed of a thick warp, with a low texture, in connection with a fine count of filling used, will take up more in its width and less in length, than compared to a structure in which equal counts of warp and filling are used. The reverse of the previously quoted case is the result, provided a fine warp, loosely set, is interlaced with a heavy count of filling.

With reference to the various systems of weaves employed by the designer, it will be noticed by him that a filling rib, if used extensively in the fabric, say for example for its ground, the structure then will contract more in width and less in length than if a common twill would have been used. Comparing this filling rib affair with a warp rib selection for the weave used, will show him that in connection with a fabric thus constructed, there will be less shrinkage in width than compared to a fabric structure interlaced with a filling rib weave.

The finishing process, as will be readily understood, is another place, where, a great difference in

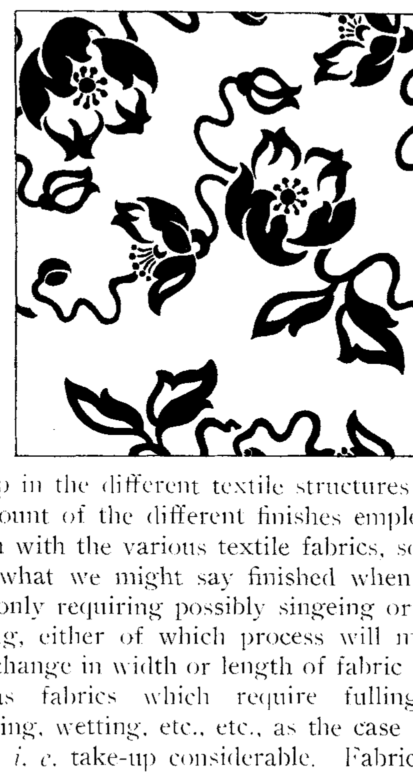


Fig. 5

take up in the different textile structures takes place, on account of the different finishes employed in connection with the various textile fabrics, some of them being what we might say finished when leaving the loom, only requiring possibly singeing or shearing or pressing, either of which process will make no material change in width or length of fabric thus treated, whereas fabrics which require fulling, scouring, stretching, wetting, etc., etc., as the case may be, will shrink, *i. e.* take-up considerable. Fabrics which are dried over hot cylinders are pulled out in their length, whereas fabrics dried on tenter frames are pulled out more particular width ways, and when consequently, in connection with the latter system of drying, the finished width of the structure can be more satisfactorily regulated than compared to the drying over cylinders.

Again, we will meet with any number of special fabrics, requiring special finishes, and which may have a tendency to vary the respective take-up of the fabric one way or the other, or both ways, which in turn will change the design proportionately between the fabric received from the loom and its finished state. A good example with reference to this variation in take up between the loom and its finished state may be quoted in connection with a crepon fabric, constructed of a

Fig. 7

Fig. 6

mohair and a cotton warp, and a pure cotton filling, a fabric which during the finishing process is treated with caustic soda, in order to mercerize the cotton for the purpose of contraction, the process in itself, not affecting the mohair yarn, which naturally then will produce a raised, curled effect upon the face of the fabric, more particular in those places where the mohair warp floats over the ground structure. It will be noticed that fabrics of this kind will shrink up to about 20% both ways and when naturally the designer is compelled, at the start, when laying out his design, to take this contraction warp and filling ways of the fabric during the finishing process, compared to the woven fabric, into consideration. Although this may be an extreme percentage of take-up, still the designer will come in contact with any amount of fabrics, where from 5 to 10%, either warp or filling ways, or both ways, in the fabric, as the case may be, are a common take up to be considered by him.

Preventing striping of design. A trouble frequently met with in connection with jacquard designs, for any class of fabrics, is the formation of stripes, either warp or filling ways, or in an oblique direction. It is a trouble caused by the designer, he not having balanced his pattern and which in this instance then, considered in longitudinal, transverse, or oblique section of it, contains more figure effect in one of these sections than in the preceding and following sections of it, said heavy sections, *i. e.*, sections containing more figure effects than others in the sketch, in turn forming the characteristic line effects, *i. e.*, striping in the fabric.

What in the fabric brings up these line effects (striping) prominently to the eye, is those numerous repeats of the design, side by side in every direction, as produced by the loom, and which show up so prominently even the smallest imperfections of a design in the fabric. To overcome this disadvantage of a design showing stripes longitudinally, horizontally or obliquely in the fabric, it is advisable for the designer to always show up more than one repeat of the pattern in his sketch, for the fact that the more repeats he shows, the sooner he will notice a tendency for the design to stripe or streak, as we call it; in fact, he should never be satisfied with showing one repeat only, since in that instance, such a defect to the design may readily escape his notice, or it may not show the trouble. To sketch two, three or more repeats of the pattern, each way, is the best plan for him, and if this was done by every designer, no streaky fabrics would be found in the market.

A good plan to overcome the tendency of streaking in the design, and consequently also in the fabric, is to always try and have figure effects overlap each other when drawing a line horizontally or longitudinally on the sketch, at the same time adhering to this plan just quoted, also as much as possible in connection with details of figures, *i. e.*, in not stopping or starting such details on the same line. Have them overlap and you will prevent lots of trouble, for the fact that it is this starting and stopping of figures or details of figures on one line which has a tendency to show up streaks, after repeats and repeats of the pattern are shown side by side, both ways, in the fabric.

This sketching of more than one repeat of your design, will always refer more to all-over patterns, yet it may be the means of improving pure-stripe patterns, although in the latter instance the experienced designer will readily avoid any faults in his sketching, even if using only one repeat.

To explain this subject of being liable to obtain poor designs in all over patterns, by sketching only one repeat, and how to correct affair, the accompanying three illustrations Figs. 5, 6 and 7 are given.

Fig. 5 shows one repeat only of an all-over design, which in its general appearance seems perfect.

Fig. 6 shows six repeats of this design, side by side, clearly demonstrating that the design is imperfect, *i. e.*, has a stripe effect.

Fig. 7, by means of similar six repeats, shows the previous design, remodeled to a perfect affair.

The best plan to avoid striping in all-over designs is to take care that some of the parts of the design of one repeat (in our case leaves and flowers—since dealing with a floral design) must properly extend into the other repeats so that the pattern will properly intermingle, or dove-tail. The student must always bear in mind that he is not sketching for one repeat only, he must remember that he is after a design to cover the whole surface of a fabric on account of the weaving process, and therefore textile designing vastly differs from the pure artistic designing, *i. e.*, the work of the artist, who never will be able to understand the value and necessity of a proper repeat for a design, whereas the successful textile designer knows that the ideal design is the one that repeats properly (with the least expense as to loom mounting) and yet successfully hides its repeat.

Lining or stripes, as shown in Fig. 6, produced by bare spaces in one direction (or the other), however, are not the only reason why more than one repeat of an all-over design must be drawn, since two or more figures of the design, of some peculiar shape, size, or execution, in one repeat, may by means of repeats, single themselves out in such a position that they form lines with the same figures in the adjacent repeats, thus causing a chain or line of figures to run in a horizontal, vertical or oblique direction in the fabric. Again, in some instances, the wrong development of a perfect fabric sketch on the point paper, may be in turn the cause of the fabric showing line effects, caused in this instance, either by the wrong selection of weaves or colors, or what is worse, both.

(To be continued.)

WHAT IS FASHION? Fashion is generally considered the companion of good taste, which is frequently the case, although sometimes bad taste enjoys popularity. More or less, fashion is a product of caprice, creating in some cases fortunes to some manufacturers, again in some instances inflicting a loss to others.

Fashion has no rules, but is constantly changing, one destroying the other; it is the result of our continuous desire for change.

WOOL, COTTON AND SILK DESIGNING AND FABRIC STRUCTURE FOR HARNESS WORK.

Lesson 2.

Our foundation weaves: The interlacing of warp and filling, *i. e.*, the different weaves at the disposal of the textile designer can be divided into the following three (3) distinct main divisions: (a) the plain weave, (b) the twills, and (c) the satins; these three divisions of weaves being the foundation for all the other subdivisions of weaves, technically known as "derivative or combination weaves."

The repeat or unit of a weave. This is a most important item to be mastered by the student; by it being meant that a perfect connection or joining in the fabric must consist between the first and the last thread in the repeat of the weave, both warp and filling ways, in order that no matter where in the fabric the interlacing of warp and filling is taken into consideration, it always will represent a proper duplicate of the unit or repeat of the weave, although a different place for starting the weave, as given in its plan, might have to be taken into consideration. In order to master the subject, it will be advisable for the student to always paint, for the first, at least, two or more repeats, each way, of every weave he will come in contact with, and when any imperfect joining, *i. e.*, imperfect connecting of the starting and ending point of said weave will be readily noticed by the student.

The plain or cotton weave. The same, as indicated by its name, is the most simple weave, requiring for its repeat 2 warp threads and 2 picks, or in other words, the lowest number of warp threads and picks possible to call for; and of which one or the other thread of either system is alternately up or down, with each change of threads in the other system. In order to simplify this weave to the student, diagrams Figs. 10, 11 and 12 are given, of which Fig. 10 shows us the plain weave executed on 16 warp threads and 12 picks, *i. e.*, 8 repeats of it warp ways and 6 repeats filling ways. Fig. 11 shows a corresponding portion of a woven fabric executed with this weave; the lines between weave and fabric structure, being given to connect the corresponding warp threads between both.

Examining fabric sketch Fig. 11, will show more in detail that the plain weave produces a very firm interlacing of warp and filling in the fabric, in fact the most thorough interlacing of warp and filling threads possible; in turn resulting in what we might term the strongest possible fabric to be produced with a certain number of warp threads and picks per inch, as each thread, by reason of its interlacing, supports the others to the utmost. This frequent interlacing of warp and filling will at the same time impart to the fabric a more or less perforated character, said perforations being regulated by the counts of the yarn used, as well as the twist imparted to the yarn; for the reason that the heavier in counts the threads are, the larger the perforations will be, and that the softer the twist, the less prominent the perforations; again, the perforations will be reduced by employing a twist for warp and filling which, when the threads are interlaced in the fabric, runs in the same direction.

Fig. 12 shows a section of a fabric interlaced with this plain weave. The warp threads are shown in full black, and in connection with the filling all the uneven number of picks are shown shaded and all the even number of picks in outline.

The first move towards figuring a fabric constucted with the plain weave is made by varying the thickness of the threads in the warp or filling, or in both systems at the same time; for example, in "repp" cloths as used

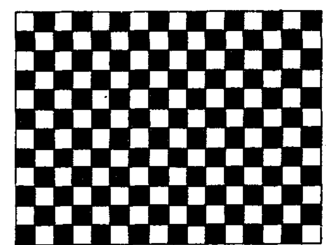


Fig. 10

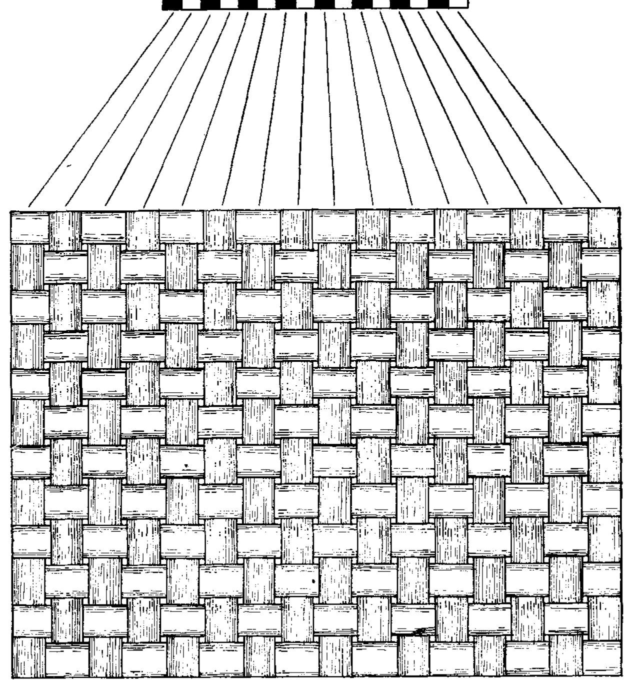


Fig. 11

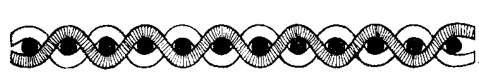


Fig. 12

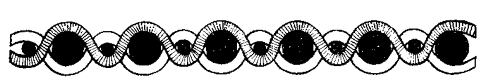


Fig. 13

for ladies' dress goods, and also for decorative purposes. In these fabrics either one kind of warp and two kinds of filling (one pick heavy, one pick light): or two kinds of warp (one thread heavy to alternate with one thread light) and the before mentioned two kinds of filling are used. Fig. 13 shows the section of such a repp fabric, one system of the threads, either the warp or the filling (in this case the warp) being shown in full black, the other system of threads, either warp or filling (the filling in this case) being shown one thread shaded, the other in outline. These changes of heavy and light threads are also used for forming borders, as observed in some cambric handkerchiefs or similar fabrics.

Twills. This is the second division of the foundation weaves, and differs from the plain weave in that warp and filling do not interlace alternately, but that either thread rests, according to the twill weave used, for one, two, three or more threads in succession, either on face or back of the structure, before changing onto the other side.

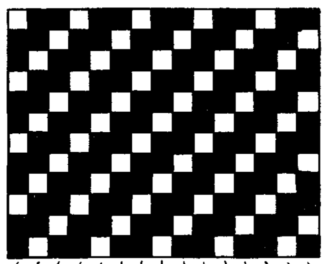


Fig. 14

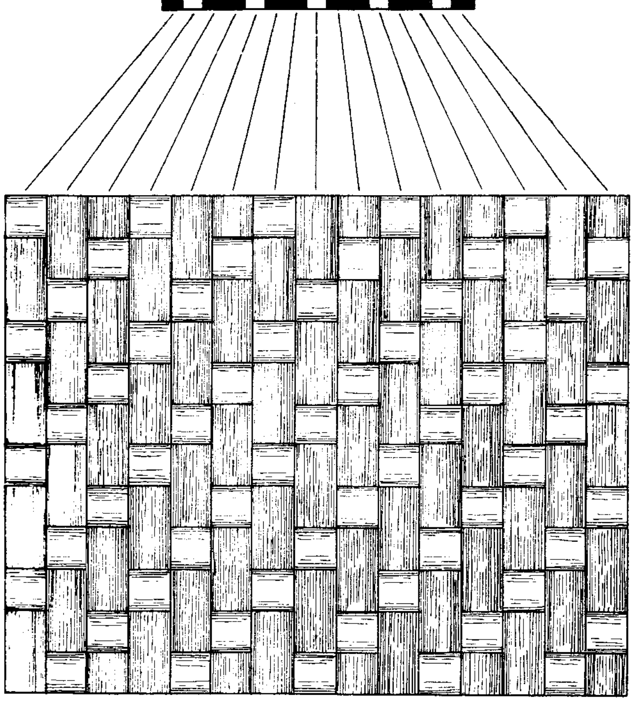


Fig. 15

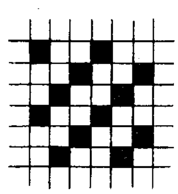


Fig. 17

Fig. 16

The rule for constructing twills is thus: After indicating on your point paper the interlacing of the first warp thread or the first pick, remember that every successive warp thread interlaces with its successive pick; for example, if the first warp thread interlaces with the first pick, the second warp thread interlaces with the second pick, the third warp thread with the third pick, and so on; again, for example, if the fifth warp thread should interlace with the second pick, the sixth warp thread in turn will interlace with the third pick, the seventh warp thread with the fourth pick, the eighth warp thread with the fifth pick and so on until the repeat of the complete weave is obtained. This manner of interlacing warp and filling will produce a distinct pattern upon the cloth, *i. e.*, lines running in a diagonal direction across it.

Comparing fabrics constructed with twills to those interlaced with the plain weave, we will notice readily that twill weaves permit of the introduction of more material, both with reference to warp as well as filling in the fabric structure, resulting in turn in a closer or heavier fabric than is possible to be made with the plain weave, for the fact that twills only interlace at intervals of threads and consequently permit warp and filling to lay closer towards each other in the structure. The direction of the twill itself can be either arranged to run from left to right, or *vice versa*, according to the nature and purpose of the fabric, although as a rule, the twill running from left to right in the fabric is the one mostly met with. This twill effect is more prominent to the eye provided the same runs in the same direction as the direction of twist in the warp, since in this way the weave will more closely lay the twist in the yarn, and hold it in the finishing process, for which reason this is the plan observed when dealing with fabrics requiring a smooth face; whereas when a rough face is desired, running the twill against the direction of twist in the warp yarn will assist the finishing process.

The least number of threads, of each system (warp and filling) required for constructing twills is 3, after which they can be designed for any number of threads for their repeat.

Twills can be divided into two sub-divisions, *viz*:

(a) *"uneven sided twills,"* are twill weaves in which more or less warp-up indications appear on the design, compared with filling-up indications, or the amount of indications for warp and filling balance but the general arrangement is different in one compared with the other. For example, the $\frac{3}{2}$ 5-harness twill is an uneven sided twill, for reason first stated, whereas the $\frac{2}{3}\frac{2}{1}$ 8-harness twill is an uneven sided twill, for the reason last stated, since although there are found ($2 + 2 = 4$, and $3 + 1 = 4$) four raisers and four sinkers in the repeat of the weave, still the arrangement (2, 2 and 3, 1) differs.

(b) *"even sided twills,"* are twill weaves in which the amount and arrangement of warp up and filling up, is completely balanced.

3-harness twills. Two twills can be constructed for a 3-thread repeat, in warp and filling, and which are the 2 up 1 down (technically written $\frac{2}{1}$) and the 2 down 1 up ($\frac{1}{2}$) 3-harness twill. The first mentioned weave is what we call the warp effect, *i. e.,* warp predominates on the face of the fabric, whereas the second referred to weave is its mate filling effect, *i. e.*, the filling predominates on the face of the fabric in this instance. Both weaves are uneven sided twills, consequently, if one of them forms the face of the fabric, the other forms its back, however with the twill running in the reverse direction from the direction of the twill on the face of the fabric.

In order to simplify matters to the student, diagrams Figs. 14, 15 and 16 are given, and of which Fig.

14 shows us the $^{2}{-}_{1}$ 3-harness twill, warp effect, executed for 15 warp threads and 12 picks. Fig. 15 shows its corresponding fabric structure, with connecting guide lines between it and the weave, so the student can readily follow the interlacing of each thread between both diagrams. Fig. 16 shows the section of the fabric, showing 6 warp threads in their section (shown in full black) taken in connection with pick number 1 of the weave or fabric structure, the latter being shown in outlines shaded.

Diagram Fig. 17 shows us two repeats each way of the $_{2}{-}^{1}$ 3-harness twill, *i. e.*, the mate twill to weave Fig. 14.

We call our twills by the name "harness," in place of "warp threads, as required for one repeat of the weave," since this is the custom to do; the word harness indicating the lowest number of harnesses required in the loom for said weave, although small twills of a 4, 5 or 6 harness repeat, will be frequently doubled up on the loom, *i. e.*, woven with 8, 10 or 12 harnesses respectively.

Four harness twills. Three twills can be constructed on this number of harnesses, or for a 4 thread repeat warp and filling ways, *viz:* the 3 up 1 down ($^{3}{-}_{1}$), the 3 down 1 up ($_{3}{-}^{1}$), and the 2 up 2 down ($^{2}{-}_{2}$) twill. Of these three weaves, the first two are uneven sided twills—one weave the mate of the other—the last quoted weave being the first even sided twill come into contact with, it being the most frequently employed weave met with in the textile industry, and is also known as the cassimere twill, on account of being the most useful weave in that line of the industry. Of our plate of twill weaves accompanying this lesson, Fig. 18 shows us the 3 up 1 down, Fig. 19 the 3 down 1 up, and Fig. 20 the 2 up 2 down twill.

Five harness twills. Six different twills can be constructed on this number of harnesses, *i. e.*, twills repeating on 5 warp threads and 5 picks, *viz:*

The 4 up 1 down—see Fig. 21,
The 4 down 1 up—mate of it.
The 3 up 2 down—See Fig. 22,
The 3 down 2 up—mate of it.
The 2 up 1 down 1 up 1 down—see Fig. 23 and
The 2 down 1 up 1 down 1 up—mate of it.

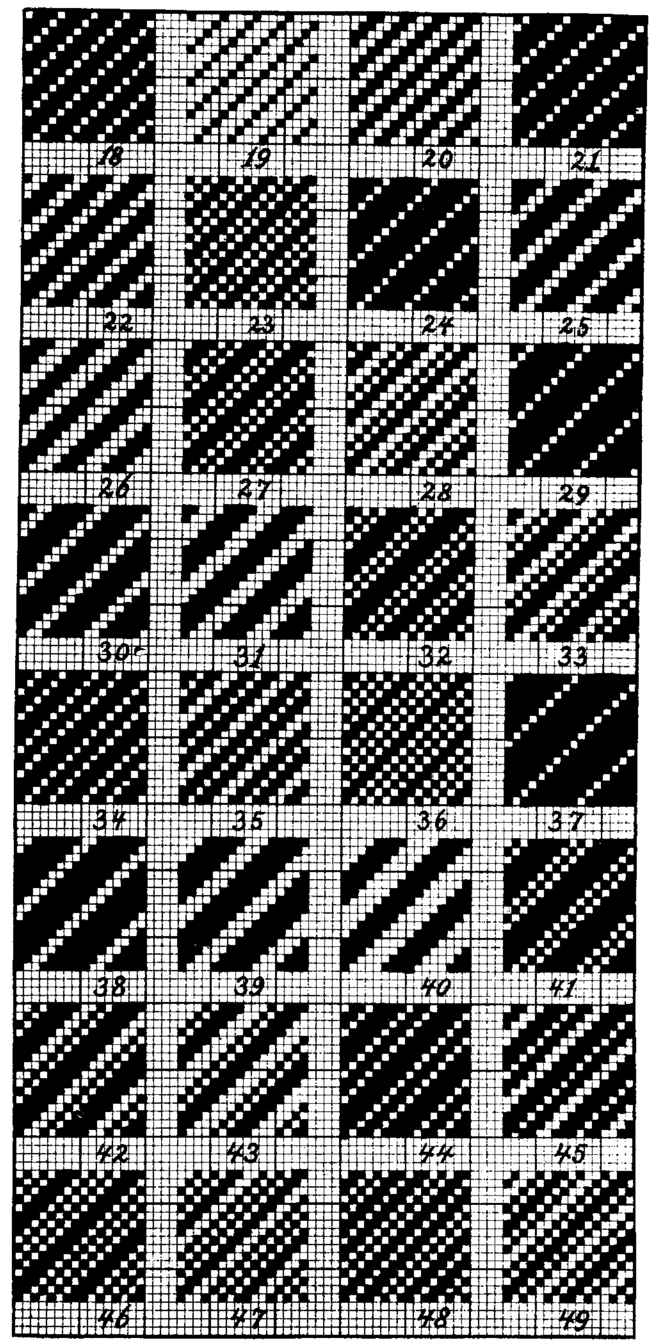
Six harness twills. Eight different twills can be designed for this repeat, which are:

The 5 up 1 down—see Fig. 24,
The 5 down 1 up—mate of it.
The 4 up 2 down—see Fig. 25,
The 4 down 2 up—mate of it.
The 3 up 3 down—see Fig. 26,
The 3 up 1 down 1 up 1 down—see Fig. 27
The 3 down 1 up 1 down 1 up—mate of it, and
The 2 up 1 down 1 up 2 down—see Fig. 28.

Seven harness twills. Sixteen different twills can be made on this repeat, and of which eight are shown in diagrams Figs. 29, 30, 31, 32, 33, 34, 35 and 36, the other eight being the mate weaves to those given, *i. e.*, consider in this case □ for risers and ■ for sinkers in said eight diagrams Figs. 29 to 36.

Eight harness twills. Twenty-two different twills can be made on this repeat, and of which thirteen (13) are shown in diagrams Figs. 37 to and inclusive 49, the remaining nine being mate weaves to those shown in Figs. 37, 38, 39, 41, 42, 44, 45, 46 and 48, considering again in connection with these nine weaves □ for risers and ■ for sinkers.

We have given every one of the twills possible to be made on 3, 4, 5, 6, 7 and 8 harness for the purpose



to show the student not only the immense variety of twills at the disposal of the textile designer, but at the same time to supply him with the best plan of constructing twills for any number of harnesses called for; which of these twills to use depending on the character of the fabric to be made. The larger the number of harnesses at our disposal, the greater is the number of twills that can be constructed for each repeat. In connection with diagrams Figs. 18 to 49 we have shown each weave executed for 16 warp threads and 16 picks, in order to present this collection of twill weaves in the most convenient manner, it being understood that in connection with the 3-harness twills we showed ($16 \div 3 = 5\frac{1}{3}$) 5 repeats + 1 end, warp and filling ways; with the 4-harness twills ($16 \div 4 = 4$) 4 repeats, warp and filling ways; with the 5-harness twills ($16 \div 5 = 3\frac{1}{5}$) 3 repeats + 1 end, warp and filling ways, etc.

Questions:

(1) Quote sub-divisions of our foundation weaves.

(2) Why does the plain weave, texture of fabric, counts and twists of yarn alike, produce a stronger fabric than any other weave?

(3) Quote rule for constructing twills.

(4) What is the difference between an even sided and an uneven sided twill? Illustrate affair with an example of two 10-harness twills, painting two repeats warp and filling ways of each weave.

(5) Quote least number of harness, twills can be designed for.

(6) Construct 42 different twills for 9-harness. Produce no duplicates. Construct each twill with two repeats warp and filling ways. Be sure you have no duplicates. Mate twills are included in the 42 weaves asked for.

(7) Produce all four twill line twills possible to be made on 13 harnesses.

(8) Produce all the even sided twills you can find for 11 harnesses.

(9) What is the reason that you can use a higher texture, both warp and filling ways, with any twill weave, as compared to the plain weave?

THE TESTING OF TEXTILE FIBRES, YARNS AND FABRICS.

Necessity of Testing Yarns and Fabrics by the Textile Manufacturers, Commission Merchants, etc. Yarn Testing. Textile Fibres of Commerce: Wool, Shoddy, Mungo, Extract, Flocks; Silk, Spun or Waste Silk, Wild Silk, Weighted Silk; Cotton, Flax, Jute and Ramie. Tests by Burning. Chemical Tests for distinguishing Wool, Cotton, Silk and Flax from each other. Testing Artificial Fibres. Testing for Moisture. Silk Conditioning. Testing Yarns and Fabrics as to Fastness of Dye: Fulling, Sun and Rainproof, Perspiration, etc. Testing Yarns as to their Counts, Twist, Evenness, Breaking Strain. Testing Fabrics as to Weight, Weave, Texture, Strength and Elasticity, Color, Finish, Count, Twist and Quality of Yarns used, etc., etc.

(*Continued from page 7.*)

Flocked goods are always treated with more or less suspicion by the commission merchant and clothier, as well as by the consumer, possibly for the fact that flocks and the process of flocking the goods do not receive the care they should. One of the disadvantages of flocked goods frequently met with, is the tendency of the flocks to drop out of the fabric and gather in the lining of the garment; for which reason such garments as are lined, as coats, for example, have their lining loose at the bottom, so that whatever flocks work out of the fabric during wear, will drop out of the garment and not get a chance to lodge in the bottom seams of the lining. However, when flocks are thus coming excessively out of the fabric or garment (some certainly will always more or less come out), it is a sure sign of an error somewhere, either poor flocks, a wrong way of flocking, or more flocks used than is consistent with the structure of the fabric under operation, etc.

A good plan to test a fabric as to its contents of flocks, is thus: Take a large white sheet of paper and rub the sample, holding it between thumb and forefinger of each hand, change position of fingers frequently so each portion of the sample thus receives thorough rubbing, and when a considerable portion of the flocks, provided the fabric thus tested was flocked, will be liberated and drop onto the paper. Dissecting sample, *i. e.,* separating warp and filling, will liberate an additional amount of these flocks, more particularly such as had worked their way into the structure. Take each thread, whether warp or filling end, as picked out by you, and liberate all flocks possible from the thread by pulling it between the thumb and forefinger of one or the other hand, using one or the other of the finger nails for scraping off flocks as may adhere to the particular thread.

Fig. 2.

Silk is the simplest, and in its properties, the highest and most perfect of all spinning materials. It differs from other textile fibres, both as to its nature as well as the machinery used in preparing it for the loom, the machinery used being much simpler and less cumbersome than the processes employed in preparing other fibres. The silk fibre, when in its natural or gum condition, consists of a double fibre, and viewed under the microscope (see Fig. 2) has the appearance of two fibres cemented together. When scoured or degummed, the two individual fibres are separated. As seen from the illustration, the surface of the fibre appears smooth, transparent and structureless, with occasional little nodules in the side of the fibre. It resembles a cylindrical glass rod, in some portions uniform in thickness, while at others of somewhat irregular diameter.

Spun, Waste, Floss, Chappe, or **Filosella Silk,** is obtained (1) from the coarse, loose, outer layers surrounding the true cocoon; (2) defective cocoons, double cocoons and those from diseased worms; (3) the parchment like skin left behind in reeling the sound cocoons; (4) the waste made in reeling the cocoons, as well as such as are made in silk throwing mills. This waste silk fibre, after being properly prepared, *i. e.,* boiled off, in turn is carded, combed, drawn and spun into a yarn partaking of some of the qualities of raw silk, although it is not as bright as the latter, its lustre varying largely according to the amount of gum retained on the fibres. The more the gum has been boiled out, the greater will be the lustre of the fibres. Again, spun silk is weaker than thrown silk, both in strength and elasticity. The waste made during spinning these spun silk, waste silk, floss or chappe silk yarns, is afterwards used either by itself or in connection with better stock in spinning still lower qualities of silk waste yarns. In this instance the yarn is spun after the woolen yarn system.

Silk Shoddy is prepared from silk cuttings and remnants by a similar treatment to that employed with wool shoddy, the short staple product being worked up as an adjunct to waste silk in the cheapest grades of yarns.

Wild Silk. Like cultivated silk, wild silks consist of two filaments which however, instead of being struc-

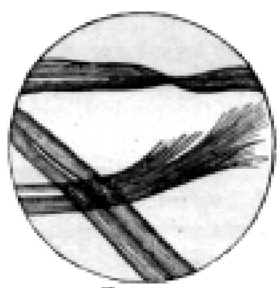


FIG. 3.

tureless are composed of individual fibrils, readily recognized under the microscope by decided, parallel, longitudinal striations, as seen from our illustration, Fig. 3 showing Tussah Silk, the most important variety of wild silk, as it appears if viewed under the microscope. Wild silk has a dark color, which cannot be removed except by means of a powerful bleaching agent; its lustre, softness and elasticity being inferior to those of cultivated silk. They are hard and difficult to reel, unless specially treated, for which reason they are mostly worked up in the same manner as defective cocoons of cultivated silk in connection with spun silk.

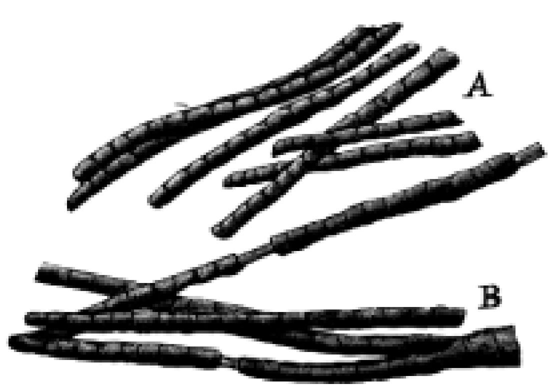


FIG. 4.

Weighted Silk. The weight taken from the silk during the boiling off process is a considerable item, and to compensate for this loss, the practice of artificially adding weight to some silks received its start, the amount of weighting done having been continually increased above the original weight of the silk, until now from 3 to 4 or more times its weight is thus added. In order to show the appearance of loaded silk viewed under the microscope, Fig. 4 is given, showing different amounts of weighting: *A* shows weighting from one and one-half to twice the weight of the silk, *B* shows this weighting increased to from three and one-half to four times the weight of the silk. The weighting of silk is confined to raw, *i. e.,* reeled silks, for the prices of waste or spun silks would not make it worth while extending the system in that direction.

Cotton. The cotton fibre is the filament which grows around the seeds of the various species of the cotton plant. When viewed under the microscope, the fully matured or ripe cotton fibre has the appearance of a spirally twisted band or ribbon, with finely-granulated markings. A grooved appearance will be also noticed, on account of the cell walls being thicker at the edges than in the centre. Fig. 5 is given to illustrate cotton fibres viewed under the microscope, and of which *A* shows two unripe or dead fibres, by which is understood that such fibres have not attained full maturity. Their detection is very important, since their presence is very detrimental to yarn and fabric. They are recognizable by the very thin transparent filaments, which, though ribbon shaped, are not twisted, and do not exhibit the slightest trace of lumen

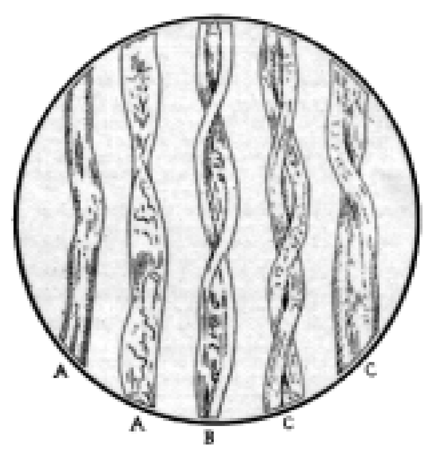


FIG. 5.

in the cell. *B* shows us a specimen of a half ripe fibre, and which is a medium between ripe and dead fibres, and in conjunction with the latter, according to amount present in a lot of cotton, depreciate its value to the manufacturer, such fibres being the result of the cotton being removed from the pod before fully matured. *C* shows us two specimens of matured or fully ripe fibres. These are hollow nearly throughout their entire length, with the exception of the end which had not been attached to the seed. This hollowness of the ripe fibre allows the dyestuffs to penetrate, and produce evenly dyed yarns or fabrics, whereas unripe or dead cotton, which practically has no central cavity, is very difficult to dye, and frequently appears as white specks on dyed pieces, particularly in such as are dyed indigo blue or turkey red.

Amongst the varieties of cotton of importance to us are the Sea Island, the Mainland, Egyptian and the Peruvian cotton. (*To be continued.*)

Posselt's Textile Journal

A Monthly Journal of the Textile Industries

PUBLISHED BY
E. A. POSSELT, 2028 BERKS STREET,
PHILADELPHIA, PA.

SUBSCRIPTION RATES:

United States and Mexico, $3.00 per year.

Other countries in the Postal Union, $4.00 per year.

Single Copies, 25 cents.

This Journal is published on the tenth of each month.

Postage prepaid by the Publisher.

Subscriptions begin with the number following the date on which the subscription is received at this office.

In writing about subscriptions, always give your full name and address.

When writing for changes in address, always give the old address as well as the new address to which copies are to be sent.

Money should not be paid to agents or solicitors unless they can show authority from this office. This Journal cannot be responsible for money paid to unauthorized persons.

Subscriptions are payable in advance. Money can be sent by check, draft, money order or in registered letter. Make all drafts, checks, money orders, etc., payable to E. A. POSSELT, Publisher, 2028 Berks Street, Philadelphia, Pa.

ADVERTISING RATES:

WANTS, FOR SALE, ETC. If set solid under Classified Advertisements, Special Notices, Help Wanted, Situations Wanted, Machinery for Sale, Etc., will be inserted at the rate of 25 cents per line, for each issue, if the answers are to come in care of this office to be forwarded; 20 cents per line, if replies are directed to advertiser. Count 10 words to one line.

Payment must be made in advance for all transient advertisements.

Rates for Regular Advertisements will be furnished on application.

COPY FOR ADVERTISEMENTS must reach this office not later than the 25th of month preceding date of issue, to insure proper attention

ALL COMMUNICATIONS WILL BE CONSIDERED AS CONFIDENTIAL.

Letters to receive attention must be accompanied by the signature of the sender, but this will not be published unless so requested.

We will always be glad to receive articles of a practical nature relating to the textile industries, and will publish such as are available.

EUROPEAN AGENTS: Sampson Low Marston & Co., Ltd., 100 Southwark Street, London, S E., England.

Application for the entry of this Journal as SECOND-CLASS mail matter has been made.

India is in the Market for American Machinery.

The Gaekwar of Baroda, the immensely rich Indian Maharajah, is about to place large orders for machinery in the United States. Machinery for ginning, spinning and weaving, printing, mercerizing and dyeing are wanted.

The Maharajah desires all manufacturers interested to communicate with him by writing to R. C. Whitenack, c/o Sampatrao Gaekwad, Sect. to his Highness the Maharaja of Baroda, Baroda, India. Mr. Whitenack, is an American, and a subscriber to our literary works.

The Gaekwar recently toured the United States, making a study of our industries, and so impressed was he with our methods of Textile processes that he desires to adopt them.

The Hazard of Open Beltways.

One of the most vital questions of the day regarding the protection of mills from fire, brings to light the most common fault found in a majority of the older as well as some of the newer mills.

Open beltways as they occur in the mills form an easy way in case of fire, for the flames to communicate with different parts of the building, and thus are the indirect cause of many of the larger conflagrations. President Gray, of the Boston Manufacturers Mutual, in discussing this matter cites a number of instances where fires have originated in open beltways and the flames carried by the defective arrangement to all parts of the mill. As a matter of precaution he suggests:—

1st, that all combustible material as far as possible be kept out of belt inclosures;

2nd, that the walls and floors of the inclosures be thoroughly swept at least once a week;

3rd, that all beltways and inclosures, including flywheel casings, are thoroughly equipped with automatic sprinklers.

It is necessary that the inclosures should be not only surrounded by automatic sprinklers, but that heads should be placed within them, and not over eight feet apart, in order that a fire, if one occurs will be met at once by the water from the sprinklers.

Is the Middleman a Necessity?

In these days of keen competition and close margins, a question of utmost importance to the cotton spinner is: how to get his supply of raw cotton, consistent with quality, at the lowest figure.

Again the main feature for the farmer is: how can he secure a higher price for his cotton.

Lately lots of writing, etc., has been done to bring these two factors into "closer relations."

It sounds well and as a matter of fact such closer relations and a feeling of good fellowship are much to be commended. It is highly proper and desirable that the most cordial relations possible should be encouraged; the one buys what the other grows—both are at once mutually dependent upon and indispensable to the other. But to refer in high sounding rhetoric to their imaginary community of interest is pure nonsense, beyond the bare fact that both are vitally interested in cotton. One wants cotton high and the other wants it low, and that is the whole truth of the matter.

They say they desire to do without the so-called "middleman." This "sounds good" to the farmer, but the spinner knows the idea is totally impracticable. How is the cotton going to get from the farm in Texas to the mill without the intervention of the middleman? The farmer would cut a pretty figure taking his cotton direct to the spinner, and the spinner buying direct from the farmer. Both would have to employ the services of various intermediary agencies, which is exactly what is now done, and doubtless done more economically than could be done by any other plan that could be devised.

Peculiar Cloths Imported for Italian Children.

Two samples of cotton goods manufactured in Italy have been furnished the Bureau of Manufactures. One is a piece of bleached duck, which is exported to the Philippine Islands, and might well be made here, the preferential tariff in our favor being remembered. It is made of somewhat coarse yarns, apparently about 20s warp and filling, and has 104 warp threads and 56 picks to the inch. It is made 28 inches wide and is sold at 0.61 franc per meter, less 2 per cent. discount.

The second sample, a narrow bleached fabric, 16 centimeters wide, is sold to the Italian residents here. It is woven in a fancy Jacquard design, somewhat after the style of "Marseilles" quilt in miniature. It is cut up in lengths of about 20 inches, and, following a well-established Italian custom, used as a binder and wrapped around the bodies of very young children. Near each end of the 20-inch lengths there is woven in some endearing expression, such as "Caro Angiolette." The piece is evidently woven several pieces in one width with centre selvages between each other, so as to leave perfect selvages on each side of the individual fabrics, and yet allow quite a number of them to be woven side by side in one loom simultaneously.

The yarns are approximately 2/20's warp and single 20's filling, with 84 warp threads, and 88 picks to the inch.

There is said to be a considerable trade between Italy and the United States in these peculiar fabrics and that it is increasing in importance with the rapidly growing Italian population of this country. Therefore it would seem that the production of like goods by our manufacturers ought to be well worth further investigation by the trade. The samples will be loaned to manufacturers, by applying to the before mentioned bureau.

Cotton Textiles in the Philippines.

The total value of imports in the Philippines, and of which cotton goods are the most important item, for the fiscal year ending in June, 1907, increased from $6,642,329 for 1906 to $8,320,079 in 1907, or nearly 25 per cent. The increase in the value of cotton goods imported from the United States was even more marked, rising from $278,796 for 1906 to $1,056,328 for 1907, approaching 400 per cent.

This increase is indirectly due to the amendment to the tariff of 1905, enacted by Congress on February 26, 1906. This act distinguishes single width from double width goods and thus provides a comparatively low rate of duty upon goods produced in narrow looms. Evasion by the splitting of double width goods into narrow breadth is prevented by the imposition of a surtax upon goods thus slit. This increase is not alone an increase in value, for the quantity imported in 1907 was 23,319,593 pounds, as against 19,432,973 pounds in 1906, and the quantity of American goods rose from 791,560 pounds to 2,895,437 pounds.

Ribbons.

There is a heavy continuous demand for ribbons of narrow widths, known commercially as baby ribbons, and considerable difficulty is experienced in meeting the demand. Mills are in most instances behind with deliveries, and this with little prospects of catching up to the demand. In addition to this steady demand, the coming holidays will tax deliveries to their utmost.

With reference to wider ribbons, the business is not as brisk as it might be. High prices causing buyers to hesitate, and even manufacturers regard the outlook for spring in a rather doubtful manner. The cause for this depression of the demand no doubt lies in the fact that the millinery trade have diverted from ribbons to broad silks, cutting them up into ribbon widths, and using them for trimming purposes.

Reputed Discovery of a New Silk in the Tropics.

According to Consul G. E. Eager, of Barmen, Germany, an important discovery was made a few months ago by a German resident of New York, who has just finished an exploration of the region surrounding the East African lakes. The consul writes:

A wild silk has been found by the traveler which is not only of importance to the silk trade, but will also be of interest to scientists as well. To the latter chiefly, that it may bring the source of the silk of the ancient races nearer to its final solution. The discoverer of this silk has secured concessions from both the English and German colonial authorities.

I am informed that there is every likelihood that the cocoons can be unwound in a single thread if proper care be taken in the process, which enhances the value of the silk. Experiments to this end have not as yet been concluded. Besides the cocoons, these caterpillars give with each spinning a large quantity of superior material for spun silk or schappe. The cocoons are inclosed in numbers of from 50 to 80 or more in a thick covering or nest, the material of which consists of pure silk fibre, and being available in large quantities might influence the schappe market to a large extent as soon as operations are started on a sufficient scale. A most important and valuable fact in regard to this silk is that it can be bleached to a very fine white, which is contrary to other well known wild silks, among which Tussah silk is the best known. The African lake regions seem to be a promising land for silk culture, there being an abundance of the trees, the leaves of which the caterpillar prefers for its food.

Cotton Supply and Consumption.

Henry G. Hester, secretary of the New Orleans Cotton Exchange, reports that the amount of cotton brought into sight during 322 days of the present season was 13,305,877 bales, an increase over the same period last year of 2,415,060 bales. The exports were 8,298,958 bales, an increase of 1,938,349 bales. The takings were, by Northern spinners, 2,524,062 bales, an increase of 179,629; by Southern spinners, 2,347,834 bales, an increase of 129,373 bales.

COTTON SPINNING.

RING SPINNING:—A General Description of the Modern Ring Frame—The Creel—Roll Stands—Weighting Rolls—Top Rolls—Bottom Rolls—Clearers—Care of Rolls and Roll Stands—Faulty Work of Rolls—Thread Boards—Rings—Ring Holders—Size of Ring to Use—Traveler Clearers—Setting Rings—Care of Rings—Finishing of Rings—Ring Travelers—The Action of the Traveler—How Travelers are Made—Weight of Travelers—Spindle Rails—Spindles—Setting Spindles—Lubrication of Spindles—Bobbins—Bobbin Clutches—Banding—Banding Machines—Band Tension Scale—Tin Cylinders—Ballooning and Separators—Winding—Builder Motions—The Warp Builder—How to Set the Builder Motion—The Filling Builder—Spinning Filling on Paper Tubes—The Combination Builder—The Care of Ring Rails and Lifter Rods—Some Causes for Badly Shaped Bobbins—Doffing.

NOTES:—Management of the Spinning Room—Data on Ring Frames—A new Spindle Drive Device—Care of Machines—Oiling—Leveling Frames—Power Tests—Power Consumption—Arrangement of Machinery.

FAULTY YARNS:—Knots and Bunches—Variations in Counts—Uneven Yarn—Thick and Thin Places—Weak Yarn—Kinky Yarn—Dirty Yarn—Kockled, Curled or Knotty Yarn—Slack Twisted Yarn—Hard Twisted Roving—Cut Yarn—Harsh or Wiry Yarn—Badly Wound Yarn—Bobbins Wound too Low—Soft Wound Bobbins—How to Prevent "Double"—Colored Work—Waste—Breaking Strength of Yarn.

CALCULATIONS:—A general Description on the Subject of Draft, Twist, Production and Gearing—Calculating the Draft from the Gearing—To find the Draft—To find a Constant—To ascertain Draft Change Gear—To Ascertain Hank Roving—To Ascertain Draft—Twist—Standard Twists—Contraction Due to Twist—Notes on Twist—Calculating Twist—To Ascertain Speed of Spindles—Calculating Twist from Gearing—Traverse Gear—Taper—Sizing the Counts—The Grading of Cotton Yarns, Single, Two or More Ply—Production—Programs for Spinning Yarns of Various Counts, from Bale to Spun Thread—Illustrations with Descriptive Matter of the Different Makes of Ring Frames.

The Ring Frame.

(To be continued.)

The bobbins used vary in shape accordingly, as the yarn wound is to be used for warp, or hosiery, or for filling, as does also the manner of winding the yarn upon each type, this being regulated by the builder motion, as will be explained later.

Spindles vary in design, working parts, method of support, and attachment on the spindle rail, etc., as made by different manufacturers, but the object sought for in all patterns is the securing of rapid revolution in a true vertical alignment with the minimum of friction and expenditure of power. It is absolutely essential that the spindle shall be held rigidly in alignment, so that the bobbin will revolve true and have no wobbly motion, otherwise the yarn would be broken constantly and spinning be made impossible. The spindle and the ring must be set concentric in order to accomplish perfect work, the ring may be set to the spindle, or *vice versa,* in either case the adjustment must be exact and rigidly fixed. The top flange of the ring must also be a true circle.

The ring frame, like all the other spinning machinery, has its various parts adjusted according to the yarns being spun. For instance, the velocity of the ring rail is slower for fine than for coarse yarns. The inclination of the axis of the drawing rollers is greater for coarse than for fine yarn, so as to lessen the friction on the thread board.

The revolution of the spindle, which is run at a very high speed (about 9000 R. P. M.), in its attempt to wind on the yarn, pulls the traveler round with it, and consequently relieves what would otherwise be a tension to the yarn; at the same time, each revolution made by the traveler puts a twist in the yarn, and as the bobbin can only wind on the amount of yarn delivered by the rollers, it follows that the traveler is made to revolve almost as quickly as the spindle, so that we get a most effective twisting operation performed. The function of the traveler being to put twist in the yarn and at the same time lag behind the spindle sufficiently to enable the length of yarn delivered by the rolls to be wound on the bobbin, this necessitates that different weights of travelers be used for different counts of yarn, and the coarser the yarn spun the heavier must be the traveler. The imparting of twist to the yarn and the winding of it on the bobbin are closely related, and if the rotation of the traveler is constant, the yarn will be evenly twisted and properly wound, hence the necessity for having the traveler carefully adjusted to the ring, and the flange of the latter made true and smooth, for if the ring is rough or not perfectly round, a retardation of the speed of the traveler (from friction) will occur when it is passing the uneven parts.

THE OPERATION OF THE RING FRAME MAY BE BRIEFLY DESCRIBED AS FOLLOWS: The passage of cotton through the frame, after the creels have been filled, commences, where double roving is used, by passing the ends from two bobbins through a trumpet which is fastened to the traverse guide rod, the ends being then passed between the top and bottom back rolls, and drawn between the middle and front rolls. The end of the drawn roving is delivered between the front rolls, which are set at such an angle that the twist which is being imparted by the traveler will run as far as possible up to the nip of the front rolls. When this twist has been inserted, the roving becomes yarn, and now passes forward through the thread guide, past the separator plate, if such are used, through the traveler and on to the bobbin. It is desirable that the yarn shall receive the twist instantly as it leaves the nip of the front rolls, on account of the speed and the tension that is put on it. This is especially necessary for soft twisted yarns, such as filling and hosiery yarn, and the angle of the rollers is therefore made as large as possible for these yarns. Fig. 227 shows the passage of the yarn from creel to spindles, in which it will be noticed that the position of the thread board and guide wires is directly over the spindles.

The revolution of the spindle begins to wind the yarn on the bobbin, but since the drafting rolls deliver only a certain length of yarn with each turn, and as the spindle is revolving at a high rate of speed, a tension is produced in the yarn, and this acting on the traveler pulls it around the ring at almost the same speed as the bobbin itself. Every revolution of the traveler puts a turn of twist in the yarn, and at the same time winds on the bobbin the amount of yarn given out by the front drafting rolls. On account of its lag behind its spindle, the traveler also guides the yarn to its proper place on the bobbin, as actuated by the motion of the ring rail, either for warp or for filling wind as explained later.

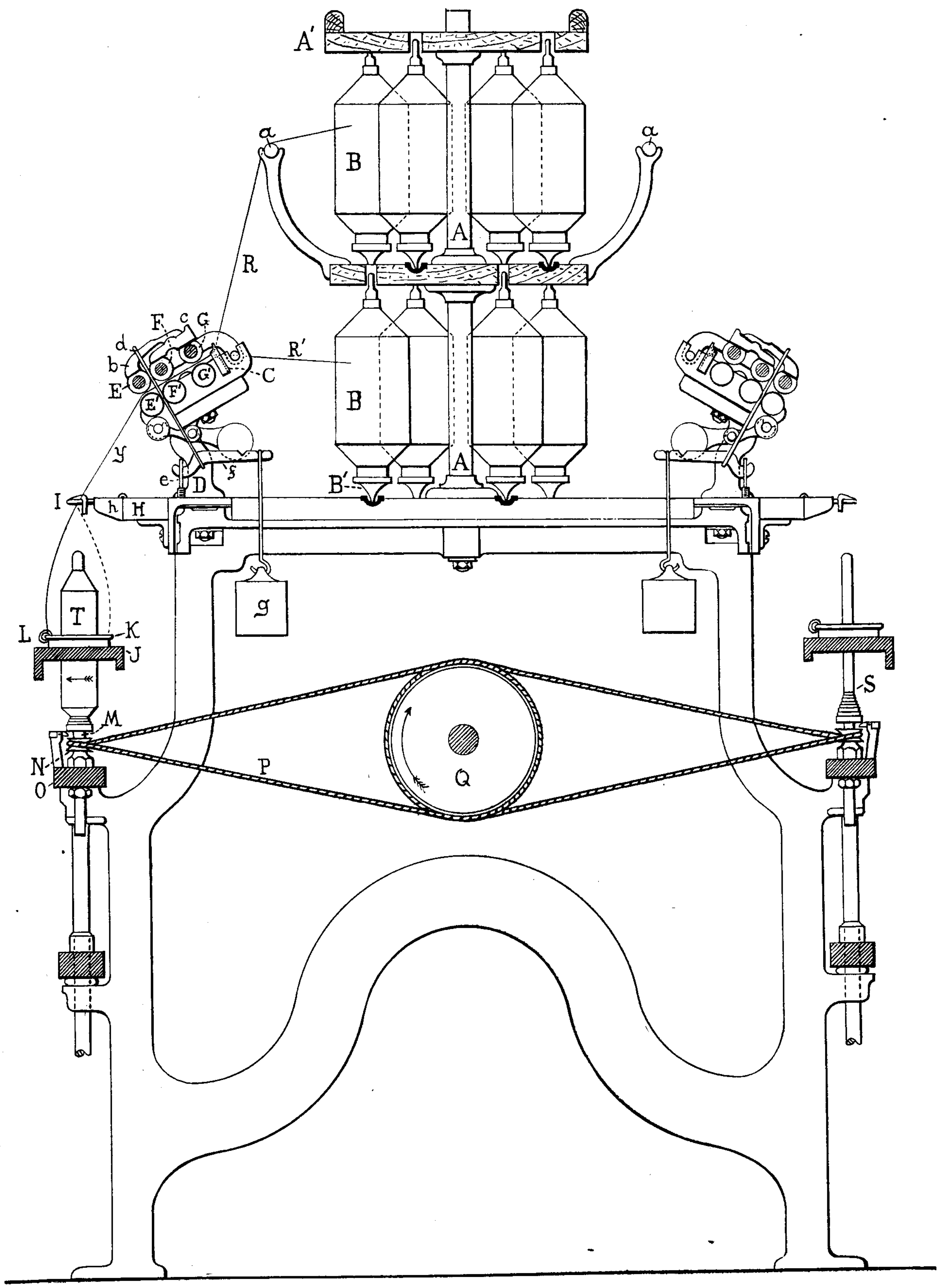


FIG. 227.

As mentioned, the shape of the bobbins varies as they are to be used for warp or for filling, and the winding of the yarn on the bobbins also varies accordingly, in both cases the difference in wind being secured by the up and down movement of the ring rail. In the warp wind, the bobbin is shaped like the roving bobbin and the yarn is wound upon it with each succeeding layer shorter than the preceding one. In the filling wind, the bobbin is built on an entirely different principle, its base being made with a taper, instead of cone shape, and the main barrel has ridges so that the yarn will unwind in layers and not become tangled. The ring rail is moved up and down by the builder motion so that there is first wound a traverse of yarn from the base of the bobbin a short distance up, then each successive traverse starts a trifle higher, the same length of traverse being retained, and this continues until the bobbin is filled, this peculiar shape being the only one possible for the unwinding of the yarn from its bobbin in the shuttle of the loom.

The builder motion, that part of the ring frame which determines and secures the varying methods of winding yarn on the bobbins will be treated fully under a separate heading, its function being to raise and lower the ring rail *J* at determined intervals and distances.

When the bobbins have been filled with yarn, the frame is doffed, *i. e.*, the filled bobbins removed and empty ones placed on the spindles, the procedure being fully described in the chapter on doffing. When the frame starts up, the yarn is guided properly to the bobbin by the ring rail and traveler and the spinning proceeds as before.

The gearing of the ring frame consists principally of one simple train, there being no calculations required except for draft, twist and production. All the power for driving the spindles is derived from the cylinder Q, which carries spindle bands for the spindles on both sides of the frame. Another type of a ring frame (of narrower construction—little used here) has two cylinders, one for each side of spindles. Power may be applied to the tin cylinder in various ways, by gearing, belts or individual motors, in any case, the cylinder, acting as a shaft, must be supported so that the power applied at one end and transmitted its entire length, will not cause it to bend, buckle or twist out of true alignment. Cylinders are usually constructed of two thicknesses of tin, to make them stiff and capable of withstanding high speed. They are rarely over 10 feet in length and are commonly made 7 inches in diameter, less frequently 8 or 9 inches. Cylinders usually have steel shafts which revolve in bearings, carrying oilers, etc., and should be carefully balanced before being set into the frame.

The Creel.—The roving bobbins, as coming from the fly frames, are held in a creel, being allowed to revolve on skewers supported in glass or porcelain steps. Creels are built either one or two tiers high, depending upon whether one or two ends are fed together. If intended for single roving, there is only one roving bobbin for each spindle and the creel is one tier usually, whereas for double roving, there are two roving bobbins or ends for each spindle and the creel is two tiers high. The boards of the creel are generally made adjustable, to accommodate different lengths of roving bobbins, and they may also be hinged to allow easy removal and replacement of bobbins.

A view of a sectional elevation of the creel for a ring frame, for double roving, with the bobbins in place, is shown in Fig. 227 at *A*. The creel consists of bottom, middle and top boards. The latter serves for a shelf upon which full roving bobbins can be placed for a handy supply for the spinner, when needed. The skewers *B'* for holding the roving bobbins *B*, rest in either glass or porcelain steps or cups, which are set into the wood, flush with the top surface of the boards forming the creel. The upper part of the skewers in the illustration referred to, are shown as fitting into sockets in the board above, whereas

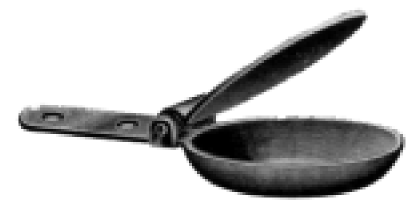


FIG. 228.

wire rings are employed in some types of ring frames for holding the top of the skewers. Bobbins should be held in true upright alignment by the skewers and these should be held tightly enough by the creel boards to prevent undue wobbling, otherwise the roving will not be unwound properly. The skewers are supported on steps made of glass or porcelain, or other hard substance, so as to reduce the friction of the skewers to a minimum, and allow the bobbin to rotate with

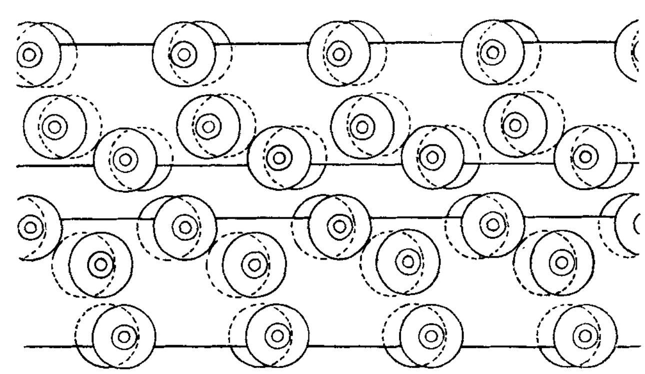


FIG. 229.

the greatest ease. Undue friction will result in too much tension of the roving, or will frequently cause it to break. On each side of the creel are seen brackets which support guide rods *a*, to conduct the ends of roving to the traverse guide rod *C* without its coming in contact with the creel board.

In some mills, a fixed iron box, known as a traveler cup, is placed at each end of the creel, of which an illustration is given in Fig. 228, as a receptacle for a handy supply of travelers, their use contributing to convenience, neatness and economy.

Fig. 229 shows the plan of a typical creel with bobbins for double roving, the bobbins in the upper tier being shown by full lines, and those in the bottom tier by dotted lines, the bobbins being so spaced that the back row can be removed without disturbing the front ones. Creels should be always made as roomy as possible to allow plenty of space for the bobbins and for greater ease and quickness in removing and replacing these—creeling.

It is sometimes customary to have the roving bobbins in the creels some filled more than others (at one time) so that they will not all run out together. Creeling, *i. e.*, to replace the bobbins as they run off, is performed by the spinner, or in some mills by extra hands —creelers. In creeling, it is advisable to see that short piecings are made and that said piecings are not made too hard, in order that they will be properly drawn out by the drafting rolls. Creels should be thoroughly cleaned at least twice a week, removing all the dirt that has accumulated, either on the skewer tops or feet. Between this semi-weekly cleaning, it is necessary that they be dusted oftener by the operator

A defect, which may cause considerable annoyance to the spinner, is the over running of the roving bobbins on the creel, more particularly in connection with the upper tiers of bobbins, on account of the weight of the roving strand from bobbin to the traverse guide eye, and when, as in the general construction of frames, it is only supported by a common guide rod. Various devices have been employed, more particularly abroad, to obviate this defect, the chief being the employment of a corrugated metal roller, which is brought so close to the bobbins that the weight of the roving between the bobbins and the roller is insufficient to cause the bobbin to rotate. This corrugated surface of the roller acts as a brake. This roller may be formed either out of one piece of tubular metal corrugated on its periphery as required, or can be made up of two parts, namely, a tubular body and an outer metal corrugated covering. When the apex of the flutes or corrugations are brought to a fairly sharp edge, it is found that they offer in conjunction with the projecting fibres of the roving, a certain resistance to the roving, which is sufficient to prevent the loose strand of roving, between bobbin and guide eye, by means of its mere weight, from over running, *i. e.*, unwinding. The fluted roller is driven at the required speed, which is the same as that of the back drafting roll, and the roving is drawn off from the bobbin at a speed which synchronises with the speed of the fluted roller.

(To be continued.)

RING SPINNING is an American invention and dates back to the patent granted in 1828 to John Thorpe, of Providence, in which he dispensed with the old flyer as used for imparting twist to the yarn in the old water frames. Thorpe by his invention, produced the same result by passing the yarn through a slot in the outer of two concentric rings, between which it revolved with the motion of the spindle and bobbin, the friction and drag between the two rings holding it back of the spindle, imparting to it the required twist.

SILK FROM FIBRE TO FABRIC.

True Silk—Silk Throwing—Splitting and Sorting—Soaking—Winding—Cleaning—Doubling—Tram—Organzine—A Typical Silk Spinner—A Silk Doubler and Twister—Defects met with in Thrown Silk—Singles—Reeling—Numbering the Silk—The Denier System of Numbering Silk—Dram System of Numbering Silk—The Ounce System of Numbering Silk—Comparison of Denier and Dram—Denier Constant—Testing Silk as to Counts—Conditioning—Scouring—Boiled-off Silk—Tinting—Souple Silk—Ecru Silk—Bleaching Silk—Soap—Testing Soap—Soap Economy—Water—Weighting—Dyeing—Washing—Lustering—Wild Silk—Spun Silk—Waste Silk—Statistics — Winding — Warping — Drawing-in — Quilling — Weaving—Finishing.

(Continued from page 29.)

Winding. The next process to which the washed silk is subjected, as well as silk that is to be thrown bright, is winding, *i. e.*, transferring or winding the silk, then in the shape of skeins, onto bobbins. Winders contain any number of swifts or reels, upon which the respective splits or sections of the mosses or large skeins are stretched, one split on each swift. The girl attending the winder then finds the end of the silk on the outer portion of the split and passes said end through the eyelet of a vibrating guide, which thus

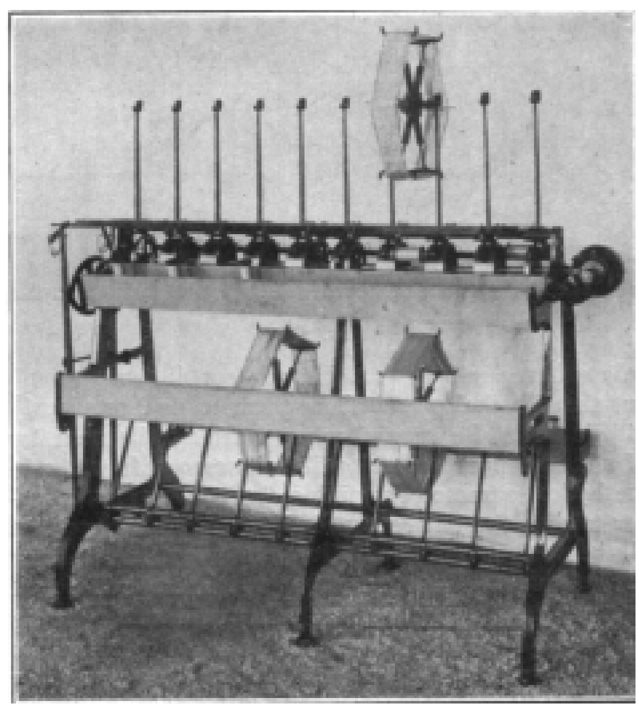


FIG. 1.

guides the thread, to and fro, across the width of the spool, until the latter is filled. When filled, a new spool is substituted, a new split being put on whenever the one being wound runs out. The construction of the winder is such that the silk thread is wound on the bobbin without any friction, *i. e.*, is not flattened in this way. At the same time, it must be understood that finding the ouside end of the split is not all the trouble that there is in store for the winder, since the split, *i. e.*, the small skein, will not always run smooth, quite the contrary. The end will break because of one reason or the other, and when the broken end will have to be found and the same pieced up, at the same time taking any poor lengths of silk out of the split by unwinding by hand, provided this was the cause of the break and not the entanglement of ends in the skein, or a wrong handling of the outside end. Waste thus made in this winding process is known as winder's waste and is kept separate from such waste as is made in the next process, which then will be known as cleaner's waste.

Defects in the winding process met with are: hard spools, long knots and looped ends. The first are the cause of a poor washing, *i. e.*, an inferior quality of soap used, or insufficient drying; the surplus gum covering the threads, in place of being removed being

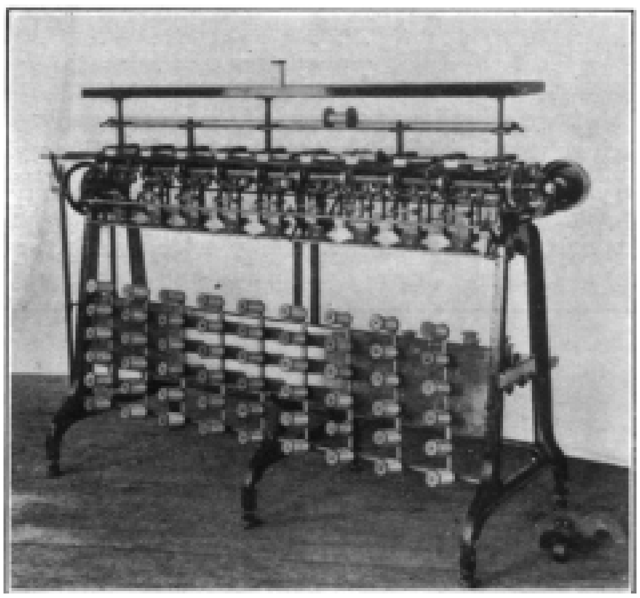


FIG. 2.

only softened into a paste. If such trouble occurs, comb out the silk skeins and allow them to dry, previously to winding. Be careful when washing the next lot of silk and pour several pails of warm soft water in the hydro-extractor containing the washed silk, in order to give the latter a good rinsing, and be sure that all the water is extracted before removing the silk from the machine. With reference to the second defect referred to, *i. e.*, long knots, they will catch during the next processes of throwing, and will be the cause of split ends, more particularly so in "no-throw" or "tram" silk. With reference to the last mentioned defect, be careful that when tying up an end, a previously wound-on length of the thread is not looped over the end to which you tie on, since then the yarn, during the next processes, will unwind with friction, *i. e.*, come off the spool tight and in turn cause loopy yarn. More particularly will this cause trouble in connection with no-throw or tram silk.

A perspective view of a silk winding frame used for the operation just described is shown in Fig. 1. The illustration shows what we might call a sample machine only, showing only a double banked nine-spindle outfit, *i. e.*, eighteen spindles and swifts, whereas a standard frame contains 60 spindles and swifts complete, measuring 18 feet, 4 inches in length x 2 feet, 10 inches wide and 5 feet, 1 inch from floor to centre of top swift. However, machines are built to any desired length to suit the demands of a mill. By double bank is meant that there are rows of bobbins wound, one on each side; one row of bobbins being fed from the top swifts, the other row, from the bottom swifts. As will be readily seen from the illustration, the swifts are conveniently placed for the operative; the spindles are of the double-head driven type, allowing great speed; the supports for same are fitted with anti-friction bearings. One central shaft drives both sets of spindles, thus reducing the friction and the tension required. The machine is fitted with either pin or friction hub, standard swifts, up to 28 inches diameter, the knee-rail being adjustable to the different sizes of swifts to be used.

Cleaning. This is the next process the thus wound silk is subjected to, although in some cases the cleaning is also practiced in connection with the winding process, previously explained, however, more often it is carried on as a separate procedure in connection with silk throwing. In this process, the silk thread is simply transferred from one spool onto another, passing during this transfer through a cleaning device, which either is a steel plate with a slot in it, or two parallel plates placed close to each other to catch any irregularity upon the silk. When such occurs, at the same time, by means of suitable connections, the motion of the receiving spool is arrested, and then the operator takes out the faulty piece of the thread, pieces up the ends, and the process of winding and cleaning the thread continues. This cleaning process, according to the condition of the silk, in turn, is two or three times repeated, in order to obtain the required quality and cleanliness of the thread. Chinese and Canton silks always require the most cleaning, whereas Italian silks require only very little, and in fact with the best grades, in some instances, no cleaning at all is necessary.

Having thus obtained a clean silk thread, future operations now depend on whether the silk is destined for (a) doubling, (b) tram, or (c) organzine.

Doubling, or as sometimes also called "no-throw," consists in bringing two or more single threads from two or more spools, side by side onto one spool, but without any twist, as we might say, the throwster only imparting sufficient twist to bind the two, three or more threads together to permit re-reeling later on. The greatest of care must be exercised in that process, in order that the threads, as doubled, do not separate and form kinks, which not only are objectionable to the face of the fabric, but at the same time weaken the thread. However, it is essential, on account of the face of the fabrics these yarns are to be used to cover, that not too much twist be imparted. Fig. 2 shows a perspective view of a small sized doubling frame; regular frames being built of any desired length, a standard frame being 60 spindles, 18 feet, 4 inches long, 2 feet wide, 3 feet, 9 inches high to take-up spindle. This machine has hinged reversible jackboards fitted for six end-pin doublings, the angle of this jack-board being adjustable, allowing more or less friction on spools.

Tram. In this instance, two or three single ends, and in some cases four single ends, are united into one end, the same as in doubling, the only difference being that somewhat more twist is given to the compound thread, which is chiefly used for filling purposes. If two single threads are thus united into one thread, the latter is known as 2-threads tram, when three are united, it is known as 3-threads tram, and when four are united it is known as 4-threads tram. As a rule, from $2\frac{1}{2}$ to 3 turns of twist per inch are put into tram, although, in connection with such as are destined for the elastic webbing trade as well as hosiery, up to 6 turns of twist per inch are then put in.

Organzine is the union of two or more single threads of silk, which first receive twist in one direction, each thread by itself, and when united into one thread are then re-twisted in the opposite direction. Twisting the individual of the ply first, is only practiced in connection with organzine, no twist being put in the single threads of tram or no-throw silk; at the same time, the amount of twist put in by the second process of twisting into the organzine is considerably more than that put into tram. This is done for the reason that organzine is destined for warp purposes, where it has to stand the strain of warping and weaving, besides the chafing action of the harness and the reed, during the latter process. In judging silk to be made into tram or organzine, a mistake in judgment by the manufacturer may mean considerable loss to him. The greatest of care is required in order to have satisfaction in its after manufacture, it being a fact that some manufacturers can get a better fabric, as to appearance and wear, from a low quality of silk than others can from the best quality.

A typical silk spinner or twister is shown in illustration Fig. 3. This machine is the invention of Mr. Joseph E. Tynan, of Paterson, and has for its object to insert twist into the single silk thread (as destined for organzine) after the same has been cleaned. The process consists in winding the thread from one spool onto another, at the same time putting twist into the thread. This spinner also has two stop motions, one for operating the fallers when a supply thread breaks, the other acting to stop the rotation of the supply bobbins (and this without operating the stop motion first referred to) at the moment when the shipper lever of the machine is shifted onto the loose pulley. Our illustration is an end view of the machine, showing the several mechanisms referred to, one "bank" only being shown; if a double-bank machine, the spinning and twisting devices, with its "faller stop motion" and "kink preventers," are duplicated for the other side of the machine. In this illustration *A* indicates one of the side frames of the machine, on which is mounted the spindle rail *B*. In this spindle rail *B* are mounted the two series of spindles *C* and *D*, one series carrying the supply spools C^1 and the other carrying the spool D^1, onto which the thread is wound. From the spool C^1 the thread passes up and around guide and feed rollers and thence down to the spool D^1, on which it is laid by a ring traveler mounted on the ring-rail *E*, said traveler putting at the same time the required twist into the thread. The fallers *F* of the "faller stop motion" normally remain in vertical position (as shown in the illustration), *i. e.*, resting against the faller stand *G*, but if a thread breaks on its passage from one spool to the other, said faller

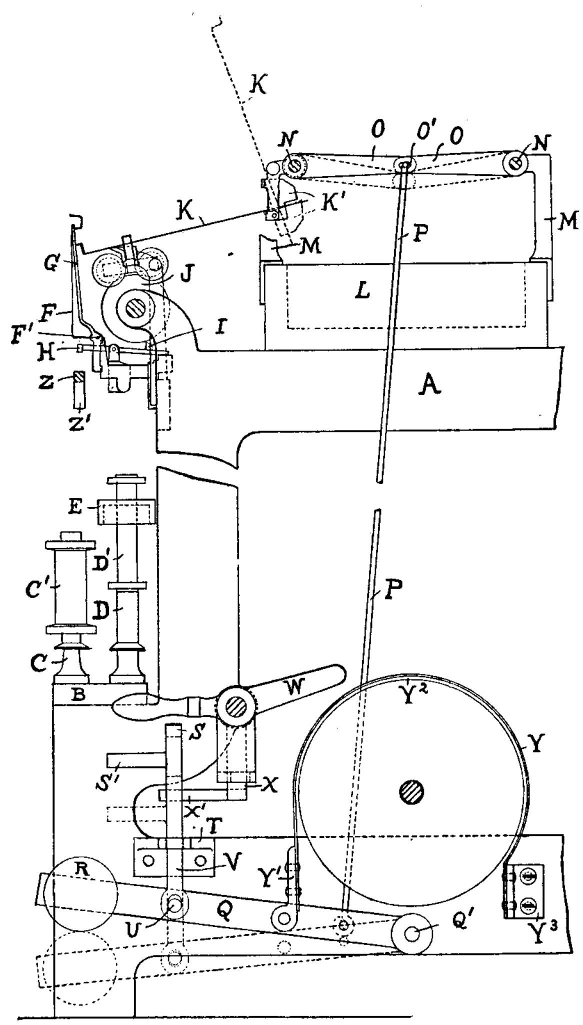


Fig. 3.

drops down so that the portion F^1 engages with the end of lever *H*, rocking said lever and bringing its tooth *I* into engagement with the driving roller *J*, and thus (through intermediate connections) stops the machine. With this stop motion is combined another stop motion, acting either in connection with said faller stop motion or independent when the machine is stopped by the operator. This second stop motion arrests at once the rotation of both series of spools and simultaneously throws the lever *K* (technically called a kink preventer) upward, carrying any paid-out supply thread up with it, thus keeping the threads from becoming slack and forming kinks, which always are a disadvantage to perfect yarn.

On each end of the spool-supply box *L*, as mounted on top of the frame *A*, is secured a bracket *M*, in which are formed bearings for a shaft *N*, which extends the entire length of the machine, and has mounted on it the weighted levers or kink preventers *K*, said shaft having at the driving end of the machine secured to it an arm *O* provided with a hole O^1, into which is hooked one end of a rod *P*, having its other end secured to a lever *Q*, pivoted at Q^1 to the frame of the machine, and carrying at its outer end a weight *R*. At about its middle portion the lever *Q* is provided with a stud *U*, which enters a hole in a latch *V*; said latch slides in a slotted bracket *T* and has at its upper end a hook *S* and handle S^1. On the frame of the machine and above the latch *V*, is mounted the shipper lever *W*, formed with a part *X* and extension X^1, the latter being adapted to engage with the latch *V*. A shoulder on the inner end of the bracket *T* holds the latch *V* and, in turn, the lever *Q* in raised position (see full lines in illustration), as is the case when the machine is running, but when the machine is stopped for any cause whatever, the extension X^1 of the shipper lever *W* engages the latch *V* and forces the same from its notch in bracket *T*, thus allowing the lever *Q* to drop into position shown in dotted lines.

To the lever *Q* is also secured a brake band *Y*, by means of a buckle Y^1, said brake band extending over a brake pulley Y^2 fast to the driving pulley of the machine (not shown), provided the same is driven by means of fast and loose pulleys, or to one of the friction members in case the machine is driven by friction device. At its other end, this brake band *Y* is fastened to bracket Y^3, thus when the lever *Q* drops, as previously mentioned, the brake band engages the brake pulley Y^2, and thus immediately stops all running parts of the machine. On the dropping of the lever *Q* the rod *P* is simultaneously pulled down, which in turn causes the shafts *N* to be rocked, causing the balanced lever (kink preventer) *K* to be tipped so that the weight K^1 is overbalanced and the lever *K* raises (to the dotted line position shown), carrying the thread with it, and thus prevents kinks in the yarn.

In order that the operator is able to stop the machine without the faller stop motion to operate, a bar *Z* is provided, extending all the way across in front of the machine, resting on support Z^1 and adapted to be brought in contact with the ends of levers *H* to thus control their operation. To stop the machine, the operator first raises this bar *Z* and next knocks off the shipper lever *W*, which drops the lever *Q*, and in turn operates, as described, to throw the levers *K* upward simultaneously with the stopping of the machine.

(To be continued.)

DICTIONARY OF TECHNICAL TERMS RELATING TO THE TEXTILE INDUSTRY.

(Words Selected at Random.)

(Continued from page 24)

MOIRÉ:—Literally meaning "watered." A finish produced on corded silk fabrics by the use of heavy engraved rollers under great pressure, the pressure on the fabric being uneven in places, the desired parts are flattened and given a glossy appearance, resembling the marks left by drops of water. The process is applied to a wide variety of silk fabrics of the gros grain type, which are given special names to indicate the style of finish. Wool moiré is a fabric made from wool and silk, to which the process is applied; the fabric resembles Bengaline, but has a watered effect added.

NEPS:—An entanglement of fibres centred into a small knot; an impurity to yarn.

OXFORD SHIRTING:—A fancy gingham, used for making shirts, or ladies' and children's waists.

PEARL EDGE:—A narrow thread edging sewed on lace to give it a special finish. Also, the narrow border on some styles of ribbon that has been formed by allowing the filling to project in loops.

PEAU DE SOIE:—A silk fabric interlaced with an 8-harness double satin weave, the additional spot being added obliquely, imparting to the fabric a somewhat grainy appearance

PERCALE:—A term applied to a closely woven fabric, usually of cotton, of the cambric class, differing from cambrics by lacking gloss but containing more dressing than ordinary muslins. Percales are brought in the market either white or printed.

PIQUÉ:—A variety of cotton cloth whose surface has a ridged or waled appearance, in the direction of the filling. The ridged effect is produced by using two warps for making the cloth, one tight the other slack, the slack warp making a plain face, the tight warp being interwoven to form ridges by drawing down the portion of the fabric interlaced with the slack weaving threads. The number of loose weaving warp threads is more than that of tight weaving warp threads. To heighten the raised appearance of the ridges on the face, stuffer or wadding picks are often inserted. Piqués are most commonly brought in the market bleached, although they are also made in colors.

PLATED:—A term applied to hosiery or underwear that appears different on each side, different materials being used to form its face and its back. Plated goods may be made with wool on one side and cotton on the other; or, both sides of the same fibre but of different colored or different sized yarns.

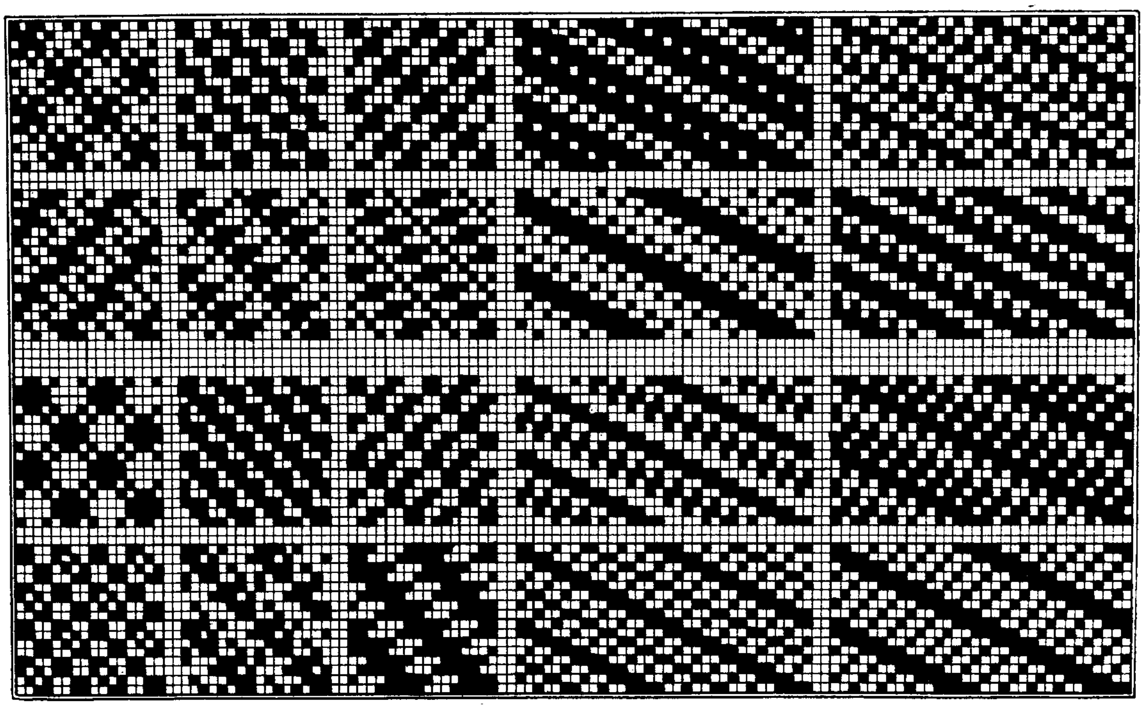
PONGEE:—A plain silk fabric, woven from silk in the gum, usually of "singles." The fabric may be used in that form or boiled-off, and either piece dyed or printed.

POPLIN:—From the French popeline—lustre. A fabric of many varieties, usually constructed of silk and worsted, like Irish poplin, which is made of silk warp and worsted filling.

WOOL TERMS:—*Clothing Wools.*—The opposite to "combing wools." In former times wools were divided into clothing and combing wools, *i. e.*, short wools and long wools. At present this division is no more true, for wools that are called combing wools are now frequently used for the manufacture of woolen goods, and wools sold as clothing wools are frequently used for combing. *Combing Wools.*—Formerly long wools only could be combed when combing had to be done by hand, but since the successive improvements of the combing machine by Heilman, Donisthorpe, Lister, Noble and Holden, any free, firm-stapled clothing wool of 1½-inch staple can be combed. *Teg, Hog, or Hogget.*—The first fleece from a sheep that has not been shorn as lamb. *Shurled Hogget.*—First fleece from a sheep after it has been shorn as lamb. *Wether Wool.*—All fleeces cut from sheep after the first or hogget fleece has been removed. *Brightness.*—Refers to a half-lustre; a soft shade of lustre. *Fineness.*—Smallness of fibre. *Quality.*—Fineness, with high character of breeding. *Silkiness.*—A combination of softness, fineness and brightness. *Broad or Thick-haired.*—Denoting loss of character; straight-fibred, devoid of elasticity. *Hardness.*—Dry, unkind feel. *Stringy.*—Thin, delicate-stapled wool. *Mushy.*—Open, fuzzy. *Noily.*—Wasty, mushy, perished. *Discolored.*—Stained by dead yolk. *Stained.*—Brown, or burnt-colored, caused by urine, etc. *Cast.*—A rough, coarse, bad-bred fleece. *Cot.*—A matted or felted wool. *Kemps.*—White and dark brittle hairs; a fibre grown on sheep and which resists dyeing; is an indication of want of purity of breed. *Dags.*—Matted fibres and dirt.

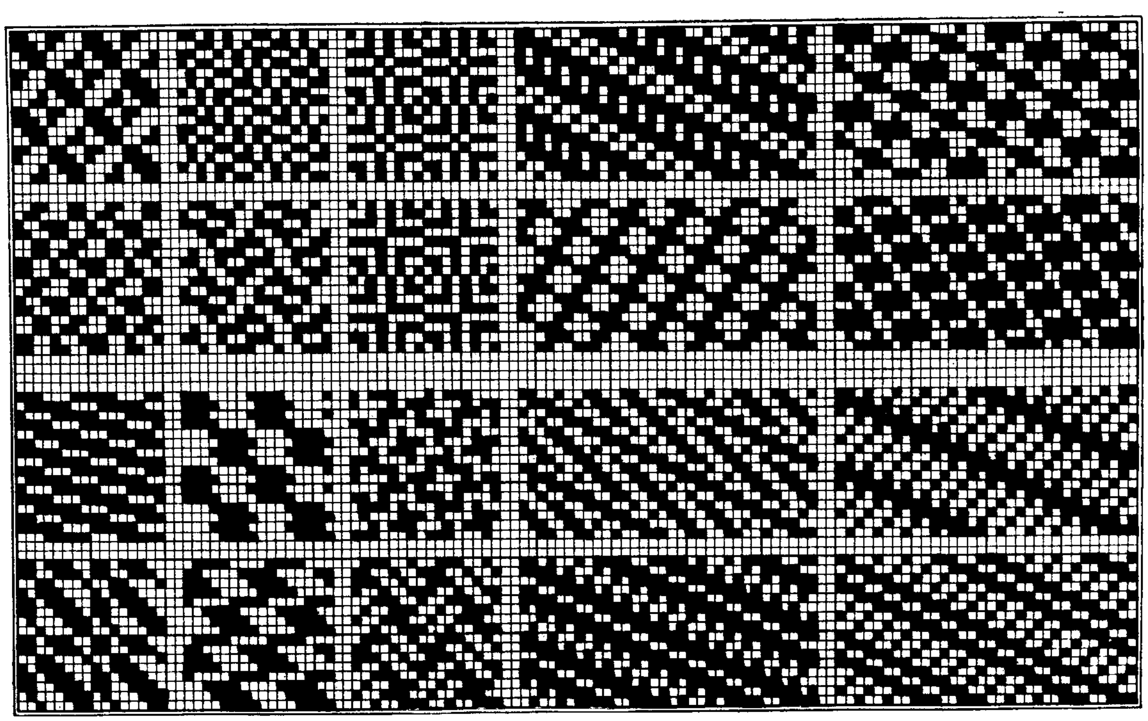
DICTIONARY OF WEAVES.

EIGHT HARNESS



8 · 8 and 8×16.

EIGHT HARNESS

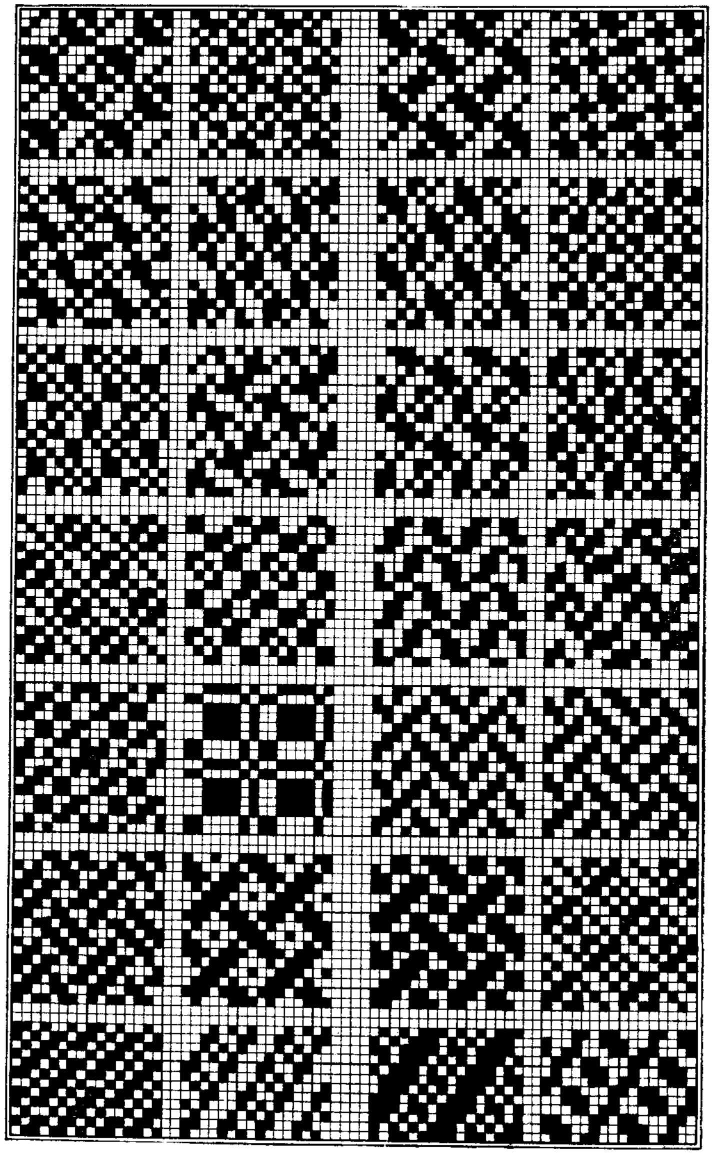


8 · 8 and 8 · 16

This collection of Eight Harness Weaves is continued from page 25, where the first instalment, of eight harness weaves (56 of them) was given.

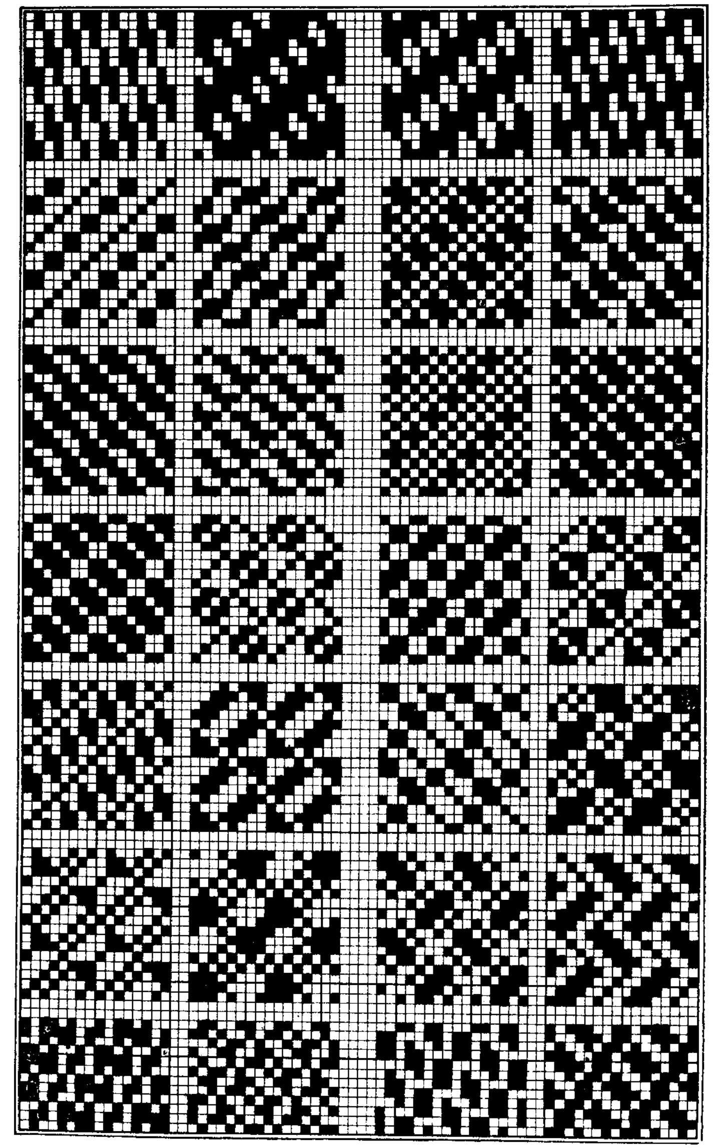
DICTIONARY OF WEAVES.

EIGHT HARNESS



8 × 8 and 8 × 12

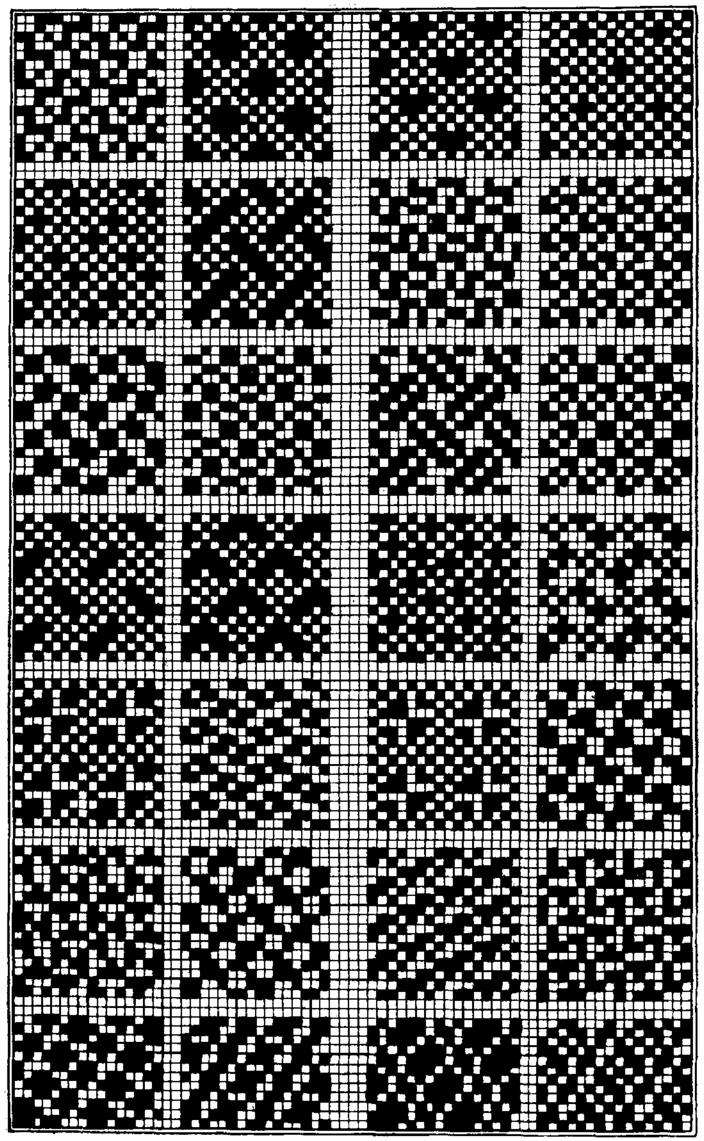
EIGHT HARNESS



8 × 8 and 8 × 12

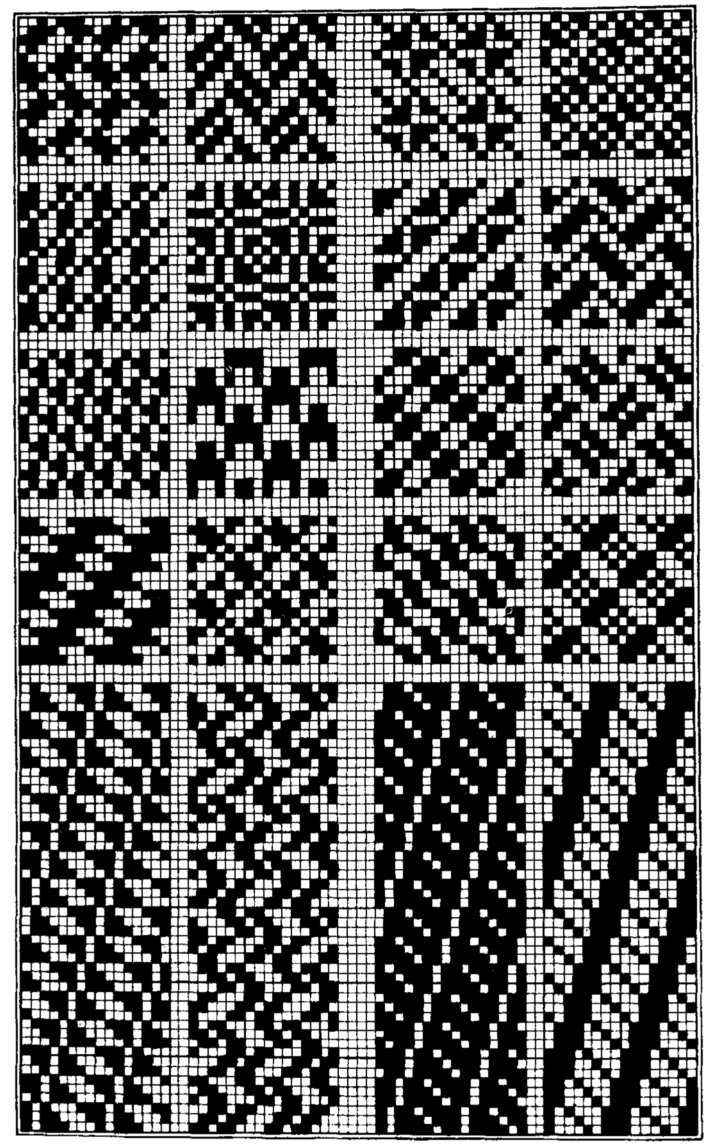
DICTIONARY OF WEAVES.

EIGHT HARNESS



8 × 8 and 8 × 12

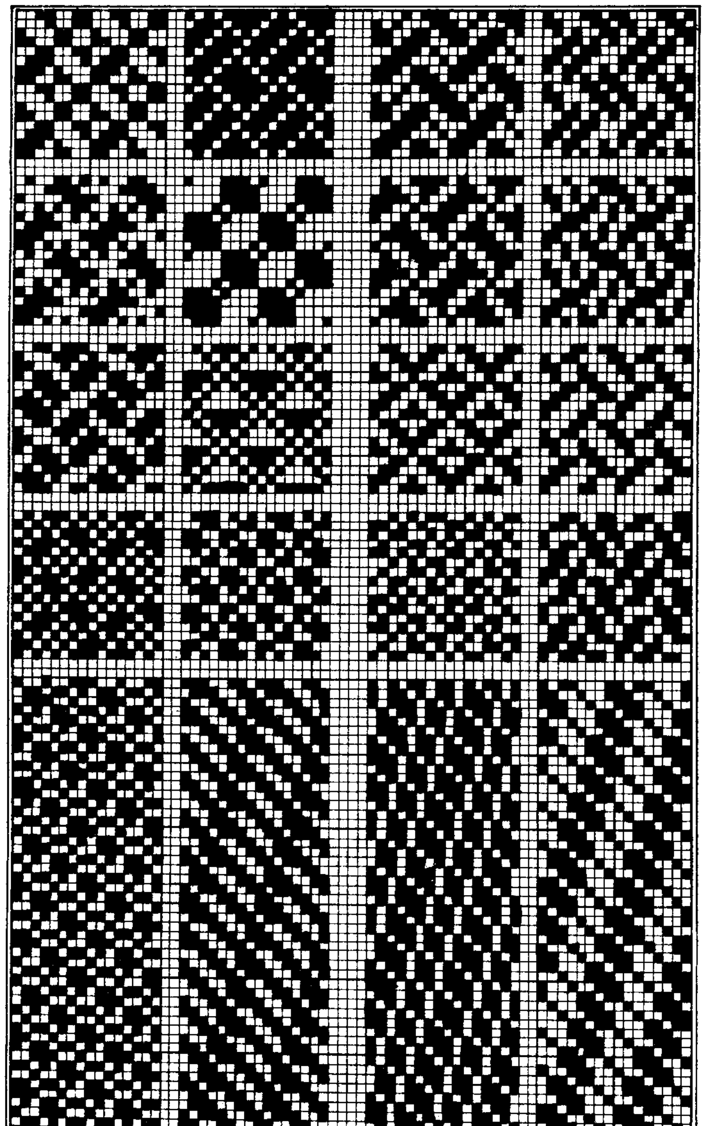
EIGHT HARNESS



8 × 8 and 8 × 24

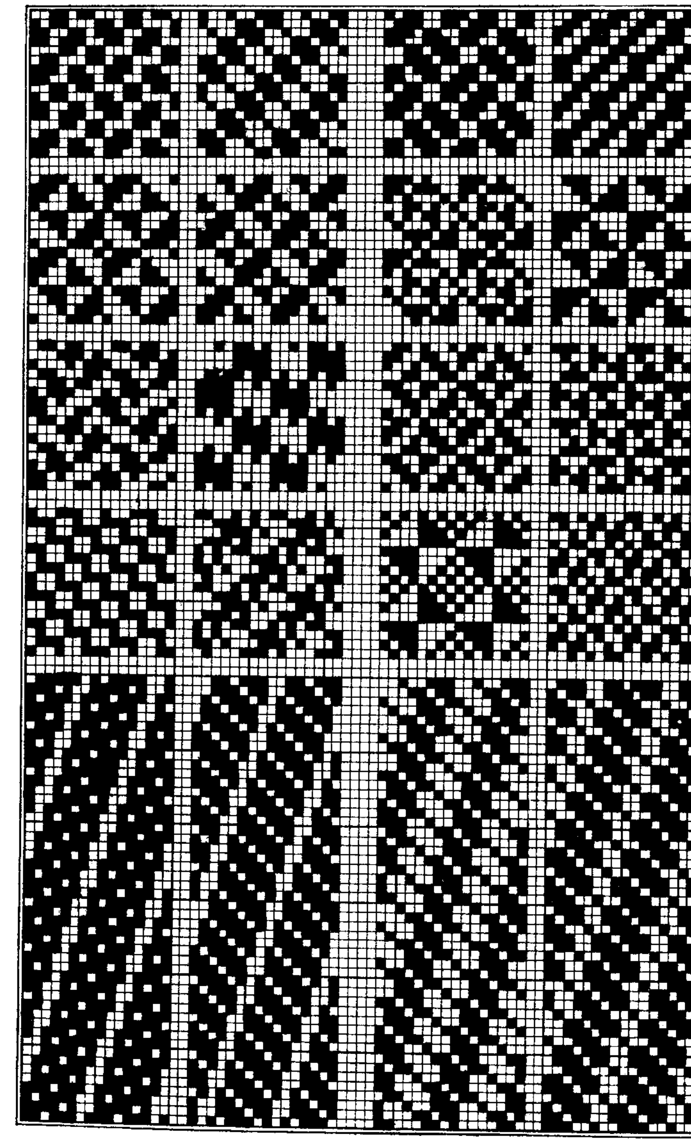
DICTIONARY OF WEAVES.

EIGHT HARNESS



8 × 8 and 8 × 24

EIGHT HARNESS



8 × 8 and 8 × 24

KNITTING:—PROCESSES AND MACHINERY.

A STUDY OF KNITTING

With a Description of Knitting Processes and of the Construction and Operation of the Prominent Knitting Machines.

(*Continued from page 34.*)

Mock Rib Stitch. Again, derivations of a foundation stitch may be used for regular work, as, for example, the so-called "mock rib" stitch. As its name indicates, it is used in place of a regular rib stitch, because it can be knitted on the same machine as the plain knit stitch, whereas the rib stitch can only be knit on a rib machine. This, of course, saves the additional outlay for rib machines and consequently is more economical in production. The mock rib stitch is more frequently practiced with machines using spring beard needles than with machines using latch needles.

Spring Beard Needles, or simply spring needles, differ materially from latch needles in their form of construction, which necessitates a different method of operation in knitting and a different type of machine for this purpose, although the same styles of stitches and the same kinds of fabrics are made equally as well with both needles. The principal point of difference in construction between the two needles is the hook, by which the yarn is held and the stitch made; in the latch needle, the hook is short and open and is closed by a separate piece, the latch, whereas, in the spring beard needle, the hook is long and its prolongation, the spring beard, serves the same purpose as the latch, in the latch needle, closing the hook when its point is pressed into the recess in the shank provided for this purpose. Another difference between the two needles is the method in which they are fastened in the needle cylinder. The end of the latch needle, the butt, fits into a slot cut into the cylinder, in which it can move up and down or in and out, accordingly as it is placed, vertical or horizontal, while the end of the spring beard needle is embedded in a small block of lead alloy, the blocks, holding a set of these needles, being clamped in the cylinder to form a circular row, and consequently the needle is immovable as to the cylinder, *i. e.,* can move only as the cylinder moves. "Trick" needles, a form of the spring beard needle, when used in place of the former, are also fastened immovably in the cylinder, by means of a projection, called the trick (see Fig. 5) at the lower end, which is clamped fast between plates, and these needles work the same as the ordinary spring beard needle.

The method of forming the stitches with the two needles differs chiefly in the following respects: (1) With the latch needle, the needles themselves take up the yarn from the carrier, and by their own movement, up and down or in and out, form the stitches from it and cast them off when completed; with the spring beard needle, the yarn must be laid in the hook of the needle by a special device, the burr wheel, and all the different operations of making the stitch and casting it off must be performed by other devices, the needles themselves remaining stationary in the cylinder, which revolves with them, and perform no operation except holding the yarn during the formation of the stitches. (2) With the latch needle, the yarn of the last formed stitch closes the hook, while the new stitch is being made, by pressing up the latch as the needle moves downward or inward; with the spring beard needle, the yarn itself has nothing to do with closing the hook, this being done by a slotted wheel, placed at the outer edge of the needle cylinder, which presses the spring beard inwardly so that its point (5 in Fig. 4) enters the slot (4 in Fig. 4) in the stem of the needle. (3) In knitting with the latch needle, the yarn practically remains stationary and the needles move, up or down or in and out, in making the stitches; whereas in knitting with the spring beard needle, the needles remain stationary, while the yarn is moved up and down by the burr wheels, etc., to make the stitches.

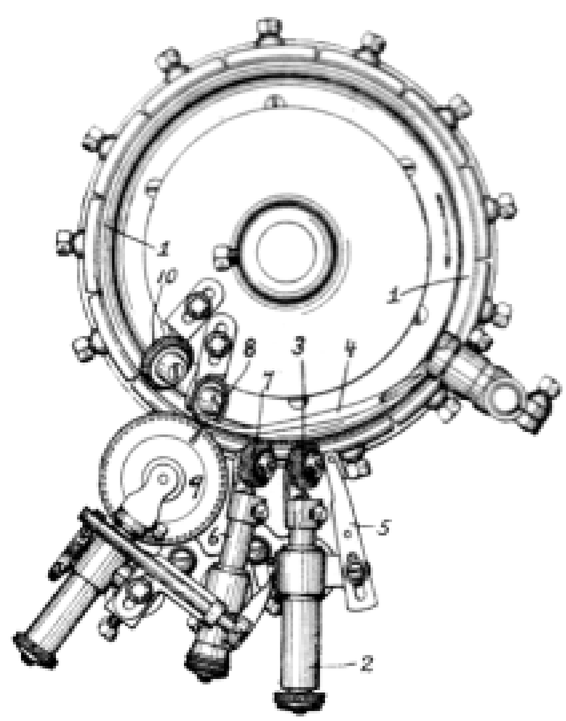


Fig. 17.

In short, the two needles may be distinguished thus: the latch needle does all the work of knitting itself, the other parts of the machine being merely accessories, whereas the spring beard needle is an accessory in the operations of making the stitch, the actual work being done by other parts of the machine, the burr wheels, etc. The difference in the two types of needles can be plainly seen in comparing Figs. 1 and 4, the latter showing the form of the spring beard and how the slot is formed in the stem of the spring beard needle to receive its point.

As the method of making the stitches on a spring beard needle is so widely different from that of the latch needle, and as the various burr wheels, etc., of the spring beard needle knitting machine have such an important part to perform in making the stitch, the formation of a stitch can best be explained by a brief description of the machine and its operation. Fig. 17 shows a perspective view of the principal parts of a spring beard knitting machine.

The needles are set into the cylinder so as to form a circular row, the spring beards of the needles opening outward, this cylinder and the needles having a positive motion in the direction of the arrow, but are otherwise immovable. The operations of knitting are performed by the various burr wheels, etc., shown, acting in connection with the presser wheel, the burr wheels pushing the yarn onto and between the needles and otherwise manipulating it until the stitches are formed, when they are cast off by other devices. The spring beards are pressed in and held closed by the cogs on the presser wheel while the yarn is being pushed up over them, and are then released by meeting the recesses between the cogs. Other attachments, such as the sinker burr and the holding down wheel, serve to keep the stitches and the finished fabric in their proper positions during the revolutions of the needle cylinder.

Referring to the illustration, 1 indicates the needles, which are secured in the needle cylinder, said cylinder being positively rotated in the direction of the arrow. Situated without the needle cylinder, on the frame stand is the feed burr stand 2, on the inner end of which the feed burr 3 is journaled on a pin, said burr being set at such an angle that the thin plates or teeth composing the burr will pass separately in between the spaces of the needles as they come around. Owing to the way in which the burrs are built and the angle at which they are set in the machine, the movement of the teeth, while in the spaces between the needles, will be downward and hence any yarn with which they come in contact will be pushed downwardly also. The needles themselves cause the rotation of the burrs. As shown in the illustration, a push back 4 is used to press the web down in front of the feed burr 3, although in many instances a wheel is used for that purpose.

Situated just to the right of the feed burr is the thread guide 5 through which the yarn is fed by means of the feed burr to the needles. The teeth of the feed burr, by entering into the spaces of the needles, carry the yarn in with them, and thus produce enough slack yarn to properly make a stitch without straining the yarn. Located next to the feed burr stand is the dividing wheel stand 6, carrying at its end the dividing burr wheel 7, which is placed at a corresponding angle to that of the feed burr 3. It is used to even the loops formed by the feed burr 3.

The burr 8, known as the landing burr, is located within the needle cylinder and is inclined at such an angle that the movement of its teeth, when in the spaces of the needles, is upwardly and thus it serves to move the loops upwardly over the spring beards of the needles, said beards being pressed inwardly at the same time by a presser wheel 9, located on the outside of the needle cylinder, in order to allow the loops to pass over them.

The presser wheel plays a very important part in making different kinds of stitches, since by making grooves in its circumference, according to some pattern, certain loops are prevented from being cast off, because certain beards are not pressed in and consequently the loops on those needles which are not pressed in, when actuated by the landing burr, go up again into the hooks of their needles.

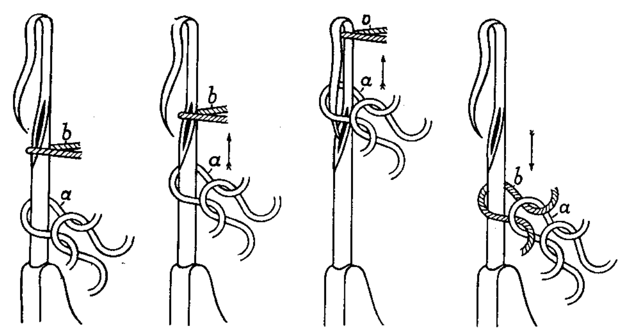


FIG. 18. FIG. 19. FIG. 20. FIG. 21.

Figures 18, 19, 20 and 21 show the position of the yarn on a needle at various stages of the stitch, the burr wheels, presser wheel, etc., being omitted for clearness. The stitch is made in the following manner:

As the needle cylinder revolves, the needle meets the feed carrying the yarn and the first burr wheel, which lays a loop of yarn onto the needle and presses it down below the point of the spring beard, as shown at *b* in Fig. 18, so that it can go up into the hook of the needle in the next movement. At the same time, the cloth wheel, or other similar device, presses down the web of the already knit fabric, so that the last formed loop, resting on the needle, is pressed down below the loop of yarn newly laid on, as shown at *a*, Fig. 18. The cylinder continues to revolve and the needle meets the second burr wheel, which pushes loop *b* up, until it enters the lower part of the hook, loop *a* also being pushed up with it, as shown in Fig. 19. Just before loop *a* reaches the slot in the stem of the needle, the spring beard engages with the presser wheel and its point is pushed into the slot of the needle and held there, while the next attachment, the landing burr, acting in conjunction with the presser wheel, pushes loop *a* over the spring beard and loop *b* up into the hook of the needle, where it is held by the closed spring beard, as shown in Fig. 20. Loop *a* is finally pushed entirely *over* the spring beard by the burr wheel and is cast off, *over* loop *b* and consequently engaged with it, loop *b* reaching the top of the hook. At this moment, the needle reaches the sinker burr, which follows the burr wheel, when loops *a* and *b* are both pressed down by it to the position shown in Fig. 21, loop *a* now being a completed stitch and loop *b* taking its place on the needle, consequently loop *b* in Fig. 21 corresponding to loop *a* in Fig. 18 for the next stitch. In the illustrations, loop *b* is represented shaded, for clearness, and the small arrows indicate the direction the loops travel.

The needle is now ready to receive yarn again and make another stitch, the completed stitch and the last formed loop being pressed down in position by the cloth wheel. When the needle comes round again to the feed carrier, another loop is laid on it and the operations just described are repeated, a continuation of the same forming the knitted fabric. These operations form what is known as the plain stitch, which has been previously referred to and described. Other stitches can be made with these needles by varying the method of forming them, or by other and different attachments to the machine.

(*To be continued.*)

The Principle of the Working Plan of the French or German and the English Circular Frames,

are given by the Hosiery Trade Journal as follows:

The French or German circular frame is supported from a centre axle which is secured to overhead beams, the latter in many cases being built into the walls. This centre axle carries two circular plates. The upper one is fixed and carries the brackets to which are attached the loop-forming parts. The lower one which revolves is the needle ring and in this is placed the radially horizontal bearded needles. These needles have turned shanks which fit into small holes in the needle ring and are held by sectional plates. The needle ring is revolved from the driving shaft by bevel wheel connection, the driving shaft itself being driven by a clutch from a single pulley.

The thread is supplied and measured to a large revolving sinker wheel by a thread regulator, the latter consisting of two toothed wheels, the lower one being driven indirectly from the needles and the upper one by the lower one. The amount of thread supplied depends upon to what depth the wheels gear with each other. The sinker wheel is driven by bevel gearing from the needle ring and consists of three discs, two of which contain the sinkers and revolve, the other being the stationary cam plate which gives the necessary movements to the sinkers. The sinkers travel under a sinking cam which, in conjunctive adjustment with the thread regulator, determines the length of loop. Directly the loops are formed by the sinkers they are brought underneath the needle beards, the latter are then closed by the presser and the old loops are brought on to the needle heads by the platines or knocking-over sinkers traveling round the edge of a landing cam; all this taking place within the space of a few needles. Afterwards the loop-forming sinkers are carried away by the revolution of the sinker wheel and the platines being brought forward by the knocking cam, an extension of the landing cam, push the old loops off the needles. The loops then pass by a clearing wheel which is a revolving disc placed at such an angle that any improperly knocked over loops are pushed completely off the needle heads. The loops are then taken back to the shanks of the needles by the push back wheels and guard, the latter separating old and new loops until the landing cam is reached.

This machine is invariably supplied with a stop motion, so that when a thread breaks—and in some cases when a needle breaks causing a hole in the fabric—the driving pulley is disconnected from the shaft. The stop mechanism is as follows:—The breaking of the thread or the forming of a hole causes a small lever to give action to a pawl. This pawl falls onto the teeth of a ratchet wheel and sets in motion a system of levers culminating in the freeing of another pawl. Now over the two halves of the clutch, and encircled by it, is a ratchet wheel with a boss cut into inclines, this wheel is revolved by a pin attached to one half of the clutch but when the pawl falls and prevents its rotation the pin travels up the incline and thus the halves of the clutch are disconnected and the machine stops. In addition to this the supporting screw of the knocking-over cam has been released; preventing any pressing off which might occur owing to the frame's momentum.

The English circular frame has a vertical needle cylinder around which are cut tricks for the reception of the needles. This cylinder has at its lower end a bevel wheel which gears with a bevel wheel on the driving shaft thus imparting motion to the needle cylinder.

The needles are soldered into jacks, the latter having butts which stand clear of the needle cylinder and travel in a camway. This camway is cut in the cam cylinder which is stationary and which encircles the needles. The camway, and consequently the needles, has three heights:—(1) Ordinary; so that loops resting on top edge of needle cylinder are held securely round the latches of the needles. (2) A high position where the needles are raised to free the loop from the latch and at the same time receive the thread. (3) A low or knitting position which causes the needles to descend to draw their loop and simultaneously cast off, by the aid of the edge of the trick, the old loop. This cam is adjustable to regulate the length of loop.

Frames on this principle are also built having many feeders in which case the cam cylinder is simply cut into inclines, the needles traveling from their lowest to their highest position direct, and in some cases where a large number of feeders are required on a small head, angle jacks are used.

Norristown, Pa. The extensive mills of the Wyoming Knitting Company, at the foot of Swede Street, were, November 2nd, partly destroyed by fire. For an hour the entire fire department was unable to make any headway because of the dense smoke, which enveloped the mills. A sixty-mile-an-hour gale which was blowing and fanning the flames added to the difficulty. The damage is upward of $10,000.

A couple of years ago the same mill sustained a $25,000 loss by fire.

THE MAKING OF ARTIFICIAL DYE-STUFFS.

The majority of the artificial dyes are made from coal tar products. The object of this article is to show how a dye is made from the crude coal tar.

Coal tar is a side product, obtained by the distillation of coal, in the manufacture of illuminating gas. It is a black viscous liquid, composed of many compounds which are separated from one another, principally by distillation. The coal tar is introduced into a still, and distilled until a thick residue is obtained, this is generally accomplished between a temperature of 530° to 570° F. Sometimes it is carried to a higher temperature, all depending on the quality of residue wanted. This residue is pitch.

The oils which distil over are redistilled and are separated into different fractions. The first fraction includes all the oil that distils over up to 340° F., and is known as light oil. The second fraction includes the oils that distil between 340 to 400° F., and is known as heavy oil. The third fraction is that which distils between 400 to 430° F., and consists mainly of napthalene or coal tar camphor. The residue contains *anthracene oil* and many other complex products.

The light oil is now treated with concentrated sulphuric acid, to remove tarry matter which it still contains. The sulphuric acid is then drawn off and the oil washed with water; the water is allowed to settle and is then drawn off. The oil is now washed with a weak solution of soda (NaOH) to neutralize any acid that may remain; the solution after settling is again drawn off. The last traces of soda are washed away with water. The washed oil now undergoes fractional distillation, in a column still, (a column still is used for careful distillation). The product that distils between the temperature of 174 to 178° F., known as *benzene* or *benzol* is caught in one fraction, and the product that distils between the temperatures of 233 to 237° F., known as *toluene* or *tolual* is caught in another fraction. It is from benzene and toluene that most of our artificial dyes are indirectly made, and it is necessary that the benzene and toluene be made very pure by repeated fractional distillation. Benzene and toluene are clear colorless highly refractive liquids. They have a characteristic odor which is not at all unpleasant; they are so similar in appearance that the best way to distinguish them is by their boiling point; benzene boils at 176° F. and toluene at 233° F.

The benzene is now treated with a mixture of strong sulphuric and nitric acid and nitro benzene results. This operation is carried out in cast iron vessels, three to four feet in diameter, and three feet deep. The mixture of nitric and sulphuric acid is slowly added to the benzene, to prevent the action from becoming too violent and for the same reason in the early part of the operation these vessels are cooled by a water jacket through which a current of cold water is constantly passing. Later on, as the reaction becomes more quiet, the cold water is shut off and hot water is passed through the jacket.

The nitro benzene floats on the top of the mixed acids which are now drawn off and the nitro benzene is carefully washed with water, and dilute soda, to remove and neutralize the acid which remains; it is then washed with water until all traces of the alkali are removed. Toluol is nitrated in exactly the same way as benzol, the resulting product being nitro toluol. Nitro benzene is a clear yellow liquid with an odor resembling that of bitter almonds. It is commonly known as oil of myrbane and is used to a large extent for scenting cheap toilet soaps.

Although there is only one nitro benzol, there are three nitro toluols, which have exactly the same amount of chemical elements, carbon, hydrogen, oxygen and nitrogen, in them, but they are arranged in a different manner. The most important of the three nitro toluols is *ortho* nitro toluol. All three are formed in the nitration of toluene, but the *ortho* is formed in the greatest quantity, the manufacturers making it a point to obtain those conditions which will give the greatest yield of *ortho* nitro toluene. The nitro toluene obtained is similar in appearance to nitro benzene. One of the nitro toluenes obtained, the *para*, is a solid, but this dissolves in the ortho nitro toluene which is a liquid.

The nitro benzol and toluols are now converted to their respective amido compounds, aniline and toluidine. This is done by treating the nitro product with ground iron filings and hydrochloric acid. This operation is carried on in a cast iron clyinder fitted with a stirring apparatus. When the reaction is complete, lime is added and the aniline is distilled with steam.

The heavy oil from coal tar contains a substance very important in the manufacture of artificial dyes, this substance is *phenol* or carbolic acid. This is extracted from the heavy oil by treating it with a 10% solution of caustic soda and agitating the mixture in an iron tank for a number of hours. After a while the mixture is allowed to settle, the soda solution containing the phenol separates from the oil, and is drawn off. This soda solution is now treated with dilute or weak acid, to neutralize the soda, and carbolic acid, or phenol is set free. This separates out as a black oily liquid which can be easily separated from the water solution. This oily liquid is crude phenol.

This crude phenol is then refined first, by fractional distillation, and finally by crystallization which is accomplished by placing the distilled carbolic acid in cans which in turn are placed in a cold brine solution for 18-30 hrs.; by the end of that time the pure carbolic acid crystallizes to a solid mass, and is separated from its impurities which are liquids, by draining them off. Carbolic acid or phenol is too well known to require a description.

The third fraction, that which distils between the temperatures 400 to 430° F. contains napthalene. This third fraction is cooled to about 50 or 60° F., and when the napthalene crystallizes out. The oil is drained off and the napthalene that remains is then subjected to hydraulic pressure to eliminate as much oil as possible. It is then washed with sulphuric acid and water in a similar manner as benzene is. The dried product is then either distilled or sublimed. Napthalene, is coal tar camphor which we see displayed in the druggist's window every spring and fall in the form of balls and flakes. It is used to keep out moths from the clothes and furs, when they are packed away for the season.

We now have aniline, toluidine, phenol and napthalene and from these four substances nearly all the artificial dyes can be made. We will now take a few examples.

Magenta is manufactured in the following manner: Two parts of toluidine (One part *para* and one part *ortho* toluidine) and one part of aniline are heated with arsenic acid in a boiler fitted with a distilling tube. The temperature must be somewhat above the boiling-point of aniline (360° F.). Water, and a part of the aniline will distil over. The residue is then boiled with water, and filtered from the insoluble part. The solution contains arseniate and arsenite of rosaniline, a yellow bye-product (chrysaniline), besides excess of arsenic acid and resinous substances.

To the solution containing arsenic, a large excess of common salt is added. A double decomposition takes place, rosaniline hydrochloride (magenta) and arseniate of soda being formed. The excess of salt dissolves, and the coloring matter, being sparingly soluble in salt solution, separates out. This method of separating coloring matters by salt is much used, and is technically known as "salting out."

The separated magenta is then crystallized from water, or dissolved again, salted out, and crystallized.

Picric acid is easily made; for this purpose, carbolic acid is heated with sulphuric acid to 212° F. till a sample dissolves completely in water. The liquid is then slightly diluted, run into strong nitric acid, and warmed. The sulphuric acid is used because it helps the reaction by forming some intermediate compound, which is more easily acted upon by the nitric acid than is the phenol.

The acid liquor contains picric acid, nitric acid, sulphuric acid, and resinous impurities. It is diluted with water, and soda is added till the resins are separated, after which it is filtered and more soda solution added, which precipitates sodium picrate, which is dissolved in water and decomposed with sulphuric acid. The picric acid is salted out in the same manner as is magenta.

The manufacture of indigo is quite a complicated one. The starting product is napthalene. When napthalene is heated with strong sulphuric acid, in the presence of a small amount of mercury, it is oxidized to *phthalic* acid. Phthalic acid is heated to drive out the water which it contains and dry ammonia gas is passed over it, and a substance known as *phthalimide* results. Phthalimide when treated with bromine and caustic soda gives *anthranilic* acid. Anthranilic acid combines with a substance known as *mono-chloracetic* acid, forming a very complex compound known as *phenylglycocoll-o-carboxylic* acid. On fusing this substance with caustic soda *indoxyl* is formed, which in the alkaline solution is converted by atmospheric oxidation into indigo.

WATER SOFTENING AND FILTRATION PROCESSES.

(*Continued from Page 45.*)

For the purposes of the textile manufacturer, it is to be desired that a water should be perfectly soft. It is of course true that a special examination of the water used in a technical industry may reveal the fact that the water is perfectly fitted for the work to be done. At all events the water should receive especial attention and nothing should be done without consulting an experienced and capable man. The first cost of a water-purification process is in some cases high, but the saving in material as well as the increase in value of the final product, will soon offset this expense.

Many methods of water purification have been devised, and some of these have been experimentally tested and found of value. But only a very few of these methods have succeeded in actual practice. Many of the methods have been the outgrowth of mere mechanical work, but the more successful devices have been the result of a thorough study and the principles and conditions which govern the processes have always been kept in mind.

As before stated, a water may contain suspended matter as an impurity or the impurity may be in solution. Processes for the removal of dissolved impurities include softening processes which have already been considered. The method of purification by distillation might be mentioned here.

Practically all the impurities, both suspended and dissolved, are removed by distillation. The various methods of sterilization in which the bacteria are killed are not important enough to textile mills, to merit more than passing mention. There are two general methods for the removal of suspended impurities, sedimentation and filtration. These methods are really natural processes.

Sedimentation, is a more or less thorough process depending to a certain extent upon the character of the impurities. The water may be entirely freed of its suspended matter, depending upon what length of time is devoted to the process. The process is carried out artificially in large storage reservoirs, or in small settling-basins, which are especially designed for the purpose. Often the work is aided by the introduction of chemicals which produce a precipitate which coagulates and settles, carrying the finely divided matter with it to the bottom. The particular process to be used depends upon the character and quantity of suspended matter to be dealt with.

The sediment in most streams is principally of an inorganic nature, consisting of particles of sand and clay. These particles vary greatly in size. In some waters the finer particles of clay are less than 0.00001 inch in diameter. A small amount of organic matter may also be present in the water. Bacteria, which, so far as is now known are not particularly harmful to the textile industries, may also be present. The amount and character of the sediment varies greatly from time to time; it depends largely upon the stage of water in the tributaries of a stream and also upon the geological character of the various parts of the drainage area. The great variation in amount and kind of suspended matter is a most troublesome factor in connection with the purification of a water supply. If the water contains little that is objectionable besides the inorganic matter, sedimentation processes will often render the water fit for use.

Two methods of sedimentation are in common use:—Plain sedimentation, so-called, and sedimentation with the aid of a coagulant.

The particles of sand and clay are quite heavy and are kept in suspension by virtue of the currents maintained in the water. If these currents become retarded, part of the suspended matter is deposited. Fine particles resist sedimentation more than the coarser particles. While much of the coarser material may be deposited by a slight retardation of the current the finer particles will be held in suspension by the weakest currents. To secure thorough sedimentation in the case of finely divided impurities, it is therefore essential that the water be brought to a state of perfect rest. It is an open question whether or not the finer particles would ever settle, were it not for the fact that they are borne to the bottom by the coarser particles. The time required for complete sedimentation varies; some waters require weeks and even months to remove all turbidity, while others require but a day or two to accomplish good results. A period of twenty-four hours is about the minimum allowed, this seldom accomplishes perfect sedimentation. The average removal of suspended matter shown in the following table is taken from a Report on Water Purification for the City of Cincinnati:

Time of Subsidence	Amount of Suspended Matter Removed.
24 hours	62 per cent.
48 "	68 " "
72 "	72 " "
96 "	76 " "

There is a marked degree of purification noticeable after this sedimentation process is carried out. But in the case of a sewage polluted water, frequent tests of the water should be made, as organic compounds may be present and remain even after a long period of subsidence.

Various chemicals when added to water will combine with certain substances ordinarily present, forming precipitates which are more or less gelatinous in character. These precipitates readily coagulate and collect the finely divided suspended matter into large masses which are readily removed by sedimentation. The color of a water may be changed by this process and a clear sparkling water may be the result. In some cases, however, the water may have a peculiar coloring, the presence of which has never been satisfactorily accounted for.

This process is not an expensive one, the space required to put it into practice is not large and its efficacy from a textile standpoint is undoubted.

Several substances can be used as coagulants, alum, ($K_2 SO_4$. $Al_2 (SO_4)_3$) and sulphate of alumina ($Al_2 (SO_4)_3$) are commonly used. When this substance is introduced into water containing (as water most often does) carbonates and bi-carbonates of lime and magnesia [$Ca CO_3$, $Ca (HCO_3)_2$, $Mg CO_3$, $Mg (HCO_3)_2$], it is decomposed.

This action may be represented as follows:—

$$3CaCO_3+Al_2(SO_4)_3+3H_2O=3CaSO_4+2Al(OH)_3+3CO_2$$

$$3Ca (HCO_3)_2 +Al_2 (SO_4)_3=3CaSO_4+2Al (OH)_3+6CO_2$$

$$3MgCO_3+Al_2(SO_4)_3+3H_2O=3MgSO_4+2Al (OH)_3+3CO_2$$

$$3Mg (HCO_3)_2+Al_2(SO_4)_3=3MgSO_4+2Al (OH)_3+6CO_2$$

The salts are transposed. The aluminum hydroxide is a bulky gelatinous hydrate and constitutes the coagulating agent. The exact amount of alum required to combine with the carbonates present must be calculated. Any excess of the sulphate remains dissolved and upon coming in contact with an iron pipe, the sulphate, which is an acid salt, is apt to rust the pipes and to make matters quite complex. If the water is not alkaline enough to unite with sufficient sulphate to furnish the necessary amount of coagulant, lime may be added to the water. Much more coagulant will be required if the sediment is fine than if it is coarse. Theoretically, one grain of sulphate will decompose eight parts of calcium carbonate, but it has been found that the suspended matter absorbs a certain amount of the coagulating agent before precipitation takes place. Water in which this coagulation has taken place is apt to be slightly hard, owing to the increase of sulphates of lime and magnesia. But with the quantities of coagulant ordinarily used, one to two grains per gallon, this increase in hardness would amount to from nine to eighteen parts only, per million. This is not a very important matter, but the objectionable increase in hardness may be avoided by the use of sodium carbonate instead of lime in case the water is not sufficiently alkaline. In most textile processes, the slightest degree of hardness is objectionable. The carbonic acid set free remains absorbed in the water, and its corrosive action is increased. This is a minor detail, however.

The amount of chemical to be used depends upon the amount and character of the sediment, upon the degree of purification desired and upon the time allowed for subsidence. The proper amount can only be determined by experiment. In general, the more chemical used, the greater the effect, and by using a sufficient quantity and by allowing enough time for sedimentation, a clear water can be secured. The rate of sedimentation depends greatly upon the amount of coagulant employed. Sedimentation takes place much more quickly than where no coagulant is used, so that a large part of the action will occur in a few hours. One day will be the time most generally allowed. Much less time can be allowed in many cases. Where a water contains large amounts of sediment, it will often be more economical to allow the coarser particles to settle out before introducing the chemical, this will effect a considerable saving in the cost of chemicals and will give a very satisfactory result.

Settling-basins for the purpose of allowing sedimentation are constructed as is any reservoir. Often a distributing or storage reservoir is used to allow the suspended matter to settle. If but a limited time can be allowed for sedimentation, special basins are constructed. These basins may be arranged so that the clear water is constantly flowing off, while the impure water flows in, or the basins may be arranged to allow the water to be drawn off at intervals. These basins are designed so that the water can be drawn off to any desired level, usually to a depth at which complete sedimentation has taken place.

Settling-basins are often used in connection with filtration systems which will now be considered. Sand filtration will be explained in a broad way.

When a solution containing suspended matter in it, is passed through a fine, porous medium, the suspended matter is caught and retained by this medium and only a clear solution passes through. This process of eliminating suspended matter from water is known as filtration. The filtering material may be paper, cloth, sand or charcoal. Natural filtration is occurring continually. Spring water is the result of this natural filtration. Rain water, falling from the clouds through the air, collects in its downward flight the dust and dirt which is in the air. The rain when it strikes the earth is absorbed by it, and trickles through the different strata and in this way it is freed from its suspended impurities. The water collects under ground in natural reservoirs, from which we get our spring water.

All filtration processes are based upon the same principle, the passing of the impure water through a compact, yet porous medium. Sand is the material generally used for filtering water.

To best explain the principle upon which all filters are based, let us consider a filter of the most simple type: A tank is fitted with a false bottom through which a number of holes are drilled, over this false bottom is stretched a piece of strong canvas cloth. On top of the canvas is placed a layer of fine sand, four to eight inches thick, and above this, a layer of coarser sand, six to ten inches thick. Above the coarse sand is placed a layer of fine gravel, three to four inches thick. The water is allowed to flow in from the top; as it trickles through the coarse sand, the larger particles of suspended matter in water are caught and held, the finer particles being carried along, till the water reaches the fine sand, when they in turn are caught and held. The clear water then passes through the cloth and the perforated bottom, to the compartment below, from which it is drawn off to wherever required. This of course is a very simple filter; the objection to it is that after it is in use for a long time it becomes clogged up with impurities and filters very slowly or not at all, and when this occurs the filter requires cleaning. The length of time such a filter can be used without washing, depends upon the character of the water filtered. If the latter contains a large amount of suspended matter, it must be washed more frequently, than when the water only contains a smaller amount of impurities.

When having to clean such a home made filter, the gravel must be taken off first and washed by placing it into a tank and allowing a stream of water to flow constantly through the tank, meanwhile stirring the gravel with a paddle or pole. It is better that the water should flow in from the bottom and overflow at the top, but this is not absolutely necessary. The rubbing of the particles against each other scours them and rubs off the impurities which are carried away by the running water.

The coarse and fine sand are then separated from each other, as good as possible, and washed in a similar manner as was the gravel. In the washing of the sand and gravel there is always some loss, because the running water will carry away some of the sand: the greatest loss occurs in washing the fine sand as this is more easily carried away. This loss must be made up with fresh material. Finally the cloth is taken out and thoroughly washed.

After washing, the cloth, sand and gravel they are put back into the tank in the same order that they originally were, when the filter is again ready for use.

The disadvantage of such a home-made filter is the trouble in having to wash the sand, cloth and gravel, and the replacing of them in the filter.

There are patent filters on the market, which reduce this trouble to a minimum; they are known as self washing filters. The sand or filtering material is then washed in the filter itself, and all the work that is required by the operator, is the opening and shutting off of certain valves. These patent filters are simple in construction and operation, and produce good results. They are built in various sizes in order to suit the various demands of a mill, again any number of these filters may in turn be connected to one main supply of filtered water in the mill. The filtering material in these patent filters is sand, the same as in the specimen filter previously described.

These filters consist of large tanks of cast iron, or steel shells, supplied in their interior at the bottom with specially constructed brass strainers, which retain the sand and permit the filtered water to flow freely from the sand during filtration. Moreover these strainers are so constructed that when the filter is to be washed the strainers distribute the wash water equally through all parts of the bed.

Another important feature of these patent filters is that every operation of the filter can be controlled by valves. These controlling valves are so simple that the most ignorant workman can operate them, in fact some filters have only one controlling valve operated by a lever outside of the filter, the said lever pointing against a dial carrying five different readings viz: (1) cleaning filter; (2) filtering purpose; (3) by passes-cut out filter for passage of water, when for example no filtering is needed for a short time; (4) setting valve so that the first filtered water which naturally is dirty will run in the sewer, in place of the supply pipes for the mill; (5) closed—everything closed up, filter completely placed out of use, *i. e.*, temporarily not needed.

These patent filters have an ingenious device by means of which a solution of potash alum is fed drop by drop into the unfiltered water before it enters the filter.

The alum, as has been explained, coagulates the impurities in the water and collects the exceedingly fine particles into gelatinous masses which the sand retains; these fine particles would pass through the filter if alum was not used. The supply of alum solution can be regulated so that an excess of alum is avoided.

There is also a great saving of time, for ten to fifteen minutes is usually sufficient for cleaning the filter, moreover no time is wasted in refitting the filter, as it is ready for use immediately after washing. The first cost of such a filter is much larger than the cost of a specimen filter previously referred to, but saving of time, labor, and material (since there is no loss of material in cleaning the patent filters) makes the final cost of the patent filter less in the end.

NOTES OF GENERAL INTEREST ON DYESTUFFS.

Dyes may be divided into two classes, the *natural* dyes and the *artificial* dyes. The natural dyes are those which nature supplies to us in the crude form, in plants and animals. Artificial dyes are those which chemists have prepared from chemicals, such as the coal tar dyes. As may be supposed, the natural dyes have been in much longer use than the artificial ones, natural dyes having been used by the ancients, whereas the artificial dyes are of a comparatively recent origin.

Dyeing is one of the most ancient arts. We have positive proof that the ancients dyed skins and fabrics. In the Bible we read that Moses dyed red the ram skins which covered the tabernacle; Solomon imported dyers from Tyre skilled in dyeing of fabrics purple and blue. The Purple fabrics of the Tyrians became famous, edicts were passed forbidding all people except emperors and kings from wearing purple cloth; death was the penalty for all who disobeyed these laws. Purple garments were prized as highly as gold and gems. If one king wished to please another, he would present him with a purple garment.

The Tyrians obtained this purple dye from a small shellfish known as the *murex purpura,* and other members of the *murex* family. The dyestuff was extracted from these shellfish, either by crushing them in their shells and extracting the coloring matter with water, or by removing the animals from their shell and then extracting the coloring matter. Since this dye was only produced for members of the royal family, very few people knew the secret of preparing this purple dye, and its method of preparation finally became lost. The purple and blue colors produced by the Tyrians were very brilliant and permanent, and it is to be regretted that this art was lost.

Pliny says that when Alexander the Great returned to Greece from his conquests in the East, he brought with him methods of dyeing black, blue and yellow.

In India, cotton was dyed in rich and permanent colors and indigo was used. The Romans and later the Venetians learned their methods from the Greek.

Madder was known to the Egyptians, Greeks and Romans, who fixed it upon cotton in practically the same manner as we do to-day. Madder is the root of a plant (*rubia tinctora*) originally grown in Asia Minor, later in France and Italy.

Indigo was introduced into Europe in the 16th century, but very little was used because laws were passed to protect the woad cultivators, prohibiting its use, and in England the statute prohibiting its use has never been repealed. It was not until the 18th century that it was used to any great extent in Europe, but finally it was regarded as one of the most important and valuable coloring matters.

In North and South America, the natives used dyes extracted from trees. When the Spaniards, under Pizarro and Cortez, in the 16th century conquered Mexico and Peru, they were surprised to find that the natives had richly colored fabrics and skins, and moreover the colors were permanent. The dyestuff with which these fabrics were colored, was extracted from the dyewoods which flourished in these countries, the most important being logwood, fustic, peach wood and Brazil wood. The Mexicans also extracted cochineal from the small female insect known as *coccus cacti.*

The coloring matter obtained from plants does not exist as such in the plant. The plants, *e. g.* indigo and logwood, contain a substance known as chromogen, which on oxidization is converted into a dye. The general method of extracting the coloring matter from the plant is the same; the plant is either bruised or cut into small chips, and then the coloring matter extracted with water, sometimes boiling water being used, whereas at other times cold or luke warm water is used.

Sometimes the oxidization takes place before extraction with water, as in the case of logwood, which is piled into heaps, then moistened and allowed to remain in the air for three or four weeks, the heaps being frequently turned.

In other instances the oxidization takes place during the extraction, *e. g.* as with indigo. The leaves of the indigo plant are allowed to stand in a tank of water for some hours, then the extract is churned by means of a revolving wheel with paddles, and it is by this churning that the air, which oxidizes the chromogen in the plant, is brought into the extract. Alkali hastens the reaction, but must be used with care. The indigo formed then sinks to the bottom, since it is insoluble in water, and is removed by filtration, dried and then pressed into cubes, in which form it appears in the market.

The coloring matter obtained from any plant is not chemically pure, it consists of a mixture of things. For example, in addition to indigotin (the blue dye) indigo contains indigo red, indigo brown and indigo gluten. These impurities can be removed by extracting them with water, alcohol and ether, but in practice they are generally allowed to remain. If the pure indigo blue is desired, the artificial product is used. Some dyers think the impure natural product gives better results than the pure artificial product; the question is still an open one.

The natural dyes, having been used from time immemorial have held supreme sway up to the 19th century; then, the natural dyes received a rude shock. Up to this time it was thought impossible to produce any substance which occurred in organized nature from any chemical or inorganic substance, unless the influence of a force known as the vital force was used. This so called vital force could only be supplied by living bodies, plants or animals. But in 1828 Wöhler produced *urea*, an organic compound from inorganic substances; investigations followed and many organic substances were made in the laboratory of the chemist. Alizarin was discovered to be the principal coloring matter in madder; and a little later we had artificial alizarin. This soon was made so cheaply that it has practically driven the natural product out of the market and has stopped the cultivation of the madder plant.

Now it looks as if natural indigo will suffer the same fate as madder. Within the last decade *synthetic* or artificial indigo has been manufactured cheap enough to compete with the natural product. At present it is impossible to tell which will triumph, the natural or the artificial product.

But the researches of the chemist have not ceased; he is still making numerous dyes from coal tar products. He knows the active principle of logwood and fustic. Who can say where, and when, the researches of the chemist in this field will end? What natural dye will next be prepared synthetically?

PRACTICAL POINTS ON THE SHEAR AND THE SHEARING OF WOOLEN AND WORSTED GOODS.

Introduction—The Object of Shearing—Preparing Goods for the Shear—The Construction of a Shear—The Single Shear (Illustrated)—The Double Shear (Illustrated)—A Few Practical Points—The Rests—The Plain Steel Rest (Illustrated)—The List Saving Steel Rest (Illustrated)—The Rubber Rest (Illustrated)—The Ledger Blade—The Revolver—The Operation—The Material Used and the Condition of the Cloth—Slack Selvages—Oiling—Grinding and Setting of the Shearing Mechanism (Illustrated)—A Shear Grinding Machine (Illustrated).

(*Continued from page 50.*)

Experience will soon teach a wide-awake shear-tender how to do this raising and lowering of the revolver in order to have a seam pass the cutting device of the machine in less time than he would at first have considered possible. A lever arrangement is provided with the modern shear and which is a great improvement over what is met with on the old style shears. It consists of levers and toggle joint connections, arranged in such a manner that by simply pulling the lever on either side, towards the operator, the whole cutting arrangement is raised. No special exertion is required, in fact, the levers and toggle joints make the work of lifting the blades a very easy job for the shear-tender.

The tension to put on the cloth during the shearing process is not uniform for all kinds of fabrics, the same depending upon the weight and character of the goods under operation, it being readily regulated by the adjustment of the friction plate on the draft roll shaft. Sometimes the effect of this friction is destroyed by not taking proper care of the friction plate. The leather on the friction plate may get too hard and dry, and when such is the case, take off said leather and carefully rub into the latter a small amount of good oil, so as to soften it, but under no circumstances oil the friction plate in a common way of oiling, since such is apt to destroy its usefulness. Be careful that no oil from the roll bearing works through into the friction wheel.

In order that the operator of the shear can see all that needs looking after, he must stand himself in a position where he can see the whole width of the cloth as it passes before him, being at the same time near enough to the shipper handle (*Z* Figs. 1 and 2) to stop or start the shear conveniently. A side view against the light is better than any other position for him, in order to detect any unevenness in the shearing. It is not necessary for the shear-tender in connection with shears where the lever arrangement previously referred to is not provided, for the lifting of the revolver, to use both hands for this purpose, by taking hold of the top bar in the centre, as there is no necessity for using both hands; in fact, it is much better for him to use only one hand for this operation, leaving him in turn a free view of the cloth as it is shearing. For this reason, when being on the left side of the shear and the revolver has to be lifted to permit a seam to pass, lift the latter with the left hand, and when standing on the right side, do the lifting with the right hand.

With reference to cutting the nap, the revolver should be lowered very gradually between the runs, especially in connection with fabrics where the nap is very heavy, and where it is impossible for the blades to cut level, all the way across the fabric, otherwise it will be found advisable in connection with any number of fabrics to rather give them two or more extra runs at one point of the shearing process, more particular towards its finish. Never push the shear for work by close setting, it will not pay in the end, it will result in an imperfect finish to the cloth; it will frequently result in goods sheared too closely, *i. e.,* in a hard handle to the goods thus treated, whereas several additional runs in the process, with one or two notches higher and the shear blades consequently brought less closely into contact with the fabric, will often bring out the pattern just as clearly, and still leave a slight nap on the face of the fabric thus treated, and what will be the means of imparting to the fabric at the same time a soft feel.

The Rest. There are two kinds of rests met with, *viz:* the steel rest and the rubber rest. The first mentioned rest is the one shown in connection with our illustrations and the same is either met with as a common or a plain steel rest or in connection with a list saving attachment. The latter is the rest more frequently met with, the same referring to a rest in which the thick or curling selvage is guided away from the path of the blades on the shear cylinder, by means of a self-operating mechanism which automatically extends or lessens the effective edge of the cloth rest.

The plain steel rest is shown in its outline section in Fig. 3 and in which *A* indicates the rest, *B* the ledger blade and *C* the revolver or shear cylinder (having 14 edge fly blades). The run of the cloth (as shown by means of dotted line in connection with Figs. 1 and 2) has been omitted in this illustration

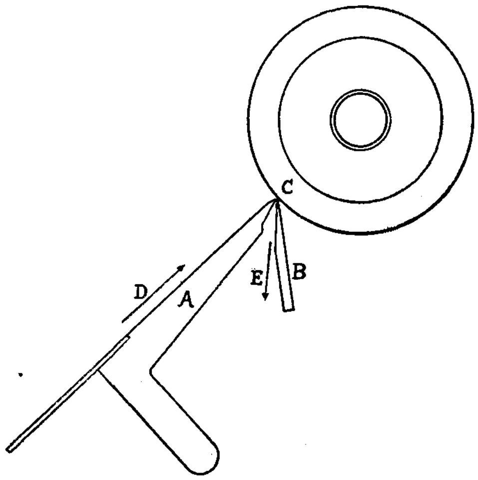


FIG. 3.

for the sake of clearness; the cloth passing in the direction of arrow *D* over the cloth rest, coming under the action of shearing mechanism, where cloth rest,

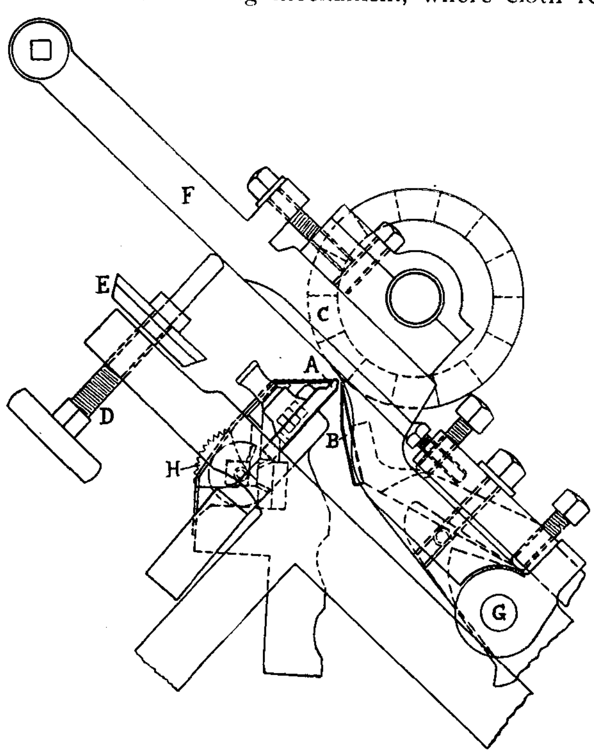


FIG. 4.

ledger blade and fly blades nearly meet, and leaves the shearing mechanism, passing between cloth rest and ledger blade, in the direction of arrow *E*.

The list saving steel rest. An illustration in section of this rest, showing also position of ledger blade and shear cylinder to the rest, is given in Fig. 4, and in which *A* indicates the cloth rest proper, *B* the ledger blade, and *C* the shear cylinder (having 14 edge fly blades). *D* indicates the dial screw for setting the shear cylinder nearer or farther away from the cloth rest according to amount of shearing to be done, *E* is the dial, *F* indicates the frame for carrying the shear cylinder or revolver, being pivoted at *G*. The feeler of the list saving attachment is shown at *H*. The passage of the cloth to be sheared (and as shown by dotted lines in Figs. 1 and 2) has also not been shown in this case, in order to better show up the various parts composing this shearing device.

With reference to the setting of this rest, the builders give the following details: Lay the rest centrally right and left in its place on the top end frames. Test its edge, the slides being pulled out of their end positions, with the straight edge and dry tissue paper, both on top of the edge and on the back of the edge toward the blades. It should pinch the paper equally at every point. If there are a few high places and these are slight, they can be worked off with a fine flat file, drawing it lengthwise. If the inaccuracies are considerable, the rest must be trued on a planer. Screw in the binder screw as situated, one screw in each attachment, in about the centre of the latter, loosely. Turn out the two elevating screws as situated, one screw in each attachment, at the bottom of the latter, until the rest is high enough to allow the outer ends of the feeler catch holders, as screwed to the slides, to escape the horns of the top end frames, said slides being in their outermost positions. Turn in the two set screws as situated in each arrangement, one above and one below the binder screw previously mentioned, until the rest is level, right and left on its edge, and also level on its top flat, front to back. When once the rest is set, leave it alone, and in turn adjust the blades of the revolver and under no consideration the rest to the blades. Ordinarily, and for close shearing, the edge of the ledger blade should be brought up exactly level or "at sight" with the top of the rest edge, making this adjustment with the elevating screws of the blade frame pivot boxes on the top of the back end frames. Lower the knife close to the rest edge so it will barely pinch thick letter paper, by turning back the dial screws so the blade frame arms rest evenly on their points. Test this by placing your finger at the junction of the blade frame arm and dial screw point, and hitting the blade frame arm with a light upward blow with the fist of the other hand. The feel of the give, will enable one to adjust it evenly after a little practice. Being assured that the ledger knife is dead true, by testing with the straight edge and dry tissue paper, both on the face and scarf bevel, see if thick letter paper pinches evenly the whole length between the rest edge and the ledger knife. If the paper chances to draw a trifle loosely in the middle, due to the sag of the rest, this can be corrected by turning in the screw driver set screws, one with each attachment—situated just above each binder screw—a little. On heavy-weight face finish goods, it is often the practice to set the ledger knife edge a little below the rest edge. If the knife edge is set above the rest edge there is danger of pinching the goods, making them fluff up in front of the blades and cut the face. Never run the rest, if the slides work hard, since in such a case the list motion needs either cleaning and oiling or refitting. Don't try and run the rest with worn feeler catches or ratchets, but renew these parts. Keep the list motion free from flocks, dirt, and well oiled. The sheet steel guard in front of the rest and over the flock brush should be straight at its front lower edge and the flock brush should barely touch it.

(To be continued.)

THE TESTING OF CHEMICALS, SUPPLIES IN TEXTILE MILLS AND DYE WORKS, ETC.

Introduction

In these days of keen competition and narrow margins of profit in all branches of the textile industry, success does not lie so much in the marketing of goods as it does in making or finishing them at the lowest possible cost. Market prices for selling the finished product and for buying the raw material, wage scales, the fixed expenses of operating, etc., are fairly uniform over wide areas, therefore, since general trade conditions are the same for all, the man who makes the most money will be the man who runs his plant with the lowest expenses. Expense may be cut down in various ways, according to various local conditions, but there is one expense that can be lessened solely by careful supervision, and that is the expense, loss rather, of waste; everything wasted is something taken from profits. There are so many ways in which waste can occur in the various textile processes that eternal vigilance is the price of success, carelessness or heedlessness will run up losses from waste to a big figure in a very short time. For instance, there is waste of raw material spoiled in process of manufacture or finishing, waste in the development and utilization of power, light, etc., waste by unskilled operatives, waste by throwing away useful material, waste by purchasing and using inferior raw material, supplies, etc., etc., in endless detail. Material wasted means money wasted, and while the big losses and wastes are usually quickly noted and steps taken to prevent or lessen them, the little losses and small things wasted are overlooked or taken as inevitable. Yet, it is just these seemingly trifling losses, waste, etc., that in the end often make the difference between profit and loss, and cause the thoughtless manufacturer to wonder and worry why his business does not pay.

Any system, method or device that will prevent losses or lessen waste is worth a trial if it is practical and sure in results and does not cost too much. One of the most practical ways to prevent certain losses in the textile industry, especially in its branches of dyeing, bleaching, finishing, etc., is by the practical application of chemistry in systematically testing raw materials and manufactured supplies before purchase and before using them in the various processes. Waste can be prevented also by the systematic testing of dye-baths, solutions of chemicals, etc., while these are in use, so that only the proper additions need be made to keep their strength uniform, and also by testing used baths, dye-liquors, solutions, etc., to ascertain the amount of useful material they still contain, so that this can be saved and further utilized.

Many of the problems of waste and losses in textile industries are to be solved only by the application of engineering or mechanical skill, others can be solved or lessened by training the help or making it to their advantage to be careful—with such problems this article will have nothing to do. Its object will be, first, to point out how savings can be made at many points, by the knowledge and application of the chemical operations of analysis and testing, the many ways and important uses to which these can be put, and then to show how this chemical knowledge can be obtained. The scope of instruction proposed will be referred to later.

It must be remembered that the buyer of chemicals and mill supplies is at the mercy of the seller as to their quality, strength, purity, etc., unless he is able himself to check the seller's statements by testing his purchases. If not employing a chemist or having the services of himself or some other person capable of making the necessary tests, the buyer has only the seller's guarantee or statement to guide him, and if he depends solely on the usual trade guarantee, he may find to his sorrow that it means nothing. Moreover, most dyeing processes are exact chemical reactions, and unless the exact strength of the chemicals used is known, the processes are sure to be based on guess work and the results depend on chance. How can uniformity be secured if a uniform quality and strength of materials be not used each time? Suppose a specially brilliant color be obtained with a certain dye-bath, how can this same color be repeated unless the exact amounts and proportions of its ingredients be known, so that the former conditions can be exactly duplicated?

The Necessity for Testing Chemicals and Mill Supplies: While the recently enacted federal and state "pure food and drug laws" protect the consumer against fraud and adulteration in articles used for food or medicine, there is absolutely no safe-guard for the purchaser of industrial chemicals and supplies except the guarantee of the manufacturer, and this is often merely a conventional compliance with trade uses and generally means nothing. The only sure protection against fraud, adulteration, substitution and inferior articles is that supplies be tested or analyzed by, or for the purchaser, except in the sole instance that the manufacturer sells them accompanied by a guaranteed certificate of chemical analysis or other test. In many industries, everything is bought according to rigid specifications and must correspond to these requirements on chemical analysis before it is accepted, and while it is not always possible for the small dyer or mill owner to follow this system in its entirety, still, he can insure that he is getting what he pays for by insisting on testing the supplies he orders before paying for them. The cost of a single purchase of inferior material or the delivery and use of a mistakenly or fraudulently substituted wrong article, will, in many cases, amount to more than the cost of testing the entire year's supply.

There are many reasons why the materials used in the dye-house or mill should be tested before being used. In the first place, there is an enormous quantity of inferior or adulterated chemicals put on the market every year, as is proved by the published results of a series of tests of chemicals, bought in the open market, recently conducted by the U. S. Department of Agriculture. Many samples of staple chemicals were found to be far below their labelled or required strength or purity, and some of them were actually not at all what they were sold for. The most important chemicals used in the arts and industries were found full of impurities, from careless manufacture or purification, and some were grossly adulterated with cheaper adulterants or inert substitutions of cheaper substances resembling the true article.

The conclusion reached, and published officially, was that the label is no guarantee of the quality, strength, purity, value or even the identity of the so-called industrial chemicals sold in the open market, if these are not accompanied by a certified guarantee from a responsible manufacturer. That there is no standard for industrial chemicals and that the label seldom indicates the strength or purity of the article and is sometimes actually false, are facts which must be borne in mind by every buyer.

Chemicals and mill supplies vary widely in strength and value even if pure, that is, free from foreign substances or other chemicals. Carbonate of soda, for instance may contain ten molecules of water of crystallization or only one molecule of water. At the same price for the two different articles, their value would be very different; in the first case, the purchaser would get only 40% of what he actually wanted, carbonate of soda, the rest of the weight being made up of water, which is no use to him, whereas in the second he would get 85% of useful material. Again, in many processes of dyeing, iron is a very undesirable factor, its presence giving very inferior colors, therefore a lot of bichromate of potash containing iron would be worth far less to the dyer than a lot free from iron, in fact he would not want the first lot at any price. But, how is the purchaser to know these things unless he has his purchases chemically tested, he cannot take the meaningless commercial catchwords of "standard purity," "strictly pure," etc. as a guarantee?

Another reason for testing supplies is to guard against mistakes or the fraudulent substitution of one article for another. There are so many chemicals that look alike and behave alike in some ways that it is very easy to mistake one for the other, unless a chemical test is made.

Take for example epsom salts and zinc sulphate. These two salts look somewhat alike and it requires some experience to distinguish them from one another, unless a chemical test is made; yet if zinc sulphate was used by mistake in place of epsom salts, it would cause great confusion and damage. To prevent any mistake, all chemicals should be properly and carefully labeled and marked and if these markings or labels become destroyed or lost, and there is any doubt as to the chemical, it should be tested to make its identity certain. Moreover, chemicals are often heavily adulterated with useless or deleterious substances and these must be detected for the protection of the purchaser.

In the actual work of the dye-house, bleachery, etc., the ability and means to apply chemical tests at various stages of many processes are very valuable. Many times, failure can be prevented by testing dye-baths or solutions when something seems wrong, learning the cause and taking the necessary steps to correct things. Again, many times, used solutions can be saved for further use, if the amount of the chemicals in them can be known exactly, thus much valuable stuff can be saved that otherwise must be thrown away, for fear that its use would spoil good material. Take the bichromate of potash bath used for mordanting wool—this is often used over and over again by adding fresh bichromate, acid, or water, or all three, but if the strength of the bath is only guessed at, no one can know what quantity of fresh materials to add to it to keep it at the proper strength, consequently there is every prospect of wasting chemicals, by using too much or of spoiling the wool by using too little of one ingredient or another. If the bichromate bath be tested after each batch of wool has gone through it, its exact strength can be easily ascertained and the proper quantity of bichromate, acid or water can be added to it, and it can again be used safely many times.

The mill owner can protect himself from fraud or over-payments by having his lubricating oils, soaps, greases, sizes, paints, etc., etc. tested before buying them, and he can establish standards of strength and purity for all his supplies, that will not only save money in their purchase but will also pay good profits in securing for him uniform results and operating conditions. It will not take long for him to find out just what standards suit his conditions best, and every mill owner of experience knows that uniformity in operating means a good deal of money saved. By testing articles, he is also protected against the possible presence of harmful materials in what he buys which might damage either machinery or finished goods; grit in greases, excess of alkali in soaps, for examples.

Moreover, uniformity in the goods will obtain and hold the good will of the consumers because they will know that the goods they buy will be always of the same grade and character. There will be no complaint that the last lot of material was not as good as that sent before.

Still another valuable result secured by the ability to test one's supplies is that a person can go into the open market and buy goods that come up to his standards at much lower prices than he would have to pay for trade-marked or guaranteed brands. Rest assured that you will have to pay the manufacturer for the expense of testing and guaranteeing his products, why not do your own testing and save the money for that, as well as the fancy prices charged for articles of guaranteed quality? The very fact that you must pay more for guaranteed quality shows how much inferior stuff is sold.

The value, rather the positive necessity, of chemical analysis of their crude and finished materials has been recognized by every industry, and most large plants have a staff of chemists and completely equipped laboratories, but on the other hand, few small manufacturers think it worth while to follow their example, either from fear of the cost or else from the mistaken idea that their practical experience will carry them through. It would, of course, be out of the question for a small mill or dye-house to employ a high-priced chemist and to fit up an expensive laboratory, but it is practical for some one person connected with it to learn enough chemistry to perform simple tests and for the testing of their various materials purchased or used to be made a regular part of his duties. Such work would neither require much chemical knowledge and training nor the use of expensive apparatus and chemicals; the necessary skill would soon be obtained by practice and a little instruction in the general principles of chemical analysis and the individual tests for various articles. All that is really necessary is a moderate outfit and a few hours' study and the desire to succeed. Of course, this is not said in disparagement of the expert chemist, his work will require all his skill and training, and he cannot be dispensed with in a large plant, but where the mill or dye-works is not large enough to afford such a man, much can be done along the lines mentioned by the owner or manager himself.

The boss dyer is the proper man to do the testing in smaller dyeing establishments which have no chemist, since frequently he may have a knowledge of general chemistry as well as a practical and thorough knowledge of dyestuffs. He is used to chemicals and knows that they require care in handling.

The purpose of this series of articles will be to give only such general information and directions as are necessary for the understanding and application of the tests to be described later, then to give the best and most practical way of testing each substance separately, to ascertain its identity, purity, strength, amount present in a solid mixture or solution, its value for various uses, etc., etc. The work will not go into general chemical analysis any further than is necessary for its application to certain operations or substances, nor will detailed methods requiring complicated or expensive apparatus be given—for such the reader is referred to the standard works on industrial chemistry and analysis. The system followed will be to give just enough detail to make every test described clearly understood, and to enable any person of good intelligence to perform them by carefully following the instructions given. Certain general operations, such as making test-solutions, drying and weighing precipitates, handling chemical apparatus and the use of various appliances, measuring, weighing, etc., will be described as a preliminary, and discussed in sufficient detail to make them clearly understood by the student.

Lists of the necessary apparatus and chemical reagents will be given, as far as practicable, with directions for fitting up a compact and complete laboratory, to assist the reader in ordering his outfit. The space needed for this will be small, the only absolute essential being a supply of running water. If gas is not available, alcohol (grain or wood) can be used in the various operations requiring heat, although gas is by far preferable for use.

The scope of this series of articles can best be described by giving an outline of the work to be undertaken under chapter headings. It will be in three parts, and, as far as possible, the article in each issue will be separate and complete.

PART I.

Fitting up the Laboratory. List of Chemicals and Apparatus Required.

(1) The Principles of Chemical Analysis and their Application, etc. The Metric System.

(2) Volumetric Analysis, or Testing by Standard Solutions. Directions for Making and Testing the Standard Solutions. How to use Them. Indicators, etc.

(3) Gravimetric Analysis or Testing by Weight; Scales, Weighing, etc.

(4) Operations Requiring Heat; Boiling, Drying, Fusing, Igniting, etc.

PART II.

(5) General Methods of Testing. Operations Required, Results to be Secured, etc.

(6) General Methods of Testing Chemicals and Mill Supplies.

(7) General Methods of Testing Dyes, Dye-stuffs, Colors.

(8) General Methods of Testing Fibres and Fabrics.

PART III.

(9) Tests for and Estimation of Chemicals, alphabetically arranged.

(10) Tests for and Valuation of Mill Supplies, alphabetically arranged.

(11) Tests for and Valuation of Dyes, Dye-stuffs and Colors, alphabetically arranged.

(12) Tests for and Valuation of Fibres and Fabrics, alphabetically arranged.

(13) Water Analysis. Tests for Impurities and Estimation of Amount Present.

(14) General Tests for Fuels, Paints, Oils, Various Materials.

It is recommended that *Part I* be carefully studied and preserved for reference, as the skillful and correct performance of the tests, etc., given in *Part III* depends on the thorough understanding and application of the principles and directions there explained. By mastering the general principles of *Part II,* the student will be able to make many tests not mentioned in this article, as they are applicable to any article whose value can be estimated by chemical analysis.

It must be clearly understood that while exact accordance with the general principles of chemical analysis herein stated is necessary, modifications can often be made in the individual tests, or others may be used with equally good results. The various methods and special tests given are by no means the only ones that can be used, but an effort has been made to select and describe those which will give accurate results in the hands of a person not thoroughly versed in chemistry and chemical manipulations, and which are practical both in method and application. As before remarked, this article is not intended for the expert chemist, but rather for those whose knowledge of chemistry is slight, and it is hoped that the instructions given will enable the student to undertake the testing of all the chemicals, mill supplies, dyes, raw materials, etc., commonly used in the textile industries.

Fitting up the Laboratory: About the only essentials for a laboratory sufficient for the needs of a small plant are a long work-table, a sink with running water, gas for heating and light, and good light, from a window for the daytime and a good lamp or burner at night. If available, a small room can be set aside for a laboratory, with the advantages of quiet and better facilities for work, but it is not necessary, the table can be set against the wall near a window and shelves built over it. It will be better if a light partition be run up enclosing the table, shelving, etc.

The one absolutely necessary equipment is a sink with running water, without which the work will be severely handicapped and will be sloppy and messy. If no other way be possible, install a fair-sized water tank at the ceiling and run pipes to the sink. The sink will be most conveniently placed if set in the work-table, at about the middle, the upper rim of the sink being brought flush and level with the top of the table. The joints between the sink and the table should be made water tight. Good drain pipes are necessary.

If gas be at hand, run a pipe over the table and fit it with one or two outlets for quarter-inch rubber tubing, for connection with Bunsen burners, etc. If there is no gas connection, alcohol lamps can be used for those operations requiring heat, one style of lamp now made giving as high a degree of heat as does the "blue-flame" gas burner. Either wood alcohol or denatured alcohol is economical.

The table should be strong and solid, with a good thick top, about six feet long and three feet wide, set at a convenient height from the floor. If a hot mixture of paraffin and turpentine be well rubbed into the planed surface of the table until the wood is saturated, the excess wiped off and the surface well polished, the table top will not be affected by acids, etc., spilled on it.

It would be better to cover the top of the table with sheets of asbestos. These can be obtained for a small price and will be better in case of fire which may be caused by accident. It will keep the table in good condition and where the asbestos becomes old and dirty it can be renewed with fresh clean pieces. Moreover, asbestos is better because it is softer than wood and very often hot beakers are picked up and the person who picks them up generally wishes to put them down quickly and these would break if they came in contact with the hard wood.

Several drawers will be found useful for containing apparatus, tools, etc.

The shelving need be only sufficient to hold the bottles of chemicals, test solutions, apparatus, etc. Two or three shelves, about 8 inches wide, placed above the table will be found convenient for holding the bottles mostly used. These shelves should run the full length of the table, the bottom shelf being set about two feet above the table, the other shelves set about 10 inches apart. Other shelves can be put up as needed. A small folding shelf near the table will be found handy for use as a desk.

Of course, other and more elaborate fittings may be put in if desired. If it is wished to fit up a complete laboratory, the entire necessary equipment can be ordered from any one of several firms making this a specialty, and the furniture can be bought, shipped and put up at the mill by its own employees or by hired carpenters.

(*To be continued*)

THE LIGHTING OF TEXTILE MILLS.

(Continued from page 54.)

Skylights. The remarks as to protecting windows apply with equal force to skylights, for these, wired-glass in metal frame work is desirable. As most textile mills have more than one story, skylights will seldom be a necessity unless the floor space is of considerable area, then the skylights can be combined to advantage with light shafts, if the mill be more than one story high. In locating skylights, they should be placed so as to have a northern exposure and to admit diffused light instead of direct sunlight. The so-called "saw-tooth" form of construction is the best, since the openings in these can be arranged so as to admit diffused light instead of sunlight. It must be remembered that if flat skylights be used, their effect will be to transform the room underneath into a sort of hot-house, even if direct sunlight be shut out by awnings, shades, etc., or by using opaque glass. Therefore, the saw-tooth skylight, whose light opening is perpendicular, or nearly so, is the best, and here again Luxfer Prism glass can be used to great advantage for diffusing the light. Skylights must be ventilated to obviate condensation of moisture inside, and should be made watertight and be well drained into a near-by gutter.

General Data. The finish of the inside of a room has a great influence on its illumination. If the walls be covered with dark paint, paper or wood-work, the room will appear ill-lighted, even though well provided with windows or artificial light, and also a dark floor or carpet will darken a room. To obtain the maximum effect of light from any source, the walls of a room should be smooth, and painted or covered with a light color, and the floor likewise should have a light-colored covering. In textile mills, all the exposed interior surfaces, walls, ceilings, partitions, columns, etc., should be a light color, the best results being secured when white is the prevailing covering. White paint of good quality is the best to use, and the finish should be dull rather than glossy to avoid painful reflections affecting the eyes of operatives, although there will be a slight loss in the amount of light reflected. For the same reason, a pearl gray or cream tint will be found less fatiguing on the eyes. If all exposed surfaces are thus treated, there will be little absorption of the light that enters the room, as most of it will be reflected and diffused. The extra amount of illumination caused by painting the interior light-colored will amply repay the cost of the paint, especially where artificial lighting is employed.

Machinery absorbs a vast amount of light when painted dark, and therefore, wherever possible, it will be of benefit to paint machines some light tint, one that can be easily cleaned off and with a paint that will resist oil, grease, etc.

The following data showing the comparative amount of light reflected by walls of various colors is given as a guide for the selection of colors for painting indoor surfaces. A *white* wall will reflect from 70% to 80% of the light falling on it, a *yellow* wall reflects 35% to 45%, *emerald green* reflects about 18%, *deep blue* reflects only about 3%, *dark red* about 10% to 15%, and a *dead black* surface will reflect less than 1% of the light received.

Shafting, belting, etc., should be arranged so as to obstruct light from windows, etc., as little as possible, and so as not to throw dark shadows on the working parts of machines. The overhead system of shafting, etc., should be above the general line of illumination, lamps or windows. Columns also should not be placed in front of windows, especially a line of columns.

It is not good economy to use whitewash, kalsomine, etc., in place of paint, for the interior surfaces of rooms where machinery is operated. In addition to the defect that whitewash soils easily and cannot be cleaned, and therefore requires frequent renewal, the jarring and vibration of the machinery will loosen fine particles, or even flakes, which will fill the air and settle on the cloth or yarn, causing spotting, etc., in later operations. Because of the tendency of lead paint to darken, from sulphur, etc., in the air, a good zinc-oxide paint is the best to use, and this should be put on evenly and thoroughly. The paint should stand washing, as this will be necessary at intervals. Walls will require painting oftener than ceilings.

While dark floors will absorb light to a marked extent, it is hardly practicable to do anything with them. However, an attempt should be made to keep them as clean and light colored as is possible. White tiling would be the ideal floor if the cost were not so high. A cement floor will cost less than a wood floor. In building a mill of fire-proof construction, of course a light-colored concrete floor can be laid at less cost than in an old mill, and at less cost than a wood floor. In laying a new floor, if wood is used, it will be found economical in the end to specify a floor of some light-colored hard wood like maple. The added first cost will be repaid by the better wearing qualities, lessened repairs and less liability to fire, in which qualities it is superior to pine flooring.

Artificial Lighting. The previous remarks apply to the mill under ordinary conditions of daylight operation. If the mill is properly designed and constructed, is in a good location, and suitable means are provided for utilizing natural light in all interior spaces, no artificial illumination during daylight working hours will be necessary, except on very dark days or when running after sunset in the short days of winter. However, as many mills are run both night and day, and as there are many mills so constructed that they must have artificial light during the daytime, the installation of some system of artificial lighting is a necessity. The question then becomes, which is the best and most efficient system of artificial lighting for textile mills, the question of cost being given second importance, because the most efficient lighting system is always the cheapest in the end. It may cost more to install, but when results are considered and the running costs are compared, the system that seems cheapest in first cost will be found to be the dearest in maintenance.

Whatever system of lighting should be decided on, the first consideration of the mill owner should be plenty of light everywhere that it is needed. It is the poorest kind of economy to stint the lighting of a textile mill, as has been said before, and you can't have proper lighting if you do not put in enough light sources, be they electric lamps or gas burners. Data as to the amount of illumination required in various parts of mills and how to obtain the best results from light sources will be given later in this article, and the practical application of the principles there explained is suggested to every person having charge of mill lighting.

A second consideration is the reliability of the lighting system. Due regard must be given to this question to safeguard the mill against shut downs because of failure of its lighting system. If necessary, provide duplicate plants.

Choice of Lighting Systems. Practically, there are but two systems of artificial lighting adapted to textile mills, gas lighting and electric lighting, oil lamps being out of the question. The two systems, however, are applicable in several ways, thus we have various types of arc and incandescent electric lamps, and gas burners, with and without mantles, and also acetylene gas, and each of these has its advantages and disadvantages. These will be discussed later, to furnish data for those interested.

Of the two systems, gas lighting and electric lighting, the latter is in every respect the best for textile mills. In fact, electric lighting is the only artificial system of illumination that should be used in textile mills for very many reasons, and wherever it is practicable to replace gas by electricity, it should be done. Gas lighting has the following fatal objections: danger from fire; great heat production and contamination of the air, these seriously affecting the temperature and humidity of the mill; necessity for increased ventilation, *i. e.*, more power required; lack of flexibility and extension; impossible for use in many places, cannot be procured in many localities, etc., etc. Electricity for lighting can now be bought almost in every town or city, or it can be generated by the mill itself; electric lamps do not affect the atmosphere and cause little heat and can be used anywhere.

When electricity is used, the choice may be either arc lamps or incandescent lamps, or the recently perfected "vapor lamps" can be used. The comparative cost and efficiency of each will be given later. As a general proposition, it is recommended that a combination of enclosed arc lamps and incandescent lamps be used, or the enclosed arc alone, or high candle power incandescent lamps can be used. It does not pay to use the common 16 candle-power lamp by itself.

HUMIDIFICATION, ITS RELATION TO THE VENTILATION OF TEXTILE MILLS.

Now add to the losses, from waste and material spoiled, the decrease in the production of the mill because of the frequent stoppages of machines to repair broken threads and to patch up defects, stoppages due to imperfect action or jamming of parts of the machines, faulty action from the parts being warped or shrunk out of shape, belts drying out and slipping or breaking: does it not seem a necessity to overcome these conditions if we expect to operate the mill with any profit at all? Then there is the question of extra cost of power to be considered, it being a well-known fact that the spinning frames or the looms will require a great deal more power when they are working in a hot, dry atmosphere than when operating under favorable conditions of moisture and temperature. Artificial conditioning of the air, therefore, is seen to be an absolute necessity.

The answer to the second question is this:—that there is no mill in the whole United States that can depend upon uniform conditions of climate or weather from one day to another. Our climate is about the most variable in the world, temperature and atmospheric conditions are seldom the same for consecutive hours, let alone days. It is a physical impossibility to maintain uniform conditions in a mill if depending on climate alone, some means must be employed to counteract the differences between the heat of summer and the cold of winter. Then there must be considered the differences in the humidity of almost every day, not to mention at all the difference between that of day and of night. Unless some means are taken to counteract it, the effect of the machinery in operation will alone cause great variations in atmospheric conditions, as before referred to.

There is but one answer to the third question, unless the natural atmospheric conditions of our mills be modified by artificial means they cannot operate upon any but the coarsest yarns and fabrics. We cannot compete with the mills of England or Continental countries in the production of fine goods, neither can we manufacture as good qualities of the coarser grades. For self-preservation, we must use artificial means for obtaining the favorable conditions that our foreign competitors have naturally, our changeable climate is a handicap that can only be overcome by the employment of mechanical devices to secure the conditions that they have by Nature's bounty. Furthermore, our mills would be practically unfit for occupation during part of the year if nothing was done to modify the effects of our climate; no employees could work in them. The practical confinement of mills in our Southern States to the manufacture of coarser grades of yarns, because of climatic conditions, until artificial conditioning was adopted, shows conclusively the futility of trying to spin yarn without providing means to counteract our natural climatic conditions.

The answer to the last question, the comparison of the cost of operating a system for artificially conditioning the air of a mill with the value of the increase in the quantity and the quality of the mill's production, depends largely upon the system itself. Is it really efficient or is it only a makeshift? Does it actually modify the natural conditions of the air or does it only seem to do so? Does it do its work regardless of outside atmospheric conditions or is it dependent upon certain favorable conditions of wind or weather or on the perfect action of complicated devices? Does it work automatically and uniformly or does it require constant attention or manipulation? If a system or method or device does not comply with all the conditions stated and does not do its work efficiently under all conditions of weather, climate and mill operation, it is not worth its first cost, let alone the cost of its operation.

Many of the devices and systems that are claimed to modify the atmospheric conditions of a textile mill are dependent upon certain favorable conditions of weather or temperature or methods of operation for their success, and consequently they cannot possibly maintain uniformity of either temperature or humidity. There are other devices that attempt to operate in direct variance with natural laws, which sometimes work well when everything is just right, but oftener fail under stress when most needed, these need not be given serious attention. It is a waste of time and money to install any system that does not work efficiently and positively at all times and under all conditions, no matter how cheap it be in first cost and operation. The only basis for our comparison is a system that works right at all times and under all conditions and that maintains the desired temperature and relative humidity; let us see what the comparison is.

An efficient system that will maintain uniform and favorable conditions of temperature and humidity will pay for its cost of operation in the saving of the one item of waste alone. Take the spinning room for example, if there is 20% of waste in a hot, dry spinning room, and if this can be cut down to only 5% by properly conditioning the air, the bigger the mill and its output, the greater will be the saving in actual money value. Then take the question of operating the machinery of the mill. If the spinning frames can be run smoothly and evenly and without frequent stoppages on account of broken ends, thin places, kinks, knots, etc., will not this give a much greater output and will not this be worth money? If the machines be run smoothly, will not they turn out a better quality of yarns and fabrics and will not this better quality be worth more money than poor, or even moderately good, yarns or cloth? And so the comparison can be carried on through all the departments of the mill—there will be a saving of waste and losses from materials spoiled, a saving in the time and labor otherwise lost from stoppages of machinery, etc., lessened cost of repairs, etc., etc. Then there will be the added profit from an increase in the quantity and the quality of the goods manufactured in all operations and in all departments of the mill, and in the better prices that can be obtained for them. Still further, there will be a considerable saving in the amount of power needed to operate the machinery, because the machines will work with less power if the atmospheric conditions be favorable than if they are subjected to hot, dry air. There will be, consequently, a saving in the cost of power transmission, shafting, belting, pulleys, etc., on a lessened cost for the power itself, in fact, there will be a saving all through the mechanical department of the mill.

The effect upon the mill help of good ventilation and a proper degree of humidity has not been touched on yet, although this is an important consideration by itself alone. It has been too well proven to admit of contradiction that a person can do more work and better work in a place that is kept at a moderate temperature and is well ventilated than in a close, hot, ill-ventilated one. From the standpoint of getting more work and better work from the employees, it is a paying proposition to provide them with workrooms kept at a proper atmospheric condition, even if there be no consideration given to this question as affecting their health and welfare. It pays well in their better spirits and contentment and work cheerfully done is generally work well done.

The question of what constitutes an efficient system for conditioning the air inside a textile mill having been answered, *i. e.,* it must be a system that does the work it is required to do under all conditions, regardless of anything short of an actual breakdown, effectually and cheaply, the next question will be, "What must be the mechanical construction and operation of such a system?" Omitting for the present any detailed description of the mechanical parts, we would answer that the system must be one that will deliver air of the requisite degree of humidity in sufficient volume to replace the air that is continuously being heated by the machinery, and that this heated air must also be removed at an equal rate to the fresh air supply, so that practically uniform conditions of temperature and humidity will be maintained in all parts of the mill.

There is only one system that will, or can, meet these requirements, and this is a system of artificial ventilation by which the air is taken from outside, filtered, warmed or cooled, and saturated with the required amount of moisture, then delivered, by means of ducts, and distributed to the various parts of the mill, this system working in conjunction with a secondary system that removes the heated air from the rooms in proportion as the fresh air is supplied. The movement of the fresh air through the air-ducts and the discharge of heated air from the rooms are secured by the use of fans or blowers, one set working positively, the other set working negatively, the size of the fans being proportioned according to the volumes of air to be moved rather than using excessively rapid revolutions of small fans to produce the same results.

Long and exhaustive tests have proven that the only satisfactory way of handling the problems of ventilation and humidification in places where large amounts of heat are generated by machinery or processes, is to provide some means for removing the heat as fast as it is given off to the air, as well as to supply tempered fresh air. It has been demonstrated by tests made that neither the "plenum" system nor the "exhaust" system alone will give satisfactory results under the foregoing conditions. The plenum system by itself will work very well when it is simply a question of supplying fresh air in places where there is little or no heat generated, but it fails of its purpose where heat is a factor, because the fresh air must become more or less mixed with the heated air, and both will escape in about the same volume unless special care is taken in locating both inlets and outlets.

Lest some may not understand the terms "plenum" and "exhaust," as applied to ventilation, the following explanation is given. The "plenum" system of ventilation is a system in which air is forced into a room, or other space, by means of fans or blowers, this causing the air in the room to be under a certain amount of pressure, as compared with the outside air, which forces the vitiated air out of the room through natural or artificial openings. The "exhaust" system is just the reverse of this, the vitiated air is drawn out of the room or space by means of suction fans, and the fresh air enters through the openings, because the outside air is at a greater pressure than the air inside. This system can never be made to work with full efficiency, because the air is supplied by a negative, or indirect, process instead of by a positive, or direct, process; there is no control over either the quantity or the quality of the air supplied and it cannot be regulated, either as to temperature or humidity. In the plenum system, there is a positive control of both the volume of the air supply and of its temperature and humidity, and there is no probability of the air in the room becoming contaminated from outside because there is always an excess of air pressure inside. However, there is this defect in the plenum system, there is no way to regulate the rate of discharge of the heated air except by forcing in more or less fresh air, and even then there is no way to prevent the fresh air from escaping as well as the heated air. To insure positive displacement of the heated air as fast as it is formed, it is necessary to force in the fresh air at considerable pressure, and this will cause objectionable air currents at and around the openings of the air ducts.

There is only one system, therefore, by which the air in a textile mill can be maintained at the proper conditions of temperature and humidity, and that is a system that combines both supply and exhaust ventilation, a system by which the heated air can be removed as fast as it is formed and the supply of fresh air can be regulated both as to its volume and condition, so that it will continuously replace the vitiated air by an equal amount of air of suitable temperature and degree of humidity. The supply system alone should not be made to do all the work, because, if it is so forced, much more power will be required to operate the fans and strong air currents will result, whereas, if the heated air be removed by another set of fans, the fresh air will distribute itself naturally and less pressure will be required. This method will be referred to hereafter as the "combination system."

This combination system of ventilation and humidification is absolutely certain in its action and effects, if it be properly designed to meet the requirements of the mill and is erected in accordance with correct mechanical principles. With it, the air in the mill may be kept at a fixed and constant temperature and degree of humidity, within narrow limits of variation. There is no waste of power, time or labor in trying to keep a body of air that is continuously being heated and reheated supplied with the moisture needed to keep it at the required relative humidity—in other words, trying to do an impossibility—the problem of conditioning the air is solved in the simple way of removing the heated and dry air bodily, as fast as it is heated, and supplying fresh air of the proper temperature and humidity in its place. Neither is it necessary, with the combination system, to saturate the air supplied with an excess of moisture, to allow for its being heated after entering the room, as must be done with the plenum system used alone, because with it there is no way for the heated air to get out of the room except by diffusion, and the incoming air will soon be heated and will then need more moisture to preserve its relative humidity.

The air in the mill is conditioned actually and positively, at whatever degree of temperature and humidity is desired, by the combination system—the air supply can be cooled in summer and heated in winter, can be dried or more moisture be added, just as may be needed, and with proper regulation, the incoming fresh air need never mix with the hot air in the upper part of the room. Thus, the machines will always work in the atmosphere best suited to them and their heat will be taken care of effectually.

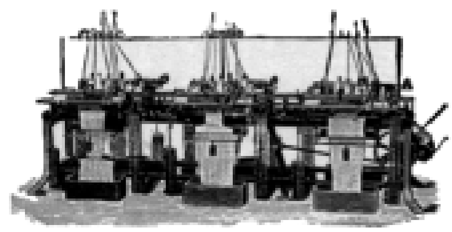
The problems of maintaining a suitable degree of relative humidity in the mill are much simplified by the employment of this combination system of ventilation, because the air can be kept at a comparatively regular temperature with only small variations in winter and summer; *i. e.*, the air can be heated in winter and cooled in summer by appropriate means. Therefore, if the air be kept at about the same temperature, the same amount of moisture added to it will keep it at the same degree of relative humidity. In practice, however, the air must be brought to within the allowable range of temperature before attempt is made to humidify it. The success of this system of humidification depends largely upon the effectiveness of the exhaust fan in removing the hot air from the room as fast as it becomes heated by the machinery, otherwise it will be difficult to prevent the air supply from being itself heated, and thus lowered in relative humidity, by the downward diffusion of the hot air in the upper part of the room.

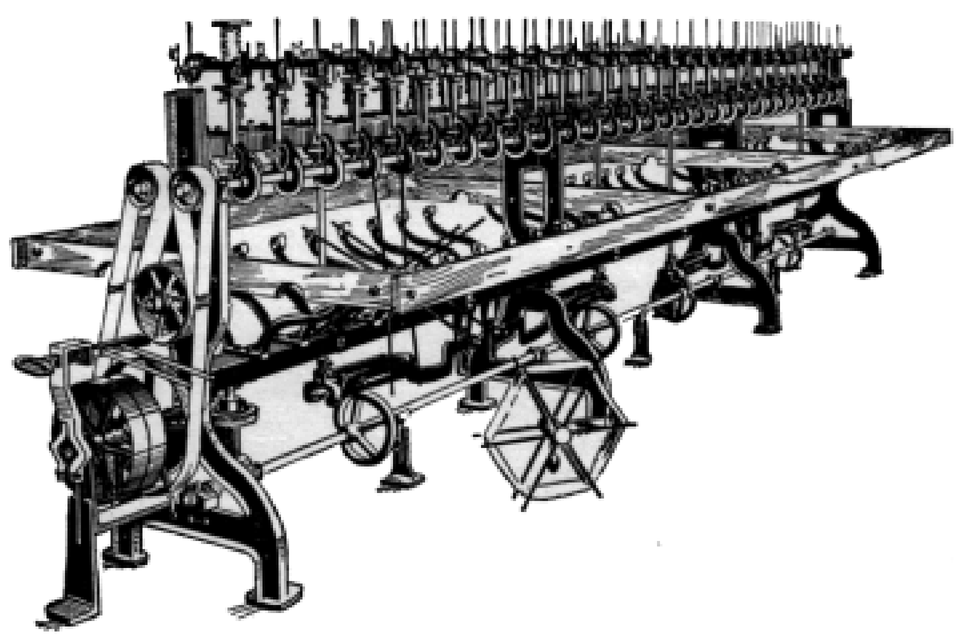
In operating the system referred to, any practical method of heating or cooling the air can be used, similarly, any practical method of humidifying the air supply may be employed, the only requirement is that they should work economically and efficiently. A discussion of these different methods or devices more properly belongs to the engineering of ventilation, for which there is not the space available in this article. However, it is expected that in an early issue of this JOURNAL the subject of ventilation from an engineering point of view will be taken up and its application to the textile mill discussed. From the data given, it will be possible to compare some of the humidifying devices in use in regard to their efficiency and value for use in the mill.

(To be continued)

LIST OF ADVERTISERS

BUYERS' INDEX





BUYERS' INDEX—Continued

ITEMS OF INTEREST

Extensive Use of Knitted Cloth in Manufacture of Gloves.

Consul Thomas H. Norton reports that knitted cloth is manufactured on a large scale in Chemnitz and the adjacent region from both silk and mercerized cotton yarn, the methods being as follows:

Special forms of chain frames are used for the purpose. Frames of German make produce goods up to 75 inches in length; those of English makes attain 120 inches. These knitted fabrics are made in a great variety of grades and colors and are used extensively in glove manufacture. Apart from the direct use of the material for gloves, there is a large demand for the finer silk products as a lining for the heavier varieties of gloves. When used as a lining for kid gloves the tissue is pasted into place. In the case of woolen and cotton gloves it is attached by sewing.

Less extensive is the use of these knitted cloths for underwear, and for this purpose the mercerized product is chiefly employed. The bulk of the knitted cloth made in Saxony is used by the manufacturers themselves as described, or is sold to near-by glove and underwear factories. Very little is exported. Practically none goes to the United States. France is the best customer among European countries. At present it is exceedingly difficult for foreign buyers to secure knitted cloth at any price. The entire output is contracted for months ahead to meet the needs of Saxon glove makers, who are struggling to meet the demands from every quarter of the globe made upon their productive capacity. [Samples of both silk and mercerized knit goods forwarded by the consul may be inspected at the Bureau of Manufactures.]

The World's Visible Cotton.

Secretary Hester of New Orleans estimates the world's total visible supply of raw cotton to be 2,788,827, against 2,640,047 last year. Of this the total, American cotton is 2,000,951, against 1,892,047 last year. Of all other kinds, including Egypt, Brazil, India, etc., 787,876, against 748,000 last year.

Of the world's visible supply of cotton there is now afloat and held in Great Britain and Continental Europe 1,528,000, against 1,172,000 last year; in Egypt 81,000, against 88,000 last year; in India 340,000 against 416,000 last year, and in the United States 840,000, against 964,000 last year.

Lyon's Silk Export.

The principal purchasers of Lyon silk last year were: The United States, $11,764,122 (against $8,162,600 in 1905, and $12,052,000 in 1904); the United Kingdom, $26,278,880; Germany, $3,688,037; Switzerland, $1,178,000; Belgium, $1,687,206; Turkey, $1,314,137; Italy, $792,844; Austria, $711,591. Postal parcels are not included in these figures.

Argentine Wool Exports.

The export of wool from the Argentine Republic for the present season has closed. Shipments amounted to 349,283 bales up to May 17, which is less than last year by 30,764 bales. The greatest falling off was in shipments to the United States, 19,381 bales being sent, compared to 29,093 for last season, while England took 40,247 bales, or 6,363 more bales than last year.

MILL NEWS

Middle States

Philadelphia. Sauer & Hahn have been commissioned to prepare plans for the erection of a $100,000 cotton spinning and hosiery mill for the Standard Hosiery Company. The plant will include a five-story spinning mill, an engine and boiler house, a picker house, a dye and bleach house and a reinforced concrete reservoir.

The buildings will be of reinforced concrete and slow-burning construction, with walls of brick. The work will also include the erection of a five-story addition to the present hosiery mill.

Philadelphia. The Robert Meyer Co., 3839 to 3961 N. 5th St., Gustave Svelle, supt., manufacturers of improved split sole cotton hosiery (Robert Meyer's Patent, No. 759,184) and who also are dyers of fast black and colors on hosiery, and bleachers and finishers of hosiery for the trade, have doubled their capacity; having enlarged, both, the knitting and finishing departments. This company also operates the Franklinville Dyeing Works, Ltd., and the German-American Hosiery Mills, of Kensington, and in which plants they are also installing new machinery.

Philadelphia. T. Brophy's Sons' "Kensington Dye Works," Jasper St. above Clearfield St., Dyers of all kinds of yarn, had a serious fire October 16. The plant is a big one, employing fifty men and boys, and extending about 150 feet on both Jasper and Clearfield Streets. It is composed of one, two and three-story buildings. It was in the drying room, located in a single-story structure, that the flames were discovered, and they found plenty of inflammable material to feed on. The building was practically gutted and this in spite of the fact that the fire had started the automatic sprinklers.

Philadelphia. George Cramer has been appointed receiver for J. H. Sprowl Company, hosiery manufacturers, Wayne avenue, near Berkley street, Germantown. The embarrassment is unimportant.

Philadelphia. The Kensington Mills, York and Jasper streets, 126x150 and 215 x 120 feet respectively, were sold by Thomas Bromley, Jr., to J. Harper Dripps, for $4,000, subject to a mortgage of $106,000, but have been resold by the latter to George Bauer at $7,220, with the same mortgage.

Frankford, Pa. Fire of unknown origin almost completely destroyed the large building occupied by the Alba Rug Mills Company and other industries at Oxford and Mead streets. So rapidly did the flames spread that within fifteen minutes after it was discovered the entire building was practically doomed. The building was erected at the close of the Civil War for the Van Kirk Manufacturing Company, and has been used for various purposes ever since. The loss is estimated at $75,000, partly covered by insurance.

Boiling Springs, Pa. A new knitting plant for the manufacture of men's half hose has been installed here by Frank T. McAlroy, formerly of Steelton. The mill started September 23d with five girls and has since been increased to twenty-two. About ten more girls are needed to run all the machines. Forty-two knitters, ten ribbers and five loopers constitute the working plant. When running full, about 300 dozen pairs of hose per day will be the production of the mill.

Wilkesbarre, Pa. The Sterling Silk Mill, at Upper Pittston, which has been in operation the past few weeks with a much reduced force due to a majority of the employees being on a strike, has shut down. It is stated that work will not be resumed for some time.

Allentown, Pa. Julius Suter, of Brooklyn, N. Y., is the superintendent of the new silk mill in South Allentown, which has just begun work.

Allentown, Pa. The Stuyvesant Silk Company, of Paterson, N. J., has leased the former Fisher & Harrington factory in South Allentown. The product will be goods manufactured from the raw silk to the finished fabric, with the exception of the dyeing, and give employment to about 50 hands. The machinery is installed and the plant has begun operations. John Schwartz, Jr., of Allentown, is president, I. Sapperstein is the vice-president, Chas. Sapperstein, secretary, and Frederick W. Heinrich, of New York city, the treasurer.

Elverson, Pa. The Hawk Knitting Company has begun the manufacture of stockings. About 40 hands will find employment.

Reading, Pa. The Pennsylvania Knitting Mills, a Heinze company affiliation, against whom a petition in bankruptcy was filed recently, have had receivers appointed by Judge McPherson in the United States District Court. The receivers are Jacob Bauer and George W. Chapin, both of Philadelphia. The liabilities are placed at about $600,000 and the assets at $210,000.

The receivers were granted leave by the court to operate the mills for a period of three weeks and at the end of that time to report to the court whether a continuance of the business would be profitable. There are 325 persons employed at the plant.

Scranton, Pa. The Renard Silk Company will hold a meeting of its stockholders in this city on November 25 to take action on a proposed increase of the capital stock from $75,000 to $150-000, in order to be able to engage more extensively in the silk business.

Bangor, Me. An important session of Maine woolen manufacturers was held here, and the Maine Woolen Manufacturing Association formed, for mutual protection in business as well as the safe-guarding of their interests in national and State legislation.

New York. The Middlesex Company of Lowell, manufacturers of woolen goods, is to be represented in New York later on by H. & W. H. Lewis, 76 Leonard Street. S. F. Lefferts will be in charge of this account.

New York. A new hosiery and underwear jobbing firm in this city, is that of the Republic Knitting Company, 57 Leonard St.

New York. The Hartley Silk Mfg. Co., of New York, will erect a silk mill at Benton, Pa., at a cost of $30,000. The equipment, it is stated, will consist of 100 looms, and give employment to 125 hands.

New York. Adolph Werthman, dry goods jobber, now at 295 Church street, will remove February 1908, to the S. E. Cor. of Church and Walker Sts.

New York. Trenor L. Park, a member of the well known firm of Catlin & Co. since 1894, died at the New York Hospital. He had been ill since Labor Day.

Buffalo, N. Y. Fire in the Schoellkopt, Hartford & Hanna Company dye house caused $2,000 damage to the building.

New York. William H. DeForest, secretary and treasurer of the Summit Silk Manufacturing Company, of Summit, N. J.; the Palisades Silk Company, of Weehawken; the Upland Silk Company, Paterson; and G. W. Graham & Co. (throwsters) of Paterson; died unexpectedly at his home. He was at the offices of the companies, at 482 Broome Street, New York, in the afternoon before his death, apparently in his usual health. Mr. DeForest was one of the best known men in the trade, and was the son of one of the American pioneers of the silk industry. Personally, Mr. DeForest was very highly regarded in the silk district of New York and he was recognized as one of the influential factors of the industry in this country.

New York. George Andrade, well known in the silk trade and recently with Scheffer, Schramm & Vogel, died suddenly.

Little Falls, N. J. The Paterson Dye Works company has been registered with a capital stock of $10,000. The incorporators are Frank Dwyer, George McLean and Thomas F. McLean. The company is to dye and finish cotton, wool, silk, etc.

Jersey City, N. J. Certificate of incorporation of the American Silk Yarn Company has been filed. It has been formed to manufacture textile fabrics that will resemble silk, by an entirely new process.

Passaic, N. J. The Botany Worsted Mills will build another addition costing about $12,000 to its plant. It will be a one story addition to a three story brick mill 70 x 108 feet of the company's plant on Dayton avenue.

Wilmington, Del. The Susquehanna Knitting Co., was incorporated here with a capital stock of $1,500,000.

Wilmington, Del. The Susquehanna Knitting Co., has been incorporated with a capital stock of $1,500,000.

New England States

Lowell, Mass. Orlando Saunders, agent of the Middlesex Woolen Mills has resigned, in order to accept the position of manager of the Assabet plant of the American Woolen Company at Maynard. Mr. Louis Bume is the genial superintendent of the Middlesex.

Winooski, Vt. Night work in the carding and spinning departments of Mill No. 2, of the American Woolen Co.'s plant here, has been stopped for an indefinite time.

Clinton, R. I. The Victor Manufacturing Company plant is being changed to an all-worsted mill. The mill will spin all its own yarns.

Limerick, Me. The Limerick Water & Enterprise Company will construct next spring a new concrete dam, which will be twenty feet high. The dam will develop 300 horsepower, the cost being estimated at about $50,000. The worsted yarn business of the Limerick Mills, and of which Robert Halford is the manager, has grown of late to such an extent that the capacity of the mills has been doubled. The power from the new dam will give a hydro-electric plant that will furnish ample power all the year.

Woonsocket, R. I. F. P. Simmons, of Providence, has purchased and taken possession of the Reeves Spinning Company with plant on Pond street. This company manufactures linen yarn. Richard J. Reeves is retained as manager.

Woonsocket, R. I. The City Finance Committee, it is claimed will recommend to the City Council that the Lawton Spinning Company be granted the ten years' exemption from taxation that was petitioned for provided the company erect a yarn mill in the city within a year, the value of which will be $400,000.

The Lawton Company already has a $400,000 plant in Woonsocket.

Providence, R. I. The machinery and mechanical equipment of the historic Allen Print Works, Dryden lane, North End, were sold under the hammer. The highest price paid for any one article was $690 for a soaper, and the other prices ranged down to $1. The largest buyers were William J. Dunn, of Fall River, and the United States Finishing Company.

It will be interesting to note, that calico cloth was printed for the first time in America in the Allen Print Works, where also were developed processes of importance to manufacturers of calico cloth throughout the country. The works were established in 1830. The company ceased business a short time ago and the plant was thrown upon the market.

Providence, R. I. The new mill which the Colwell Worsted Company is erecting is about finished. Electricity will be the motive power.

Providence, R. I. The Weybosset Mills, of the American Woolen Co., are erecting a new office building 50 x 24 feet, 2 stories high.

Providence, R. I. The Stone Mill will resume operations about January 1. It will be operated by Albert H. and Fred L. Sayles. Fancy worsted goods will be the output.

Chicopee Falls, Mass. The Chicopee Manufacturing Company is installing fifty new spinning frames and a new generator. This addition will increase the output of the company about 40,000 to 50,000 pounds a week.

Riverpoint, R. I. The Warwick Lace Works have been incorporated, with Henry C. Dexter as president, and Henry T. White as secretary and treasurer.

The new structure will be 47 x 140 feet, two stories in height, and will be of brick and ordinary mill construction.

The works are to have a capacity of 11 lace looms, although it is intended to install but six of the machines at the beginning.

The looms, which have to be imported from the centre of the lace industry at Nottingham, England, will weigh 25 tons each, and will have a capacity of 12,000 ends each. The other machinery, used for the subsidiary processes of lace manufacture, will be of American make. The product of the mill will be edgings, insertions, and narrow laces of all kinds.

The plant will cost about $100,000 and it is expected to have it in operation not later than next spring, and when running will give employment to between 70 and 80 operatives.

Fall River, Mass. George A. Chace, treasurer of the Bourne Mills, Fall River, died after a short illness. Mr. Chace was an able manufacturer and was the first Fall River agent to advise the complete equipment of his weaving department with automatic looms.

Worcester, Mass. The Crompton & Knowles Loom Works are to double the capacity of their plant.

Dracut, Mass. The carding and spinning department of the Merrimack Woolen Mills are again running on night work, in order to be able to keep up with the demands for their product.

Montville, Conn. The mill of the Monarch Woolen Company, successor to Arnold, Gilbert & Hawkins, has been closed indefinitely, it is claimed on account of their various set backs. An offer of 25 per cent. has been made to the unsecured creditors, conditioned on its being accepted within ten days by all. The capital stock of this concern is $80,000, of which, it is claimed, about $50,000 was paid in. The concern manufactured piece dyes, thibets and had four sets of cards, and 20 looms. Walter G. Hartford, the treasurer of the concern, was at the same time its manager.

Fall River, Mass. The Shove Mill, after having been closed for a few weeks on account of a fire, has resumed operation. The mill has been re-painted, besides other improvements made during the enforced idleness of the plant.

North Adams, Mass. An addition of a new weave shed has been made to the Waterhouse & Howard plant of this city. It is equipped with 90 looms.

Chelsea, Mass. A fire practically destroyed the rope-walk at the old works of the Chelsea Cordage Co. The damage to the structure is estimated at $15,000, and to its contents, mostly machinery, at $5,000.

Lawrence, Mass. George S. Silsbee, for many years treasurer of the Pacific mills, of this city, died at his summer home in West Peabody, Mass., from injuries sustained while riding. Mr. Silsbee's horse slipped in a puddle of water and rolled on top of its rider.

Preston, Conn. The Preston Woolen Mill, destroyed by fire some time ago, will be completely rebuilt. Contract has been let for the erection of a 60 x 80-foot building of modern mill construction, and work is now in progress.

Moosup, Conn. The Cranska mill, which for fifteen years and more has been run night and day, has the past week by reason of the addition of more room and the placing of new machinery gone on to a day schedule exclusively.

Lowell, Mass. It is reported that it is the intention of the American Woolen Company to enlarge its plant by the erection of a fine white goods finishing plant on the land belonging to the company on Beachman street, below Parker avenue, at the Navy Yard, Dracut. It is expected that the plant will probably employ at least 100 hands.

Western States

Eaton Rapids, Mich. On account of the steadily increasing demand for their output, Honner Bros., the proprietors of the Eaton Rapids Woolen Mills, are soon to erect a new two-story building, 55 x 150 feet, for their new spinning department, adding at the same time a two-story brick addition, 55 x 75 feet, to their present plant.

Milwaukee, Wis. Contracts have been closed by the Allis-Chalmers Company for the installation of three steam turbines for the 10,000 horsepower plant of the Pacific Mills, at Lawrence, Mass.; one turbine of 2,200 horsepower for the American Thread Company's Watuppa Mills; one of 3,000 horsepower for the Tremont & Suffolk Mills at Lowell, Mass., and machines of 800 horsepower each, for the Jamestown Worsted Mills of Jamestown, N. Y., and the Cherry Cotton Mills of Florence, Ala.

Mishawaka, Ind. The Mishawaka Woolen Manufacturing Company, manufacturers of knit and felt boots and lumbermen's socks, has purchased additional water rights, and the 18,000 square feet of its present plant will be about doubled.

Chicago. The Holeproof Hosiery Co., of Milwaukee, has applied for an injunction to restrain the Washington Shirt Co., of this city, from manufacturing and selling the Washington socks.

Southern States

Natchez, Miss. The Natchez Cotton Mill No. 1, lately added 40 automatic looms to their plant, placing at the same time an additional order for 300 more. The latter are promised by the first of next year.

Bristol, Tenn., is to have a new knitting mill financed by Philadelphia capital.

Paducah, Ky. The Dixie Knitting Mills have assigned.

Yorkville, S. C. Electric power is to be used in the new Lockmore Cotton Mills, about 200 horsepower to be supplied by the Southern Power Company. Individual motors will be installed. The building, now under construction, will be 75 x 300 feet. The equipment of the mill, when finished, will be 6,500 spindles running on 40's to 50's. The president of the new concern is Thomas P. Moore, and its capital $100,000. It is expected to have the mill running during the beginning of next year.

Clearwater, S. C. The new buildings of the Seminole Manufacturing Company are completed. The machinery consisting of 20,000 spindles and 500 looms are nearly all put in place, and the steam and water plant is ready for use. The capital stock of the concern is $800,000 and the output will be fine drills and wide sheetings.

Shelby, N. C. Plans have been completed for the cloth mill of the Ella Manufacturing Company, and the construction of a one-story structure, 77 x 356 feet is under way. The equipment will consist of 5,000 spindles and 126 looms. The capital stock is $100,000.

Roanoke Rapids, N. C. An additional building is to be erected for the Rosemary Manufacturing Company. The equipment will consist of 10,000 spindles and about 300 looms. The present mill operates 12,000 spindles and 270 looms.

Fayetteville, N. C. It is reported that the Victory Mfg. Co. has decided to enlarge its plant, by the addition of another print mill during 1908, to its present mill and which is equipped with 12,500 spindles and 400 looms. Mr. W. S. McNeill is the manager of the mills.

Randleman, N. C. A new yarn mill costing $100,000, will be the next addition to this prosperous manufacturing locality. J. H. Mills will be the president and W. N. Elder the secretary and treasurer of the new concern.

Denton, N. C. The Denton Cotton Mills, with a capital stock of $100,000, have been incorporated. Site for the mill has been secured and a plant of 5,000 spindles will be established for the manufacture of cotton yarns. Steam will be the motive power.

Gastonia, N. C. The Dunn Mfg. Co. has been incorporated here by C. B. Armstrong, C. M. Dunn, W. T. Rankin, R. L. Swan and A. G. Meyers. It will be a 4,000 spindle mill, laid out so it can accommodate 1,000 spindles more when so required. Cotton yarn will be the product of the mill.

Taylorsville, N. C. Work is progressing rapidly in connection with the erection of the new cotton mill here. Dimensions of the various buildings of the new mill are: The main building 77 x 287 feet, the boiler and engine house 25 x 41 feet, and the cotton warehouse 50 x 1000 feet. The capacity of the mill will be 5,000 spindles, and the product hosiery yarns.

Davidson, N. C. The Linden Manufacturing Company is to install electric motors.

Newton, N. C. The management of the Ridge View cotton mills has decided to install electricity for motive power for their new mill. 2/30 to 2/40's yarn will be the product.

Burlington, N. C. The Whitehead Hosiery Mill has been incorporated. R. H. Whitehead, manager. The capital stock is $100,000. of which $10,000 has been paid in.

Douglasville, Ga. The new Lois Cotton Mill is expected to be running by the first of the year. The building is a brick structure, two stories high, 100 x 400 feet, and will contain 20,000 spindles and 500 looms. The cost of the mill is about $250,000; and the same will turn out print cloths.

Ashburn, Ga., is reported to be assured of a new cotton mill, to be erected at a cost of two hundred and fifty thousand dollars.

Augusta, Ga. Organization of a $200-000 cotton mill company at Junction City is proposed.

Zebulon, Ga. Operations have begun in the new hosiery mills here with twenty-five knitting machines, producing fine seamless hose. The mill building is 40 x 105 feet, with walls of concrete block. It is the intention of the management to have one hundred knitting machines in operation by the first of the year. The capital stock of the new concern is $100,000.

Burlington, N. C. The Sellars Hosiery Mills have been recently organized, with a capital stock of $15,000. Work on the erection of a 40 x 80 foot building has been begun. Fine gauge hosiery will be the output.

Radford, Va. The new knitting mill started here will employ about fifty women. It is expected to be in operation by the first of the month. Its capital stock is $25,000. The officers of the concern are W. R. Jordan, president; W. H. Galway, secretary and treasurer; J. M. Sonner, manager.

Sylacauga, Ala. The Sylacauga Mill has been incorporated with a capital of $85,000. Yarns and cloth are to be manufactured. It will be a 5,000 spindle mill.

New Orleans. In the captain's stateroom of the steamer Albanian, which is now on its way to England, is a bale of cotton known as the President's bale and named after President Roosevelt. Since he operated the machinery of one of the floating Mississippi River cotton compressors which made this bale, this huge bundle has had a remarkable trip.

It was decked with ribbons and traveled down the Mississippi in captains' staterooms, not being allowed to touch the wharves over which it has been transferred. Six negroes held it on their shoulders in New Orleans until it was ready for loading, which was done by putting it on a special tug and taken into mid stream for loading. It will be sold for charity by the Royal Exchange at Manchester, England, to which city it is consigned.

SPOOLING ONTO SIX-INCH WARPSPOOLER.

To meet the conditions of the various Yarns, necessitates the use of means, whereby production and quality of work can be obtained.

To produce satisfactory results, there must be provided appliances, to meet the requirements, that will give results.

To get general results or universal satisfaction from one factor, has been heretofore not so permanently expected as to-day: what has been used by us on the Drumspooler, has to a certain extent given results to-day.

We advise our improved Swift on the machine, with the pressure, that yarns in the fine grades, we are able to handle with ease.

Yarns that have any great amount of twist, have to be cared for with the revolving of the yarn with the swift.

Yarns are taken care of in all conditions, any grade from any form, or whatever it may be.

Various Kinds of Spoolers in Various Lengths, to any number of drums desired are built.

Whatever conditions are required, we will meet them, and guarantee, to give you best results.

Jacob K. Altemus.

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 $^{1}_{3}$ 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 $^{2}_{2}$ 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 $^{2}_{2}$ 4-harness twill (*e*), the common plain (A) and the 8-leaf satin (8) are used in the construction.

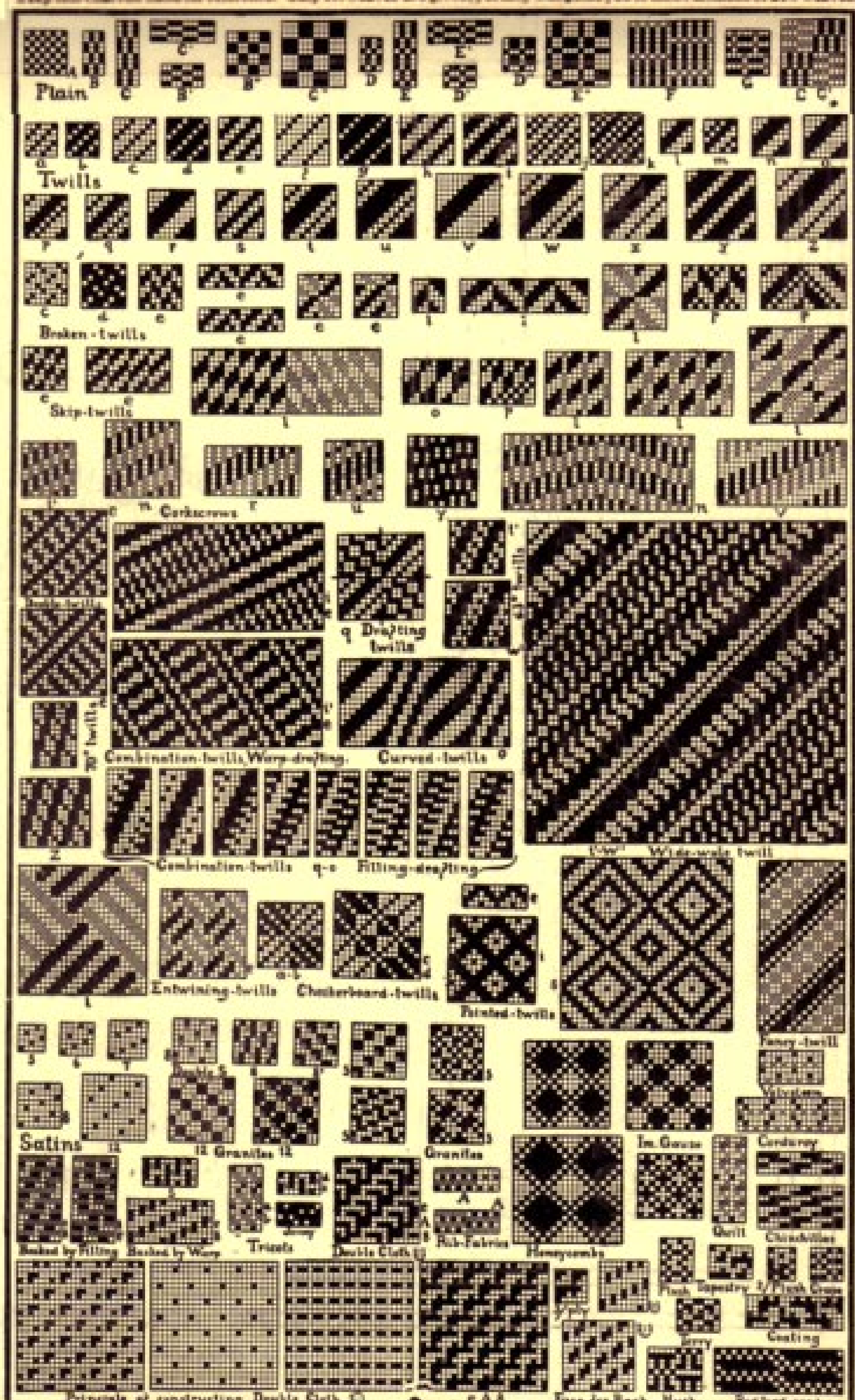
Example.—Rib fabric A, indicates that the plain weave forms the foundation.

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.

"TEXTILE DESIGNING SIMPLIFIED."

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



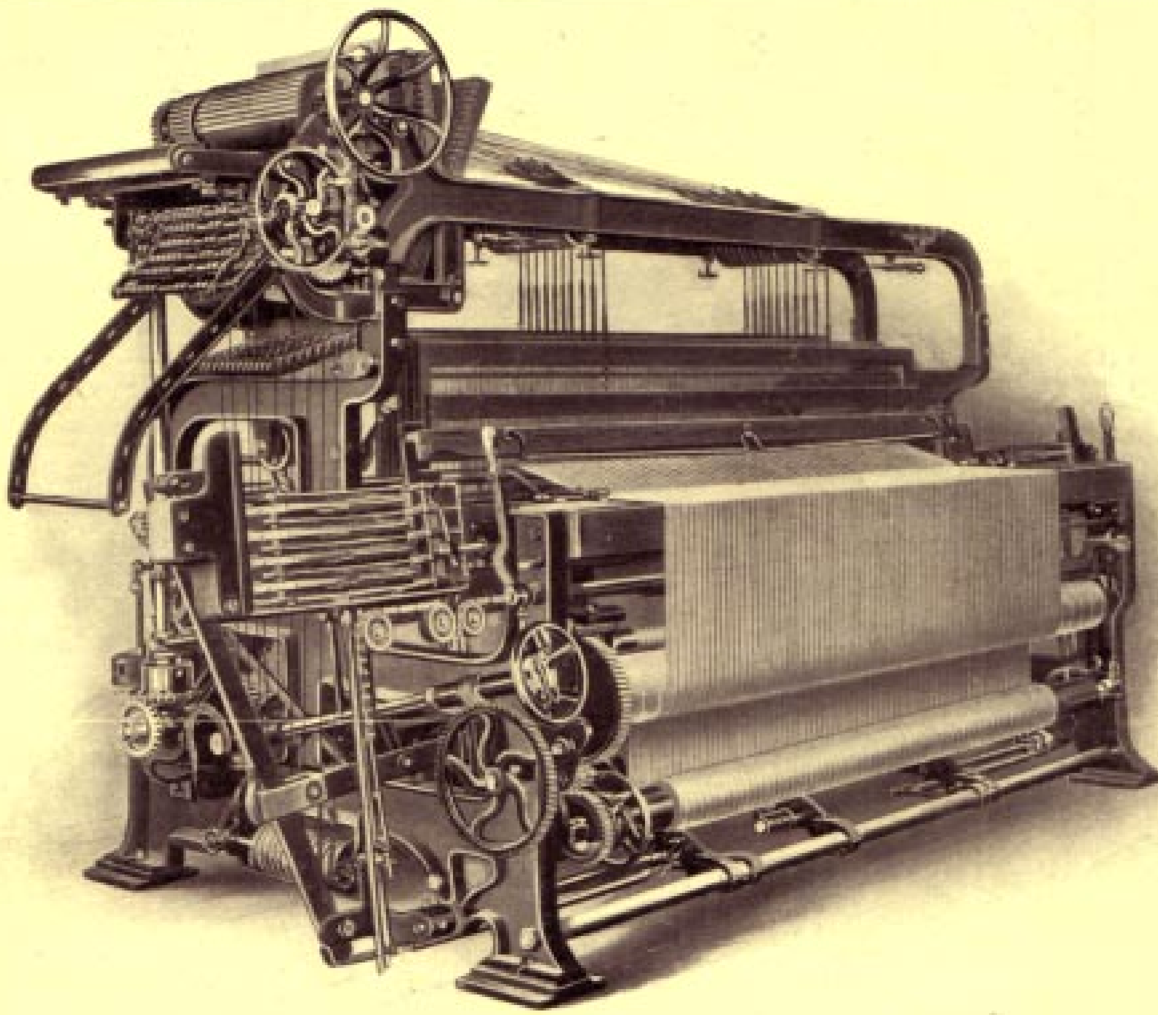
LOOMS

FOR WOOLENS, COTTON, SILKS

AND ALL SPECIAL FABRICS

DOBBIES, JACQUARDS, WOOL COMBS

PRINTING DRUMS, REPAIR PARTS and SUPPLIES



CROMPTON & KNOWLES LOOM WORKS

WORCESTER, MASS. PROVIDENCE, R.I. PHILADELPHIA, PA.

Southern Representatives—ALEXANDER & GARSED, Charlotte, N. C.

Foreign Representatives—HUTCHINSON, HOLLINGWORTH & CO., Ltd., Dobcross, England