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Posselt's Textile Journal

A Monthly Journal of the Textile Industries

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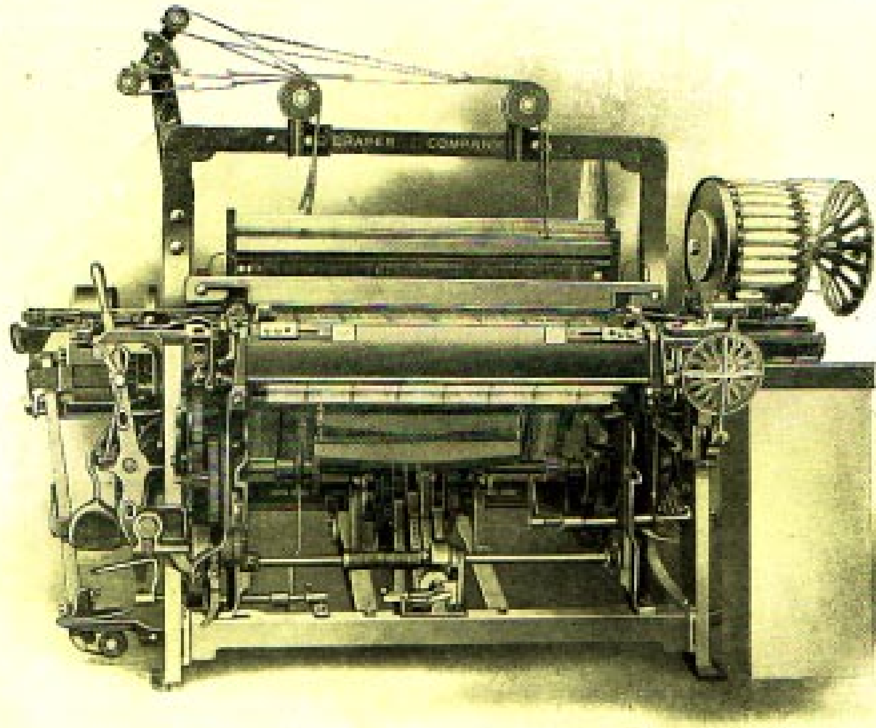

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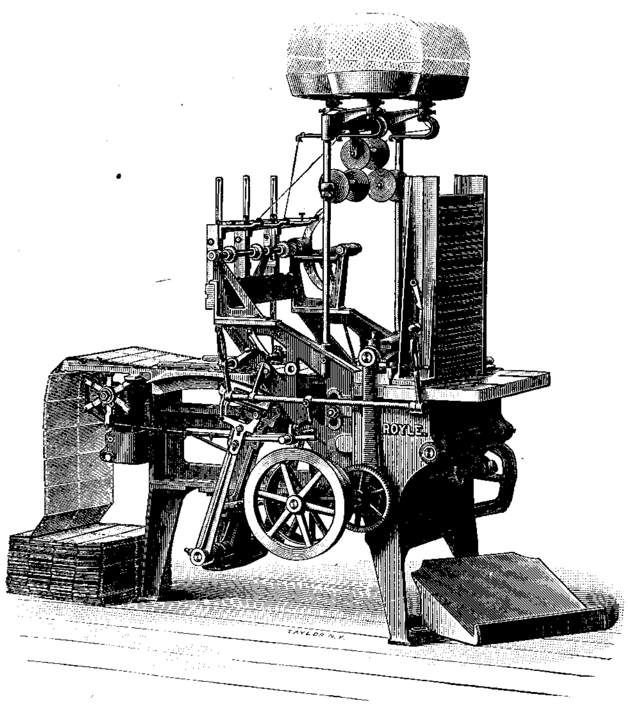

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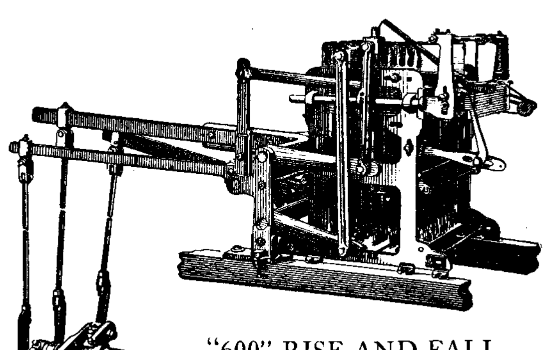

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Posselt's Textile Journal

Vol. I. October, 1907. No. I.

A STUDY IN THE DESIGNING OF COTTON, SILK, AND WORSTED, FIGURED DRESS GOODS.

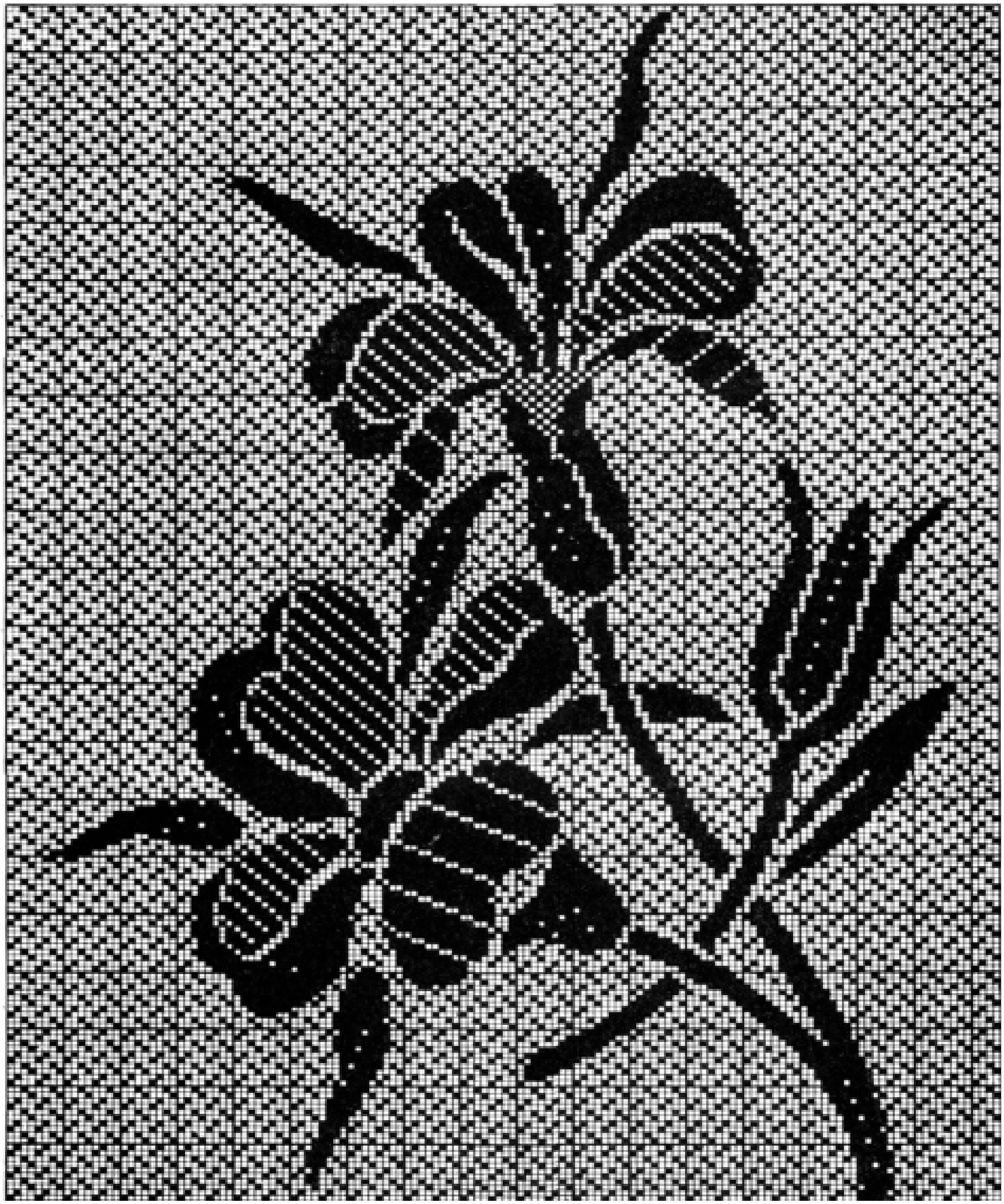

FIG. 1.

Dress goods considered from a technical point of view generally refer to what is known as single cloth structures, and which construction of figured, *i. e.*, Jacquard dress goods we will take up for our present subject, covering with details given, Cotton, Silk, Worsted, Mohair, and Union structures, in all their varieties, as any textile manufacturer may come in contact with. The only difference which will present itself will be a change in the nature of the subject, size of design, and texture of fabric structure, to suit the commercial demand; with its consequent change in size of sketch and working design on the point paper, as well as kind of point paper required to suit the fabric structure to be made.

By single cloth structures are understood fabrics requiring only one system of warp and one system of filling for their construction. Other constructions of Jacquard fabrics will be dealt with, one in each successive issue of the journal.

Texture. Previously to planning design on our point paper, the first thing we have to do, is to take the texture of the fabric to be made into consideration, whether it refers to an original idea or a duplicate.

For Example, let us consider fabric texture required to be 90 x 112, by which is meant a fabric having 90 warp threads and 112 picks per inch, in its finished state.

To ascertain kind of point paper to use. *Rule:*—Warp texture in finished fabric (90 in our example): Filling texture in finished fabric (112 in our example) :: Point paper to be squared for warp: point paper to be squared for filling.

We now have to find the ratio for the point paper to use, with reference to our example, more particularly the first term of said ratio, *i. e.*, the ruling of the point paper for the warp, since the same is subject to the rows of needles used in the Jacquard machine, in order to facilitate over-ruling of the design for the purpose of card stamping. The most frequently used arrangement of rows of needles of Jacquard machines used for this class of fabrics is 8, 12 and 16 rows, the first (8), being the one we will take into consideration with our example, for the reason that as will be seen later on, we will use a 400, *i. e.*, an 8 row deep Jacquard machine, for design illustrating this article, hence proportion previously given as a rule for ascertaining point paper reads thus:

90 : 112 :: **8** : x, and

$112 \times 8 = 896 \div 90 = 9.955$ or practically **10**,

hence 8×10 is the point paper to use.

A good plan when thus laying out calculations for the point paper to use, is to keep at the same time the repeat of the weave to be used in the design for ground work (provided the same, as is generally the case, repeats all over) under consideration, for the reason that the work of the designer will be greatly simplified, provided the ruling of the point paper covers one repeat, or a multiple of the repeat of said ground weave; or if this is not possible, see if one or two heavy squares do not call for one or more complete repeats of said ground weave. By this we mean that if, for example, the over-ruling of the point paper used—warp ways—is done in 8's, then 4, 8, 12, 16, 20, 24, etc., will be suitable repeats for ground weaves, since

2 repeats of a 4-harness weave = 1 square
1 repeat of a 8-harness weave = 1 square
2 repeats of a 12-harness weave = 3 squares
2 repeats of a 16-harness weave = 4 squares, etc.

In the same manner, provided the Jacquard machine to be used should be a 12 row Jacquard machine, *i. e.*, a 600, 900 or 1200 machine, then 4, 6, 12, 8, 9, 18, etc., would have been suitable repeats for ground weaves to use. In the same manner proceed, provided a "fine index," *i. e.*, a 16 row Jacquard machine is used.

Fabric sketch. This is the next item to be considered by us, the same referring either to an original design or a copy, and for which the Jacquard machine at our disposal, as well as the commercial demand of fashion and cost of cloth regulates size and character. Suppose (as mentioned previously) it is a 400 Jacquard machine we have at our disposal, tied up straight-through, using 50 rows @ 8 row deep of the machine, for fabric; the remaining 2 extra rows of the machine over the 400 (every Jacquard machine is built with two extra rows, and which may be used or not) being used for selvage, or one row for selvage, one row missed—hooks taken out, so no hitch or smash up in the loom during the weaving, caused by the idle hooks getting caught in the machine, is possible.

This in turn will give us

400 (needles of Jacquard machine used) ÷ 90 (warp texture, finished) = 4.45 inches as the width of one repeat in finished fabric.

It will be readily understood that in the loom, in connection with the reeding of the warp as well as the planning of the comberboard, a slightly lower warp texture has to be used, to compensate for the difference in texture of warp in reed to that in the finished fabric, technically known as the take-up of the fabric on the loom, the difference depending on the character of the fabric, *i. e.*, kind of material used, counts and twist of yarn, as well as weaves used for ground and figure. To explain the subject from a practical point, suppose our example refers to a low textured silk fabric, or a mercerized cotton warp with regular cotton yarn as filling, or the reverse selection, or the use of a cotton warp in connection with a waste silk or a worsted filling, or a worsted structure all around, etc., and when then, using a reed #42 @ 2 ends, will give us 4.76″ for the repeat of the design in the reed, as well as for tie-up of the harness in the comberboard. In connection with a worsted warp, it will be advisable, in place of a #42 reed, to use a #28 reed @ 3 ends, again it then may be found advisable to slightly lay fabric somewhat wider in comberboard and reed—say for example a #27 reed @ 3 ends.

We will now turn back to our finished fabric structure and design to be made for it, *i. e.,*

400 needles $\div$ 90 warp threads $= 4.45$ inches and which can be covered either by 1, 2, 3 (if dropping ends) 4, 5 or more repeats of a design, and when

using 1 repeat $=$ 400 warp threads at our disposal,
" 2 repeats $=$ 200 warp threads at our disposal,
" 4 repeats $=$ 100 warp threads at our disposal,
" 5 repeats $=$ 80 warp threads at our disposal.

For our example we selected one repeat, and in turn produced the fabric sketch herewith shown, one repeat 4.45 inches wide—actual size of design in fabric—being given.

To ascertain repeat of design on point paper, filling ways, from sketch and texture given. *Rule:* Multiply length of fabric sketch with picks per inch in finished fabric, being careful to remember that product obtained must be evenly divisible by the repeat of the ground weave, which in our example will be the 4-harness broken twill.

Length of repeat of finished fabric sketch Fig. 1, is $5\frac{3}{4}$ inches, which if multiplied by 112 (picks per inch in finished fabric) equals 644 picks for the repeat of the design on point paper; 644 being evenly divisible by 4—the repeat of the ground weave.

Point paper design. We thus have to use for the complete design on the point paper, in connection with using an 8×10 point paper ·

$400 \div 8 = 50$ heavy squares for warp, and

$644 \div 10 = 64$ heavy squares $+$ 4 lines, for filling.

To illustrate the execution of the complete Jacquard design on point paper to the reader—as will be readily understood, would require such an immense reduction of said design, that the same would become useless, considered from a practical as well as educational point of view; for which reason, we will only show a portion of it, the same, however, to cover one of the main figures used in the design, complete, and consequently fully explaining the procedure.

For Example: Square *a, b, c, d,* on fabric sketch is the portion of the design we now want to show up, practically executed on point paper.

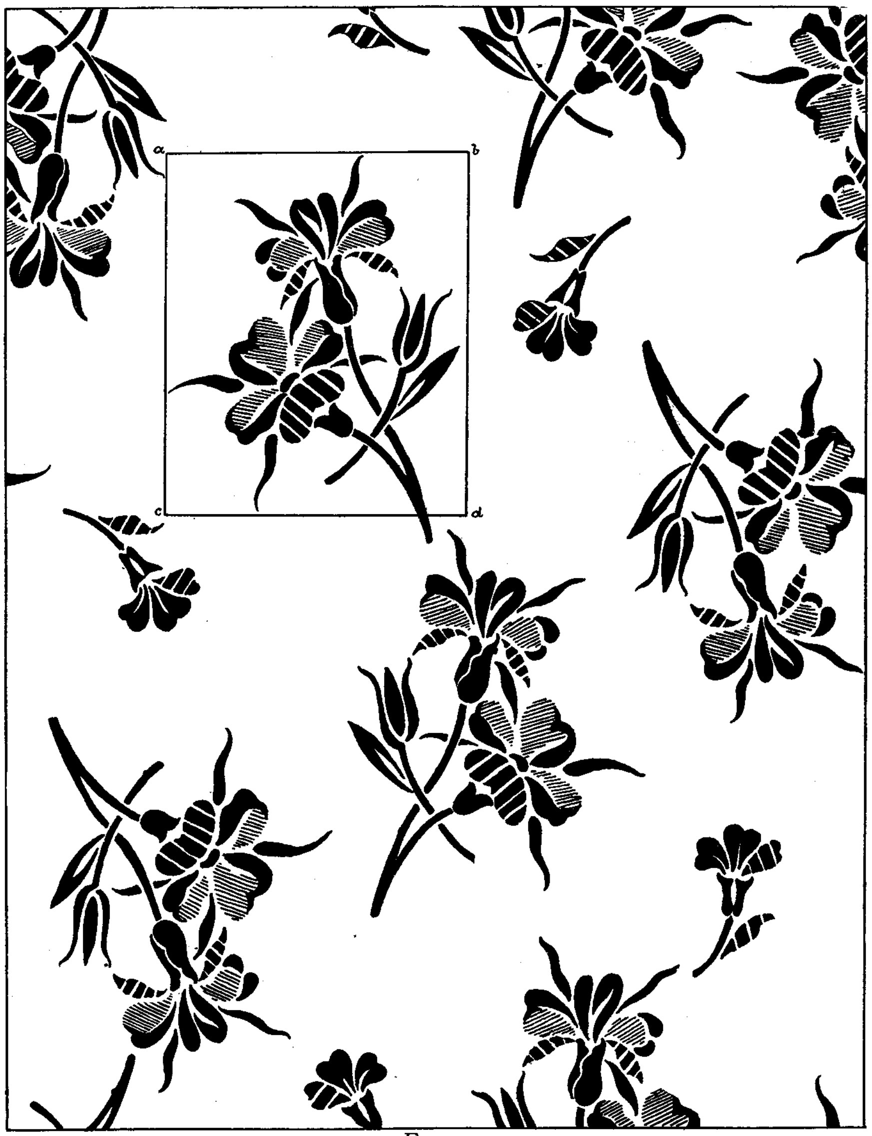

FIG. 2.

Warp: a to b or what is the same c to $d = 1\frac{5}{9}$ inches, and $1\frac{5}{9} \times 90 = 140$ warp threads of the design $= (140 \div 8 =)$ $17\frac{1}{2}$ squares, required for this portion of design, warp ways, to be shown on point paper.

Filling: a to c or what is the same b to $d = 1\frac{6}{7}$ inches, and $1\frac{6}{7} \times 112 = 208$ picks of the design $=$ $(208 \div 10 =)$ 20 squares $+ 8$ lines, required for this portion of design, filling ways, to be shown on point paper.

The point paper design, based on explanations thus given (*i. e.,* rectangle *a - b - c - d* - or portion of fabric sketch) is shown on the preceding page, using for its execution 140 warp threads × 208 picks, as compared to the complete design, which would call for 400 warp threads × 644 picks.

This point paper design is executed, as they always are: *"empty squares"* for warp up, and *"painted squares"* for filling on face.

The ground of the design is formed by the warp for face, with the *"3 up 1 down"* 4-harness broken twill for its weave, and the figure of the design is produced by the filling for face, floating said filling irrespective of a regular weave, *i. e.,* stitching the filling at such places where required, on account of detail effects of sketch.

In the same manner as thus explaining the construction, sketch and working design, on a low texture (90 × 112), we proceed with higher textures for cotton or silk fabrics, remembering that the higher the texture of the fabric you design for, the easier it will be found to bring up any details of the sketch, for the fact that then more warp and filling ends, in proportion, are at your disposal for thus working out any detail work of a figure or part of the design.

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.

The requirements exacted by the market with reference to the quality of a fabric, make the testing of fibres and the yarns spun from it a necessity to any textile manufacturer or his superintendent; the same as the commission house or the buyer, in order to be successful, must be acquainted with the various test of fabrics, as to quality, construction, strength, color, etc., *i. e.,* must know whether a fabric under consideration is up to its standard or not. Although these tests of fabrics have always played a most important item in connection with goods manufactured for government purposes, city departments, corporations, railway companies, etc.; textile fabrics nowadays, made for most any purpose, have to stand the test as to their being up to standard, all around; any deficiency in one way or the other giving the buyer a chance for claims and what always means not only a financial loss to the manufacturer, but also a loss in reputation to the mill in the market. For this reason, this article will be of interest, not only to the textile manufacturer and the yarn spinner, but also to the commission merchant, to clothing inspectors in all their different branches, the salesman, as well as the textile student in general.

For the textile manufacturer, *i. e.,* his superintendent, and who has to stand the brunt of all possible claims and damage, his ability to be able to submit textile fibres, yarns or fabrics, as the case may be, to a detailed examination at any period of the various processes through which they pass, from the raw state to the finished fabric, becomes every day more and more a necessity for him.

Shoddy, Mungo, Extract, Hair, Flocks, Cotton, Waste, etc., have become now what we might consider staple by-products in the manufacture of the bulk of our wool goods; cotton yarn finds extensive use in connection with worsted goods; the loading of silk, two, three or more times its original weight in many instances—although to the detriment of the trade in general—has become a necessity to the silk manufacturer, on account of keen competition; the extra heavy sizing or weighting of certain cotton goods being another necessity for manufacturers to bring goods up in weight, by means of adding substances to the fabric never belonging there, if considered in the interest of the consumer of the respective fabric.

Yarn Testing. Yarn is the final product of the process of spinning, *i. e.,* the transforming of textile fibres into a single thread by twist, the most essential factor in spinning, since without twist there would be neither yarn, nor textile mills. According to the nature of the raw material used, we come in contact with woolen, worsted, silk, cotton, linen, jute, etc., yarns; union yarns being the mixture of two different raw materials into one thread; for example, we speak of a merino woolen yarn, which actually may be a mixture of 50% wool and 50% cotton, or more or less per cent of either. Under silk yarns we generally comprise those produced by means of carding, drawing and spinning, *i. e.,* spun or waste silk yarns, whereas the true silk yarn is simply known by the word silk. Yarns, according to the use they are put to, are either known as warp, filling or hosiery, etc., yarns, and according to their method of preparation are known either, as in the gray or bleached, dyed or undyed, printed, sized or weighted yarn, coming into the market either in the shape of hanks, on cops or bobbins, in chains, on dresser spools, etc., as the case may require. Yarn comes in the market, *i. e.*, is used by the textile manufacturer either in its single state, or twisted. By the latter is meant that two or more threads generally spun with a slight twist first are afterwards united into one thread by means of twisting, either to produce a stronger or a more perfect yarn, or, as the case may also require, produce a fancy yarn required for the ornamentation of special fabrics, etc. We will also meet with the union of two or three single threads, only slightly twisted, and which in this instance are known to the manufacturer as "doubled" yarns, in order to distinguish them from the "twisted" yarns previously referred to.

PERFECT YARN MUST POSSESS THE FOLLOWING QUALITIES: it must be even throughout its entire length, *i. e.*, free from knots, uneven or weak places, possess the proper amount of twist and breaking strength. The surface of the yarn is regulated by the use it is put to, whether the fabric for which it is to be used requires a rough or smooth finish. This will explain why, for example, the manufacturer of woolen yarns differs from that of worsteds; in the first instance, a rough velvety thread being desired, whereas in the latter instance, a smooth thread is the object aimed at, and when in order to increase this smoothness in the yarn, singeing of the latter is in many instances a final effort to obtain this result.

WITH REFERENCE TO TESTING YARNS by the textile manufacturers, the following points will come under his consideration: (*a*) An analysis as to the nature of the raw material, either by means of the microscope or by chemical tests. (*b*) Ascertaining the actual count of the yarn. In most instances, weighing a certain number of yards of yarn and testing them on a fine pair of scales is the procedure employed, whereas other manufacturers keep a sample card, containing all the various counts of the yarns they come in contact with, for handy reference in their office, and when then by means of examination of the yarn submitted, they then readily ascertain the count of a yarn submitted, at once to their satisfaction; this however, requires considerable experience on the part of the person. In keeping these sample cards, it is a good plan, provided the different counts of yarns are of a light color or white, to mount them on a black card for background, whereas if the sample yarns to go by and of which we know the counts are of a dark color, mount them on a white card, in order that the size of the threads may show up to the best of advantage. It will also be a good plan to have two sets of cards made for handy use, one light colors on a black background, and one containing dark colors on a white background, and when then, no matter whether light or dark yarn is submitted, we then can use the sample card most suitable for the purpose. (*c*) Test the amount of twist in the yarn as well as its breaking strength. In connection with silk, the original twist given to the cocoon fibre when reeling, as well as the secondary twist given in the process of throwing, has to be examined. (*d*) Examine the general appearance of the yarn if the same is up to the requirements; whether it refers to a smooth worsted thread or to a velvety woolen yarn, whether yarn in question has been singed or sized or if it refers to a wet or a dry spun yarn. (*e*) In connection with woolen yarns, the percentage of grease, oil or dirt, in the yarn has to be ascertained, since in connection with coarse, cheap, low classes of yarns of that kind, this may refer to a loss of 25% or more, 10% to 15% being common cases and considered a small loss to woolen yarns. In connection with worsted yarns, they also have to be tested as to their loss, although in this instance, the amount will be considerably less than with woolen yarn. Silk has to be tested with reference to the degree of its moisture, a test which more particularly, until now, referred only to silk, although it is beginning to be taken somewhat into consideration in connection with woolen and worsted yarns, the careful and consequently successful woolen or worsted manufacturer thus considering this point in his financial interest.

Textile fibres of commerce belong to two distinct varieties: (*a*) animal fibres, (*b*) vegetable fibres. Of these, the first variety comprises (1) wool, hair and fur, each having formed the covering of an animal, and (2) silk, as spun by the silk worm at its entry into the chrysalis stage. With reference to vegetable fibres, the first place (1) belongs to cotton, (2) flax, jute, ramie, etc. and (3) artificial silk as produced by treating cotton or other cellulose material chemically.

When required to determine the nature of the raw material used in the construction of a yarn or fabric, the naked eye being insufficient, then the compound microscope is perhaps the best and easiest test for distinguishing the various fibres, provided the party making these tests is fully acquainted with their appearance and characteristic markings. With reference to the microscope itself, yarns or fibres can be examined under a lens either by bringing them within or beyond focal length; in the first instance obtaining an enlarged picture on the side next the object, whereas in the other case, the enlarged picture is formed in an inverted position on the opposite side of the lens. In order to obtain high magnifying power, these two conditions are combined in THE COMPOUND MICROSCOPE, which consists in its main parts of a tube some six or seven inches in length, closed at the upper end by a large glass lens (of greater focal length—placed nearest the eye, hence termed "eye piece") and at the lower end by a smaller glass lens (of smaller focal length—placed nearest the fibres to be examined, hence "object piece"), both pieces being capable of vertical movement. This tube is blackened on the inside to exclude extraneous light. The total magnifying power of a microscope is thus the sum of the powers of the "object" and the "eye piece." The tube carrying the "eye" and the "object" piece, for adjustment in the regular microscope, is raised or lowered by a rack and pinion motion, while in connection with a high class microscope, an extra, *i. e.*, fine adjustment, is afterwards made by the micrometer screw, as provided to such microscopes. On the stand of the microscope we find fixed an arrangement for supporting the stage (pierced with a small circular aperture for the passage of the reflected light), as well as a small circular concave reflector, which is movable in any direction. The most important quality of a good microscope is, that its lenses produce a well defined, clear picture, distinctly showing every detail of structure in the object under examination.

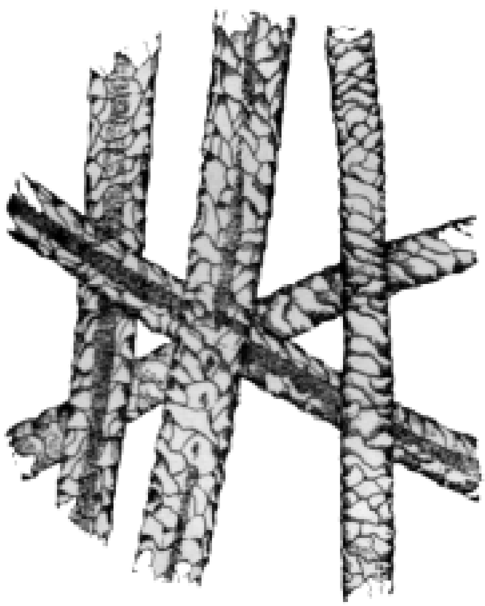

FIG. 1.

The best source of illumination for carrying on investigation by means of the microscope is diffused daylight, with a sky evenly covered with a white veil of clouds. In connection with artificial light, a glass bulb, filled with a dark blue solution of ammoniacal copper oxide, interposed between the source of light and the condenser, will be found of advantage.

Yarns to be examined under the microscope, whether in their pure state or liberated from a woven or knitted, etc. fabric, after proper removal of all dirt, so that the passage of the light will be unrestricted, are then untwisted by hand, in order to transfer the yarn back into a mass of loose fibres; selecting then a proper amount of these fibres for testing. Immersing the fibres thus to be tested in boiling water, or better still, in glycerine or Canada balsam, will increase their transparency. The fibres thus prepared are then separately laid, side by side, on a glass slide and covered with a thin cover glass and are then ready for testing.

Wool is the hairy covering of the sheep; it is softer than the actual hair, also more flexible and elastic, and besides having a wavy character, it also differs in certain details of surface structure. Although wool and hair are found in the fleece of the sheep, yet wool predominates in all cases, hair in the properly bred sheep being practically absent. The covering of certain other animals, such as the Cashmere goat, the Angora goat, the Llama, etc., are also classed as wool. Viewed under the microscope, wool appears as a solid rod-shaped substance, the surface of which presents a peculiar scaly appearance, being covered externally with small plates or scales, the edges of which either protrude from the body of the fibre, or are only surface markings. The cylindrical shape is best observed where two fibres cross one another. A central core of medullary matter, running longitudinally in the fibre is sometimes visible, particularly in the coarser types.

Fig. 1 shows five wool fibres as seen by means of the microscope, and of which three of the fibres show the central core of medullary matter, previously referred to, which however is missing in the other two; all five fibres being specimens of coarse long staple wool fibres In the better classes of wool, this medullary portion is entirely absent, its presence or absence depending upon the breed, health and care of the sheep and also the part of the body upon which the wool is grown. Wool fibres which contain this medullary portion are less suitable for manufacturing purposes than such where this portion is absent. Besides their scaly surface structure, wool fibres are characterised by their wavy structure, technically known as the "wave of the crimp" being another item depending upon the breed of the sheep; the finer the quality, the more of these waves to one inch of fibre.

Other animal fibres used in the textile industry are the covering or fur obtained from the Cashmere Goat, the Angora Goat (Mohair), the Alpaca, the Camel, the Common Goat and the Cow; besides Horse hair.

The fur of the Cashmere goat is of two sorts, *viz.:* a soft, woolly, white or grayish undercoat, and a coarse covering of long hairs. The woolly undercoat is the more valuable fibre and is wool fibre in its structure. These fibres vary in length from 1¼ to 3½ inches and possess no medullary substance. They are plucked from the animal, exported, and used in the manufacture of some of the finest textiles, both on account of the fineness of the fibres as well as its high price. However, as a rule, the supply of this fibre is considerably intermixed with those long hairs of the outer fur of the animal, and which, according to amount present, reduce its value, since they must be separated from it. These outer hairs are of a length of from 3½ to 4½ inches, and possess the central or medullary substance, and are used in the manufacture of cheaper grades of yarns.

Mohair is the name given to the hairy covering of the Angora goat. Besides our domestic supply, mohair is also imported. It is of a pure white color (more rarely gray) rather fine, more or less curly, of high lustre, and on an average of from 5 to 6 inches long, although in some cases as long as 12 inches. Their outer scales are extremely delicate, giving the fibres a spotted appearance all over their surface. Besides the mohair, there grows upon the Angora goat a short, stiff hair, which is technically known as "kemp", a relic of the common goat. Its presence depends entirely upon the kind of breed of Angora, being nearly nil in the pure animal. This kemp fibre in mohair always reduces its value, in proportion to the amount that is present.

Alpaca and similar wools are obtained from a group of animals indigenous to the highlands of the South American Cordilleras, where they are met with in a domestic as well as wild state. It is a lustrous fibre, although this lustre is inferior to that of mohair. The outer scales of the fibre are extremely fine and the central or medullary substance is present either throughout its entire length or in small elongated masses.

Camel Hair is obtained from the Camel and the Dromedary. Their hair is of two kinds, *viz.:* very fine curly, reddish or yellow brown hairs, about 4 inches in length and known in commerce as camel wool, and coarse straight, dark brown to blackish body hairs, about 2 to $2\frac{1}{2}$ inches long. Both kinds of hair show under the microscope, faint scales. The medullary substance always appears in the coarse hair, whereas in the fine hair, it is either wanting or appears in insulated masses.

The Common Goat, when raised in the open air has a woolly fur, which is shed in the spring and which hair is adapted for spinning, with sheep wool, into coarse yarns.

Cow and calf hair is also used for textile purposes, and is the hair removed from the hides of these animals in the tannery, by means of subjecting the pelts to the action of lime, the same as practiced with the pelt of the sheep. They are coarse, stiff fibres of a white, reddish brown or black color, possessing a slight lustre, and in turn are spun, mixed with low grades of sheep wool into coarse yarns, used for rugs, horse blankets, and similar coarse fabrics, as well as for backing yarns in cheap grades of overcoating, cloakings, etc.

Horse Hair. Of this, two kinds are met with in commerce, *viz.:* tail hair, or the long hair, measuring at least 23 inches, though it occasionally attains a length of 32 to 34 inches, and mane hair, or the short hair, and which rarely exceeds 19 inches in length. White and black are the colors most esteemed, whilst red, gray, etc., hair is less valuable.

Artificial Wool. The same are re-manufactured products from old or new wool waste, or recovered from rags, and according to their source are divided into four classes, *viz.:* Shoddy, Mungo, Extract and Flocks. Of these

Shoddy is the best, being the wool fibre recovered from worn, but all wool materials, which had never been fulled, or if so, only slightly. Amongst these materials, we find knit goods, shawls, flannels and similar fabrics, also the yarn and fabric waste made in the process of manufacturing them. The fact that these materials, known in the market as "softs" are readily disintegrated, causes the resulting fibres to be comparatively long and sound, they varying in length on an average of from $\frac{2}{5}$ to $1\frac{1}{5}$ inches, according to the original length of the staple in the fabric from which the shoddy is made. Shoddy is occasionally worked up alone into heavy counts of yarn, but more generally is mixed with new wool and thus used in the manufacture of a great quantity of good average grades of yarns for all classes of all wool fabrics.

Shoddy fibres are sometimes found to be spoiled by scales being worn off or the ends of the fibres broken, and which may be caused during the process of rag picking or garnetting (coarse carding). In most instances, dyed shoddy can be detected from similarly dyed new wool, in the yarn, for the reason that the color of the former will betray the inferior article compared to wool, since the rags or waste, previous to the re-dyeing, except when coming from white softs, had been dyed different colors and which will consequently influence the final shade of color obtained from re-dyeing accordingly.

Mungo is obtained by reducing to fibre pure woolen rags, from cloth originally heavily fulled, and when the natural consequence of the strong resistance to disintegration offered by felted fabrics, results in that short fibres, about $\frac{1}{5}$ to $\frac{4}{5}$ of an inch in length, are obtained. Mungo, for this reason, is never worked up again alone into yarn, but is mixed with new wool or cotton and spun into low counts of filling yarn. On account of mungo referring to a fibre once before having been felted, the same has lost its capacity for further felting.

Extract wool is the product obtained by disintegrating fabrics composed of animal and vegetable fibres, chiefly wool and cotton, instead of wool only.

Flocks will only come into consideration when testing fabrics, since the same are added to the woven cloth during fulling, whereas shoddy, mungo and extract are introduced into the yarn, during the mixing, picking and carding processes. Flocks are woolen rags ground in the flock cutter into minute portions of fibres, which then during fulling the cloth are made to adhere to, *i. e.,* felted onto the back of the fabric, as well as working their way more or less into the body of the latter.

(*To be continued*)

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

Lesson 1.

The design in woven fabrics is produced by the weave, *i. e.,* the interlacing of warp and filling, either in connection with plain, or a fancy arrangement, or blending of colors. In the first case, the weave alone is the important factor with reference to design, whereas in the second instance, the effect produced by the combination or blending, or mixing of colors, (color effect) is, at least, of equal importance to that of the weave, in fact in many instances, far more.

We will for the present consider the weave of a fabric only, and take up the subject of color and fabric structure, in all its details, later on.

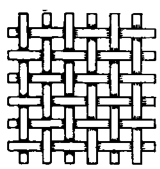

Fig.1

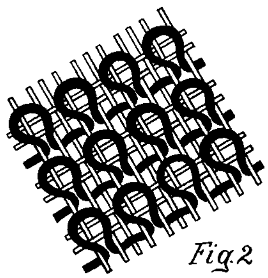

Fig.2

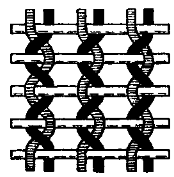

Fig.3

All woven fabrics can be divided into three main groups:

(*a*) Regular fabric structures, *i. e.,* fabrics in which one system of parallel threads is interlaced at right angles with a second system of parallel threads. For illustration see diagram Fig. 1.

(*b*) Pile fabrics, *i. e.,* fabrics produced in a similar manner as the previously mentioned system, the difference in this case being that certain threads of one or the other system of the threads are raised, either during weaving, or with some fabrics later on during finishing, so as to produce a pile structure—cut or uncut—on top of the body structure of the fabric. If the pile is produced during weaving, it refers to a warp pile fabric. For illustration. see diagram Fig. 2, in which the warp, as forming pile during weaving, is shown in full black, so as to contrast it from the other warp (body or ground warp) as well as the other system of threads—the filling, and which are shown in outline.

(*c*) Gauze or leno fabrics, *i. e.,* fabrics in which one of the two systems of threads, as characteristic to any fabric structure—the warp in this instance—in addition to interlacing with the other system of threads. are twisted with threads of its own system. For illustration see diagram Fig. 3, in which the warp threads, as twisting against each other besides interlacing with the filling, are shown in full black and shaded, in contrast to the filling, as shown in outline.

Regular fabric structures. These are the fabric structures we will first consider, the same being again divided into the following sub-division:

(1) Single cloth, *i. e.,* fabrics constructed with one system of warp and one system of filling.

(2) Fabrics constructed with an extra warp, *i. e.,* using two systems of warp in connection with one system of filling.

(3) Fabrics constructed with an extra filling, *i. e.,* using one system of warp and two systems of filling.

(4) Double cloth, *i. e.,* fabrics constructed with two systems of warp and two systems of filling.

(5) Fabrics more than double cloth.

(6) Special fabric structures.

Before going into any detail with reference to weaves, we will first take up the subject of

Point Paper, or our squared designing paper, as used for representing the different weaves for textile fabrics, *i. e.,* take up its relation to the fabric structure for indicating the method of interlacing warp and filling. The object of designing on point paper is to reproduce, or to produce, on said paper, a plan of the fabric, respectively made, either from a woven structure, or to be made for a fabric to be woven with it.

There are two systems of threads which constitute a woven fabric, *viz:* the warp and the filling, both systems crossing each other at right angles. The warp is the set of threads (consult Fig. 1) running lengthwise in the fabric, the filling crossing the latter at a right angle. In the point paper, each distance between two lines, whether they are shown by fine or heavy lines, or lines of two colors, if considered in a vertical direction, represents one warp thread, as clearly indicated in diagram Fig. 4 in connection with six warp threads. In the same way, each distance on said point paper, between two lines, considered in a horizontal direction, see Fig. 5, represents one filling thread, technically known as one pick.

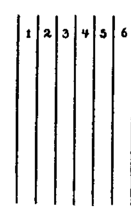

Fig. 4

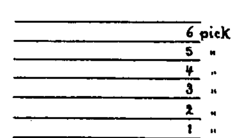

Fig. 5

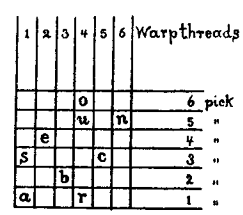

Fig. 6

Now let us unite these two series of threads, *i. e.,* diagrams Figs. 4 and 5 into one diagram, by drawing the lines of one series at right angles over the other series, as done in diagram Fig. 6; the union of these two series of lines resulting in ($6 \times 6 =$) 36 small squares. Since, as explained, the distance between each line, in either direction—whether considered horizontal or vertical—represents a thread, it will thus be seen that each square, as formed in diagram Fig. 6, indicates the place in the fabric, where a certain warp thread meets with a certain pick. Now, it is well known that in the same place where one body is, another cannot be, for which reason, the warp thread, where it meets a pick, must then rest either above or below the filling in said place; the usual custom being to insert on the point paper in its respective place, a mark of some kind, either by pencil, pen, or, what is better, filling the square by means of a small camel's hair brush, with paint (Vermillion-water color), so as to thus indicate that in that particular spot the warp thread covers, *i. e.* rests above the filling. If the reverse should be required, (technically known as "considering sinkers in plan of weave, for warp up") such must be plainly stated in writing on said plan of weave.

Having thus shown how and for what purpose the squares are formed on the point paper, we will now consider diagram Fig. 6 more in detail, and for which reason we placed different letters of reference in the latter, quoting that:

Square *a* indicates the meeting of warp thread 1 and pick 1; square *b* indicates the meeting of warp thread 3 and pick 2; square *c* indicates the meeting of warp thread 5 and pick 3; square *e* indicates the meeting of warp thread 2 and pick 4; square *n* indicates the meeting of warp thread 6 and pick 5; square *o* indicates the meeting of warp thread 4 and pick 6, and if considering the letter of reference as a mark for said square, it then would mean that the respective warp thread is up and the respective filling down.

Through this exchanging of warp and filling, as visible on the face of the fabric, technically known as *"Raisers"* or *"Sinkers"* we thus form the interlacing of both systems of threads, known as the weave.

The usual custom for indicating warp up on the point paper, if using a pencil or pen for this purpose, is a multiplication sign (×), a dash (/) or a circle (○), the multiplication sign being the most satisfactory character to use for this work; although as mentioned before, painting or filling up the square, by means of brush and paint is more satisfactory. How to proceed to do this quickly and systematically will be later on more particularly explained.

This now gives us the following *Rule:* Indications of any kind, in any square, inside the repeat of the weave upon the point paper, means "warp up" in its corresponding place in the fabric, whereas such squares as left empty, inside the repeat of the weave upon the point paper, means "filling up" in its corresponding positions in the fabric.

To explain subject more clearly to the student, Figs. 7 and 8 are given, and of which diagrams *A* in both illustrations shows one row of longitudinal squares, (considerably enlarged, if compared to our regular point paper) *i. e.,* one warp thread with its picks taken from a weave, *i. e.,* the point paper; diagrams marked *B* in both illustrations showing the respective interlacing of said two warp threads with its respective picks, and of which in both examples, 12 are used.

Examining, *i. e.,* reading off either diagram *A* or *B,* in connection with Fig. 7, and beginning to read from the bottom, illustrates the warp threads alternately down and up six repeats of the affair (6 × 2 =) or 12 picks being shown in either diagram.

Fig. 8 illustrates the design and working of a similar warp thread with the same number of picks in its repeat, the arrangement used in this case being 1 up and 2 down — four times repeated = 12 picks being shown in either diagram.

The object of the heavy square on point paper is only to serve as a unit of measurement, *i. e.,* to show readily and exactly, the size of a weave. The eye can readily grasp the meaning of this large square, and thus the repeat of a weave is most readily ascertained, whereas minus these heavy squares, frequent mistakes in counting the number of small squares used, would be the result.

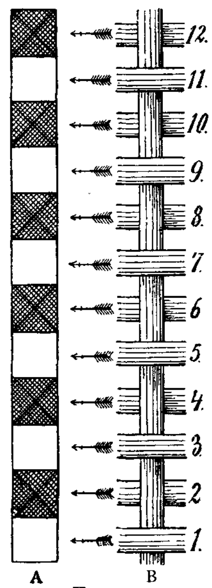

Fig. 7.

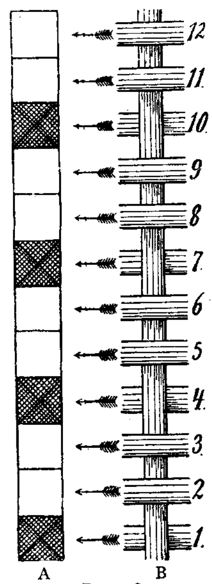

Fig. 8.

For harness work, the usual kind of point paper used is 8 × 8, and which in connection with some papers is ruled in two colors in place of light and heavy lines, as a rule green or blue being used for the light lines, and which are then overruled with red, every 8 squares warp and filling ways, said red lines taking the place of the heavy lines in the point paper, shown herewith, and referred to later on. This 8 × 8 paper is the only point paper in the market thus ruled in two colors and in connection with which, no painting is to be done, pencil or pen only being used by the designer for indicating the weave.

Heavy overruled papers like 10 × 10 or 12 × 12 can be similarly used by designers for harness work; however, 8 × 8 is the one preferred, since 8 is the most convenient multiple or fraction of a multiple of the bulk of our weaves for harness work - 4 - 8 - 10 - 12 - 16 - 20 and 24 being the most often met with repeats of weaves, and when then 4 means half of a heavy square, 8 one heavy square, 10 one heavy square plus two light squares, 12 one and one-half of a heavy square, 16 two heavy squares, etc.

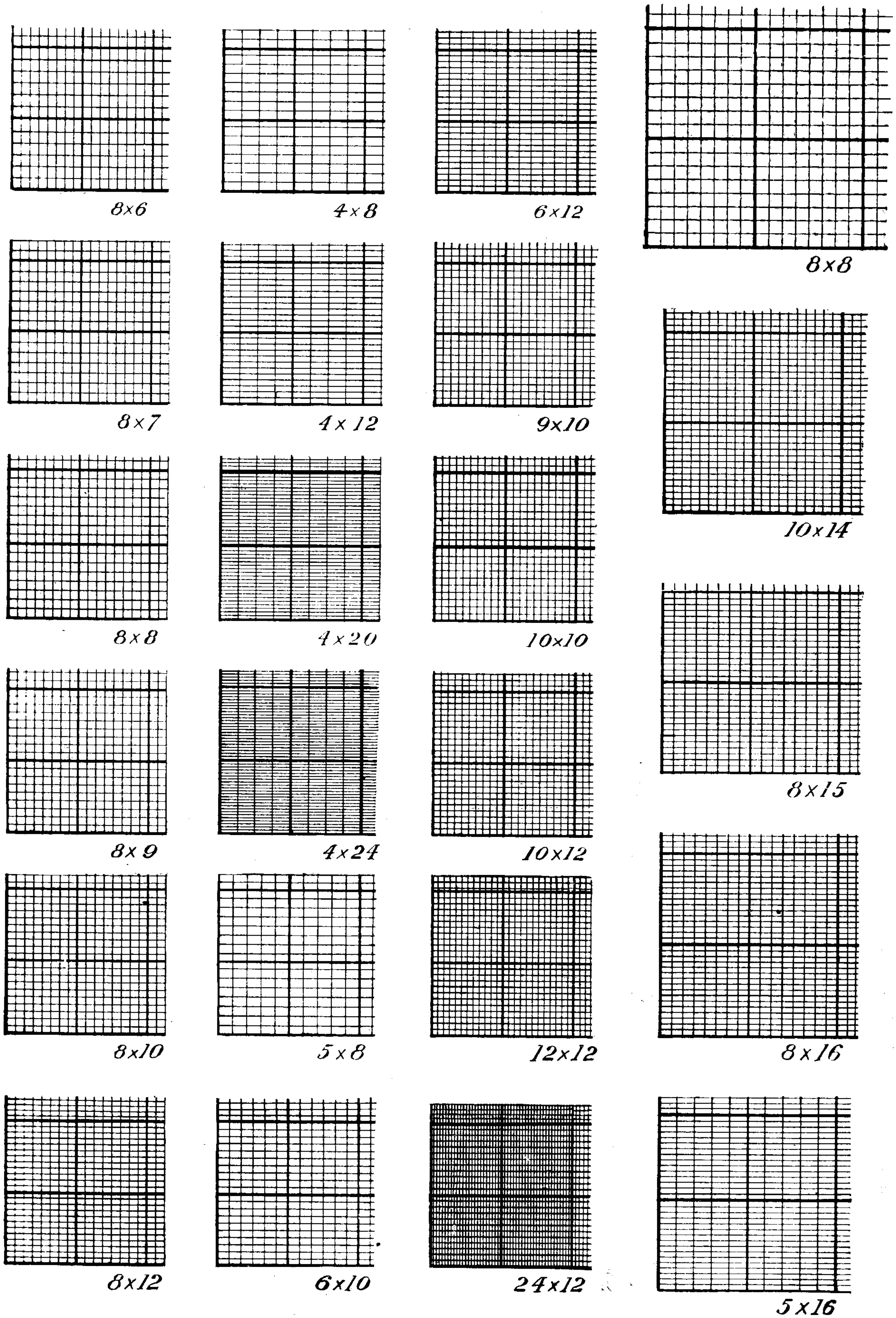
8x6
4x8
6x12
8x8
8x7
4x12
9x10
10x14
8x8
4x20
10x10
8x9
4x24
10x12
8x15
8x10
5x8
12x12
8x16
8x12
6x10
24x12
5x16

FIG. 9.

Plate Fig. 9 shows us a collection of some of the different kinds of point paper, the more advanced designer will come in contact with, each different specimen of a paper being correspondingly marked below it.

In mentioning a certain kind of point paper, the warp dimension is indicated first, and a design paper having eight rectangles vertical, with eight horizontal, is variously read and indicated as 8 by 8, 8 × 8 or 8/8; a design paper having eight rectangles vertical, with ten horizontal, is read and indicated as 8 by 10, 8 × 10 or 8/10. The size of the square may vary in each kind of paper, and must be selected according to the fabric. For example, there are two different styles of 8 × 8 point paper illustrated: one forming ½ inch heavy squares and one forming ¾ inch heavy squares. These sizes may still be varied. The principle of these two kinds of point paper is identical, the size preferred being left to the pleasure of the designer. Certainly it will be understood by any student that in preparing a design or weave with a large number of threads for repeat, it will be advantageous to use a design paper containing the smallest sized rectangles practical to use.

With reference to these kinds of point paper shown, with the exception of the 8 × 8, they refer more particularly either to more advanced harness work, or to Jacquard work, and have simply been given to make the subject on point paper complete for future instruction papers. The kind of point paper then to use, in connection with single cloth structures, depends upon the texture of the finished fabric, or upon the texture of the effect in connection with figured cloth other than single.

Selection of proper brush and color. We would advise the student to at once begin to paint his weaves, right from the start, so as to get familiar with it, since later on, in connection with more complicated weaves, as well as in studying lessons and getting up his original weaves from the latter, he has to paint these weaves anyway, in order to make satisfactory progress with his work.

With reference to the brush, select a common artist's imitation camel's hair brush (a number 3 for ½ inch 8 × 8 point paper) costing about 8 cents, although if the student chooses, he may pay as high as 25 cents for a camel's hair brush, the 8 cent brush, however, with careful use, doing good work for months, in fact will last him up to a year. The brush to be used for painting designs on point paper, has then to be clipped to suit the width of the small squares, which it has to fill, one sweep of the hand of the designer filling one or any number of squares in succession in a vertical direction on the point paper. For trimming the brush, point it with your mouth, place it with your left hand on a smooth piece of wood and trim it with one cut, by means of a very sharp knife held in your right hand. Never trim too much, *i. e.,* too deep into the brush, rather less, since you then can correct the proper size of cut by a second procedure. A pronounced difference in size of square, calls for a different number, as well as more or less trimming of the brush. A brush trimmed too much, can be used in connection with point paper, having larger squares.

With reference to paint, use Vermillion, water color, and which can be obtained, in most any artists' material store, in two styles, small porcelain cups at 12 cents, or large hexagon glass jars at 25 cents. Although this prepared water color—ready for use—is more convenient all around for use, at the same time provided you can not procure this color in your city or town, you may prepare your own paint by mixing vermillion, in powder form, and which you can buy in any paint store, with sufficient mucilage to have it not rub off after drying, adding at the same time sufficient water to permit it to be properly mixed. Mix it well —a few drops of alcohol will greatly assist the mixing, if added before the water.

Advantages of painting your weaves are: a more satisfactory representation of the weave, mistakes are quicker noticed, and finally, provided a mistake is made, it can be corrected by washing out the error with clear water, using for this a somewhat larger common artist's brush:—about a number 6, costing 10 cents—will be found the most satisfactory for it.

Provided the point paper does not take the paint freely, has become greasy, for one reason or the other, wipe the paper off with a damp sponge. Do not have your hand rest on that portion of the point paper you may have to paint on later, keep a piece of waste, or blotting paper between hand and point paper.

For the beginning, always paint out two or more repeats (warp and filling ways) of a weave under consideration, to be sure that the latter repeats properly.

Questions:

(1) What is meant by "regular" fabric structures?

(2) What is the purpose of point paper?

(3) Explain *what,* letters of reference *r, s* and *u* in diagram Fig. 6, represent?

(4) Why is point paper squared off with heavy lines?

(5) Which kind of point paper is most commonly used for harness work, and why?

P. S. This lesson will be examined, corrected if necessary, and returned to the student with suitable comment, at a uniform rate of 25 cents per lesson, to partly cover cost of clerical work, time, postage, etc.

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

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

BY WAY OF THANKS.

The decision to launch this journal was reached at a time when an optimistic mood prevailed. When in a calmer moment the enormity of the undertaking was revealed and the over-crowded condition of the field of textile literature was taken into consideration, a fit of the most pronounced pessimism succeeded. That the "Journal" would top the list of textile magazines and be a leading factor in the field of textile education as well as that of textile literature was my hope and belief. But I became discouraged long before the venture reached a definite point. Great was my delight and immense my satisfaction when quickly following the publication of the plan and scope of the work, it became apparent that the idea had been enthusiastically received by those most closely interested in the project. Congratulations poured in; friends, former pupils, and others interested in the most progressive textile practice were delighted beyond measure. From the whole textile world, from Maine, Georgia, Michigan, Pennsylvania; from New England, from the Middle Atlantic States, from the South, from the West, in fact from North, East, South and West, and even from far-away Japan, words of encouragement came.

One prominent textile manufacturer, President of a National Textile Organization, wrote, "It will fill a long felt want in textile literature, and will go to the most progressive textile manufacturers and their overseers." All branches of the textile industry were interested. A woolen manufacturer wrote, "From my heart I wish you every success which you surely deserve." Another wrote, "It will be hard sledding for some time, but I have no doubt of your ultimate success." From a Michigan knit goods manufacturer, "Judging from the specimen copy, it is just what we have been wanting along the lines of knitting information, and not too technical." Another wrote, "You do not consider every reader an expert, nothing seems taken for granted, each item is carefully explained." A commission man wrote, "I think very well of it." A manufacturer of silk goods was highly enthusiastic, "Best ever, I cannot praise your work too highly. If the succeeding issues are one-half so good as the first, there is not the slightest doubt in my mind about the success of the journal." A buyer in the Southern cotton market has this to say, "I must say that I think you have the magazine that the practical man wants and cannot see what can hinder you from making the affair a huge success." A boss dyer wrote, "Have shown the specimen copy to several other mill men and they were pleased; I predict a great success for the work." From a Southern cotton mill came, "I enjoyed reading it from the start to finish. It is instructive to the ignorant and informs the learned." Every one was "well pleased," all "delighted," and "ultimate success" was prophesied by many.

To merit this praise and prove worthy of the many friends who have spoken these words of kindness and pleasure will be the constant aim and desire of the editor.

SOUTHERN PROSPERITY.

A celebrated economist, Secretary of a New York scientific organization, who has just returned from the South, has this to say in regard to conditions there, "In all my experience in digging into economic conditions, I have never discovered such progress as can be noticed in the South. In ten years the growth has been marvellous." This is a somewhat broad statement, but had the authority quoted known the exact figures showing the increase along all lines of Southern industry, he would have been even more emphatic. Industries which were unknown a few years ago in the South are now flourishing. Several years of immensely profitable cotton crops, and renewed interest in agricultural and textile pursuits have enabled the South to branch out and to undertake enterprises too numerous to mention. By this a new measure of independence has been achieved, and the South is no longer at the mercy of the Northern or Western industries. Of course a great amount of the capital invested there comes from the financial centres of the country, but the fact that investors are willing to devote large sums to Southern industries is renewed proof that the South is in the midst of a great era of prosperity. Many tempting fields for profitable investment are to be found there and the credit of that section of our country was never better.

An event of more than passing interest to the South was the Conference of Cotton Growers, Spinners and Manufacturers, held in Atlanta, Ga., on October 7th, 8th and 9th. By invitation of the American organizations interested in the cotton industry, one hundred and twenty foreign delegates were in attendance. This conference was truly an International one, for these men represent the Cotton Spinners' and Manufacturers' Associations of England, Austria, Germany, France, Spain, Portugal and Italy. They represent 90,000,000 spindles while the American delegates represent 25,000,000 more. Men from every walk of life, Southern Planters, Ginners, Compress Companies, Insurance Companies, Railroad and Steamship lines, were present. There was a frank interchange of views and many steps were planned toward the smoother and more economical working of the allied interests of the industry. This industry has been a remarkable one, only 36,000 bales were marketed in 1800 while in 1906, 13,500,000 bales were marketed. This great development renders it necessary that a closer relation be established between the many varied interests, and that all unite to combat the growing evil of cotton speculation. It is absurd that a group of men who have no legitimate connection with the industry should be able to manipulate and control the market. The question of controlling this speculation will receive a great deal of attention and time, and it is hoped that some definite result will be reached.

The advice of Governor Hoke Smith, to the farmers of Georgia, is therefore timely and interesting. He advises them to hold their cotton and to market it gradually through the year instead of flooding the market and allowing speculators to control the situation and create an artificial condition. The Governor's idea is that the mills should be in the market to buy, as much as the farmer is in the market to sell. He dreams of fifteen cent cotton. What universal prosperity would come to the South if fifteen cent cotton became a reality, no one can imagine.

EXPLANATORY.

We appreciate the fact that many things still remain to be perfected before we can hope to have a finished journal. But so overwhelming is the work in connection with the enterprise that the editors have decided to go slowly, not to attempt too much in the beginning but to wait until the project is under way. When we see daylight, and some of the handicaps under which we now labor are removed, we will begin to add and to better; but new features will be introduced each month. Everything will be done to reach the goal we have set ourselves—to become the foremost textile journal of the country.

This may probably seem an extravagant declaration, but we are in the field to produce a journal which will justify the expectations of those who knowing, the high quality of work we have turned out in the past, will expect an equally high class of work in this Journal. Every effort will be bent to secure original and timely articles by the various authorities on textile subjects and nothing will be left undone which will tend to make this *"the"* Monthly Journal of the Textile Industries.

As many of the subscribers who will receive this first regular number will not have seen the Specimen Copy, issued early in September, much of the material used in that number has, for their benefit, been included in this issue. This is especially noticeable in the case of the "Dictionary of Weaves" and the "Dictionary of Technical Terms." In order to illustrate the breadth of this work, the "terms" and "weaves" defined in that early installment are still used in this number. In next month's issue, both works will be started at their proper points, and portions, in their regular order will appear in each succeeding number of the Journal. In the same manner the lessons on "Designing and Fabric Structure, etc.," begun in this number, will be continued and will receive the personal attention of Mr. Posselt.

"Some Defects in Textile Fabrics."

When one recalls the number of "seconds" and faulty pieces of fabric annually turned out by every mill, the timeliness and importance of this article, which commences with this issue, will be appreciated. Mr. Walter M. Gardner, F. C. S., Director of the Chemistry and Dyeing Department of the Technical College of Bradford, England, is indeed well fitted to write on the subject he has undertaken. That he will handle this work in an able and finished manner is a foregone conclusion. His name stands high in the textile world, as an educator, as a contributor to the foremost English textile journals and as the author of some of the standard books in use throughout the world to-day. He is indeed an authority and we feel sure that his contributions, which will appear regularly in the Dyeing Department of this Journal, will be read with interest and profit by every one.

"The Journal's Textile School."

This department of the magazine in which the whole subject of Designing and Fabric Structures, both for Harness and Jacquard work, will be treated in full, is under the personal direction of Mr. E. A. Posselt. The first lessons are planned so that the student will receive a good basis for higher work, the fundamental principles being dwelt upon at length. This is done so that the progress of the student will be smoother and faster, and the belief is that if a good foundation can be laid the future work will take care of itself to a great extent.

The absence of the article on "The Testing of Chemicals and Supplies in Textile Mills and Dye Works" will be noted. This is made necessary since it is desired to revise this series of articles and present them in later issues in a more logical manner.

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.

The object sought for in the preliminary processes of cotton spinning, as practised in the carding department, has been the production of a strand of cotton, the roving, cleansed from all impurities, etc., with its fibres perfectly parallelized and uniformly distributed throughout its entire length and section. Having obtained this perfect evenness in the rough strand (the roving) there is next required a process for imparting to yarn its other essential feature, strength, which is given to the strand by twisting the roving received from the fly frames, after first subjecting it to a drafting process by which it is still further evened and attenuated. This twisting may be done in two ways:—The intermittent process, as practised in mule spinning, and the continuous process, ring frame spinning; each method having its points of merit in the production of the separate kinds and varieties of yarns demanded by the trade for various uses.

The ring frame, for spinning yarns, is rapidly replacing the mule, both in this country and abroad, on account of its greater economy in operation and greater production, so that it may be considered the standard method of to-day, especially in our Southern mills, where yarn spinning by the ring frame is practically universal and mules are used only in a very few mills. However, the mule will always find use and favor when the quality of the yarn spun is an important consideration, and this is more particularly the case where higher grade yarns are required, because the operation of the mule is based on a principle, correct both in theory and practice.

The advantageous features of the ring frame, that have caused it to largely supersede the mule, are chiefly the absence of complicated parts and the smaller floor space required. The former feature permits its operation by younger or less experienced help (with a consequently great saving in cost of labor) while the latter enables a larger number of spindles (and therefore increased output) to be secured from a given area of mill room, since the ring rail upon which the spindles are fitted has a vertical movement, whereas in the mule, the spindle carriage moves in a horizontal direction, to and from the roll stand. In addition to these advantages, there are no intermittent changes in the motion of the ring frame, as are peculiar to the mule, consequently there is no loss of time from backing-off, and the yarn therefore has a less distance to traverse before it is wound upon the bobbin, *i. e.*, a greater quantity of yarn can be wound in a given time. However, it must be remembered that in order to spin the roving on the ring frame, somewhat more twist must be introduced into the thread than compared to the same yarn if spun on the mule, in order to hold the fibres together during the spinning process, the extra twist thus necessitated giving in turn to the resultant yarn a somewhat harder feel. Coarse yarns up to and including 26's can be spun from single roving, and it will be strong enough, owing to the size of the thread; however, since higher counts of yarns must be stronger in proportion, the proper way to do is to spin such yarns from double roving, not with an extreme draft, although the double roving will allow for a larger draft, not possible with a single roving. Double roving, usually, will result in a stronger yarn than such as spun from single roving, the yarn besides being more smooth and even.

In its theory and mechanical operation, the ring frame is a comparatively simple machine. Its duties are similar to those of the roving frame, draft being introduced in practically the same manner as in the latter. In addition, however, the strand of cotton is twisted and wound upon a bobbin in an entirely different manner from fly frame winding.

In a spinning frame, the roving is drawn out 6 to 15 times its original length, according to roving and yarn under consideration, by three lines of drafting rolls, the same as in the roving frame. In the same manner, twist is put in by means of revolving spindles, however, the winding is altogether different, although it could be done in the same way, as is shown by the fact that coarse counts of cheap yarn are occasionally spun on a roving frame.

Drawing, twisting, and winding are carried on simultaneously in both ring and fly frames, the only difference being that in the fly frame, the speed of the flyer, (the equivalent of the traveler in the ring frame) in connection with what is known as "bobbin leads" arrangement, and which is the one generally used, (see page 200, 201, etc. of Part 2) is less than that of the bobbin, the winding then being due to this faster speed of the bobbin; while in the ring frame, the speed of the bobbin being constant, the winding is due to the lag or slip of the traveler. If, every minute, a length of roving equal to the product of the speed of the bobbin and its circumference were delivered by the drafting rolls, the traveler then would remain stationary upon its ring, and the roving receive no twist, but be merely wrapped upon the bobbin, that is, provided it would stand the strain. The same as in the roving frame, the amount of twist in ring spinning may be regulated by altering the speed of the delivery roll of our set of drafting rolls, that

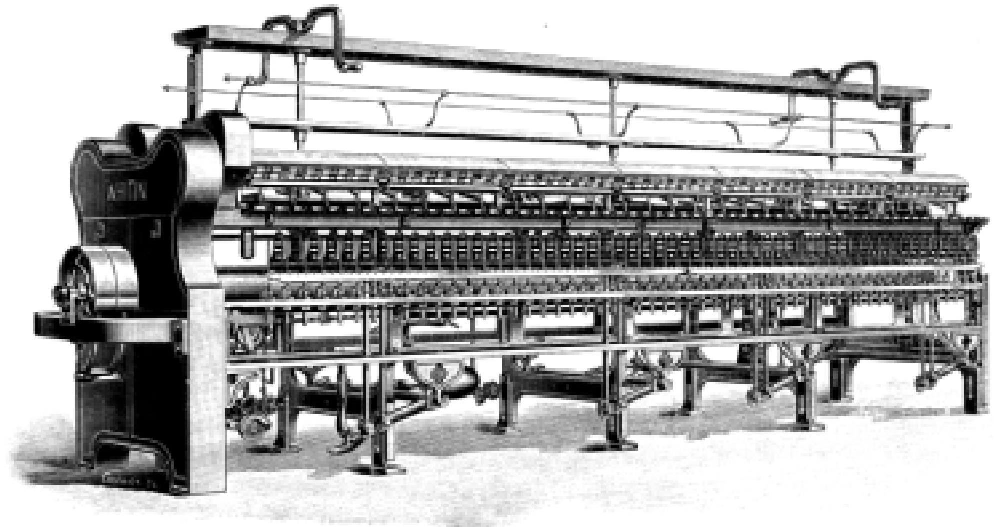


FIG. 226.

of the spindle remaining constant. When every minute a quantity of roving less than the surface speed of the bobbin is then delivered to the spindle, it is taken up by the bobbin as before, and the traveler pulled around upon its ring, in order to compensate for what is wanting in length.

THE PRINCIPLES UPON WHICH THE RING FRAME IS CONSTRUCTED ARE AS FOLLOWS:—

1st. The strand to be spun into yarn—the roving—is attenuated to the proper degree by means of drafting rolls.

2nd. Twist is then imparted to this roving by means of a mechanical principle, peculiar to the ring spinning frame, namely, by having the yarn, after leaving the front roll, pass through a traveler before being wound on the bobbin. The traveler is made to rotate at a high speed around a ring, which encircles the bobbin, and the rotations made by this traveler, in conjunction with the revolutions of the spindle, give the twist to the thread.

3rd. The winding or building of the yarn, in suitable form for the next process, is attained by traversing one part of the machine (the ring rail), while the other parts (spindle and bobbin) remain stationary. The ring rail, which carries the rings and travelers, is traversed so as to wind the yarn in layers on the bobbin, which is stationary so far as any vertical movement is concerned.

The ring frame is a comparatively simple machine, both in operation and construction. If any one of the modern standard types be examined, the various working details will be found simple in construction and movement, conveniently located, so as to be readily accessible, and composed of few parts, so that there is no difficulty in understanding the theory and operation of the ring frame and the functions of each separate part of its mechanism. It is only when several different styles of machines are considered and compared at one time, that special explanations become necessary, since each frame has some details of mechanism or operation (or both) peculiar to itself, consequently, the general description of a standard type will apply in principle to all ring frames. It should be clearly understood, that while different frames have different details, the underlying principle is the same in all, and the object aimed at is the most efficient and economical spinning of yarn by means of the rotation of traveler and spindle.

To simplify the description, and to explain the process of ring spinning, a standard type of ring frame will be shown and its parts described, omitting here, for the sake of clearness, any reference to the builder motion and its mechanism. A detailed description of all the separate parts of the frame and their modifications in different makes and styles, including the builder motion, will be given later in due order, these being more easily explained after the principles of ring frame spinning are understood. Fig. 226 gives an illustration of a standard type of ring frame in perspective view, showing its general appearance when set up in the mill.

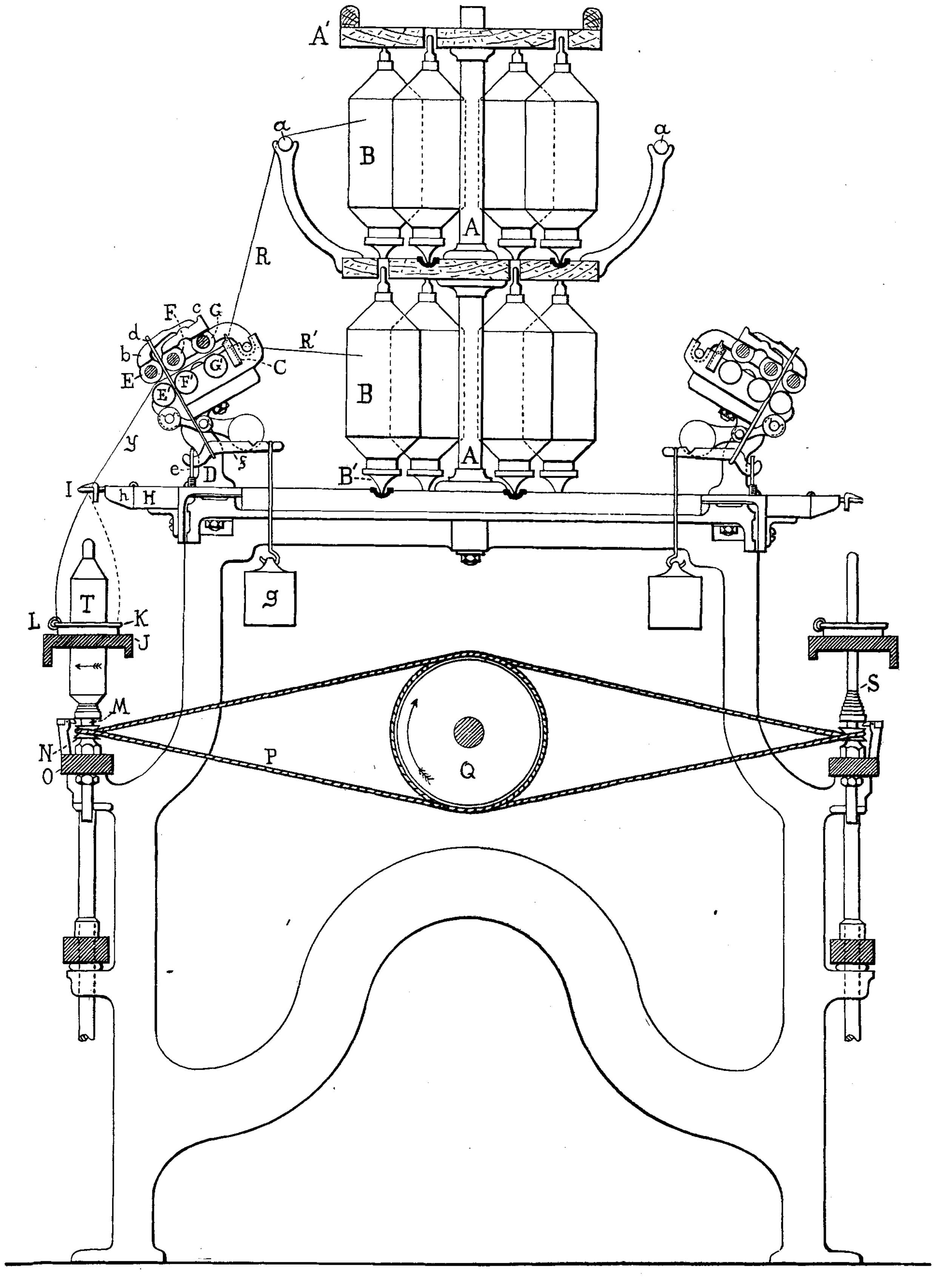


FIG. 227.

Fig. 227 is a sectional view of the side elevation of a ring frame without the builder motion mechanism, which is here omitted to simplify the explanation of this machine. The various parts are lettered to correspond with the text following, and should be referred to in connection with later illustrations, as given in detail of the working parts, treated separately.

A is the creel, usually of wood, supporting the roving bobbins *B*, with a top board *A'* for holding the extra supply of full roving bobbins. Creels used may be one tier or two tier creels. The creel which is shown is a two tier creel. The upper creel board is used for storing full bobbins. The creel boards are adjustable so that the distance between can be changed so as to accommodate bobbins of longer or shorter lift. Two tiers of roving bobbins, as shown, are usually used, the roving from a bobbin in each tier being carried to the drafting rolls (*E, F, G—E', F', G'*) and there united to form the yarn, but for lower grades of yarn, only one roving bobbin is put up in back, and consequently only a one tier creel is required. The bobbins are held in place on the creel by being slipped over skewers *B'*, the lower end of which rests in a glass or porcelain cup, set into the creel board, the upper end fitting into a ring or in a socket in the respective upper board, so that the bobbins will revolve with the least amount of friction as the roving unwinds itself from it. Creels should be roomy so as to allow plenty of space for creeling. The roving *R*, from the upper bobbin is directed by the guide rod *a*, to the traverse guide rod *C* where it joins the roving *R'* from the lower bobbin, and both pass into the drafting rolls together. This guide rod *C*, has a reciprocating motion, to and fro, in front of the rolls, so that the roving is shifted a slight distance along the rolls, continuously, and prevents them from being worn unevenly, or into ruts, by friction of the roving.

The drafting rolls, 3 pairs, the upper *E, F, G* leather covered, the lower *E', F', G'* of fluted steel, are carried on the roll stand *D*, which is supported by a bracket on the thread board *H*. The upper tier of rolls is here shown as being weighted by means of a weighted lever system, which consists of the top saddle *b*, back saddle *c*, stirrup *d*, lever fulcrum *e*, lever *f* and weight *g*. This method of regulating the pressure between the drafting rolls is known as top weighting, in distinction from the other system, possibly met with in reading foreign literature on ring spinning—self weighting—in which the top rolls are themselves given the required weight. The usual cleaner, for removing lint, etc. from the rolls is not shown in our illustration, as the several styles in common use can be better shown by detail views which will be given in the chapter on "Clearers."

The thread board *H* may be either wood or metal, rigid or hinged; usually the thread board is hinged, so that it can be lifted up when doffing the frame. At the outer edge of the thread board is set the thread-guide *I*, commonly a twisted piece of wire, through the opening of which the yarn passes down to the yarn bobbin, fixed so as to be in perfect vertical alignment over the spindle *M*, its functions being to guide the yarn *Y* to the traveler *L*, and to prevent it from whipping and breaking, by restricting the length that revolves with the bobbin and traveler. The thread-guide eyes should be directly over the tip of the spindles, so that the yarn as it revolves will move in the path of a perfect cone, that is, the line formed by the yarn from the thread-guide to the traveler will be the same length regardless of the part of the ring which the traveler may be moving over. If the guide eye should be too far to one side, the yarn, when it revolves on that side, is liable to strike against the adjacent thread.

The separators shown in Fig. 226 between the bobbins are omitted in Fig. 227 so as not to obscure the details of the ring rail.

Below the thread rail comes the ring rail *J*, having open spaces through which the yarn bobbin (shown at *S*) projects, the ring *K*, a circular piece of metal being fastened on this ring rail in such a manner that it encircles the bobbin. The ring rail is capable of vertical motion, up and down the height of the bobbin, and which is given to it by the builder motion mechanism. The ring rail must be set perfectly level, both longitudinally and transversely.

Around the top flange of the ring is fitted the traveler *L*, a piece of wire, so shaped that it can be sprung and clasped over the flange in such a manner that it will travel freely around the ring and yet be prevented from flying off. The yarn *Y*, in coming from the drafting rolls, passes through the traveler before it is wound upon the bobbin *S*, the motion of the traveler around the ring and bobbin imparting the characteristic twist to the yarn, the traveler also guiding the yarn as it is wound upon the bobbin. At *S* is shown the yarn bobbin empty, at *T*, on the opposite side of the frame, is shown a full bobbin. The bobbin fits over the spindle *M*, by which it is revolved, motion being secured by friction or by a locking device between bobbin and its spindle. The yarn is wound on the bobbin by the traveler, the bobbin itself being stationary, as far as any vertical movement is concerned.

The seat of the spindle *M* is secured to the spindle rail *O*, which is a stiff metal bar extending the full length of the frame, and the spindle is caused to revolve rapidly in a vertical plane by means of the spindle band *P*, passing around the whirl *N* from the tin cylinder *Q*, the spindle band being usually a soft twisted cotton yarn.

The tin cylinder *Q* extends the full length of the frame and revolves all the spindles on both sides of the machine, by means of similar spindle bands.

(*To be continued*)

JACQUARD DESIGNING.

Lesson 1.

The qualifications for the designing of textile fabrics, requiring the Jacquard machine for its execution on the loom, are the ability of the person to arrange on his drawing or sketching paper pleasing forms in such a manner that they will repeat, in order that they can be executed on the loom and still be agreeable in the finished fabric.

The importance of free hand drawing. A reasonable amount of skill in drawing, to draw with ease and freedom, is a necessity for the person who wants to become a Jacquard designer, which, when attained, should be followed by him in practice in the technical details of ornamental pattern construction.

Under no circumstances should the student rush his study by means of taking up too early the making of original designs, and it will be found that the student who has given the most attention to free hand drawing, as well as to the principles of ornamental design, will in turn make the most successful Jacquard designer, surpassing the student who in his study has skipped too rapidly over these somewhat uninteresting subjects (to him), in order that he can take up the more interesting branch of designing (original work) to him. Too much stress cannot be laid on the importance of a thorough training in free hand drawing, from the fact that it gives freedom and position to the hand, as well as training the eye to grasp the proper position and details of figures in a design; besides this, it will impart to him the feeling for beauty of line and form that it helps to bring out in the complete design.

Sketching from woven fabrics. After having mastered free hand drawing, an excellent study for the student will be to practice drawing, by copying from good examples of woven fabrics at his disposal, or from good reproductions of such work, giving the student thus at the same time very useful lessons in the study of actually woven figured textile fabrics, although in the present instance, the study more particularly refers to imparting freedom of drawing to his hand, besides a knowledge of the importance of the repeat of the pattern.

If dealing with multi-colored fabrics, as will be readily understood, the study previously referred to will also be to him a lesson in the harmony of color, *i. e.*, the blending of colors in textile fabrics, to produce pleasing effects.

Outlining subject. In the beginning of thus drawing (sketching), either from fabrics or from reproductions of such, it will be advisable for the student to help himself along in his work by means of "squaring-off" the subject before him, using the same principle of squaring-off on his sketching paper, a feature which, in turn, will guide him as to the proper position and shape of each figure he is copying. As will be readily understood, the more of these squares, or lines of help, made by the student, the easier the work for him, as well as the more accurate his reproduction.

As the student proceeds in his study, less of this squaring-off process will be necessary to be done by him, until finally it would be a waste of time on his part, and then he will be able to re-draw any sketch, or idea given to him, direct from the subject, on the sketching paper, or, later on, direct on the point paper.

To illustrate this outlining of an illustration, design, fabric-sketch or actual fabric structure, to the student, the accompanying illustration Fig. 1 of a Jacquard fabric is given. In the same, letters of reference *a, b, c* and *d,* show us the four points of one repeat of the design, the same being in turn connected (see heavy lines) in order to enclose one repeat, *i. e.*, the unit of the design, which is always a most important item for the student in textile designing, since without a perfect repeat, the best design is of no use for practical work on the loom.

Outlining one repeat of the design for an expert in drawing may be all that there is required, however, considering our instruction more particular for the student, the novice in drawing, he who shall most benefit by it, we next divide:

Line *a b* in two equal parts, getting in turn point *e,* line *b c* in two equal parts, getting in turn point *h,* line *c d* in two equal parts, getting in turn point *f,* and finally line *d a* in two equal parts, getting in turn point *g.*

Connecting *e* with *f,* and *g* with *h,* will in turn divide the repeat of the pattern in four equal squares, *viz: a, e, i, g; e, b, h, i; i, h, c, f,* and *g, i, f, d.*

What then is in one square on the subject, the student, after mapping out his drawing, *i. e.*, sketching paper, with a corresponding network of lines, then draws in the corresponding square on his drawing paper, and when it will be readily seen that these guiding lines cannot help but be of the greatest of assistance to him in placing figures, or details of figures, in the proper place or position on his drawing paper.

This will readily convince us of the fact that the more of these lines used, the easier the work of reproducing the subject, more so when dealing with a student not well up in drawing, a person to whom it is hard work, as we might say. For this reason, drawing the two oblique lines *a-c* and *b-d* (see dot and dash lines) will prove of additional advantage to him, dividing by means of these two lines, the repeat of the pattern into 8 triangles, or units, in place of 4 squares, or units, as before.

Keeping up the affair of lining-off the subject to be re-drawn, in order to still more simplify the work for the student, divide each previously quoted square into four squares again, as done in our example by means of dotted lines *j k, l m, n o* and *p q,* which will, in turn, result in dividing the repeat of the subject into (4 x 8 =) 32 triangles or units, when the work to reproduce the design thereby will have been immensely simplified for the student, he laying out for this purpose a corresponding network of lines on his drawing paper, the guide lines assisting him as to position and size of figures to be re-drawn, since what free and easy hand for drawing, and for which reason, as the student proceeds with his study, it is in his interest to always use less and less of these guide lines until the time arrives when, with the exception of the unit of one repeat, they are of no value to him.

Enlarging and reducing. Another valuable study for the student will be the process of enlarging and reducing sketches, or designs submitted, by means of this squaring-off process, from the fact that this sub-

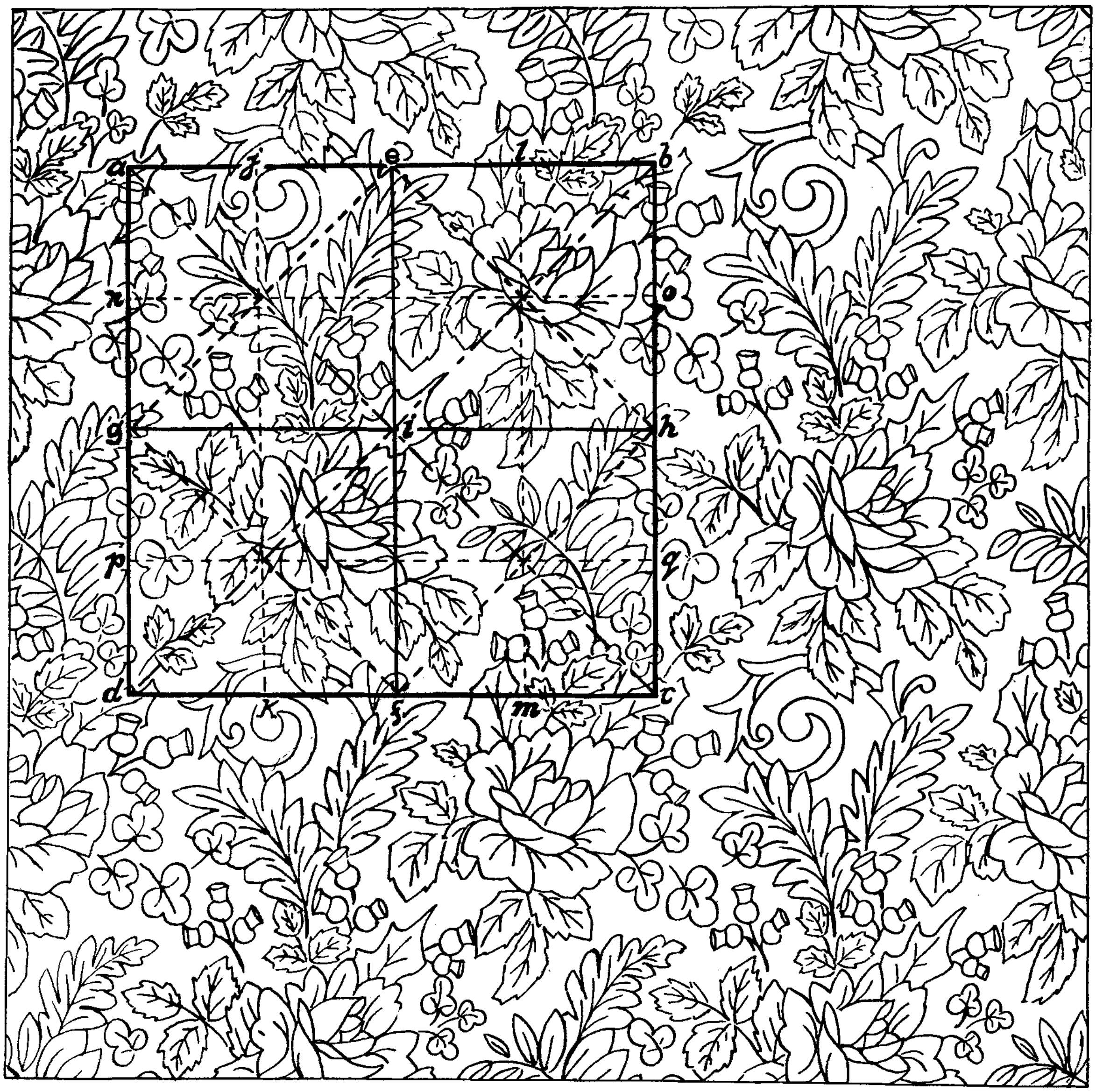


Fig. 1

is in one unit in the subject has to go into its corresponding unit on his drawing paper.

This feature of squaring-off a given subject in always smaller units, for the sake of easier reproduction, as will be readily understood, we might keep up, still we must not overdo it, since too many guide lines will become bewildering to the eye, and actually rather a hindrance than a help; again they will not permit the student to train his eyes to measurements, they will more or less prevent him from obtaining a ject will be an important item for him in his practical work later, on account of the difference in his design on the point paper from that of the woven fabric.

Squaring-off woven fabrics. The squaring-off, of the fabric structure to be copied, is frequently done by means of thread run around common pins, fastened for this purpose in the proper place to the fabric structure, the latter being first tacked onto a drawing board to permit the insertion of the pins and hold them in proper position, so as to permit in turn the thread to be run around them, the threads thus strung over the face of the fabric taking the place of lines on the drawing or the sketch.

Drawing from nature. Another useful study for the student, to obtain a good, free hand, with reference to drawing and at the same time lay the foundation for proper, future original work by him, is to draw as much as possible from such forms in nature as will lend themselves readily for decorative treatment. For example, the Analysis of Plants is a most important item, since it forms the basis of some of the best textile designs, although other natural elements should be used by the student in the same way, since they also form a basis frequently met with for figured textile designs.

Brushing up the sketch. After having obtained a fair facility in drawing with the pencil, it will be advisable for the student to use the brush frequently, which can be used in this kind of drawing more readily than the pencil, lending itself more readily for producing solid forms of varying thicknesses, since with one stroke of the brush, a form graduating in thickness from the finest point is easily obtained.

Brushing up the design, *i. e.,* a sketch, by the student will give him a better idea of how it will look in the woven fabric, from the fact that a sketch executed in outlines only, is more or less deceiving to the eye; said sketch may look or appear to the observer to be crowded, and yet when filled up with the brush, *i. e.,* brought up similar to the effect in the woven fabric, it may reveal one of the best fabric designs.

To the eye, an outline is always liable to be misleading, a feature readily explained in connection with illustrations Figs. 2 and 3, of which Fig. 2 shows us the design in outlines, and which appears crowded to the eye, whereas Fig. 3 shows the same design having its figure effect in the fabric brushed up, *i. e.,* shown in black, and which shows at once a perfect distribution of figure and ground all over the pattern, the design itself looking a great deal less complicated compared to the design in outline previously given.

This example will readily explain to the textile student the importance of considering the figure effects as solid forms, as they are almost always in the woven fabric, and *not* as outlines, because it rarely, if ever, happens that designs in textile fabrics are brought out in outline only. Certainly, if such should be the case, it then would be correct to prepare the sketch in outline only.

The best plan for the student, in preparing a fabric sketch, is to sketch the design roughly in pencil and then paint the figure or the ground effect, as the case may require, with a brush in black, or in colors, provided the affair refers to a multi-colored fabric. In the latter case, it may be found advisable for the student to first brush up the effect in black or in any other dark color, in order to first ascertain if the distribution of the effects, *i. e.,* the design in itself, is perfect. If such is then found to be the case, wash the design down with water and the sponge, let it dry, and in turn paint in the design then in the required colors. This procedure will simplify the work for the student more than if he went to work at once and painted the different colors direct on the pencil sketch, and where the design always is more or less only in its experimental stage.

Subjects to be studied. The study of Jacquard designing may be divided for the student into three subjects:

(*a*) the study from woven fabrics, in order to gain familiarity with the different fabric structures, motives, materials and treatment. It will be also of advantage, if in connection with this affair, the student makes a study of old examples of decorations as found in art galleries, museums, illustrated works of art on this subject, etc., which will enable him to become familiar with the various treatments of ornaments of different periods and countries, besides it will teach him the change of fashion. It will educate him in the formation of modern designs from older masterpieces in the art, discovering the beauties of the latter and how to turn them to value in his work, both with reference to design as well as color. By this we mean to say, not for him to duplicate these older designs, no matter how interesting they may become to him, from the fact that they would be of no value to the manufacturer of the present day; but simply to take such ideas from them as can be used by him to advantage in modern designs.

(*b*) he will have to study the principles of construction of designs as well as color harmony, in order to get foundations for new designs as well as a thorough understanding of the laws observed in connection with both.

(*c*) it will be advisable for him to study designing from nature, in order to get new ideas, this being a subject of the greatest importance to any textile designer, it being the source from which most all ornament has been derived.

Points to be considered before starting sketch. With reference to the practical side of making new designs, the student has to consider the purpose to which the finished fabric is put, as well as the kind of yarn to be used, *i. e.,* whether it is to be a cotton, silk, wool or worsted, or a union fabric. He must also be aware of the counts of the yarns to be used, as well as the texture of the fabric under consideration, *i. e.,* the number of warp threads and picks per inch. Another point which requires careful consideration is the weave to be used; whether it is to be single cloth, or a combination of two systems filling and one system warp, or two systems warp and one system of filling, or double cloth, or 3-ply cloth, etc., etc. Another feature to be known by him, before being able to successfully prepare a new design, is the style of finish of the fabric, *i. e.,* whether it is to be a threadbare finish (singed or sheared) or whether it refers to a velvet, or a nap finish, etc., etc.

The designer must also know the compass of the Jacquard machine, as well as the principle by which the Jacquard harness is tied up, which, in connection with texture of the fabric, then guides him in the size of the design (one repeat) in the fabric. It will readily be understood by the student, that, the finer the counts of the yarn and the higher the texture, *i. e.*, the more warp threads and picks per inch used in the construction of the fabric, the more details in the design will be permissible, when, naturally, a threadbare finish of such fabrics will increase the clearness of the pattern, rather than dull it.

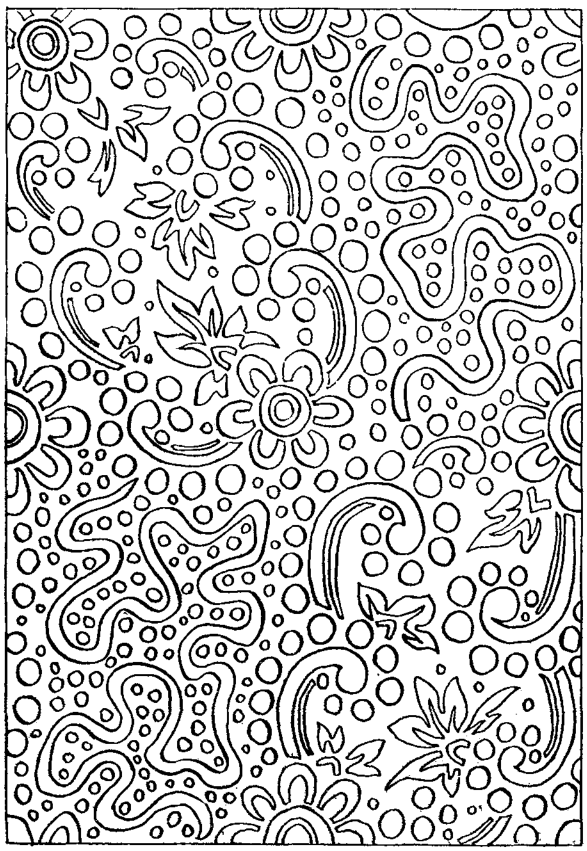


Fig. 2

The proper development of intricate designs in fabrics calls for fine counts of yarns in connection with a high texture of warp and filling. This feature, as will be readily understood refers to any kind of yarn used, whether silk, cotton, linen or worsted. It will demonstrate to the student, that, in most instances, the higher the texture of the fabric under consideration, as well as the larger the capacity of the Jacquard machine at his disposal, the easier the task to produce well developed, pleasing designs.

From this, it will be readily understood that silk fabrics will lend themselves more readily to the formation of complicated designs, on account of the nature of the material, as well as the high texture generally used, as compared to cotton, wool or worsted, and then every part of it can be worked out fully in detail. However, we must remember that, in connection with these fabrics as well as any other fabric structures, better results are generally obtained by treating the design boldly, producing required variations in the design, whenever possible, by change in weaves, in this way giving the silk threads a chance to display their luster to the greatest advantage. At the same time we must take into consideration, that, the less broken up the floating of the warp, the higher the lustrous effect produced in the fabric, for which reason, prominent warp floating weaves, like for example, satins-warp effect, etc., will preserve this luster in the silk warp superior to any other weave.

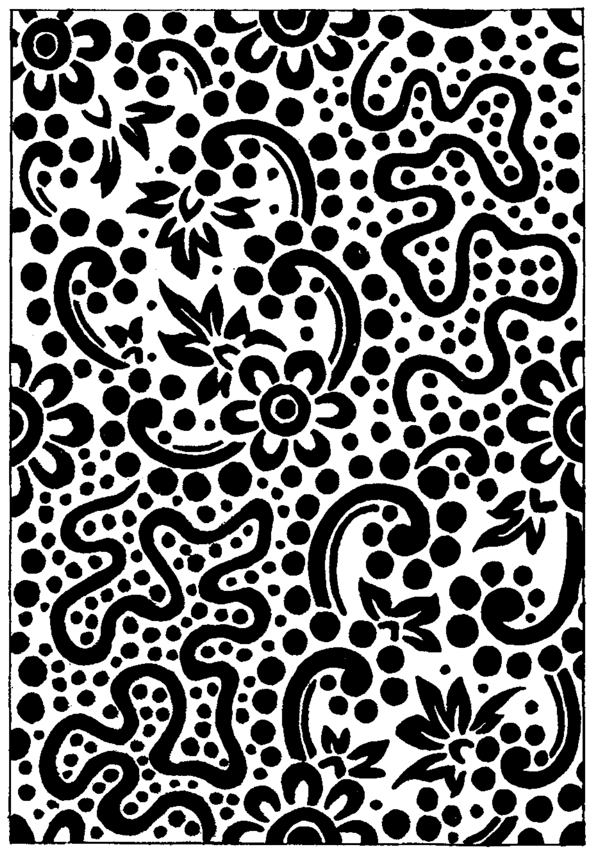


Fig. 3

Points thus mentioned also refer to cotton fabrics, constructed with high counts of yarn and a lustrous Sea Island, or Egyptian, or a Mercerized cotton fibre.

A great deal more care and judgment, however, will be required in connection with mohair or lustre worsted yarn, when such is used for figuring purposes in a textile fabric, and when it is desired that the lustre of the material is to be brought out to its fullest extent. In order to accomplish this, it is well to use these yarns for figure, using in connection with them, for the back ground, a non-lustrous cotton, worsted or woolen yarn; using at the same time as bold a figure as is possible in connection with as large a floating of the warp as is permissible, consistent with strength to the fabric, in fact only tie down the warp floats wherever absolutely necessary, so as to preserve in this way the lustre to the mohair or the worsted yarn. In connection with these yarns, it will be well for the designer to carefully study the effect, *i. e.*, the influence on the lustre of the yarn, produced by each system of weaves, and then the designer will notice that some weaves, for example, satins, large twills, etc., will reflect light directly to the eye, and consequently bring out the lustre of the yarn to its fullest extent, whereas other weaves, for example, small broken-up effect weaves, like granites, etc., will tend to lean towards the reverse. Besides the lustre itself, the fineness of the fibre will play an important part, the same also referring to the staple, *i. e.*, the length of the fibre, since it will be readily understood that a shorter staple will result in yarns having a somewhat rougher surface, on account of the increased number of points projecting from the surface of the yarn. For which reason, do not cut up your figures in the pattern too much in detail, using at the same time, whenever possible, the most simple weaves only for the interlacing of warp and filling.

Questions:

(1) Take sketch Fig. A, of a leaf, ruled with ten squares each way, enlarge it twice, three times, and four times, its size on drawing paper, using a similar net work of lines in your sketches. This will give three examples to be drawn by you.

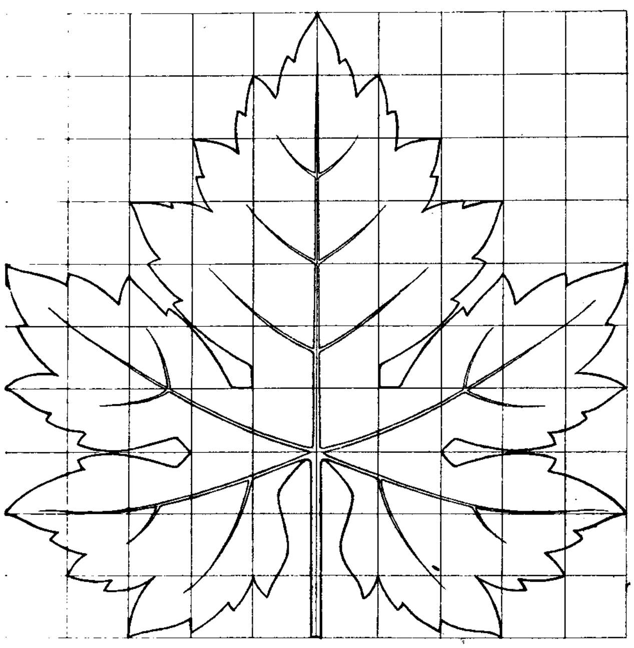


Fig. A

(2) Take sketch Fig. B and enlarge it twice, and three times, its size, using again the net work of lines given correspondingly in your sketches, in order to assist you in your work. You will notice that in this instance, less lines are used in the design, in order to train you to obtain a free, easy, hand in drawing. This will give two sketches to be produced by you.

(3) Take unit of design *a, b, c, d* in Fig 1, and enlarge it to 24 inches square on your drawing paper, drawing for this purpose on design given, the following additional net work of lines: connect *l - o, j - q, n - m, p - k, n - j, p - l, k - o, m - q*.

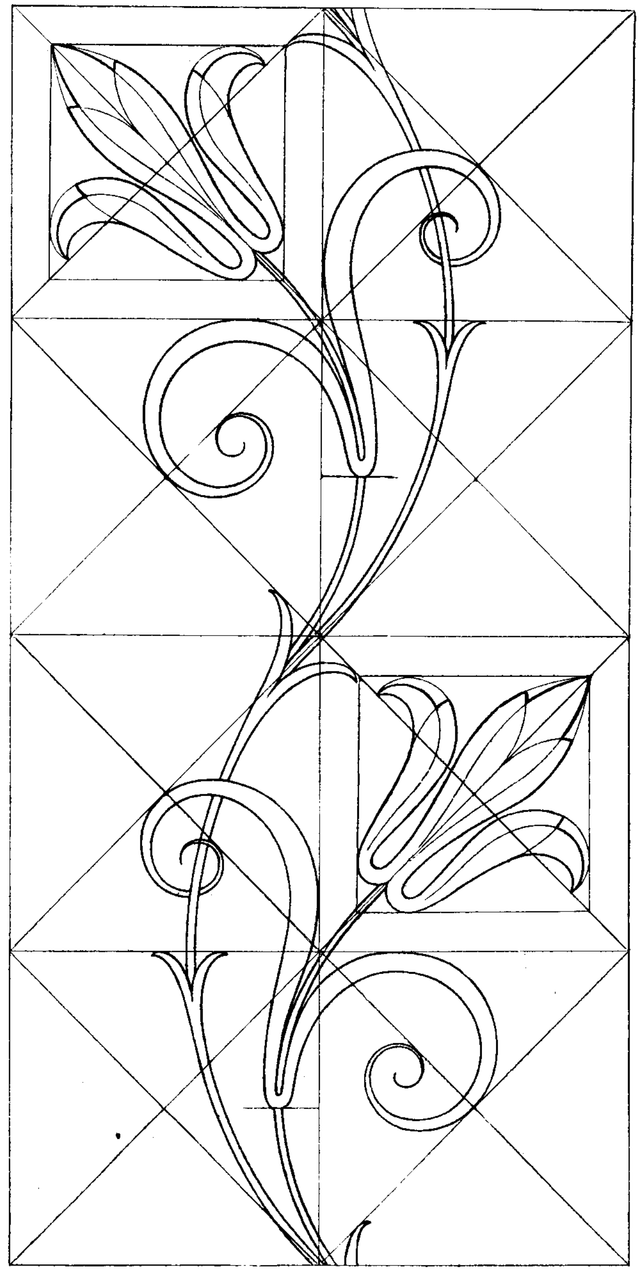


Fig. B

(4) Take the same unit of design *a, b, c, d* in Fig. 1, and redraw it, minus additional lines on your design paper, 16 inches square.

(5) Reproduce one repeat, actual size, from a woven fabric, and then trace three additional repeats (one to the right, one below, and one oblique to the first and below the second) in order to show proper connecting.

(6) Enlarge one repeat, of answer 5, five times its size—taking the repeat from the centre of answer 5.

DICTIONARY OF TECHNICAL TERMS RELATING TO THE TEXTILE INDUSTRY.

(Words Selected at Random.)

BACKWIND:—To unravel a knitted fabric and wind up the resulting yarn into convenient form for re-using.

BALBRIGGAN:—A term now used as applying to all classes of light-weight, flat underwear made of cotton yarn dyed to resemble the color of Egyptian cotton. Originally, the term was first applied to a style of full-fashioned hose made in Balbriggan, Ireland; later, it was also used in connection with knit underwear, both being made from unbleached cotton yarn.

BATISTE:—A light-weight fabric, of French origin, differing from nainsook in that it is heavier and wider than that fabric. The term batiste is generally adopted by the trade as referring to a light, sheer cloth made from a fine grade of yarn, which will average about 14 to 16 square yards to the pound. Batistes are made from various fibres, and may be bleached, unbleached or colored.

BEAVER:—A thick, warm cloth, technically known as a double cloth structure, chiefly used for overcoats and cloakings. The fabric is heavily fulled and "face finished." The average weight of the fabric met with is about twenty-eight ounces finished.

BEDFORD CORD:—Bedford cords are what might be technically termed ribbed fabrics, the face of the cloth structure being chiefly produced by the warp, the filling resting (more or less floating) on the back of the structure, in order to produce the characteristic rib or cord effect in the fabric, the ribs running in the direction of the warp.

BENDERS:—(or Bender cotton). Cotton grown on the fine black alluvial soil of the bends of the Mississippi River.

BILLIARD CLOTH:—A fine, green-colored cloth, piece dyed, from 72 to 81 inches wide, manufactured from a rather soft spun yarn, heavily fulled, with a short velvet finish; used for covering billiard tables. The plain weave is used for the better grades, the 3-harness twill for others.

BINDER WARP:—Extra warp threads added for giving strength to a fabric; if used as an interior warp it is not visible in the finished fabric.

BROADCLOTH:—A fabric made from a rather soft twisted woolen yarn (more particularly the filling), in a plain or 3-harness twill weave, finished with a high lustre, in which the threads cannot be distinguished. During the finishing process, the cloth is much shrunk and the fibres felted together, giving it a soft, glossy appearance, the so-called "face finish." Until 40 years ago it was the material in common use for gentlemen's dress suits; made also in a less dense construction for ladies' dressgoods.

BROCADE:—A fabric in which the design is raised in "floats" and appears on the surface of the fabric as though it were embossed. Made on a Jacquard loom, so as to produce the characteristic elaborate designs.

BURRING:—The process of cleaning or removing the burrs and other foreign impurities from the wool previous to carding. Two methods of doing this work are in use; either the wool is carbonized, *i. e.,* the burrs, shives, etc., are chemically extracted, or the scoured wool, after drying, is passed through a burr-picker. The chemical process is preferred, if dealing with screw burrs, etc., whereas the burr-picker is generally brought into use where larger burrs are to be contended with.

CALICO:—A term now generally applied to any printed cotton cloth that is coarser than muslin. Originally, the name given to a printed cotton fabric imported from Calcutta, India, hence the name, from the native name of the city —Calicut.

CANTON FLANNEL:—A strong, cotton cloth with a long, soft nap, usually on one side, although in some instances the fabric may be napped on both sides; used for under garments, bath robes, etc.

CASSIMERES:—A name applied to fancy suitings or trouserings made from woolen yarn; the fabric being more or less fulled during its finishing process. Given to almost any woolen cloth, that, for one reason or another, may be conveniently classed as cassimeres by the trade.

CASSIMERE TWILL:—The most frequently used weave in the construction of textiles, and considered all around, is the most serviceable weave. This weave is technically known as the 4-harness, even-sided twill.

CHINÉ:—A name given to silks which have a warp-printed effect produced by printing the warp threads in blocks and then grouping them in the loom so as to form a pattern. Must not be confused with Chine, which means China, as Soie de Chine—China silk.

CLAY WORSTEDS:—Fabrics woven with a twill similar to that of serge, but in which the diagonal lines characteristic of this weave are flat on the surface of the cloth and barely perceptible. Clay worsteds do not gloss as readily as other fabrics made from hard-twisted worsted yarns, on account of the warp and the filling being only slackly twisted. Named after Clay, the English manufacturer who first introduced this make of fabric in the market.

COLD PIG:—A shade of cloth that, for some reason, has not appealed to the public and therefore does not sell well. Such cloth is often sent to the dyer and re-dyed some more fashionable shade, this being governed by the original color, so that the same cloth that was previously neglected by the public will now find favor and sell.

CONDITIONING:—All textile fibres contain moisture in their normal condition. Since this amount of moisture present can be increased, with a consequent loss to the buyer, up to twice its normal percentage, in 1875 an international congress met at Turin, Italy, and when the following allowance or "reprises" were adopted as the normal amount of moisture allowable in the various textile fibres: *Silk* 11%, *Wool*-carded 17%, *Wool*-combed 18¼%, *Cotton* 8½%, *Flax* 12%, *Hemp* 12%, *Tow* 12½%, *Jute* 13¾%, of the absolute dry weight of the fibres. To-day, every prominent textile centre in Europe has a conditioning establishment, the decision of which is final in law. The skeins of yarn, after having been reeled, measured and weighed, at first together and then separately, are, for the purpose of conditioning, then dried in ovens, and when perfectly dry, a certain amount of water is added to the yarn equal to the permissible percentage (normal amount) of moisture, for each fibre previously referred to. The count of the yarn thus treated is termed its conditioned count.

CORDUROY (or Fustian):—A cloth made with a filling pile (which is cut in the finishing), the bindings of the filling with the warp, forming rows or cords lengthwise the fabric, thus giving its surface a corded or ribbed effect, the back of the cloth being usually a twill weave. Corduroys are cotton fabrics noted for their wearing qualities. They are also used for upholstering furniture, in which case they are often finished with fancy patterns.

CORKSCREWS:—Corkscrews are what might be called double twills, or, oblique warp-effect rib weaves. The name given to fabrics made with these weaves. Corkscrews require a high warp texture, since the warp forms (more or less) both the face and the back of the cloth, the filling resting, more or less, imbedded between the warp threads, being only partly visible on either the face or the back of the fabric. Corkscrews are made in plain and fancy effects.

CRASH:—A fabric formerly used chiefly for towelings, etc., but now also used to some extent for outing skirts, etc. Both broken-up as well as twill weaves are used for making these fabrics, accordingly as a rough or a smooth finish is desired. Crash may be made from cotton, flax or silk. When made from cotton, it is often produced in fancy weaves and patterns to imitate linen; silk crash has an effect similar to linen canvas.

CRAVENETTE:—Originally, the name of a process of treating cloth to render it waterproof, invented by an Englishman named Craven, hence the name. The term is now applied to waterproof or water-resistant fabrics,regardless of their nature, the designation (or proper name) of the cloth, however, not being changed by the application of the water-proofing process to them. (U. S. Custom House decision.) The process of cravenetting consists of treating the fabric with a solution that destroys the absorbent nature of the fibre and makes it water-repellent, the pores in the threads and the interstices of the fabric, however, not being filled up, so that the fabric remains porous.

DELAINE:—An abbreviation of "mousselaine-de-laine." A term applied to a light worsted cloth made from specially selected fine, strong and long-staple wools.

DELAINE WOOL:—Specifically, the term applied to long, fine wools from sheep of the merino breed; commonly applied to wools from sheep that have more or less of the merino strain, also to fine wools that are carded before they are combed, to distinguish them from the shorter wools of the same quality, which are only carded and are called "clothing wools."

DENIM:—A heavy cotton fabric used chiefly for making rough garments, like men's overalls, etc., and women's skirts. Denim is made from coarse yarns in a twill weave, and is usually dyed dark blue or brown.

DOUBLE CLOTH:—The fabric produced by the union of two single cloth structures, either for special ornamental effects or to increase the bulk of the cloth.

DOUBLE DYEING:—A method of dyeing fabrics composed of distinct or mixed wool and cotton threads, in which the wool part is first dyed with a dye that has no affinity for the cotton, after which the cotton part is dyed with a dye that has no affinity for the wool, then finishing the fabric.

DRILL:—A heavy, twilled, cotton fabric, usually sold for export in an unbleached condition. Used extensively in China and is a large item of the exports of cotton goods from the United States.

DUCK:—A heavy, coarse fabric woven from coarse cotton yarn, with a plain weave. Commonly used where a strong, heavy fabric is necessary, as for sails, awnings, etc., but is also used for making men's and women's garments, for summer wear, in which case only the lighter weights are used. Usually finished white or unbleached, but is sometimes dyed, for specialties.

FRISE:—A pile fabric, woven so that the pile is in loops and stands out from the face of the cloth, the loops not being cut. Differs from plush and velvet in this respect. The loop effect is produced by using two warps, the threads of one being stretched with greater tension than the other, using the tight weave for building up the body of the fabric and the loose warp for forming the face. The loops are formed by the loose warp, which comes from a separate warp beam, operated with a positive let-off, in order to feed this warp freely, the filling taking the greater lengths and thus forming the characteristic loops.

FULL FASHIONED:—A term applied to underwear that has been finished with flat seams, selvage edged, throughout, Also used for hosiery. Full-fashioned goods are knit-flat, in separate sections, and are made to conform to the desired shape by the machines automatically dropping stitches to narrow them at certain parts. The final shape is given by stretching them on suitable boards and drying them before removal.

FULL REGULAR (or looped):—A term applied to hosiery or underwear that has the seams fastened together by hand knitting instead of machine looping.

GAUFFRÉ:—A silk fabric which has had forms in relief pressed into it by an operation known as "gauffrage," these figures being retained by the fabric for some time if carefully done. The process is applied chiefly to light fabrics, such as pongees, muslins, etc. Satins can be made in imitation of moiré in this way. Fluted and accordion-pleated effects are also produced by it.

GLORIA:—The name given to a fabric made with a silk warp and a wool filling, the silk warp being floated on the face of the cloth as much as possible to give it the characteristic lustrous appearance. Gloria cloths are best known as a covering for umbrellas and as dress goods. They are dyed all colors, and are distinguished for their softness and high lustre, being made from the best organzine silk for a warp and fine woolen yarns for their filling.

HENRIETTA:—A term originally used to designate a fabric of the cashmere variety having a silk warp and a wool filling. Later, it was used to distinguish German cashmere from French cashmere; now generally applied to a fabric made with a twilled face and a smooth back, produced by the 3-harness twill weave, from various fibres, alone or combined. When silk is used for a warp, it is made from spun silk.

HERRING BONE:—A fabric interlaced with broken twill weaves, broken warp-ways only, the weave showing plainly on the face of the fabric. The effect resembles a herring bone, hence the name given such fabrics.

HONEYCOMBS:—A variety of fabric that has a honeycombed surface, hence its name, the cloth being used largely for bedspreads, towels, etc. The honeycomb effect is produced by interlacing warp and filling in the weaving, so as to form small squares, by floating threads, with plain woven center portions, said centers, on account of the tight interlacing, being made lower than the sides of the squares, thus forming the characteristic honeycomb effect.

HOSE:—A term applied to stockings, for women or children, which are knit the full length of the leg. *Half-hose* are men's stockings, so called from their being only half the length of the leg. *Three-quarters* hose is the name given to a style of children's stockings made three-quarters' length. *Opera hose* is a style of women's stockings made of extra length, so as to come well above the knee. Hose are made on a plain stitch knitting machine, the ribbed tops, if such are used, being first made on a rib machine, then transferred onto a plain stitch knitting machine and the hose completed by it.

LAPPETS:—A name given to a plain or fancy cloth on which figures are stitched by means of special threads. This is done by passing an independent set of threads through a series of needles set in a frame, situated between the reed and the shuttle-raceway of the lay. This frame is arranged so as to slide horizontally to and fro, regulated by the "pattern wheel," and the needles are depressed at proper moments to allow the figuring-thread to interweave with the ground cloth by passing the shuttle and its filling over the figuring-thread. This method of producing figured effects in fabrics was extensively used prior to the invention of the Jacquard loom.

LENO OR GAUZE:—The name given to a variety of fabrics characterized by their openwork effect, somewhat resembling lace. Leno fabrics are fabrics in which the warp threads, in addition to interlacing with the filling threads, are twisted with threads of their own system. Leno weaving is also practiced in connection with other systems of weaving to produce fancy effects. Lenos are usually cotton fabrics, although they are occasionally made from silk or worsted yarns.

LIBERTY:—A name given to their products by Messrs. Liberty & Co., silk merchants of London and Paris, who made a specialty of certain effects in silk fabrics, produced by dyeing, printing and finishing. The term is now applied generally to figured silks resembling the original products.

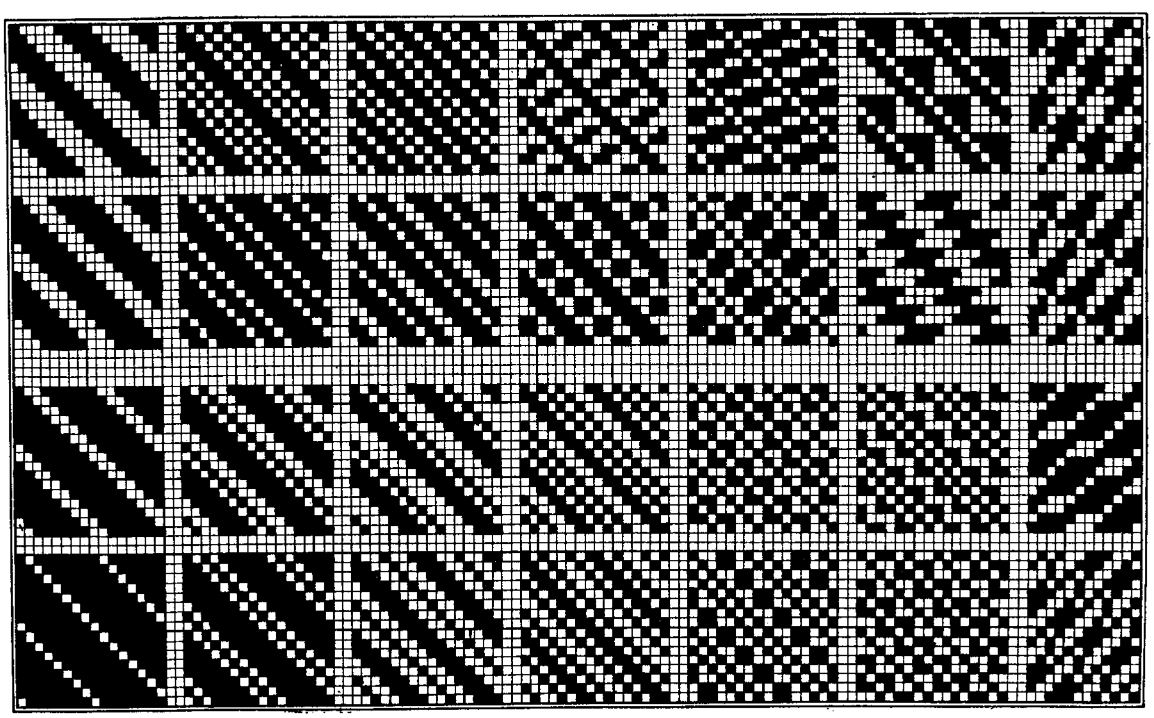
LISLE THREAD:—A thread made from a long-staple cotton, hard twisted, and passed through a flame to remove the loose, adhering fibres ("gassing"). Used for fine qualities of hosiery and underwear on account of the smooth finish and appearance given them.

MERINO:—A term applied to hosiery or underwear of soft quality, which is properly made by using both cotton and wool mixed together, but which is sometimes made from cotton only. Also to the yarn whether used for knitting or weaving purposes—merino yarn.

MOCK LENO:—A variety of cotton fabric made with a weave which produces openwork in imitation of the real leno. This open effect is produced by interlacing warp and filling so that they are drawn together into groups, this forming open spaces between the different groups, which appear in the woven fabric. The openwork in mock leno is not as pronounced as in real leno, neither is it as durable, hence is used only in cheap fabrics.

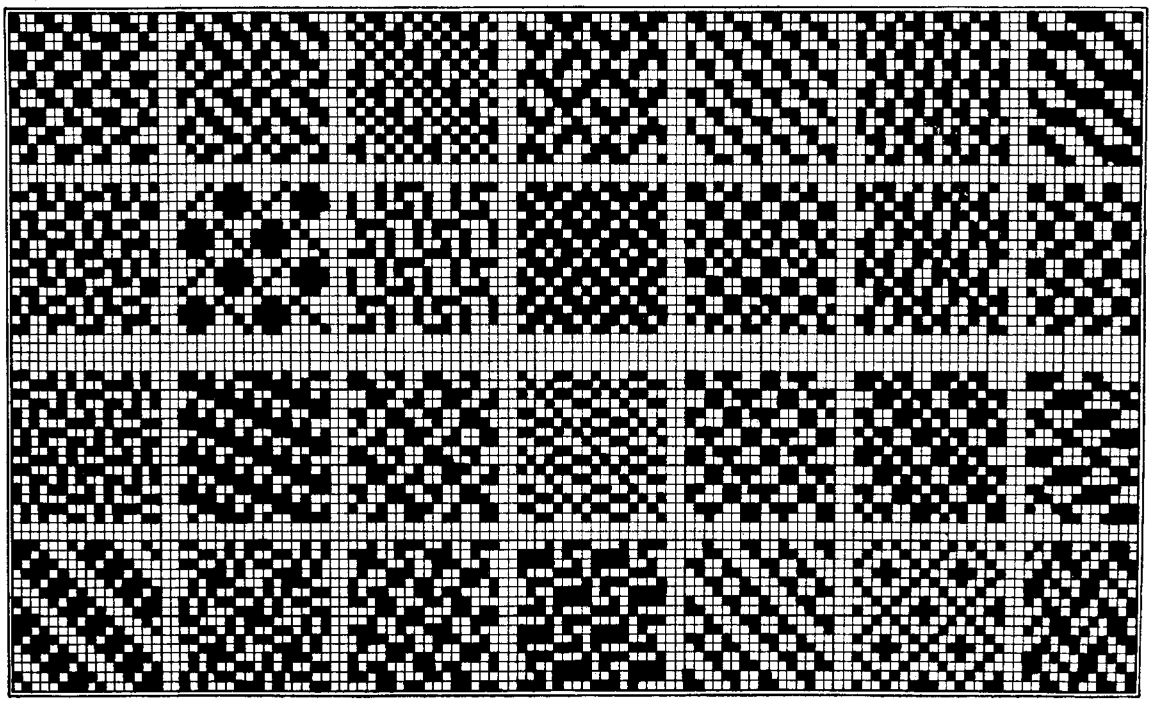
DICTIONARY OF WEAVES.

EIGHT HARNESS



8×8 and 8×12

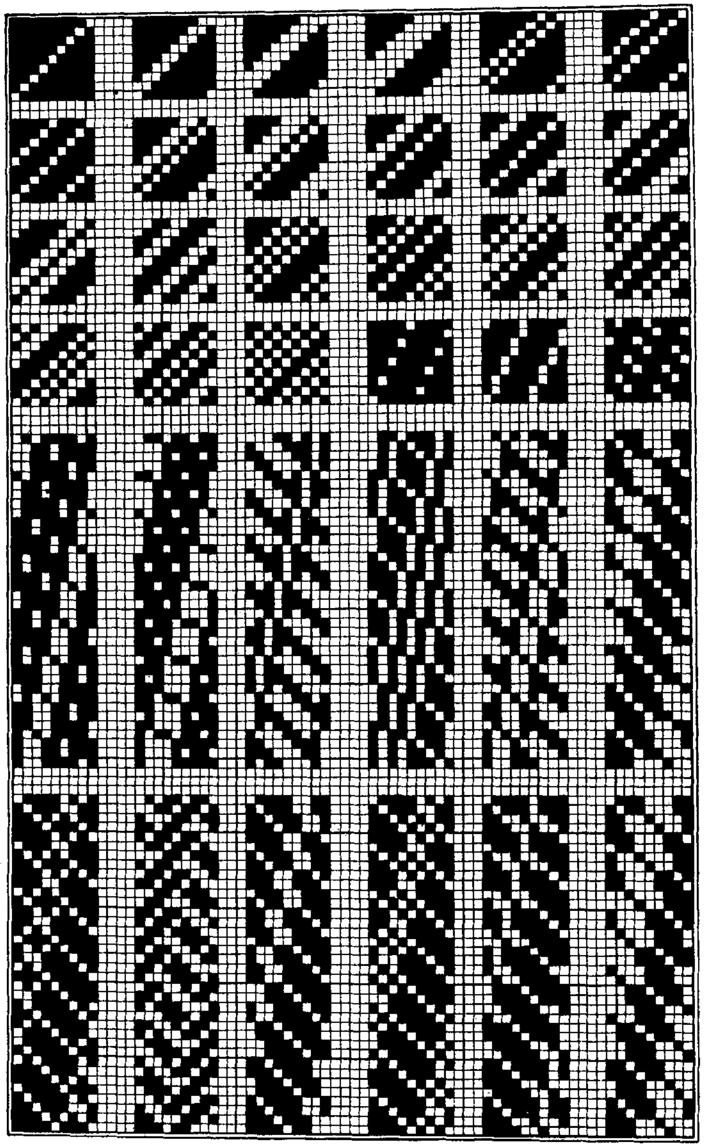
EIGHT HARNESS



8×8; 8×4 and 8×12

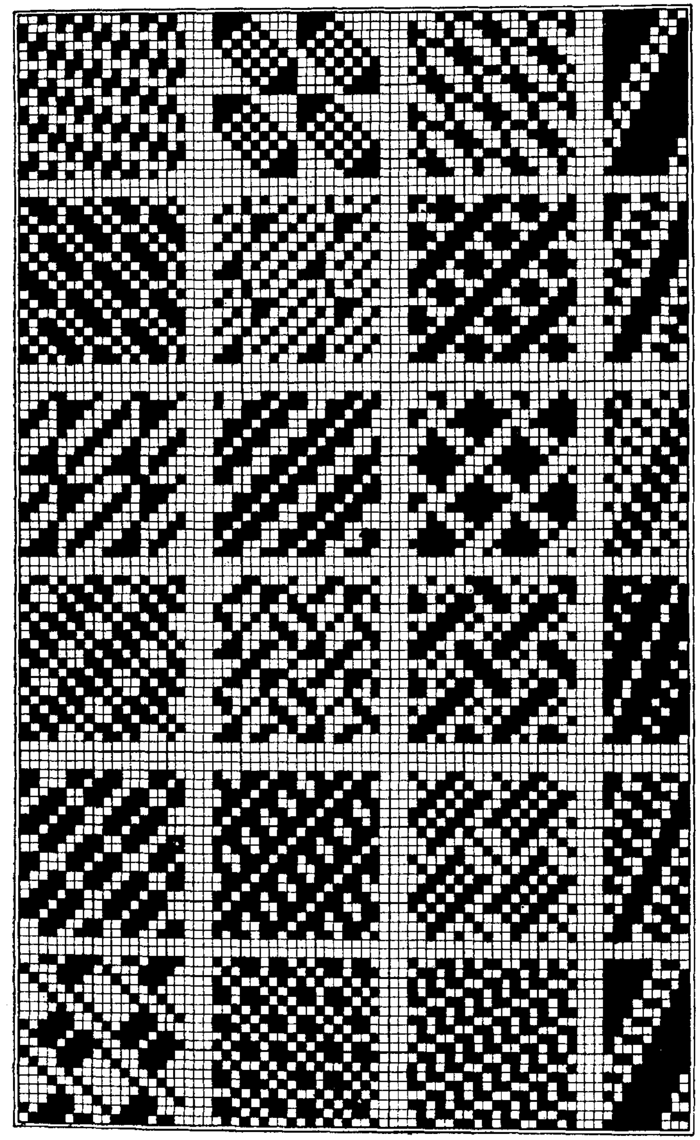
DICTIONARY OF WEAVES.

NINE HARNESS



9 × 9 and 9 × 36

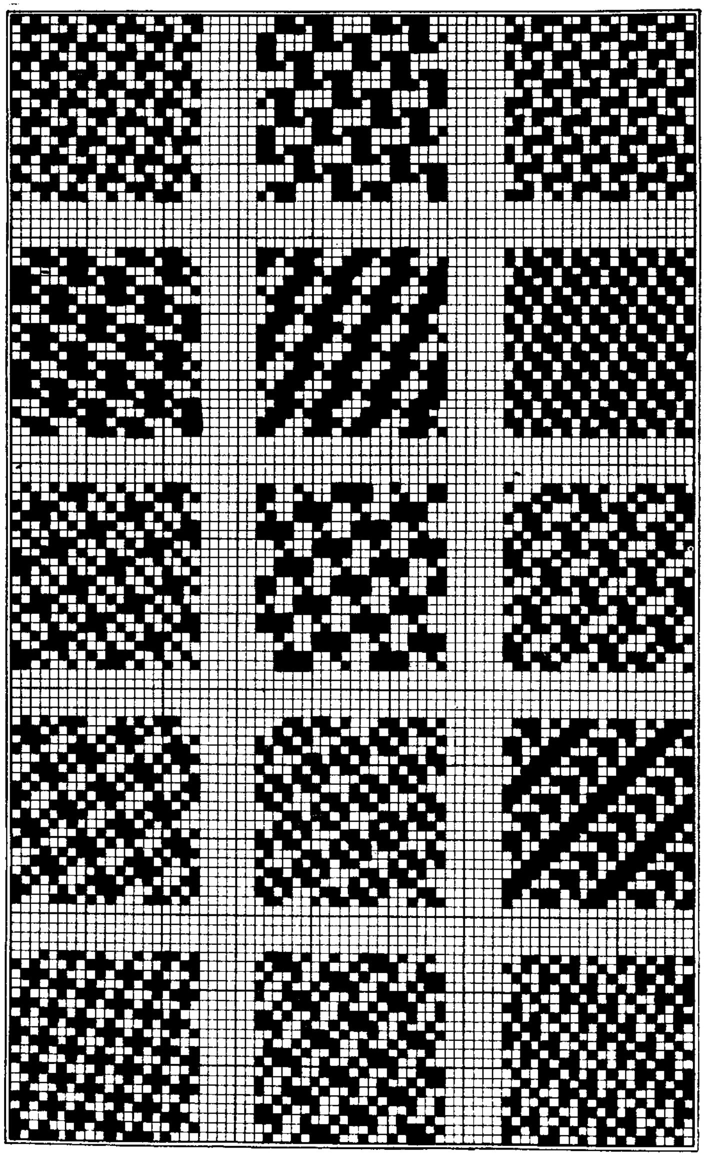
NINE HARNESS



9 × 9 and 9 × 18

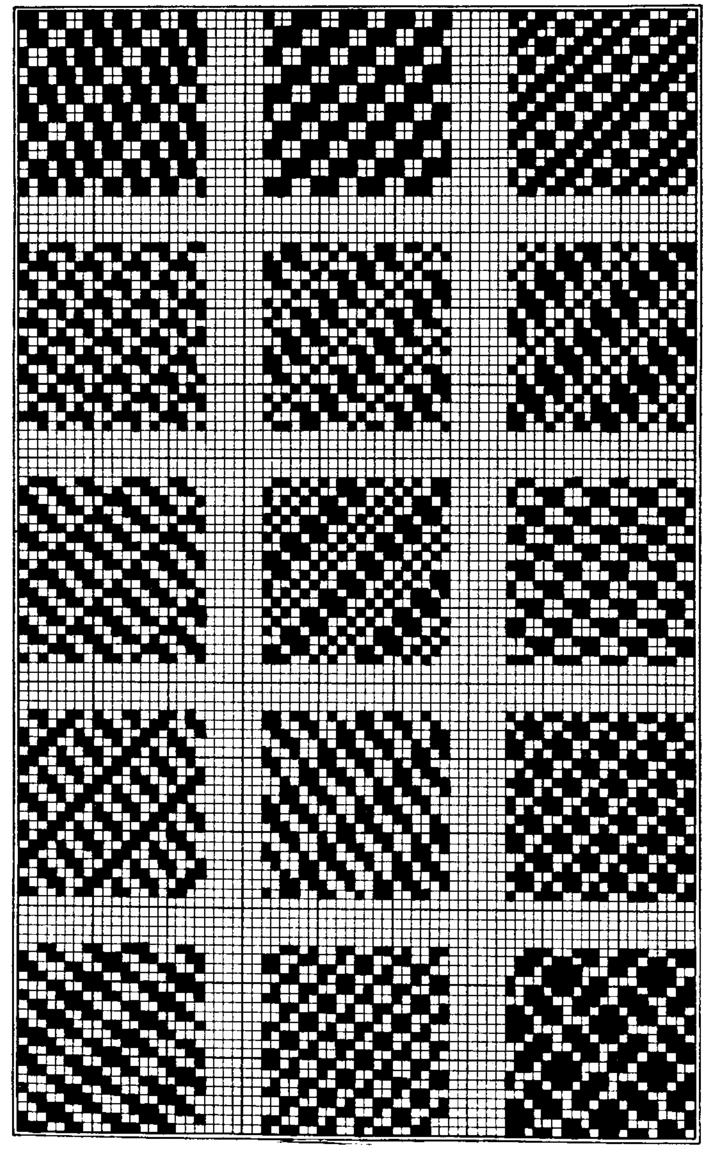
DICTIONARY OF WEAVES.

TEN HARNESS



10 × 10

TEN HARNESS



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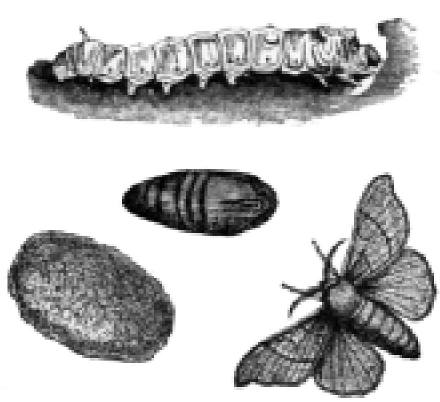
SILK FROM FIBRE TO FABRIC.

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.

True Silk or Cultivated silk or (plain) silk is the lustrous, fine, but comparatively strong, thread spun by the silk worm (the larva of the silk moth Bombyx mori) at its entry into the chrysalis stage.

Silk differs from our other textile fibres in the fact that the silk worm produces a (double) delicate thread, hundreds of yards in length, and four, five or more of these threads, by means of a simple process of reeling, (at the places where the silk is raised, in order to produce a thread which can be commercially handled) are then united into one thread and wound in a skein, in which state, after having been carefully packed in bundles, the silk thread then reaches our manufacturers. The silk manufacturer thus dealing with a thread for his raw material, explains why the machinery and processes used in preparing silk for the loom are much simpler and less cumbersome than the machinery and processes necessary for preparing other textile fibres and making them into thread.



THE SILK WORM.
Larva,—Cocoon,—Chrysalis,—Moth.

The factors which make silk the most valuable fibre for textile fabrics are: (a) its high state of brilliant lustre, surpassing in that respect the other textile fibres; (b) its strength, which also surpasses that of the other fibres; (c) its elasticity, and (d) its great durability.

Peculiar characteristics of silk are: (1) When passed through an acid bath (acetic acid) and afterwards dried, when handled, it gives out a peculiar rustling, grating noise, termed "scroop." (2) It takes coal-tar dyes with ease, and (3) exhibits a very great affinity for weighting materials, which is made use of by manufacturers to a great extent, in fact, in some instances is overdone, since such silk fabrics are mainly composed of metallic weighting matters with a very small percentage of silk fibre.

The quality of silk is judged, to a great extent, by its fineness and regularity of thread, and its clearness or freedom from knibs and badly attached filaments.

Like all other textile fibres, silk absorbs moisture from the atmosphere without appearing very damp to the touch of the hand, for which reason, on account of its high cost, when purchasing a lot of silk for his mills, the manufacturer must carefully look into this matter. The legal limit of moisture permissible is fixed at 11 per cent.

The countries that produce cocoons and silk are in the temperate zone. Starting from Japan to China and the belt of Central Asia, including a part of India, the silk-producing belt runs westward through Persia, the Caucasus, Syria, Asia-Minor, Turkey, and the countries of South and Western Europe, stopping at the Atlantic, which to any extent, it has not yet crossed, Asia and Europe being the two Continents on which the world has to rely for its silk supply.

The annual supply of raw silk throughout the world is approximately thus: China 40%, Japan 20%, Italy 20%, Levant 10%, France, Austria, Spain and Portugal 10%. Of the total silk supply of the world, this country consumes about one-third, and of which about 46% is furnished by Japan, 30% by China and 24% by Europe. The raw silk reaches this country in skeins made up into bundles, called "books," which are carefully packed in bales of linen, with an outer covering of rush matting.

China supplies two distinct kinds of silk, *viz.:* a silk shipped from Shanghai, known as "China silk" and a silk shipped from Canton, known as "Canton silk," both of these being either home-reeled, re-reeled or steam-reeled. Of these, home-reeled is the inferior silk, the reeler being careless whether one, two or more cocoons are run out—any old haphazard way of reeling will do. The term "re-reels" refers to home-reeled silk re-reeled, bad ends as well as poor piecings being taken out during the process; at the same time the silk thus treated is given a general cleaning, with the result of a pronounced improvement to the yarn, accompanied by a higher market value. Steam-reeled silk refers to the most even silk, consequently more valuable than either one of the kinds of silk previously mentioned, the reeler in this case being careful to keep the thread, as reeled, as uniform as possible, replacing any run out or broken down cocoons at once with new ones. The average weight of a silk bale, as coming from China, is 100 lbs., and each bale contains 12 books. The latter, in turn, are subdivided into 12 "mosses," and these again into "slips," which vary in length according to the quality of the silk. Coarse silks, not suitable for throwing, are used for tying up the books as well as for protecting the ends, and these coarse silks are used in Waste Silk spinning. Comparing China silk and Canton silk, the first thing we notice is a difference in their color, as well as the difference in feel when handling both kinds. Chinas, as a rule, are white silks, whereas Cantons are of a variable greenish brown. Again, China silk is a firmer thread than Canton silk, a feature readily noticed at throwing, when the latter will work "fluffy." Steam-reeling in connection with both silks is fast superseding home-reeling.

With reference to Japan silk, most all of it is either re-reeled or steam-reeled silk, and is a clean, fairly even thread, of a grayish white color (not as white as China), the books weighing from 4¼ to 4¾ lbs., and are put up in bales weighing below 150 lbs. Most all Japan silk is shipped via Yokohama. The best grades of this silk closely rival European silk.

The various kinds of silks of India are collectively known as Bengal silk, and they differ from those previously referred to in color as well as in their mode of packing. The color is generally a bright yellow, and in a few cases a greenish white. The first is the more valuable. The skeins are not made up in books, but are packed with their heads loose, in bales weighing about 145 lbs.

The European silks, including those of the Levant, are the finest, and consequently highest priced silks in the market, the best of them, if demanded, running as fine as 480,000 yards to the pound. The usual color is yellow, although some varieties are of a grayish white. They are divided into four grades, *viz.:* (1) Extra classical, (2) classical, (3) sublime and (4) common, and are packed in bales of one hundred kilos, (about 220 lbs.).

New York City is the only raw silk market here, and now holds the first place among all the raw silk markets of the world, Shanghai alone excepted; more raw silk being now sold here than is consumed in France.

The standard sizes of swifts in our mills are 22 to 24", that is to suit skeins to measure 56 to 58" in circumference. Of the silks handled by our throwsters, Japan silk conforms more to this standard than Canton and Italian silk. China steam-reeled silk, is also quite uniform in the diameter of skein, but the common complaint amongst throwsters is that they put too little silk in their skeins, which makes them, in throwster's parlance, too "skinny," by this is meant not enough yards of silk in a skein, to suit production. There is little uniformity in the length and size of Canton skeins. However, with the general introduction of steam-reeling, all over the silk belt, the standard of the skein gets more uniform every year.

The counts of silk most in demand by our broad silk and silk ribbon mills are 13/15 deniers.

Silk Throwing. This is the name given to the series of operations through which the raw silk passes to transform it into what is known as thrown silk.

Splitting and Sorting. The raw, or hard, silk is received by the throwster in the shape of books or in large skeins, each skein in turn containing several matted parts, *i. e.,* sections of skeins, called slips or gums. If the silk is received in the form of books, the throwster separates them into their separate parts, called mosses, which is easily accomplished, since they are entirely apart from each other in the book. The large skein would be too heavy to put upon the reel of the winding frame, *i. e.,* the strain on the single end in the winding process would be so great that it would continually break and thus cause endless trouble to the winder, with its consequent amount of waste to the mill. For this reason, the throwster splits up the large skeins into sections, generally from 3 to 6, and thus has a chance to handle them properly. The size of these splits or sections, as made from the large skeins, varies, although it is the throwster's object to have them as much alike as possible. It will be readily understood that this separating of the skein into slips is a most tedious work when handling poorly reeled silk. After thus separating the large skeins into workable slips for winding, the latter are then carefully sorted out as to counts, color and general condition, each kind being put in separate piles and worked separate.

It now depends on the throwster whether he will work the silk "bright" or with "soap." By the first is understood that he will work the slips as they are, whereas by the latter is understood that the slips are subjected to a general washing process first.

Soaking. This is not a very complicated operation, the slips being soaked in a solution of hot water and soap. The hot water, in connection with the alkali contained in the soap, will soften the natural gum of the silk, which makes the threads adhere to each other, in turn, separating the threads from each other, which, until soaked, more or less tenaciously adhere to each other. The fatty matter the soap contains is simultaneously deposited onto the thread and this prevents the matting together of the ends during the drying of the skeins of silk. The soap being the prime factor for this loosening of the silk threads from each other, and since it must be used, in order to facilitate winding, it must be a white curd soap of the best quality, since a cheap soap of poor color, will dry yellow on the silk, and consequently lower its quality and value. A poor soap used will thus not only act harmfully to the silk to be thrown, but also to the waste made during the process, cheapening both. The fatty matters of the soap thus deposited on the silk will naturally act as a weighting compound, some throwsters using more soap than others for this purpose, the most satisfactory plan being to use enough soap to cause a moderate weighting. Silk thus washed with a good white curd soap will lose about 28% during the boiling-off process later on, whereas silk thrown minus washing, *i. e.,* thrown bright, will lose only from 20% to 22%, showing a weighting of silk by the soap, of from 6% to 8%. Some throwsters also use special compounds in place of the soap, which they put on the silk skeins by means of a brush, the silk being left to lie in this state for a day, *i. e.,* until the gum gets softened. A good reliable soap, however, is preferable.

After washing, the skeins are wrung out, thoroughly hydro-extracted and somewhat dried, either in the open air or in a dryer.

(*To be continued*)

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.

Knitting forms one of the great divisions of fabric structure, and differs radically in the principle of producing the fabric from that of weaving, being based on the principle of forming a fabric or web by means of a series of interlocking loops, from one or more continuous threads. Different systems of interlocking the loops produce different styles of stitches, each being best suited for certain kinds of fabrics, etc.

The early history of mechanical knitting, *i. e.*, the origin of the stocking frame, the first practical knitting machine, is surrounded with considerable uncertainty, both as to the inventor himself and to his motive or reason for planning such an invention. Some few writers ascribe the invention to one Jean Hindret, a Frenchman, but the weight of authority is in favor of William Lee, an English clergyman, who, it is claimed, perfected the first practical knitting machine in the latter part of the 16th Century. Accepting this latter conclusion as being true, we find ourselves confronted with more or less romantic stories as to the cause of the invention, that is, why Lee, a clergyman, should turn to so prosaic a subject as knitting stockings.

The first of the stories might be taken as showing the power of love, or, that a man in love is capable of doing anything to gain the society of his lady-love. In this version, Lee is represented as being deeply in love with a young lady whose passion for knitting exceeded her love for her suitor; every time Lee visited the young lady, he found her knitting, knitting, and knitting, so that in sheer self-defense, he turned his attention to making a machine that would do the knitting itself and leave his lady-love free to accept his attentions. He succeeded, history says, in inventing a machine that could be operated by one hand, leaving the other hand of the young lady free to be used in the lover's pastime of "holding hands."

The second story is more prosaic, the compelling motive for the invention being necessity, the mother of all inventions, according to the poets. This version goes on to say that Lee was reduced to great poverty by being expelled from his university living, on account of marrying in violation of its rules, and that his wife was compelled to work day and night knitting stockings to help support his family. History does not say whether or not Lee himself worked, but, from the statement that he got his ideas for a knitting machine from watching his wife's daily task, it may be presumed that he did little else, which is a habit of inventors. Possibly he had worked up more trade than his wife could supply with stockings, hence the desire for a machine to supply the demands, the perfection of which took five years of his time. History is also silent as to how the Lee family lived meanwhile, but it may be accepted that his wife continued her knitting by hand; nor is there any reliable account of the effect on the family fortunes of the finally perfected knitting machine.

It must be confessed that both of these stories seem plausible and are strikingly like other "romances of invention," in which the inventor is always either in love and spurred on to great deeds, or else is in the deepest poverty, with a loving wife and large family, who work while he dreams, but, unfortunately, there are some actual facts on record that tend to discredit these romantic versions of the occurrence. The only value they possess, from a historical point, is in their agreement on the name of the inventor, William Lee, and that he was a clergyman. Why a clergyman, of all men should conceive and perfect so radical and so complete an invention, none seem to be able to explain, except as just stated. The real facts in the case seem to be quite different. We find the following statement in Cooper's "Athenæ Cantabrigienses," quoted by Felkin in his history of Lee and his invention:

"William Lee, who was born in Woodborough in Notts, and who is said to have been heir to a good estate, was matriculated as a sizar of Christ's College, in May, 1579. He subsequently removed to St. John's College, and as member of that house proceeded B. A., in 1582-3. We believe that he commenced M. A. in 1586; but on this point there seems to be some ambiguity in the records of the University. In 1589, at which time it is stated he was curate of Calverton, about five miles from Nottingham, he invented the stocking frame."

This statement certainly connects Lee more closely with the invention of the stocking frame than the ones previously referred to, since it shows Lee to have been a man of means, which certainly enabled him to defray his living expenses during the time it took him to perfect his machine, and also the expense connected with a great invention. Besides this, it shows Lee to have been a man of college training and education, and these possibly of such an advanced nature as to take the place of practical experience in mechanics, and thus enable him to invent a machine, which, in its originality of conception, surpasses any other inventions in the field of textile machinery. It must be remembered that knitting by hand (as it is claimed Lee saw his lady-love or his wife doing) and mechanical knitting (his invention, *i. e.*, the stocking frame, which is the foundation of every existing hosiery machine) have scarcely a single common feature with each other in their operation.

Other men, since Lee's time, closely connected with prominent improvements in knitting machinery are:

William Cotton, the inventor of "Cotton's Patent," (who was at first a stockinger in a remote Leicestershire village); Samuel Lowe, a foreman in a hosiery factory, (who was the inventor of "striping," "splicing," and "chevening" applications to Cotton's patent); Luke Barton, (who between 1838 to 1840 invented the first effective rotary frame, and, in 1858, in addition to it, an automatic narrowing apparatus); Walter Aiken, of latch needle frame, etc.

The Operation of Knitting is performed by means of knitting needles, there being two general styles in use, *i. e.*, the latch needle and the spring beard needle. The "knitting needle" of the knitting machine must not be confused with the knitting needles used for knitting by hand, as they are radically different, both in construction and operation. Machine knitting needles resemble more nearly the so-called "crochet needles," in having a hook at the working end, while hand knitting needles have no hook, being, in fact, nothing more than a piece of polished wire, blunt at both ends. The method of forming the loops with the machine needle is different entirely from that used for forming loops with the hand needle, but it is similar in principle to the method used with the crochet needle.

The following diagram, based upon the uses of the two kinds of needles, as a foundation for classifying the processes of knitting, will explain itself. It shows the development of the final processes and products through the variations of the two styles of needle.

- KNITTING
  - Latch Needle
    - Plain — Hosiery and Underwear
    - and
    - Rib — Hosiery and Underwear
    - Seamless or Seamed
  - Spring Needle
    - Plain — Hosiery and Underwear — Seamless or Seamed
    - and
    - Rib — Hosiery and Underwear — Seamless or Seamed

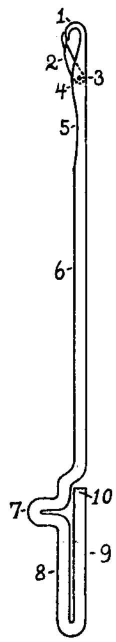
With reference to knitted fabrics, (exclusive of novelties) the same can be classified in the following three main divisions: (a) Hosiery, (b) Ribbed goods, (c) Flat goods.

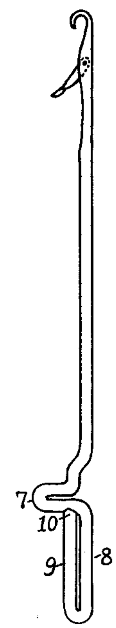
Hosiery includes: Full length and half hose, either seamless, full fashioned, or seamed.

Ribbed goods include: Tops for hose and for sleeves and legs of garments, also underwear of various kinds.

Flat goods include: Underwear, full fashioned or else cut and shaped from the piece and sewed up into the garments, etc.

The Latch Needle. Fig. 1 shows us a specimen of a typical latch needle, and in order to acquaint the reader with the technical names of the various portions of this needle, numbers of reference have been given. In this illustration 1 indicates the Hook of the needle, 2 its Latch, held by the Rivet 3 to the Cheek 4 of the needle; 5 is the Throat, 6 the Stem, 7 the Butt, 8 the Shank and 9 the Back-Shank of the needle. The needles, as used in the different makes of machines, vary somewhat in shape of construction, more particularly with reference to the Stem, Butt and Shank.





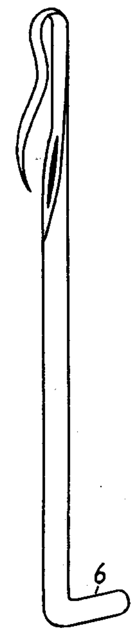


Fig. 1. Fig. 3. Fig. 4. Fig. 5.

The most important function of the latch needle is the free and easy working of the latch, *i. e.*, the proper rivet used. A few years ago, the Dodge Needle Co. patented an improved method of riveting their needles. which is shown (enlarged as compared with Fig. 1) in diagram Fig. 2, *a* is the rivet, *b* the cheek of the needle. It consists of a sunken-head rivet which takes the head of the rivet out of the way of

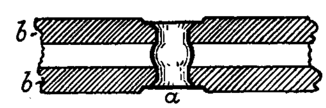


Fig. 2.

the fibres of the yarn as fed to the needles, with the result that no roughening of the yarn by a swollen or protruding rivet (as may be the case with a flush head rivet) will take place, in turn resulting in a smoother surface to the knitted fabric.

Another improvement to knitting needles, made by this same firm, consists in providing a "Lock Back-Shank" to the needles, in order to prevent the displacement of the bent-over part, *i. e.*, the back of the needle, during the operation of the machine, and which, if it occurs, will be the reason for the needle to bind in its slot, and, in turn, in many instances will be the cause of needles breaking, damaged goods, and besides, a loss in production. Fig. 3 shows this Lock Back-Shank, and by comparing with Fig. 1, it will explain itself (see number of reference 10 in both illustrations, as referring to the end portion of the back-shank).

There are some makes of latch needles met with, which differ, with reference to the shape of their shank, with those described. The principle of the head portion of the needle, in all cases, however, remains undisturbed. The shape of the latch needle used in connection with the different makes of knitting machines we will illustrate when taking up the construction of the different machines.

The Spring Needle, also called the spring beard needle, is shown in diagram Fig. 4, the same referring to a typical specimen of such a needle, that shown being what is known as a "not leaded" needle.

Numerals of reference accompanying the diagram indicate thus: 1 the Head, 2 the Spring Beard, 3 its Crimp, and 4 the Eye, or recessed place, into which the Point 5 of the Spring Beard 2 enters, *i. e.*, is pushed into, during one stage of the process of knitting. The Shank of the needle is shown at 6. Fig. 5 shows a spring needle known as the "Trick" needle. The shape of the Shank 6 is changed, (to form what is called the "trick") as will be readily seen by comparing diagrams Figs. 4 and 5 with each other; the other parts of the needle are not changed.

The Principle of Latch Needle Knitting. As previously referred to, the Latch needle is used for Plain and Rib Knitting. Having given a description of the needle itself, we now will take up the two kinds of knitting and describe their operations in detail.

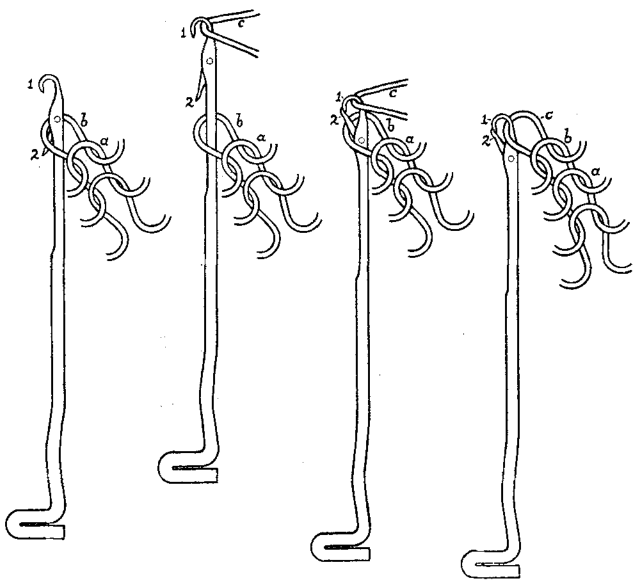


FIG. 6. FIG. 7. FIG. 8. FIG. 9.

Plain Stitch. The principles of knitting, or making a stitch on the latch needle, can be best explained by means of the accompanying illustrations, Figs. 6 to 9, which show a single needle, (for clearness) also showing the successive positions of the yarn and the needle during the operation of making a stitch. In these illustrations, only one needle has been used and the stitches are shown as made by that needle alone. It must be understood, however, that each needle on the machine makes, in turn, a similar stitch from the same thread, and that the different loops or stitches, shown in these illustrations as different threads, are really only different portions of the same continuous thread, the stitches shown being made, one at a time, until a complete circular course of the fabric has been completed by one revolution of the cylinder, or of the yarn carrier, according to the type of machine in question, and then the same operation is repeated for each succeeding course of the fabric. It is here understood, that, for clearness, the yarn carrier is not shown, since the same has nothing to do with the knitting operation any more than to feed the thread, in rotation to the hooks of the needles.

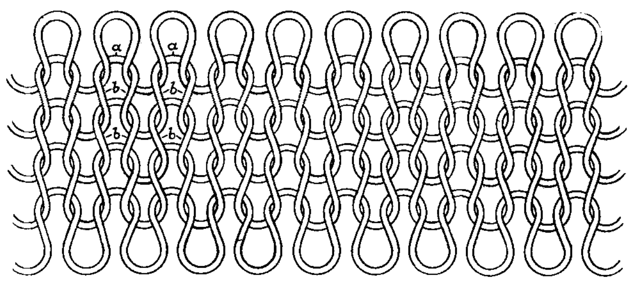


FIG. 10.

Fig. 6 is a diagram, showing the position of the needle and a loop of yarn *b* resting on it, when said needle is in its normal or resting position, the stitch *a* having been made previously by this needle. It will be noticed that the loop *b* is resting on the latch 2, which is turned back at this particular stage of the operation, thus leaving the hook open.

Fig. 7 shows the needle as it would be when raised to its highest position, in which it is seen that the loop *b* is resting on the neck of the needle, below the latch, and that the yarn *c*, for forming the next loop, has been deposited in the hook 1 of the needle. The needle is now given a downward movement, and the latch 2 and the loop *b* now take the position shown in Fig. 8, the loop *b* practically remaining stationary while the needle moves, thus causing said loop to push up the latch 2 and close the hook, as the needle slides in the loop. The loop *b* is now free to slide over the end of the closed hook, while the newly deposited yarn *c*, which now also is formed into a loop, rests in the closed hook. The needle descends further until the loop *b* finally slides over the end of the hook, or is, what is technically termed, *cast off*, as shown in Fig. 9. After casting off the loop, which we now call a *stitch*, the needle returns to its normal position, shown in Fig. 6, and the loop *c* takes the same position as was held by loop *b* in that diagram.

By using a set of needles, as is done in a knitting machine, a series of loops are formed at every course, and on the next course new loops are drawn through these, thus interlocking them and making a uniform web.

This system of knitting with one set of needles will produce a "plain stitch" web, a diagram of a portion of which is shown in Fig. 10. It will be noticed that all of the loops *a* of the stitches are on the back of the web; in a knitted fabric, however, the loops are longer than they are wide, as shown in the diagram, hence they produce a smooth and even surface. The sides, or converging portions *b,* of the stitches are all on the face of the web, and being close together in the

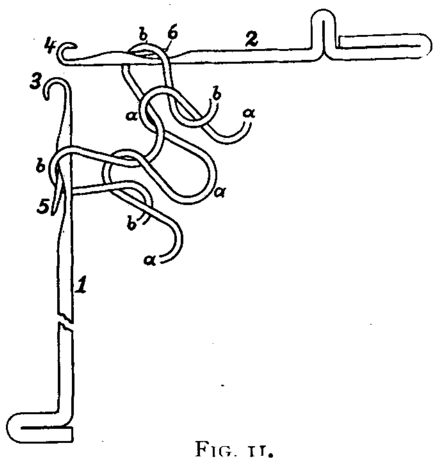


FIG. 11.

fabric, will form a rib or raised line for every vertical row of stitches, said raised lines being close to each other.

Owing to the smooth inside surface of the web produced, this style of stitch is used almost exclusively on fabrics worn next to the body, such as underwear, stockings, etc.

The Rib Stitch. The operation of knitting by means of two separate sets of needles is best shown in connection with Figs. 11, 12, 13, and 14, which are diagrams representing the four principal positions which the needles occupy during the making of the

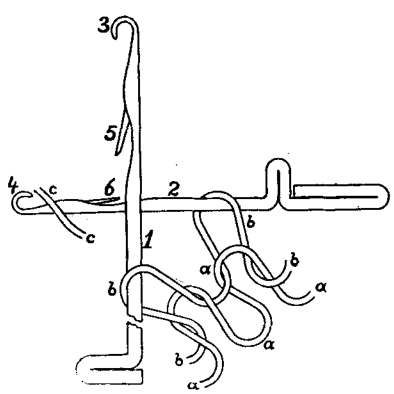


FIG. 12.

stitch. The action of the needles is similar to the action of the single needle already explained, and the two sets work in conjunction with each other. Only one needle from each set is shown, and the web produced is shown twisted out of line in order to see the stitches to better advantage. In the illustrations, 1 and 2 indicate the body of the vertical and horizontal needles, respectively, 3 and 4 are their respective hooks, and 5 and 6 their latches. Each needle makes a stitch from the same yarn, as shown by the loops on both needles made from the yarn *b*, stitch *a* having been previously deposited on them and the stitches formed from it. Fig. 11 is the normal position of the needles and loops, in which it is seen that the loops *b-b* of the yarn rest on the latches of the respective needles, which are turned back at this stage of the operation. These needles are, at the proper time, moved, respectively, upwardly and outwardly, and the loops then rest behind the needles, as shown in Fig. 12 at *b-b*. At the same time, the yarn carrier, not shown here, deposits the course of yarn *c,* which rests on the projecting end of the horizontal needle 2, just below the hook. Then the vertical needle 1 starts downward, as shown in Fig. 13, and its hook 3 catches the yarn *c,* as deposited on the horizontal needle, and begins to draw it into a loop. Just after this, the horizontal needle 2 is drawn inward, and catches the same yarn in its hook, and as the two needles continue

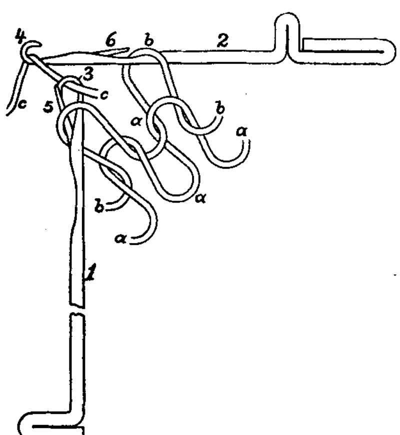


FIG. 13.

to move away from each other, the respective loops *c-c,* which were resting behind the latches, now close said latches by coming under their back-turned ends, thus enclosing the new loops of yarn *c-c* in their hooks.

The loops *b-b* which were resting on the needles are now free to be cast over their hooks, when the needles have moved sufficiently far inwardly and down-

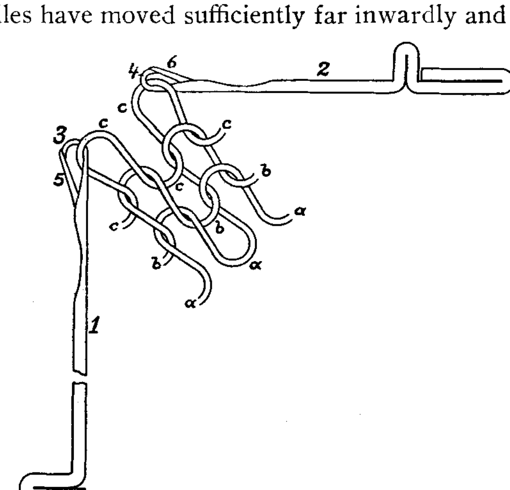


FIG. 14.

wardly. This last position is shown in Fig. 14, in which the needles have moved downwardly and inwardly, respectively, as far as possible, thus casting off the loops of the yarn *b-b* and making stitches of them. The needles then assume again the positions shown in Fig. 11, the loops of the yarn *c-c*, of course, taking the place of the loops of yarn *b-b*, and the procedure is repeated.

The appearance of the web made with two sets of needles is different from that made with one set, and this fabric is known as "rib stitch." A rib fabric is characterized by the fact that each side presents a similar appearance, that is, each side contains rib lines with a small space between each of these lines. The

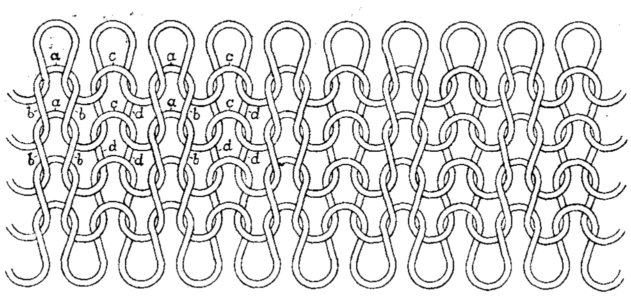


FIG. 15.

rib lines on one side of the fabric come opposite to the spaces on the other side, which can be readily understood by referring to diagram Fig. 15, which represents a portion of the web. It will be noticed that every alternate horizontal part of the loops *a* is on the back of the web, and therefore the converging parts *b* of the stitch will be on the face of the web, and will make vertical rib lines with the successive stitches drawn through them. The loops *c* of the stitches, between those just referred to, are on the face of the web, and consequently the converging parts *d* of the stitches will be on the back and form rib lines there. As the loops on both sides of the web form smooth places, it will be readily seen, that, by the stitch thus explained, these smooth places occur just opposite to the rib lines on the other side of the web, and also come between the rib lines on the same side of the fabric. Owing to the elasticity of this style of web, it is used for making tops for half hose, wrists of undershirts, etc.

The stitch thus explained is known as 1 : 1 rib stitch. Other varieties of this stitch are derived by combining the action of the two sets of needles either 2 : 2, 3 : 1, 4 : 1, etc., by which we mean, that, for instance, with the 2 : 2 rib stitch, 2 rib lines alternate with 2 smooth spaces on each side of the fabric, the rib lines on one side of the fabric being directly opposite the smooth spaces on the other side of the fabric. It will be readily understood that in order to produce this stitch, two needles from one set must be placed side by side to alternate with two needles of the other set.

In order to produce a 3 : 1 stitch, three needles of one set must be placed side by side to alternate with one needle of the other set. The fabric produced will, of course, show a predominance of rib on one side, and smooth portion on the other. It thus will be seen that the varieties in rib stitches may be obtained by simply arranging the two sets of needles according to the stitch desired.

The Tuck Stitch. This stitch is derived from the rib stitch, by a modification of the action of the needles. The tuck stitch is made from two sets of needles, and on the same machine as used for the rib stitch, by a certain cam action that will be explained when describing a typical machine. With the rib stitch, each loop on each needle is cast off after every course of yarn has been deposited in the hooks, as was explained, while with the tuck stitch, the loops on the vertical needles are cast off after every course of yarn has been deposited, but the loops on the horizontal needles are only cast off after every other course, thus making two loops to be cast off at the same time instead of separately, this operation, in turn, resulting in half the number of stitches being made by the horizontal needles as are made by the vertical needles.

Since both loops are always cast off the needle with only one loop remaining in the hook of the needle, only one loop forms a stitch, the other simply being bound in with the stitch. A diagram of a portion of a web made with the tuck stitch is shown in Fig. 16, from which the method of interlocking the loops is easily seen.

In the diagram Fig. 16, the stitches *a* are made by the vertical needles, therefore the loops are on the back of the web as in the rib stitch. The stitches *b* are the tuck portion and contain two loops cast over one stitch, said loops being on the front side of the web, indicating that the stitches were made by the horizontal needles. This style of stitch gives a wider fabric than the rib stitch, and is used a great deal for making ladies' underwear, together with the rib stitch, the latter being used when knitting the waist portion of the garment and also for knitting the wrists or ankles of the same or other garments.

The stitches thus explained comprise what are

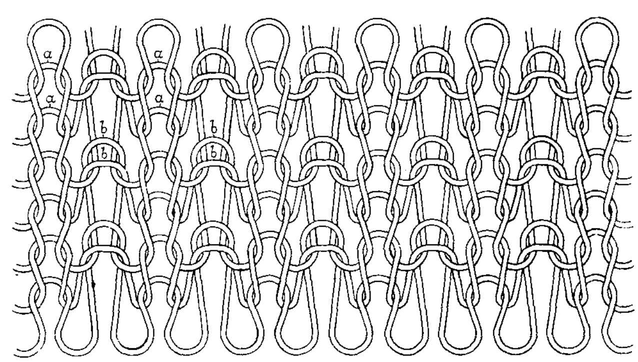


FIG. 16.

termed the foundation knitting stitches, and are found, separately or combined, in all knitted fabrics, either in the original form or in a modification thereof. Different combinations of stitches produce varied effects in the fabric.

(To be continued)

THE BLEACHING, DYEING AND FINISHING OF KNIT GOODS.

The preparation of knit goods (hosiery, underwear, etc.) for the market, which includes bleaching, dyeing, finishing and trimming, as well as the sorting, boxing, wrapping, etc., is really the most important operation in the entire process of their manufacture, since no matter how well they are made or how good the fabric itself is, unless the finished articles are made up in an attractive and pleasing form, they will not be salable. It is a positive fact that the appearance of knitted goods is the first consideration with the buyer, and an attractively finished article is almost always preferred to another less carefully finished, although the former may be an inferior fabric, the defective finish and untidy appearance of the better article making it seem the poorer quality of the two. Consequently, to produce goods readily salable, it is not enough to *make* them good, they must be made to *look* good, and this must always be borne in mind. Don't think that because *you* know that your knit goods are better in quality and make-up than your competitors that the public know it too, you must not only make them *actually* better than others, but you must make them *look* better, if you want to get the public's trade and money.

After all is said, the sales department of a mill is its vital part, for, unless the goods it makes are sold, there is very little use to make them; unless they sell promptly and profitably, there will be no money coming in to pay the operating expenses of the mill, let alone a profit to the owner, and the mill might just as well shut down as to make goods that people will not buy. To make knit goods that will *sell,* in these days of keen competition, is much harder than to *make* goods of the finest grade and quality, the latter is easy, given good machines and skilled operatives, but to sell these goods, they must be made to meet the public taste and must be a little more attractive than the common run. It is a very unfortunate state of affairs that the majority of people prefer articles that *look* good to articles that *are* good, but which are less attractive, but such is the case, not only with regard to clothing, underwear, etc., but even as to foods, and it is also true that the majority of people are totally unqualified to judge of the quality and excellence of textile fabrics, knit goods especially, therefore we must take these things into consideration and be guided accordingly. It is a condition, not a theory, that confronts us, and we must give the public the things they want *in the way* they want them, if we want them to buy our goods, for by the time people are educated up to buying things solely on their merits, most of us will not need money at all.

This does not mean that the knit goods manufacturer should neglect quality and turn all his efforts to making trashy stuff that will satisfy people because it looks pretty and suits their tastes, not at all, this would be a suicidal policy, to say nothing of its bad morals. It does mean, however, that to create a demand for his goods, the manufacturer must spare no time or trouble to make them what people want in regards to style, finish, etc.; let him take a lesson from the trashy stuff that sells so easily because it is made to appeal to buyers by its neatness, ornamentation, design, color, artistic appearance, etc. In addition to making his goods of the best quality, he should finish them in the latest styles of shape, color and design, give them as nearly a perfect appearance as possible, sort and pack them carefully and neatly, put them up in attractive ways so that their merits are at once shown; all this will make people believe them to be the best in the market and such goods will appeal to their taste and pocket books.

No matter how carefully the manufacturer may have selected his raw material and how skillfully it has been worked up into the knitted article, unless the latter is carefully and neatly finished and made of artistic and pleasing design, it will not sell. Bear in mind that every other manufacturer can get just as good machinery and just as good help as you, and consequently can make just as good a quality as you, therefore, to succeed, you must make your products *look* better than anybody else's, and strive to keep always a little ahead of them in newness of style, special designs, artistic trimmings, etc.

Making up Knit Goods. In making up knit goods, the designer's field for novelties is somewhat limited, the general styles, shapes and the character of knit garments having become practically standardized. Thus, the vest or shirt of a two-piece suit of underwear can be only slightly altered in shape or general finish, the same is even more the case with the drawers, while with hosiery there is still less opportunity for change. The only radical variation from the two-piece suit of underwear, the one-piece or union suit, has already been developed and standardized, and unless some new garment is invented, there is little possibility of novelty in shape. In fancy goods, such as sweaters, leggings, caps, etc., there is but little more chance for novelty in shape and general appearance, in fact, entirely new and novel garments or developments of knitted fabrics seem to be a crying need.

Under such conditions, it does not seem practicable to make any radical changes in the cut or shape of these garments, hence the designer's field is, of necessity, limited to the minor details of style, texture, color, finish, ornamentation, trimming, etc. In shape, about the only changes would be the variations of the ordinary shirt and drawers and the union suit, long or short sleeves and legs, high or low necks, etc. About the only novelties in shape, one might say, are the recently designed "athletic underwear," patterned after the garments worn by athletes, and the "coat shirt," which opens all the way down the front or side and is fastened by buttons or hooks.

In texture, for underwear, the variations range all the way from the closest knit fabric to a wide open-mesh work, in all sorts of fabric structure, then there are the so-called "fleece-lined" garments, which are now very popular for winter wear. Various fibres can be used, either alone or in combination, and along this line there is a chance for the development of novelties in fabric structure.

It is in the details of texture, finish, color, trimmings, ornamentation, etc., that the designer has the greatest chance for designing something novel and pleasing, here his taste and artistic abilities can have full scope. Endless variety is possible by the use of various textile fibres and of various stitches, alone or in combination, contrasts in color or trimmings, the use of various materials for trimming and various styles in trimming and finishing, etc., etc. Even in the smaller details of the stitch used for sewing on trimmings and of the kind of buttons used, there is opportunity for making garments novel and attractive in appearance, and these finer points of the art of making knit goods should be given careful attention.

If the goods are to be colored, the nature and qualities of the fibres or materials in reference to dyes and dyestuffs should be considered, since some dyeing agents and mordants are best suited to one fibre, others can be used equally as well with all fibres or mixtures thereof. The details of coloring must be suited to the quality and kind of garment; gaudy colors in underwear will make even the finest grades look cheap and trashy. It is better to finish underwear in natural color or bleached white, and to depend for color-effect on the trimmings, using simple or contrasting tapes, lace, braids, borders, etc., with or without colored, plain or fancy stitching. If colored trimmings are used, the colors should be fast to perspiration, washing, etc., otherwise, the neatest finished garment will look trashy and cheap after being worn a couple of times.

Another thing to be considered is simplicity of finish, as to fastening, buttons, buckles, straps, etc., especially in men's garments. The average man despises underwear that has a complicated system of tapes or straps or buttons and which cannot be put on or taken off with ease and quickness. Women may be satisfied with long rows of buttons or intricate lacings, but men are not, a man may be attracted by the novelty of such a garment and try it once, but ten chances to one, he will never buy another, or even wear the one he bought at first. The manufacturer who will sew the buttons on men's underwear so that they will stand a little wear and use, will gain the gratitude of mankind generally. This can be made a strong advertisement for your goods. Sew the buttons on securely, and then make a specialty of telling about it; when once your underwear becomes known as "the kind that the buttons stay on," you will have a steady demand for them that will keep your mill busy. These seem like trifles and not worth attention, but where several hundred mills are making the same thing, the man who makes his products just a trifle better than the others will sell the biggest amount.

Still another important point in connection with underwear is that they must be made and finished so as to be comfortable to the wearer. They should be of an even thickness throughout, and whatever is added in the way of trimmings, such as tapes, laces, braids, bands, etc., must not be put on so as to make the garment thick or lumpy at any point. The seams that unite the several parts of the garment must be flat, as well as strong, and without a ridged or corded or ragged appearance, and they should be located in the garment, as far as possible, so that they will not cause discomfort from chafing or pressure. Large seams should be overlapped and overstitched, to prevent ripping or ravelling, and where extra thicknesses of fabric are used for reinforcement, as in the seat of drawers, the extra piece should have its edges turned down and double-stitched, flat and evenly. Coarse seams or ridges, or a cord-like appearance at the junction of ribbed tops or cuffs, etc., with the main fabric of the garment should be avoided, and this particular part of the garment should have as much elasticity as the parts above and below it, otherwise, threads will soon be broken and the seam ripped out. The seam at the toe in hose should be made as flat and as thin as possible, with no raw edges.

Having determined the particular fibre to be used for the garment, the gauge of the fabric, its color, etc., the designer should lay a piece of the finished fabric before him and study it carefully before he begins to lay out the pattern for cutting and shaping the garment. He should consider the nature and peculiar qualities of the fabric, its elasticity, whether it will shrink or stretch after being washed or dyed, its behavior to sewing and stitching, how and where it is to be trimmed and what allowances must be made for seams, facings, shaping the garment, etc. For fine grades of underwear, the patterns should be made so as to allow liberal margins for making up the garments, so that when finished they will not look "skimpy" or as if the maker stinted the material to make more money out of it.

In the cheaper grades of underwear and hosiery, of which the price does not warrant much trimming or finishing beyond what is absolutely necessary, there cannot be much attention given to ornamentation or novel effects, but there is still an opportunity for making even the cheapest garment look attractive. The trimmings, buttons, etc., can be selected and put on so as to give them the appearance of being a much higher grade than they really are, care and attention to the details of finishing will make them appear to be of a better quality, and all this will make them much more desired by the purchaser, with only a little money to spend, than better goods carelessly finished. Even if the manufacturer does not get a higher price for such goods, he will be able to sell them much more readily and to make a good profit on the larger volume of sales. Not the least benefit that will accrue to him will be the reputation for making first class, salable goods, which reputation will bring him orders in dull times when other mills are idle. Good goods are always in demand, when properly marketed.

Preparing Goods for the Market. This is a matter to which too much care and attention can hardly be given. How often does one see the finest and best goods made practically unsalable because of careless preparation for the market, careless mixing of grades, glaring contrasts of color in the same box, careless assortment of sizes and shapes, etc. It would do the manufacturer good if he were to take a day or two off from the mill to go around through the big retail stores and look at the way goods are put up, perhaps he would learn why his own sales are slow and why his rival cannot fill his orders.

Take woolen hosiery for an example; if the overseer of the finishing department has not watched things closely, imperfect goods and bad mends will be put in the same lot as first-class goods, inferior grades will be put in with the better grades, sizes will be mixed and colors will be poorly assorted. In consequence, such lots cannot be sold for first-class goods, the presence of faulty pieces will condemn the whole package, and no matter how good the others are, unless the package is re-assorted, the whole lot must be sold as "seconds."

In examining hosiery, previously to packing them for the market, see that every piece that needs it is neatly mended, and do not allow badly-mended pieces to go in under any circumstances, sort and mate the heels and toes and the legs, and see that only one size is packed in the same box and that they are folded neatly and evenly. Have the boxes packed neatly, in dozens or in half-dozens, as the trade demands, see that the packing is done snugly so that the pieces will not be all shaken up in shipment, and send out different colored hose, for assortments, with some regard to color contrast. Carry out such points as these in the finishing department and your goods will never be turned down as "unsalable."

In preparing underwear for the market, the chief desideratum is that each garment shall appear neat and clean and attractive, and that all defective places shall be carefully mended so as not to appear as defects. If the garments are to be white or uncolored, they should be thoroughly washed, cleaned or bleached, and pressed, and should not show any stains or grease spots. Colored garments must not show irregular shading or unevenness and must not be soiled or stained. All pieces should be carefully folded according to trade requirements and then pressed, so as to present a good appearance.

The folding and packing should be done so that the garments will "show up" to the greatest advantage, *i. e.*, so that any special novelty or attraction in design or finish will at once strike the eye of the purchaser. Goods poorly packed will not show up their good points and will be passed over in favor of an inferior article that has been packed so that its best points are made prominent.

These are but a few of the many details that go to make successful business, they are mentioned more in the way of suggestions, which the manufacturer can develop, than with any idea of covering the subject.

The Washing and Bleaching of cotton knit goods is of great importance, their final appearance depending largely on the processes connected with these operations and the care with which they are performed. The knitted fabric, as it comes from the machine frame, is not very clean, and it must be well scoured and cleaned and bleached before it becomes salable. the extent to which these processes are necessary depending on the condition of the fabric as well as on the character of the finished article.

If the fabric is sold in its crude state, *i. e.*, if the manufacturer does not make it up into garments himself but sells the knitted cloth to others, it must still be cleansed from dirt, grease spots, etc., and if it is to be delivered in a pure white state, the fabric must be bleached as well as scoured. If the goods are to be dyed light colors, this preliminary scouring and bleaching are also necessary, but if they are to be dyed black or dark colors, the bleaching may be omitted.

Usually, a fabric that is to be sold in the crude state can be sufficiently cleaned by boiling it in a soap solution, to which a small percentage of alkali may be added if the goods are very dirty. If the fabric must be white, the cleansing process must be more thorough, to remove all the natural wax and fatty matters from the cotton fibres as well as dirt and grease, so that the bleaching agent can act on the yarn evenly and effectively, and the bleaching must remove all spots and traces of color or pigments, no matter of what origin. If this is not done in a systematic and thorough manner, there will be trouble in the dyeing later. Goods should be well rinsed, so as to remove all soap and alkali.

It is sometimes a question as to whether to use a raw yarn or a bleached yarn for knitting fabrics that are to be finished white. In any case, the grease and dirt received during knitting must be removed by washing the finished fabric, so it will probably be cheaper to use raw yarn and carry out all the scouring and bleaching in the finished fabric. This is especially the case with cotton hosiery, which is mostly finished in black or dark colors, as the washing, dyeing, etc., can be performed on the completed article better and with more satisfactory results than on the yarn itself before it is knitted into hose.

Whether white or natural color, the knitted fabric made from raw cotton yarns must be washed with soap and alkali before it is fit for making underwear, as the fibres of the yarn are coated with the natural wax and fatty matters of the cotton, and these must be removed, or the fabric will not absorb moisture, perspiration, etc. It is not desirable, however, to make the yarn for underwear too absorbent, as in that case it will hold the moisture from perspiration instead of allowing it to evaporate freely, making the garment feel damp and uncomfortable, therefore it is an advantage to leave some of this wax on the fibre. The ideal underwear is that which absorbs perspiration freely, yet which allows the moisture to evaporate readily from its outer surface, and which is porous enough to permit a slow circulation of air to and from the skin. Hosiery, on the other hand, should be knit closely and firmly so that it will stand the wear to which it is subjected, and it should not be so absorbent as underwear.

Scouring. Scouring, cleaning and washing are the primary operations in preparing knitted fabrics for bleaching and dyeing. Knitted fabrics made from raw cotton yarns cannot be cleaned successfully with soap alone, as it will not "cut" the wax and fatty matter coating the fibres, and an alkali must be used in connection with it. The alkali may be either caustic soda or caustic potash (soda lye and potash lye) or the carbonates of soda or potash, the soda salts being much cheaper than the corresponding potash salts. Soda lye is harsher in its action than potash lye, whereas carbonate of potash is more caustic than carbonate of soda. The strength of the solution should be proportioned to the strength of the fibre, and should also be varied according to the quality and nature of the yarn or the knitted fabric. Cotton goods can be treated with caustic alkalies without much risk of deterioration, but wool and silk would be entirely destroyed by exposure to their prolonged action. This explains why, when scouring mixed goods, *i. e.,* merino underwear, great care must be taken not to injure the wool fibres, and why caustic alkalies must not be used, carbonate of soda being employed instead. The scouring solutions must not be too strong nor hot and the goods must not be left in them any longer than necessary.

All substances used in scouring must be perfectly dissolved in the water of the scouring bath before the goods are entered, otherwise they are liable to come out spotted or unevenly washed, from coming in contact with undissolved soap or alkali. It is a good plan, and saving of both time and trouble, to dissolve soaps, alkalies, etc., in a small quantity of hot water outside the scouring tub, then to add this solution to the remainder of the water in the vat. With soap, it is advisable to melt down the hard soap with about three times its weight of water, which will make a sort of jelly or paste, easily handled and dissolved. When ready to use this, we simply take a proportionate quantity equal to the required weight of hard soap and stir it into the water in the vat, when it quickly dissolves.

In correct washing or scouring, the bath should cover the goods completely, so that no part of them is exposed to the air, and this point is especially important when handling cotton fabrics. If the fabric is exposed to the air when saturated with alkali, especially when heated, the cotton fibre becomes oxidized and loses its strength, *i. e.,* the yarn becomes "rotted" or "tendered," and the part of a garment thus exposed will soon wear out or the threads will break during the finishing, leaving defects. The fabric may also lose in weight, from the soft parts of the yarn becoming weakened and falling off during the scouring or dyeing process.

THE FIRST OPERATION is boiling the cotton goods with caustic soda, the best proportions being about one and one-half pounds of caustic soda for each one hundred pounds of goods. The boiling requires from four to five hours, and must be continuous, *i. e.,* the temperature of the bath must be kept at the boiling point, 212° to 215° F., during the entire process. After boiling, the goods are taken out, drained and squeezed, or still better, put through a hydro-extractor, after which they are well rinsed in clear water and then passed into a soap bath, four pounds of soap to one hundred pounds of fabric. This second boiling should be kept up for about two hours. After a most careful rinsing, the goods are ready for bleaching, if they are to be finished white; or if to be dyed dark colors or black, they may be at once entered into the dye bath. If the goods are to be finished in natural color, they may go to the finisher without further preparation.

Instead of using caustic soda in the first scouring, the bath may be made up by using 8 to 10 pounds of good carbonate of soda (GRAN-CARB-SODA) and 1 to 2 pounds of soap to each 100 pounds of goods. This solution is less apt to injure the fabric and is therefore suitable for the finer qualities of knit goods. It has been found that the time for boiling-off cotton goods can be much reduced if the goods be first immersed in a weak, lukewarm bath containing about 2% of sulphated oil, neutralized with a slight excess of ammonia water, or in a soap bath containing 1% to 2% strong ammonia. This treatment not only completely removes all the natural oils, etc., on the fibres but also more thoroughly *wets* the goods, *i. e.,* leaves them in a condition so that bleach or dye liquors thoroughly penetrates the goods. The sulphated oil may be either castor oil or olive oil, treated with strong sulphuric acid. It is best to buy it, as the process of making it requires care and skill.

Scouring Machines. Scouring nowadays is usually done in machines, which act on the same principle as the familiar washing machine of the home laundry, the goods being kept in motion through the scouring solution until cleaned. Steam is admitted into the bath through perforated pipes.

A much better machine, in which large quantities of goods can be handled quickly and thoroughly, is the Klauder-Weldon Machine, which is also used for dyeing knit goods, hosiery, etc. The details of the construction and operation of this machine are shown in the accompanying illustration, Fig. 1, which is a cross-sectional view through the central part.

In this illustration, 1 indicates the washing tank, made of wood and reenforced with heavy cast-iron frames at each end, to which the gearing, not shown here, is attached. The cylinder of the washing part of the machine 2, is made almost entirely of white pine and cypress staves, the end heads of the cylinder being supported by bronze castings on the driving

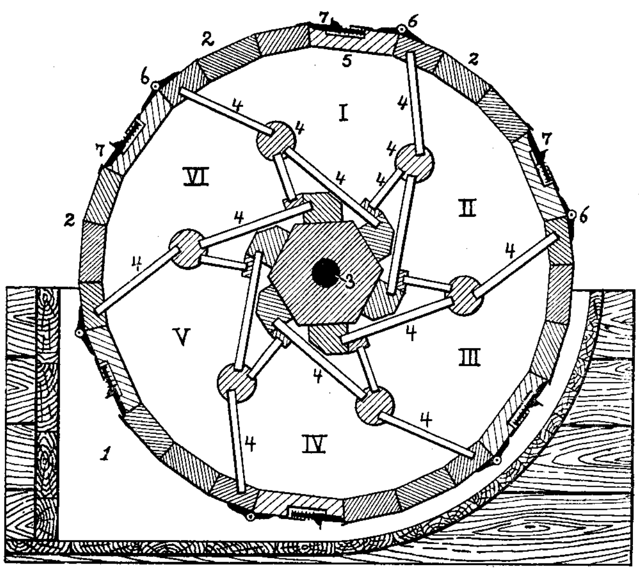


Fig. 1

shaft 3, the hubs of the castings being keyed to the shaft so that the cylinder and its contents revolve with it. This driving shaft 3 extends through the centre of the cylinder and rests in bearings supported by the iron frame of the washing tank. The driving shaft is entirely covered with wood on the inside of the cylinder and made water-tight, so that the goods being washed will not come in contact with it, this being necessary to prevent rust spots from the steel of the shaft.

The cylinder is divided, inside, into six compartments, by the partitions 4, which are so shaped as to prevent the goods from being matted together by the revolution of the cylinder and its contents during the washing process, thus enabling them to be washed evenly and thoroughly. These partitions may be either perforated boards or a series of pins, so placed that there is a perfect circulation of the washing liquor through the goods, an important point, as it insures thorough washing.

Each compartment is provided with a door 5, through which the goods are loaded and unloaded, these doors being perforated to allow the wash liquor in the tub to enter freely into the compartments. Heavy bronze hinges 6 and catches 7 are provided for fastening these doors.

The top covering of the machine (not shown here) is supported at each end by cast-iron frames and is well strengthened with rods. The openings at the back and front of the machine are covered by canvas curtains, which can be rolled up out of the way during the loading and unloading processes. This top covering and the canvas curtains are a decided advantage, as they save steam, by confining the heat, and also insure the maintenance of the required temperature. These, and the shape of the washing tank, allow the minimum of wash liquor to be used. Steam is admitted in the tank through a pipe, which enters at the bottom and extends across it. The goods, being inside the cylinder, are not exposed to the direct action of the steam and cannot thus be injured by it. The tank has an outlet valve, at one side, to discharge used liquors, water, etc., the valve being made as strong as possible.

The cylinder is rotated by a driving arrangement, either from the side or from the back of the tank. When driven from the side, a worm gear is attached to the end of the driving shaft 3, and this gear is driven from a second worm located on the same shaft as the driving pulley. When driven from the back, a bronze head is attached to the periphery of each end head of the cylinder, and this is driven from a shaft extending across the back of the tank, on which are placed two pinion gears which mesh with the teeth in the bronze rack. A worm gear is placed on the end of this back shaft, which, in turn, is driven by a worm attached to the driving pulley, the same as in the first instance. This back drive is preferable, since it does not throw the strain on the central main shaft, the latter simply supporting the cylinder and rotating with it. A hand crank is attached to the machine, so that, in case anything happens to the power during a run, the cylinder, etc., can be turned by hand and thus prevent spoiling the batch of goods.

Care must be taken not to run the machine too fast, or there will be trouble from knotting and bunching of the goods. One machine can handle several lots of goods a day, and from 150 to 400 pounds of goods can be put in at one run, according to their nature. One man can attend three or four machines while they are running.

(*To be continued*)

THE ORIGIN OF SOME DEFECTS IN TEXTILE FABRICS.

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In order to produce a perfect piece of cloth it is not only necessary that the raw material of which it is composed should be of good quality, but that all the various operations involved in its manufacture should be carried out with proper skill and care and with a due regard to each other. Thus the carder, or comber, the spinner, the manufacturer, the dyer and the finisher should each work with a sufficient knowledge of the bearing of his particular operation on other processes of manufacture.

It is therefore very desirable that the dyer should know something about yarn and cloth structure and manufacturing processes generally, while the manufacturer should be acquainted with the nature and effect of scouring, fulling and dyeing operations. The high degree of specialization in the textile trades renders co-operation between the various branches specially necessary, and, at the same time, specially difficult. It is not at all unusual for five or six different firms to be concerned in the production of a piece of cloth and only the manufacturer or the merchant is in a position to know even the names of the whole of the firms.

As a particular case a striped cloth made with white and colored cotton warp threads and a colored worsted filling may be taken. The merchant may take the pieces from the manufacturer with the filling undyed in order that the particular coloring of the pieces may be varied according to the orders received from customers. The manufacturer then orders from the warp dyer the necessary number of bleached warps and dyed warps and after weaving these with the "gray" worsted filling delivers them to the merchant. The latter then sends them, usually in batches at different times, to the piece dyer who dyes the filling and finishes the pieces. In such a case the difficulty of finding the cause of an imperfect result is sometimes very great. Supposing for example, some of the warp threads in the finished piece are found to be broken. This defect of "cracked ends" may arise from a variety of causes; the spinning of the cotton may have been defective or the warp dyer may have tendered the warp in bleaching or dyeing, or again the defect may be due to an improper texture of the fabric structure, or to tendering of the warp during the operation of piece dyeing, or rupture by too great tension during the finishing processes. If however, the exact character of the finished cloth is known by all concerned, and each has a knowledge of the whole series of processes of which his own forms a part, and the general aim is kept in view throughout, there would be much less likelihood of such defects occurring. For example. if the warp dyer knew that the warp would necessarily be subjected to great strain by the finisher he would take special precautions to avoid any weakening of the warp threads and the manufacturer would avoid "crowding" his picks. Then if the piece dyer knew the exact process employed by the warp dyer, he would be the better able to avoid any injury to the warp during the dyeing of the filling.

This example may serve to emphasize the statements as to the desirability of co-operation and mutual knowledge of processes and will also indicate the great difficulty of producing perfect results. As a matter of fact no single piece of textile material is free from blemishes, but it is only when these are of some magnitude that they legitimately constitute commercial "defects."

It will be obvious from what has been stated that a general investigation of the origin of defects in fabrics would involve the consideration of the whole range of operations involved in the various stages of manufacture and of the influence of each process on others. When such a book is produced it will be a most valuable addition to the literature of the textile trades but its compilation will need the collaboration of experts in each of the various branches of manufacture; and all that will be attempted in this series of articles will be a survey of some of the causes of defects which more particularly concern the dyer.

Good dyeing and finishing is perhaps the most important branch of the textile trades as regards the selling qualities of the manufactured article, for however well designed and constructed a fabric may be and however good the raw material from which it is made, its value as a salable material greatly depends on the taste and skill brought to bear in dyeing and finishing. If faulty, the value is correspondingly decreased, but on the other hand the dyer is often able to greatly enhance the value of a cloth made from inferior raw material or of indifferent design or inferior workmanship, by a skilful treatment in dyeing and finishing.

The defects in the dyeing of textile materials are so varied that any classification of them is not easy. Such grouping may, however, be attempted in two ways, *viz.:* (1) as to cause and (2) as to character. In regard to the latter such defects as the following would be distinguished.

1. Irregular colors.
2. Spots and stains.
3. Bad matches.
4. Fugitive dyes.
5. Dyes which rub off or smear.
6. Defects which cause a reduction of the lustre, impoverishment or tendering of the fibre.

An attempt at treating the subject on these lines would however lead to much repetition in explanation of causes: since, for example, defective scouring may give rise to most of the irregularities above mentioned.

The more convenient classification is therefore that based as far as possible on the underlying causes and from this point of view the following headings may be distinguished.

1. *Use of Defective Raw Material.*
2. *Use of Hard or Ferruginous Water.*

3. *Defective Spinning or Weaving.*
4. *Inefficient Scouring and Washing.*
5. *Defects due to Bleaching, Mercerizing, Sizing, &c.*
6. *Mordanting Defects.*
7. *Bad Selection of Dyes.*
8. *Defective Dyeing Processes.*
9. *Defective Finishing Processes.*
10. *Defects due to Machinery and Apparatus.*
11. *Defects due to Drying.*
12. *Unclassified.*

These various causes will be considered seriatim, examples which have occurred in the course of the author's practice being given in most cases.

1. The Use of Defective Raw Material.

WOOL: If any sample of dyed wool is examined under the microscope considerable differences will be noticed in the color of various fibres and even in different portions of the same fibre. This occurs even when the whole of the wool is of the same quality and kind, but such inequalities are not usually apparent as the color of the individual fibres is blended in the eye. In the case of low quality wool, however, white specks may frequently be seen after dyeing, which when examined under the microscope are seen to be structurally different from the dyed fibres, having the appearance of solidified rods of jelly and showing little or none of the cellular structure characteristic of the dyed fibres. These abnormal fibres are known as *"kemps"* and may be found to a greater or less extent in most wools. When present in considerable numbers the kempy wool is difficult to dye satisfactorily, though some dyes cover these kemps much better than others; for example the basic better than the acid dyes, and a chrome-logwood black better than a diamond black.

Different kinds of wool have very different absorptive power for dyes, and defects not unfrequently arise from the use of two kinds of wool in one material. If hanks of Merino yarn and of English wool are dyed at the same time in the same liquor, the former will usually acquire a much deeper color; and this cause of irregularity should receive much more attention than is the case. If the dyer is aware that various qualities of wool have been used in any particular case he may minimize the difference in dyeing properties by a slight treatment of the material with dilute bleaching powder solution coupled with a special selection of dyes, but usually the spinner and manufacturer are unaware of the above facts and the dyer gets the blame for a faulty piece for which he is really in no way responsible.

Another somewhat similar case is the use of *"skin wool"* along with ordinary wool. Skin wool is obtained from the skins of animals slaughtered for food and even when clipped from the skin it differs considerably in dyeing properties from wool which has been sheared from the living animal. Skin wool is however often removed by the felmonger by means of lime and this very greatly increases the difficulty of its treatment by the dyer.

Defects appearing as brown or gray stains have recently been very frequent in goods made from certain English wools. In the case of several defective fabrics, the cause of these has been shown by the author to be a diseased condition of the sheep resulting in the presence on the wool of fragments of cuticle or skin which adhere strongly to the fibre and pass right through to the finished piece. These skin fragments have a very selective action on various dyes, and are readily colored yellow by alkalies. They do not become visible until the pieces are scoured or dyed, but then form a very apparent defect. Such wool should be dyed with acid dyes, and logwood and other mordant-dyes should be avoided.

Naturally colored brown or black wool frequently causes trouble in the case of pale delicate shades. Even with the greatest care it is difficult to prevent a few dark colored fibres getting into a yarn or piece and it is remarkable how such will show up in a finished piece of cream or other delicate tint.

Another great defect which is indirectly due to the wool fibre, sometimes arises from the production of sulphide of copper, iron, or more especially, lead by contact of the fibre, while in an alkaline condition, with metallic pipes, &c. Wool fibre naturally contains sulphur which is partially in an active and partially in an inactive condition. In presence of alkali, solution of the former occurs with immediate production of a dark colored metallic sulphide if the wool comes into contact with a metallic steam pipe. This defect is fairly well recognized, and may be avoided by the use of aluminium vessels, pipes, &c. It may also be eliminated when necessary by alternate treatment of the wool with lime water, and hydrochloric acid, washing between each steeping and repeating the operations until a stain ceases to be produced under the conditions named above.

SILK: The very different dyeing properties of wild and cultivated silk make the dyeing of a fabric in which both are used a matter of extreme difficulty. As a rule, however, silk is dyed in hank form, and mixed yarns are rarely met with. The dyeing of the two kinds of yarn to match in shade is an ordinary dyeing problem and hardly comes within the scope of this article.

ARTIFICIAL SILK: The treatment of materials partially composed of artificial silk is a matter which is a prolific cause of defects in the work of garment dyers and cleaners. There are several varieties of artificial silk and they differ fundamentally in dyeing properties. For example, Chardonnet silk may be dyed to some extent like natural silk with acid dyes, whereas Lehner silk dyes best with basic dyes and Thiele and Viscose silk with direct cotton dyes. Beyond mentioning the necessity for great caution in dealing with such material, little can be said by way of assistance. The dyeing properties of the material should wherever possible be determined by actual trial of a small piece.

All forms of artificial silk are more or less tender when wetted, the tensile strength of most kinds being very low under these conditions. Great care in manipulation is therefore necessary.

COTTON: The chief dyeing defect due to cotton fibre is the appearance of white specks on dyed material. These are caused by the presence of so-called "*dead cotton*" which is really immature fibres which for some cause have never become ripened or fully developed. Under the microscope "dead" cotton fibres appear as thin, transparent bands and they have practically no affinity for many dyes. A considerable number of the direct cotton dyes will however color them sufficiently to make them practically unseen in a cotton piece.

(*To be continued.*)

WATER SOFTENING AND FILTRATION PROCESSES.

Fundamental Principles. That a supply of water free from impurities is greatly to be desired, is shown by the money annually expended to secure such a supply. Plants have been erected by municipalities for filtration purposes; Edinburgh, Scotland, and Southampton, England, have in addition installed water softening plants. A plentiful supply of water free from contamination and impurities is a valuable asset for any manufacturing concern, but the value to the textile industry can hardly be over-estimated. Of course some chemical impurities in water are an aid to certain textile processes, but such a condition rarely exists.

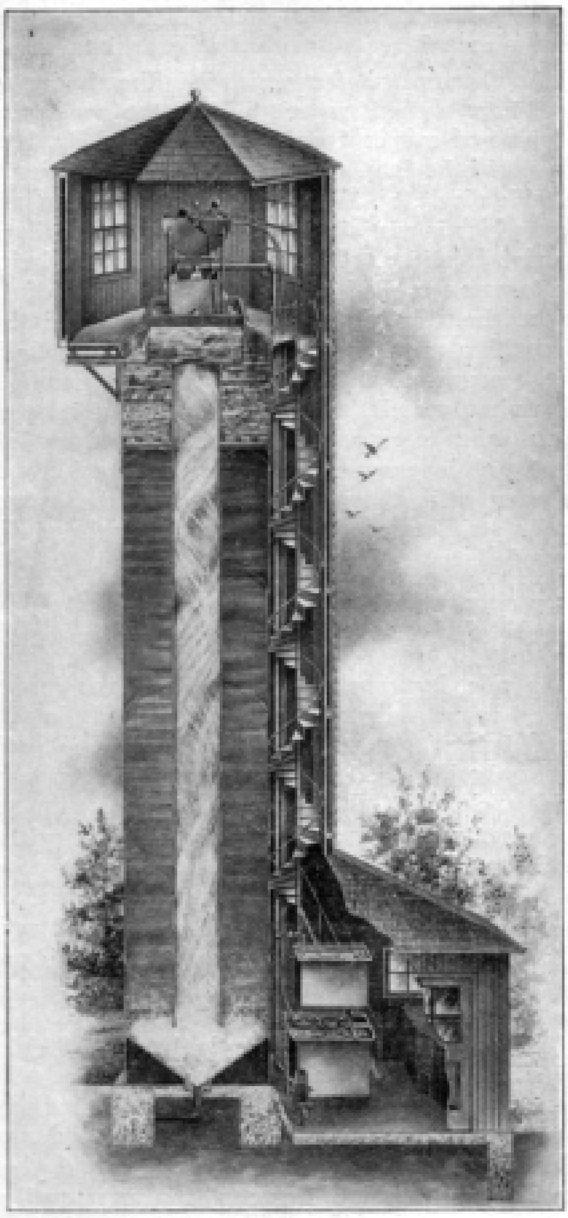


FIG. 1.

To a great extent, the content of a water depends upon its source; of course the original source of all water supplies is the rain which falls upon the earth, but as little or no rain-water is used as such, we will consider only the direct sources of supply,—surface waters (rivers and lakes) and ground waters (springs and wells).

Surface water is frequently contaminated by refuse, waste and sewage from towns; such water is difficult to deal with and the methods to be used will be set forth under filtration processes.

Ground waters are seldom contaminated, unless from a cess-pool. But both surface and ground water are apt to contain chemical impurities in solution. Water is an excellent solvent, and, as such, takes many salts into solution. The salts most often taken into solution are calcium and magnesium compounds; free acids, basic impurities and occasionally a ferric compound may be present.

At present the effect of the salts of magnesium and calcium will be considered. Water, containing these salts is usually spoken of as *hard water*. The calcium and magnesium are present usually as carbonates and sulphates, but occasionally as chlorides and nitrates. The carbonates cause temporary hardness, while the sulphates, chlorides and nitrates cause permanent hardness. Temporary hardness is removed by boiling, a friable deposit is produced which is readily removed. Permanent hardness is not removed by boiling and the scale which is formed by water which is permanently hard is difficult of removal.

The softening of water is accomplished by the simple process of precipitation by the use of chemicals. To remove the carbonates, lime is used as the precipitant. The carbonates are held in solution by reason of the carbonic acid dissolved in the water. Upon adding lime, the acid unites with it, forming carbonate of lime. Since the acid is no longer present, the almost insoluble carbonate is precipitated. This reaction may be represented as follows:

$$CaCO_3+CO_2+Ca(OH)_2=2\ CaCO_3+H_2O$$

or with the magnesium salt

$$MgCO_3+CO_2+Ca(OH)_2=MgCO_3+CaCO_3+H_2O$$

but in this case the magnesium carbonate is quite soluble in water so that an added quantity of lime is necessary, as,

$$MgCO_3+Ca(OH)_2=Mg(OH)_2+CaCO_3$$

The magnesium hydroxide then precipitates out. To remove the sulphates, sodium carbonate is used, and in the case of magnesium, lime is also added:

$$CaSO_4+Na_2CO_3=CaCO_3+Na_2SO_4$$

and

$$MgSO_4+Ca(OH)_2+Na_2CO_3=Mg(OH)_2+CaCO_3 +Na_2SO_4$$

The sodium sulphate, Glauber's salt, is very soluble, but in the small amount present after this operation, its presence is unobjectionable. The chlorides and nitrates are removed in the same way, by the use of sodium carbonate.

Iron is occasionally present in water; when so occurring, it is usually in the form of the carbonate, or as the sulphate. The sulphate, present as ferrous sulphate, is easily oxidized and dissociates, ferric oxide being precipitated. Therefore, a cure for iron impurities is to thoroughly aerate the water. This process can be represented as follows:

$$FeSO_4+2O+H_2O=Fe_2O_3+H_2SO_4$$

Free sulphuric acid remains in the solution, but this can be precipitated as sodium sulphate, by the addition of sodium hydroxide.

Sulphuric acid is the only mineral acid which is commonly present in water; but frequently certain organic acids may be met with. These acids are good solvents for iron, and are therefore objectionable.

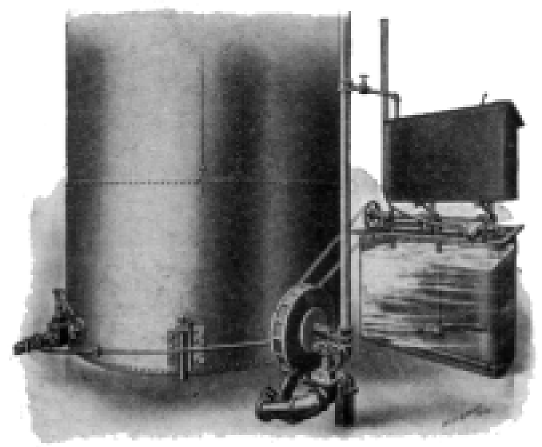
Sodium carbonate is the only alkaline impurity likely to be present. This readily precipitates on the addition of sulphuric acid. Lead and copper impurities occasionally occur, and their presence requires especial attention.

Commercial Processes for Water Softening. In the Clark Process, called also, the lime process, lime-water is added, and the precipitate removed by subsidence in large tanks. The Porter-Clark process, one of the most commonly used, has the same underlying principle, but after the application of the lime, the water slowly rises through an iron cylinder containing broad shelves. The precipitate settles on these shelves and is removed either by means of sludge cocks or the shelves are scraped. Ordinary mechanical filters have also been used.

There are many different devices used to operate water-softening plants. The same simple principle governs all, but the machines devised to accomplish the action are some more complicated than others. After a comprehensive study, the following process, as used by the American Water Softener Co., has been selected for description. The devices used are simple, the process is thorough, and the cost of operation very small. In addition the system has been in extensive use and has always been up to requirements.

Fig. 1 shows a sectional view of a typical plant. The water, direct from the source of supply, enters the motor, revolves it, passes out through the pipe on the opposite side and rises to the top of the tower. The motor which is shown to better advantage in Fig. 2, is a motor of the direct and positive type, and with an effective water pressure of three pounds this motor will supply enough power to operate the entire apparatus.

The mechanism for mixing and handling the softening solution is shown in Fig. 2. This apparatus is situated at the ground level. In the upper tank, sufficient lime (CaO) is slaked to operate the plant for twelve hours. After the lime is thoroughly slaked ($Ca(OH)_2$), the valve is opened and the milk of lime flows into the lower tank through a screen that removes any foreign matter that may be present. Soda-ash (crude sodium carbonate) is then added in



sufficient quantity and the whole solution thoroughly stirred and kept in constant motion by the agitator. (Both lime and soda are added, so that temporary and permanent hardness may both be removed. Before this apparatus is installed, the water to be operated on is analyzed and the proper amounts of reagents to secure absolutely soft water are determined.) The shafting which operates the agitator also operates the pump, which, drawing the solution through a fine strainer, raises it to the chemical tank at the top of the tower. Any surplus is returned to the lower tank by the overflow pipe.

The upper mechanism is shown in Fig. 3. The water flows through a large pipe into a chamber of the oscillating receiver. As the chamber is filled, the centre of gravity moves until the equilibrium of the "tipper" is destroyed, and the contents poured into the tank; at the same time the other chamber of the receiver is brought beneath the orifice of the supply pipe. Above the receiver is the semi-cylindrical reservoir containing the softening solution. In the bottom of this tank is a valve through which the solution falls into the oscillating receiver. This valve is operated by the mechanism shown in the illustration. It is readily to be seen that by the system of levers, this valve is made to open each time the receiver oscillates. There is a constant head of the solution over the orifice of this valve so that a constant quantity of the solution is delivered at each operation of the valve. The lift of this valve can be regulated for any definite amount of softening solution. The oscillator, of course, is always operated by the same weight of water and the valve must feed exactly the required amount of solution whether there is one or ten oscillations to the minute. Therefore, if the pressure head on the pipes which deliver the water supply be not constant, the apparatus is as efficient as if the head were constant. Fixed to the underside of the oscillating receiver is a paddle, which acts not only to prevent too violent movement of the "tipper," but also more thoroughly mixes the water and the softening solution, which have already become well mixed through the motion of the oscillator. The solution in the chemical tank is constantly agitated, and the reagents kept

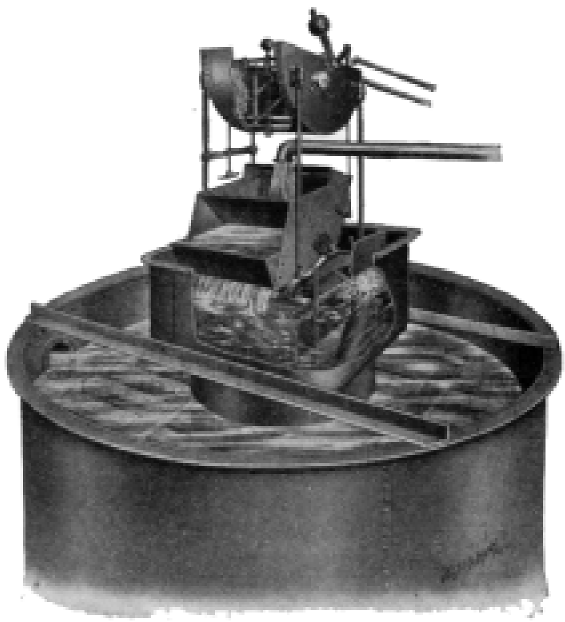


FIG. 3.

mixed, by means of the rod and rocker arm connected with the "tipper."

The water with the precipitate that results upon the addition of the softening solution passes to the bottom of the small tank. From here it goes under the division plate and enters the pipe which is inclined at an angle of 45°, so that the water entering the cylindrical downtake, shown in Fig. 1, is given a decided whirling motion. This whirling motion causes the precipitated matters to coagulate rapidly so that almost all the suspended matter is deposited before the water rises in the stand-pipe. The precipitated matter which collects in the bottom of the stand-pipe can be readily remove by opening a waste valve, provided for the purpose, and allowing the pressure head of the water in the tank to blow out the slimy material, which is not of a very heavy consistency.

If two or more sources of water be tapped in order to secure a sufficient supply, it is possible to provide a final output of water of the same degree of hardness. This is accomplished by using separate softening solutions for each source of supply, and introducing the reagents by means of separate oscillators. The apparatus can be so mounted that only one stand-pipe is necessary.

By the use of this method, plants using as much as 15,000 gallons of water, per hour, have been supplied with water of a uniform character, free from any trace of chemical impurities. For plants, which in comparison require a very small supply, it is advisable to dispense with the motor previously described, and periodically to run the softening solution directly into the upper tank; but of course, the head on the discharge valve would then vary. To overcome this difficulty the solution reservoir is divided into two parts by a division plate which rises only part up in the tank. The paddles which agitate the solution in this tank are made scoop shape. At each oscillation of the "tipper," these scoops raise a certain quantity of the softening solution over the division plate into the valve compartment. The amount raised is in excess of the amount discharged, the surplus flowing back into the solution compartment. By this means a constant head is kept on the orifice of the valve and the same amount of softening solution is delivered at each movement of the "tipper."

For some purposes it is better to install a rectangular type of softener. The process both as to mixing and introducing the reagents is fundamentally the same as for the type illustrated; but instead of using the high cylindrical downtake and stand-pipe for settling, the water flows under a partition from the compartment, into which it is discharged by the "tipper," to a chamber, in which the water rises to flow through a downtake pipe into a settling chamber. Then the water flows through a filter to a storage compartment. The flow of water from the filter is regulated by a balanced valve attached to a float in the storage compartment.

The cost of operating an "American Water Softener" is slight. The chemicals used are mainly lime which costs about ¼ cent per pound and soda-ash costing 1 cent per pound. The quantities used makes the total cost range from ½ to 3 cents per 1,000 gallons of water treated, depending on quality of water. There is no hoisting of material, no climbing to top of tank, except at rare intervals, everything is automatic except that about 15 to 30 minutes a day has to be devoted by some laborer to mixing the chemicals —this costing say 15 cents a day. The plant automatically starts or stops, according to the amount of treated water required.

The saving that will immediately follow the installation of a water-softening plant cannot be exaggerated. One degree of hardness (this means one part, of the foreign matter present, to seventy thousand parts of water) due to salts of calcium or magnesium will kill one and one-half pounds of good soap per one thousand gallons. One reason for dull colors, spots and blemishes is hard water. In dyeing, scouring, fulling and finishing as well, pure, soft water gives better and more economical results. In printing and bleaching works the same arguments apply. Then the saving in fuel and boilers is no inconsiderable item. Hard water causes boiler scale and one sixteenth of an inch of boiler scale requires thirteen per cent more coal. The boiler itself becomes pitted and is constantly in need of repairs. The scale makes frequent overhauling of the boilers necessary, tubes have to be taken out and replaced and the varying expansion of scale and iron causes a great amount of breakage.

In this day of germs, perhaps a few words as to the bacterial efficiency of the various softening processes is timely. Experiments by Frankland, and results obtained by practice show a considerable degree of bacterial purification, in some instances results were secured quite as good as those obtained by special purification processes.

(To be continued)

THE USE OF PEROXIDE OF SODIUM FOR BLEACHING.

The use of Peroxide of Sodium for bleaching textile fibres and fabrics, wool, cotton and silk, is rapidly being enlarged in spite of the present drawback of its greater cost than the older bleaching materials, *i. e.*, sulphur and chlorine in their different forms. Doubtless, when the price of this material has been lowered by improvements in the processes of its manufacture or by competition, its use will become universal and it will almost entirely supersede the older agents.

The reason for this superiority of peroxide of sodium is very plain, in bleaching with it we simply follow Nature's process, using identically the same agent that she does—nascent oxygen—the only difference being that we use it in a more concentrated way and thereby hasten the operation. Like all of Nature's processes, it is very thorough, since it is based on destruction, not modification or addition, oxygen, the active agent, being the same agent that is employed by Nature when she wishes to destroy something for which she has no use in her scheme of economy. There is nothing left but the ultimate products of oxidization, water and carbon dioxide, when the process is complete, and consequently there are no bodies left in or on the fibre that can be restored or regenerated by the after action and oxidization of the air.

A further marked advantage of this natural process, and one that makes sodium peroxide very valuable to the bleacher, is that the action of the nascent oxygen it evolves is selective, that is, it acts only on the unstable bodies that are present and does not attack at all the stable bodies unless it is aided by heat. Consequently, when brought into contact with raw cotton, wool or silk, it attacks the unstable coloring bodies present, and satisfies their affinity for oxygen, without affecting at all the stable fibres themselves. The unstable coloring matters are converted into either stable, colorless compounds or are completely oxidized into still more stable water and carbonic acid gas, which may remain, in the former case in part, or which may be wholly removed by the after washing.

Its action is directly opposite to the action of the sulphur bleach, in which sulphurous oxide gas combines with and takes away some of the oxygen of the coloring matters of the fibre, reduces it, and thereby forms a still more unstable body than existed at first. This unstable compound has a greater affinity for oxygen than the original substance, therefore, it is only a matter of time and exposure to the air when the fibre will regain its natural color, by the oxidization of these unstable bodies formed by the reducing action of the sulphur bleach. Thus it is that a sulphur bleach is not a permanent bleach, and it can never be made to give a permanent bleaching effect by itself alone.

The chloride of lime bleach is an oxygen bleach, its ultimate action being that of oxidization, but, in addition to this, we have also to consider the action of a powerful corrosive agent, chlorine, which has a marked affinity for animal fibres and which exerts a strong oxidizing effect on vegetable fibre, converting it into unstable oxy-cellulose. This is the cause of the well-known "tendering" of cotton goods when bleached by chlorine compounds. Even with the cheapness of chloride of lime and similar compounds, the care necessary for handling goods bleached by them and the complicated and tedious processes of after treatment make their use expensive in the end.

In addition to the drawbacks mentioned, there is the still greater fault that in both the sulphur and the chlorine processes of bleaching, compounds are formed which are very difficult to remove from the fibres or the fabric so treated, and these compounds exert a very harmful action on both the fibres themselves and on the dyes used later for coloring them. For an example, we have the fact that wool bleached by the sulphur process cannot be successfully dyed with many of the so-called coal-tar colors, the sulphurous acid remaining in the wool, in spite of washing, being directly antagonistic to some colors, and, if it does not actually destroy others, it seriously affects their shades. Similarly, when using chloride of lime, chlorine compounds are left in the fibre that require long and tedious processes for their removal, and if this is not completely done, the color or shade of the dye used will be greatly harmed.

Not only do sulphurous acid and chlorine compounds affect the dyes used but they also have an injurious action on the fibre itself, weakening and gradually rotting it. This is due to the former body being oxidized to sulphuric acid and the latter oxidizing the fibre itself. A serious defect in the sulphur process when applied to mixed goods, consisting of wool and cotton, is this after oxidization of the sulphurous acid and the production of sulphuric acid, which will "carbonize" the cotton fibres when the fabric is subjected to heat in later treatment.

In fact, both sulphur bleaching and chlorine bleaching are processes inherently defective, and they are really only makeshifts, producing results by indirect action, which is never as effective as direct action, and they are never wholly satisfactory or permanent in their effects.

The process of bleaching by peroxide of sodium has none of the defects of the older ones just mentioned, either in its application or in its after effects on the materials treated. Nothing is used to do the actual work but oxygen, a gas, which combines with the coloring matter of the fibre to form inert products of oxidization, water and carbonic acid gas, the action being exactly the same as if we burned off a coat of varnish from an iron rod by heating it in the air. The bleaching of the fibre by peroxide of sodium is actually a similar process, in which the coloring matter is "burned off" the cotton, wool or silk, leaving the fibre itself intact, the only difference being that one is rapid combustion and is accompanied by heat and the other is a slow combustion, the heat of which is taken up by the water of the bleaching bath. Neither are there any products of this process left in the fibre that can harm it by later action or combination, the only substance formed in the bleaching bath being an inert salt (or salts) of sodium, dependent on the acid used with the bath, which is readily soluble in water and can therefore be easily and completely washed out.

These points will be brought out clearly if we consider the methods of using peroxide of sodium as a bleach and of making the bleaching solution. The practical application of peroxide of sodium as a bleach is based on its property of being decomposed on contact with water into caustic soda and peroxide of hydrogen, the latter, in the presence of easily oxidized organic matter, gives up oxygen to it and itself is decomposed into water and oxygen. The oxygen is given off in a "nascent" state, *i. e.,* newly formed, and in this condition has a much more powerful chemical action than when it is in the form of a fixed gas. Therefore, any easily oxidized body or any substance that has an affinity for oxygen which is put in a bath of peroxide of sodium and water will be at once acted on by the oxygen evolved, and it will either be completely oxidized to water and carbonic acid gas or to a stable body of a higher oxidization. The only active agent in such a bath is the nascent oxygen given off by the peroxide of hydrogen formed from the peroxide of sodium, this substance playing the part of a carrier only. Herein lies the superiority of this substance over peroxide of hydrogen itself; the former is a solid and stable body, the latter is an unstable liquid, the former gives up more oxygen for an equal weight than the latter, and is therefore commercially more readily available and economical. There are other highly oxidized bodies that act similarly to peroxide of sodium in the presence of water, but there are certain disadvantages of lack of control, too slow or too rapid action, higher cost, no commercial supply, etc., which render them unsuitable for use on a practical scale. Peroxide of sodium combines the desired action and qualities with commercial availability and reasonable cost, and is therefore the best.

Theoretically, to bleach with peroxide of sodium all that would be necessary would be to add the chemical to water and immerse the articles to be bleached in this solution; practically, the procedure must be different. In the first place, the addition of peroxide of sodium to water causes a great amount of heat, because of the chemical action, and this heat would cause a rapid evolution of the oxygen and consequent loss; secondly, the strong alkali formed, caustic soda, would be injurious to many materials if not neutralized. These practical considerations require that certain modifications be made in the process of preparing the bleaching solution and of using it, an acid being added to the solution in sufficient amount to neutralize the alkali. The acid most commonly used is sulphuric acid, because of its cheapness, and also because of the inert and soluble nature of the salt it forms with the alkali, Glauber's salts, or sulphate of soda. Oxalic acid is also sometimes used in preparing the bath.

In practical operation, the method of using peroxide of sodium for bleaching is as follows:

To cold pure water, sufficient to cover the goods to be bleached, without packing them too closely together, is added the calculated amount of acid required to neutralize the alkali formed from the peroxide and thoroughly mixed with the water. Then the peroxide of sodium, in calculated amount, is added slowly from a scoop, and during the addition, the bath and the goods are continuously agitated, care being taken that the peroxide is dissolved completely and that no undissolved lumps are allowed to remain at the bottom of the vat. Towards the end of the addition of peroxide, steam is turned on through the lead heating pipe provided for this purpose at the bottom of the vat, to hasten the solution of the powder, this also later on serving to keep the liquid in circulation around the goods in the bath and to increase the rapidity of the bleaching. The material is left a sufficiently long time in the bath to allow perfect bleaching, then removed, drained and well rinsed off in fresh water.

This is the general method of procedure, the operation can be modified by the addition of a little ammonia or silicate of soda to increase the rapidity of the evolution of oxygen, since the peroxide of hydrogen decomposes more rapidly in an alkaline bath than in an acid one. If oxalic acid be used, it should be dissolved in hot water, and this solution be added to the bath, as this acid is rather slowly soluble in cold water.

There are a few points connected with peroxide of sodium bleaching that need special attention. First: the vat or vessel used to hold the goods and the bleaching solution must be so made as to be absolutely free from iron, that is, there must be no nails, bolts or anything of this metal used anywhere that it will come in contact with the bleaching solution. A vat made of clear white pine, free from knots, is the simplest and best form for large quantities; earthenware or glass vessels are best for small operations. The pipe in the bottom of the vat, for admitting steam into the bath, should be made of lead, outside the vat for a few feet as well as inside it, to prevent possible contamination from iron rust or scale.

The water and the acid used must also be free from iron, otherwise, spots of iron rust will be formed on the goods that are very difficult to remove. Care must also be taken that no particles of iron, from tools or other objects, be allowed to fall into the vat. Second: the bath must be made as nearly neutral as possible when freshly made up, this being regulated by frequent testing with litmus paper. Then, if it is desired to hasten or to retard the bleaching action, the solution may be made alkaline or acid with exactness and the proper action insured. Third: the material or goods to be bleached must be thoroughly washed with soap or carbonate of soda and then rinsed off before being placed in the bath, to remove all grease, oil, dirt, etc., as the first two will prevent the oxygen from acting on the goods, or, if at all, very unevenly, and the last will waste it.

Peroxide of sodium is a chemical that requires very careful handling, both to preserve it from deterioration and to prevent accidents. It should always be kept in air-tight containers, and these must be well sealed every time some of the salt is taken out for use, otherwise it will absorb both moisture and carbonic acid gas from the atmosphere. On exposure to the air, peroxide of sodium rapidly "deliquesces," becomes liquid, and is converted into carbonate of soda, losing its available oxygen in both instances. Peroxide of sodium, in powder or in solid form, must *never* be brought into contact with damp organic matter, as it is so powerful a chemical that it may set fire to combustible substances in the presence of a little moisture. Never allow it to remain in contact with paper or in wooden barrels or stow it in a damp cellar.

A bath prepared with sodium peroxide can be easily used more than once and for separate lots of goods by adding to it fresh quantities of this chemical and acid, preserving the same proportions as at first. If it is not convenient to use the bath a second time the same day, it can be preserved in strength by making it markedly acid, since the solution of sodium peroxide gives off oxygen only very slowly when acid. To start up the bath the next day, all that is necessary is to add sufficient alkali—ammonia water or silicate of soda—to make it alkaline.

It is easily seen that peroxide of sodium is not only an ideal bleaching agent from the standpoint of efficiency and permanency, but that it is also ideal from the bleacher's standpoint, because of the ease with which the bleaching solutions are made up and the perfect control that he has of their action, and the absence of harmful fumes or poisonous gases. Furthermore, the apparatus required is of the simplest kind and can be easily and cheaply obtained and set up, in fact, the cost of the wooden vat, the lead steam-pipe, etc., used in bleaching with peroxide of sodium is but a fraction of the cost of the apparatus necessary for any other method of bleaching. These are important considerations, and when it is borne in mind that the peroxide solution can be used in any part of the mill, or in any room, without danger of its injuring other apparatus or the workmen there employed, it certainly is plain that its greater cost, compared with other bleaching agents, is more than counterbalanced by its unique advantages and properties.

Of course it must not be taken for granted that any old way of handling it will do for peroxide of sodium; to get good results requires care and attention to details, then it pays in results and costs.

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).

Shearing is a most important process in the work of finishing woolens, not so much on account of the skill required to run the shear itself, but more particularly on account of the experience necessary to produce uniform work, as well as the mechanical training required by the operator to have and to keep the machine in proper condition for good work. Uniform shearing is required to produce "matching" or as it is also termed "shading" of goods, in order to permit the various parts of the same garment to be cut from different bolts of cloth, as is frequently the custom in connection with our ready-made clothing establishments; therefore, the proper cutting of the shear, *i. e.*, having it in perfect working condition, is an absolute necessity, even if dealing with single piece orders only.

No matter how carefully goods have been dealt with in the wet finishing department, it may take but a little carelessness or lack of judgment on the part of the shear-tender to spoil goods, for which reason, it is necessary that every shear-tender must be attentive to every detail of his work and that everything done by him, no matter how small and seemingly insignificant, must be done well, upholding the golden rule "What is worth doing at all is worth doing well." It will be found wrong economy in a mill to put a boy or an inexperienced or careless person to work at running a shear, thinking that most anybody can run this machine and that a cheap hand is the most profitable to the mill. Goods spoiled by such a person will soon make him a most expensive fixture to the finishing department. A competent shear-tender, besides, if possible, being somewhat of a mechanic, must in all cases be a person who attends strictly *only* to his vocation while the shear is running; he must watch his machine only and pay no attention to other affairs in the room. He must be a person capable of saying whether a piece under operation is sheared sufficiently or still needs one or more runs; he must be able to match the fabric under operation to a sample given him to go by; he must be able to sew (thread) the fabrics to be sheared by him so that they will not wrinkle, *i. e.,* so that they permit him to shear as close as is possible to both ends of the piece, without cutting in the fabric or making shear marks, which will be the case provided the cloth is allowed to wrinkle; giving in turn to the mill every possible inch of finished length of cloth in the piece. For this reason, the stitches must be made fine and regular, a mill sewing machine being a very valuable adjunct for this work. It will be readily understood that a careful shear-tender, even at higher wages than a boy, or a careless person, will soon repay his cost to the mill.

The object of shearing is to level the nap, as previously raised by means of gigging, napping, or brushing, on the face of the fabric, this nap, or pile, is, of course, more or less irregular in length and has to be sheared off level to different lengths in different fabrics, to permit the certain finish required by the particular fabric under operation to be produced. In some instances, the nap or pile is completely sheared off, in order to produce what is called a *"clear face,"* or *"threadbare"* finish on the face of the fabric, in which case, the interlacing of the threads producing the weave or pattern is clearly shown; whereas in other instances, a short nap is left, standing more or less erect on the face of the fabric, to produce what is termed a *"velvet finish;"* again in connection with some fabrics, the nap or pile may be required to be laid down on the face of the fabric, producing in this manner what is known as a *"face finish"* to the fabric. In the latter two instances, the interlacing of warp and filling is not discernible, neither the individual threads, both being hid, or covered, by the pile or nap on the face of the fabric.

Preparing goods for the shear. After the goods have passed through the wet finishing process and are dried, they should then be back-burled, preparatory for shearing, that is to say, have all knots or bunches removed that may be found upon the back of the cloth and which may have been overlooked in the burling as was done before fulling, so that there will be no chance for holes being cut in the cloth, caused by said knots or bunches raising the face of the fabric when it is going over the rest. Although the first burling, if carefully done, should insure us against the necessity of this extra back-burling at this point, still it is well to do it, since there may be found some small threads and bunches which have not been noticed in the first burling, which during the process of wet finishing have become enlarged. It must be remembered that most any bunch upon the back of the cloth is apt to be the cause of a hole, or, at least, a shear mark in the cloth, in the process of shearing.

We next take the piece from the back-burlers and put it into the shear, taking care to get it as straight as possible, in order to avoid chances for wrinkles and to keep it running straight during the process of shearing. To impart a uniform appearance to goods of the same style, *i. e.,* so that they shade exactly alike, requires skill and taste, as well as good judgment on the part of the shear-tender; he must remember that no matter how perfectly every previous process the fabric has passed through was performed, that only a slight variation in the amount of shearing will cause a corresponding change in the appearance of the goods. Goods of one order batch, no matter how well manipulated the mill, will always vary somewhat in their weight, a point which needs consideration by the shear-tender, from the fact that any variation in the weight of the goods, will call for a variation in the treatment by him, in order to insure a uniform appearance amongst the number of pieces comprising the order. For example: Among two pieces of the same style, one may have come ½ oz. lighter in weight from the loom than the other, and while the fuller rectified this difference, either by shrinking the lighter fabric sufficiently less in length or flocking it sufficiently heavier in order to balance the weight required, still they will not shear exactly alike. One piece may need to be sheared with the blades a trifle lower than on the other, or, on account of a denser nap occasioned by the difference in the fulling, it may be necessary to give the one fulled heavier one or two extra runs on the shear, so as to properly clear its face, work which, as will be readily understood, requires experience as well as good judgment on the part of the shear-tender, in order to be able to obtain the best results. The overseer certainly may assist the man in difficult cases; however, as a rule, he has other work to look after, which will not admit of his troubling with average variations in the goods, for which reason, in order to insure the best possible results, the shear-tender must be thoroughly competent, under the direction of the overseer, to attend to such affairs himself.

To a great extent, the skill required by the shear-tender varies with the kind of goods made by the mill. For this reason, for example, with some styles of dress goods, or light-weight cheviots, and with others where only a slight cropping is all that is needed, little change, if any, as to the setting of the blades will be required, whereas in connection with goods requiring considerable gigging, for example, fancy cassimeres and face goods, more skill on the part of the shear-tender will be required. In connection with such goods, care should be taken to set the blades up so that they can accomplish the work well, since, if set too low, more nap will be delivered to them than they can properly cut, the blades in turn pulling, *i. e.,* drawing out some of the nap from the fabric, besides wearing out the blades more than is necessary. Set the blades well up, lowering them in turn gradually, allowing them at the same time to cut the nap of the fabric under operation clean and even, as the work proceeds. It is best to lower the blades gradually; and if the required clearness can be obtained by several runs, with the blades in one position, this is more preferable than to lower the blades another notch, as it leaves a soft, velvety face to a fancy cassimere, and an even finish upon face goods.

It is necessary for the shear-tender to save a sample of each style, by which to shade, the other pieces of the same style, in order to get the number of pieces comprising the lot as near alike as to shade as possible, in turn avoiding variations in the appearance of the face of the goods, which will appear in different pieces if depending upon memory or judgment only. A slight difference in the light, often leads to misjudgment.

The construction of a shear. Before going into any further details, it will be well to give a description of the construction and operation of the shear, a feature best explained in connection with the accompanying illustration, Fig. 1, being a diagram showing in outlines, the construction and working parts of what is known as a *"single shear"* (taking the Parks & Woolson Shear as a model). In said illustration, the dotted line *A* represents the run of the cloth, to be sheared, through the machine. The same, as received from the back-burling, is then placed in an open folded condition into the scray *B* of the machine. Next, the front end is passed up over guide rod *C,* then down around another guide rod *D,* to a front draft break roll *E,* which, with another guide rod *F,* acts to put tension on the cloth as it is passed to the shearing mechanisms. From the rod *F,* the cloth passes upwardly and over a guide rod *G,* then around a specially shaped brush rest *H,* which puts the cloth in position to have its nap, on the face, raised to a perpendicular position by means of raising brush *I,* and in which condition the cloth travels to the cloth rest *J* of the shearing mechanism. The brush rest *H* is made adjustable, so that the cloth can be given more or less raising (brushing effect) as may be required. In passing from the brush rest *H* to the cloth rest *J,* the back of the cloth is operated upon by a flock brush *K,* provided for the cleaning off of any loose threads, flocks, etc., from that side of the cloth, so that they will not get under the cloth at the cloth rest *J* and lift the corresponding places on the face of the fabric into the path of the blades of the shear cylinder *L.*

The shearing mechanism consists of the cloth rest *J,* over which the fabric passes, the ledger blade *M* which acts as the lower part of the mechanism for the actual shearing, and the shear cylinder or revolver *L,* which is made up of a series of spirally placed blades, with their cutting edges extending the same distance from the centre, said shearing cylinder being revolved at a high rate of speed.

After leaving the cloth rest *J,* the fabric then passes down past a guide roll *N* and under two rolls *O* and *P,* and up again over a guide roll *Q.* A laying

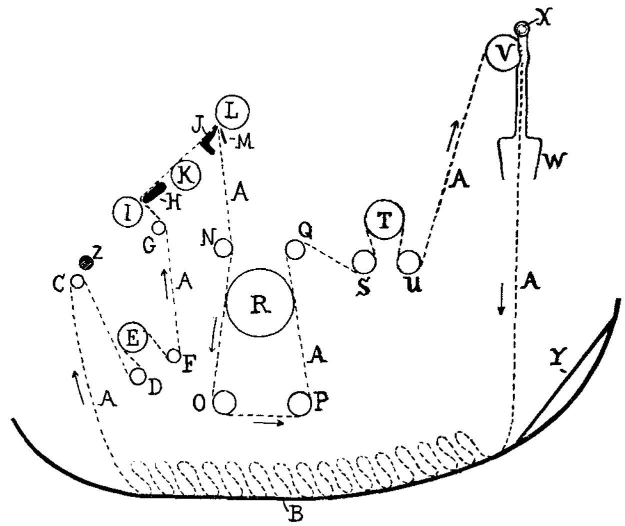


FIG. 1.

brush *R* is conveniently placed, so as to act on the face of the fabric twice, and which brush thus does the work of two single contact brushes. From the guide roll *Q,* the cloth passes under a guide roll *S,* then up over a draft roll *T* and down again under another guide roll *U,* and from there it passes up over a folder roll *V* to the folder *W,* which is given a vibratory motion, using the point *X* as a pivot for this motion. From the folder, the cloth drops back into the scray *B,* until, on the final run through the machine, it is folded, as shown in the illustration Fig. 2 on the table *Y,* which, when not needed, is turned out of the way. *Z* indicates the shipper rod, extending across the front of the machine, being connected at one end to the shipper lever so that the machine can be stopped or started by the operator from either side.

The other style of shears met with, are those known as *"double shears,"* the same being simply two single shears set tandem on the same frame, the two sets of blades being stationed at different heights on the machine, in order to permit the operator to watch both cutting lines at the same time. In connection with work requiring but one or two runs, the single shear certainly has its proper place in such a mill, still at the same time, it remains a question whether it would not pay such mills, in order to get a better finish without loss of time, to install double shears, the extra price of a double shear being only slightly above that of the price of a set of extra blades. Since you need the latter anyway for emergency cases, this certainly speaks in favor of the double shear, and then no stoppage is possible, since in case of damage, etc., to one set, said double shear then can be run temporarily as a single shear until the other set is returned, repaired, or re-ground, etc., as the case may be, from the builder to whom it was shipped, or the repair shop of the mill in connection with larger establishments who employ competent mechanics for such purposes.

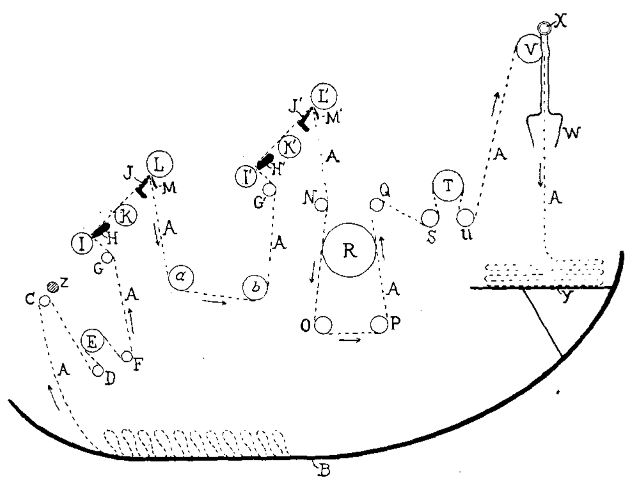


FIG. 2.

However, with the greater majority of our mills, the use of the double shear is an absolute necessity, all fabrics made there requiring absolutely more than one run through the machine, and when by the use of the double shear, double the amount of work, as compared to a single shear, can be done, and this with no additional expense for labor and at much less cost to install (one double shear being a great deal cheaper to install as compared to two single shears). A saving of room is also effected, one double shear requiring very little more room, and this in depth only, than a single shear, whereas each single shear calls for the same amount of light as a double shear does, *i. e.*, a claim for windows.

In order to illustrate to the reader, the principle of construction and the working of a double shear, diagram Fig. 2 is given, showing the working parts of a double shear (P. & W. Model) in outlines. Letters of reference in this illustration are selected to correspond to those as have been used in connection with diagram Fig. 1, the second shear-set being indicated by prime (′) signs. Two additional rollers *a* and *b* are needed to transfer the fabric from the first cutting arrangement (*J*, *L* and *M*) to the second cutting arrangement (*J′*, *L′* and *M′*), and of which roller *a* is a guide roll and roller *b* is a draft roll.

A few practical points. A shear must be set firm and level on its feet, so that there will be no twist or other stresses in the blades or rest, and so that all bearings will run free. Machine builders do not advise bolting of the feet of the machine to the floor.

Another good suggestion is thus: Level right and left by the edge of the rest. If the rest is not in proper position, place the level on the driving shaft. Level front to back by the top of the main frames of the machine.

A steel straight edge is an absolute necessity to the finisher, since without it, in connection with the setting, grinding and running of the shear, he is at sea. Although straight edges can be had in all lengths, those carried in stock by the builders are 72 to 80 inches, 66½, 60½, 38¾ and 32⅛.

The proper position of the raising brush *I* is often overlooked, which is a big mistake, and often times the cause of uneven shearing. It should be set just close enough to raise the fibres lightly and on each side alike, for if the one side raises more than the other, it will cause it to shear lower on that side of the fabric. Do not force the fabric too hard against this raising brush *I*, since in this way, the nap of the cloth would get reversed from the way as laid at gigging. The proper way to adjust this brush is to have it raise the nap as nearly straight as possible on the cloth, so that the shear blades can act on the nap to the best advantage. When this brush gets badly worn and will not raise the nap uniformly all across the width of the cloth, the brush must be cut down to make it cylindrical, or when in too bad a condition for having this done, refilled.

Flocks, as accumulating in the flock-pan of the back brush *K*, must be removed regularly, because if said pan is allowed to become too full—in connection with the steel rest—flock-holes are liable to be made.

In passing the seams through, the blades must be lifted, but on no consideration should they be let down with a plunge, because this action puts the rest out of its proper position. The seams should be very carefully sewed, using a mill sewing machine for this purpose, it will pay for the extra trouble it may take to do this. When the seam comes along, permit the same to run up as close to the shear-blades of the revolver as can be done, without cutting the seam, and when then the revolver is lifted quickly. After the seam has just passed between the rest and the blades of the revolver, let the latter down quickly but without any jar, a feature which must be positively avoided since continued jarring, caused by letting down the blades harshly, will in time affect the setting devices of the revolver, and which will become out of true, with the consequent result of uneven work.

(*To be continued*)

THE LIGHTING OF TEXTILE MILLS.

One of the most important factors in the successful operation of a textile mill, from the standpoint of quality and quantity of production, is its lighting, both natural and artificial. Good lighting means good work and satisfied employees, poor lighting means poor work, frequent mistakes and accidents, and surly, discontented work-people. The hygienic value of good lighting is too often overlooked or under-estimated, yet everybody knows from personal experience the difference in their feelings and spirits on a bright clear day and on a dark, gloomy one. People who are compelled to work or live in dark or ill-lighted places are never so healthy or strong as those whose work is done in well-lighted rooms or work-places—witness the stunted growth of a plant in a cellar as proof of this—and good health has a direct relation to the capacity of a person to perform work.

From a consideration of the better physical and mental condition of his employees alone, an investment for securing ample and adequate illumination in his mill will pay the owner in the increased quantity of output and its better quality. Cheerful people can always do better work than low-spirited folks, and nothing else in physical surroundings will depress a person more than confinement in a dark, ill-lighted place. If this is doubted, note the difference in production, and in the mill help themselves, on bright days and on dark days, a few observations will convince anyone that the lighting of a work room has a positive effect on work done there.

Necessity for ample illumination. (1) It scarcely seems necessary to urge that the greatest possible illumination should be provided in all parts of a textile mill, yet too often this is treated in a perfunctory way, or efforts are made to secure the greatest possible floor space and close grouping of machinery without a thought as to whether there will be sufficient light in all parts to enable work to be done properly. Especially in weave rooms, the construction of the mill should rather be long and narrow than wide, unless skylights be provided, so that the looms in the middle of the room will receive proper lighting.

(2) It is requiring too much of help to expect them to turn out good work in a poorly lit work room, faults and imperfections will pass unseen and will be detected too late in the finished goods. Where close matching of colors or threads is necessary, no effort should be spared to secure good lighting—there will be a great saving in time alone, if the work can be done at the machine without having to make frequent visits to a window or a light. In dye rooms, good light is, of course, a necessity.

(3) Not only must adequate illumination be provided for day work, but if the mill is to be run at night, equal provision should be made. The lighting should be of such a nature that sharp shadows and excessive concentration of light will be avoided, and the character of the light should approach that of daylight as nearly as possible, in other words, it should be diffused light. Every machine should be illuminated so that its working parts are in the brightest light, avoiding shadows from columns, belts, etc.

Natural lighting. As the greater part of textile work is done in the daytime, the question of daylight illumination is naturally the most important. Since sunlight and daylight are free, at present at any rate, many people do not think that light costs anything, yet it costs money and thought to secure proper lighting inside of a mill when planning and building it, and it is often a pretty expensive job to alter an old mill so that it will be properly illuminated. The truth is that daylight itself does not cost anything, but the trouble and expense comes in because we first shut it out and then try to bring it in! If we built our houses and factories with due regard to the laws of light and left plenty of channels for the light to enter and be diffused, every foot indoors would be well lit up, but we try to make the light travel around corners, shut it off with walls and partitions and then fill the spaces inside with objects that absorb the little light that is admitted. You can't have light if you don't let it in.

In designing a mill, due attention must be paid to its location. If possible, do not locate it on low ground where the light is shut off from it by higher ground or buildings, and if such a location is the only one available, allow for natural deficiencies by providing as much window space as is practicable, and make the longitudinal direction of the building such that it will receive the most amount of sunlight. If more than one building is to be erected, do not crowd them close together so that they mutually darken one another. Provide ample light shafts, or wells, wherever walls come close together, or if the building is wide for its length and is several stories high.

Mill construction. Nowadays, with modern steel and concrete construction, it is possible to make the outside walls of mills almost skeleton in form, the entire exterior surface being practically divided into open spaces for windows by narrow columns of reinforced masonry or brick work. This form of construction gives the best possible window lighting, as the windows can be made almost the entire height of the space between floors and of any width desired, and there is not so much obstruction of light from the thickness of the window-reveals. If a solid stone or brick form of construction is used, there cannot be as much window opening in the surface of the outer walls as in the former type of construction, because there must be a greater width of masonry between windows to carry the loads of the building, floors, etc.

If the mill has an unobstructed exposure on all sides and is not too wide for its length, light wells and skylights will not be necessary, but if the walls are close to those of other buildings, light wells, shafts and courts should be freely provided. The sacrifice of floor space required for ample light shafts or courts is more than compensated for by the better lighting, for, in many instances, the absence of these will necessitate artificial lighting of some parts of the mill all the time, and the cost of this will greatly outweigh the value of a few feet of floor space.

In a mill erected in open country, the only questions to be considered are the provision of ample window space and locating the mill so that it will receive diffused daylight rather than direct sunlight. The design of the mill naturally will be that it is two or three times longer than it is wide—this longer axis should be laid out so that the mill extends about northeast and southwest, if this be practicable, considering the size, contour, etc. of the building site. The side walls, which should be built with as much window space as possible, in a mill thus located will not be exposed to direct rays of the sun except for a short time, the end walls, which will receive the direct sunlight half the day respectively, should be built with few, if any windows. This arrangement will prevent the mill from being flooded with sunlight half the day alternately on each side, requiring shades or awnings during much of the year, and the rooms will be more evenly illuminated by the diffused daylight admitted through unobstructed windows. A further advantage is that the mill will be cooler in summer, less of its wall surface being heated up by the sun.

If two buildings are erected side by side, they should be far enough apart so as not to darken one another. The distance the two buildings should be separated varies according to their height, the taller the buildings, the wider must be the space between them. Builders are apt to place separate mills close together with the idea of saving time and trouble in getting from one to another. It is a poor economy to try to save a few steps or moments of time at the expense of poorly lit work rooms, if necessary, build a covered passageway connecting the two buildings. If the mills have basements, these too should have ample provision for light, else their value for storage, work rooms, etc., will be partly nullified.

These statements are made with a mill of several stories in mind. If the mill be only one story high and covers considerable area, skylights must be used for lighting the central spaces or rooms.

City Mills. The hardest problems in mill lighting occur in mills built in large towns or cities, where ground is valuable and buildings must be concentrated and run up as high as possible. Very often, too, there are already tall buildings on the adjacent building sites which will shut off more or less light from our mill, and it is seldom that a mill so located can have more than one side with unobstructed exposure. The best way out of the difficulty is to build a mill with a central court, or, if this be impossible, to provide ample light shafts. If the ground area permits, a central court is by far the best, since this insures a supply of light on four sides. In the hands of a competent architect, an interior court can be designed that will take away only a comparatively small floor space, and the ground space of the court can be utilized by erecting there a one-story building for engines, etc., or as a store and shipping room, if ample skylights be provided.

When erecting a mill or group of mills, if the ground area is too small to permit construction with a court, then ample light shafts must be provided, both inside the mill and outside, by building the wall with recesses for windows. No rule can be given for the size of light shafts or side recesses, they should be proportioned according to the width of the mill and the height of adjacent buildings, their closeness, light obstruction, etc. Some may say "yes, this is all very nice, but it costs money to build extra walls." So too does artificial light cost money. The difference is that you pay once for building your mill, whereas you not only pay for the installation of artificial light, but you also have the continual daily expense of your lights, which must be kept burning all the time that the mill is in operation.

Another argument would be the loss of floor space, *ergo,* loss in quantity of machinery that can be operated. This is a condition where the least of two ills must be chosen. It is possible for a competent architect to design a mill so that the "cut-ins" or recesses will be located where they will least interfere with placing machinery and yet give the needed light. The same holds good for light shafts. The point to be considered is, whether or not the few extra machines that can be put in a room with no light shafts or recesses will give sufficient extra output to pay for the artificial lighting that must otherwise be provided. The question simply comes down to comparative cost and production, if the floor space alone be considered, and to the cost of the extra walls and windows compared to cost of lighting artificially. In any estimate, the value of good lighting on the quality and quantity of production, through its effect on employees and their ability to work, must also be given consideration. The decision will always be in favor of a construction that will secure the best natural lighting, this costing nothing to maintain if once provided, while the cost of artificial lighting will be a continuing annual expense.

There is an important point to be borne in mind when building light shafts up through the floors of a mill—these shafts must be built of fire-proof materials and of closed construction throughout, and must not communicate, through passageways or openings, with any floor, nor must they be used for elevators, hoisting, etc. The sides should be metal tiling, re-inforced concrete or plaster, or other forms of good fire-proof construction, the glass should be a good quality of "wired glass," *i. e.*, glass in which is imbedded a mesh work of strong wire. These windows or glazed openings must be built in solid so that they cannot be opened by the help, leaving only one protected opening on each floor that can be used for access to the interior of the shaft, for painting, etc.

Under no circumstances should the light shafts be used for ventilation or communication or be open in construction; under such conditions, a fire on a lower floor will be apt to spread rapidly to other floors, the shaft acting as a chimney to draw up the flames and smoke with powerful draft. The light shafts should be used for lighting and nothing else, the practice sometimes seen of putting stairs or fire-escapes in light shafts is criminal folly. If built throughout of fire-proof and fire-resistant materials and constructed so that there are no openings nor communication on any floor, such fire shafts will add little, if anything, to the insurance risk. It is wooden shafts with ordinary wooden sash windows that have brought light shafts into bad repute, for they are fire traps.

The top of the light shaft may be either open or closed with skylights; in the latter case, the skylight should be rain-proof and have ventilators for ventilating the shaft. A superior type of ventilator for skylights is the Burt Glass Top Ventilator, which has a glass top instead of the usual metal, thus causing the least possible amount of light obstruction, while at the same time ample ventilation is secured. These ventilators are made in a special type to fit on glass skylights, with water-proof joints and setting, the ventilator itself being rain-proof, and are worthy of attention. The Royal Ventilator is also another good type. In fact, wherever skylights are used, these ventilators may be installed with good results, since they cut off the minimum of light. Skylights should have ventilators in almost every location, since this prevents much of the condensation of moisture that will occur on a cold day when the air inside is warm and humid.

Assistants to Lighting. Since light will travel only in a straight line, unless reflected or refracted, many corners of a room may be dark, although there be windows, skylights, etc. In no way has the problem of diffusing light throughout interior spaces been aided in solution more than by a study of the refracting possibilities of light. By interposing a suitable refracting material in its path, light from outside may be "bent" (or refracted) and thrown in straight horizontal rays wherever wanted. One of the best systems of this utilization of daylight by refraction is that known as the Luxfer Prism System, which consists of the use in windows, etc., of a special form of glass sheets, one side of which is moulded into rows of prisms of various angles to suit conditions. When this glass is used in a window, or other opening, the rays of light, which would otherwise enter at an angle and strike the floor and be lost, are refracted so that they enter the room in horizontal beams, thus lighting up the farthest positions. The Luxfer Prism glass has long since passed the experimental stage and its value has been amply demonstrated.

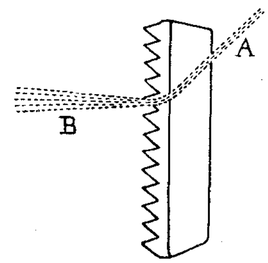


FIG. 1.

The manner in which Luxfer Prism Glass acts on light is shown in Fig. 1. In this illustration the slanting ray of light *A* strikes the Luxfer glass at an acute angle, passes into the glass and is refracted out in a straight line by the prisms, as shown at *B*. None of the penetrative effect of the light ray is lost, and very little is absorbed by the glass itself, and it will illuminate the far end of the room equally as well as the part near the window.

It must be understood that Luxfer Prism glass does not *increase* or *magnify* the illuminating power of the light it transmits, all it does is to *utilize* the light that would otherwise be lost, by changing its angle of direction and throwing this light into the interior of the room, etc. This effect often increases the volume of light received in a room from five to ten times more than the amount it would receive from a window with ordinary glass. The variety of ways and places that refracting glass can be used should make the study of its adaptation in textile mills one worth attention.

In considering the use of Luxfer Prism glass, its cost should not be compared with the cost of ordinary glass alone, some estimate must be made of the cost of the artificial lighting which its use makes unnecessary. It is plain that if Luxfer Prism glass in the windows will light a room that previously had to be illuminated with gas or electricity, its actual cost will be lessened by the cost of the artificial lights for the length of time the glass remains unbroken.

The first cost will be the only cost, artificial light costs every day it is used.

One of the best and cheapest ways to secure adequate light from the windows of a mill would be to use sheets of Luxfer Prism glass in the upper sashes instead of ordinary glass. This glass would be specially valuable for windows opening into narrow courts or where a high wall is opposite and separated by a narrow space from the mill, or for use in light shafts; in these cases the entire window should be glazed with the Luxfer Prism glass. As explained, this glass refracts slanting rays of light, which are the only ones received in narrow courts, etc., and throws the light in straight beams right across the room. Another advantage is that this glass being semi-opaque to direct view, privacy can be secured by its use in windows in place of plain glass, at the same time the amount of light being increased many times.

For basements or rooms partly underground, the Luxfer system is indispensable; by the use of Luxfer sidewalk prisms set in concrete in place of the usual "bull's eye" lights on the sidewalk, the darkest basement may be made light and available for any purpose. Where the basement is deep, it should have its openings into the sidewalk vault glazed with Luxfer prism glass, the so-called "lucidux" being used. The location of the various windows and the amount and direction of the light they receive should be taken into consideration. The best way is to describe the conditions and results required to the Luxfer Prism Company direct, as it makes a specialty of this form of construction.

Window Construction. Windows not only have the duty of furnishing light to the interior of a building, they have also the function of protection against wind, rain, etc. A still further duty that should be performed by windows is that of protection against fire, but unfortunately, this is seldom thought of. In a city mill, surrounded by other buildings, every window is a danger point in case of a fire in any of these; ninety per cent. of the fires in buildings adjoining one that is burning are due to communication through unprotected windows, which afford free passage to the flames. When surrounded by other and combustible buildings, the rate of insurance paid is in direct proportion to the amount of exposed window surface. Put on strong fire-proof shutters and see how quickly the insurance rate will be lessened. In the great fires at Baltimore and San Francisco, every building with unprotected windows, even the so-called fire-proof buildings, in the path of the fire suffered, the flames entering the windows and gutting the interiors. Now it is often impracticable, and always expensive, to equip a mill with fire-proof shutters, and there is always the probability that the shutters will be open just at the time they are most needed, but it is only common sense economy to protect these weak spots somehow. In lieu of fire-proof shutters, the best alternative is fire-proof windows.

Fire-proof, or more accurately, fire-resisting windows, can now be secured at a moderate cost. In such a window, all the wood work of the sashes, frames, etc., is replaced by metal, pressed steel being the cheapest and easiest to secure, and the glass should be the so-called "wire glass." Pressed steel window frames, sashes, etc., can now be had from many manufacturers, either galvanized or painted, and they are much cheaper than copper. Zinc is not suitable and should not be used, as it melts too easily if exposed to heat, and would leave the window opening unprotected. The wire-glass should be of good quality and heavy enough to resist heat. The advantage of wire-glass is that even if the glass be cracked by heat, the pieces of glass will be held together by the wire netting imbedded in it, the glass retaining its form at any temperature short of melting the wire and glass themselves. Luxfer Prism glass previously mentioned is now made with a wire mesh protection and this should be used wherever exposed to danger from fire.

If fire shutters are used, they should be actually fire-resistant, not mere wooden shells covered with thin sheet-metal or tin. To be worth the investment, fire-proof shutters should be of heavy metal, properly hung so that they will not sag down or fall when exposed to heat, and they should have stout bolts for secure fastening. To derive any benefit from their protection, these shutters should be closed as soon as the mill is vacated by employees and kept closed until work starts up the next day. Some persons should be assigned the special duty of closing these shutters at night and should be held strictly responsible for their security. Employees should be taught by drill to fasten and close the fire-proof shutters when the alarm of fire is given.

Fire-proof shutters are more a make-shift for mills already built than for those being erected. When building a new mill, the fire-proof windows previously described will be found a good investment, both from added security and lessened annual cost for insurance. At the present high prices for lumber, metal window fittings are not comparatively expensive, while their greater cost, if any, is offset by the saving in repairs, durability, etc.

(To be continued)

HUMIDIFICATION, ITS RELATION TO THE VENTILATION OF TEXTILE MILLS.

While nowadays it is generally known and understood by those in charge of textile mills that atmospheric conditions in the mill have an important effect both on the quality and the quantity of the production of yarns, fabrics, etc., and while in most mills of any size there is an effort made to secure and maintain certain conditions of temperature and moisture, there is, nevertheless, too little attention given to this subject, and its importance is underrated. Every one of experience in textile work is familiar with the troubles and trials with machinery and materials in a room in which the air is hot and dry and knows how waste piles up and work goes wrong, but not many follow up these troubles to their final effect and consequence as regards the output of the mill. Too often the mill owner puts in some sort of humidifying device that is urged on him and thinks that this is all that he needs or is the best that can be obtained, contenting himself with the belief that there is no help for unfavorable conditions anyhow, and that one must make the best of what cannot be helped. When things go wrong, he blames it on the machines or on the help or on both, or possibly he recognizes that something is wrong with his "humidifier" and tries all sorts of schemes to help it out, usually ending with disgust and despair, disgust with the "cussedness" of things and despair over the impossibility of getting favorable atmospheric conditions in his mill.

Then there are some men who sneer at all devices and systems for conditioning the air in mills, calling them "theories" and declaring that a "practical man" can get along very well without them. Maybe his mill is located where a moist and even climate prevails, then he can go along very nicely, depending on doors and windows only, until some day Nature gets a cranky spell and then his troubles begin. Eventually, this man, like all textile workers, will realize that the air of a textile mill must be conditioned artificially and will order some system for the purpose, but, will he investigate and learn the proper methods of humidifying or will he let some one else think for him and get his money for the thinking part, with some sort of a machine thrown in for a bargain? That is where the most of the trouble lies, the mill man does not investigate for himself and must therefore put up with the devices and makeshifts of men with something to sell, but who haven't the first rudiments of the problems solved. Now, let us do a little thinking ourselves and see what this question of humidifying a mill means, and how it can be done practically and dependably, and what its cost will be when considered with its results on production.

First, let us consider the merits of the question,—is it necessary to maintain artificial conditions of temperature and humidity in a textile mill? What are the actual conditions of the mill in this country, does it need an artificial conditioning of its atmosphere, and if so, why? What is the effect of climatic and operative conditions on textile processes if no attempt be made to modify the natural conditions inside the mill? How does the cost of a system for modifying atmospheric conditions in a mill compare with the cost of producing an equal quantity and quality of goods,—with the system and without any system or aid at all? Will the system pay for itself or not? These questions should be carefully studied by every mill owner or manager, on their answer depends success.

The first question has long ago been answered and settled by the experiences of textile workers everywhere. The operation of textile machinery generates a great deal of heat, which is given off to the air of the room and which must be removed in some way, this excessive heating of the air in turn causing its relative humidity to be greatly lowered. It has been found by actual tests that the operation of a roomful of spinning frames will raise the temperature of the room as much as thirty degrees above what it is when the machines are idle, and this heat will make the air seem extremely dry unless it is removed or counteracted. A further disadvantage caused by this heating by the machinery is that the dryness of the air permits the fibres of cotton and wool to become highly electrified, from the friction to which they are subjected, this electrification making it almost a physical impossibility to spin decent yarns in coarse counts and an absolute impossibility to spin fine yarns satisfactorily. In fact, good yarn cannot be spun in a room where the temperature is high and the relative humidity is low, and, therefore, some means must be employed to alter these conditions if the mill is to operate successfully.

That this is no exaggeration is shown by the following data on the effect of high temperatures and insufficient moisture on fibres and fabrics. Lack of moisture and a high temperature in the spinning room will cause a decrease of from 10% to 30% in the strength of cotton yarns; a variation of from 5% to 25% in the evenness of the counts spun, with a consequent variation in the relative weights per hank; a difference of from 10% to 30% in the amount of twist per inch; and, finally, almost any amount of difference in the smoothness and evenness of the yarn. These conditions in the weave room will cause variations in the thickness of the cloth, because of the variations in the warp and filling yarns used; unevenness of the cloth, because of the uneven action of the shuttles and bobbins, and there will also be numerous defects in the cloth, from knots and lumps, due to the frequent breaking of threads, etc.

In addition to the many and serious defects in yarns and fabrics due to hot, dry air in the workrooms of the mill, there will be a big percentage of loss from waste —and waste always means loss of that much good material and its value in hard cash—which will amount up higher and higher the longer conditions are allowed to remain unchanged. There will be quantities of loose fibres licked up by the drafting rolls and the clearers of the spinning frame, knotted and tangled threads, broken ends, uneven and weak places in the yarn, etc., etc. Cloth will be spoiled in the weave room, machinery will get out of order or else will run only at a heavy increase in power consumption, in fact, every operation will be made more difficult and costly and much of the raw materials will be spoiled or wasted.

(To be continued)

THE ELECTRIC DRIVE FOR TEXTILE MILLS.

The application of electric motors for the operation of textile machinery is a growth of the last few years only and its adaptability to all conditions and circumstances has hardly yet been fully worked out, although certain standard forms have been found to be best suited to the requirements of textile mills and have been pretty well perfected. This application of electric motors for power purposes is commonly called the "electric drive," and as such is usually spoken of.

The use of the electric drive in textile mills, its drawbacks and its advantages, have been so much discussed of late years that there is very little to be said upon the subject that will be new. The application of electric power to textile machinery has ardent advocates and equally ardent opponents, but it is a significant fact that the strongest supporters of the electric drive are those men who have used it in their mills and tested its capabilities and possibilities, and added to this is the equally strong argument in its favor that no mill fitted up to use electric power has yet reverted to the use of either steam or water power. The chief cause of the success of the electric drive is that it increases the output of the mill, as a prominent engineer has said "the main reason for the adoption of the electric drive lies in the increased efficiency of human energy that is secured by it." That is, the same person and the same machine can turn out more goods and better goods with the electrical operation of machines than otherwise, and since the cost of labor and machinery are the largest items in the operation of a textile mill, an increased efficiency of either of these means increased profits.

Indeed, so thoroughly has the superiority of the electric drive been demonstrated that its adoption has now largely become a matter of cost, and one hears more discussion of which type of motor or drive to adopt than he does of the question whether or not electric power shall be used. There are several different types of motors, which, in turn, are divided into two classes, direct current motors and alternating current motors, so there is often a question of which style or class to adopt for a particular purpose. In modern textile mills there is a good deal more than just spinning and weaving machines to be considered, for instance, there are fans and blowers, elevators for freight or communication, machines and tools for repairing broken machinery, etc., the electric lighting, etc., etc. To meet the particular requirements of each of these operations, different types of motors have been developed, which are the result of severe evolution, painstaking care and endless experimenting, and only those fittest have survived the ordeal. So perfectly has the differentiation of types been worked out that it would be wasteful folly to use one motor for work to which another is better suited.

The following brief references to the different styles of electric motors and the work or service for which they are best suited may be of interest to the practical mill man, as showing the type of motor that can be most economically and efficiently used not only for textile machinery but for the secondary machinery of the mill as well. The nature of the electric current employed, whether direct or alternating, must also be taken into consideration, as a motor wound for one of these currents should never be put to work on the other current, unless specially built to work with both.

Motors are divided into two different classes according to the kind of current they use; these are:—

DIRECT CURRENT MOTORS. ALTERNATING CURRENT MOTORS.

Direct current motors include the following types: —the Shunt Motor, the Series Motor and the Compound Motor.

Alternating current motors include the Single-phase Induction Motor, the Poly-phase Induction Motor, the Single-phase Series Motor and the Single-phase Repulsion-Induction Motor.

Each of these types is built with certain conditions of current, work and operation in view, and each have special advantages and uses. The different uses to which these motors are best adapted are easiest explained by reviewing the various kinds of work for which the electric drive is adapted. Under this system the classification would be about as follows:—

1. Service requiring constant speed with varying loads, with no control of speed beyond that which keeps it automatically constant at a given speed when once so adjusted.

For such work either direct current shunt motors or single-phase or poly-phase induction motors on alternating currents may be used. If the service is varied by having a large number of stops, starts and possibly reversals, compound motors can be used with better advantage than shunt motors; where a constant speed is not required, shunt motors may be used as well.

The conditions named are those prevailing in textile mills, for ring frames, mules, looms, etc. For operating this class of machinery, the poly-phase induction motor on an alternating current is the most suitable, on account of its freedom from sparking and its positive transmission of power. Direct current motors are unsuited for textile work on account of their liability to sparking.

2. Service requiring large starting torque (or turning moment) for rapid acceleration of the load and a comparatively small running torque with frequent starts, stops and reversals.

For this service, it is customary to use direct current series motors, although the recently developed single-phase series motors, (alternating current), have equally as good capacity for this kind of service.

(To be continued)

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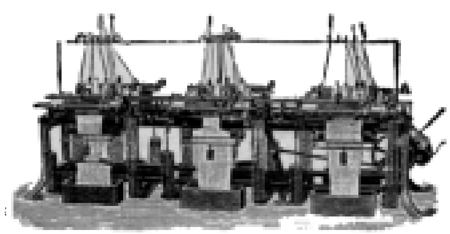
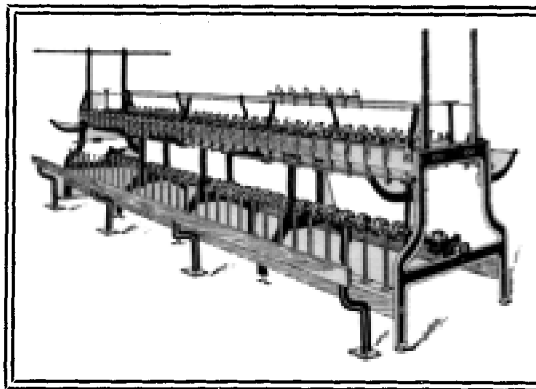




BUYERS' INDEX—Continued

ITEMS OF INTEREST

MARKET CONDITIONS SUMMARIZED.

A general unsettled condition has prevailed in the COTTON MARKET throughout the month. The uncertainty as to the size of the crop and the unsettled weather conditions made a waiting policy a good one. The stand taken by the farmers of the South and by the foreign cotton spinners against manipulation and the dealing in cotton futures caused a flurry, but the market has shown no great nor decided change throughout the month.

A general slump seems imminent in the COTTON YARN MARKET. The dealers, who have considerable stock in hand as well as a large output coming forward, seem anxious to dispose of their holdings; however, conditions may be deceiving and the market may have a decided reaction.

There was very little selling of COTTON MILL STOCKS. The market was strong and holders of certificates seemed willing to hold them in the hope of their final future value.

The WORSTED YARN MARKET has been steady. The situation has been normal; fine yarns have been strong.

The WOOL MARKET has been rather weak, although fine wools remain fairly strong. The DRESS GOODS MARKET has been particularly dull, and a very unsatisfactory period seems to be at hand. CARPET and JUTE YARNS have been quiet the entire month.

There was little interest displayed in the DRY GOODS FIELD. Sales were few and there does not, at present, seem any prospect of improvement. For this time of the year the market condition is unusual, and the tendency is for manufacturers to dispose of the stock on hand.

The Importance of Winding Yarn from Skeins to Shuttle Bobbins or Quills, Butts, Paper Tubes, and Cops.

This is one of the most important processes carried on in a textile mill, for the fact that good winding machinery means increased output of perfect fabrics to the mill. Since larger production means larger dividends, it will be readily understood that any textile manufacturer must pay proper attention when in need of winding machinery.

There are at all times problems to be solved by the builders of winding machinery, on account of the constant change of styles in the market, and consequently also in the construction of fabrics; items all of which must be carefully considered by the manufacturer when ordering new winding machinery, and which machinery then should be of the most improved pattern only.

To get production as well as quality of this end of textile manufacturing, requires various means to be employed by the builder of the style of machinery needed, in order to get the best results, for which reason the well-known firm of Jacob K. Altemus, Textile Machinery Builders of Philadelphia, keep constantly in touch with all the demands made upon winding machinery, in order to produce the best results in connection with the class of fabrics the winder is designed for.

Messrs. Jacob K. Altemus, 2824 N. 4th St., Philadelphia, have made the building of winding machinery a specialty as far back as 1865 and consequently, as will be readily understood, on account of this long connection with the building of winding machinery for all classes of fabrics, are able to meet any condition, and any proposition presented to them by any textile manufacturer for any kind of yarn is promptly taken up by Mr. Altemus personally. He will direct his men to show and instruct his customers, i. e., how to wind to get the best results.

Washington, D. C. As a result of a meeting held during the National Cotton Manufacturers' convention, interests engaged in the production of textile machinery and mill supplies perfected a permanent form of organization as the Textile Exhibitors' Association, and decided to hold their first display, probably at the next regular meeting of the Cotton Manufacturers' Association at Boston.

Mr. George Otis Draper, secretary of the Draper Company, of Hopedale, Mass., was elected president, and Mr. F. H. Bishop, general manager of the Universal Winding Company, Boston, vice-president. An executive committee, consisting of Messrs. E. B. Hathaway, E. M. Savecool, M. E. Merrill and H. W. Butterworth, was appointed.

About thirty firms became members of the association. The movement has been started under extremely favorable auspices and can not help to be entirely successful.

Washington, D. C. The census bureau has issued its complete report, showing that the quantity of cotton ginned from the growth of 1907 up to Sept. 25, was 1,559,977 bales against 2,057,285 last year, and 2,355,716 in 1905. Report counts round bales as half bales.

The total number of active ginneries reported was 18,152. Total ginneries reporting to Sept. 25, last year was 20,415 and in 1905 was 21,389.

The number of round bales for 1907 was 41,356, as compared with 66,502 for 1906 and 74,816 for 1905.

Sea Island bales numbered 4,240 for 1907, as compared with 2,689 for 1906 and 11,936 for 1905.

Washington, D. C. Mr. Otis Draper's most interesting address at the big convention of mill men, was on "An Analysis of Usage," in conclusion of which he said, "I think our organization as a whole has shown greater interest in economizing the production of cotton fabrics than in extending their use. I see no reason why it is not both legitimate and advisable for us individually, and as a body, to stimulate the further use of cotton fabrics. Since our labor cost is relatively high, and our tariff by no means impregnable, the majority of us are interested in spreading the use of the cheaper fabrics, increasing consumption by the common people. Such increase will assume even more importance if the tariff be reduced to interfere with our present prosperous production of fine cotton goods, thereby forcing fine mills onto cheaper fabrics, and increasing the competition of our present mills on medium grades. It is by no means impossible that a concerted, definite, studied, vigorous, educated campaign might not accomplish important results in such an open field."

Washington, D. C. Director North of the census bureau at the sessions of the National Convention of Cotton Manufacturers predicted that at the next census and at each succeeding census for a long period, the Southern States will show a greater relative advance, both in agriculture and manufactures than any other section. If the cotton growth continues at the present rate, Mr. North claims that a majority of the American spindles will be south of the Mason and Dixon line.

He predicts that the next great advance in the evolution in handling lint cotton would be the supplementing of the "present preliminary and somewhat loose form of packing by the general introduction of gin compressers." The gradual perfection of the methods of the ginning census, he said, had been followed by the complete elimination of speculative estimates of the size of the crop as a factor in fixing the price.

MILL NEWS

PENNSYLVANIA.

Philadelphia, Pa. The firm of Fred. Holdsworth and Co., on N. Cadwallader St., have removed all their machinery to the mills of the Hamill Spinning Co., in Germantown. Since Mr. Holdsworth's death the business has been managed by Mr. Fred. Holdsworth, Jr., who has now accepted the superintendency of The Rossmore Manufacturing Co., of Trenton, N. J.

Philadelphia, Pa. The cloth and blanket mills of John Dobson, employing 500 persons, after being idle for nearly three months has resumed operations. Early in July the cylinder head of an engine blew out necessitating the closing down of the plant.

Philadelphia, Pa. The weavers in John & James Dobson's plush mills, who struck a short time ago, have come to an agreement with their employers and resumed work.

Philadelphia, Pa. The John B. Stetson Co., which is said to operate the largest hat factory in the world, may double its capital. The present capital is $4,000,000; and the large and persistent growth of the business requires an addition to its working capital and more money for much needed extensions. The company since organization in 1891 has paid an 8% dividend on its preferred stock each year, and last year a dividend of 25% was paid on the common stock.

Philadelphia, Pa. The Contrai Manufacturing Co., Keith K. Skeen, Supt., are rapidly moving their machinery from their old plant on Franklin St. above Church, to the mills recently renovated for them at Unity and Margaret Sts. The tremendous growth of this firm in the course of three years has caused them to seek larger quarters for the third time.

Philadelphia, Pa. The Henry Goldthorp Manufacturing Co. have removed their plant from the Ontario Mills to larger quarters at 1415-17 North St.

Philadelphia, Pa. The Kilmarnoch Textile Mfg. Co., has opened a new plant at Emerald and Adams St., manufacturing Art Squares, etc. Mr. Wm. T. Scott, formerly connected with their Chicago plant, is the Superintendent.

Philadelphia, Pa. McIlwain & Co., are reported to have shut down temporary.

Reading, Pa. The Central Knitting Mills Company, has received its charter. The capital stock of the concern is $15,000, divided into one hundred and fifty $100 shares.

NEW YORK.

New York. About Five Million more yards of French Worsteds were imported this year than last.

Of Woolen Cloth (dress goods) about Thirty Seven Million yards have been imported during this year.

$9,438,943 is the increase in import of Laces and Embroideries during the eight months ending Aug. 1907, over the imports of the same goods in the corresponding time in 1905.

19,719,048 yards is the increase of import in cotton cloth, from England alone to this country, during the eight months ended by August 1907, over that class of goods imported from the same source during the corresponding eight months of 1905.

With reference to cotton Knit goods, the increase for the eight months ending with August 1907, as compared with the corresponding eight months, two years ago, is $1,713,179.

These items clearly show that the tariff does not fulfill its purpose.

In contrast to these figures it is interesting to note, that although there exists an immense home demand for ribbons, the importations were less as compared with those in the preceding two years, showing that our domestic mills are supplying more and more our home market.

The import of Carpets has also dropped, compared to last year.

New York. The Royalton Woolen Company, after January 1, will finance its own account. At present they are connected with Battelle, Hurd & Co.

New York. Ludwig Littauer, Successor to Moeller & Littauer, 109 Greene St., New York, Importers and Manufacturers of Silk, Worsted, Woolen and Mohair Yarns and Tinsel in all their varieties, are rushed with orders for the product of their mills. They are just starting a new mill at Boonville, N. Y. for the throwing of Tram and Organzine. One of the latest specialties added to the output of this progressive concern is the manufacture of Artificial or Wood Silk for the weaving trade and braid manufacturers.

Port Leyden, N. Y. A new Knitting Mill, the Port Leyden Knitting Company, has been incorporated here. Mr. Fogarty will be its Manager.

Boonville, N. Y. Ludwig Littauer of 109 Greene St., New York City are starting here a new mill for the throwing of tram and organzine.

NEW JERSEY.

Paterson, N. J. One of the most busy establishments in this city is the Sipp Electric & Machine Co., this concern being sold ahead on their specialties for months to come. A new feature is their Measuring Device for Winders, etc., an attachment to silk throwing machinery which will be fully explained and illustrated in our article on "Silk from Fibre to Fabric" in one of the succeeding issues, when dealing then with that class of silk throwing machinery to which the device more particularly refers.

Paterson, N. J. The Atherton Machine Co., E. E. Atherton, President, Frederick L. Atherton, Vice-President and Treasurer, and Ira Dumont, Secretary, are rushed to their utmost manufacturing warpers, winders, and double quillers. They are at present at work on machinery for the new plant for A. & M. Levy; for the addition to McGill & Blum's mill, and for the Maple Silk Co.

Paterson, N. J. The executors of the estate having control of the Todd mill, on Van Houten Street, have sold the latter to Robert Muller & Co., manufacturers of hat bands, the consideration being $45,000. In a few weeks the company will install about sixty looms, of a special make, imported from Germany.

It is probable that within a short time the plant will be enlarged and additional hands employed.

SOUTHERN STATES.

Calhoun, Ga. At a meeting of the Echota Mills, Mr. T. W. Harbin was elected President of the Corporation, and the following were elected Directors: H. A. Dover, T. W. Harbin, A. H. Chastain, W. L. Hines, J. B. Watts, L. R. Pitts, H. Henson, O. L. Starr and Dr. G. W. Mills.

Taylorsville, N. C. Messrs. C. L. Alspaugh, U. L. Alspaugh, T. C. Alspaugh, W. L. Moose, L. C. Hafer, and Theo. Watts have incorporated the Broad-Shoals Mfg. Co. with a capital stock of $100,000. It is proposed to manufacture cotton goods of the various staple classes.

Huntsville, Ala. The stockholders of the Huntsville Cotton Mills held their annual meeting and elected the following officers: President, R. E. Spragins; Vice-President, A. S. Fletcher; Treasurer, J. Robert Jones; General Manager, Charles H. Fletcher. The following were elected directors: A. S. Fletcher, Robert E. Spragins, W. H. Fletcher, Harry M. Rhett, T. M. Jones, Dr. J. A. Hill, J. Robert Jones, Thomas H. Wade and Isaac Schiffman.

Davidson, N. C. The Linden Manufacturing Co. intends to install electric motors for power and to operate them by electricity which will be supplied by the Southern Power Co., of Charlotte, N. C. At present the Company has 9,232 spindles in operation.

Griffin, Ga. The new stock issue of the Cherokee Mills has already been over-subscribed. With $180,000 signed and in sight, it is proposed to make the capital $200,000 in common stock instead of issuing $50,000 in preferred stock as has heretofore been the custom.

Caroleen, N. C. R. P. Scruggs has been appointed Superintendent of the Caroleen Mill. He succeeds F. M. Mosher, who has resigned to accept the management of a mill at Edgefield, S. C.

Harrison, Ark. H. E. Cantrell will establish a mill for manufacturing common three and four-ply wrapping twine, the daily output to be about 2,000 pounds.

Natchez, Miss. Mill No. 2 of the Natchez Cotton Mills, is now running short-handed. The mill has just been re-opened after a three year shut-down. The management report business as being very brisk, and they are desirous of running the mill to its full capacity.

Columbus, Ga. The new plant for the Swift Spinning Mill on North Highland is now completed and will soon be in operation. The plant will be driven by electricity and the power is to be supplied by the Columbus Power Co.

Columbus, Miss. The Columbus Yarn and Textile Mills have been organized for the manufacture of cotton, wool and silk yarns.

Columbia, S. C. The Chapin Manufacturing Co., with a capital stock of $75,000 has been incorporated by Messrs. J. J. Blackwelder, M. C. Carlisle, C. P. Robinson and E. T. Branch. The mill, which will be started with 3,000 spindles, will later be increased to 5,000 spindles. The entire product will be turned over to the Ashley Manufacturing Co. of Newberry, S. C.

Birmingham, Ala. The addition to the buildings of the American Net & Twine Co. is now almost completed. This new mill will have a final capacity of 10,000 spindles, but operations will commence with 5,000 only. Cotton and twine will be manufactured.

Hartsville, S. C. The Hartsville Cotton Mills are to add 6,000 spindles and 120 forty-inch looms to their equipment. When these are installed the plant will have a total of 33,000 spindles and 800 looms.

Charlotte, N. C. The Klotho Mills of King's Mountain, formerly the Enterprise Mills, have decided to spin yarn exclusively. The looms have all been removed, and a contract awarded for an additional 2,000 spindles.

Birmingham, Ala. The Alabama division of the Farmers Union has completed organization of the cotton company, for the sale of the cotton for its members. Sales will be made as before through the Birmingham cotton exchange. The local union warehouses are to supply the central exchange with samples of the cotton offered for sale and the sale will be made direct with the millman, by the manager of the exchange, Mr. J. M. Thornton. The capital of the organization is $10,000. The object in view is 15 cent cotton.

Salisbury, N. C. Mr. Frank L. Robbins, formerly manager of the Kesler Manufacturing Company, has begun the operation of his new mill in North Salisbury.

Raleigh, N. C. The Raleigh Cotton Mills are installing six Whitin high-speed combers, they are also adding a roll covering department.

Woodruff, N. C. The W. S. Gray Cotton mills have been incorporated with a capital stock of $160,000. Mr. W. H. Gray is president, W. S. Gray vice-president; D. B. Irby secretary, and W. H. Gray treasurer.

Clinton, N. C., may have a $125,000 Cotton Mill. Mr. W. D. McNeil, a prominent manufacturer of Fayetteville, was chosen for president.

Alexandria, Va. Manufacturers have offered to establish a silk and hosiery knitting mill at this place, provided they can be assured that sufficient operatives can be secured. The Chamber of Commerce, J. T. Preston, Secretary, is greatly interested in the project.

A report comes from Scranton, Pa., to the effect that Valentine Bliss, who operates mills in Jessup, Dickson City, Dunmore and North Scranton, has begun to move his silk business to this city. The strike of the employees of the various mills has tied up the silk industry in the vicinity of Scranton. Mr. Bliss is reported to have purchased a knitting mill and to have already started to remodel it.

Carthage, N. C. A building has been secured and knitting machinery installed at this place for the Bismarck Hosiery Mills. Full length hosiery will be manufactured. J. C. Newsom is President, and J. F. McArthur is Secretary-treasurer.

Burlington, N. C. Mr. D. E. Sellers is to be manager of the Sellers Hosiery Mill, which is to be established with forty knitting machines. Fine gauge half-hose in the gray will be manufactured.

Wilson, N. C. A committee has been appointed, with David Boykin, Chairman, by the Business Men's Association, to investigate the knitting industry and obtain prices on the machinery required for a knitting mill.

Union, S. C. John W. Fant, President and Treasurer of the Monarch Cotton Mills died at this place on September 24th. The deceased was largely interested in many important enterprises, and was 49 years of age.

Macon, Ga. The Macon Chamber of Commerce and the Macon Cotton Exchange will probably be merged. Plans for the merger are now being considered and the proposal to consolidate the two bodies is receiving much favorable notice from the local merchants.

Enfield, N. C. The new Enfield Knitting Mills have begun operations, giving employment to about 80 hands.

Greenville, S. C. The Westminster Knitting Mills contemplate making improvements, having added for this purpose $20,000 to its capital stock.

Greenville, S. C. Construction on the Leesville Cotton Mill has been started. Of its subscribed capital stock of $100,000 the first call has been collected. It will be a yarn mill.

Gastonia, S. C. The Dunn Mfg. Co., chartered recently with a $100,000 capital stock, will manufacture white goods.

Anderson, S. C. The Conneross Yarn Mill has been sold to Mr. A. S. Farmer, the consideration being $25,000.

Shelby, S. C. Operations have been started on the construction of the Elba Mfg. Co., situated between the Belmont and Lilly Mills. The output of the new mill will be convertibles.

Mooresville, S. C. The new number 2 Cotton Mill here, has most of its machinery installed, some of the Preparing, Carding and Spooling machinery being already in operation.

Kinston, S. C. $70,000 has been subscribed towards a new mill. The new company will be organized as soon as the hundred thousand dollar mark is reached.

Griffin, Ga. Work is nearly finished on the addition to the Kincaid cotton mills. This will double their capacity, making 50,000 spindles in all.

Columbus, Ga. The new Swift Spinning Mill is completed.

Columbus, Ga. The Swift Mfg. Co. has installed 12 new Saco & Pettee Drawing-frames in place of the same number of old H. & B. frames taken out.

NEW ENGLAND STATES.

Providence, R. I. A most remarkable and peculiar accident is reported from here. Napoleon Norguet, a weaver, was employed by the Paramount Worsted Mills. On February 19th, of this year, while running a loom, a shuttle of the loom next to him, jumped out, puncturing his liver and intestine and causing permanent injuries. The cause of the accident was a defective picker stick and box. The man was able to return to work, and on May 31st, while working at a loom he suspected that the same defect existed in the neighboring loom. A loom fixer who examined the loom pronounced it all right. The man continued his work when the shuttle jumped out, striking him in the right side, puncturing his liver and knocking him unconscious. That a man should on two separate occasions receive identically the same injury from the same cause is certainly very remarkable.

Fall River, Mass. The new plant at North Dighton for the Chadwick Print Works, will be ready for occupancy within a month or six weeks.

Fall River, Mass. A quarterly dividend of 7½% has been declared by the Richard Borden Mfg. Co. This makes a total of 20% in dividends for the whole year. In addition a stock dividend of 25% has been declared, increasing its capital from $800,000 to $1,000,000.

Fall River, Mass. The Weetamoe Mills, Geo. H. Eddy, Pres., Enoch J. French, Treas. and Agt., have declared their regular quarterly dividend of 2% on their capital of $550,000.

Fall River, Mass. The Osborn Mills, John C. Milne, Pres., S. B. Chase, Treas., have declared a quarterly dividend of 1½%.

Boston, Mass. The directors of the American Woolen Company have declared a regular quarterly dividend of 1¾% on the preferred stock, payable October 15, 1907. This is the thirty-fourth consecutive quarterly dividend declared on the preferred stock, equivalent to $59 per share, making the aggregate payment $13,212,500.

Woonsocket, R. I. The new mill of the Montrose Woolen Co. has begun operations. The plant is located on East School Street, and Jacob H. Hary is the agent.

Woonsocket, R. I. On account of pressing demand for their output, the Guerin Spinning Co. has commenced night work. The period of this double system will continue indefinitely.

Athol, Mass. S. G. Ball is fitting up a worsted mill at this place. Looms are being set up and it is hoped to have the machinery running within a short time. Thirty hands will be given employment. The building secured for the mill is well adapted for the purpose and is furnished with excellent water and steam power.

Waterville, Me. George F. Terry, general manager of the Riverview Worsted Mills, emphatically denies the report, which has been generally circulated, to the effect that the concern was in the near future to change hands.

Helena, Mont. A prominent Eastern manufacturer is in correspondence with Secretary W. T. Hull of the Commercial Club in regard to locating a woolen mill in this city. The power which would be available from the two dams across the Missouri near Helena, would be very favorable to this project.

Worcester, Mass. The Queensbury Mills, H. Hodgson, Pres., and Fred. Hodgson, Supt., are rushed with orders. The entire product of their mills for the next eight months is contracted for.

Bennington, Vt. Geo. Rockwood & Co., A. Buel Sibley, Manager, are exceedingly busy. They have been so rushed with orders that they have been compelled to buy two new Tiffney Knitting Machines. Their entire product for the next eight months has been spoken for.

Bridgeport, Conn. The Salt's Textile Manufacturing Co. are very busy on Pile Fabrics, Silk Velvets, Cottons, Silk and Mohair Plushes and Woolen and Worsted Fabrics. The President, Frederick E. Kip, is authority for the statement that if trade continues coming their way, other and more adequate arrangements will have to be made to supply their trade.

Boston, Mass. Morris Weinbaum, a woolen goods merchant of 52 Salem street, who was petitioned into bankruptcy Sept. 13, filed his schedules in the United States district court, showing total debts of $33,102 and total assets of $11,100. Secured debts amount to $8200.

New Bedford, Mass. Another large spinning mill, to employ 600 hands, is to be established in New Bedford within a short time. The new plant will be on the Hastings wharf property, at the foot of Grinnell street. Work will be begun either this fall or early next spring, the mill to be completed within a year. The plant is to be a four story building 480 x 130 feet, and provide room for 70,000 spindles.

New Bedford, Mass. Foundations are completed for a new four story cotton yarn mill, 50 x 131 feet, for Harding, Whitman & Co., of Boston. The estimated cost of the mill is $250,000.

Pawtucket, R. I. The first step of the agitation for an eight-hour law for the textile workers of this state was taken last evening, when the executive committee of the Rhode Island Mule-spinners' association met in the Cottrell block, and appointed a committee consisting of President Joseph Grey and William Burke to agitate the enactment of such a law. The annual convention of the Textile Council will be held in this city on Oct. 15.

Providence, R. I. Fire completely gutted the cotton waste storehouse of the A. E. Emerson Company of Boston, causing about $30,000 damage. The fire threatened the nearby factory of the Rhode Island Braiding Machine Company.

Woonsocket, R. I. The Perseverance Worsted Company on a site adjoining its well equipped River street plant has staked out for the foundations of a new three-story brick weaving mill of 120 looms capacity. The present plant, which will continue in operation after the new one is constructed, has 81 looms. The new mill will be in operation by next spring.

Fall River, Mass. Important changes in the management of the Estes Mill, in Maplewood, went into effect when Benjamin Kirk, formerly Superintendent of the Shove Mills, became Superintendent of the plant. John H. Estes, President of the corporation, is to retire from active management and his place will be taken by J. Edmund Estes. Elmer B. Estes will succeed his brother.

Fall River, Mass. Messrs. Greene & Son, representing a syndicate of cotton investors, have purchased from Sarah S. Brayton and the Estate of John S. Brayton, two large tracts of land. These tracts are situated on both sides of Pleasant street, the lot on the South side of the street fronts on the Quequechan River.

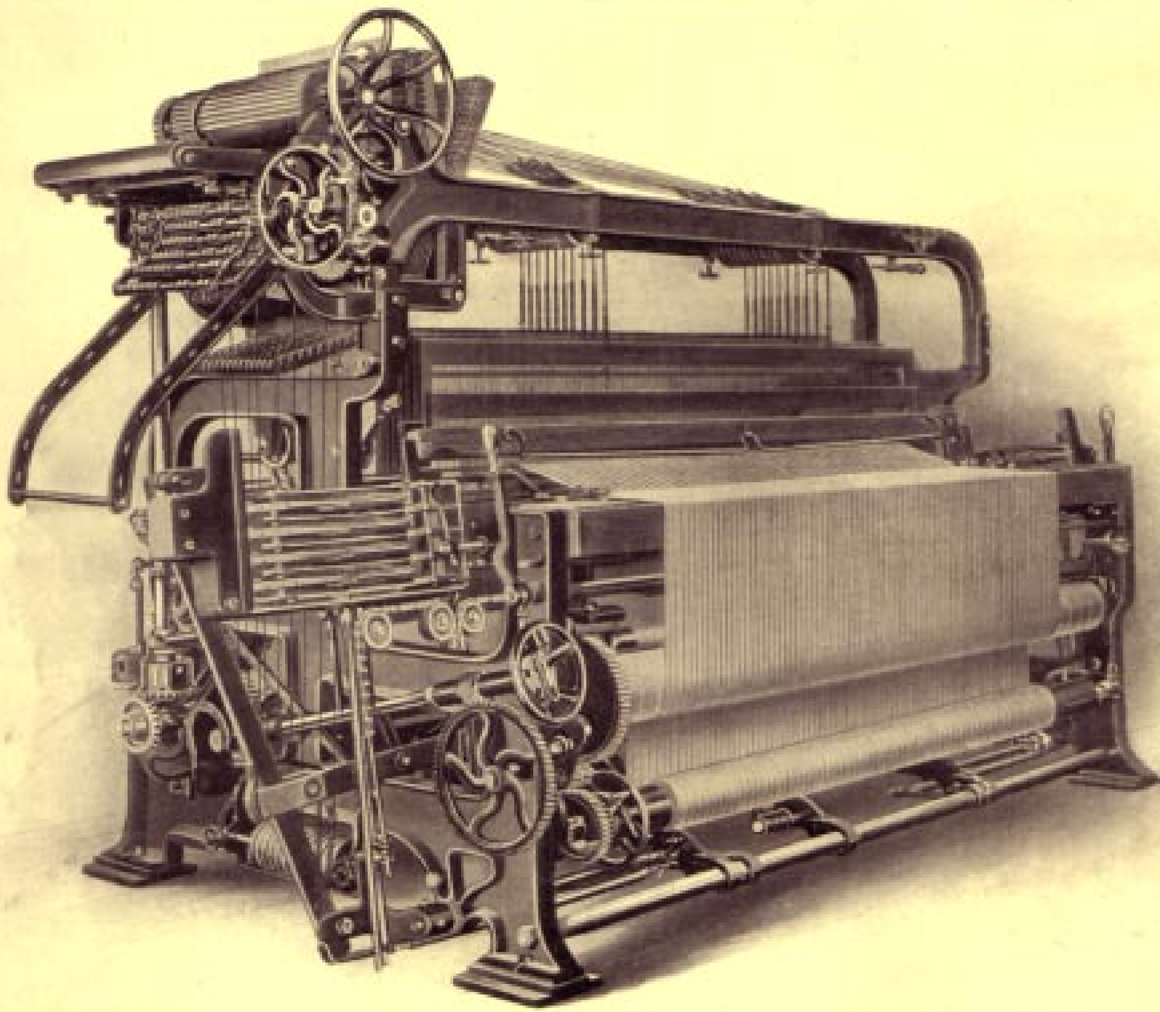
LOOMS

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