Yours Truly
A. A. Baldwin,

THE

SELF-INSTRUCTOR IN TEXTILE DESIGNING;

OR,

A Practical Guide in Designing & Weaving.

AN INSTRUCTOR & GUIDE ADAPTED TO THE REQUIREMENTS OF ALL ENGAGED IN THE ART.

ILLUSTRATED WITH

THREE-HUNDRED FIGURES REPRESENTING SINGLE, DOUBLE, TRIPLE AND COMBINED WEAVES IN VARIOUS FORMS OF CONSTRUCTION AND COMPLETION, THE PRINCIPAL METHODS OF ATTACHING BACKS TO FABRICS, AND EIGHT CLOTH SAMPLES MADE SPECIALLY TO DEMONSTRATE THE PRINCIPLES OF THE WORK, INCLUDING A FANCY PICKOUT SHOWING FIVE METHODS OF REDUCING AND WEAVING THE SAME; DIAGRAM OF PATTERN SHEET; ALL MANNER OF STOCK FIGURING FROM THE WOOL IN THE GREASE TO THE WOVEN STATE, INCLUDING MAKING MIXES; ALSO YARN TABLES, RULES, CALCULATIONS, ETC., ETC.

The Most Practical and Complete Work on Designing and Weaving Ever Offered to the Craft.

BY A. A. BALDWIN,

AUTHOR OF

"A Treatise on Designing and Weaving Plain and Fancy Woolen Cloths," "The Designers' Chart," and "The Loom-Fixers' Manual." Also ex-Editor and Publisher of "The Designer & Weaver"—1880-1,—and "Baldwin's Textile Designer"—1888-9,—both monthly publications.

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PREFACE.

IN fulfilling a task so difficult as that of writing a "Self-Instructor in Textile Designing," the author feels it a duty to state the causes which led him to undertake it, and the principles which have guided him in carrying it to a conclusion. First, to overcome past failures in books relative to the Art, by demonstrating in a comprehensive manner such points as have heretofore been ignored by their authors; or, points on which they failed in conveying to the reader the intended meaning. Second, to produce a self-instructor founded on practical experience and study of the art; a work demonstrating so plainly, with the assistance of the cloth samples made specially for it, that all who will, may comprehend the whole and thus be their own instructor. Third, to spread a knowledge of designing as widely as possible among those who have not the advantage of personal instruction.

Furthermore, the author wishes to place in the hands of would-be designers such a work on the subject as will enable them to understand more clearly, and comprehend more thoroughly the details and technicalities of the art. That he has succeeded in this, and in bringing the rudiments of designing to that state of perfection wherein they can be easily learned, and practically applied by those who are dependent almost wholly on books for their instruction in designing, will, he believes, be conceded by all fair-minded persons capable of judging.

The aim has been to lay before the craft a plain, clear, practical view of all the rudiments required to be known by those who are interested in an art, the fundamental principles of which have been heretofore but very imperfectly demonstrated in books. Although not intended as a literary production, and although apparently small, it is believed that the work covers the entire field of designing for which it is intended. That it may succeed in awakening among the craft the same interest in its subject-matter which called it into existance, is the earnest desire of the author.

A. A. BALDWIN.

Dec. 18, 1890.

CONTENTS.

CHAPTER XVII.

CHAPTER XVIII.

CHAPTER XIX.

CHAPTER XX.

CHAPTER XXI.

CHAPTER XXII.

ERRATA.

On page 32, twentieth and twenty-first lines, read "into 5 warps, will give 440 yards per warp of 12 cuts,—that is $36\frac{2}{3}$ yards per cut or piece," instead of "into 6 warps, will give 350 yards per warp of 10 cuts,—that is 35 yards etc."

On page 93, Fig. 8, bar 3, read "■■■■■□■■□■■■," instead of "■■■■■□■■□□□□."

On page 129, in table, second column, read "$20\frac{1}{4}$ runs," instead of "$29\frac{1}{4}$." Also, in fifth column, read "$35\frac{5}{7}$ Nos." instead of "$36\frac{5}{7}$."

Besides the above, there are on other pages misprint and typographical errors, but none that will in any way lead the reader astray or change the general meaning. We acknowledge, however, that such are due to carelessness in proof reading and hurrying the work.

THE

SELF-INSTRUCTOR IN TEXTILE DESIGNING;

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CHAPTER I.

HINTS TO WOULD-BE DESIGNERS.

DESIGNING is that branch of textile manufacturing which requires each and every part thereof to be performed both accurately and thoroughly. These results cannot be expected from the novice, nor from a person of no taste in the calling, as such can be accomplished only by those who have more or less of the natural qualifications for it. These qualifications are by no means of a superficial nature. The designer, like the artist, ought to possess an unlimited fancy, a strong and lively imagination, a refined taste and good judgment. Of these qualification, the judicious cultivation of *taste* should not be neglected, for upon this largely hangs his fate.

Taste, (which will be more fully spoken of in another chapter) is not simply an inborn faculty requiring no further thought on the assumption that nature controls its actions; but is an intellectual faculty, a perceptive power depending on education and exercise nearly as much as any faculty of the mind. It must not only be cognizant of the beautiful, but trained by art to a familiarity with the laws governing it. What can appear more offensive to a person of delicate taste than a design crowded with an incongruous assemblage of colors? Good taste never changes, but fashion changes often.

If the designer is employed in a mill of limited facilities in the dyeing and weaving departments, it stands him in hand to bring forth his best skill in the display of colors, novel mixes and weaves in order to produce sufficient diversity in his patterns. His work is certainly very tedious and trying under the most favorable circumstances.

A design must be developed in the mind, to a certain extent, before it can be committed to paper. Originating a texture does not complete the whole; everything pertaining to the manufacture of the fabric in its finished state, must be taken into consideration. Even then, the design would be almost useless should it call for expenditures too great for the manufacturer to reap any profit from it. Hence, it will be seen that, in the designing of a fabric, all details in relation to its manufacture, appearance, sale, etc., must be fully considered. The would-be designer who expects to perform these duties in their entirety, must train his mind to a realizing sense of the importance of every detail, as well as to *patience* and *perseverance*. The lack of these virtues have, without doubt, been the means of discouraging many a promising young-man from following this vocation who might, in time, have mastered the art.

The time has passed, when the would-be designer can reasonably expect to reach the highest degree of success while he neglects to educate himself for his vocation. As well might the lawyer, the physician, or the clergyman expect distinction who ignores the necessity of mastering the principles of his particular porfession. There are text-books for the design student as well as for those in other pursuits, and he should study them as the law student would "Blackstone," or other similar works, until he is familiar with their teachings. He, who plods on in ignorance of the progressiveness in these modern times, can only look for success to what may be termed *fortunate accident.*

The *true* designer is not one who gets his ideas from the patterns of others, but is a man of original power, who knows when to design, what to design and how to design it; how to apply colors, and what colors are required for a particular effect to meet the wants of the fastidious public. He understands the principle of arranging colors so as to produce the strongest, as well as the faintest effect; and also that of the weave to use. He knows that in the arrangement of colors, some will have more brilliancy and effect when placed together than when placed separately or beside of others. This arises neither from taste nor imagination, but is founded upon nature and may be explained by the principles of optics. He knows that the seven prismatic colors—red, orange, yellow, green, blue, violet and purple, —have the same relation to each other as the notes in an octave of music; and that the effect, produced by artfully disposing of these kindred colors, is no less pleasing to the eye, than is the concord of musical sounds grateful to the ear.

Colors, therefore, with respect to the effect which they produce, may be properly arranged under two heads, namely: those which are *contrasting*, and those which are *harmonizing*. The contrasting colors are those most opposed to each other; the harmonizing colors are those intermediate tints which lie between the contrasting ones, and, as it were, blends them together.

Contrasting colors may be discovered by a simple experiment. For example, place a red wafer on a sheet of white paper and look at it steadily until the eye becomes tired when a ring of green will begin to appear around its edge, and even after the eye has been removed to another part of the paper the green ring will be visible. Hence, green is said to be the contrasting color of red, and red the contrasting color of green. In like manner it will be found that purple is the contrasting color of yellow; blue, of orange; violet, of a mixture of yellow and orange; and black, of white.

The compounds of these colors will also have their contrasting colors. Thus, purple inclining to red, has for its contrasting color, yellow inclining to green; purple, inclining to blue, has yellow inclining to orange; likewise with the other compounds. On the other hand, a harmonizing color will be the nearest tint to the original, but farthest, except the original, from the contrasting color. Yellow is, therefore, the harmonizing color of white; orange, of yellow; red, of orange; violet, of red; and blue, of violet; etc.

Different shades of the same color, such as light and dark green; light and dark red; light and dark blue, etc., when they are distinct, likewise form very bold contrasts. But when the same color runs through a variety of shades from a very dark to a very light tint, such tints approach to the nature of harmonizing colors.

It is an established fact that there are persons who find it very difficult to distinguish one color from another, in consequence of which they make mistakes that appear perfectly incomprehensible to a person of ordinary vision. Taking, for instance, red for green, is one of the mistakes most frequently made among this class who are called color-blind. A person thus afflicted, cannot reasonably expect to succeed as a designer of textile fabrics. To succeed in this business, a man should have good eye-sight, should be quick to discern colors, and well versed in their effect. He will, if possessed of these qualities, be much benefited in the early stages of his pursuit.

The procuring of a great variety of samples, of different styles, and examining into their construction even to the minutest detail, is of no small importance. This kind of experience will greatly assist the beginner in putting into shape such textures or ideas as his own fancy suggests; at the same time he should avoid as much as possible a certain sameness of style. His taste in this direction will govern, in no small degree, his peculiar "style" ever after. Hence, good taste is essential in every part of designing.

We will now bring this chapter of "hints" to a close by saying to the would-be designer, do not wait to obtain your knowledge entirely by the slow process of personal experiments; but study the published experiences and demonstrated theories of writers on questions that underlie manufacturing. If you will but study, and try to profit by such teachings, keep a complete record of your own experience with different weaves and combinations as applied to different colors and mixes, their effect on the different grades of yarn, and gather knowledge from all other available sources, you may with proper care, close attention and practice after the theory is thoroughly understood, reasonably anticipate success.—"Knowledge is power."

CHAPTER II.

DELICACY AND CORRECTNESS OF TASTE.

Since taste has such a controlling power in every class of textile designing, and, at the same time, it is so difficult to distinguish between the good and bad, it may be well to present here a few brief remarks as to the true standard by which the taste of different designers may be compared with each other in order to discriminate between the true and the false.

In some men only the feeblest glimmerings of taste are visible, and things which they call beautiful are of the coarsest kind. Even of these, they have but a week and confused impression; while in others, taste rises to an acute discernment, and a lively enjoyment of the most refined ideas. In general, we may remark that in the powers and pleasures of taste, there is more reasonable inequality among designers than is usually found in point of common sense, reason and good judgment.

The characteristics of taste are all reducible to two, namely: *delicacy* and *correctness.*

Delicacy of taste represent, principally, the perfection of that natural sensibility on which taste is founded. It implies those finer organs of power which enables us to discover beautiful points that lie hid from the vulgar eye. One may have a strong sensibility, and yet be deficient in delicacy of taste. He may be deeply impressed by beauties as he sees them, but he perceives only what is in some degree coarse and bold, while the more chaste and simple beauties escape his notice. In this state, taste generally exists among those of an uncultivated mind. A designer of delicate taste sees both keenly and accurately. He sees distinctions and differences where others see none, while the most simple thing does not escape his notice; he is also sensible of the slightest fault.

Delicacy of taste is judged by the same tests that we use in judging of the delicacy of an internal sense. As the acuteness of the palate is not tested by strong flavors, but by a mixture of ingredients, when, notwithstanding the confusion, we become sensitive of each. In like manner delicacy of taste is shown by a quick and lively sensitiveness of the finest as well as the most potent objects.

Correctness of taste represents chiefly the improvements which the faculty has received through its connection with the understanding. A designer of correct taste is one not easily imposed upon by counterfits—who carries in his mind that standard of good sense which he employs in judging of everything. He estimates with propriety the comparative merit of the several beauties which he meets with in any work of genius; refers them to their proper classes, discovers the principles, so far as they can be traced, on which their power of pleasing depends, and is pleased himself precisely in that degree, in which he ought, and no more.

It is true that these qualities of taste, delicacy and correctness, mutually imply each other. No taste can be thoroughly correct without being delicate; but still a predominancy of one or the other quality in the subject is often visible. The power of delicacy is chiefly observed in discerning the true merit of a work; the power of correctness in rejecting false pretentions to merit. Delicacy leans more to feeling; correctness more to reason and good judgment.

The former is more the gift of nature; the latter, more the product of culture and art.

From the above we desire the reader to understand that a designer—in the full sense of the term—ought to possess, like the poet and artist, an unlimited fancy together with a strong and lively imagination, in order to be deeply impressed with the objects of his work, and thus be able to bring out the principal effect in his designs.

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CHAPTER III.

HOW TO BECOME A DESIGNER.

Without doubt there is not a question relating to the manufacture of textile fabrics which is asked so often, and with so much earnestness, and usually receives such indifferent answers, as that of the young man who asks: "How can I become a designer?"

In nearly every case the young man asking this question feels that the circumstances which surround him are such as absolutely forbid his attending a designing school, and not knowing of a good competent designer who would personally instruct him in the rudiments, he turns away discouraged.

It is for such young men that this chapter is intended. In it we shall endeavor to answer the question before us by speaking of those points which we know, from actual experience, are necessary in order to become a designer. And, when we speak thus, we mean a designer in the full sense of the term. Nearly any person, with a common-school education, may become a designer theoretically, but only a few become a designer practically. Hence, the former class we shall not take into consideration, but will call the reader's attention wholly to the latter.

First, the four principal rules of arithmetic should be thoroughly understood.

Second, a man should be gifted with good taste, good judgment and originality.

Third, he should have a fair knowledge of the mechanism of looms.

With these qualifications—even without a common-school education or attendance at a designing school,—it is safe to predict that a man may become a designer. To aid him in the undertaking, he should purchase such good practical books, relating to the art, as he can afford; books written by practical men capable of handling the subject, but stear clear of those written by amateurs, or wholly from theory. After purchasing such books, study them carefully. Remember, that the watch-words of designing are, *think, study, advance:* Think at all times; study in all places; advance by degrees. One hour of earnest thought upon a subject after studying it, will advance him more than ten hours of continuous reading. The young man who persistantly follows this course will not down; but will certainly come to the front, even though he has many jealous opponents working against him.

Looking on the practical side of the question, the young man should carefully study the class of goods with which he comes in daily contact. A long time occupied with one pattern may seem like waste of time, but if the pattern be once thoroughly understood he has travelled a long way on the road leading to the comprehension of many others.

By understanding a pattern, we mean not only understanding how it was woven, but how it was made in general: the size of yarns, ends in warp, picks, stock, colors, proportions of each, and, in fact, every thing pertaining to its general construction. Nor is this all; every item in this direction should be recorded and compared with his everyday experience. After extracting satisfactory information from one pattern, take up another of a different style and go through it in the same manner as before; a comparison of the first pattern, with that of the second, will give him some idea of the latitude that is to be experienced as a designer of textile fabrics.

If the young man has the true designer's instinct, these investigations will have an absorbing interest; they will open up in his mind a field for thought that will in after years bring forth better results than any school of design, so called.

Designing is an art, which is advancing with time. Although new ideas are not originated every day, yet almost every day is productive of new novelties by some designer gifted with originality, or by an attractive combination of old-time novelties. Hence, it will be seen that, the young man who starts out to follow this profession, and is determined to reach the goal of his ambition, must be ever on the alert for new ideas; and when brought in contact with new novelties, he should be ever ready with his pencil to sketch all attractive features from memory—if impossible to procure a sample of the fabric. For this purpose, he should have a scrap-book in which to make such sketches, and keep samples for future reference. By this means, he will obtain many valuable ideas which otherwise might never have come to his mind.

When an idea is obtained in this manner, proper attention should be paid in detail to its execution. If a stripe or plaid is required in several colors, skill should be displayed in their arrangement; the effect is invariably spoiled when some unsightly color predominates.

If mixes are wanted, good judgment should be displayed in the percentage to use of each color, as a little out of the way here may spoil what would otherwise have been a creditable result. Better have a less pretentious design, with colors creditably displayed, than one too pretentious in both texture and colors.

There is another feature to this question, of which we wish to speak before closing, and which should be borne in mind, namely: the exercise of good judgment in the selection of stock, and in deciding the size to spin the yarns.

There are too many designers, whose judgment in this respect, is as execrable as their mechanical execution may be commendable. In other words, from a purely mechanical standpoint, their productions may be comparatively faultless, yet, they invariably display a lack of judgment and appreciation in the "eternal fitness of things," which robs the goods, as it were, of their merits. In this profession, as in all others, skill, directed by practical knowledge, will prove the victor.

Again, it will be well to remember, that whatever prominence is attained by the young man of to-day, in the art of designing, must, properly speaking, be the result of his own industry and perseverance. Both in the mill and out of it, he should be of an inquiring mind, ask for, as well as give explanations, and make friends of those who are willing to exchange knowledge with him.

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CHAPTER IV.

EXPLANATION OF THE SIGNS AND CHARACTERS USED IN DESIGNING.

The necessity of introducing certain mathematical signs into a work of this kind is unavoidable, and perhaps by some beginners the use of these signs may not be fully understood—especially by those of a limited education in the use of figures. It is for this class of readers that the following explanations are intended.

MATHEMATICAL SIGNS:

$+$ Addition.
$-$ Subtraction.
$\times$ Multiplication.
$\div$ Division.
$=$ Equality.
% Per Cent.

$+$ The sign of addition when placed between two numbers, or in a row of various numbers, signifies that they are to be added together; the result obtained is called the *sum*.

— The sign of subtraction, when placed between two numbers, signifies that one number is to be subtracted from the other; the result obtained is called the *difference* or *remainder*.

× The sign of multiplication, when placed between two numbers, signifies that one number is to be multiplied by the other; the result obtained is called the *product*. The multiplicand is the number which is multipled by another; the multiplier is the number by which the multiplicand is multiplied.

÷ The sign of division, when placed between two numbers, signifies that one number is to be divided by the other; the result obtained is called the *quotient*. The number which is divided by another is called the dividend; the one by which it is divided is called the divisor.

= The sign of equality when placed between two numbers, signifies that what stands before it equals what comes after it, whether it be the "*sum*," "*remainder*," "*product*," or "*quotient*."

% The sign of per cent. is used for the words *per cent.*, meaning *by the hundred*. Thus, 20% of a number equals $\frac{20}{100}$ or $\frac{1}{5}$ of the number; 50% equals $\frac{50}{100}$ or $\frac{1}{2}$ of the number, etc. Hence, it will be seen that, *percentage* or *per cent.* is an allowance made by the hundred. The *base* of percentage is the number on which the percentage is reckoned. This is fully illustrated by the following table.

FRACTIONAL EQUIVALENTS IN PERCENTAGE.

$50\% = .50 = \frac{1}{2}$.	$16\frac{2}{3}\% = .16\frac{2}{3} = \frac{1}{6}$.	$6\frac{1}{4}\% = .06\frac{1}{4} = \frac{1}{16}$.
$33\frac{1}{3}\% = .33\frac{1}{3} = \frac{1}{3}$.	$12\frac{1}{2}\% = .12\frac{1}{2} = \frac{1}{8}$.	$5\% = .05 = \frac{1}{20}$.
$25\% = .25 = \frac{1}{4}$.	$10\% = .10 = \frac{1}{10}$.	$3\frac{1}{3}\% = .03\frac{1}{3} = \frac{1}{30}$.
$20\% = .20 = \frac{1}{5}$.	$8\frac{1}{3}\% = .08\frac{1}{3} = \frac{1}{12}$.	$2\frac{1}{2}\% = .02\frac{1}{2} = \frac{1}{40}$.

The characters used to represent the working of threads in a weave, design, texture, or fabric, differ among designers as well as among publishers of textile works, each using them according to their own liking. Hence an explanation of the characters used by us both in designing and in our publications is in order. When originating a design, or dissecting a sample, we use this character × to represent a *riser*, or in other words, a thread *up;* to represent a *sinker*, or in other words, a thread *down*, we skip one small square of the design paper without making any mark. If we wish to designate the points of binding—as in case of a double weave or backing,—we use this character 0 to represent a *binding riser*, and this character • to represent a *binding sinker*. Sometimes we bring into play these two latter characters for pointing out certain peculiarities in a design.

In the publishing business, we use the following

DESIGN CHARACTERS:

■ This represents a common riser.
◈ This represents a binding riser.
□ This represents a common sinker.
◇ This represents a binding sinker.

Of the different styles of characters used in publishing in this line—and there are many of them—the above are far ahead of all others. They are not only tasty and compact, but show up a design to the best advantage.

Characters are sometimes used, by both the designer and publisher, over the top and at the side of a design to represent certain parts or threads, instead of writing out and printing the particulars in full each time. When such is the case there is, or ought to be, a reference made to the fact in the subject-matter.

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CHAPTER V.

EXPLANATION OF DIFFERENT TERMS USED BY DESIGNERS.

There are so many different terms used by designers, and so many of which mean the same thing in mill parlance, that we deem it best to present here a few words of explanation in regard to the relation these terms bear to each other, and their proper use and full meaning as applied in this line of industry.

Dissecting,
Picking Out,
Pattern Picking,
Drafting,
Copying,

are synonymous terms, which mean, taking a piece of fabric and picking the threads out from each other in rotation, and marking down on design paper the same in detail, for the purpose of ascertaining how it was woven, the number of threads in warp, picks per inch, different colors, proportions of each, kind of stock and size of yarns; also all other points necessary in order to imitate the fabric. Therefore, the beginner should bear in mind that no matter how, or where, these terms are used in connection with textile designing, they mean one and the same thing. The term "dissecting" is, generally speaking, the most proper, although "picking out" and "drafting" are often used as the most natural, while "pattern picking" and "copying" are used the least of all.

Pickout,
Design,
Weaving Plan,
Texture,

are synonymous terms applied to the full plan of interweaving the threads in a fabric; the plan being obtained by dissecting a fabric, or from origination. This result is then reduced (if possible, and found necessary) to its lowest term for finding the weave, and drawing-in draft. If, after dissecting or originating a design, it is found that it cannot be reduced, it would be taken as the

Weave,
Chain Draft,
Harness Chain,
Pegging Plan,

all of which are synonymous terms, and apply to the setting of that part of the loom which causes the harnesses to work up and down in their respective order. The term "pegging plan" is seldom used except in connection with looms not having the roller and tube system of chain.

Drawing-in Draft,
Cross-drawing-in Draft,
Harness Draft,
Heddle Draft,
Cross Draw,
} are synonymous terms, and apply to drawing the warp threads into the heddles in the order as required on each harness.

If figures are employed to represent threads in the drawing-in draft, each number is to represent one thread, and to be drawn into a heddle on the corresponding number of harness: If characters are employed, then each character will represent a thread to be drawn into a heddle on the number of harness in *line* of the character. Harnesses should always be numbered from the front of loom to the back or rear harness in their numeral order, as 1, 2, 3, 4, etc.

The above is fully demonstrated by the following illustrations:

FIG. 1.

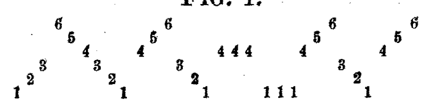

FIG. 2.

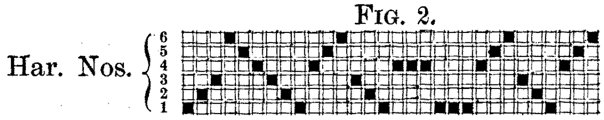

Fig. 1 illustrates the drawing-in draft of a six-harness herring-bone and basket pattern, made out with figures: The position of these figures clearly indicate which is the front of the draft; hence it is not necessary that the harness numbers be placed at the left.

Fig. 2 represents the same draft made out with characters, and the harness numbers given at the left. If these numbers were not so placed, the drawer-in would have no practical guide to follow; therefore, it is *always* best to mark the harness numbers at the left of the draft, whichever way it is made out, to avoid mistakes.

The figure method is more practicable for general use in mills; the character method is better adapted to publishing, hence the reason of its being used so commonly.

Straight Draft, Draw-in straight across, Straight Draw, } are synonymous terms signifying to commence with the front harness and draw a thread on each harness in numeral order to the back; thus continuing throughout the warp.

Binding, Stitching, Tying, } are synonymous terms, and in this work apply to certain threads or parts of a texture which unite separate weaves, one above the other, in such a manner that when cloth is woven from them the result is one fabric; or, in other words, unite fabrics of the same or different weaves so that they appear and in fact become one. This is accomplished by the warp of one being interwoven with the filling of the other, or *vice versa;* but it should be done in such manner as not to interfere with the general appearance of the top weave or face of the cloth. Hence, it will be seen that, the points selected for binding must be where the filling of one, and the warp of the other meet, so that there will be no chance when they do meet of one shoving the other up to the surface.

The amount of binding is governed by the designer's option. If he desires a tight and hard-feeling cloth, he will bind the weaves as often as practicable; while on the other hand if a loose and soft-feeling cloth be desired, he will bind the weaves only as often as necessary to properly hold them together. Whether it be desired to have the binding of a tight or loose nature, the same principle should be adhered to in regard to the point or place of binding.

The beginner will observe from these remarks that he should possess a thorough knowledge of this branch of weaving.

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CHAPTER VI.

HINTS ON PREPARING AND EXAMINING SAMPLES BEFORE DISSECTING.

There is an unlimited number of styles in woolen fabrics, all of which are dissected on the same principle; but there are different methods of preparing samples for dissecting, and determining the warp and filling, which we will endeavor to explain in a comprehensive manner.

When having in hand, to dissect, a sample of the much-felted kind with more or less nap on one or both sides, the nap should be removed by shaving it off; or, by holding the sample over a burning match until the nap is evenly singed, then, with a knife, scrape off the burnt nap. Now, if the threads do not show up clear on both sides, repeat the operation until they do, leaving the threads bear on both the face and back of sample.

Now, with the dissecting instrument,—which should be a small, round, sharp-pointed awl, or a large needle fastened into a handle suitable to the hand—remove a few threads each way of the sample, and by carefully testing their strength, and the amount of twist in them, it may be easily determined which are the warp and which the filling, as the warp is supposed to be the harder twist and stronger yarn of the two.

The above manner of ascertaining which way the warp and filling run in the sample, is necessary only with those of plain-face; as those having figures or stripes of different yarns and colors, or a combination of weaves, make this point discernible in the sample at once. There are, however, samples in which it is almost impossible to distinguish the warp from the filling except by backing threads which if found to run one way only, may usually be considered as filling. But if backing threads are found to run both ways, those in the warp are not usually as coarse as those in the filling.

There is another class of fabrics in which it is almost an impossibility to distinguish the warp and filling ways of a sample except by dissecting and studying it out from the appearance of the pickout; in such cases a man must be pretty well versed in weaves or he will be led astray.

Again, there is a variety of fabrics which are woven with what we call the square and evenly-balanced weaves; that is, they have the same number of threads in the texture both warp and filling ways, with the same number of risers and sinkers. With this class of fabrics, it makes no material difference which side up or which way a sample is dissected, the result would be the same.

There is also a class of weaves, and goods, to which we wish to call the beginner's particular attention. They are known as "corkscrew" weaves, and the goods are usually made of worsted, or an imitation of worsted yarns. These goods are woven with an odd number of harnesses and bars of chain—both the number of harnesses and bars of chain being equal when weaving plain,—such as 5, 7, 9, 11, 13, 15, etc.; but when weaving in dots or figures of fancy colors, the chain draft often exceeds the drawing-in draft several times over and *vice versa.*

It would be very difficult for a beginner, not acquainted with "corkscrew" weaves, to take a plain sample all of one color, cut square, and tell either by the yarn or from the pickout which is the warp way, and which the filling way. However, this may be readily determined by the twill or bias rib, which runs more biassing or diagonally across the fabric the filling way,—the least bias running the warp or length way of the fabric—being just opposite from what a person would naturally think from general appearance, and never having seen the goods in a full piece or made up.

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CHAPTER VII.

THE PROCESS OF DISSECTING AND LAYING OUT FOR THE FABRIC ILLUSTRATED.

Having explained the signs, characters and principal terms used in designing, and also the manner of preparing samples for dissecting, we will now proceed with the dissecting of a sample in the full sense of the term. For the purpose of illustrating the operation, and to show the beginner more fully whereof we speak, the author has expressly designed and made the following fabric: See *sample card*, Sample No. 1.

By referring to this sample it will be seen that it is composed of two diagonal stripes with a basket stripe running between them, at each side of these there is a series of narrow herring-bone stripes forming a stripe a trifle narrower than the two diagonals and basket, making in all a combined stripe, or pattern, of about 1⅝ inches in width. A glance at the sample is sufficient to show that the stripe runs with the warp the short way, and that the filling runs right and left the long way, also that it contains two complete patterns; but as the sample was cut through the centre of one of the diagonal stripes, it leaves eight or ten threads at the right of the herring-bone stripe.

Now in making ready to dissect fancy patterns, bear in mind to commence at some distinct point in the pattern when possible to do so; that is to say, commence at the beginning of a stripe or figure whether the same was produced in dressing the warp, or in weaving. For instance, with this sample, it would be proper to commence on either side of the herring-bone stripe, or with the basket stripe, and pick out to another similar point in the sample; this will produce the pattern on design paper undivided, while if it were commenced in the middle of the herring-bone, or either of the diagonal stripes, it would divide that part of the pattern and not produce as good an appearance on the paper; besides too, it would divide both the dressing pattern and drawing-in draft, thus giving the work a more complicated appearance. This should be avoided if possible, and the pickout made to appear as simple as possible. Of course it does not, generally speaking, make any material difference at what place in a sample you commence to dissect; for if you pick out to the commencement point the result will be the same. But always commence at the right-hand side of a pattern and pick to the left, setting the result down on design paper working to the left. We are well aware that all designers do not agree with us in this manner of working, as some commence at the left-hand side and work to the right, but practical experience will prove that the former way is the better for general convenience.

The manner of holding the sample is as follows: Place it in the left hand over the first or index finger, then bring the thumb down on one side and the second finger up over the sample on the other side; with the thumb and second finger draw the sample down tightly across the first finger. Now take the dissecting instrument in the right hand, with it raise and pull out the filling threads until about ¼-inch of the warp threads are free and clear of the filling across the sample, or as far as necessary to pick out, width way. Now cut off a few of the warp threads on the right-hand side of sample, down to the filling, and in for about ¼-inch. Our sample in the present instance has, as before stated, eight or ten threads of the diagonal stripe left at the right of the herring-bone stripe; we will therefore cut off these threads in to the first thread of this stripe, which, as will be seen by referring to the sample, is a red and green double and twist thread, (usually written D. & T. thread). This being a fancy thread, and the first one come to in the herring-bone, we will take it as the guide thread or starting point. Every thing now being in readiness for operation, the dissecting is continued in the following manner.

With the dissecting awl, raise a filling thread up loose from the others and on examination we find that it passes under the first two warp threads; now as these two threads must have been raised in order to admit the filling passing under them, we call them *two up* and mark down the same on design paper thus ×× , then over the top of these characters write down the color and kind of thread each character represents. Now pass these two threads to the right and under the second finger. Examine the next threads in rotation (being careful not to get them crosswise of each other), and we find there are three of them down in succession, under the filling thread; now as these threads must have been sunk in weaving to admit the filling passing over them, call them *three* down ~~*up*~~ and note the same on design paper by passing three blank squares without making any mark, or by marking down three dots thus · · ·, after which the color and kind of thread is written over the top of each character as before, then pass these threads to the right, under the second finger. In this manner proceed to the left marking down the warp threads as they appear *over* and *under* the filling thread, whether *one* or *more* at a time, until a repetition of the work is found, or in other words, the full width of the weaving plan. This brings us to a place in the pattern corresponding to the place where we commenced. Now pull out this filling thread, No. 1, and write down the color with other particulars, if any, at the right. Now loosen up another filling thread and proceed in the same manner as before, except there will be no writing down of warp threads as that was done away with in picking out the first thread. The filling threads ought to be marked at the right of the pickout only as they are taken out one at a time, and this is not necessary unless there are two or more kinds of filling. After taking out the second filling thread, then take up the third, and so proceed until the twelfth thread is taken out, which brings us to a repetition in the weaving of the warp threads; that is, the thirteenth thread is found to be the same as No. 1, thus making a repeat in the pickout both warp and filling ways. This gives us what is called a

PICKOUT.

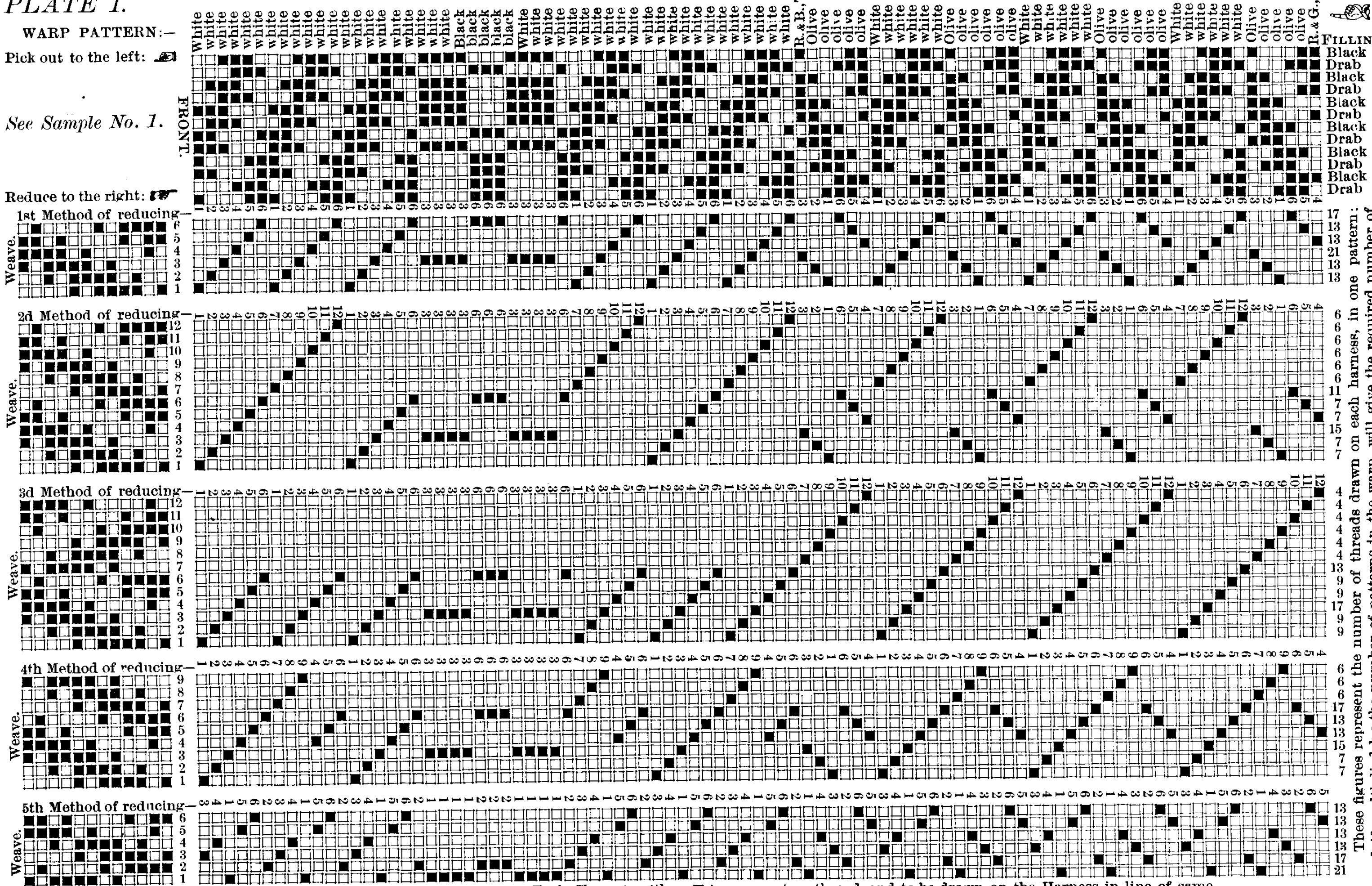
PLATE I.

WARP PATTERN:—

Pick out to the left: ☛

See Sample No. 1.

Reduce to the right: ☛



Cross-Drawing-in Draft. Each Character (thus ■) represents a thread, and to be drawn on the Harness in line of same.

These figures represent the number of threads drawn on each harness, in one pattern: and, if multiplied by the number of patterns in the warp, will give the required number of heddles for each harness. See pages 38-9.

"*pickout*".—See *Plate I.* On counting the threads in this pickout we find there are 90, or in other words, there are 90 threads in the pattern crosswise of the warp, the way the filling runs; and 12 threads in the pickout crosswise of the filling, the way the warp runs. Therefore, to weave this pattern with a straight draft, that is, without reducing it, would require a loom operating 90 harnesses and 12 bars of chain. Hence it will be seen, that to weave this pattern in an ordinary fancy loom, it must be reduced and wove with a cross draft, which is accomplished in the following manner.

Commence with the *first warp thread at the left-hand side of pickout*—which is called the "front," and reads from the bottom upwards, 1 up, 1 down, 4 up, 1 down, 1 up, 4 down—and mark it as No. 1, then proceed to the right, looking over each warp thread in rotation, and all threads found to read the same as No. 1, mark with the figure 1. There are found, in looking through the whole pickout, 17 threads that read the same as No. 1, consequently each of them is marked with the figure 1. All of these 17 threads are to be drawn into the heddles on No. 1 harness, and as these threads read, so must that part of the *chain draft* read that operates No. 1 harness.

Commence again at the left-hand side, the first thread we come to which *is not numbered*, mark as No. 2, then proceed in the same manner as before, marking each thread that reads the same as No. 2, with the figure 2. There are found 13 threads, which are to be drawn into the heddles on No. 2 harness, and as these threads read, so must that part of the *chain draft* read that operates No. 2 harness.

In the above manner continue the reducing, working to right, numbering the threads found to read differently, in their numeral order, until every thread in the pickout is numbered. The highest number obtained represents the least number of harnesses required to weave the pattern with a cross draft. In the present instance, it will be seen that the highest number is six; hence this pattern of 90 threads straight draft can be reduced to and woven on six harnesses with a cross draft. Each thread, as numbered at the bottom of the pickout, is to be drawn into the heddles on a corresponding number of harness. Also, the weaving of *one thread* of *each number*, drawn off and set down in their numeral order, produces the *chain draft* or *weave* to be used with the cross draft.

See first method of reducing, *Plate I.*, which illustrates the above and the pickout reduced to its lowest term; also the dressing pattern, which is as follows:

21 White,	6 White,
5 Black,	6 Olive,
22 White,	6 White,
1 Red and Blue D. & T.,	5 Olive,
5 Olive,	1 Red and Green D. & T.
6 White,	—
6 Olive,	90 threads in one dressing

pattern. Filling, 1 pick of black, and 1 pick of drab, alternately—commonly called "pick and pick."

If it is more convenient or easier to pick out the warp threads from the filling, then commence at the lower right-hand corner of sample, (see sample) turn it part way round until this corner is in the position of the present upper right-hand corner; then proceed with the dissecting as before described, except in reading and writing down the result, the work is just the *reverse*: Thus, for instance, when the filling threads are *down* or under the warp threads they should be read as UP, and when the filling threads are *up* or over the warp threads they should be read as DOWN, and marked on the design paper reading *upwards* so as to read from the *bottom to the top*. Thus the first thread of the pattern before us, picked out in this manner, would read 1 down, 1 up, 4 down, 1 up, 1 down, 4 up.—See pickout.

The weaving of each thread should be marked down at the left of the first, which will produce the same result as though dissected the former way.

In dissecting this sample the filling way, there have to be picked out 12 threads of filling that were interwoven with 90 threads of warp; in dissecting it the warp way, there have to be picked out 90 threads of warp that were interwoven with 12 threads of filling.

The next thing in order, in this business, is

TO FIND THE NUMBER OF THREADS IN THE WARP:

First, ascertain the number of warp threads contained in one inch of the sample; in the present instance we find by actual count that there are 66. Now multiply this number by the number of inches the good are to measure when finished, which is as a general rule 27 inches, (three-fourths of a yard) for single width cassimeres inside the selvage.

Thus, $66 \times 27 = 1782$ threads; but as 1782 is not divisible by 90, the number of threads in a pattern, and as it should be, we will add 18 threads, making in all 1800 in the warp. This number divided by the number of threads in one pattern will give the whole number of patterns in warp, as follows: $1800 \div 90 = 20$ patterns of 90 threads each, thus

61 White,
5 Black,
22 Olive,
1 Red and Blue D. & T.,
1 Red and Green D. & T.

90 threads in pattern; 20 patterns in warp would require just twenty times that amount of each kind of yarn in a warp, thus:—

$61 \times 20 =$	1220	threads of white.
$5 \times 20 =$	100	threads of black.
$22 \times 20 =$	440	threads of olive.
$1 \times 20 =$	20	threads of red and blue D. & T.
$1 \times 20 =$	20	threads of red and green D. & T.
90	1800	threads in warp.

In estimating the number of ends in a warp on a basis of 27 inches, it is better to add to, than to take from the result, as marketable goods are more apt to be 27½ or 28 inches inside of selvage than under 27 inches, hence the reason of adding 18 threads in the above instance.

Some designers use 28 inches as a basis of figuring in order to make sure of enough threads; in which case a few threads may be taken from the result if found necessary to even up on the number of ends, or to secure whole patterns.

A warp should always contain a whole number of patterns, (though the number of patterns may be odd or even) that is, there should be no threads left over a whole pattern.

In dressing warps, if the warp is all one kind of yarn, it will make no material difference in the result as shown above, except, adding to, or taking a few threads from the result, will often make the spooling and dressing much handier, thus saving the dresser both time and trouble.

The next thing with which we have to deal is the laying out—

TO FIND THE AMOUNT OF YARN REQUIRED FOR WARP.

For this purpose we will suppose that we are required to lay out and make of finished goods 2000 yards like sample. Roughly estimating, we will add for the takeup in weaving and shrinkage in finishing 10 per cent. This will make a total of 2200 yards of warp to figure on, which if divided into 6 warps, will give 350 yards per warp of 10 cuts,—that is 35 yards per cut or piece.

The warp yarns, in this sample, were spun as follows:

White	$3\frac{3}{4}$	runs.	
Black	$3\frac{5}{8}$	runs.	
Olive	$3\frac{3}{4}$	runs.	
Red	7	runs.	Weighed in the D. & T., $3\frac{1}{8}$ runs.
Blue	7	runs.	
Red	7	runs.	Weighed in the D. & T., $3\frac{1}{8}$ runs.
Green	7	runs.	

The question now before us is, how many pounds of each kind of yarn are required in 2200 yards of warp? This is figured out (and answered) as follows:

Multiply the number of threads of each kind, by the number of yards of warp we are required to make; the product will be the total length in yards of that particular thread or kind of yarn; this number divided by the number of yards the yarn is spun to the pound, will give the number of pounds of yarn required of that one kind.

In this manner figure out for each different kind and size of yarn used in the warp.—Thus,

	Threads of each kind in warp.		Yds. of warp required.		Yds. of each kind.		Yds. spun per lb.		Lbs. of each.
White	1220	×	2200	=	2,684,000	÷	6000	=	448
Black	100	×	2200	=	220,000	÷	5800	=	38
Olive	440	×	2200	=	968,000	÷	6000	=	161
D. & T.	20	×	2200	=	44,000	÷	5000	=	9 ($4\frac{1}{2}$ each, r. & b.)
D. & T.	20	×	2200	=	44,000	÷	5000	=	9 ($4\frac{1}{2}$ each, r. & g.)

Total, 665 lbs., the combined weight of yarn required to make 5 warps of 440 yards; being 12 cuts of $36\frac{2}{3}$ yards each, or in all, 2200 yards.

If the warp had all been of one kind of yarn, and spun $3\frac{3}{4}$ runs throughout, the figuring then would have been as follows: $1800 \times 2200 = 3{,}960{,}000 \div 6000 = 660$ lbs.; being 5 lbs. less than the former figuring. This is owing to the black yarn weighing $\frac{1}{8}$-run, and the double and twist $\frac{3}{8}$-run heavier than the other yarn. Besides too, in the former figuring, we reckoned all fractions of pounds as whole numbers. This gave us whole pounds as follows: 448 white yarn, 38 black, 161 olive, 9 red and blue D. & T., 9 red and green D. & T. Of course, as red was used with both the blue and green threads, there would necessarily be the same amount of red yarn as in both those colors taken together; making separately of the D. & T. yarns, 9 lbs. of red, and $4\frac{1}{2}$ lbs. each of blue and green.

In figuring for the amount of clean wool required to produce each kind of yarn, add a percentage sufficient to cover the loss in carding, spinning, spooling, and dressing; this will vary between 15 and 35%, according to quality of stock, general facilities, and supervision of the work in the several departments. The next thing in order is,

TO FIND THE REQUIRED REED.

Divide the total number of ends in warp, by the number of inches wanted in the reed inside of selvage; this quotient divided by the number of threads wanted in a dent, will give the number of reed required.

EXAMPLE.—The warp contains 1800 ends, and we desire to lay it 36 inches in the reed, inside of selvage, 4 threads per dent. What is the number of reed required?

Threads in warp.		Inches in reed.		Threads per inch.		Threads per dent.		No. of reed.
1800	÷	36	=	50	÷	4	=	$12\frac{1}{2}$. Or 5 thr's per dent, thus
1800	÷	36	=	50	÷	5	=	10 reed.

In patterns of combined weaves, it is sometimes found necessary to reed each weave or figure differently in order to produce the desired effect in the finished fabric; that is, each dent will not contain the same number of threads throughout the reeding, as in the ordinary way. In cases of this kind, we find the average number of threads in each dent, then proceed as before.

EXAMPLE.—Suppose we have a warp to reed, 2 threads in the 1st dent, 3 in the 2d, 4 in the 3d, 5 in the 4th, and 6 in the 5th; what will be the average number of threads in each dent?

Add together the number of threads in the set, and divide by the number of dents in that set. Thus,

$2+3+4+5+6=20$ threads, in a set of *5 dents;* $20\div5=4$ threads, *average per dent.*

Again, suppose we wish to draw 6 threads in each of six dents, and 3 threads in each of three dents:

$6+6+6+6+6+6+3+3+3=45$ threads in a set of *9 dents;* $45\div9=5$ threads, *average per dent.* In this manner the average number of threads per dent, in any style of reeding, may be easily found. The next thing, to which we will call the reader's attention, is how

TO FIND THE AMOUNT OF YARN REQUIRED FOR THE FILLING.

Multiply the number of picks per inch, in loom, by the number of inches the warp is laid in the reed, including selvage; the result obtained will be the number of yards of filling in one yard of flannel; multiply this product by the number of yards of warp to be filled, divide the result obtained by the number of yards the filling is spun per pound, and the quotient will be the total weight of filling required.

To illustrate, suppose we find by actual count that there are 65 picks per inch in the sample; the filling of which was spun 4 runs, or 6400 yards to the pound. Now, as there is the "take-up" in weaving, as well as the contraction of the cloth in finishing, for which we must make allowance, it will not do to figure on 65 picks in loom; hence, we will calculate on a shrinkage of 1 pick in 13, which will give us 60 picks per inch in loom, for 65 picks per inch when finished. As previously decided, the warp is laid 36 inches in the reed, inside of selvage; to this we will add 1 inch for selvage, making in all, 37 inches the total width in loom. This multiplied by 60 picks per inch, will give the following:

$37 \times 60 = 2220$, yards of filling in one yard of flannel. This product multiplied by 2200, the yards of warp to be filled, will give the following:

$2220 \times 2200 = 4{,}884{,}000$ total number of yards of filling required to fill 2200 yards of warp. This product divided by 6400 yards, length the filling is spun per pound, will give the following:

$4{,}884{,}000 \div 6400 = 763\frac{1}{8}$ lbs., call it 764, of filling yarn required to fill 2200 yards of warp; one-half (382 lbs.) of which is black yarn, and the other half (382 lbs.) drab.

To get at the amount of clean wool required to make each kind of filling, add a percentage sufficient to cover loss in carding, spinning and weaving; this will vary in the same manner as when figuring the wool for warp.

This figuring on the loss or shrinkage between the clean wool, as taken to the picking room, and the finished goods or even goods in the flannel, can be gotten down to a fine thing only by close observation on the part of the designer or superintendent; even then it requires much skill, as well as practical experience.

Having figured for the warp and filling yarns in the above calculations, the next thing in order is,

TO FIND THE NUMBER OF SECTIONS AND NUMBER OF SPOOLS REQUIRED UP.

Divide the number of threads in warp, into sections containing a whole number of patterns in each; that is, each section should contain whole patterns, though these may be either even, or odd in number; but no pattern should be divided, by running part of it in one section and part in another section, except in *extreme* cases.

In the present instance we have calculated on 1800 ends in warp, which consists of 20 patterns of 90 threads each. What is the required number of sections? Both 1800, and 20 are divisible by 2, 4, 5, 10 and 20 without a remainder, hence one of these latter numbers must be taken as the number of sections to make. Now as 2, 10 and 20, are in the extreme, it rests with the number 4, or 5, and we will proceed to find out which of the two is preferable. Thus,

Thr's in warp.		No. of sect's.		Thr's in section.		Thr's on spool.		No. of spools.	
1800	÷	4	=	450	÷	40	=	$11\frac{1}{4}$	up, in dresser frame; or,
1800	÷	5	=	360	÷	40	=	9	spools up.

In this figuring we have based our calculations on 40 threads to a spool, as that is the number most commonly used.

In the former figuring it would require 4 sections of 450 ends each, or $11\frac{1}{4}$ spools up; in the latter figuring it would require 5 sections of 360 ends each, or 9 spools up. This latter result being the more preferable of the two, we will therefore base our figuring on 5 sections in the warp. Now the next thing necessary, is

TO FIND THE NUMBER OF YARDS REQUIRED ON EACH SPOOL.

Multiply the number of yards calculated for a warp by the number of sections; the result obtained will be the number of yards required on each spool to run the length of that warp. Thus,

Yd's in warp.		Sections.		Yd's on spool.
440	×	5	=	2200; add a little for loss in tying up, etc.

The above calculations are for straight work all of one color; but in figuring and making up the spools for a warp of different colors,—like the sample just dissected—proceed as follows: Divide the number of threads of each color, by the number of sections, which will give us the number of threads there are of each color in a section; this quotient divided by 40, (the number of threads on a spool) will give us the number of spools, or parts of spools, required of each color. Thus:—

	Threads of each kind in warp.	Sections.	Thr's of each kind in section.	Thr's on spool.	Spools of each kind.	
White	1220 ÷	5 =	244	÷ 40 =	6,	4 thr's over.
Black	100 ÷	5 =	20	÷ 40 =	0,	20 threads.
Olive	440 ÷	5 =	88	÷ 40 =	2,	8 thr's over.
R. & B. D. & T.	20 ÷	5 =	4	÷ 40 =	0,	4 threads.
R. & G. D. & T.	20 ÷	5 =	4	÷ 40 =	0,	4 threads.
Totals,	1800		360		8	40 threads;

or 1 spool made up as follows: 4 white, 20 black, 8 olive, 4 red and blue D. & T., 4 red and green D. & T. This spool added to the 6 spools of white, and 2 of olive, will give us 9 spools in all. Now we are ready for

THE DRESSING OR WARPING.

This is a process by which the warp yarns are arranged on the dresser frame into patterns and sections, before being wound off to the warp or loom beam. In the dressing, great care should be taken to have the patterns properly arranged, as well as to have each section reeled alike, as regards the tention on the dresser reel. Also avoid letting the threads run loosely, and see that the lease is correctly taken up. Make sure of this before putting in the lease rods. Next in order is,

TO FIND THE NUMBER OF HEDDLES REQUIRED ON EACH HARNESS WHEN USING A CROSS DRAFT.

Take each harness in its numeral order, and count the number of threads drawn on it in one pattern, or a complete drawing-in draft; this number multiplied by the number of patterns or drafts in the warp, will give the required heddles for that particular harness. In this manner proceed with each harness. See 1st method of reducing—*Plate I.*

By this method, we find that it requires six harnesses to weave the pattern, and that there are 13 threads drawn on each of the 1st and 2d harnesses, 21 on the 3d, 13 on each of the 4th and 5th, and 17 on the 6th, as demonstrated by the following table. It will be seen that in making out this table, we commence with the back or 6th harness, and work to the front or 1st harness. The object of this is, to keep the harness numbers before us in the same position as the harnesses occupy when hung up for the drawer-in.

				Thrs.		Pats.			
Harness	No.	6	has	17	×	20	=	340	heddles.
"	"	5	"	13	×	20	=	260	"
"	"	4	"	13	×	20	=	260	"
"	"	3	"	21	×	20	=	420	"
"	"	2	"	13	×	20	=	260	"
"	"	1	"	13	×	20	=	260	"

Threads in pattern 90 × 20 = 1800 heddles.

See 2d method of reducing—*Plate I.* By this method we use twelve harnesses, and find that the number of heddles required on each is as follows:

				Thrs.		Pats.			
Harness	No.	12	has	6	×	20	=	120	heddles.
"	"	11	"	6	×	20	=	120	"
"	"	10	"	6	×	20	=	120	"
"	"	9	"	6	×	20	=	120	"
"	"	8	"	6	×	20	=	120	"
"	"	7	"	6	×	20	=	120	"
"	"	6	"	11	×	20	=	220	"
"	"	5	"	7	×	20	=	140	"
"	"	4	"	7	×	20	=	140	"
"	"	3	"	15	×	20	=	300	"
"	"	2	"	7	×	20	=	140	"
"	"	1	"	7	×	20	=	140	"

Threads in pattern 90 × 20 = 1800 heddles.

See 3d method of reducing—*Plate I.* In this, we also use twelve harnesses, and find that the number of heddles required on each, is as follows:

				Thrs.		Pats.			
Harness	No.	12	has	4	×	20	=	80	heddles.
"	"	11	"	4	×	20	=	80	"
"	"	10	"	4	×	20	=	80	"
"	"	9	"	4	×	20	=	80	"
"	"	8	"	4	×	20	=	80	"
"	"	7	"	4	×	20	=	80	"
"	"	6	"	13	×	20	=	260	"
"	"	5	"	9	×	20	=	180	"
"	"	4	"	9	×	20	=	180	"

(Continued on next page.)

Harness No.	3	has	17 × 20 =	340	heddles.
" "	2	"	9 × 20 =	180	"
" "	1	"	9 × 20 =	180	"

Threads in pattern 90 × 20 =1800 heddles.

See 4th method of reducing—*Plate I.* By this method we use nine harnesses, and find that the number of heddles required on each is as follows:

			Thrs. × Pats.		
Harness No.	9	has	6 × 20 =	120	heddles.
" "	8	"	6 × 20 =	120	"
" "	7	"	6 × 20 =	120	"
" "	6	"	17 × 20 =	340	"
" "	5	"	13 × 20 =	260	"
" "	4	"	13 × 20 =	260	"
" "	3	"	15 × 20 =	300	"
" "	2	"	7 × 20 =	140	"
" "	1	"	7 × 20 =	140	"

Threads in pattern 90 × 20 =1800 heddles.

See 5th method of reducing—*Plate I.* This carries us back to six harnesses, with the same number of heddles on each as used in the first method, but it places the 3d, and 6th harness in the position of the 1st and 2d, as follows:

			Thrs. × Pats.		
Harness No.	6	has	13 × 20 =	260	heddles.
" "	5	"	13 × 20 =	260	"
" "	4	"	13 × 20 =	260	"
" "	3	"	13 × 20 =	260	"
" "	2	"	17 × 20 =	340	"
" "	1	"	21 × 20 =	420	"

Threads in pattern 90 × 20 =1800 heddles.

To make out a regular heddle list to go by in stringing up a set of harnesses, cross out the two middle columns of figures and use only the harness and heddle columns. An allowance of a few extra heddles ought to be made for broken ones, mistakes, etc.

Of the above five methods of reducing and drawing-in, it may be well to state, that they are all practicable, and will produce the same result in weaving. The first is the original one and generally adopted, but we will endeavor to show, that it is not always policy to use it. In the present instance, it will be seen that, the third harness has to operate 420 threads, the sixth 340, while the remaining four have each 260. This would not be an improper division with fine and well-sized yarn; but with the yarn coarsely spun from long coarse wool, it would be quite difficult to produce a clear, open shed with this number of harnesses, owing to the third and sixth having so much to carry; this would cause the warp to cling and chafe, thus making bad work. But, by using the second method this difficulty would be overcome, as will be seen by the division of the warp on six more harnesses. This change does not necessarily make it any harder for the weaver, but easier on the yarn and loom.

If it be required to modify the work as much as possible for the weaver's benefit, the third method would be the one to adopt; for in this the drawing-in draft is, what might be called, a straight draw, except where the basket figure comes in, thus making it much easier for the weaver to keep the threads in right, especially when mending large break-outs. Although, in this case, the warp is not as equally divided as in that of the second method, yet, of the two, all things considered, it is more preferable.

The fourth method is somewhat more complicated for the weaver, but in case of an old and badly worn loom that would operate all right nine harnesses, but not twelve; or in case of being short of harnesses, we would prefer it to the first method.

The fifth method is the most complicated of the five, for both the drawer-in and weaver; and, on the other hand, is the easiest for the loom, as it will be seen that the harnesses carrying the most warp are brought to the front of loom. With a good, fancy weaver, we would prefer this method to all the others; and if desired, it could be easily carried to twelve harnesses on the same principle.

We might illustrate several other plans for weaving this design about which we have said so much; but believe the above are sufficient for the beginner to comprehend our meaning. However, it should be borne in mind, when laying out for cross drafts, that the harnesses carrying an extra amount of warp should be placed in front, and even then, it is often advisable to double up on those particular harnesses if on no others.

Production and quality are the two great points to aim at in running a weave room. These results are more easily accomplished if the work is laid out to the best advantage for both the weaver and loom. Therefore, if the designer, or overseer of weaving, finds that he can simplify a cross draft by adding on harnesses, he ought to do so providing it will not interfere too much with the working of loom, which is often aided by such changes as much and sometimes more than the weaver.

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CHAPTER VIII.

ESTIMATING THE PER CENT. TO ALLOW FOR LOSS OF STOCK DURING THE PROCESS OF MANUFACTURE.

This is a branch of designing which brings into display the designer's arithmetical qualifications, as well as his judgment. In speaking of judgment, in this connection, we wish it to be borne in mind, that *judgment* is the only basis on which to figure, and this *basis* must be estimated from personal observations. There is a wide variation in the different grades of stock, in working with different machinery, in different mills, and under different circumstances; so that arbitrary rules in relation to these calculations are of little or no use. Hence, the convenience of minute records, in estimating stock, must be apparent.

To continue the work before us, we will take each kind of warp yarn figured on in the preceding chapter, and estimate the amount of wool required to be taken to the picking room for each. To the white yarn, we will add 20% for the loss on wool, in reaching its spun state; and to each of the colored yarns, we will add 25% for loss before reaching the spun state. Now the question arises, what amount of clean dry wool of each color do we require of each to produce the given number of pounds of yarn?

RULE FOR ADDING PERCENTAGE.

Divide the known number of pounds, by 100% *less* the per cent. to be added. This is done by annexing two ciphers to the dividend, and dividing as though the divisor were a whole number. The quotient will be the total number of pounds required. Thus,

White yarn 448 lbs., to which we wish to add 20%.

$$\left.\begin{array}{lll} \text{Black} & \text{yarn} & 38 \text{ lbs.} \\ \text{Olive} & \text{yarn} & 161 \text{ lbs.} \\ \text{Red} & \text{yarn} & 9 \text{ lbs.} \\ \text{Blue} & \text{yarn} & 4\frac{1}{2} \text{ lbs.} \\ \text{Green} & \text{yarn} & 4\frac{1}{2} \text{ lbs.} \end{array}\right\} \text{to which we wish to add 25\%.}$$

EXAMPLE.—100% less 20% = 80% for a divisor; take 448, the pounds known, with two ciphers annexed, as a dividend:

80)448.00(560 lbs. of white wool required.
448 00

Again, 100% less 25% = 75% as a divisor, in figuring the wool for the remaining yarns:

75)38.00(50⅔ lbs. black wool.
37 50

50

75)161.00(214⅔ lbs. olive wool.
160 50

50

75)9.00(12 lbs. red wool.
9 00

75)4.50(6 lbs. blue wool, and
4 50 6 lbs. green wool.

This will give us wool lots, as follows:

White wool	560 lbs.	
Black wool	50⅔ lbs.	(will call it 51 lbs.)
Olive wool	214⅔ lbs.	(will call it 215 lbs.)
Red wool	12 lbs.	
Blue wool	6 lbs.	
Green wool	6 lbs.	
	849⅓ lbs.	

849⅓ lbs. or say 850, of warp wools required to make 2200 yards of warp, as previously laid out.

For the filling yarns, we have previously figured on 382 lbs. of black, and 382 lbs. of drab; to each of which we will add 25% for the loss on wool, to its spun state. What amount of wool do we require for each kind of yarn?

EXAMPLE.—75)382,00(509⅓ lbs. black wool, and 509⅓ lbs. drab wool, or say 510 of each; making in all, 1020 lbs. of filling wool required to fill 2200 yards of warp. This will give us, as follows:

375
—
700
675
—
25

Lbs. warp wool. Lbs. filling wool.

850 + 1020 = 1870 lbs. of clean wool, in all, to produce 2000 yards of *finished* goods; weight, $9\frac{4}{10}$ oz. per yard.

To find the number of ounces of clean wool per yard, multiply 1870 by 16 (ounces per pound), and divide the product by 2000; the quotient will be the ounces per yard.

$1870 \times 16 = 29{,}920 \div 2000 = 14\frac{96}{100}$ oz. of clean wool required to produce one yard of the finished goods, reckoning on an average, a loss of $23\frac{58}{100}\%$ in the wool for picking, carding and spinning; and 10% loss in the yarn for spooling, dressing, weaving and finishing: In all, $33\frac{58}{100}$ per cent.

The goods, for which we have been figuring,—sample No. 1,—weighed when finished, just $9\frac{4}{10}$ oz. per yard; being $\frac{54}{100}$ oz. less than estimated in the above calculations, which would have made the goods finish $9\frac{94}{100}$ oz. per yard. Therefore, considering that in all the preceding figuring for both the yarn and wool, we reckoned each fraction as a whole pound, and that our figuring has been done on the basis of judgment, and *not* from records obtained in making the fabric; it will be conceded that these estimates have come out very close, under the circumstances. Then too, if these estimates had been put into actual work, we might have had a little of the warp or filling, or both, left over. Again, the yarn might have been spun on the light side of what was calculated. Any one of these causes, say nothing of taking them all together, would have caused this small fraction of difference.

Above we spoke of the average loss being $23\frac{58}{100}\%$; it may be well for us, before proceeding any further, to demonstrate how it was obtained.

To 665 lbs. of warp yarn were added 185 lbs. to find the number of pounds of wool; and in the same way, to the 764 lbs. of filling yarn were added 256 lbs. to find the number of pounds of wool. Now find the sum of the amounts added: $185+256=441$; annex two ciphers and divide by the sum of the whole number of pounds of wool required for both warp and filling. $850+1020=1870$.

$1870)441.00(23\frac{58}{100}$ lbs., the average weight added to each
374 0
———
$76\frac{42}{100}$ lbs. of yarn, which equals
67 00
56 10
100 lbs. of wool to produce the same.
———
10 90 remainder, this is equal to the above fraction and a little over, but not sufficient to take into account. This method of finding the average per cent. holds good in figuring on any number of different percentages.

Before closing this chapter, we wish to remind the reader that this percentage of loss must not be considered as so much stock *lost* to the manufacturer, for only a part of it, or such as consists of foreign matters in the wool, can be so taken. The waste made in every department, from the wool room to the goods in the case, can be again worked over into other goods; if not in the mill where made, then in some other mill that will pay cash for it.

Weight added to stock by oiling, we do not take into consideration.

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CHAPTER IX.

ESTIMATING THE PER CENT. OF COLORS IN MIXES, AND OF DIFFERENT WOOLS IN BATCHES.

In order to demonstrate this subject in a practical manner, we will suppose that we are required to get up a batch of 960 lbs. of wool, to be composed of 70% black, 20% white, and 10% orange. What is the amount of each color required to produce the batch of 960 pounds?

TO FIND THE AMOUNT OF EACH COLOR REQUIRED IN A BATCH, THE SIZE OF BATCH AND PER CENT. BEING KNOWN.

Multiply the whole number of pounds in batch, by the per cent. of each color, and point off two figures at the right; the product will be the amount required of that particular color. Thus,

960	960	960
.70 black.	.20 white.	.10 orange.
672.00	192.00	96.00

This will give us wool as follows:

Black	672 lbs.
White	192 lbs.
Orange	96 lbs.
Total,	960 lbs.

Again, suppose we went into the wool room and made up a batch, as follows:

Oregon	230 lbs.	white.
S. pulled	20 lbs.	
Oregon	70 lbs.	olive.
Pa. fleece	65 lbs.	
Ohio "	65 lbs.	
Va. "	50 lbs.	plum.

Total, 500 lbs. in the lot. What is the per cent. of each color? Also, what is the per cent. of each kind of wool? Proceed in the following manner:

Annex two ciphers to the whole number of pounds of each color, or kind of wool, and divide by the whole sum.

$230 + 20 = 250$ lbs. white; annex two ciphers: 250.00.

$250.00 \div 500 = 50\%$ white.

$70 + 65 + 65 = 200$ lbs. olive; annex two ciphers: 200.00.

$200.00 \div 500 = 40\%$ olive.

50 lbs. plum; annex two ciphers: $50.00 \div 500 = 10\%$ plum. This gives us the per cent. of each color. Now we will find the per cent. of each kind of wool.

$230 + 70 = 300$ lbs. Oregon; annex two ciphers: 300.00.

$300.00 \div 500 = 60\%$ Oregon wool.

20 lbs. S. pulled; annex two ciphers: $20.00 \div 500 = 4\%$ super pulled wool.

65 lbs. Pa. fleece; annex two ciphers: $65.00 \div 500 = 13\%$ Pennsylvania fleece wool.

65 lbs. O. fleece; annex two ciphers: $65.00 \div 500 = 13\%$ Ohio fleece wool.

50 lbs. Va. fleece; annex two ciphers: $50.00 \div 500 = 10\%$ Virginia fleece wool.

By the above figures, it will be seen that this rule works the same, whether figuring the per cent. of colors, or the qualities of stock.

Again, suppose we have 770 lbs. of fleece wool, to which we wish to add 30% of shoddy. What will be the amount of shoddy required?

Figure this as demonstrated in the preceding chapter: $100 - 30 = 70$ for the divisor.

70)770.00(1100 lbs., total weight; from which subtract 1100
770 00
the pounds known 770

330 lbs., amount of shoddy required.

On the other hand, if we had 330 lbs. of shoddy to which we wish to add 70% of fleece wool, it would require 770 lbs. of wool, making a total of 1100 lbs., shoddy and wool.

We believe the illustrations given under this head, are sufficient for the reader to comprehend our meaning, and will therefore bring the chapter to a close.

CHAPTER X.

FIGURING THE SHRINKAGE OF WOOLS, AND THEIR COST WHEN SCOURED.

For the purpose of demonstrating the work under this head, we will suppose that we have a lot of unscoured fleece wool, the shrinkage of which is not known, but must be obtained in order to know the cost when clean.

TO FIND THE SHRINKAGE OF UNSCOURED WOOL.

From the pounds taken in the grease, subtract the pounds of clean wool got back after scouring and drying, and divide the remaining pounds, with two ciphers annexed, by the pounds taken for a trial; the quotient will be the rate per cent. of shrinkage.

EXAMPLE.—Had scoured, 500 lbs. in the grease.
Got back, 300 lbs. of clean wool.

Lost, 200 lbs. in scouring, to which annex two ciphers, and divide by 500 lbs.

500)200.00(40%, rate of shrinkage, or 40 lbs. lost for each
200 00
—— 100 lbs. 100—40=60 lbs. of clean wool from each 100 lbs. in the grease.

This wool, we will suppose, cost 35 cents per pound, in the grease. What is its cost in the scoured state?

TO FIND THE COST OF SCOURED WOOL, THE MARKET PRICE AND SHRINKAGE BEING KNOWN.

Divide the market price, with two ciphers annexed, by the pounds of clean wool obtained from 100 lbs. in the grease; the quotient will be the cost per pound of clean wool.

EXAMPLE.—Market price, 35 cents per pound; wool shrunk 40% in scouring, leaving 60 lbs. of clean wool from 100 lbs. in the grease:

60)35.00 market price.

$58\frac{1}{3}$ cents per pound, cost of the clean wool.

The reader should bear in mind, that the above figuring does not include the cost of freight, cartage, sorting, and scouring; all of which adds to the *actual cost* of scoured wools, the extent depending on circumstances.

Again, suppose we wish to add to the 300 lbs. of clean fleece—which we obtained from 500 lbs. in the grease, being 40% shrinkage,—the same amount of clean second-grade fleece, which we had previously found, shrunk 45 per cent. How many pounds of the second-grade fleece, will it be necessary to scoure for the 300 lbs. of clean wool?

TO FIND THE AMOUNT OF WOOL REQUIRED IN THE GREASE TO PRODUCE A GIVEN AMOUNT CLEAN, THE SHRINKAGE BEING KNOWN.

Divide the pounds of clean wool wanted, with two ciphers annexed, by the pounds of clean wool obtained from 100 lbs. in the grease to scoure; the quotient will be the pounds required in the grease.

EXAMPLE.—The second-grade fleece shrinks 45%, which gives us 55 lbs. of clean wool for each 100 lbs. in the grease, and 300 lbs. of clean wool are wanted:

55)300.00 pounds wanted.

$545\frac{5}{11}$ lbs. required in the grease, at 45% shrinkage, to produce 300 lbs. clean wool. The reverse of this rule will also hold true.

We believe this, with the two preceding chapters, is sufficient for the beginner to understand how to figure percentage from any standpoint; and we trust that they will show him the necessity of thoroughly understanding this branch of the business.

CHAPTER XI.

DRESSING PATTERN WARPS AND WEAVING PATTERN SHEETS.

Nearly every woolen mill, and nearly every designer have their own particular method of performing this piece of work for the loom, any one of which may prove satsifactory to the designer under the circumstances surrounding him; hence we shall not attempt to lay down any new methods, but simply give a few suggestions applicable under certain conditions.

We always make it a point to dress a pattern warp on the dresser frame, if convenient to do so: this spreads the threads much evener, when reeling off to the warp beam; gives an evener tension, and does away with watching the lease and patterns so closely, when once rightly started: besides, the work is then in a position for any length of warp required. If only five or six pattern stripes are wanted, make each one a section in itself; but if several other stripes are wanted, two of these pattern stripes may be run in as one section.

Between each pattern stripe, run in two threads of a fancy or different color, not too bold, or too faint, but such as will make sufficient contrast and look well with the colors with which they are to come in contact. Hence, it will be seen, that it is not always policy to use the same color for the dividing lines, as other colors in the same warp may be often brought into use, for this purpose, with a decided and pleasing effect.

Again, when only a few small changes are desired from that of a regular warp, a good pattern sheet may be gotten up by breaking out a few threads and tying other colors in their place on the first end of warp, when being started in the loom, or on the latter end when running out. A yard or more can be finished on the end of a regular cut, and thus save the expense of getting out a special pattern warp. Of course, to produce a pattern sheet in this manner, the number of harnesses in the loom, and style of drawing-in must correspond with the designer's ideas; but a change in the weave may be made if necessary.

Then again, when but a few changes are desired from any one particular style, either in certain warp threads, or in the filling, it is good policy to weave sufficient of each change to make a pants' pattern. We have woven whole cuts in this manner, when only slight changes were wanted. These styles are cut apart after finishing, and will generally sell without causing any material loss to the manufacturer. When making patterns in this way, no change should be made in the weave; and the filling should be of the same size of yarn and kind of stock, to insure the same finish on each style, and not cause too much unevenness in the piece. These suggestions or methods, are calculated for use more especially in mills not having a pattern loom, or ample facilities for getting out regular pattern sheets.

Large mills usually have ample facilities in the pattern department, which is fitted up to their own liking; and each designer, in his turn, has to follow the same course as his predecessor, so that to make any suggestions, relative to them, would be of no material use. Suffice it to say, that they all, generally speaking, have to dress their pattern warps on the peg or "pin" system. With this system, some use one style of frame for holding the bobbins of yarn, and some another; each one of which is thought to be good enough for its particular place. Therefore, comments, or suggestions on them, would be out of place here. We will, however, continue the subject by calling the reader's attention to our method of weaving a pattern sheet.

We have before us, a pattern sheet which we will endeavor to illustrate in such a manner that our idea on this subject will be fully understood. This sheet was woven with the regular eight-harness twill, and consists of a series of patterns made in mixes, solid colors, stripes, and plaids. To begin with, it has five sections, or in other words, five pattern stripes as follows:

1st sect.	2d sect.	3d sect.	4th sect.	5th sect.

The finished width of each section is 5½ inches; making in all, 27½ inches inside of the selvage. Each section contains 240 threads of 2-run yarn; this gives us, in five sections, 1200 threads independent of the dividing threads, or selvage.

The yarns which compose the sections in this pattern sheet, were spun from mixes as follows:

First section, No. 10 mix; 50% black, and 50 dark olive. (We always give our mixes a distinguishing number.)

Second section, No. 11 mix; 50% red brown, and 50 white.

Third section, No. 8 mix; 85% black, and 15 orange.

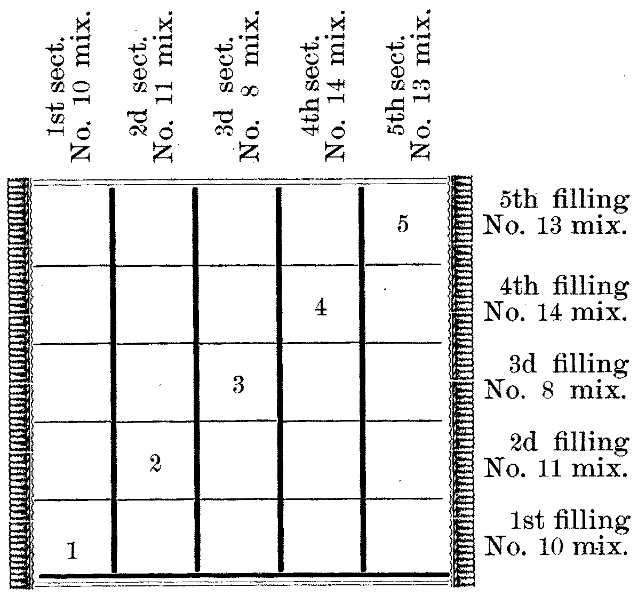
Fourth section, No. 14 mix; 45% red brown, 45 white, and 10 orange.

Fifth section, No. 13 mix; 45% black, 45 olive, and 10 white.

Between each pattern stripe or section, and also between the outside ones and selvage, are two dividing threads, one of red and green D. & T., and one of orange and black D. & T. This completes the full construction of the warp.

The weaving of the pattern sheet is the next in order. For this purpose, we have five kinds of mixes for the filling, the same as used in the warp. After weaving in a fancy heading, we commence with the first or left-hand section, using filling of No. 10 mix, and weave in sufficient to bring the pattern or sample out square when finished; or as near that as we can calculate. Now we weave in two dividing threads, the same as in warp; this gives us the *first* regular pattern. Next we use filling of No. 11 mix, which corresponds with the second section, and weave the same amount as before; this gives us the *second* regular pattern. In this manner we proceed with the third, fourth and fifth sections, using filling to correspond with the mixes in those sections.

This will give us the *third*, *fourth*, and *fifth* regular patterns. We have now taken up each section in turn, and worked the whole width of the warp, making in all, twenty-five patterns, as herewith demonstrated.



From this illustration, it will be seen that patterns 1, 2, 3, 4, and 5, are called "regulars;" that is, each one by itself is the same in both warp and filling. The remaining twenty patterns are called "irregulars," or, "hit-or-miss."—Sometimes, called "bastards." It is in this irregular class of samples, that the designer often finds his most attractive and best selling patterns.

Presuming that the warp was four yards in length, and having used only about 30 inches, or say one-fourth, of its weaving capacity in making the *first* series of patterns, we will now use five other kinds of filling, say of solid colors, and work off another series of twenty-five patterns on the same principle as before. Now we will break out a few of the warp threads in any *one* section, or *all* of them, as desired, and tie other colors in their place; this changes the plain work into stripes, with which we will use the first set of filling and weave another series of twenty-five patterns. Again, taking the second set of filling, we will weave the fourth and last series of patterns by running in, with each kind of filling, such threads as were previously tied in the warp, and in the same proportion, which gives us twenty-five plaid patterns; making in all, one hundred patterns in the whole pattern sheet. From this it will be seen, that there is no end, so to speak, to the number of patterns and changes that may be produced by following up this principle of pattern weaving.

On fancy warps, figured weaving, and cross-drawing-in drafts, it will sometimes occur that only a limited number of changes can be advantageously made. It is in such instances that the designer needs to bring into play his best skill, instead of working on the "go-as-you-please" system.

The designer must use his own judgment, as regards the size to weave his samples. If he is to get out a sheet of fine, plain, and firmly woven samples, small ones will usually answer every purpose. On the other hand, if he is to get out a sheet of large patterns, in the weaving, or dressing, large samples are preferable.

We have made pattern sheets that contained as low as three and as high as nine samples in width; but the usual number is five, six, or seven, which makes a fair size sample without much expense.

Our practice has been invariably, to make these sheets wide enough to finish three-fourths in width; this gives us a good basis on which to figure the weight of the goods, shrinkage, etc.—far better than if made narrower.

Speaking about figuring on the weight of goods, it may be well to demonstrate here the manner of

FIGURING ON THE WEIGHT OF CLOTH BEFORE WEAVING.

Divide the number of ends in warp, by the number of runs the yarn is spun, and point off decimally two figures at the right of quotient; this quotient will then represent the number of ounces of warp in one yard of cloth.

EXAMPLE.—Suppose that we have a warp of 2160 ends of 4-run yarn, and 20 threads of selvage on each side, or 40 in all, of 2-run yarn; how many ounces have we of warp?

Runs, 4)2160 ends.	Runs, 2)40 selvage threads.
5.40 oz. of warp.	.20 oz. of selvage.

Add together these quotients, 5.40 + .20 = 5.60 oz. the total weight of warp to one yard of cloth.

To ascertain the amount of filling, proceed as follows:

Multiply the number of picks per inch, by the number of inches the warp is laid in the reed; this product divided by the number of runs the yarn is spun, with two figures pointed off decimally at the right of quotient, will give the number of ounces of filling to one yard of cloth.

EXAMPLE.—Suppose that we put in 75 picks per inch, of 5-run yarn, and the full width in reed is 40 inches; how many ounces have we to one yard of cloth?

$75 \times 40 = 3000 \div 5 = 6.00$ oz. weight of filling to one yard of cloth. This, added to the warp, gives $5.60 + 6.00 = 11.60$ oz., or near enough,—allowing for the "take-up," of yarn in weaving—to call it 12 oz. weight of cloth from loom.

The above manner of figuring on the weight of goods previous to weaving, will give a good basis on which to make other calculation, if followed out closely. Of course, practical judgment is required, in order to estimate closely what allowance to make for the "take-up," which must be governed by the kind of weave used, size of yarns, and the strain on warp. Then again, the yarn must be accurately spun to the size figured on; if spun either too coarse, or too fine, the result of the figuring will vary accordingly; while if too many picks are put in, or not a sfficient number, the result will also be too large, or too small—as the case may be.

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CHAPTER XII.

THREE METHODS OF ATTACHING A BACK TO FABRICS.

The designer is often called on to produce light-weight fabrics in heavy weight. To do this, without changing the appearance of the face of the fabric, is an undertaking of no small importance; however, it can be done by attaching a back. This back may be attached by the filling, warp, or by both the warp and filling methods. One of the principal points to observe, in this operation, is to have the binding done in such a manner that the effect will not be noticed on the face of the fabric when finished.

In the manufacture of worsted fabrics, this fact has an especial bearing for the reason that imperfections, in the stitching or uniting of the textures, will show more in this class of goods, than in common woolens, and fancy cassimeres. This is owing to the fact that worsteds are mostly made in the loom, or in other words, are woven narrower, and require but little or no felting. On the other hand, common woolens, and fancy cassimeres, are woven much wider, requiring considerable fulling, which has a tendency to cover up a great many defects that would otherwise be seen, especially in worsteds.

There are three methods of attaching a back to fabrics, which we will illustrate; any one of which will answer for its particular purpose.

First method.—This is what is called a filling back; that is, the warp works single, and the filling works double —one thread on the face of the fabric, and one on the back.

To illustrate this method, we will take Fig. 1, which is known as the four-harness cassimere twill, carried out to eight threads both warp and filling ways, or in other words, eight harnesses and eight bars of chain, as numbered at the

FIG. 1.

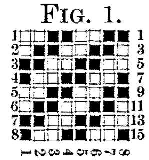
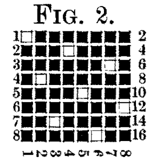


FIG. 2.



bottom and left-hand side. To this weave we will attach Fig. 2, which is called an eight-harness doeskin weave.

Now, if we take Figs. 1 and 2, and unite them—one bar of each, alternately—it will give us a weave of eight harnesses and sixteen bars. Hence, we will number the bars at the right of each weave or figure, in the order in which they will appear when united.

FIG. 3.

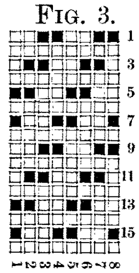


FIG. 4.

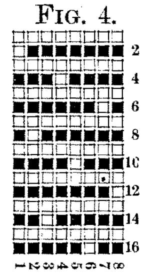


FIG. 5.

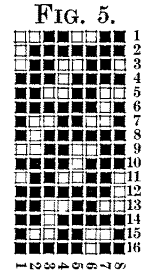


Fig. 3, shows the face weave laid out in its order for receiving the back.

Fig. 4, shows the back weave laid out in its order for receiving the face.

Fig. 5, illustrates Figs. 3 and 4 united, making one complete weave, ready for the loom.—See *Sample No. 2*, made from this same weave.

The main point to overcome, when attaching a filling back, is not to affect the appearance of the face of the fabric. To avoid this, the binding must be done in such a manner that the warp threads will all have the same tension. This is accomplished by placing the backing weave in a position, that whenever, or wherever a back pick has a sinker, it should be *preceded* and *followed* by a sinker on the face threads, which will give us three sinkers in succession, reading the warp way. This will bring the binding in between the twills alternately, as will be seen by referring to Fig. 5. However, there are weaves with which it would be impossible to follow this rule closely: Sometimes a back pick may have to be preceded by a sinker and followed by a riser, or *vice versa*; but in no case should it be preceded and followed by a riser on the face threads.

Second method.—This is what is called a warp back, and is woven in a reverse manner to that of the filling method; that is, the warp works double and the filling single. To illustrate this, we will take the same four-harness cassimere weave, Fig. 1, to which we will attach a back, one and one; that is, one thread on the face and one on the back, alternately. For the backing weave, we will take an eight-harness satin, Fig. 6,—as it proves to be well adapted in this instance, for even stitching. Again, we will attach a four-harness satin twill repeated to eight harnesses and eight bars. At the bottom of the face and both back weaves, we have numbered the harnesses in their numeral order; also a second time in the order in which they will appear when united or stitched together.

FIG. 1.

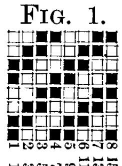


FIG. 6.

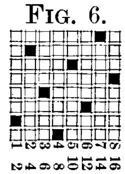
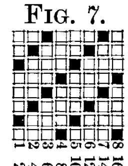


FIG. 7.



Hence it will be seen, that in attaching a warp back, the number of harnesses have to be increased, while the number of bars remain the same—being just the reverse of the former method. Proceeding in this manner, we will carry out these weaves (Figs. 1, 6 and 7), in their respective order for uniting, which will give us Figs. 8, 9 and 10.

Next in order, is the uniting of Figs. 8 and 9. To do this, we will take the working of a harness from each figure alternately, and setting them down in their numeral order, it will give us Fig. 11.—See *Sample No. 3,* made from this weave. In a similar manner, proceed with Figs. 8 and 10, the result will be as shown by Fig. 12.

FIG. 8.

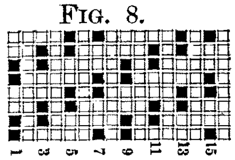


FIG. 9.

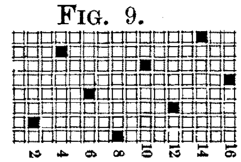


FIG. 10.

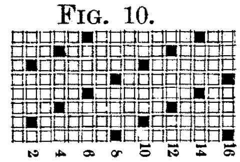


FIG. 11.

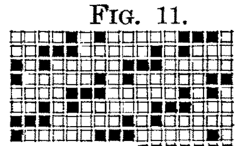
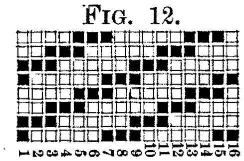


FIG. 12.



It will be observed, by examining those figures, that wherever the backing threads rise, they come up in between two risers of the face threads; that is, one face thread is up on the right, and one up on the left—reading the filling way. This point should be observed, if possible, when attaching a warp back. There are instances, however, where this rule cannot be adhered to, in which case we must do the next best thing:—have a face riser on one side of the backing riser, and a sinker on the other side. In no case should a backing thread be raised to the face of the fabric, where there would be no riser on either side to join it.

The next thing which we will call the reader's attention to is, that when required to unite two weaves, each containing a different number of harnesses, or bars, or both, they must be carried out to that point where *both* weaves *will repeat* at the *same time.* This can be seen in the case of Fig. 11; the cassimere weave being, originally, but four harnesses in width by four bars in length; and the satin eight harnesses in width by eight bars in length; in order to have both weaves repeat at the same point, the cassimere had to be carried out to its present size. But in the case of Fig. 12, the backing weave being the four-harness satin twill (Fig. 7), it will be readily seen, that both the face and back weaves have been doubled each way, or in other words, repeated to four times their original size, as four harnesses and four bars complete the full weave of either. We have carried these weaves out to their present size for the purpose of presenting a better illustration; besides, eight bars of chain are necessary to reach around the chain cylinder of the loom.

Fig. 11, shows each alternate backing thread tied in each twill alternately.

Fig. 12, shows each backing thread tied in each twill in succession.

We will now illustrate the manner of attaching a warp back with *two* threads on the face and *one* on the back. In this operation the same points must be observed as previously described, in regard to the uniting of the weaves, and having the number of tyings equal in each twill. See Figs. 13, 14 and 15 completed for use; while Figs. 16, 17 and 18 shows the backing plans, with the working of the harnesses numbered as they appear in the completed weaves.

Fig. 13.

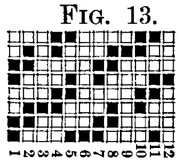


Fig. 14.

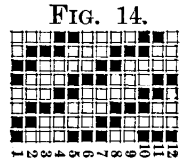


Fig. 15.

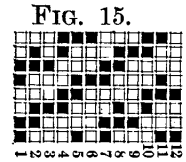


Fig. 16.

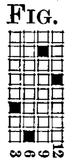


Fig. 17.

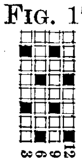


Fig. 18.

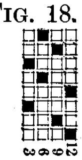


Fig. 13, has four risers on one pick and five on the next, alternately, which is owing to the backing threads being tied alternately in each twill.

Fig. 14, has four risers on one pick and six on the next, alternately, which is owing to the backing threads being tied in succession in each twill.

Fig. 15, has five risers on *each* pick in succession, which is owing to the backing threads being tied irregularly; that is, the tying is different on each alternate twill, although each twill has the same number of tyings. This latter figure will answer in some cases and be preferred to all others; but generally speaking, the two former are the most preferable, and those usually adopted.

Third method.—This is what is called a double or warp and filling back, and consists of the two preceding methods combined. This method is called by some, double weaving, owing to there being two warps and two fillings employed in weaving the fabric. While this may seem perfectly proper, it will be shown further on in this work, that what the author calls double weaves, are those having the face weave doubled, or two separate fundamental weaves united; the object being to produce the same design, or a different one, on both the face and back of the fabric, in *addition* to increasing the weight, without the aid of coarse yarns; or, over-crowding of the warp and filling. Therefore, we shall confine this principle of weaving wholly to that of attaching a back, whether of coarse, or fine yarns, and *not* for the purpose of adding beauty to the fabric, in the way of stripes, checks, or plaids on the back, as usually done by the regular double-weave method.

To continue the subject, we will take the same cassimere weave as before, and to it attach a back, two and one; that is, there will be two threads on the face of the frbric, to one on the back, both warp and filling ways. To do this

Fig. 19.

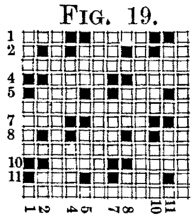


Fig. 20.

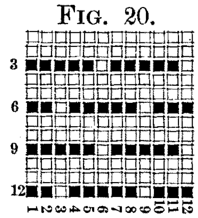
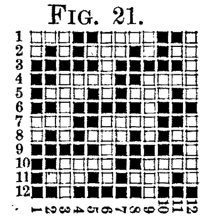


Fig. 21.



we will carry out the cassimere weave to twelve harnesses and twelve bars, as shown in Fig. 19. By this figure it will be seen, that where the backing threads are to appear, on both the harnesses and bars—3, 6, 9 and 12,—we have all sinkers. These sinkers are to be filled in by the texture of the backing threads, as shown in Fig. 20, which is really a two-harness plain weave, when reduced to its actual weaving capacity. Figs. 19 and 20, united, will give us Fig. 21; but, as this figure now stands, the face and back are not stitched or tied together, hence it is not a completed weave.

Fig. 22, represents Fig. 21 completed, and tied on the plan as shown by Fig. 23, being once on every third thread, both warp and filling ways; thus making four risers on one pick, and five on the next alternately—face threads.

FIG. 22.

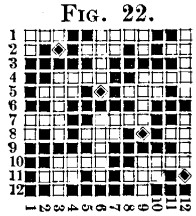


FIG. 23.

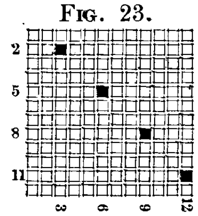


FIG. 24.

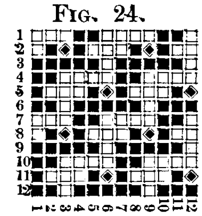


Fig. 24, represents the same weave, and tied on the plan as shown by Fig. 25, being twice on every third thread, both warp and filling ways; thus making four risers on one pick, and six on the next alternately.—See *Sample No. 4*, made from this weave.

Fig. 26, also represents the same weave, and tied on the plan as shown by Fig. 27, being twice on every third warp thread, and once on each face filling thread; thus making five risers on each face pick in succession.

FIG. 25.

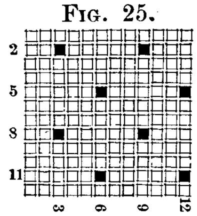


FIG. 26.

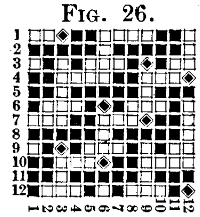


FIG. 27.

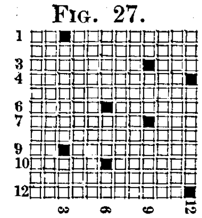


Fig. 28, illustrates Figs. 20 and 23 combined, and represents the backing texture, both warp and filling ways, in Fig. 22.

Fig. 29, illustrates Figs. 20 and 25 combined, and represents the backing texture, both warp and filling ways, in Fig. 24.

Fig. 30, illustrates Figs. 20 (with the backing bars placed one nearer to the top) and 27 combined, and represents the backing texture, both warp and filling ways, in Fig. 26.

FIG. 28.

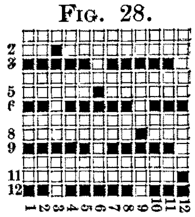


FIG. 29.

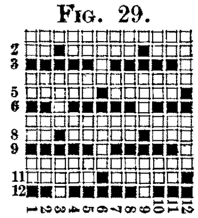
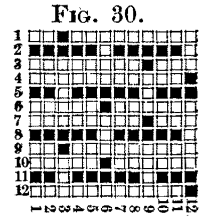


FIG. 30.



These three latter figures were designed more especially to show the reader, the manner of drawing off and illustrating backing textures, in this class of weaving; and, we believe them to be sufficient in their line.

Figs. 31 and 32, are the same as Figs. 22 and 24, except the back filling threads float under eleven warp threads, instead of five.

Fig. 33, weaves the same face as Fig. 26, but the tying is done in the opposite direction, and the position of the back filling threads are changed.

FIG. 31.

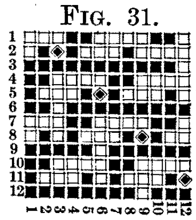


FIG. 32.

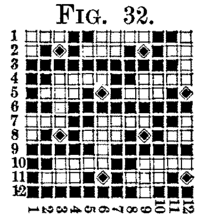
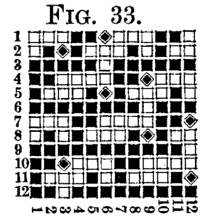
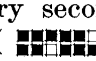


FIG. 33.



The style of back attached to these three latter weaves, is more especially adapted for coarse stock, and a heavy backing filling, as it has less tendency for the back to show through, on the face of the fabric.

It will be observed, that the stitching or tying in this method of backing fabrics, is conducted on the same principle as in the preceding method; hence it requires no further explanation in this direction.

By this combined warp and filling method of backing fabrics, a back may be attached to any weave desired, on every second, third, or fourth thread, as the case may require, by observing the following manner of running in or weaving the *back* filling threads: For every second thread, thus (); every third thread, thus (); every fourth thread, thus (); tying, in each case, as often as deemed necessary.

Following, we present a few illustrations of standard weaves, with a back attached in various ways, which will more fully demonstrate our ideas on the question of tying.

Figs. 34, 35, 36 and 37, are those of a double-pick or basket weave, carried out to twelve harnesses and backed every third thread, both warp and filling ways.

FIG. 34.

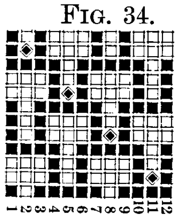


FIG. 35.

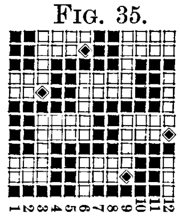


FIG. 36.

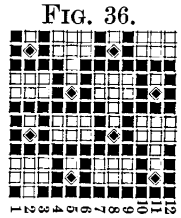
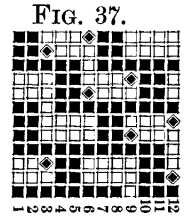


FIG. 37.



Figs. 38, 39 and 40, are those of the regular six-harness twill, backed every third thread, both ways. Figs. 41 and 42 are the same weave, with a backing every fourth thread.

FIG. 38.

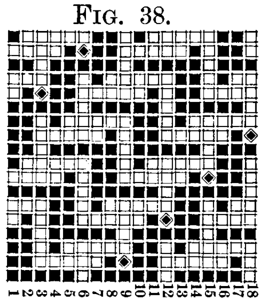
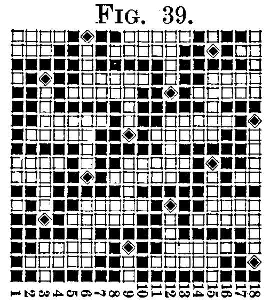


FIG. 39.



Figs. 43 and 44, are those of a six-harness basket weave, backed every third thread, both ways. Figs. 45 and 46 are the same weave, with a backing every fourth thread.

Figs. 47 and 48, are those of the regular eight-harness twill, backed every third thread, both ways.

FIG. 40.

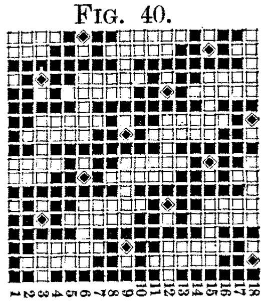


FIG. 41.

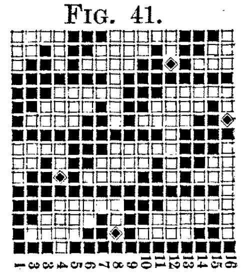


FIG. 43.

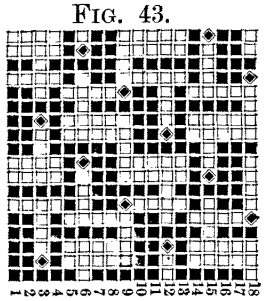


FIG. 44.

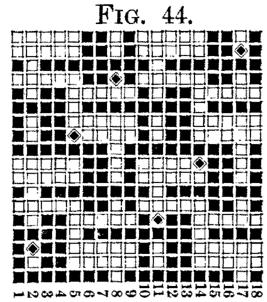


FIG. 42.

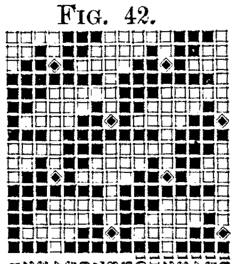


FIG. 45.

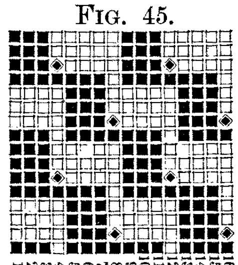


FIG. 46.

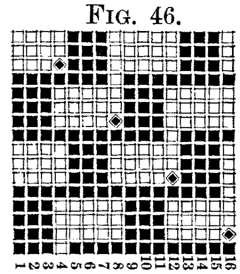


FIG. 47.

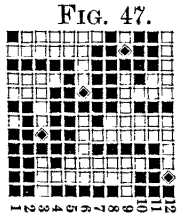


FIG. 48.

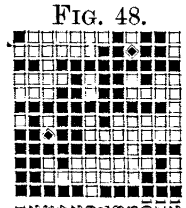


FIG. 49.

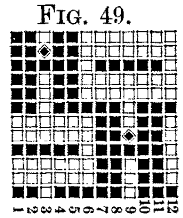
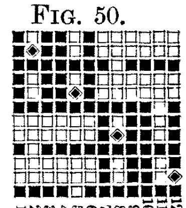


FIG. 50.



Figs. 49 and 50, are those of the eight-harness basket weave, backed every third thread, both ways.

Fig. 51, represents a herring-bone and double-pick texture combined—four-harness work.

FIG. 51.

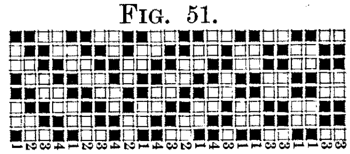


Fig. 52, represents the same texture as the above, but with a back attached every third thread, both warp and filling ways. We illustrate four methods of reducing this

FIG. 52.

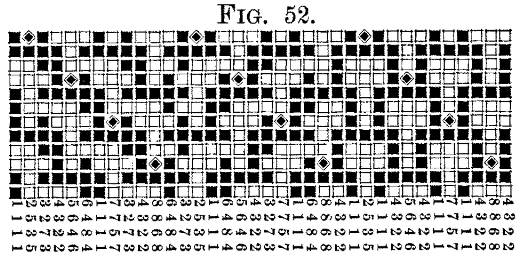


figure to its lowest terms, and of making out the chain drafts

FIG. 53.

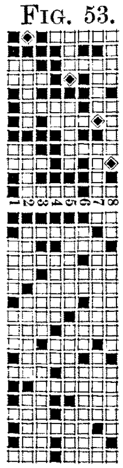


FIG. 54.

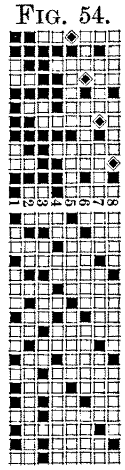


FIG. 55.

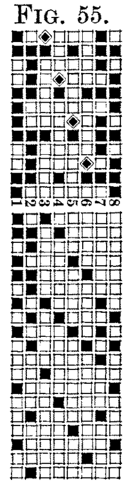
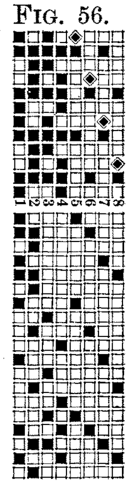


FIG. 56.



and drawing-in drafts as shown in Figs. 53, 54, 55 and 56.

The first method of reducing is made out in the usual manner, by commencing with the first left-hand thread and working or reducing to the right, which will require a chain draft and drawing-in draft as shown in Fig. 53.

Second method, we reduce the *face* threads first, in their numeral order, then go back and take up the backing threads in the same order, which will require a chain draft and drawing-in draft as shown in Fig. 54.

Third method, we commence with the twenty-fifth thread and reduce the double-pick (face threads), then go back and take up the four backing threads in their numeral order, after which we commence with the first thread and reduce the remaining ones, which will require a chain draft and drawing-in draft as shown in Fig. 55.

Fourth method, we begin at the same place as before, reduce *all* the face threads first, then take up the backing threads in their numeral order, which will require a chain draft and drawing-in draft as shown in Fig. 56. This latter method it the best of all the others for the harness layout.

Fig. 57, represents a herring-bone and basket texture combined—eight-harness work.

FIG. 57.

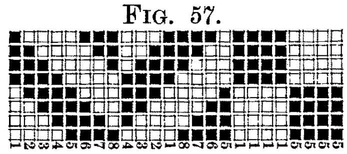
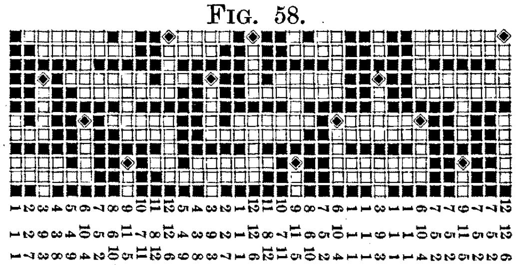


Fig. 58, represents the same texture as the above, but has a back attached every third thread, both warp and

FIG. 58.



filling ways. We illustrate three methods of reducing this figure to its lowest terms, and of making out the chain drafts and drawing-in drafts, as shown in Figs. 59, 60 and 61:—on the same principle as before described—the latter method being the best layout for the harnesses.

FIG. 59.

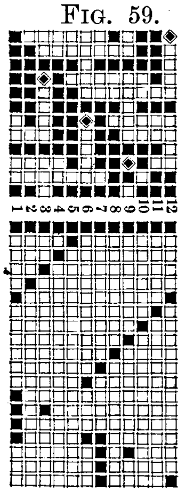


FIG. 60.

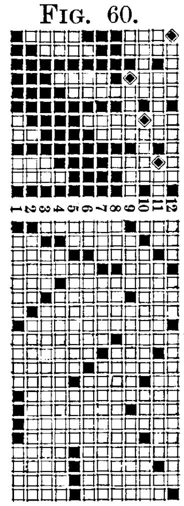
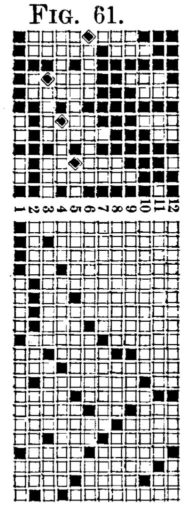


FIG. 61.



By referring to the above combinations (Figs. 52 and 58), the reader will observe, that in each of them the back filling threads are woven in the same every time; that is to say, there are the same number of risers in succession on each of those picks, across the whole width of the pattern; or, in other words, no break in the risers where the weaves change. This is a point which should be observed as much as possible, in combining weaves with a backing; thus producing an even back to the fabric, and often doing away with bad effects on the face.

We have endeavored to demonstrate this subject of attaching a back to fabrics, in as plain a manner as possible on paper; and should anyone interested herein, fail to comprehend our meaning, we would advise copying off on design paper, such figures as they do not understand, observing carefully the working of each harness and pick as they do so. This will prove of great aid to the beginner in enlarging his mind to a better understanding; or, in other words, he will accomplish in this manner, what he might not have accomplish in several hours of continuous reading the subject.

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CHAPTER XIII.

COMBINING WEAVES ILLUSTRATED.

Combining weaves is an important branch in the art of textile designing. It is not only important, but it covers a great field; in fact, so great that it is beyond the power of man to comprehend its scope. Hundreds, yes, thousands of designers, have been engaged in this business for many generations, and yet, new combinations are being brought out every day. How utterly useless then, for us to attempt to cover the field, in its entirety, in a work of this character. Therefore, all that we shall attempt to cover is, to bring up and illustrate the principal points, obtained by practical experience in the business.

In the first place, generally speaking, a complete break or cut-off should be made when reversing the position of a weave, or combining it with that of another, if possible to do so; and thus avoid threads from floating over or under each other any more than required in the regular weaving of them.

In the second place, when a sufficient break or cut-off cannot be made without causing too much of a float, another method of weaving for one, two or more threads, as the case may require, should be introduced between such weaves, to form the cut-off and properly unite them.

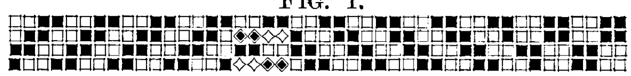
In the third place, avoid combining weaves of too great a difference in the textures to be used in the same design, as such are apt to cause the fabric to weave either too tight or too loose in their respective places; thus making more or less trouble and dissatisfaction from the weaving to the selling of the goods; besides, greatly impairing the wearing qualities.

In order to demonstrate the points spoken of, we will call the reader's attention to the following illustrations:

Suppose that we wish to make a fabric consisting of a four-harness cassimere twill, and a double-pick or basket weave, combined as follows:

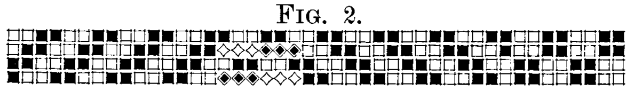
16 threads, right-hand twill;
4 threads, basket;
16 threads, left-hand twill;
8 threads, basket:—in all, 44 threads with a perfect cut-off,—it will give us Fig. 1.

FIG. 1.



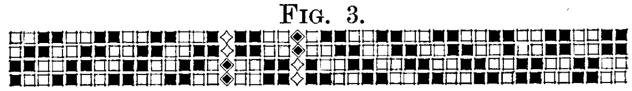
The manner of combining these textures would prove all right in many cases, but were it required to run the filling two and two of different colors, and have the basket show the same in both places of the pattern,—either a perfect pin-check or stripe—it would not answer the purpose. For it will be seen by referring to the figure, that while the eight threads of basket, at the right, were weaving as desired, the four threads of basket, between the twill stripes, would produce a broken appearance as shown by the different characters; or, in other words, they would appear as though woven pick and pick. Hence the combination must be changed so that the basket, in both places of the pattern, will stand in similar positions. By referring to Fig. 2, it

FIG. 2.



will be seen that this point has been overcome; but the result is, we have not got a perfect cut-off, there being three risers and three sinkers, side and side, on each alternate pick, as shown by the different characters. Now, this will not do in a texture of this kind, for in those places the fabric will show an over-shot appearance, which will spoil the effect of the basket figure. If, for certain reasons, it were essential that just 44 threads should be retained in the pattern, and have a perfect cut-off, then change the position of the middle basket figure, and the first thread on each side of it to read as shown in Fig. 3. But if it were not essen-

FIG. 3.



tial to retain 44 threads in the pattern, then take out those threads on each side of the basket, and transpose this basket figure, as shown in Fig. 4; the result is, there are now but fifteen threads in each twill stripe, while before there were sixteen.

FIG. 4.

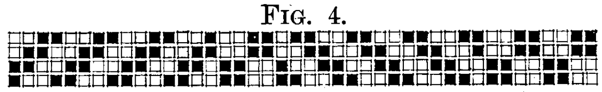


FIG. 5.

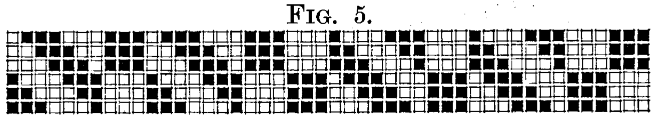


FIG. 6.

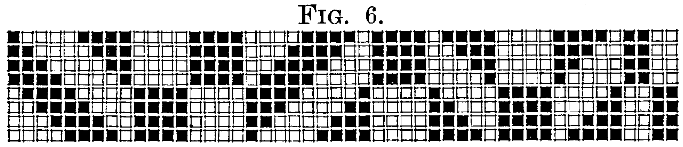


Fig. 5, illustrates a six-harness twill and basket weave combined.

Fig. 6, illustrates an eight-harness twill and basket weave combined.

On looking over the above figures it will be seen, that in each one of them the twill stripes contain an uneven number of threads. From this, we wish to have it understood, that in order to combine twills with basket weaves so as to have the basket figures stand in the same relation to each other, there *must* be an uneven number of threads in the twill stripes or figures. But bear in mind, this is not necessary when using all one kind of filling, or when running a filling pattern to produce a hit-or-miss effect.

When reversing regular twills, which contain an even number of harnesses, for the purpose of producing herring-bone effects, the cut-off should be made at the *completion*, or in the *middle* of the twill, the same as shown in Figs. 7, 8 and 9.

FIG. 7.

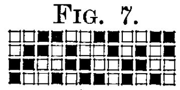


FIG. 8.

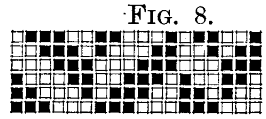
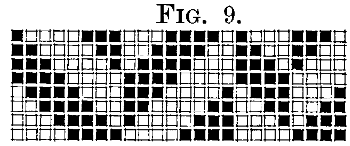


FIG. 9.



Each of these reversings may of course be carried out to any size of pattern required.

The above described points apply equally the same when combining twills and basket weaves, into patterns of blocks, checks, or diamonds of any size, and of any number of different combinations.

FIG. 10.

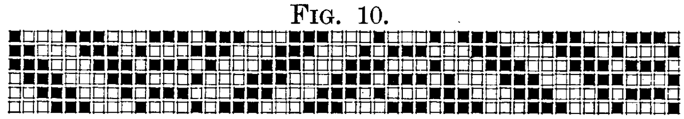


Fig. 10, illustrates the manner of combining a cord with a twill. In this figure, it will be seen that on each side of the cord, one thread is run in on the plain-weave principle to make a perfect cut-off for the cord. This is a rule quite commonly adopted in this class of weaving, and often two threads are wove in as a plain weave, in place of one for a cut-off. However, it should be borne in mind that these threads, in many instances, should be of a strong and elastic nature, in order to stand the extra strain which comes on them. On this principle a cord may be combined with any style of weave. Although in some cases it is advisable to run both the cord and cut-off with two picks in a shed, instead of one. If two colors were used in the filling of this pattern (Fig. 10), and run in pick and pick, the two outside cords would be the same in color as one of those colors, and the middle cord would be the same as the other color; hence the position of the cords must be governed according to requirements, on the same principle as demonstrated in the first four figures.

FIG. 11.

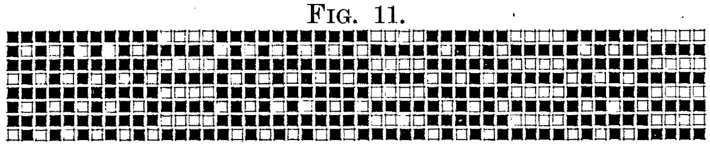


Fig. 11, illustrates a combination of ribs and cords; as here show, they represent but one independent weave, for neither the rib nor the cord texture alone, make a complete weave. Observe the position of each, which may be carried out, or reduced to whatever size required. The texture of this figure, forms a sufficient cut-off in itself without inserting special threads for such.

FIG. 12.

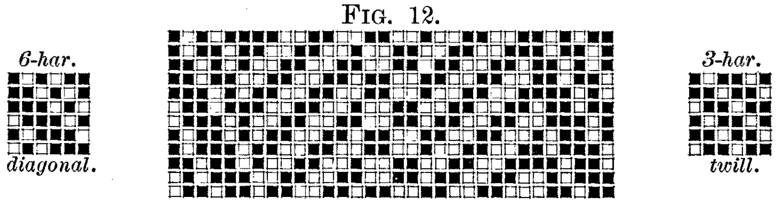


Fig. 12, illustrates a six-harness diagonal combined with a cassimere twill, and basket weave. Although there is a perfect cut-off in the twill and basket combination, yet it will be seen, that such is lacking between the twill and diagonal. However, in this place it is not necessary to have a perfect cut-off, owing to the nature of the diagonal being such that a float under four threads would not be out of place. The diagonal in this figure is, of itself, a combined weave as will be seen: If we commence with the top bar and take each alternate bar or pick, and set them down under each other in the regular order, it will give us the six-harness diagonal; and the remaining bars handled in a similar manner, will give us the three-harness twill.

FIG. 13.

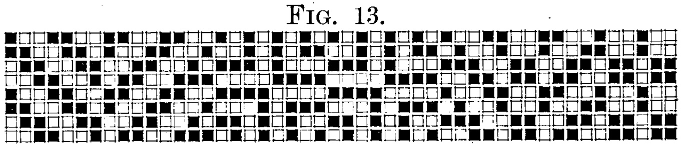
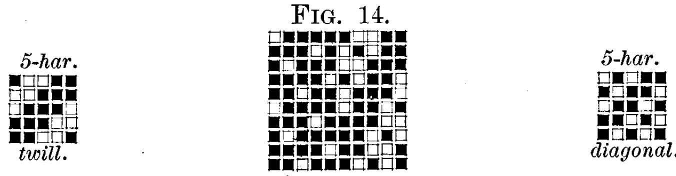


Fig. 13, illustrates a peculiar combination, particularly the middle part, which is often used in both light and heavy weight goods. The texture is such that by aid of the cotton stitch, it can be readily applied with nearly any weave, and yet produce a sufficient cut-off.

Fig. 14, illustrates a five-harness doeskin and a five-harness diagonal, combined. This does not make a perfect cut-off, yet it is so near, owing to the nature of the weaves, that no extra floats will be observed. From this it does not follow that these weaves could be placed in any position with each other, and obtain a similar result. For, were we to move the diagonal up one pick on the doeskin, thus

FIG. 14.



throwing the top bar to the bottom, we would then have *seven* risers side and side on the sixth bar. Hence, it will be seen that when combining weaves, which will not admit of a perfect cut-off without inserting extra threads or harnesses for such, the best position in each of them for uniting is found on the cut-and-try principle. In the diagonal there is combined a twill and diagonal of five bars each as shown, which are found in the manner previously described.

Fig. 15, illustrates a five-harness doeskin, of both warp and filling face; also the same texture arranged into twills, of warp and filling face; all of which are combined into a block pattern, forming a complete cut-off. In this man-

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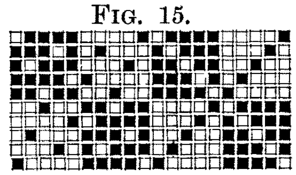
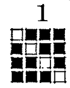
ner an unlimited number of different combinations may be made; and of which, such are used in weaving ladies' dress goods. The three and four-harness weaves on this principle are also used quite extensively for that purpose.

FIG. 15.



Speaking of block combinations, perhaps it may be well to illustrate a figure method which we use when combining weaves of an equal size, both ways, that will make a perfect cut-off. For this purpose, we will take the four following four-harness weaves, and call them 1, 2, 3, and 4; and when using any one or all of these figures, they will each respectively stand or represent that full weave.

1



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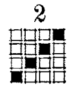

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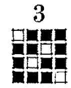

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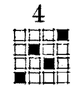
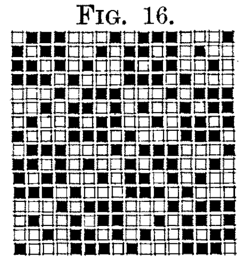


Suppose that it were required to combine all of these figures (weaves) into a small block pattern, on the plan of a twill, we would arrange the figures to read as below, which would represent a pattern of sixteen threads both warp and filling ways, as shown in Fig. 16.

1	2	3	4
2	3	4	1
3	4	1	2
4	1	2	3

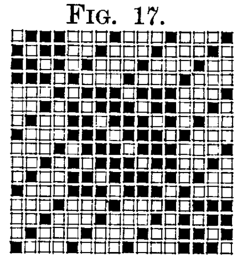
FIG. 16.



Now we will take 1 and 2 only, and combine them into another style of pattern by arranging them in the manner given below, which will give us a pattern of sixteen threads, both warp and filling ways, as shown in Fig. 17.

(Of course, it will be understood that this style of patterns are designed more especially for ladies' dress goods, than for gentlemen's wear.)

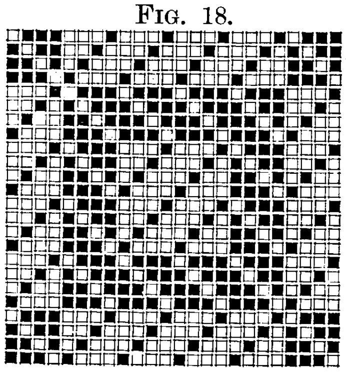
FIG. 17.



1	2	2	2
2	1	1	2
2	1	1	2
2	2	2	1

Again, we will take the same numbers and arrange them in another position, which will give us Fig. 18.

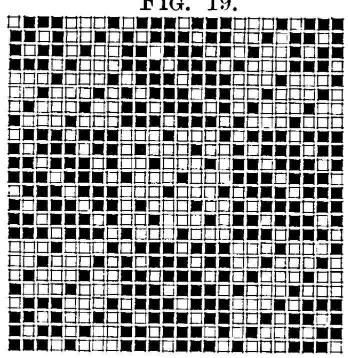
FIG. 18.



1	2	2	2	2	1
2	1	1	1	1	2
2	1	2	2	1	2
2	1	2	2	1	2
2	1	1	1	1	2
1	2	2	2	2	1

Again, taking 1, 2, 3, and 4, we will arrange them so as to produce the pattern shown in Fig. 19.

FIG. 19.



3	2	1	1	2	3
2	2	1	1	2	2
1	1	4	4	1	1
1	1	4	4	1	1
2	2	1	1	2	2
3	2	1	1	2	3

Thus it will be seen, that there is no limit to the number of combinations which may be made with these four simple weaves. These combinations may be enlarged to any size required.

By this figure method, a designer can put his ideas on paper much quicker,—without even using either design paper or characters—and thus be enabled to lay out in a few minutes, large designs which would otherwise have taken several hours to accomplish. Of course, he will have to familiarize himself sufficiently with it to keep in his mind the *exact weave*, and the *position* which each figure represents, in order to see, as it were, the run of the texture. After having completed the design to his satisfaction, it may be drawn on design paper in the usual manner if required; although, both the chain draft and drawing-in draft can be made out from the original work.

FIG. 20.

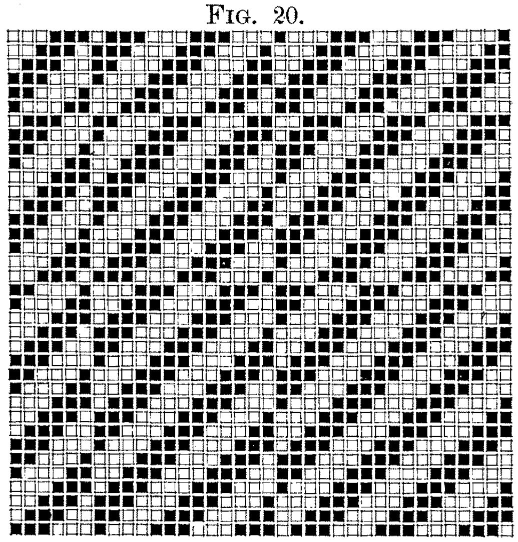


Fig. 21, illustrates a plaid block pattern, composed of common six-harness twills, all of which run in the same direction. This design produced in all one color, and kind of yarn, will show up the plaid effect to a good advantage, owing to the sharp cut-off in the twills. In this manner any evenly balanced twill may be arranged and carried out to any size required.

FIG. 21.

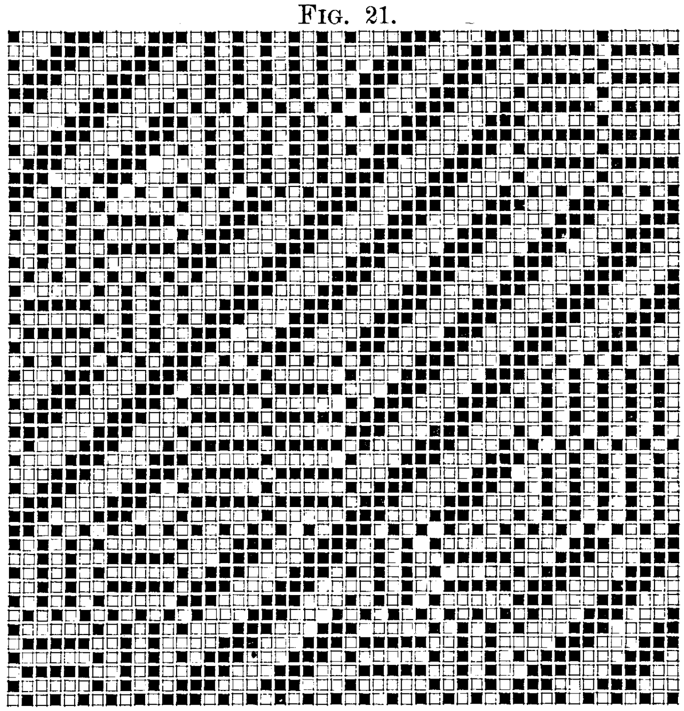


Fig. 21, illustrates a six-harness twill and basket-rib combination, which is a novelty and should be thoroughly studied, as there are some good points to be gained from it. Notice how the cotton stitch or plain texture is used to produce a proper cut-off throughout the design; also how the the two long twills join with others at the repeating of the pattern, as well as how the twills join on the basket-ribs. There is not an excess number of risers, or sinkers, in any one place throughout the design.

Fig. 22, illustrates another style of basket rib combined with a creased stripe and twill. The two warp threads that weave side and side, on the back, which read three down and one up, make a perpendicular line or crease after the style of a tricot weave; and produces a handsome effect in combination with other weaves. It will be seen, at the cut-off of the twill where the different characters are inserted, that there are five risers in succession, the filling way, and that to all appearances this would cause a float on the back or a miss-pick effect on the face of the goods; but owing to the middle thread, as shown by the different characters, being thrown to the back of the goods in the process of weaving, it does away with this bad effect—as appears.

FIG. 22.

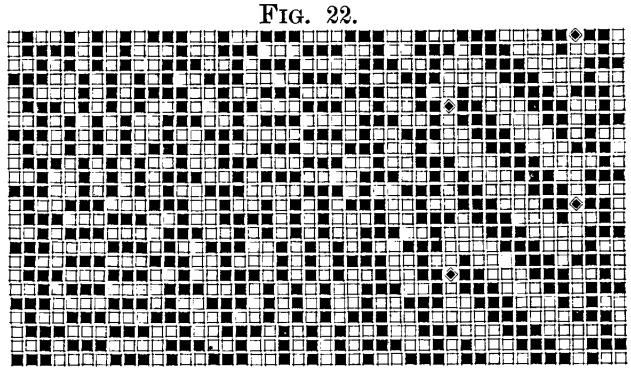


Fig. 23, illustrates another style of combination, with the crease weave used to divide the diagonal and rib figures. This style is quite often used in patterns for trouserings. The diagonal stripe should, however, be carried out somewhat wider than the basket-rib stripe.

FIG. 23.

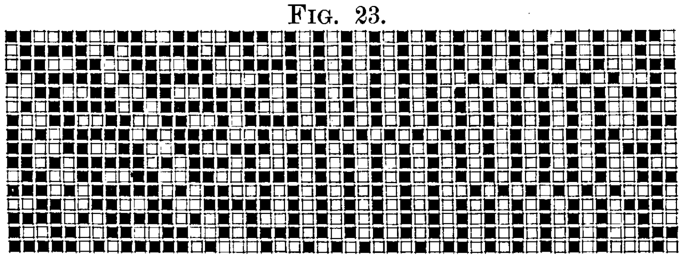
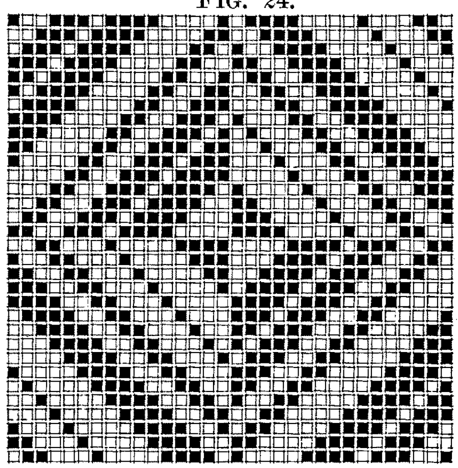


Fig. 24, illustrates a diamond pattern composed from what appears to be two different diagonals, but it is really only *one* or the same weave, transposed. It will be seen, that the upper left and lower right-hand corners are formed by the same sixteen-harness diagonal, and that there are nine risers and seven sinkers on each thread, both ways of the weave; while the upper right and lower left-hand corners are formed in a similar manner, but with the weave transposed so that each thread has nine sinkers and seven risers. This transposition is necessary in order to make a perfect cut-off. Weaves not equally balanced in risers and sinkers, are generally arranged in this manner when united to form diamond patterns.

FIG. 24.



We will now call the reader's attention to Fig. 25, which illustrates the first three bars or picks of a fancy diagonal, composed in the following manner:

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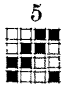

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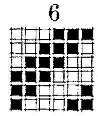

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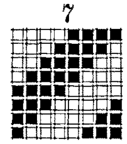
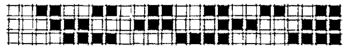


FIG. 25.



In connection herewith, we illustrate a four, six and an eight-harness twill, numbered 5, 6 and 7, respectively. Now observe that the first bar of Fig. 25, is the same as that of weave 5; the second bar is the same as the first of weave 6; and the third bar is the same as the first of weave 7; each instance the bars being carried out to twenty-four threads or harnesses in width. Now to complete the figure, continue thus: take the second bar of each weave, in their respective order, and set them in the same order under those of the figure; then take up the third bar of each weave, then the fourth, etc.; continue setting them under those in the figure until it is seventy-two bars in length. This will complete the figure and give us a large, fancy diagonal. In this operation, weave 5 had to be repeated six times; weave 6, four times; and weave 7, three times, both ways, before all three weaves would repeat at the same point as started on. Hence, it will be seen that, in combining two or more weaves of different sizes, into continuous diagonals, they must each be carried out to that point where they will repeat at the same time or place of starting. On this principle of composing diagonals, many beautiful and complicated patterns are made for worsted fabrics; in fact, there is no limit to them.

We might continue this subject, and illustrate many other combinations if we deemed it necessary, but we believe a sufficient number and variety have been given, to enable the beginner to form a good idea in this branch of designing, so that by a little study and practice, he will be able to comprehend its scope, as set forth in the first paragraph.

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CHAPTER XIV.

THE ANALYSIS OF DOUBLE WEAVES—THEIR CONSTRUCTION AND STITCHING.

This is a subject requiring much study and practice in weaving, as it were, on paper; in other words, the uniting of weaves in various ways to learn the result or effect. To be able to answer the following questions, after inspecting or looking through a double weave, is a matter of no small importance to both the professional and amateur, in these days of modern competition in the profession.

First.—What two weaves are used in the formation of this double weave?

Second.—Which one of them weaves the face of the fabric, and which one the back?

Third.—Are they properly stitched together? If so, by the face weave, back weave, or both?

Fourth.—How are we to know that this double weave is correct in every respect, without trying the same in a pattern loom?

The practical designer ought to be able to answer these questions promptly and correctly, after looking the double weave through. We are sorry to say, however, from personal observations, we know there are those who profess to have this power, that are more or less deficient in the matter. It is for the benefit of those professed designers, and particularly beginners, that this chapter is intended.

To begin the subject, we will take for illustration, Fig. 1, which represents a double weave composed of the regular eight-harness twill—four up and four down—for the face; and the regular four-harness twill—two up and two down—for the back. These weaves are tied or stitched together by the back filling threads; in other words, it is called a "filling tie," that is to say, the back filling threads are brought up into the face of the fabric, by passing over certain face threads of the warp, one at a time in regular order. It will be observed, on looking at this double weave (Fig. 1), that we have numbered the bars or filling threads at the left from 1 to 16, in rotation; also that the harnesses or warp threads are numbered at the bottom from 1 to 16, in rotation.

FIG. 1.

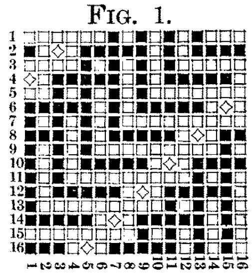


FIG. 2.

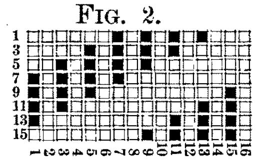
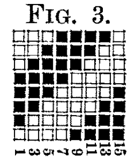


FIG. 3.



We will now analyze this weave for the purpose of demonstrating its construction, as well as to see if the above remarks prove true. To do this, proceed as follows: Take the bars, or face filling threads, numbered 1, 3, 5, 7, 9, 11, 13 and 15, and set them down under each other, in their numeral order, the result is Fig. 2. From this figure, take the harnesses, or face warp threads, numbered 1, 3, 5, 7, 9, 11, 13 and 15, and set them down along side of each other, in their numeral order, the result is Fig. 3, which is the eight-harness twill, and face weave.

FIG. 4.

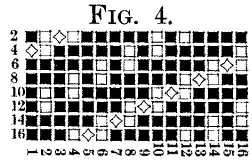


FIG. 5.

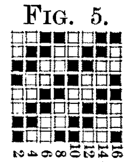
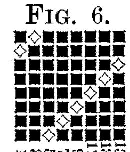


FIG. 6.



Now take the bars, or back filling threads, numbered 2, 4, 6, 8, 10, 12, 14 and 16, and set them down under each other, in their numeral order, the result is Fig. 4. From this figure take the harnesses, or back warp threads, numbered 2, 4, 6, 8, 10, 12, 14 and 16, and set them down along side of each other, in their numeral order, the result is Fig. 5, which is the four-harness twill, and back weave; also the harnesses, or face warp threads, numbered 1, 3, 5, 7, 9, 11, 13 and 15, and set them down along side of each other, in their numeral order, the result is Fig. 6, which illustrates the method or plan of tying.

If a "warp tie" is desired, that is to say, the back warp threads are brought up into the face of the fabric, passing over the face filling threads, one at a time in succession, the weave would then be as shown in Fig. 7.

FIG. 7.

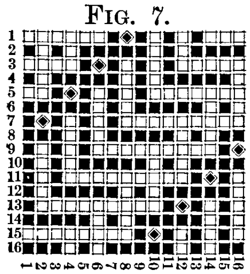


FIG. 8.

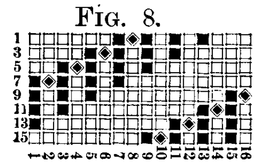


FIG. 9.

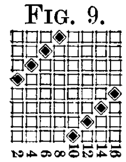
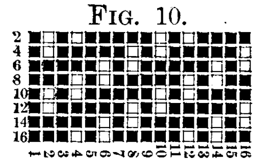


FIG. 10.



By analyzing Fig. 7, the same as just demonstrated with Fig. 1, we find Fig. 8—in place of Fig. 2,—which contains Fig. 3, and also Fig. 9 which illustrates the tying method. Then again, we find Fig. 10—in place of Fig. 4,—which contains Fig. 5.

If a "warp and filling tie" were desired,—bringing both of the above methods into operation at the same time—we would then have Fig. 11. From the analysis of this figure, we get Fig. 8, which contains Figs. 3 and 9; and again, we get Fig. 4, which contains Figs. 5 and 6.

Now we will proceed to find and lay out this double tying plan in its full and original form. To do this, we will take Fig. 11, and proceed as follows:

FIG. 11.

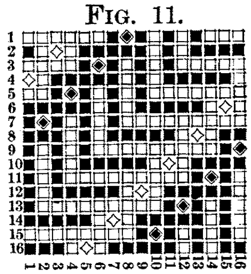
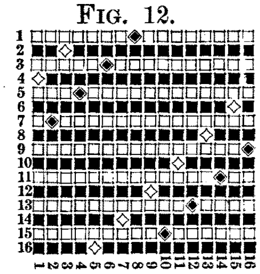


FIG. 12.



Commencing with the first pick, which is a face thread, we set it down as all sinkers *except* where the *tie* comes on the *eighth harness*, we mark that as a *riser;* then taking the second pick, which is a back thread, we set it down as all risers *except* where the *tie* comes on the *third harness*, we mark that as a *sinker;* in this manner we continue with each of the sixteen filling threads in rotation, the result is Fig. 12 which shows the whole tying plan, full size, both filling and warp methods.

FIG. 13.

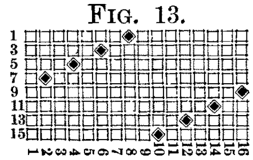
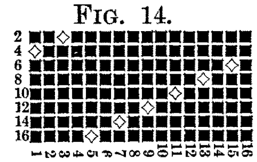


FIG. 14.



From Fig. 12, we will take the bars 1, 3, 5, 7, 9, 11, 13 and 15, and set them down under each other, in their numeral order, it will give us Fig. 13, from which we will take the harness numbers 2, 4, 6, 8, 10, 12, 14 and 16, and set them down along side of each other, in their numeral order, we obtain Fig. 9. Now we will take the remaining bars or filling threads 2, 4, 6, 8, 10, 12, 14 and 16, and set them down under each other, in their numeral order, the result is Fig. 14, from which we will take the harness numbers 1, 3, 5, 7, 9, 11, 13 and 15, and set them down along side of each other, in their numeral order, we obtain Fig. 6. By these figures it will be seen, that each demonstration has proved itself true in every point.

FIG. 15.

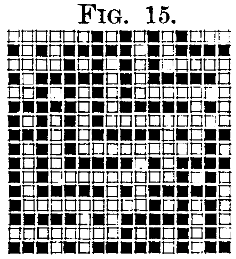


Fig. 15, illustrates the two original weaves, Figs. 3 and 5 combined, but not tied together. If we were to set a loom in operation, containing a warp drawn in straight across sixteen harnesses, with the harness chain built thus, the result would be two separate pieces of cloth, but united at the selvage only.

The analysis of any double weave may be conducted on the principle already described, and should there be any mistakes in either of the component weaves, or tying plans, such mistakes can be easily detected by the deficiency or excess of *risers*, or *sinkers*, as the case may be, which can be rectified on paper before building the loom chain; thus saving time, trouble and annoyance of finding such mistakes in the cloth, after the loom has been put in operation.

Should the reader fail to comprehend our meaning, we would advise the following: Take a sheet of design paper, on it copy off all the above figures in their numeral order, at the same time carefully read the directions which accompany them; in this manner the reader will more readily understand our meaning—it will all seem to come to him, as it were, at once.

To assist the beginner further in this important branch of designing, we will illustrate some of the most practical double weaves in use at the present day, and the different methods of stitching or tying them together.

FIG. 16.

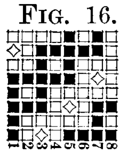


FIG. 17.

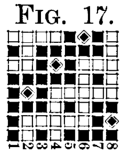


FIG. 18.

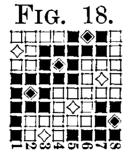
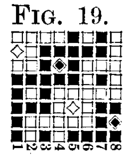


FIG. 19.



Figs. 16, 17, 18 and 19, represents the regular four-harness cassimere twill, both the face and back weave. Fig. 16

shows the filling tie; Fig. 17, shows the warp tie; Fig. 18, shows both warp and filling ties; and Fig. 19, shows a broken warp and filling tie.

FIG. 20.

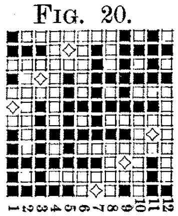


FIG. 21.

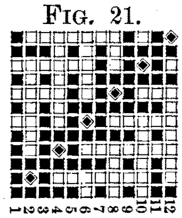


FIG. 22.

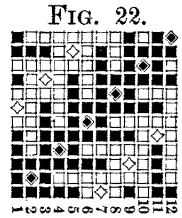
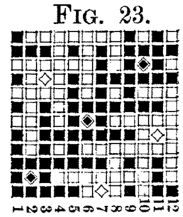


FIG. 23.



Figs. 20, 21, 22 and 23, represents the regular six-harness twill, both face and back. Fig. 20, shows the filling tie; Fig. 21, shows the warp tie; Fig. 22, shows both warp and filling ties; and Fig. 23, shows a broken warp and filling tie.

FIG. 24.

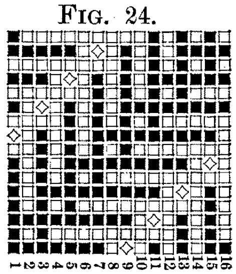


FIG. 25.

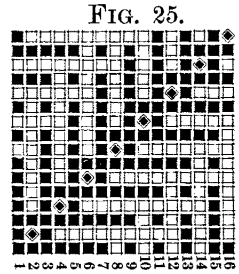


FIG. 26.

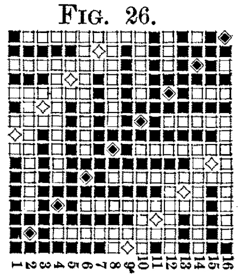
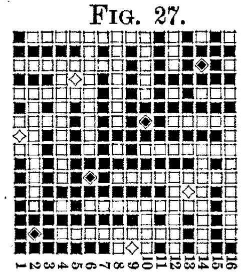


FIG. 27.



Figs. 24, 25, 26 and 27, represents the regular eight-harness twill, both face and back. Fig. 24, shows the filling tie; Fig. 25, shows the warp tie; Fig. 26, shows both warp and filling ties; and Fig. 27, shows a broken warp and filling tie.

In originating these double weaves, we placed each single weave in such a position that the twills were made to come directly over and under each other as near as possible. This is a point which should be adhered to, so far as possible, in the formation of all such weaves, as it makes it much more convenient for tying them together in a proper manner.

FIG. 28.

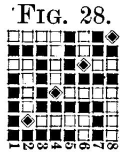


FIG. 29.

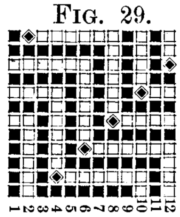
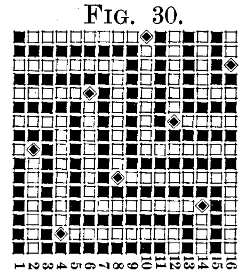


FIG. 30.



Figs. 28, 29 and 30, are respectively the above three twills (four, six, and eight-harness), and will weave the same fabrics as those; but in originating these latter figures the single weaves were combined from a different point or position, hence the difference in their appearance. The object of these figures is to demonstrate that, there is a right and wrong way of putting together two single weaves for the purpose of producing a double weave; not because it makes any difference in the weaving or appearance of the fabric, but that it *does* make a great difference in the manner of stitching them together. In the former sets of figures it will be observed how systematic the stitching is accomplished, and, in accordance with rules previously laid down; while in this latter set there is no such system to follow. In the former, each place of stitching is completely surrounded by either *sinkers*, or *risers;* in the latter, it takes both sinkers and risers to surround each stitch or tie—tie where you will, the result will be the same.

Figs. 31 and 32, represents a double-pick face (two and two, warp and filling) with a cassimere-twill back, showing two methods of tying.

Figs. 33 and 34, represents a six-harness basket face (three and three, warp and filling) with a six-harness twill back, showing two methods of tying.

FIG. 31.

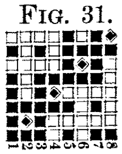


FIG. 32.

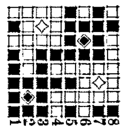


FIG. 33.

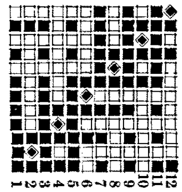
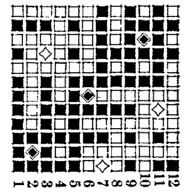


FIG. 34.



Figs. 35 and 36, represents an eight-harness basket face (four and four, warp and filling) with an eight-harness twill back, showing two methods of tying.—See *Sample No. 5*, made from Fig. 36.

FIG. 35.

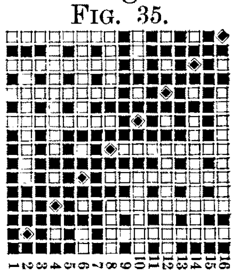


FIG. 36.

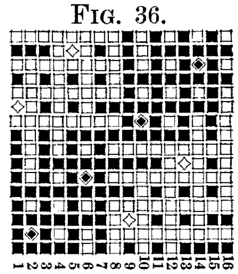


Fig. 37, represents a double-pick weave, both face and back.

Fig. 38, represents a six-harness basket weave, both face and back.

Fig. 39, represents an eight-harness basket weave, both face and back.

FIG. 37.

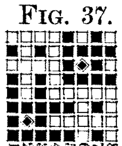


FIG. 38.

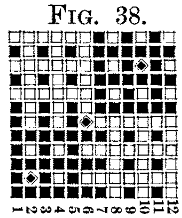
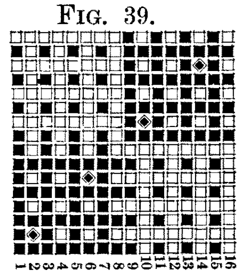


FIG. 39.



If it should be desired to give these weaves a closer tying, insert a stitch between the present ones in rotation.

Figs. 40, 41 and 42, represents respectively the same as the three preceding figures, but combined from a defferent standpoint, as described under Figs. 28, 29 and 30. Note the difference in tying.

FIG. 40.

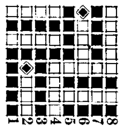


FIG. 41.

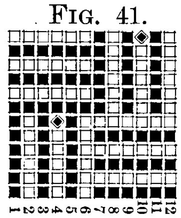


FIG. 42.

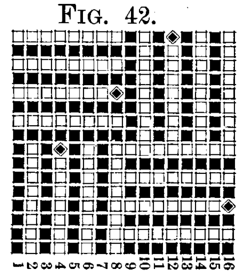


Fig. 43, represents the regular, six-harness twill face with the three-harness (two up and one down), twill back.

Fig. 44, represents the regular, six-harness twill face with the three-harness (two down and one up), twill back.

Fig. 45, represents the regular, six-harness basket face with the three-harness (two up and one down), twill back.

Fig. 46, represents the regular, six-harness basket face with the three-harness (two down and one up), twill back.

FIG. 43.

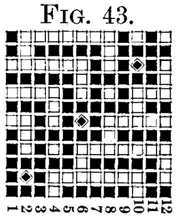


FIG. 44.

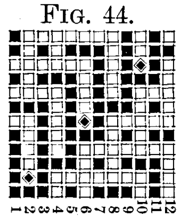


FIG. 45.

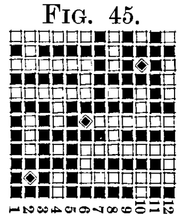
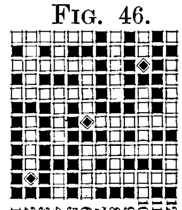


FIG. 46.



Only one method of tying has been illustrated in these last four figures, which we consider is sufficient owing to the close texture of the back weave; but should more tying be desired in some cases, increase the number of stitches as previously illustrated in the twill weaves.

If it should be required to reverse the position of any one of these double weaves, Figs. 31, 32, 33, 34, 35, 36, 43, 44, 45 and 46, that is, to throw the face weave to the back, and the back weave to the face, turn such figure one-fourth way round, either to the right or left, and build the loom chain with the figure remaining in that position. This will turn the position of the weave so that the working of the filling threads as now, will then represent the working of the warp threads; and the working of the warp threads as now, will then represent the working of the filling threads.

We will now close this chapter, after illustrating the following: Figs. 47, 48, 49 and 50, represents four different movements for weaving two pieces of plain flannel, at the

FIG. 47.

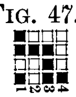


FIG. 48.

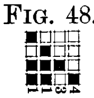


FIG. 49.

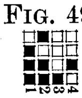
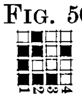


FIG. 50.



same time, one above the other. Hence, each one of those weaves will produce the same result. It is on this principle that double-width flannels are woven in single-width looms.

CHAPTER XV.

THE CONSTRUCTION OF TRIPPLE OR THREE-PLY WEAVES.

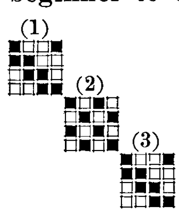
This is a class of weaves which are very little used in comparison with those of the single and double classes. Perhaps, if better understood by designers of fabrics for wearing apparel, this class of weaves would be brought into a more general use in the manufacture of certain heavy fabrics.

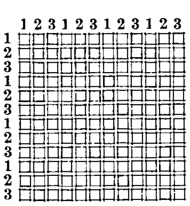
Tripple or 3-ply weaves, are those having three weaves united into one in such a manner that but one fabric is produced, as it were, in the operation of weaving. Yet, in reality, this one fabric is composed of three fabrics tied or stitched together in such a manner, during the process of weaving, that they really represent but one fabric.

The term "stuffed" is quite often used in preference to "tripple" or "3-ply," and quite appropriately too, as the principal object in using this class of weaves, is for adding weight or cheapness to the fabric by stuffing into its centre a cheaper grade, or another class of stock; the face and back fabrics completely covering from view the middle fabric. On this principle of weaving, a cotton fabric can be inserted between two all-wool fabrics—the three being stitched together as one,—so that no one could detect it without unravelling the same. This method of weaving is, therefore, adapted to the manufacture of chinchillas, worsted cloakings, overcoatings, etc.

In order to demonstrate this subject in a comprehensive manner, in the construction of the different illustrations or figures, it will be necessary for us to use the terms "face," "middle" and "back," a great many times in connection therewith; hence, we desire the reader to keep in mind, the following explanations: That these terms apply to the *face* weave, the *middle* weave and the *back* weave, and will be represented at the top, and at the side of these illustrations, by the figures 1, 2 and 3, respectively. That is to say, the figure 1, will represent the "face;" the figure 2, will represent the "middle;" and the figure 3, will represent the "back."

We will now illustrate the manner of laying out and constructing a tripple weave, to consist of the four-harness cassimere twill on both the face and back, and the two-harness cotton or plain weave in the middle. This manner of procedure, when once thoroughly understood, will enable the beginner to construct a tripple weave with any three





single weaves he may choose to use. As will be seen, we have marked the weaves named above, (1, 2, 3,) and placed them in the position that they are to occupy in the tripple weave. At the right of these weaves, we have illustrated what is to represent a piece of design paper, marked at the top and one side, 1, 2, 3, in succession. On this design paper, we will proceed to lay out and construct the tripple weave. In doing this work, it should be borne in mind that each single weave is to occupy the positions on the design paper in line of the figure which corresponds with that of the weave being laid out, and no other, both ways of the paper.

FIG. 1.

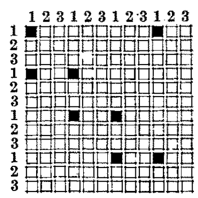


FIG. 2.

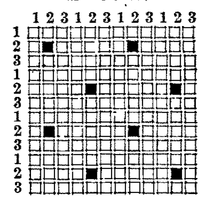


FIG. 3.

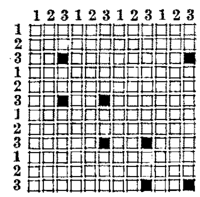


FIG. 4.

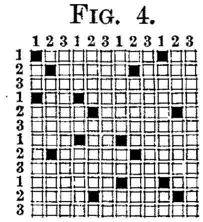


FIG. 5.

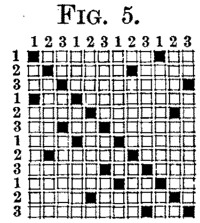


Fig. 1, illustrates the face weave laid out in its respective order.

Fig. 2, illustrates the middle weave laid out in its respective order.

Fig. 3, illustrates the back weave laid out in its respective order.

Fig. 4, illustrates the face and middle weaves combined in their respective order.

Fig. 5, illustrates the face, middle and back weaves combined in their respective order. This figure, as it now stands, would weave a single fabric of a filling face, diagonal appearance. Hence, another movement must be made that will separate these textures, and allow each one to work independent of the two others. In other words, when a filling thread is woven into either the face, middle, or back fabric, the harnesses which weave that fabric must work independent of the others. This will be seen by examining Figs. 6 and 7, particularly the latter one.

FIG. 6.

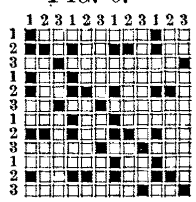


FIG. 7.

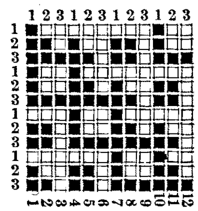


FIG. 8.

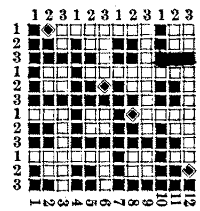


Fig. 6, illustrates the movements of the face and middle textures completed and separated the filling way only.

Fig. 7, illustrates the movements of all three textures completed and separated, both filling and warp ways. If a harness chain were built from this figure, and attached to a loom operating twelve harnesses with a warp drawn in straight across, it would produce three separate fabrics consisting of a cassimere twill on the top and bottom with a plain flannel in between them—the three pieces being united by the selvage only. Now let us look closer into the construction of this Fig. 7. Looking at it the filling way, we find that the face picks or bars 1, 1, 1, 1, remain the same as in the former figures, passing over all but two of the warp threads. The bars 2, 2, 2, 2, show an increase of four risers, all of which are marked over the face weave; thus forcing the filling to pass *under* all of the face warp threads and *over* all of the back warp threads, completely enclosing this filling between the face and back fabrics; or, in other words, allowing it to form a middle fabric independent of the two others. The bars 3, 3, 3, 3, show an increase of eight risers, all of which are marked over both the face and middle weaves; thus forcing the filling to pass *under* all but two of the warp threads, and they assist in weaving the back fabric. Looking at it the warp way, we find that the face warp works *over* all but two of the filling threads; the middle warp works the same both ways; and the back warp works *under* all but two of the filling threads.

Next in order, is the uniting or tying of these fabrics together in such a manner that, when put into operation, they will produce one combined fabric; in other words, the three single fabrics will be united, and appear as one.

Fig. 8, illustrates the completed tripple weave, with the tying as just described. On examining into this principle of tying we find that, the first tie is made by raising a middle warp thread so that a face filling thread passes under it; the second tie, by raising a back warp thread so that a middle filling thread passes under it; the third and fourth ties are made in the same manner respectively. The first and third ties, unites or binds the face to the middle weave, and the second and fourth ties, binds the back weave to the middle; hence, it will be seen that, the middle weave is the basis of tying for both the face and back.—See *Sample No. 6*, made from this weave.

We do not wish the reader to understand that it were necessary to go through with all of the above different forms of construction, in order to lay out and construct this tripple weave, as such incomplete figures are only intended to illustrate our meaning in a better manner than could be otherwise done. Fig. 8, contains all of the former figures consolidated, and is in itself, the only one necessary to have made were the principles previously understood. Hence, we will not enter so fully into the details with the comming figures as done with that of the present one.

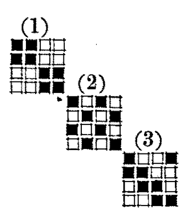


FIG. 9.

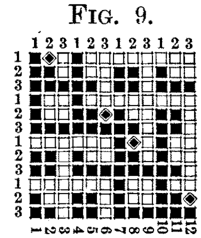


Fig. 9 is composed of the three weaves represented, consisting of a double-pick face, plain middle, cassimere back.

Fig. 10 is composed of the three weaves represented, consisting of the four-harness, broken twill face (one down and three up), plain middle, and cassimere twill back.

Fig. 11 is composed of the three weaves represented, consisting of the four-harness, twill face (one down and three up), cassimere twill middle, and the back the same as the face weave reversed.

FIG. 10.

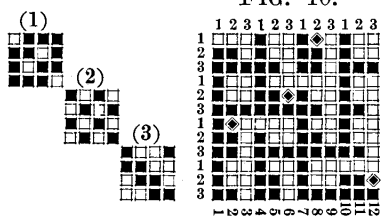


FIG. 11.

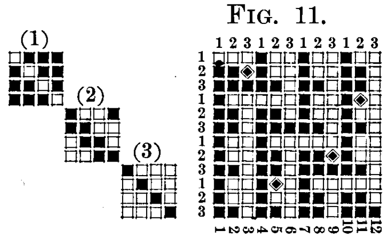


Fig. 12 is composed of the three weaves represented, consisting of a cassimere, broken twill face, the four-harness, broken twill middle (one up and three down), and the cassimere twill back.

Fig. 13 is composed of the three weaves represented, cansisting of a plain face, cassimere broken twill middle, and a cassimere twill back.

FIG. 12.

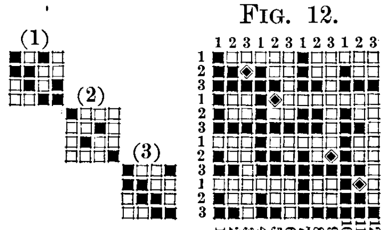
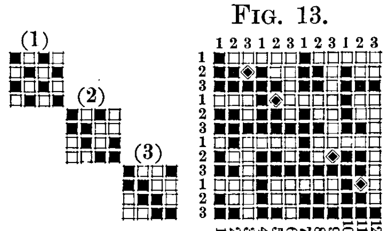


FIG. 13.



From the preceding illustrations, the reader will, no doubt, obtain a pretty good idea of the construction of tripple weaves, particularly those of the smaller class. We will now illustrate some of the larger classes (within the limit of twenty-four harnesses) without showing the weaves from which they were composed, but will name such weaves as well as the positions which they occupy. We shall, however, confine ourself to weaves of the common class.

Fig. 14, represents the common six-harness twill for the face, the three-harness twill (one up and two down) for the middle, and the six-harness basket for the back.

Fig. 15, represents the three-harness twill (two up and one down) for the face, the six-harness basket for the middle, and the common six-harness twill for the back.

FIG. 14.

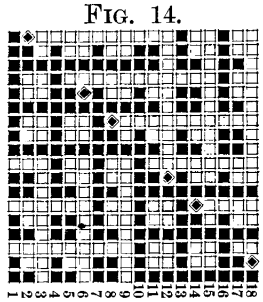


FIG. 15.

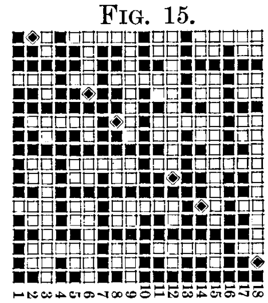


Fig. 16, represents the six-harness basket for the face, the common six-harness twill for the middle, and the three-harness twill (two up and one down) for the back.

Fig. 17, represents the common six-harness twill for the face, middle and back; each twill commencing on the same point, so that the face and middle twills lay directly under the face twill.

FIG. 16.

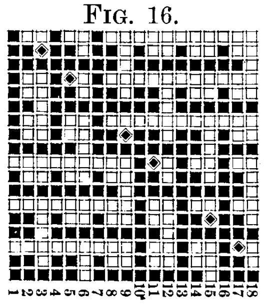


FIG. 17.

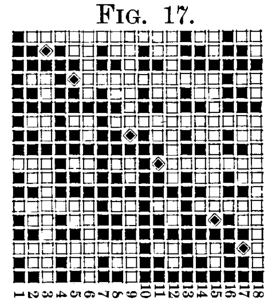


Fig. 18, represents the common four-harness twill for the face, the regular double pick (two and two) for the middle, and the common eight-harness twill for the back. This tripple weave can be reduced and woven on eighteen harnesses, if desired.

Fig. 19, represents the common eight-harness twill for both the face and back, and the common eight-harness basket for the middle.

FIG. 18.

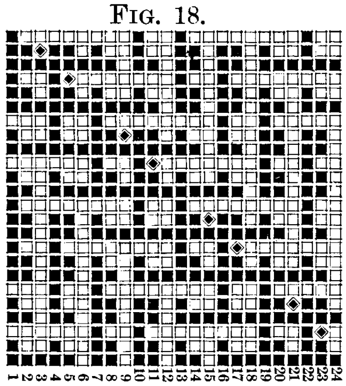


FIG. 19.

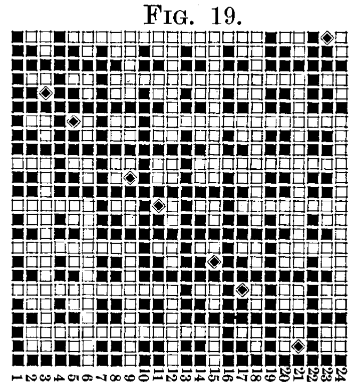


Fig. 20, represents the common eight-harness basket for both the face and back, and the common eight-harness twill for the middle.

Fig. 21, represents the common double pick for the face, the common eight-harness twill for the middle, and the common cassimere twill for the back.

FIG. 20.

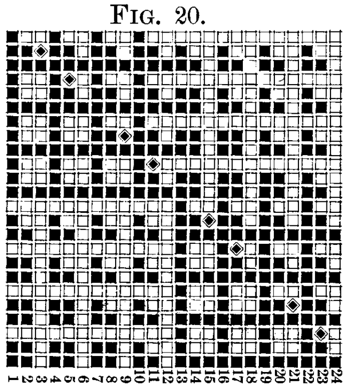
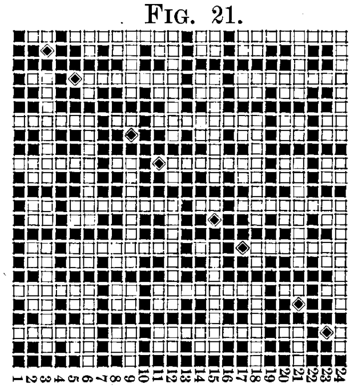


FIG. 21.



If required to reverse the position of any one of the above figures, so that the face will represent the back, and the back to represent the face, proceed in the same manner as described in the preceding chapter.

Fig. 22, represents three two-harness plain weaves combined, but not stitched together; hence, they will produce three separate pieces of flannel, but bound together by the selvage only. In this method of weaving, each fabric receives one pick in succession; hence if the warp is dressed one thread of each of three different colors in succession and filled in a like manner, the result would be three fabrics of the different colors respectively.

FIG. 22.

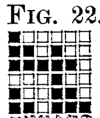


FIG. 23.

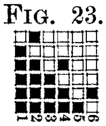


FIG. 24.

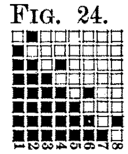


Fig. 23 represents and will produce the same as Fig. 22, but in this method of weaving, each fabric receives two picks in succession,—which completes the weave and pattern—while in the other method, each fabric receives but one pick in succession. To weave, with this figure, three fabrics each of a different color, the warp would have to be dressed two of each color in succession and filled in a like manner.

Fig. 24, represents four two-harness plain weaves combined, and will produce four separate pieces of flannel. On this principle, a weave can be carried out to any required size, each two harnesses producing a separate piece of flannel. By stitching such flannels together in the process of weaving, any required thickness of cloth may be made for feltings, or other similar purposes. Goods woven on this principle are called 2, 3 or 4-ply cloth, according to the number of different sets of harnesses employed; each single weave representing a set.

In dressing warps for 3-ply cloths, three times the number of ends should be used, if possible, in place of what would be required for the face weave if used singly.

CHAPTER XVI.

RELATIVE LENGTHS PER POUND OF WOOLEN, WORSTED, COTTON, AND SILK YARNS.

To give in detail the various systems of figuring yarns in Foreign countries, would be of little or no use here to the beginner; therefore, we shall confine this chapter to the systems generally adopted in this country, which are as follows:

1600	yards	of single	woolen	yarn	=	1 run.
240	yards	"	"	"	=	1 cut.
560	yards	of single	worsted	yarn	=	1 number.
840	yards	"	cotton	"	=	1 number.
840	yards	"	spun silk	"	=	1 number.

NOTE.—In our four-dollar work—"A Treatise on Designing and Weaving Plain and Fancy Woolen Cloths" published in 1878—we gave 300 yards as a cut; since then we find there is a great diversity of opinions as to which is correct, 300 yards, or 240 yards. After a careful research we find that the former system is more generally calculated for linen yarns, and the latter system for woolen yarns.

EXPLANATION:

A woolen thread spun to that size which requires just 1600 yards to weigh one pound, is called 1 "run."

A woolen thread spun to that size which requires just 240 yards to weigh one pound, is called 1 "cut."

A worsted thread drawn to that size which requires just 560 yards to weigh one pound, is called 1 "number."—Written, No. 1's.

A cotton thread spun to that size which requires just 840 yards to weigh one pound, is called 1 "number."—Written, No. 1's.

A spun-silk thread that requires just 840 yards to weigh one pound, is called 1 "number."—Written, No. 1's.

There is an important difference between silk and worsted, or cotton yarns, which requires to be borne in mind when making a calculation in these yarns. This difference refers to 2-ply yarns. In writing 2-ply 40's in worsted, or cotton, it is usually written 2-40's; thus indicating clearly that the actual counts of the yarn is only one-half of what it is termed; or, in other words, the actual counts of the yarn is 20's, simply because it is two threads of 40's put together, making one thread of double the weight. In writing 2-ply 40's in silk, it is usually written 40-2; thus indicating clearly that the yarn is still 40's though a 2-ply yarn; hence the single threads must each have been 80's.

COMPARISON.

$5\frac{1}{4}$ runs (woolen system)	=	8400 yards to 1 pound.
35 cuts (woolen system)	=	8400 yards to 1 pound.
No. 15's (worsted system)	=	8400 yards to 1 pound.
No. 10's (cotton system)	=	8400 yards to 1 pound.
No. 10's (spun-silk system)	=	8400 yards to 1 pound.

AGAIN:

$6\frac{2}{3}$ cuts (woolen system)	=	1 run in length and weight.
No. $2\frac{6}{7}$'s (worsted system)	=	1 run in length and weight.
No. $1\frac{19}{20}$'s (cotton system)	=	1 run in length and weight.
No. $1\frac{19}{20}$'s (spun-silk system)	=	1 run in length and weight.

Therefore it will be seen that, to convert runs into cuts, multiply the number of runs by 1600, and divide the product by 240; the quotient will be the number of cuts.

To convert runs into worsted numbers, multiply the number of runs by 1600, and divide the product by 560; the quotient will be the number of worsted.

To convert runs into cotton numbers, multiply the number of runs by 1600, and divide the product by 840; the quotient will be the number of cotton. Proceed in the same manner to convert runs into spun-silk numbers.

On the other hand, to convert cut numbers into runs, multiply the number of cuts by 240, and divide the product by 1600; the quotient will be the number of runs.

To convert worsted numbers into runs, multiply the number of worsted by 560, and divide the product by 1600; the quotient will be the number of runs.

To convert cotton, or spun-silk numbers into runs, multiply the number of cotton, or spun silk by 840, and divide the product by 1600; the quotient will be the number of runs.

EXEMPLIFICATION.

$5\frac{1}{4}$ runs, woolen thread, is equal to what size of cotton thread? Also what size of worsted thread?

$5\frac{1}{4} \times 1600 = 8400 \div 840 = 10$'s, the number of cotton.

$5\frac{1}{4} \times 1600 = 8400 \div 560 = 15$'s, the number of worsted.

No. 20's, cotton thread, is equal to what size of woolen thread—both systems? Also what size of worsted thread?

$20 \times 840 = 16800 \div 1600 = 10\frac{1}{2}$, the number of runs; or,

$20 \times 840 = 16800 \div 240 = 70$, the number of cuts.

$20 \times 840 = 16800 \div 560 = 30$'s, the number of worsted.

No. 40's, worsted thread, is equal to what size of cotton thread? Also what size of woolen thread—both systems?

$40 \times 560 = 22400 \div 840 = 26\frac{2}{3}$'s, the number of cotton.

$40 \times 560 = 22400 \div 1600 = 14$, the number of runs; or,

$40 \times 560 = 22400 \div 240 = 93\frac{1}{3}$, the number of cuts.

The beginner will find it for his interest to thoroughly familiarize himself with the above systems of yarn calculations; therefore, if the same were committed to memory, it would be time well spent.

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CHAPTER XVII.

SAMPLES OF FABRICS WITH GENERAL INSTRUCTIONS FOR MAKING THEM.

This chapter will be to a certain extent a recapitulation of former ones, this we deem advisable in order to have all of the samples with the weaves and general information concerning them to appear under the same heading.

Sample No. 1—Weave No. 1. This represents a combination stripe composed of a six-harness diagonal, but wove on twelve harnesses with a cross draw. Warp 1800 ends, dressed as follows:

21 white.	6 olive.
5 black.	6 white.
22 white.	6 olive.
1 red and blue D. & T.	6 white.
5 olive.	5 olive.
6 white.	1 red and green D. & T.
	90 threads in the pattern.

No. 12½ reed, 4 threads in a dent: 36 inches inside of selvage.

Filling, pick and pick of black and drab: 60 picks per inch in the loom.

Weight from loom 11 oz. Finished weight $9\frac{4}{10}$ oz. For further information, see chapters seven and eight.

Sample No. 2—Weave No. 2. This represents a cassimere twill wove on eight harnesses, and backed 1 and 1 the filling way.

Warp 1440 ends of black, 3¾ runs.

No. 10 reed, 4 threads in a dent: 36 inches inside of selvage.

Filling, pick and pick, 1 pick of white for the face, and 1 pick of black for the back; both fillings spun $3\frac{3}{4}$ runs: 84 picks per inch in the loom.

Weight from loom $13\frac{5}{10}$ oz. Finished weight 11 oz.

Sample No. 3—Weave No. 3. This represents a cassimere twill wove on sixteen harnesses, and backed 1 and 1 the warp way.

Warp 2400 ends of $3\frac{3}{4}$ runs, dressed 1 thread of black for the face, and 1 thread of brown for the back.

No. 11 reed, 6 threads in a dent: 36 inches and 4 dents inside of selvage.

Filling, brown of $3\frac{3}{4}$ runs: 46 picks per inch in the loom.

Weight from loom 12 oz. Finished weight $10\frac{3}{10}$ oz.

Sample No. 4—Weave No. 4. This represents a cassimere twill wove on twelve harnesses, and backed 2 and 1 both warp and filling ways.

Warp 2160 ends, dressed 2 threads of dark brown $3\frac{3}{4}$ runs for the face, and 1 thread of black 3 runs for the back.

No. 10 reed, 6 threads in a dent: 36 inches inside of selvage.

Filling, 2 picks of white $3\frac{3}{4}$ runs for the face, and 1 pick of black 2 runs for the back: 60 picks per inch in the loom.

Weight from loom $14\frac{4}{10}$ oz. Finished weight $11\frac{4}{10}$ oz.

Sample No. 5—Weave No. 5. This represents a double fabric wove on sixteen harnesses, and consists of an eight-harness basket for the face, and the regular eight-harness twill for the back.

Warp 3200 ends of $3\frac{3}{4}$ runs, dressed 1 thread of brown for the face, and 1 thread of black for the back.

No. 11 reed, 8 threads in a dent: 36 inches and 4 dents inside of selvage.

Filling, pick and pick, 1 pick of black for the face, and 1 pick of brown for the back; both fillings spun $3\frac{3}{4}$ runs: 96 picks per inch in the loom.

Weight from loom $18\frac{5}{10}$ oz. Finished weight $15\frac{3}{10}$ oz.

Sample No. 6—Weave No. 6. This represents a triple or three-ply fabric, wove on twelve harnesses, and consists of a cassimere twill for both the face and back fabrics, and a plain two-harness flannel in between them; or, in other words, in the middle.

Warp 3360 ends of $3\frac{3}{4}$ runs, dressed 1 thread of brown for the face, 1 thread of white for the middle, and 1 thread of black for the back.

No. 12 reed, 8 threads in a dent: 35 inches inside of selvage.

Filling, 1 pick of black for the face, 1 pick of white for the middle, and 1 pick of brown for the back; all three fillings spun $3\frac{3}{4}$ runs: 90 picks per inch in the loom.

Weight from loom $19\frac{8}{10}$ oz. Finished weight $16\frac{8}{10}$ oz.

Sample No. 7—Weave No. 7. This represents an eight-harness diagonal stripe.

Warp 1056 ends of 3 runs for both the single and double yarns, and dressed as follows:

1 black and white D. & T.	1 drab. } 3 times.
2 white.	1 white. }
1 black and white D. & T.	1 drab.
23 white.	14 white.
	44 threads in the pattern.

No. 10 reed, 3 threads in a dent: 35 inches and 2 dents inside of selvage.

Filling, dark blue of $2\frac{3}{4}$ runs: 32 picks per inch in loom.

Weight from loom $9\frac{8}{10}$ oz. Finished weight $8\frac{2}{10}$ oz.

Sample No. 8—Weave No. 8. This represents a combination stripe of a combined weave,—fourteen harnesses with a cross draw.

Warp 2800 ends of 2-40's worsted, dressed as follows:

20 black.	1 or. s. & blk. wors'd D. & T.
4 light drab..	4 light drab.
1 or. s. & blk. wors'd D. & T.	20 black.
11 black.	9 black and white D. & T.
	70 threads in the pattern.

No. 14 reed, 6 threads in a dent: 33 inches and 5 dents inside of selvage.

Filling, black, of shoddy and waste, 2 runs: 40 picks per inch in the loom.

Weight from loom 12 oz. Finished weight $10\frac{1}{10}$ oz.

The weight of each fabric, as weighed from the loom, applies to one yard in length, regardless of the width; but the finished weight applies to one yard in length, and 27 to 28 inches in width inside of selvage, in each instance.

In the first six samples the yarns in several instances, both in the size and colors, were not just what they should have been, neither were they what we desired them to be; but the reader will please bear in mind that, to get out samples of only several yards each, with such a variation in the style and construction, would require a larger range of yarns, particularly as to their size, than is usually found in any *one* well-regulated mill. Therefore, to avoid the additional expense of having the yarns manufactured expressly to our liking, such yarns as were already at hand were used in the construction of those fabrics; hence the reason of so little variation in some instances and none at all in others in regard to the size of the yarns used. The first six samples were accordingly made to our dictation in this State (New York), while the two others, seven and eight, were made in Bradford, England.

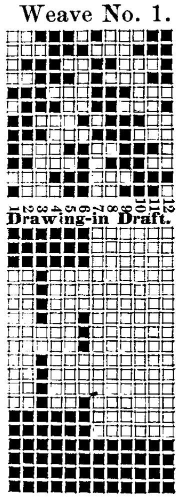
Sample No. 1 was designed especially as an illustrative piece for the foundation of this work.

Samples No. 2, 3 and 4 were designed especially to illustrate the work and appearance of fabrics when backed in accordance with the three methods demonstrated in chapter twelve.

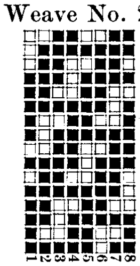
Samples No. 5 and 6 were designed especially to illustrate the work and appearance of two-ply and three-ply, or double and triple, fabrics as demonstrated in chapters fourteen and fifteen respectively.

In presenting in this work those latter five samples, we have deemed it advisable to place them in such a manner that the reader would see both the face and back of the fabric at the same instant, thus enabling him a freer scope for an intellectual view; hence the reason of each of those samples being inserted in two pieces. The following weaves are those by which the samples were woven.

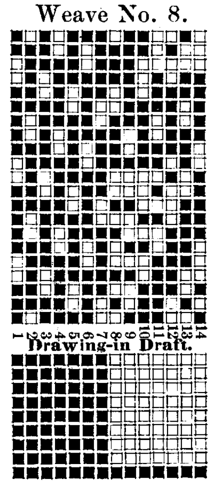
Weave No. 1.



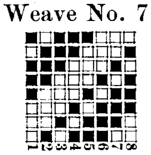
Weave No. 2.



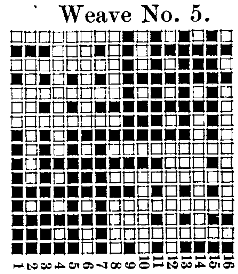
Weave No. 8.



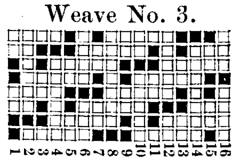
Weave No. 7.



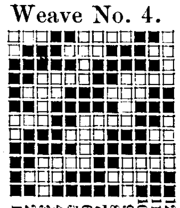
Weave No. 5.



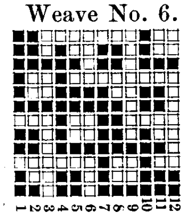
Weave No. 3.



Weave No. 4.



Weave No. 6.



CHAPTER XVIII.

MISCELLANEOUS WEAVES.

The term "miscellaneous," when used in this connection, covers a large field; in fact, so large that all we shall undertake in this direction will be to give the reader a brief description of a few of the many important weaves that are in use at the present time,—all of which have been selected with care in the interest of the beginner.

Not one of the weaves herein given is imaginary, but each and every one has been put into actual practical working; and a sample of the finished fabric, to match each weave, is in the author's possession.

FIG. 1.

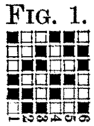


FIG. 2.

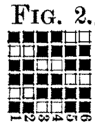


FIG. 3.

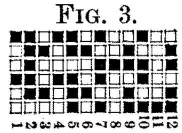


FIG. 4.

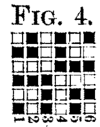


Fig. 1 represents a pretty little weave for light-weight goods of small checks, or in solid colors or mixes.

Fig. 2 represents a weave which produces a cord effect, the warp way, and is a good thing for fine stripes.

Fig. 3 represents a peculiar weave for stripes, and in reality it is a combination; the last six harnesses work the same as the first six but in a reversed position, and also the working of both the warp and filling threads are reversed. Harnesses 1, 3, 4, 6, 8, and 11, weave a warp back which may be of cotton yarn, while the remaining harnesses weave the face which should be of woolen yarn, with filling the same; thus producing a fabric of an all-wool face and a cotton back.

Fig. 4 represents a good thing for weaving fancy suitings, dressed 1 thread each of three colors, or different kind of yarns, and filled in a like manner.

Fig. 5.

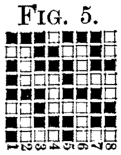


Fig. 6.

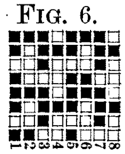


Fig. 7.

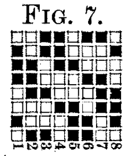


Fig. 8.

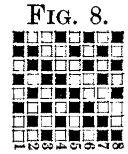


Fig. 5 represents a double plain weave suitable for making light feltings, or heavy meltons.

Fig. 6 represents the same as Fig. 5, but instead of being laid out 1 and 1 both warp and filling ways, it is laid 1 and 1 the warp way, and 2 and 2 the filling way.

Fig. 7 represents a pretty diagonal effect, and is a common weave for suitings, in either worsted or woolen yarns.

Fig. 8 represents a plain diagonal for light weights.

Fig. 9.

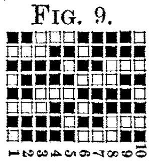


Fig. 10.

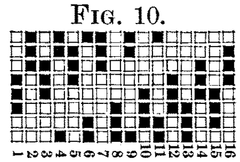


Fig. 11.

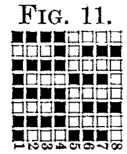


Fig. 12.

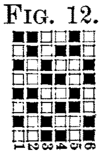


Fig. 9 represents a creased stripe, or, when produced in fine worsted yarns it may be classed as a tricot weave, running lengthwise of the cloth.

Fig. 10 represents a double twill. The warp may be made either plain or striped when, if the same be filled with two colors, run in 4 and 4, it will produce a pretty pattern.

Fig. 11 represents a good weave for producing a cord stripe in fine worsted yarns of all one color.

Fig. 12 represents a peculiar little weave, the fabric when made of fine worsted yarns, resembles a perfect tricot —showing a very small rib the filling way. The filling is entirely covered by the warp on both sides of the fabric.

Fig. 13 represents a good weave for silk mixes, either in worsted or common woolen yarns for suitings.

Fig. 14 represents the weave of an 8-thread rib with a 4-thread crease. If made of fine yarns it will produce a nice pattern for trouserings. By following this principle of weaving, a rib of any required size may be made.

FIG. 13.

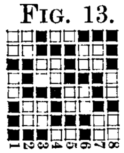


FIG. 14.

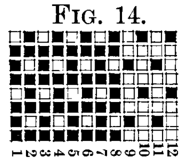


FIG. 15.

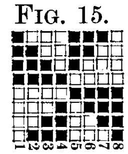


FIG. 16.

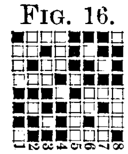


Fig. 15 represents a desirable weave for coarse yarns in two, three or four colors, run in 4 threads of each color both in the warp and filling.

Fig. 16 represents a good weave for producing a check effect with a warp of all one color, and filling of another, either in fine or coarse yarns.

FIG. 17.

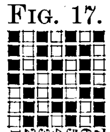


FIG. 18.

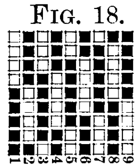


FIG. 19.

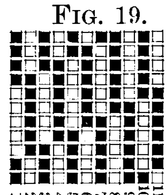
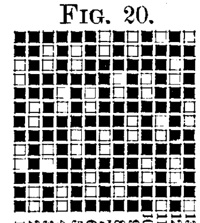


FIG. 20.



Figs. 17, 18, 19, and 20 represent what are known or classed as cork-screw weaves, and are used extensively in weaving worsted, and imitation of worsted suitings.

FIG. 21.

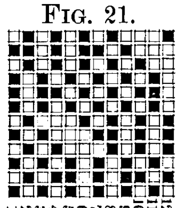


FIG. 22.

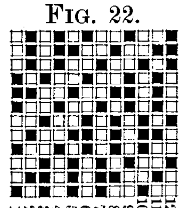
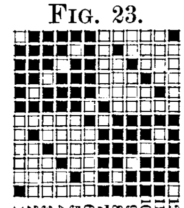


FIG. 23.



Figs. 21, 22, and 23 represent weaves designed more especially for light-weight worsteds which are extensively used in coatings, although the latter weave is used somewhat with common woolen yarns to produce a check effect: —Warp of all one color and filling of another.

FIG. 24.

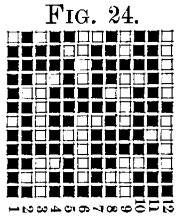


FIG. 25.

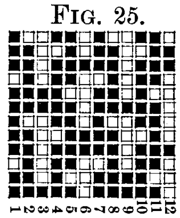
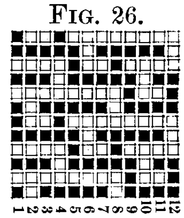


FIG. 26.



Figs. 24 and 25 represent beaver weaves, backed 2 and 1 both ways of the fabric. Sometimes these weaves are used for weaving very heavy meltons.

Figs. 26 and 27 represent fur-beaver weaves; they are also used for weaving chinchillas.

FIG. 27.

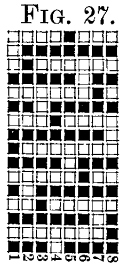


FIG. 28.

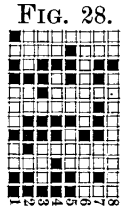


FIG. 29.

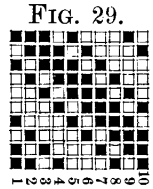


FIG. 30.

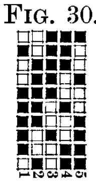


Fig. 28 represents a weave of the fur-beaver style, or chinchilla pattern. Harnesses 6 and 8 are for weaving a 2-thread stripe on the back—should no stripe be desired, drop out those two harnesses, using but six. The distance between the stripes can be governed by the number of threads drawn on harnesses 1, 2, 3, 4, 5, and 7—straight draw.

Fig. 29 represents a nice diagonal for common woolen yarns. This weave is one that will form a perfect cut-off in either a herring-bone or a diamond pattern.

Fig. 30 represents a pretty little diagonal—throwing up a nice, round cord—for fine worsted coatings. This weave is a combination of two five-harness twills—a bar of each alternately.

Fig. 31 represents a weave used in making a class of goods called Moscow-beavers, which are given a soft velvet finish, and sold for cloakings and overcoatings.

Fig. 32 represents a weave designed for a cheap grade of "Moscows" with a cotton-warp backing.

Fig. 33 represents a doeskin-beaver weave, designed for fine-face goods of a high finish.

FIG. 31.

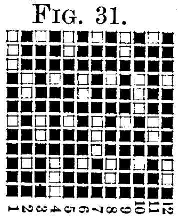


FIG. 32.

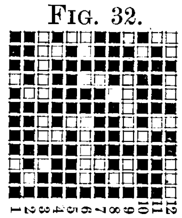


FIG. 33.

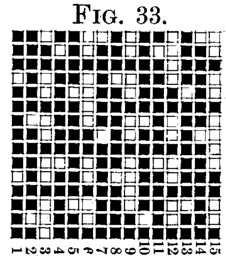


Fig. 34 represents a good diagonal for coatings, in either worsted or common woolen yarns.

Figs. 35 and 36 represent good, useful weaves for work-in up various grades of cheap stock; sometimes they are used in weaving a certain class of light-weight beavers.

FIG. 34.

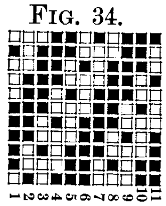


FIG. 35.

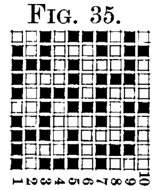


FIG. 36.

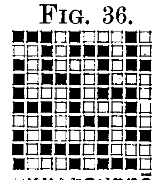


FIG. 37.

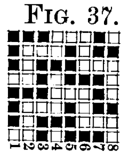


FIG. 38.

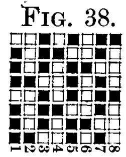


FIG. 39.

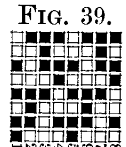
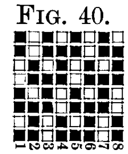


FIG. 40.



Figs. 37 and 38 represent weaves used quite commonly in making hair-lines, and various styles of narrow stripes.

Fig. 39 repsesents the common, four-harness tricot weave for fine, piece-dyed, and highly finished tricots.

Fig. 40 represents a weave used in making a fine grade of goods called Granite. They are usually woven white, piece-dyed, and finished the same as fine broadcloths for dress-up suitings.

FIG. 41.

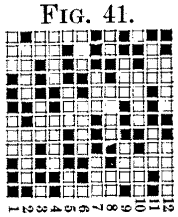


FIG. 42.

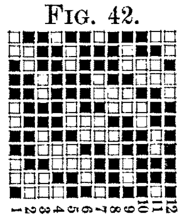


FIG. 43.

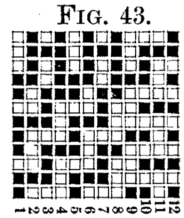


Fig. 41 represents a double twill which makes a handsome pattern when used on a warp of two colors, dressed 1 and 1, and filled with a third color.

Fig. 42 represents a weave which throws up a large diagonal cord, and is a desirable thing for coatings.

Fig. 43 represents a small, block weave having a rib appearance when produced in fine worsted yarns, making a pretty pattern for fancy suitings.

FIG. 44.

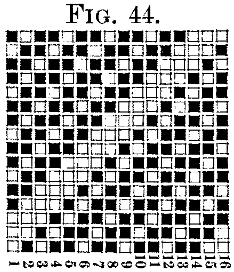


FIG. 45.

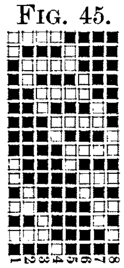


FIG. 46.

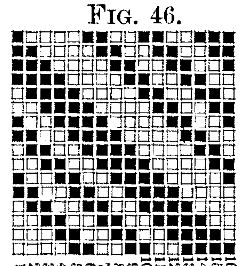


Fig. 44 represents a small, twill wale suitable for weaving stripes for trousering, or fancy suitings. There being more warp thrown to the face of the fabric than to the back, and more filling thrown to the back than to the face, it does away with that boldness commonly seen in plaids, caused by the filling showing too prominently.

Fig. 45 represents the common eight-harness twill with a filling back, and is a good thing for medium, or heavy-weight fabrics.

Fig. 46 represents a diagonal of good appearance in light weights, either in solid colors, or fancy mixes; when made of the latter, a few threads of fancy colors, or of D. & T., dressed in the warp, will greatly add to the beauty of the fabric. The filling should be all of one color or mix.

FIG. 47.

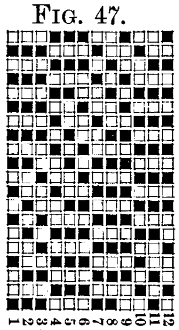


FIG. 48.

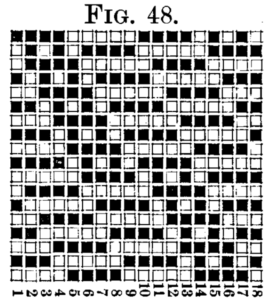


FIG. 49.

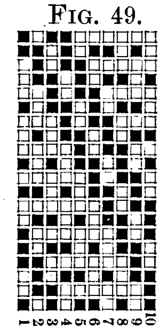


Fig. 47 represents a fancy diagonal figure, composed of small perpendicular cords, suitable for light-weight worsted coatings; or, for ladies' dress-goods of cotton warp, and fine single worsted filling.

Fig. 48 represents a fancy diagonal figure, consisting of small bias cords with a rib effect; designed for suitings, in fine worsted yarns.

Fig. 49 represents a pretty diagonal with a prominent filling cord. Warp of one color, and filling of another.

FIG. 50.

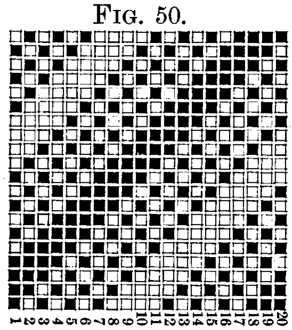


FIG. 51.

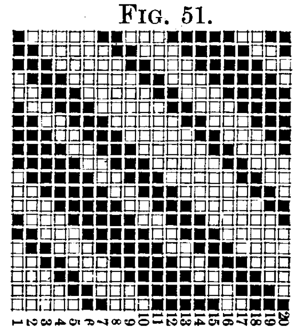


Fig. 50 represents a wide wale diagonal for cheviot suitings, made from all-wool coarse stock, in light weights.

Fig. 51 represents a wide diagonal pattern; if produced in fine all-wool yarns of fancy mixes, and given a melton finish, it makes a desirable thing for business suitings, or light-weight overcoatings.

FIG. 52.

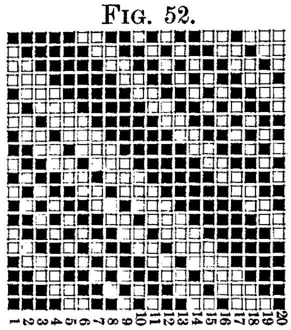


FIG. 53.

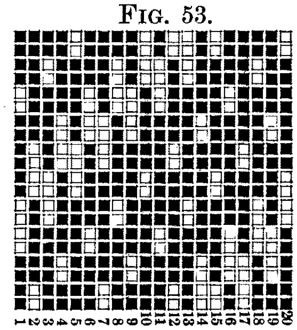


Fig. 52 represents a fancy diagonal for weaving worsted coatings, the same produced in a plaid pattern would make a good thing for fancy suitings.

Fig. 53 represents a double-pick diagonal effect, for a piece-dyed fabric, highly finished. The warp should be of good fine stock, as two-thirds of it appears on the face; but a much poorer stock can be used to advantage in the filling.

FIG. 54.

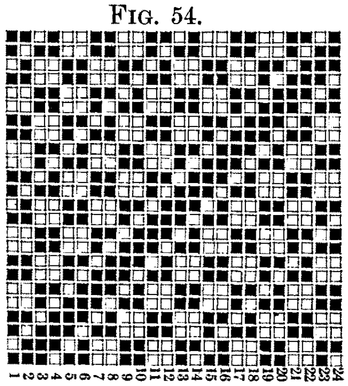


FIG. 55.

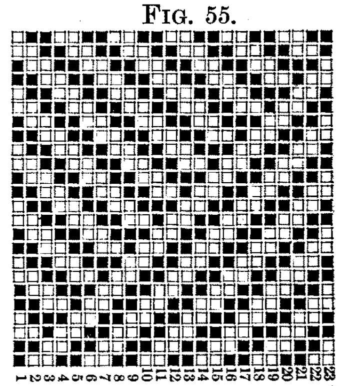


Fig. 54 represents a pretty diagonal wale, with a basket effect, suitable for either worsted or common woolen yarns.

Fig. 55 represents an old-time design, used quite commonly in weaving fine light-weight cassimeres for suitings, with a white or light mix warp and black filling. It makes a perfect cut-off in the pattern both ways. There are twenty-three harnesses and twenty-four bars; but if desired to have the pattern finish as square as possible, it can be turned side ways and woven with twenty-four harnesses and twenty-three bars; in which case the filling should be, at least, 1 run finer than the warp.

FIG. 56.

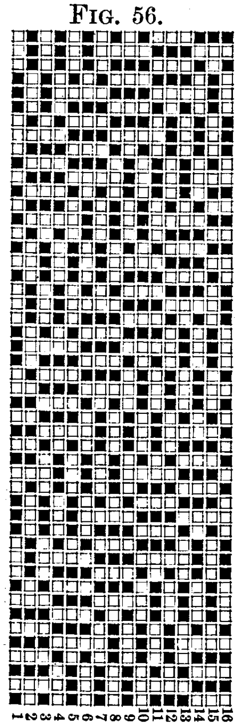


FIG. 57.

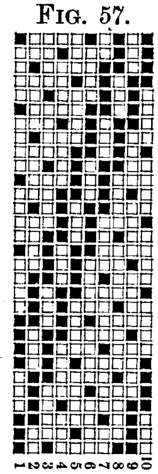


FIG. 58.

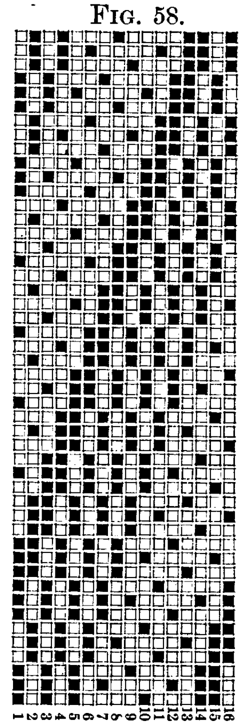


Fig. 56 represents a diagonal figure of a herring-bone rib effect, designed for coarse worsted yarns, soft twisted.

Fig. 57 represents a small diagonal with a filling face, and is a good thing for using single silk, twisted with the filling, which will produce a silk mix effect for suitings.

Fig. 58 represents a diagonal wale of a filling-rib effect, designed for solid colors in black, brown, or blue, or with warp of one color and filling of another.

FIG. 59.

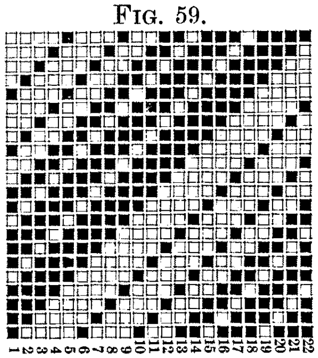


FIG. 60.

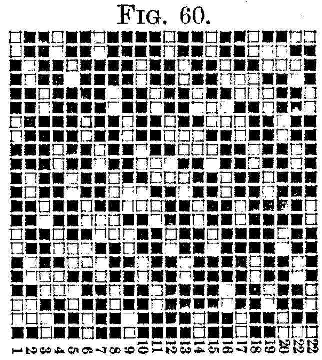


Fig. 59 represents an evenly balanced diagonal wale for worsted coatings, in solid colors.

Fig. 60 represents a handsome diagonal wale. A rich stripe effect can be produced with this weave by dressing the warp, 22 threads of right-hand twist and 22 threads of left-hand twist; both warp and filling of all one color.

FIG. 61.

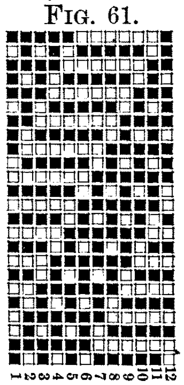


FIG. 62.

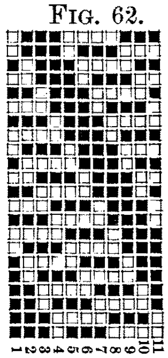


FIG. 63.

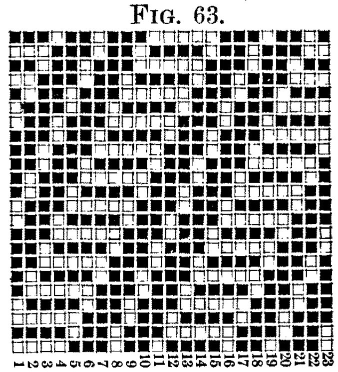


Fig. 61 represents a diagonal rib, which can be used either single or combined with other weaves to a good advantage for making fancy trouserings. It is a good weave to use alone for a herring-bone pattern, producing a sharp-point effect, by commencing on the sixth harness for the backward draw. A rib of any required size can be produced on this principle by increasing the width of the filling float, or the warp wale, or both.

Figs. 62 and 63 represent desirable weaves for three-color diagonals, the former being classed as a single diagonal, and the latter as a double diagonal. This latter figure produced with a black warp and, blue and brown filling pick and pick, will show up a black double wale, while the filling will show one blue and one brown wale alternately, making an attractive pattern for coatings. The former figure produced with a black warp and, two kinds of mixes for the filling pick and pick, makes a rich-looking pattern for either coatings or suitings.

Having given a fair synopsis in the field of miscellaneous weaves, we will now leave the subject, believing all has been said that is necessary in this direction.

——o——

CHAPTER XIX.

DESIGNING BROKEN TWILLS OR SATIN WEAVES.

In satin weaves we do not see the prominent bias lines or twills which are seen in weaves of the regular twill order; hence, they present a smoother appearance on the face of the fabric, and thus are known as broken twills, although they are called perfect twills in the order of satin weaves.

In the regular order of twills, the floating threads have the appearance of a series of small diagonal or bias ribs in the fabric; but when the succession of raising the harnesses is changed so as to raise them at intervals of one, two, three or more from each other, the twill is said to be broken; and the floating threads no longer run on a regular twill bias, but are variously changed, according to the interval of working the harnesses. In satin twills it will be found that some are perfect in respect to the intervals at which the harnesses can be raised, while others are imperfect in this respect. When the harnesses can be raised regularly, at intervals of one, two, three or more from each other, the twill is said to be perfect; but imperfect, when the number of harnesses does not admit of this arrangement. This will be illustrated by the following figures and observations.

The smallest twill that can be broken is that of four-harnesses, which is sometimes called a satin twill, but is more properly called a satinet twill.

FIG. 1.

FIG. 2.

Figs. 1 and 2 represent the broken and regular satin twill respectively. The broken twill is laid out in the following order: commencing with the first or top pick—No. 1 harness,—we place a riser on the first harness; the second harness is passed, and another riser is placed on the third harness; the fourth and first harnesses are next passed, and the third riser is placed on the second harness; the third harness is now passed, and the fourth riser is placed on the fourth harness. This gives us the order of working the harnesses as 1, 3, 2, 4; consequently, in this order of weaving, the harnesses cannot be raised at equal intervals; and, therefore, is one of the imperfect twills. In the regular twill, we find that each harness is raised in its numeral order as 1, 2, 3, 4; consequently, is a perfect twill of the regular order.

FIG. 3.

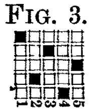


FIG. 4.

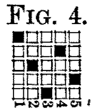


Fig. 3 will be found to raise each alternate harness throughout the whole pattern, thus—1, 3, 5, 2, 4. Fig. 4, to raise one and pass two without interruption, thus—1, 4, 2, 5, 3; consequently, the five-harness twill is perfect by each of these methods.

Figs. 5, 6 and 7 are subject to imperfections similar to that of four harnesses; the orders of working the harnesses

Fig. 5.

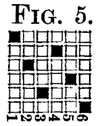


Fig. 6.

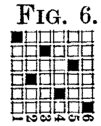
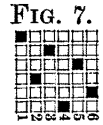


Fig. 7.



being as follows: 1, 4, 2, 5, 3, 6; 1, 3, 5, 2, 4, 6; 1, 3, 5, 2, 6, 4, respectively; consequently, are imperfect twills, although the two former ones present as perfect appearance as most any of the twills in the satin order.

Fig. 8.

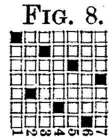


Fig. 9.

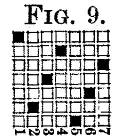


Fig. 8 will be found to raise each alternate harness throughout the whole design, thus—1, 3, 5, 7, 2, 4, 6. Fig. 9, to raise one and pass two without interruption, thus—1, 4, 7, 3, 6, 2, 5; consequently, the seven-harness twill is as perfect as that of five harnesses.

Fig. 10.

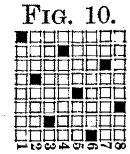


Fig. 10 makes a perfect twill by raising one harness, and passing two without interruption either way of the design, thus—1, 4, 7, 2, 5, 8, 3, 6. This eight-harness twill is the smallest satin that can be woven on an even number of harnesses.

Fig. 11.

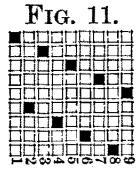


Fig. 12.

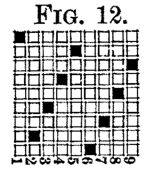


Fig. 11 is found to raise each alternate harness, thus—1, 3, 5, 7, 9, 2, 4, 6, 8. Fig. 12, to raise one and pass three, thus—1, 5, 9, 4, 8, 3, 7, 2, 6.

Fig. 13 admists of raising one harness, and passing two without interruption either way of the design, thus—1, 4, 7, 10, 3, 6, 9, 2, 5, 8.

FIG. 13.

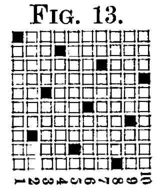


FIG. 14.

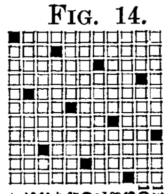


FIG. 15.

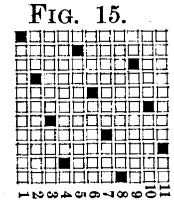


Fig. 14 will be found to raise one harness, and pass two, thus—1, 4, 7, 10, 2, 5, 8, 11, 3, 6, 9. Fig. 15, to raise one and pass three, thus—1, 5, 9, 2, 6, 10, 3, 7, 11; 4, 8.

FIG. 16.

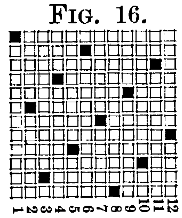


Fig. 16 admits of raising one harness, and passing four without interruption either way of the design, thus—1, 6, 11, 4, 9, 2, 7, 12, 5, 10, 3, 8.

FIG. 17.

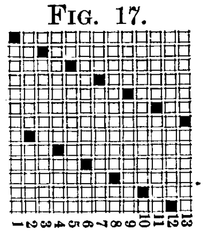


FIG. 18.

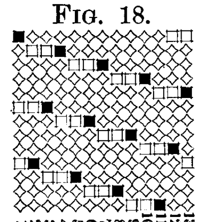


Fig. 17 will be found to raise one harness, and pass one alternately, thus—1, 3, 5, 7, 9, 11, 13, 2, 4, 6, 8, 10, 12.

Fig. 18, to raise one and pass two, thus—1, 4, 7, 10, 13, 3, 6, 9, 12, 2, 5, 8, 11. By the use of other characters in this figure, the order of raising and passing the harnesses is more fully represented. Fig. 19 will be found to raise one

FIG. 19.

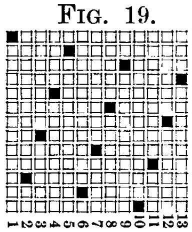


FIG. 20.

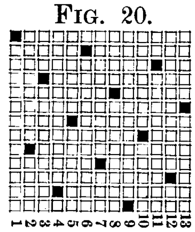
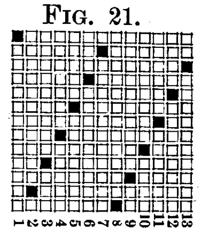


FIG. 21.



harness, and pass three, thus—1, 5, 9, 13, 4, 8, 12, 2, 6, 10. Fig. 20, to raise one and pass four, thus—1, 6, 11, 3, 8, 13, 5, 10, 2, 7, 12, 4, 9. Fig. 21, to raise one and pass five, thus—1, 7, 13, 6, 12, 5, 11, 4, 10, 3, 9, 2, 8. Thirteen harnesses have a larger number of arrangements for satin weaves, than any other number of harnesses used in this order.

FIG. 22.

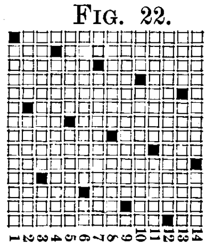


FIG. 23.

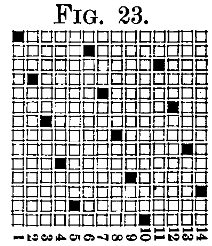


Fig. 22 will be found to raise one harness, and pass two, thus—1, 4, 7, 10, 13, 2, 5, 8, 11, 14, 3, 6, 9, 12. Fig. 23, to raise one and pass four, thus—1, 6, 11, 2, 7, 12, 3, 8, 13, 4, 9, 14, 5, 10.

FIG. 24.

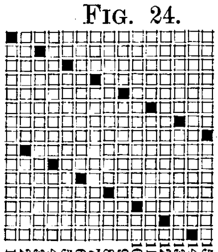


FIG. 25.

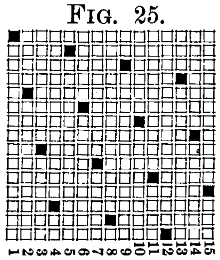


FIG. 26.

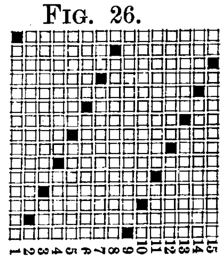


Fig. 24 will be found to raise one harness, and pass one alternately, thus—1, 3, 5, 7, 9, 11, 13, 15, 2, 4, 6, 8, 10, 12, 14. Fig. 25, to raise one harness and pass three, thus—1, 5, 9, 13 2, 6, 10, 14, 3, 7, 11, 15, 4, 8, 12. Fig. 26, to raise one and pass six, thus—1, 8, 15, 7, 14, 6, 13, 5, 12, 4, 11, 3, 10, 2, 9.

Having illustrated all of the satin weaves from five to fifteen harnesses, we will now demonstrate more clearly the basis on which satin weaves are originated.

RULE FOR DESIGNING SATIN WEAVES.

Divide the number of harnesses into two parts, which must not be equal, nor one number a multiple of the other; now take one of the numbers to count off by, or add it. Commencing to add or count off from No. 1 harness and first pick, we place a riser at the end of each counting off or addition, and continue in this manner until each warp thread or harness is occupied by one riser.

ILLUSTRATION: Five-harness weave, $2+3=5$. Commencing with one and adding two points in succession, we get as follows: $1+2=3+2=5+2=7$ or 2, and $2+2=4$. This will give us the order of raising the harnesses, thus—1, 3, 5, 2, 4, as represented in Fig. 3. If we count off or add *three* instead of two, we get as represented in Fig. 4.

In designing satin weaves of an *even* number of harnesses, such as 8, 10, 12, 14, etc., the following rule may be used, if preferred, in place of the former one: Divide the number of harnesses by 2, and if the quotient is an even number, subtract 1; if the quotient is an uneven number, subtract 2; and, in either case use the remainder for adding or counting off.

ILLUSTRATIONS: Eight-harness weave, $8\div2=4$, which is an even number; subtract 1, thus $4-1=3$ for counting off. Ten-harness weave, $10\div2=5$, which is an uneven number; subtract 2, thus $5-2=3$ for counting off. Twelve-harness weave, $12\div2=6-1=5$ for counting off. Fourteen-harness weave, $14\div2=7-2=5$ for counting off. Also $14\div2=7-2=5$, and $5-2=3$ for counting off. Therefore, both 5 and 3 can be used in this case, thus producing two weaves.

Satin weaves are used both ways, that is to say, with the filling up, as represented in the preceding figures; or, with the warp up, as represented in the following Figs. 27 and 28. The former method is called a filling face; the latter method is called a warp face.

FIG. 27.

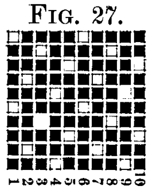
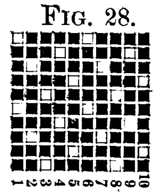


FIG. 28.



If we want a five-harness satin with a filling face, and the twill to show as prominent as possible, we have to use Fig. 4. On the other hand, if we want a warp face with a distinct twill effect, we have to use Fig. 27, which is Fig. 3 enlarged to ten threads and transposed, that is, we call the risers, sinkers; and call the sinkers, risers. If a smoother face is required, more after the doeskin style, we have to use Fig. 28, which is Fig. 4 enlarged and transposed as explained before. This method holds good in using any other of the satin weaves for twill or smooth-face effects, or in transposing from a filling to a warp face.

If we increase the number of risers in a satin weave by placing one at the right or left, above or below, or a short distance on a bias from each of the original risers, we get a sub-division of satin weaves, which are classified under

"DOUBLE SATIN WEAVES."

This class of weaves being stitched twice as often as those of the single class, so to speak, will naturally increase the strength of the fabric. If we want a double weave, filling face, we raise each warp thread next to the one already raised in the original weave. If we want a double weave, warp face, we arrange to hold each warp thread down once more after being already down in the original weave; or, in other words, when a harness is down it remains down for two picks instead of one.

Fig. 29 represents the eight-harness satin, filling face, doubled in the manner explained. In this weave we find that instead of the filling floating over 7 and under 1, it floats over 6 and under 2 warp threads; while the warp, instead of being 1 up, 7 down, is changed to 1 up, 4 down, 1 up, 2 down.

FIG. 29.

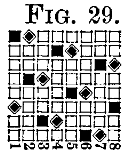


FIG. 30.

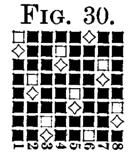


Fig. 30 represents the eight-harness satin, warp face, arranged on the double principle. In this weave it will be seen, as before stated, that the original points for stitching are down once more, or twice in succession continuously. If it is required to have the twill of the fabric show a more prominent streight-line effect, we arrange the weave so that each warp thread or harness is down for three picks in succession, as represented in Fig. 31. This principle of arranging double satin weaves, warp face, will hold good on any number of harnesses.

FIG. 31.

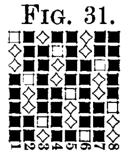


FIG. 32.

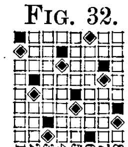
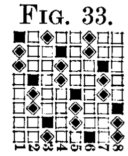


FIG. 33.



Another principle for arranging satin weaves, is to change the annex points from right to left, to up or down as represented in Figs. 32 and 33, for a filling face.

FIG. 34.

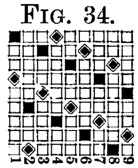


FIG. 35.

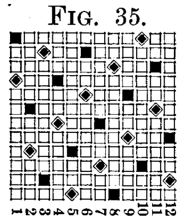
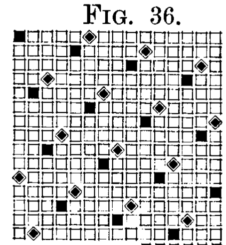


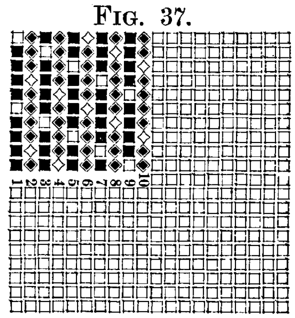
FIG. 36.



The next and last principle of designing double satin weaves, to which we wish to call the reader's attention, is to arrange the additional points for stitching, sideways on a bias at a certain regular distance from each original point in the single weave, as represented in Figs. 34, 35 and 36. This order of weaving may be reversed for warp face, in the manner illustrated before.

Satin weaves are used quite extensively in producing color effects for stripes. If we dress a warp of two colors, 1 and 1 alternately, and weave it a five-harness satin, warp face, we get a double-line effect as visible in the fabric as seen in the design, Fig. 37. A similar effect will be visible in stripes containing various number of threads and colors.

FIG. 37.



The beginner may get a better view of any one or all of the preceding figures, by drawing them off on design paper and enlarging the design both ways, in the manner represented by the last figure.

We will now close these observations on designing satin weaves, after calling attention to one other point, that is, the selecting of the proper weave for the contemplated fabric. This depends on the number of ends in warp, picks per inch, and the size and quality of both warp and filling yarns to be used in the fabric. Consequently, if we use a weave having a too-long float for the "layout," we get a fabric of a loose and spongy feeling. On the other hand, if we put too many ends in the warp, we cannot get enough picks in the fabric, hence we get an open, thread-bare appearance, without proper strength the filling way. Therefore, it will be observed that, great care should be used when selecting the weave, otherwise it may be entirely unsuitable for the contemplated fabric by having either too long or too short stitching. The necessity of good judgment must be apparent in connection with this branch of designing if we would obtain the best results.

CHAPTER XX.

YARN TABLES, RULES AND CALCULATIONS.

TABLE SHOWING THE NUMBER OF YARDS PER POUND OF WOOLEN YARN FROM ¼ RUN TO 20 RUNS.

Runs.	Yards per lb.	Runs.	Yards per lb.	Runs.	Yards per lb.	Runs.	Yards per lb.
¼	400	5¼	8400	10¼	16400	15¼	24400
½	800	5½	8800	10½	16800	15½	24800
¾	1200	5¾	9200	10¾	17200	15¾	25200
1	1600	6	9600	11	17600	16	25600
1¼	2000	6¼	10000	11¼	18000	16¼	26000
1½	2400	6½	10400	11½	18400	16½	26400
1¾	2800	6¾	10800	11¾	18800	16¾	26800
2	3200	7	11200	12	19200	17	27200
2¼	3600	7¼	11600	12¼	19600	17¼	27600
2½	4000	7½	12000	12½	20000	17½	28000
2¾	4400	7¾	12400	12¾	20400	17¾	28400
3	4800	8	12800	13	20800	18	28800
3¼	5200	8¼	13200	13¼	21200	18¼	29200
3½	5600	8½	13600	13½	21600	18½	29600
3¾	6000	8¾	14000	13¾	22000	18¾	30000
4	6400	9	14400	14	32400	19	30400
4¼	6800	9¼	14800	14¼	22800	19¼	30800
4½	7200	9½	15200	14½	23200	19½	31200
4¾	7600	9¾	15600	14¾	23600	19¾	31600
5	8000	10	16000	15	54000	20	32000

This table will be found a ready-assistant in yarn calculations, as it gives the length in yards per pound of any size thread, from one-fourth run to twenty runs, by fourths.

TABLE SHOWING THE NUMBER OF YARDS PER POUND OF WORSTED YARN FROM NO. 1 TO NO. 120.

Number.	Yards per lb.	Number.	Yards per lb.	Number.	Yards per lb.
1	560	41	22960	81	45360
2	1120	42	23520	82	45920
3	1680	43	24080	83	46480
4	2240	44	24640	84	47040
5	2800	45	25200	85	47600
6	3360	46	25760	86	48160
7	3920	47	26320	87	48720
8	4480	48	26880	88	49280
9	5040	49	27440	89	49840
10	5600	50	28000	90	50400
11	6160	51	28560	91	50960
12	6720	52	29120	92	51520
13	7280	53	29680	93	52080
14	7840	54	30240	94	52640
15	8400	55	30800	95	53200
16	8960	56	31360	96	53760
17	9520	57	31920	97	54320
18	10080	58	32480	98	54880
19	10640	59	33040	99	55440
20	11200	60	33600	100	56000
21	11760	61	34160	101	56560
22	12320	62	34720	102	57120
23	12880	63	35280	103	57680
24	13440	64	35840	104	58240
25	14000	65	36400	105	58800
26	14560	66	36960	106	59360
27	15120	67	37520	107	59920
28	15680	68	38080	108	60480
29	16240	69	38640	109	61040
30	16800	70	39200	110	61600
31	17360	71	39760	111	62160
32	17920	72	40320	112	62720
33	18480	73	40880	113	63280
34	19040	74	41440	114	63840
35	19600	75	42000	115	64400
36	20160	76	42560	116	64960
37	20720	77	43120	117	65520
38	21280	78	43680	118	66080
39	21840	79	44240	119	66640
40	22400	80	44800	120	67200

Table Showing the Number of Yards Per Pound of Cotton, or Spun-Silk Yarn From No. 1 to No. 90.

Number.	Yards per lb.	Number.	Yards per lb.	Number.	Yards per lb.
1	840	31	26040	61	51240
2	1680	32	26880	62	52080
3	2520	33	27720	63	52920
4	3360	34	28560	64	53760
5	4200	35	29400	65	54600
6	5040	36	30240	66	55400
7	5880	37	31080	67	56280
8	6720	38	31920	68	57120
9	7560	39	32760	69	57960
10	8400	40	33600	70	58800
11	9240	41	34400	71	59640
12	10080	42	35280	72	60480
13	10920	43	36120	73	61320
14	11760	44	36960	74	62160
15	12600	45	37800	75	63000
16	13440	46	38640	76	63840
17	14280	47	39480	77	64680
18	15120	48	40320	78	65520
19	15960	49	41160	79	66360
20	16800	50	42000	80	67200
21	17640	51	42840	81	68040
22	18480	52	43680	82	68880
23	19320	53	44520	83	69720
24	20160	54	45360	84	70560
25	21000	55	46200	85	71400
26	21840	56	47040	86	72240
27	22680	57	47880	87	73080
28	23520	58	48720	88	73920
29	24360	59	49560	89	74760
30	25200	60	50400	90	75600

N. B.—840 yards represents one number of cotton, or spun-silk yarn; therefore, this table will apply correctly for yarn calculations in either case.

Table Showing Equivalent Numbers by the Run, Cut and No. System, for Woolen, Worsted, Cotton and Spun-Silk Yarns.

Yards per Pound.	Woolen System, Runs.	Woolen System, Cuts.	Worsted System, Nos.	Cotton System Nos.	Spun-Silk System, Nos.
1600..........	1	$6\frac{2}{3}$	$2\frac{6}{7}$	$1\frac{19}{21}$	$1\frac{19}{21}$
2400..........	$1\frac{1}{2}$	10	$4\frac{2}{7}$	$2\frac{6}{7}$	$2\frac{6}{7}$
2800..........	$1\frac{3}{4}$	$11\frac{2}{3}$	5	$3\frac{1}{3}$	$3\frac{1}{3}$
3600..........	$2\frac{1}{4}$	15	$6\frac{3}{7}$	$4\frac{2}{7}$	$4\frac{2}{7}$
4800..........	3	20	$8\frac{4}{7}$	$5\frac{5}{7}$	$5\frac{5}{7}$
5600..........	$3\frac{1}{2}$	$23\frac{1}{3}$	10	$6\frac{2}{3}$	$6\frac{2}{3}$
6000..........	$3\frac{3}{4}$	25	$10\frac{5}{7}$	$7\frac{1}{7}$	$7\frac{1}{7}$
7200..........	$4\frac{1}{2}$	30	$12\frac{6}{7}$	$8\frac{4}{7}$	$8\frac{4}{7}$
8400..........	$5\frac{1}{4}$	35	15	10	10
9600..........	6	40	$17\frac{1}{7}$	$11\frac{3}{7}$	$11\frac{3}{7}$
10800..........	$6\frac{3}{4}$	45	$19\frac{2}{7}$	$12\frac{6}{7}$	$12\frac{6}{7}$
11200..........	7	$46\frac{2}{3}$	20	$13\frac{1}{3}$	$13\frac{1}{3}$
12000..........	$7\frac{1}{2}$	50	$21\frac{3}{7}$	$14\frac{2}{7}$	$14\frac{2}{7}$
13200..........	$8\frac{1}{4}$	55	$23\frac{4}{7}$	$15\frac{5}{7}$	$15\frac{5}{7}$
14000..........	$8\frac{3}{4}$	$58\frac{1}{3}$	25	$16\frac{2}{3}$	$16\frac{2}{3}$
14400..........	9	60	$25\frac{5}{7}$	$17\frac{1}{7}$	$17\frac{1}{7}$
15600..........	$9\frac{3}{4}$	65	$27\frac{6}{7}$	$18\frac{4}{7}$	$18\frac{4}{7}$
16800..........	$10\frac{1}{2}$	70	30	20	20
18000..........	$11\frac{1}{4}$	75	$32\frac{1}{7}$	$21\frac{3}{7}$	$21\frac{3}{7}$
19200..........	12	80	$34\frac{2}{7}$	$22\frac{6}{7}$	$22\frac{6}{7}$
19600..........	$12\frac{1}{4}$	$81\frac{2}{3}$	35	$23\frac{1}{3}$	$23\frac{1}{3}$
20400..........	$12\frac{3}{4}$	85	$36\frac{3}{7}$	$24\frac{2}{7}$	$24\frac{2}{7}$
21600..........	$13\frac{1}{2}$	90	$38\frac{4}{7}$	$25\frac{5}{7}$	$25\frac{5}{7}$
22400..........	14	$93\frac{1}{3}$	40	$26\frac{2}{3}$	$26\frac{2}{3}$
22800..........	$14\frac{1}{4}$	95	$40\frac{5}{7}$	$27\frac{1}{7}$	$27\frac{1}{7}$
24000..........	15	100	$42\frac{6}{7}$	$28\frac{4}{7}$	$28\frac{4}{7}$
25200..........	$15\frac{3}{4}$	105	45	30	30
26400..........	$16\frac{1}{2}$	110	$47\frac{1}{7}$	$31\frac{3}{7}$	$31\frac{3}{7}$
27600..........	$17\frac{1}{4}$	115	$49\frac{2}{7}$	$32\frac{6}{7}$	$32\frac{6}{7}$
28000..........	$17\frac{1}{2}$	$116\frac{2}{3}$	50	$33\frac{1}{3}$	$33\frac{1}{3}$
28800..........	18	120	$51\frac{3}{7}$	$34\frac{2}{7}$	$34\frac{2}{7}$
30000..........	$18\frac{3}{4}$	125	$53\frac{4}{7}$	$36\frac{5}{7}$	$35\frac{5}{7}$
30800..........	$19\frac{1}{4}$	$128\frac{1}{3}$	55	$36\frac{2}{3}$	$36\frac{2}{3}$
31200..........	$19\frac{1}{2}$	130	$55\frac{5}{7}$	$37\frac{1}{7}$	$37\frac{1}{7}$
32400..........	$29\frac{1}{4}$	135	$57\frac{6}{7}$	$38\frac{4}{7}$	$38\frac{4}{7}$
33600..........	21	140	60	40	40

N. B.—In this table we give such numbers only as come the nearest to whole numbers in woolen cuts and worsted numbers per pound.

TABLE SHOWING THE WEIGHT IN GRAINS OF 50 YARDS OF WOOLEN YARN, FROM 1 RUN TO 20⅞ RUNS.

Runs.	Grains.	Runs.	Grains.	Runs.	Grains.	Runs.	Grains.	Runs.	Grains.
1	218.75	5	43.75	9	24.305	13	16.827	17	12.868
1⅛	194.445	5⅛	42.682	9⅛	23.972	13⅛	16.667	17⅛	12.774
1¼	175.	5¼	41.667	9¼	23.648	13¼	16.51	17¼	12.681
1⅜	159.09	5⅜	40.698	9⅜	23.334	13⅜	16.355	17⅜	12.59
1½	145.833	5½	39.773	9½	23.026	13½	16.204	17½	12.5
1⅝	134.615	5⅝	38.889	9⅝	22.727	13⅝	16.055	17⅝	12.411
1¾	125.	5¾	38.043	9¾	22.436	13¾	15.932	17¾	12.324
1⅞	116.667	5⅞	37.234	9⅞	22.152	13⅞	15.766	17⅞	12.238
2	109.375	6	36.458	10	21.875	14	15.625	18	12.153
2⅛	102.941	6⅛	35.714	10⅛	21.605	14⅛	15.487	18⅛	12.069
2¼	97.223	6¼	35.	10¼	21.341	14¼	15.351	18¼	11.986
2⅜	92.105	6⅜	34.314	10⅜	21.084	14⅜	15.217	18⅜	11.905
2½	87.5	6½	33.654	10½	20.833	14½	15.086	18½	11.824
2⅝	83.334	6⅝	33.019	10⅝	20.588	14⅝	14.957	18⅝	11.745
2¾	79.545	6¾	32.412	10¾	20.349	14¾	14.831	18¾	11.667
2⅞	76.087	6⅞	31.818	10⅞	20.115	14⅞	14.706	18⅞	11.589
3	72.915	7	31.25	11	19.886	15	14.583	19	11.513
3⅛	70.	7⅛	30.702	11⅛	19.663	15⅛	14.453	19⅛	11.438
3¼	67.308	7¼	30.172	11¼	19.445	15¼	14.344	19¼	11.364
3⅜	64.815	7⅜	29.661	11⅜	19.231	15⅜	14.228	19⅜	11.3
3½	62.5	7½	29.166	11½	19.022	15½	14.113	19½	11.218
3⅝	60.345	7⅝	28.688	11⅝	18.817	15⅝	14.	19⅝	11.147
3¾	58.334	7¾	28.226	11¾	18.617	15¾	13.889	19¾	11.076
3⅞	56.452	7⅞	27.778	11⅞	18.421	15⅞	13.78	19⅞	11.007
4	54.687	8	27.344	12	18.229	16	13.672	20	10.938
4⅛	53.03	8⅛	26.923	12⅛	18.041	16⅛	13.566	20⅛	10.87
4¼	51.47	8¼	26.515	12¼	17.857	16¼	13.461	20¼	10.803
4⅜	50.	8⅜	26.119	12⅜	17.677	16⅜	13.359	20⅜	10.736
4½	48.612	8½	25.735	12½	17.5	16½	13.258	20½	10.67
4⅝	47.297	8⅝	25.362	12⅝	17.327	16⅝	13.158	20⅝	10.606
4¾	46.052	8¾	25.	12¾	17.157	16¾	13.06	20¾	10.542
4⅞	44.872	8⅞	24.648	12⅞	17.	16⅞	12.963	20⅞	10.479

NOTE.—This table will be found more convenient, and in several instances more accurate, than that published in our former work, owing to giving the eighths of runs, and the decimals having been carried out to the third figure; and in many instances the last figure of the decimal has been increased one, for in these calculations it is better always to figure on the heavy side.

The above table is to facilitate finding the weight of double and twist, when two or more threads are twisted together; for instance, suppose we wish to make a three-ply twist from yarns spun $3\frac{3}{4}$, $5\frac{1}{4}$ and $8\frac{3}{4}$ runs respectively, what would be the size of the three-ply thread?

EXAMPLE:

1 thread of $3\frac{3}{4}$ runs = 58.334 grains.
1 thread of $5\frac{1}{4}$ runs = 41.667 grains.
1 thread of $8\frac{3}{4}$ runs = 25. grains.

Answer, 125.001 grains = $1\frac{3}{4}$ run.

By referring to the grains column, it will be seen that the sum 25.001 grains is equal to $1\frac{3}{4}$ run. Now this $1\frac{3}{4}$ run is the combined weight of the three threads when folded, but not twisted together; hence this three-fold thread when given a medium twist, will weigh somewhat heavier, as it takes up more or less in the act of twisting, so we will make an allowance of $\frac{1}{4}$ run and call the twisted thread $1\frac{1}{2}$ run. If a slack twist, of only four or five turns per inch, is given the thread, an allowance of $\frac{1}{8}$ run will be sufficient, while if hard twisted, $\frac{3}{8}$ or even $\frac{1}{2}$ run may be allowed. Of course this allowance must be governed wholly by judgment, according to the quality of stock and the amount of twist to be given it, both in spinning and twisting. The exact size of the D. & T. can be found after twisting by weighing fifty yards, say five yards from each of ten bobbins; therefore, the above is calculated only for previous estimates concerning the original size to spin the yarns for the twist.

RULES TO FIND THE SIZE OF DIFFERENT YARNS, BY GRAINS, WITHOUT REFERENCE TABLES.

1600 yards of 1 run yarn weighs just one pound *Avoirdupois* or 7000 grains *troy.* Divide 1600 by 50, or any other number of yards used for a weighing, then divide 7000 by the quotient, and the quotient obtained will represent the weight in grains of 50 yards—or whatever number of yards weighed—of 1 run yarn.

Thus, $1600 \div 50 = 32$. And $7000 \div 32 = 218.75$ grains.

Now take 218.75 grains for a dividend, the weight of a weighing for a divisor, and the quotient will represent the number of runs. For example, we will presume that the weighing weighs 35 grains.

Thus, $218.75 \div 35 = 6.25$, or $6\frac{1}{4}$ runs.

Another method of calculating woolen yarns is as follows: $7000 \div 1600 = 4\frac{3}{8}$ grains, the weight of one yard of 1 run yarn; hence the number of yards required to weigh $4\frac{3}{8}$ grains will represent the number of runs. Thus, if it takes $5\frac{1}{2}$ yards to weigh $4\frac{3}{8}$ grains, the yarn would be $5\frac{1}{2}$ runs.

For a standard weight in worsted yarns, divide 7000 by 560, which gives us $12\frac{1}{2}$ grains as the weight of one yard of No. 1 yarn; consequently, as many yards as it takes to weigh $12\frac{1}{2}$ grains, so many numbers of 560 yards each will be required to weigh one pound.

For a standard weight in cotton, or spun-silk yarns, we divide 7000 by 840, which gives us $8\frac{1}{3}$ grains as the weight of one yard of No. 1 yarn; therefore, as many yards as it takes to weigh $8\frac{1}{3}$ grains, so many numbers of 840 yards each will be required to weigh one pound.

Rule to Find the Number of a 2 or 3-Ply Thread, in Worsted and Cotton Yarns.

A 2-ply thread is numbered according to the single numbers: thus, 2-ply No. 60's twisted together would equal, or is called No. 30's; but in order to be what it is called, the single threads would have to be somewhat finer than 60's, because in twisting, after being doubled, the yarn takes up more or less in length, which really makes the thread of twist heavier or coarser than it appears.

Again, suppose two threads of different sizes are to be twisted together, one of No. 60's and one of No. 40's, then proceed in the following manner: Multiply one number by the other number, and divide the result by the sum of the two numbers. Thus,

$$\left.\begin{array}{r} 60\times 40=2400 \\ \hline 60+40=100 \end{array}\right\} 2400\div 100=24\text{'s, number}$$

of the double thread.

To find the number of a 3-ply thread when composed of the same numbers. Divide one of the single numbers by the number of ply: thus, 3-ply No. 90's equals No. 30's, and 4-ply No. 100's equals No. 25's.

Again, suppose three threads of different sizes, say No. 20's, No. 40's and No. 80's, are to be twisted together, then the number of the 3-ply thread is found as follows: Divide the highest number by each of the other numbers and also by itself, after which divide the sum of the quotients into the highest number. Thus,

$$\left.\begin{array}{r} 80 \div 20 = 4 \\ 80 \div 40 = 2 \\ 80 \div 80 = 1 \\ \hline \end{array}\right\} 80 \div 7 = 11\tfrac{3}{7}\text{'s, number of the 3-ply thread.}$$

The sum of the quotients is 7

This rule will answer when any number of threads of varying sizes are twisted together. It will also answer for calculating woolen yarns by the run, but owing to the small numbers and the fractions which are used in that system, it is seldom brought into play when figuring woolen runs.

Rule to Estimate the Weight of Fabrics by the Weight of One Square Inch.

Multiply 36 inches, the length of a yard, by the width of the fabric, which will give the number of square inches in the yard. Multiply the number of square inches in the yard by the number of grains one square inch weighs, which will give the number of grains in the yard. Divide the number of grains in the yard by the number of grains in one ounce, which is $437\frac{1}{2}$; the quotient obtained will represent the weight of the fabric in ounces.

Example:

If a sample weighs $5\frac{1}{4}$ grains to the square inch, what will one yard of the fabric weigh, 27 inches wide?

$36 \times 27 = 972$ square inches to the yard.

$972 \times 5\frac{1}{4} = 5103$ grains to the yard.

$5103 \div 437\frac{1}{2} = 11.664$ ounces to the yard.—Answer.

WEIGHT TABLE IN GRAINS.

7000 grains (Troy)	=	16 oz. or 1 pound avoirdupois.
5250 grains	=	12 oz. or $\frac{3}{4}$ pound.
3500 grains	=	8 oz. or $\frac{1}{2}$ pound.
1750 grains	=	4 oz. or $\frac{1}{4}$ pound.
875 grains	=	2 oz. or $\frac{1}{8}$ pound.
$437\frac{1}{2}$ grains	=	1 oz. or $\frac{1}{16}$ pound.
$218\frac{3}{4}$ grains	=	$\frac{1}{2}$ oz. or $\frac{1}{32}$ pound.
$109\frac{3}{8}$ grains	=	$\frac{1}{4}$ oz. or $\frac{1}{64}$ pound.

The above table will be found useful when calculating the weight of fabrics.

RULE TO FIND THE AVERAGE PICKS PER INCH IN UNEVEN CLOTHS.

If the cloth is unevenly woven, or thicker in one place than another, take the number of picks to each count of the pick-glass in different places of the cloth where it is thickest and thinest, and add them all together; their sum divided by the number of times the picks were counted, will give, at an average, the picks per count.

Thus, supposing the pick-glass has one-fourth inch open space, if there are 12 picks in one place of the cloth, 15 in another, 14 in a third, 16 in a fourth, and 13 in a fifth; then $12+15+14+16+13=70$, which divided by 5, the number of counts, will give 14 picks as the average count; and $14\times4=56$ picks per inch as the average in the cloth.

COTTON YARN TABLE.

$1\frac{1}{2}$ yard	=	1 thread, or round of the cotton reel.						
120 "	=	18 "	=	1 skein, or ley.				
840 "	=	560 "	=	7 "	=	1 No., or hank.		
15120 "	=	10080 "	=	126 "	=	18 "	=	1 spindle.

The reel for cotton yarn is 54 inches round, 80 threads or rounds of which make a skein, ley or rap; 7 skeins make a number or hank, generally contracted No.; and 18 of these Nos. make, what is called, one spindle. The length of the several subdivisions of the spindle of cotton yarn will be found in the above table.

LINEN YARN TABLE.

$2\frac{1}{2}$ yds.	= 1 split, one ell, or 45 inches long (double).						
50	= 20	= 1 porter or heer.					
300	= 120	= 6	= 1 cut.				
600	= 240	= 12	= 2	= 1 heer.			
3600	=1440	= 72	=12	= 6	=1 slip or hank.		
7200	=2880	=144	=24	=12	=2	=1 hesp.	
14400	=5760	=288	=48	=24	=4	=2	=1 spindle.

Linen yarn is spun from flax, and reeled on a ten-quarter or 90 inch reel, and tied up into cuts of 120 threads or rounds of the reel; and 18 of these cuts represent a spindle. The spindle of linen yarn, however, admits of other subdivisions, which, with the quantity contained in each, are shown in the above table.

The fineness of linen yarn is commonly estimated by the weight of a spindle, hesp, or hank. By comparing the lengths of the spindles of cotton and linen together, it will be seen that the former exceeds the latter by 720 yards.

CLOTH MEASURE TABLE.

$2\frac{1}{4}$ *in.* (inches)	= 1 nail, marked	-	*nă.*
4 nails	= 1 quarter of a yard,		*qr.*
3 quarters	= 1 Ell Flemish,		*E. Fl.*
4 quarters	= 1 yard,		*yd.*
5 quarters	= 1 Ell English,		*E. E.*

Cloth measure is used for measuring all kinds of cloth, ribbons, and other articles sold by the yard.

The preceding tables are all that we deem proper to be published in a work of this kind, and which will be found practical in every respect to which they are applicable.

Knowing from past observations that many of the tables heretofore published in works relative to the textile industry, have been of little or no use, we have borne this in mind and have compiled for this work only such tables as we know from experience in teaching the rudiments of designing, will prove the most useful to beginners in making their yarn and weight calculations. In these tables we have given several original features which were never published before. If we deemed it advisable, we could insert many other tables, but to do so, would, we believe, be of no material benefit, while they might prove more an injury than good to the beginner, by inducing him to depend too much on them, instead of fitting himself capable of figuring out his required results, and thus be placed, at times, in an embarrassing situation when not having printed tables before him as a ready-reference. Therefore, as before inferred, we consider the tables here given, are all that is advisable in a work of this character, and that the information given in the preceding chapters is sufficient to teach the beginner in making his own estimates, for anything required in this line of calculating, which will certainly be far more commendable than having to depend on printed tables.

RAW OR TRAM AND ORGANZINE SILK YARNS.

We have not, as yet, treated on these yarns; suffice it to say that, they are numbered according to the number of drachms that 1,000 yards weigh. The drachm referred to is the avoirdupois and not the apothecaries' weight. It is $\frac{1}{16}$ of an avoirdupois ounce, or 27.34375 grains troy. Hence if 1,000 yards weigh one drachm or one-sixteenth of an ounce, 16,000 yards will weigh sixteen ounces or one pound. Therefore, 16,000 yards of No. 1's raw silk will weigh one pound; or, in other words, a number represents 16,000 yards, which is the standard or basis for calculating these yarns.

CHAPTER XXI.

WEAVING RIGHT AND LEFT-HAND TWILLS, ON CAM AND CHAIN LOOMS.

In the weaving of twills, it is usually necessary to have them run with the twist of the warp, in order to have the twill show up full and round, otherwise it will look flat and not appear sufficiently above the face of the filling threads. For instance, in a weave which throws the same amount of warp and filling on both sides of the cloth, or in other words is equally balanced in the warp, it will be noticed that the twill on one side of the cloth looks flat, while on the other side, it looks full and round. The former, is the back or wrong side of the cloth, the twill running the reverse of the twist; the latter, is the face or right side, the twill running with the twist of the warp yarn. Hence, it will be seen, if the warp is spun with a right-hand twist, the twill should run to the right; and, if spun with a left-hand twist, it should run to the left.

With the old-style treadle or cam loom, there are two ways of producing those results: one is by the manner of drawing-in the warp, the other is by the manner of hitching or strapping the treadles to the harnesses. In being governed by the former method, draw in the warp the usual way, commencing on No. 1 harness and working across to the back, drawing a thread on each harness in succession, will throw the twill one way; while commencing on No. 4 harness and working across to the front, drawing a thread on each harness in succession, will throw the twill in an opposite direction. In being governed by the latter method, draw in the warp the usual way, and hitch up the treadles as represented by Figs. 1 and 2, allowing the straight lines to represent the treadles, and the figures thus *1, 2, 3, 4,* the order of hitching them to the harnesses. The figures thus 1, 2, 3, 4, represent the harness numbers.

FIG. 1.

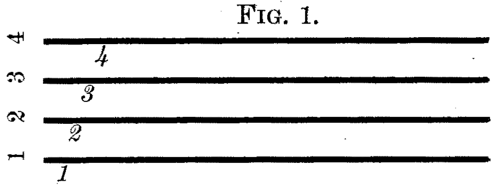


FIG. 2.

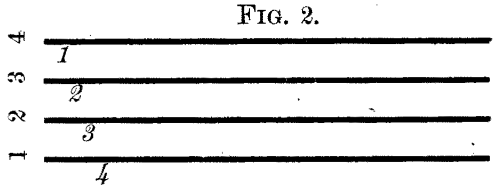
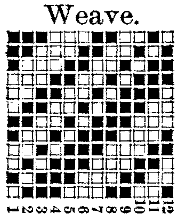


Fig. 1 represents the number of a treadle hitched to a corresponding number of a harness, which will throw the twill one way; while Fig. 2 represents the treadles hitched up just the reverse, that is, treadles 4, 3, 2, 1, are hitched to harnesses 1, 2, 3, 4 respectively, this will throw the twill in an opposite direction.

If it were desired to produce the regular broken twill, draw in the warp thus 1, 3, 2, 4, and hitch up the treadles as illustrated by Fig. 1; or, the warp may be drawn in the usual way (straight across), and the treadles hitched up thus 1, 3, 2, 4, which crosses the straps on treadles 2 and 3, and will produce the same result. This latter change may be made also by hitching up the harnesses at the top thus 1, 3, 2, 4, and hitching the treadles up in their regular order, straight across.

With a fancy or chain loom, the twill of the fabric is governed by the manner of building the harness chain, or the way it is put on the chain cylinder. For instance, suppose we buid a harness chain after the following weave, which, in the position it now stands, shows the twill running to the right: Take twelve bars of chain, place them on the chain rack, take the links off on one side, strip the bars free from the rollers and tubes for the required number of harnesses; now commence at the back or last harness of the weave, at the top, and build lengthwise of the chain, thus 1 down, 3 up, 3 down, 2 up, 2 down, 1 up; or, widthwise, thus 1 down, 1 up, 2 down, 2 up, 3 down, 3 up. In either case, continue in that manner until the vacant space on the bars is filled with the required rollers and tubes, after which replace the links and pins.

Weave.



Harness Chain.

```
§-000----00--0---------------§
§-00-----00--0-0-------------§
§-0-----00--0-00-------------§
§-------00--0-000------------§
§------00--0-000-------------§
§----00--0-000---------------§
§-00--0-000------------------§
§-0--0-000-----0-------------§
§-----0-000-----00-----------§
§---0-000-----00-------------§
§-0-000-----00---------------§
§---000-----00--0------------§
```

Now, if we pick up this chain by the top bar or the one fartherest from us, and hold it up before us, we find that the weave thus placed on the chain bars, stands in the same position as the weave or chain draft does on paper. This will be better understood on looking at the above illustrations of weave and harness chain.

The chain is now attached to the chain cylinder of the loom, in the following manner: If the cylinder revolves *outward* from the upperside, run the chain on from the underside; if it revolves *outward* from the underside, run the chain on from the upperside. In the former case attach the lower end of the chain first, as it now stands, this will run the weave upwards, from the bottom, producing it in the same position as now; in the latter case attach the upper end first, this will run the weave downwards, from the top, producing it in an opposite position, although in looking at the chain on the two cylinders, it would really stand in the same position in both instances. If, on starting the loom in either case, the twill should be found weaving in the wrong direction, take off the chain, and the end that comes off from the cylinder last, replace back on to the cylinder from the opposite side of which it came off. This operation will reverse the position of the chain and also the twill in weaving.

In building a harness chain for any loom, place the links with both ends in on one, and both ends out on the other alternately. This is the right method and if carried into effect, there will be no trouble arrising from the running of the chain.

From the above remarks and illustrations, the beginner will, we believe, be able to see and comprehend what is required, in operating cam and chain looms, to produce both right and left-hand twills.

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CHAPTER XXII.

DIRECTIONS FOR MAKING WOOL MIXES. CONCLUSION.

In mills running on fancy cassimeres, flannels, and ladies' dress goods which are mostly composed of mixes, a great deal depends upon these mixes for producing the desired effects, as well as the success of the mills. In order to be a successful designer in one of those mills, the designer must be thoroughly conversant in originating and imitating mixes, otherwise he will prove himself a failure in the undertaking, even though he may have proved himself a successful designer in other mills running on goods of solid colors and fancy double and twist yarns.

To be successful in originating mixes, the designer should be well versed with colors, know what order to assign them to, what class will produce the liveliest effect when combined, and what ones will produce the mildest effect; also to know what proportion one color will bear with another in producing the desired result. No rule can be accurately given, or table arranged by which those results can be obtained, or a mix of two or more colors may be combined to form another color or shade, unless the different colors are represented by samples.

In imitating a mix, some idea of the colors and shades in the combination may be formed by examination of the fibres. Then with a set of scales that will weigh grains,—

apothecaries' scales are the most convenient—proceed in the following manner: Suppose that we have a sample of cloth in which there is a mix we wish to imitate, or in other words, the sample is all of one kind of mix and that we wish to imitate the goods. By a close examination of the threads the mix appears to be composed of three colors, black, orange and red; the black greatly predominates, the orange and red appear equally divided, each of a small percentage, so we will call the black 80%, and the orange and red 10% each. Now weight 80 grains of black wool, and 10 grains each of orange and red wool. With a pair of hand cards or strippers, mix the colors thoroughly and compare with sample. If the mix obtained proves to be the right shade, then use grains as pounds and lay out for the stock accordingly. If the mix should not prove to be the right shade, add more, or less of the color or colors as the case requires, keeping an account of the grains. After getting the mix to shade satisfactory, arrange it in a book for that purpose with the per cent. of each color recorded by the side of it, then give the mix a distinguishing number. After some of the mix has been spun, procure several yards of the yarn and wind it into a small skein, which also place by the side of the mix and write down the number of runs the yarn was spun. By following out this plan with every mix made, a practical ready-reference may be obtained for present and future use.

Following is a record of a few desirable mixes, which were made and successfully used by the author in the manufacture of various grades of fancy cassimeres.

No. 1=75% black, 15 orange, 10 plum.
No. 2=85% black, 10 green, 5 yellow.
No. 3=50% white, 40 dark olive brown, 10 plum.
No. 4=50% white, 25 black, 25 plum.
No. 5=75% olive brown, 15 plum, 10 white.
No. 6=75% black, 15 white, 10 orange.
No. 7=75% red brown, 20 black, 5 white.
No. 8=85% black, 15 orange.
No. 9=75% olive brown, 25 orange.

No. 10=25% red brown, 25 black, 40 olive br., 10 orange.
No. 11=50% red brown, 50 white.
No. 12=50% red brown, 50 black.
No. 13=45% black, 45 olive, 10 white.
No. 14=45% red brown, 45 white, 10 orange.
No. 15=46% red brown, 46 black, 8 yellow.
No. 16=75% red brown, 25 white.
No. 17=75% dark olive, 25 white.
No. 18=45% red brown, 35 black, 20 yellow.
No. 19=50% black, 40 olive brown, 10 orange.
No. 20=50% black, 50 olive.
No. 21=85% black, 9 white, 6 red.
No. 22=50% white, 40 seal brown, 10 navy blue.
No. 23=25% black, 25 white, 25 blue, 25 dark green.
No. 24=50% white, 35 blue, 15 red.
No. 25=80% black, 10 white, 5 yellow, 5 red.
No. 26=80% black, 10 orange, 10 red.
No. 27=90% black, 5 orange, 5 red.
No. 28=92% black, 8 red.
No. 29=95% dark blue, 5 orange.
No. 30=95% dark blue, 5 garnet red.

From the above it will be seen that a plum color is used in a good share of those mixes. In each instance this color was used as so many pounds of black wool, for the purpose of enlivening the effect of the mix. For instance, a mix consisting of black and white may present a dull and dead-like appearance, while if a small per cent. of plum be added it will give the mix a bright and lively appearance.

CONCLUSION.

In the foregoing pages of this work we have given to the craft the result of twenty years' practice and study of the Art. During said time we have filled the position as Weaver, Designer and Superintendent, and for the last ten years have acted as private adviser and instructor for Designers, Superintendents and Agents of mills in nearly every state of the Union. This has placed us in a position of seeing and knowing the deficiency of knowledge among the craft in their respective callings. Our business as a publisher also, and connestion with textile journals, has enabled us to keep well posted in relation to other authors and their works, as well as in the textile industry. From these available sources of information, together with practical experience and the encouragement received from the txtended sales of our former works, we were induced to write the present work, which we trust will prove an important adjunct in this branch of the textile industry. And as far as our knowledge in manufacturing extends, we are certain there is no more important and profitable branch than that of designing. Although this work has not been written with the expectation that every one who will purchase a copy can become a successful designer by the perusal of it, even though they understand thoroughly its teachings, yet we feel assured and do expect that it will be found clear, methodical, thorough, and useful as well as a faithful instructor. Nothing now remains but to give utterance to the wish that the reception accorded to our work, by the craft, may correspond with the careful labor bestowed upon it, by the author.