

white; and mingled checks of the following shade couplets: blue and red; yellow and red; green and red; blue and yellow; blue and black; blue and white; red and black; red and white; yellow and black; yellow and white; and black and white. What a variety of lessons in colouring such a woven sample teaches! The black and white on the red adds mellowness to this bright colour, in addition to giving diversity of effect. The white in other sections in contiguity with the medium green, and crossing the yellow, has a like toning quality. The black against the yellow enhances its brightness, but in juxtaposition with the blue forms a soft shading, the latter making a clear definition of colour with the shaded green effect to which it is adjacent.

The quantities or proportions in which these colours are distributed in the pattern should be observed. Any increase or even variation in the quantities of each colour would produce a different harmony of composition. Regard must, therefore, be paid to the nature and potency of colours in determining their scheme of association in textile design.

45. *Successive and Simultaneous Colour Effects.*—In the above pattern, both successive and simultaneous contrasts are found. A simultaneous contrast is a blend or group of colours in which the several hues are in proximity. The intermingled checks of red and blue, yellow and blue, etc., are all illustrative of this type of contrast. In successive contrasts, there may be the same colours, but instead of being in juxtaposition they are separated; and, consequently, do not act in perfect unison on the eye, but each independently.

Comparison of the results of these contrasts shows, that colours suffer the most in lustre and purity of hue when in “simultaneous” association. Several examples of this kind occur in the pattern given. For instance, in those sections in which the red and green are intermingled in equal proportions, both colours undergo an apparent change in hue. In reality, it is simply the fundamental law of all colour contrasts asserting its influence on the colouring as a whole, whereby each hue is modified.

Amongst some of the most salient principles of textile colouring emphasized by this design that should be specially noticed, are these: Colours are modified the most largely in hue when in

actual contact; the stronger two or more colours, the less are they changed by simultaneous contrast; bright colours on a dark ground increase in luminosity, but are impoverished if applied to light grounds; and lastly, that intense colours gain in saturation on light grounds, but suffer in this quality on medium and dark surfaces.

46. *Methods of Neutralizing the Effects of Strong Colour Contrasts.*—It has been pointed out that when any positive colours are in immediate proximity, each suffers somewhat in purity of hue. To obviate, or partially neutralize, this sequence of colour association, some ingenious methods and technical devices are adopted. As already explained, colours change the most in hue by juxtaposition, so that the object to be attained is to separate them without bringing the divisional lines into prominence. It is not always feasible, in figured and fancy fabrics, to have the colours detached; they frequently intermingle, and it is at the points of actual contact where the skill of the colourist in obviating a defective contrast, due to the proximity of two or more brilliant hues, is exercised. No. 1, Plate XI., illustrates this feature of colouring. This pattern is composed of red and blue, and contains small quantities of a third hue which are of value to the harmony and contrast of the design. If the red had been allowed to actually touch the blue ground, the figuring would have lacked precision, and the colouring congruity of toning. Moreover, as green is the contrasting colour of scarlet, it has developed the figuring, and mellowed the effect of red on this deep blue ground. Minus this intermediate colour, the contrast would have been harsh, if not defective; but by its employment richness has been given to the red and softness of tone to the blue. Let it be supposed that red and blue were substituted in succession by green and tan (Shades 6, Plate VI., and 3, Plate IV.); by olive and rose (Shade 15, and Tint 5, Plate IV.); and by lilac and primrose (Tint 16, Plate VI., and Tint 16, Plate IV.). Tan, rose, and primrose to compose the figuring, and green, olive, and lilac the ground in the new colourings. Now, in order to prevent impingement of hues, divisional colours to take the place of the green in the illustration should be selected, which, while contrasting with the several hues employed for the figuring,

should also harmonize with the ground colours. For the first couplet, the pale blue (Tint 10, Plate IV.) may be used; for the olive and rose combination, pea-green (Tint 4, Plate VI.); while for the lilac and rose blend, the salmon in Tint 11, Plate VI., will be found useful. In each of these instances there is harmony and contrast of colours, which would prominently develop the figured sections of the design. To show these results, paint two pieces of paper similar in hue to Shades 6, Plate VI., and 3, Plate IV. Having done this, place the tan sample—which should be smaller than its companion—on the green slip, and then surround it with a narrow slip of rose, Tint 4 of Plate IV. On adding this last colour, a tasteful contrast will be formed by the green spot and the rose edging; and also soft, mellow harmony produced by this tint and the tan groundwork. Should each of the colourings alluded to be similarly experimented with, they would constitute equally pleasing combinations. As important principles underlie this kind of colour arrangement, it is advisable that numerous experiments of this class should be made by the reader; for, in order to educate the eye for colour contrast and harmony, practice in the combination of hues is essential.

47. *Harmony*.—Some colourists have propounded theories of harmony which are quite untenable in practice. For example, one scheme is based on the supposition that if the primaries are blended in the proportions of 3 parts of red, 5 parts of yellow, and 8 parts of blue, harmony of composition ensues. There can be no doubt that the ratio of quantities materially affects the congruity of tone of all shade assortments; but in designing it is not feasible to work to any set of proportions. Colour harmonies are not to be acquired by rigid adherence to a mathematical system of arrangement. Theories of this kind cannot be said to be of much technical value. Acute and cultured discriminative power for colour is of more consequence in this art than theoretical directions; the acquirement of what Rood calls “a delicate colour emphasis” is difficult even when there is natural aptitude for colouring. Systematic study of the works of designers of acknowledged capacity, and of all accessible rare and well-coloured woven specimens in harmony of tinting, should be



Plate X

SPECIMEN OF BRIGHT COLOURING IN PLAIDS

made. Adopting this course, the student will acquire a ready capacity for blending hues by such methods, as to compose choice and harmonious results.

48. *Principles of Harmony.*—Though Colour Harmony is intricate, and more or less incapable of being reduced to rigid principles, yet its general qualities may be clearly defined. For instance, certain colours when amalgamated fail to produce congruous patterns; whereas other colours invariably constitute harmonious compositions.

Harmony, moreover, is only attainable when the several colours are combined in such proportionate quantities, and on such principles of shade-association, that each hue employed will conduce to the mellowness of the whole pattern. Should any colour be conspicuous, it is sufficient to detract from the harmony of the entire colouring. Balance of hues is an important essential; and it is generally a feature dependent on the proportions in which the several colours are combined. Examine, for example, the blue-green and scarlet check on Plate XI., No. 2. Red is so much more potent than green, that when these two hues are associated in the same pattern, the former requires to be used less extensively than the latter. The common rule is that those colours which are the intensest and strongest in hue should be sparingly employed. When the various shades are of equal depth, the quantities may be more uniform, being only varied to such an extent as to impart precision to the leading features of the design.

Apart from hints that may be given in harmonious colouring, and knowledge that may be acquired by study and experiment in blending hues, in order to excel in this art the designer must possess natural aptitude for the work.

## CHAPTER IV.

### COLOUR STANDARDIZATION.

49. Objects of Standardization in Colouring—50. Systems of Colour Standardization—51. Standardization by Selected Colours—52. Analysis of Standardization Scheme, Plate XII.—53. Use of Standards in Blending—54. Applications of the Scheme.

49. *Objects of Standardization in Colouring.*—There are several difficulties in formulating a scheme of colour standardization applicable to any particular branch of woven design. This arises, firstly, from the tone of colouring which obtains in decorative, dress, suiting, and other fabrics. The manufacturer of each of these styles of textures should select standards of different degrees of brightness. In the second place, the colourist must have free scope—he should not on any account be fettered—in his work. Standardization may appear to impose restrictions. But on considering the several branches of textiles, it is obvious that certain elemental ranges of shades are mainly used in the several departments of woven manufactures, as, for example, in fabrics for men's wear, women's wear, decorative and other purposes. This not only suggests the possibility, but renders it feasible—without placing limitation upon the origina-tive faculty of the designer—of adopting in practice a standard set or series of selected colours from which other shades may, by the process of blending, be acquired.

This may be done with the object of (1) economy of colour production, a limited set of colours yielding an unlimited set of distinct shades; (2) the substitution of uncertainty of “colour” or “shade” due to independent dyeings, by certainty of result due to mixing; and (3) the manufacture of yarns by blending from a set of fixed colours which may be stocked, producing new shades as varied and solid in appearance as those obtainable in dyeing.

In the ordinary method of obtaining new shades by blending, there is an absence of a scale of fixed colours; neither in the blending is there a base of proportions, nor in the colours combined a standard scheme of colour gradation. But in standardization there is a distinct range of colours, each of which is toned or graded to the same degree.

50. *Systems of Colour Standardization.* — There are two systems on which Colour Standardization may be effected, namely, (1) the primaries, secondaries, and tertiaries may be adopted as the initial colours; and (2) a series of initial colours may be determined upon, each colour being graded from light to dark, and forming a number of intermediate shades between the two extremes.

Defining the first system, the Primary and Secondary colours have each three distinctive hues, that is, the pure or spectrum hue, and the two obtained by modification.

Red, tinged with blue, forms crimson.

” ” ” yellow, ” scarlet.

Yellow, tinged with red, becomes slightly orange in tone.

” ” ” blue, ” ” green ” ”

Blue, tinged with red, ” ” purple ” ”

” ” ” yellow, ” ” green ” ”

thus changing the hue, but to such a small degree that the original colour predominates.

The Secondaries and Tertiaries are subjective to similar changes without eliminating the definite or spectrum colour.<sup>1</sup>

On this principle, eighteen base colours are obtained, all of which, by the addition of white in variable quantities, may form a series of tints, and by the addition of black, a series of tones; or they may be softened in brilliancy by the addition of neutral grey.

In such a scheme, it would probably only be found desirable to modify the Tertiaries by mixing with black and white respectively.

The question of the brilliance of the initial colours is one that has to be fixed according to the application of the scheme. To mix pure white with the colours described would give, in many instances, useful tints for the dress and decorative trades, and also, if mixed with black, suitable tones for the same fabrics;

<sup>1</sup> See also Pars. 8 and 9.

but for ordinary textile purposes the pure elemental colours are too bright. These would require to be dulled or subdued by adding neutral grey to a definite scale of gradation.

51. *Standardization by Selected Colours.*—The second method of Standardization consists, as stated, in selecting a series of recognized workable colours and graduating them to six or more degrees. The principal colours are blue, green, and brown, with the addition of blue green, olive, and heliotrope, or colours which, with their gradations, are generally found most appropriate in fabrics for wearing purposes. (See series A to J, Plate XII.)

Having fixed upon the initial colour in each set, the question of toning or gradation is all-important. A uniform scale of gradation must be adhered to in each group. If this is departed from, mixing would result in a want of balance of gradation.

The base for the standard series of tones and tints are neutral greys (see Plate XII.). Here the mixing of black and white may be made to give ten or twelve or more tones with similar degrees of difference. A scheme of gradation formed in this way is applicable to any type of blend composed of a dark and a light shade, corresponding to black and white in the grey. Between the two extreme colours, several shades may be introduced, and yet uniform toning maintained; for whichever series of colours is selected, it will be seen that the movement from a dark shade to a lighter, in any part of the series, is correct as to depth and tone. This must be an absolute law in mixing the same number of colours in any series, or any group, providing that the scale of tones has been accurately produced in each kind of colour.

52. *Analysis of Standardization Scheme, Plate XII.*—The chart contains in specimens 1 to 6, series A to J, the simple or dyed colours which have been selected as the base or scale standards. These are varied in two ways, the specimens 7 and 8 being tinted with white, and 9 and 10 toned with black in the following proportions:—

Tint No. 7,	5 per cent.,	Standard No. 1.
	95	„ White.
Tint No. 8,	60	„ Standard No. 1.
	40	„ White.

Tone No. 9,	40 per cent.,	Standard No. 6.
60	„	Black.
Tone No. 10,	5	„ Standard No. 6.
95	„	Black.

These tints and tones could be carried out to six in each, when suitable proportions would be as follows:—

Tints	{	Colour . . .	5	20	40	60	80	95
		White . . .	95	80	60	40	20	5
Tones	{	Colour . . .	95	80	60	40	20	5
		Black . . .	5	20	40	60	80	95

In the second method, the colours are blended crossways in equal proportions. No. 1, Series A, and No. 1, Series B, give No. 1, *Xa*, *Xb*, etc. Similarly, No. 1, Series B, and No. 1, Series C, equal No. 1, *Xb*, so that whether blending shades in each series, 1 A, 2 A, etc., or blending two shades in adjacent series, 1 A, 1 B, etc., that is two shades of the same colour in the former, and two shades of contiguous colours in the latter, for practical purposes, solid shades would be acquired.

The chromatic scale is compiled as follows:—

A. Blue.	F. Yellow brown.
B. Green blue.	G. Brown.
C. Blue green.	H. Red brown.
D. Green.	I. Purple.
E. Yellow green.	J. Red blue.

It will be observed that there is no such decided change in hue or tone between any two adjacent colours as to produce, when mingled in equal quantities, an apparent mixture. This is an important elemental feature of any scheme of Colour Standardization—the several colours must be accurately graded. If, for example, any two shades are too far apart in the chromatic scale, the blending of them would produce a mixture effect. In other words, if the difference in tone or the difference in hue is pronounced, mixtures and not solid shades are formed.

53. *Use of Standards in Blending.*—In both the Woollen and Worsted trades, blending is an important department of yarn manufacture. Solid shades are obtainable in piece-dyes, but

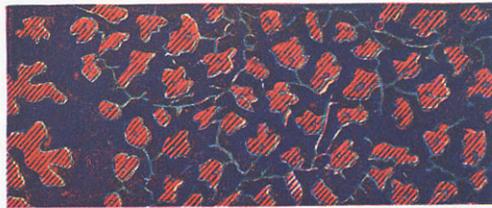
mixtures have to be acquired by the blending of coloured materials. The designer and colourist has resource to the combination of colour units in the blending of fibres in the production of shades and mixtures possessing novelty of tone. In this task he has two considerations: (1) the choice of the separate or distinct colours which, prior to blending, must form, in juxtaposition, harmony and contrast; and (2) the proportionate quantities in which they are to be combined. The latter, as every colourist has proved, may destroy the value of the former. Much of the success of colouring, whether in the material or the yarn, depends upon the relative weight, intensity, and proportions in which the colours are united. Now, when a scheme of standardization has been formed, and is used, the proportionate parts or quantities are according to a fixed mathematical scale, but the discovery of the correct colours to blend according to any series of these proportions is left to the trained faculty of the designer or expert, who must have regard to the fabrics and style of design to which they are to be applied.

The proportionate scale which is used does not affect the latitude for the exercise of the faculty for colour combination, but rather presents conditions which are so varied and yet definable, as to give a certainty of result as to depth and nature of colouring due to the process of blending.

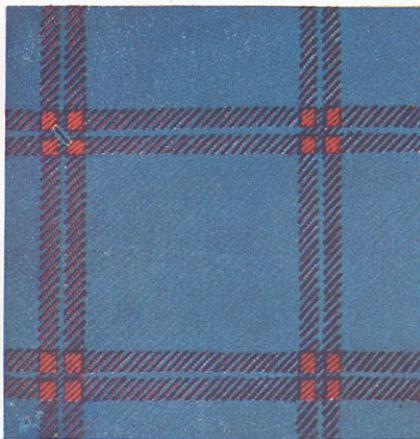
There are two great principles on which the art of Colour Blending in the raw materials is accomplished, namely—

- (1) The origination of blends or mixtures in which tone gradation is practised.
- (2) The origination of mixtures composed of several Colours to produce different hues or shades, but these to be of the same weight or tone.

In both, it is a problem of how the colour modification is to be attained. From the explanation given, it is obvious that in the first principle of blending, a fixed scale of proportions may be practised, so that the real essence of the work consists in selecting colours which harmonize with each other and coincide with the proportions adopted; or, in other words, the relative contrasts of colour must be in accordance with the relative proportions. That is to say, if a bright colour, though harmonizing with other



1



2

Plate XI  
RED, GREEN AND BLUE COLOURING  
1. Figured Pattern  
2. Check ..

colours in the mixture, is used in too large a measure, the mixture will be unsatisfactory.

54. *Applications of the Scheme.*—In this scheme there is ample scope for the colouring of many classes of woven fabrics. Bright or brilliant hues would be added as required. The scheme is, however, sufficiently complete for the ordinary styles of woollen, worsted, and other classes of fabrics. For costumes, vestings, cottons, and silks, richer colours would be desirable. If, for example, the principle of colouring was in relation to cottons and silks, then the “tints” of the standards would be found chiefly applicable, white and light grounds being mainly used; on the other hand, for fabrics with dark or medium grounds, the “tones” of the standards would be selected.

This standard scheme of colours, systematically toned, forms a practical workable base of colouring, one which, in the first place, in the use of the pure colours, makes it feasible, in the production of patterns, to obtain (*a*) ranges in which the contrast of colour in each pattern is absolutely uniform, and (*b*) ranges in which there may be perfect gradation from the dark to a light shade, and yet the same quality of contrast of colour in each pattern in the range.

In the second place, the scheme provides, by the mixture with black, grey, and white in succession, a means of acquiring a wide range of mixtures, each series of which runs by natural and constant degrees from a comparatively light to a dark result.

Third, it is possible by this system, in blending two or more colours, to acquire (*a*) graded series of mixtures of exactly corresponding depths of tone; and (*b*) varieties of mixtures in light, medium, and dark shades of similar depth of tone, but of different hues.

And lastly, the system is applicable to the production of distinct colours, such as would possess similar qualities to colours dyed in the wool, yarn, or piece.

## CHAPTER V.

### MIXTURES.

55. Varieties of Mixture Patterns—56. Elements of Mixture Colouring—57. Importance of Pure Materials—58. Several Classes of Mixtures Compared—59. Simple Blends—60. Blends of Wools and Pigments Compared—61. Modes of Testing Compositions of Colours—62. Mixtures composed of Two Shades—63. Compounds of Two Colours in which White is used—64. Illustrations in Mixtures composed of White and a Second Colour—65. Mixtures composed of Black and another Colour—66. Grey Mixtures—67. Bloomed Greys—68. Coloured Greys—69. Two-Coloured Mixtures—70. Multi-Shade Mixtures—71. Twist-Yarn Mixtures—72. Marls—73. Weave Mixtures.

55. *Varieties of Mixture Patterns.*—There are five methods of making mixture patterns, namely, (*a*) by carding several colours of fibrous materials together, producing *mixture woollen* yarns; (*b*) by combining in the process of *drawing* two or more slivers of different colours, producing *mixture worsted* yarns; (*c*) by combining in the process of *roving* two or more slivers of different colours, producing “*marl*” *worsted* yarns; (*d*) by using fancy yarns; and (*e*) by mixing two or more classes of threads in the weaving process. Each system is extensively practised; but the most intermingled effects ensue from blending the various coloured elements in the fibrous form. This system of producing mixtures yields a yarn in which the separate particles of colour, however diverse, are uniformly distributed throughout its length. Carding affords every facility for obtaining a softly toned blend, or one in which the filaments of distinct colours are perfectly mixed and intermingled. The shades are, as it were, united in this instance in the powdered or most minute particled form possible in textile compositions; whereas the methods of combining twist yarns, and of weaving shades of distinct colours together to compose mixture effects, consist of blending com-

paratively larger particles of colours. Perfect promiscuity, as a consequence, characterizes mixtures produced in the willowing and carding processes. These compositions are also distinguished by softness and mellowness of tone, entirely foreign to corresponding effects got by other methods. So completely are the elements associated on this system, that if blue and yellow wools were compounded they would constitute a green mixture, not so pure, however, as if pigments were amalgamated, for reasons alluded to in the sequel, but still they form a suggestion of this process of combination. If the same colours were united in the yarn state, even in the form of twist threads, they would still appear as separate hues; in other words, the yellow would remain yellow, and the blue would remain blue. To borrow an illustration, these methods of compounding fragments of colours in the manufacture of so-called mixture patterns may be compared with chemical and mechanical mixtures of substances; for just as in the former the bodies unite to compose a third substance, and in the latter they are mixed but not changed, so in blending colours in the fibre the mixing may be so complete as to yield an additional shade, but in blending them in the thread each hue retains its individuality. Twist-yarn mixtures possess a motley appearance of a broader character than those of blends in the wool or material, but still the richness of intermingling of tints is not wanting. In self-coloured yarn patterns of a mixture class the patchy character and detachment of individual colours are increased, while the mellowness and toned softness of the composition are diminished.

56. *Elements of Mixture Colouring.*—All mixtures require mellow treatment as to colour constituents. Patterns of this order should not be characterized by a patchy, but by a tinted appearance; every hue employed should be useful in composing an indefinite series of minute and closely mingled colour effects. To produce such styles no single hue should be allowed to obtain greater distinction or more prominence than other adjacent colours. Bright colours like red, crimson, blue, and yellow, seldom require to be used in large quantities. Black and white, browns, tans, medium blues, medium greens, olives, and other toned and tinted colours, form the main colouring of mixture

compositions: the more potent hues find a province in enriching and imparting lustre into these patterns.

The principal colours should generally be of a tempered type; still, it is important to use bright and decided hues. Murky, dull, and insipid shades should be avoided, as they are only capable of yielding dingy effects. The fragmentary nature of mixture colourings largely affects the lustre of the pattern resultant. Two colours which, when combined in large quantities, may possess congruous attributes, on being broken up into particles and intermingled lose lustre. In blending colours in the natural state, the separate hues are distinguishable after carding, for each, in the carded silver, helps to constitute quite a new and additional shade. If, for example, claret, fawn, and bright orange wools, in quantities of four parts of claret and one part of fawn and one part of the orange were scribbled together, neither the orange, fawn, nor claret would in the resulting "blend" possess precisely its original hue. Traces of each would be noticeable, but a species of indefinite drabbish-brown mixture, streaked with filaments of orange, would be the composition obtained.

57. *Importance of Pure Materials.*—Bright and lustrous mixtures can only be secured by using pure wools. Such colourings are not feasible in the low materials used in making some classes of woven goods. Scotch mixtures will always excel in brilliant tinting so long as fibres of a mungo, shoddy, and extract class are rejected by manufacturers north of the Tweed. Having a good foundation to work upon—a fibre that will not only take a vivid colour but retain it—Scotch textures, notably Bannockburn and heather mixtures, are unsurpassed in lustre and mellowness of toning. Mixtures made in centres of the low woollen industry are not comparable with them as regards freshness of colouring. Of course, a passable imitation of the pure wool production is made, but the fabric lacks not only bloom and fulness of colouring, but quality and softness of handle. How is it feasible to get these elements of good mixtures developed to the same degree in these inferior articles, made of materials which in some instances have been utilized time after time in made-up garments, and as frequently ground up or reduced to filaments, scribbled, spun into yarn, and woven into a market-



Plate XII. CHART OF

This and the next two pages are from a three-part foldout.



SCHEME OF COLOUR STANDARDIZATION. Originated and Compiled by the Author

Shade G = Brown XH Shade H = Red Brown XI Shade I = Purple XJ Shade J = Warm Blue  
*Intermediate Shades produced by mixing the standard shades A<sub>1</sub> and B<sub>1</sub>, A<sub>2</sub> and B<sub>2</sub>, etc.*



XG Series = Mixtures of Standards F and G  
 XH " = " " " " G and H  
 XI " = " " " " H and I  
 XJ " = " " " " I and J

and Mr. Thomas Hollis

able fabric, as are obtainable in the genuine woollen texture? If mixtures bright in colouring are to be acquired, resource must be had to wools of a sound quality. Stress is laid upon these points because they lie at the basis of good colouring in mixture styles; and also on account of the necessarily futile attempts made by some manufacturers to secure corresponding richness of composition in a mungo, or partially mungo production, as characterizes an all-wool article, which it is important to understand is totally impossible, for the simple fact that the better the raw material, the more lustrous the coloured effects secured.

58. *Several Classes of Mixtures Compared.*—The diversity of mixtures, acquired by blending several shades of fibres, is very large, comprising an infinite range of light, medium, and dark effects, in both woollen and worsted fabrics. There is, however, one quality characteristic of every species of this type of mixtures, namely, a rich, mottled aspect of colouring. Whether considered in the fibrous state or in the woven fabric, this mingled but continuous poly-tinted appearance is noticeable. Where the separate hues occur, and are lost to view, or how numerous they are, it is only possible to determine after careful examination. All the hues are scattered equally throughout the mixture, hence the blend in every part possesses similar qualities of bloom and diversity of tinting. These mixtures may be distinguished from those obtained by other processes, by the manner in which the various colourings are intermingled.

If a mixture fabric made on this system were compared, by analysis, with one got by using twist yarns, or by threads of divers colours in both warp and weft, some interesting results would be obtained. To dissect a mixture fabric produced by “blending,” the yarns of which the texture is composed would require to be reduced to the original filaments. The proportions in which the colours are combined, are far more difficult to arrive at than the nature of their hues. Having by this method secured the exact colour elements, some data has been discovered upon which to base experiments, which, if properly conducted, will lead to the determination of the quantities in which the colours have been combined in the production of the composition. Ordinary twist-yarn mixtures do not offer so many difficulties

to the analyzer. First, as to their colour constitution: this is easy to discover if the different kinds of threads are classified, which can be done by unravelling the texture. Next, ascertain the colour composition of each by untwining the twists or separating the threads used in their construction. By adopting this system of analysis, both the exact hue of the colours and the quantities in which they have been combined may be obtained. The reason why the routine of dissection is, in this case, comparatively simple, is because the coloured factors of the fabric may be feasibly separated, whereas in the preceding class of mixtures the isolation of the various hues of the filaments employed is more difficult to effect. To discover the composition of a mixture in which self-coloured yarns have been used, it is only necessary to ascertain the methods of warping and wefting, or the plan of combining the yarns in the production of the fabric. Evidently, in these two last styles of mixtures, exact analysis of the colourings, both as to quantities and hues, is quite feasible, but in the first kind the proportions, as well as the precise colours, are difficult to acquire.

59. *Simple Blends*.—The most economical species of mixtures belonging to this class is that obtained by combining any one colour with white. Mixtures of this kind may be defined as tinted wools, for the process of production exactly coincides with that of forming tints with pigments. They differ, however, from the latter in appearance. A tint obtained by mixing red with white, for example, constitutes quite an even surface of pink; but mix white and red wools in similar quantities, and something more than a rose compound is produced, namely, a mottled, intermingled colouring, whether seen in the material, yarn, or piece. Equal quantities of blue and white, green and white, and orange and white wools, all form colourings streaked with their composing hues. It will be evident that this class of colour amalgamation opens up a wide field for investigation. First, there is the range of colours with which white may be associated, comprising both positive and tempered hues of a primary, secondary, and tertiary character. Second, there is the considerable diversity of proportions in which the elements forming the mixtures may be combined; for either the white

or colour may preponderate, or the two shades may be equally mixed. In addition to these mixtures, which are of the most elementary class, there are those resulting from blending black with other colours, and from compounding materials of two or more colours. The two former kinds are utilized in the manufacture of yarns for serge dress textures, for which fabrics they are particularly well adapted. The tints and shades on Plates IV. and VI. illustrate the results obtained by this scheme of blending. In combining wools, however, or other materials, though the same proportionate quantities of tinting and toning elements were used as in forming these examples, still compounds of a somewhat different character would ensue, arising from the colour factors being of a fibrous character.

60. *Blends of Wools and Pigments Compared.*—It is important that the dissimilarity between wool and pigment mixtures should be thoroughly understood; for it will be quite evident from the nature of these substances that, though in each the same quantities of similar colours were blended, yet the resulting compositions would be characterized by many features of difference. To these reference will next be made. When two or more shades of wools are amalgamated, each colour—however well the materials are grouped and intermingled in scribbling, carding, and spinning—retains its individuality of hue, which, of course, is opposed to the law of pigment combinations, in which all traces of the original colours, as separate hues, disappear by admixture. Still, when fibrous materials are associated, a sort of new shade, streaked more or less with its composing elements, is obtained. For example, a species of bluish-fawn mixture would result from blending wools as follows:—

9 parts of dark brown.	6 parts of fawn.
4 „ „ pale blue.	4 „ „ green.

But while the resultant composition in this example might be designated a kind of fawn, yet, if it should be closely examined, the brown, pale blue, and green would be discovered, which give bloom and saturation of tone to the whole shade. Providing the same elements were mixed in pigments, they would

yield quite a different result. In only one particular would it correspond to its wool contemporary—it would be a fawn shade; more murky and dingy, however, and scarcely recognizable as being composed of exactly the same colours in like proportions. When paints are mixed, all colours, as individual hues, are totally obliterated, hence a shade is formed in this instance in which the green and blue can hardly be distinguished, the brown and fawn with which they are associated largely neutralizing their effect.

Of course their presence is perceivable, but not to the same degree as in wool mixtures, for the simple reason that, whereas in this latter instance, the fibres of blue and green are mixed and grouped with those of brown and fawn, and the four colours in association form a brownish-fawn mixture, tinted with each of its colour elements, in the case of pigments the particles of various colourings entirely disappear, and combine to constitute a perfectly new shade of somewhat indescribable qualities. It follows that, in one sense, fibrous blends of colours are more effective than those of pigments, for they not only possess the nature of new shades, but the several hues of which they are composed are kept unchanged, enhancing the beauty and intensity of the whole combination. Each colour of filament remains, and is traceable in the mixture as a separate hue, and thus a pleasing and attractive compound is obtained; one, moreover, only producible by blending different colours of fibrous materials. These effects are alone seen in woven textures, and in that class of fabrics in which the colours have been blended prior to weaving or in the carding operations. Should twist yarns be employed instead of various hues of fibres, a more patchy colouring results (see Pattern 2, Plate VII.); one, indeed, in which the colour factors are more prominently separated, and hence devoid of those qualities of neatness and softness invariably associated with mixtures produced in the processes of scribbling, carding, and spinning. Passing to mixtures got in the loom by self-coloured yarns, a still further divergence from a one-shade mixture, resulting from blending several colours, is obtained; for here the several tints employed remain quite detached and distinct. Undoubtedly,

in woven fabrics, the most elegant style of mixture is that secured by combining the colours in the material form, or in mixing them in the production of the thread; which method produces a promiscuous shade, tinted, freshened, and brightened with every element of colour entering into its composition; and which constitutes, moreover, quite an evenly-balanced colouring.

61. *Modes of Testing Compositions of Colours.*—Two methods of testing the effect of combining different shades may be practised. First, the most handy system consists in mixing various colours of pigments. Although it is barely possible to represent in this manner the precise result any compound of shades would have in textile materials when scribbled, carded, and spun into yarn, still a fairly accurate idea of the tone and general aspect of a mixture of tints may thus be arrived at. Tests of this kind also serve another purpose—they foster a taste for colouring, and develop the faculty of judging the depth and brilliance of the tone and tint of mixtures in general. This method of testing new sets of colours for mixtures is important. The pigments should be used in solution, which, for convenience, may be kept in small bottles, so that, in mixing, the minutest quantities can be readily and accurately measured off. When thus working with liquid colours, in order to properly test any group of shades, a surface should first be prepared of the principal colour in the mixture. Should this be black, brown, or any other dark colour, it will be necessary to mix the bright colours with white. After the body of the mixture—that is, in this instance, the black or dark brown—has been obtained, the whole should be completed by stippling on to it the other colours in succession, care being exercised not to apply a new colour before that previously used has become perfectly dry. Let an illustration be considered. A mixture of colours which it is required to put through this test is compounded thus:—

4 parts of black.	2 parts of medium green.
3 „ „ scarlet.	1 part of white.

The first process would be to prepare the black surface, employing for the purpose four parts from the bottle con-

taining this pigment in the liquid form. After this has been done, the scarlet, which requires to be first mixed with white, would be stippled over the black, leaving intervals or small patches of the black ground uncoloured. The scarlet dried, two parts of green would be similarly added, and lastly one part of white. In each addition of colour minute spaces should be left of black, and when the last tint has been applied, there should be distinct streaks of the several colours, the black, of course, largely preponderating. If this routine is carefully observed, almost any variety and proportions of colours may be represented. Necessarily there is an absence in the blend thus acquired of that mingled colouring so characteristic of wool mixtures, but still the result is sufficiently accurate to enable the colourist to form a just conception of the value of any shade composition.

Now for the second method of experimenting with colour elements in the origination of new mixtures. Here, wools are used; small hand cards being constructed for the purpose. This is obviously the best system when the exact shades of wools can be acquired, but this is often both difficult and expensive. Where the spinning of mixture yarns is a speciality, it is, however, advantageous to have a small stock of wools in as many shades as possible, which the colourist can have access to and blend in any proportion his ingenuity may suggest.<sup>1</sup> In adopting this practical system of experimenting, the several colours selected for combination ought first to be compared on a convenient surface, preferably black, and then the quantities of the separate tints determined upon. This accomplished, mixing would follow, which consists of placing the various samples on the wire of two hand cards, and then passing the teeth of one card between those of its companion till the filaments have become as perfectly mingled as if the work of mixing had been effected by the scribbling and carding operation. Assuming, for the purpose of illustration, the colours selected to be brown, blue, fawn, and sage-green, and the proportions as follows: 3 parts of brown to 1

<sup>1</sup> In the Standardization Colour Scheme these initial colours, as the principal in the blend, are stocked. Bright or fancy colours might be dyed, in addition, for toning purposes.

part of each of the remaining shades, then, providing the quantities have been weighed off, the several shades would be combined and mixed by the process just described. Care must be exercised not to overload the cards, or blending will only be imperfectly accomplished. Concluding that "carding" has been satisfactorily effected, a compound shade of a slatish or smokish class will be the result, which will contain visible traces of all the colour elements of its composition, namely, of brown, blue, fawn, and sage-green.

Both the "pigment" and the "fibrous" systems of experimenting with colour for blending purposes should be extensively practised. The former may be adopted with success when wools are not accessible, while the latter gives a result identical in every respect to that acquired in manufacturing operations.

62. *Mixtures composed of Two Shades.*—These are of three kinds; first, those in which white is a factor; second, those in which black is used; and third, those in which two fancy colours, other than black or white, are combined, as brown and lavender, purple and gold, and tan and drab. Mixtures of this kind may not only be economically produced, but are simple and neat in composition. Many of them are largely used in the production of both woollen and worsted yarns, and are produced in light, medium, and dark shades. In textures where a neat effect is requisite, they make most satisfactory combinations. Still, they lack diversity of tint; and, as compared with blends containing a larger assortment of colours, they are characterized by tameness. Of course their degree of freshness and lustre is proportionate to the brightness of the hues amalgamated. If these are washy and murky, the resulting combination will be unsatisfactory. While it is impossible to enumerate all the colours suitable for this species of blending, yet it may be remarked that one of the hues should, at any rate, possess bloom and force of tone; not necessarily harshness of hue, but fulness of tint and definite emphasis of shade, in order that it may be capable of affording colour character to the mixture in which it is used. Such colours as claret, maroon, deep purple, russet, chocolate, tan, warm olive, full-toned drab, blue, and green drab, are appropriate for this purpose.

63. *Compounds of Two Colours in which White is used.*— Blends of this class are both numerous and important. They are of many tones, depths, and intensities. Three illustrations are given on Plate XIII., comprising light and medium compositions. The first specimen (No. 1) results from mixing 3 parts of white with 1 of brown; the second (No. 2) is composed of 3 parts of fawn and 2 of white; and the third (No. 3) consists of 3 parts of reddish purple and 1 of white. In the first and last of these mixtures the proportions are the same, but in the former, white is the prevailing, and brown the subordinate tint, while in the latter, lavender is the main element, and white simply the secondary factor of the blend. This leads to the consideration that in forming such mixtures it is imperative to determine, in the first place, whether white or the colour element, whatever that may be, is to preponderate in the mixture about to be produced. Having decided upon this point, some calculation should be made as to the extent in which one element is to be overpowered by the other. The illustrations will assist us in the solution of this problem. Starting with the brown and white combination, it is quite apparent that, in this instance, it has been sought to acquire an effect of a light character, one, in a word, just tinged or toned with a brownish element. As a consequence, white should preponderate, but the point arises to what degree. If the proportions were four parts of brown to one part of white, the mixture would be too pale; if three parts of white and two parts of brown were combined, the mixture would assume a dark cast, for the brown element would be too potent; hence the proportions from which the illustration has been obtained are the most appropriate for producing a light-shaded compound. Results of this kind can only be arrived at by experiment. Theory merely expounds the principles of the art, practice alone can illustrate and verify them. With pigments, the reader may acquire much useful and reliable knowledge of these combinations; or by dyeing for himself in a small vessel a number of different shades, which is no difficult task, and using the hand cards alluded to in a previous paragraph, he may become a competent and skilful combiner of fancy shades for mixture yarns.

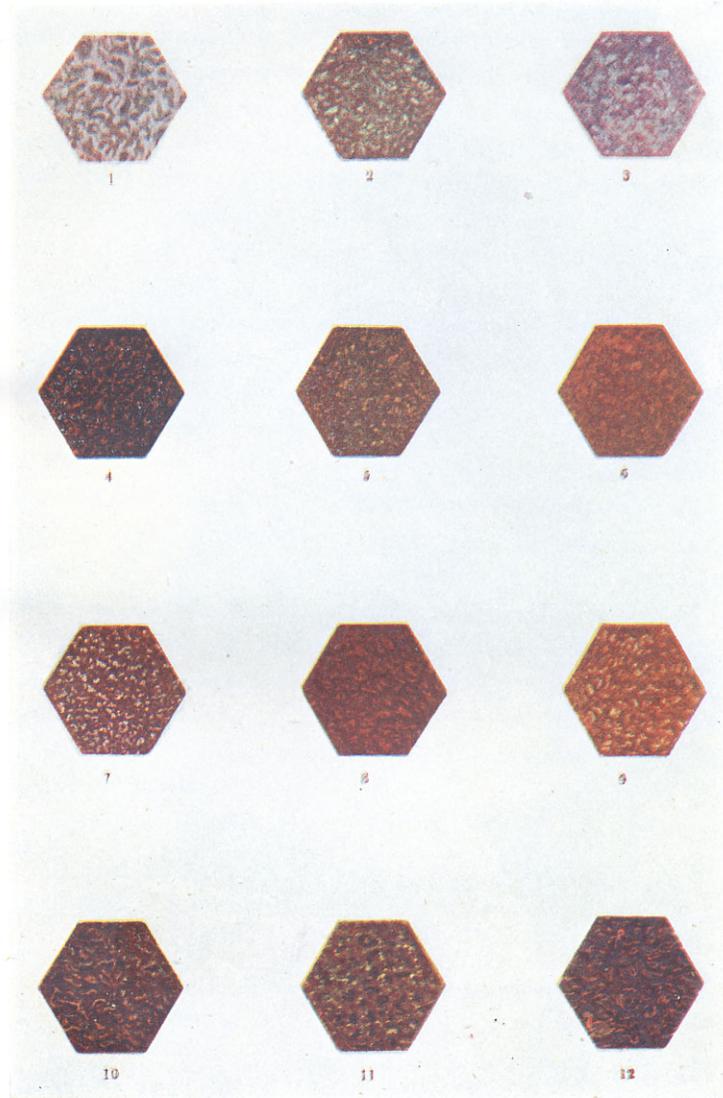


Plate XIII  
BLENDS OF COLOURED WOOLS

64. *Illustrations in Mixtures composed of White and a Second Colour.*—Mixture 3, Plate XIII., is compounded of reddish purple and white. It is suitable for either worsted or woollen yarns intended for dress goods made in the plain weave or in the simple twill. It also forms a yarn capable of giving good results when blended with Mixture 1 of the same Plate. Stripes and check patterns formed of these two mixtures, make very neat and attractive styles. The pinky aspect of Mixture 3 causes it to be applicable to textures for ladies' costumes, in which brightness and warmth of colouring are often a valuable acquisition to the fabric. The white beautifully softens the red purple, the two shades in union, and in the proportions rendered, forming a satisfactory mixture.

The remaining sample in these mixtures (No. 2, Plate XIII.) is the most suitable for tweeds, yet considered. As a compound shade, it possesses many excellent features for both summer and autumn styles. Here, as already stated, white is the minor element of the composition. While in the two preceding examples it predominates, here it simply acts as a tinting factor which gives softness and mellowness to the green drab forming the bulk of the mixture. The utility of white for this purpose is thus clearly seen.

Below are furnished some additional examples in this description of mixtures:—

I.	II.
3 parts of light bluish drab.	3 parts of tan.
1 part of white.	1 part of white.
III.	IV.
3 parts of olive brown.	3 parts of slatish fawn.
1 part of white.	1 part of white.
V.	VI.
2 parts of deep chocolate brown.	4 parts of chocolate.
2 parts of white.	1 part of white.
VII.	VIII.
6 parts of white.	3 parts of white.
4 parts of deep slatish blue.	2 „ of fawn.

Nos. I., II., and III. are specially suitable for yarns employed in the manufacture of dress and other thin fabrics of a bright and cheerful tone. No. IV. is an interesting compound after the nature of No. 2, Plate XIII., but deeper and stronger in cast. Such mixtures are most useful in the production of fancy tweeds and woollen and worsted textures intended for men's wear. Blends V. and VI. are also appropriate for tweed goods. They are both of a brownish character, but the latter is the darker and more pronounced in tone. No. VII. might be defined as a slatish blue mixture. It makes a good fancy yarn, and, in fine worsted, a thread suitable for thin fabrics for costumes. The last of these combinations possesses a very mellow appearance. The fawn is a shade between olive and brown, approaching a species of tan. By altering the proportions to three parts of fawn and one part of white, an excellent mixture results, which might be used in combination with No. VIII. in the production of checks and stripes and a large diversity of other patterns.

65. *Mixtures composed of Black and another Colour.*—These, if anything, have a more extensive application than the mixtures just alluded to, and are probably more diversified in composition and colouring. They are largely employed in the production of yarns for dark and medium-shaded goods. As the illustrations furnished on Plate XIII. indicate, many useful combinations may be obtained on this method. The first example (No. 4, Plate XIII.) that may be considered, is a russet-brown mixture. Probably, the russet is a degree too warm, but, for some purposes, the blend is all that could be desired. Bloom, mellowness of cast, and rich fulness of tint are its chief characteristics. As a tweed mixture produced by using two colour factors, it is invaluable. It contrasts with the following mixture, No. 5 of the same Plate, which results from blending one part of black with one part of light olive. The olive used is more drab than orange, and in association with the black assumes a greenish cast. By combining yarns made of this mixture with yarns made of the preceding mixture, some good patterns might be produced, simple, but neat in composition; the streaks of russet in the one harmonizing and contrasting with the filaments of

olive in the other. The qualities of bloom and warmth lacked by this latter example are possessed by the russet blend, while the mellow characteristic of the olive mixture, when associated with the russet, yields a compound colouring of tasteful properties.

But one further illustration, No. 6, Plate XIII., in this species of blend calls for description, namely, a black and fawn combination in which fawn is the principal hue. It is illustrative of the diversity of effect that may be acquired by mixing two colour elements. As the fawn composes the bulk of the blend, it possesses, when viewed at some distance, a brownish tone, but on closer examination the small flakes of fawn colouring assume a rich bloom as well as a soft, mellow aspect.

Other examples in this style of mixture, not illustrated, may be briefly described, the colourings of which are:—

I.	II.
5 parts of black.	1 part of black.
2 „ tan.	1 „ tan.
III.	IV.
6 parts of black.	4 parts of black.
3 „ bluish green.	5 „ dark purple.
V.	VI.
3 parts of black.	4 parts of black.
2 „ sage green.	3 „ drabbish fawn.
VII.	VIII.
4 parts of black.	6 parts of black.
1 part of lilac (medium shade).	1 part of rose pink.

Combinations I. and II. are quite dark. The former is a warmish, and the latter a somewhat cool colouring. Yarns from these two mixtures harmonize well when associated in the same pattern. The tan used in No. I. is similar to No. 3, Plate IV., and the bluish green to No. 2, Plate VI., but rather more blue in tone. Mixture II. is a medium colouring, suitable for suitings and the general run of fancy tweeds. Warmth, freshness, and lustre are its main and characterizing elements. No. IV. is a

unique colouring. It forms an admirable dark thread. A fabric in which the warp is composed of yarns made of this mixture and woven with yarn from Blend I. is an excellent combination of tints. Mixtures V. and VI. are both of a medium tone. No. V. is rather dull in tone as compared with No. VI., but both are useful colourings. Blends VII. and VIII. are of a different character. In these examples the colour element is small, but comparatively light and lustrous in tint. The object has been to obtain a black composition just streaked with filaments of a bright shade. The quantity of lilac in No. VII. is just sufficient to change the tone of the black, and to produce a compound approaching a species of grey, but bright and fresh in colouring. No. VIII., though very dark, is cheerful in quality, being suitable for a fancy yarn, or for thin textures for robes and costumes. It is unnecessary to multiply examples of mixtures in this class, as those furnished are typical of the endless variety of combinations which in practice are required by this scheme of colouring.

66. *Grey Mixtures.*—Amongst the most useful mixtures resulting from combining two shades are those known as greys. These are sometimes bloomed or enriched with purple or full-toned blue, but they are more frequently constituted of black and white simply. Ranges of fancy woollen and worsted patterns are rarely made without their use. For ground shades, and also for fancy colours in check and stripe patterns, they are of great utility. Some of the most important and common proportions are as follows<sup>1</sup>:—

I.	II.
6 parts of black.	5 parts of black.
1 part of white.	1 part of white.
III.	IV.
4 parts of black.	3 parts of black.
1 part of white.	1 part of white.
V.	VI.
2 parts of black.	1 part of black.
1 part of white.	1 „ white.

<sup>1</sup> See also Par. 52 and Plate XII.

## VII.

2 parts of white.  
1 part of black.

## VIII.

3 parts of white.  
1 part of black.

## IX.

4 parts of white.  
1 part of black.

## X.

5 parts of white.  
1 part of black.

## XI.

6 parts of white.  
1 part of black.

The most useful of these combinations are Nos. V., VI., and VII., which are in many instances the only ones used. No. V. is called dark, No. VI. medium, and No. VII. light grey.

To produce a perfectly gradated shade it is necessary to use some five or seven greys, but in ordinary styles, for both woollen and worsted textures, it is not customary to employ a larger number than the three mixtures just named. The following is an arrangement for a shaded pattern in five greys:—

5	or any appropriate number of threads of No. IV.				
5	”	”	”	”	V.
5	”	”	”	”	VI.
5	”	”	”	”	VII.
5	”	”	”	”	VIII.
5	”	”	”	”	VII.
5	”	”	”	”	VI.
5	”	”	”	”	V.

Mixtures I., II., and III., form very dark shades; and Mixtures XI., X., and IX., form very light shades; and are only employed in the production of extreme fancies.

67. *Bloomed Greys*.—These, as already explained, are greys tinted with some bright hue. The colours generally used for this purpose are very deep purple, rich blue, and red purple. The quantities of such hues are small, but sufficient to impart freshness of tone or lustre to the mixture. Blue is used chiefly in brightening light greys. For example, a much fresher light grey is formed by the following proportions than if black and white were alone used: 6 parts of white, 4 parts

of black, and 1 part of blue. Though the blue only constitutes one-eleventh of the mixture, still it imparts freshness. An excellent medium grey, warmed with reddish purple, can be secured thus: 8 parts of black, 4 parts of white, and 3 parts of red purple. Deep purple is one of the most suitable hues for dark greys, as it possesses both the qualities of warmth and lustre, and is a most potent hue. Two examples follow in which it is used with satisfactory results:—

I.	II.
6 parts of black.	3 parts of black.
2 „ deep purple.	3 „ white.
1 part of white.	2 „ deep purple.

Both these mixtures possess richness and depth of tone, and are preferable to the common greys inasmuch as they are fuller, more lustrous, and mellower in composition; No. I. is a dark, and No. II. a medium shade.

68. *Coloured Greys*.—Mixtures of this kind are mainly compounded of black and white, but the colouring element introduced may be so potent in hue as to impart quite a tinted aspect to the shade. It will be sufficient for the purposes of illustration, to treat of mixtures of this class in which red, blue, yellow, orange, green, and purple, or the primary and secondary hues, are used as the tinting factors. It is very rarely that more than one colour is employed in the same blend, as the examples given will show. Four standard coloured greys, in which red is the tinting element, are as follows:—

I.	II.
1 part of black.	2 parts of black.
1 „ white.	1 part of white.
1 „ red.	1 „ red.
III.	IV.
2 parts of white.	2 parts of red.
1 part of black.	1 part of black.
1 „ red.	1 „ white.

These proportions, giving typical results, will be adopted throughout the exposition of these mixtures; that is to say, when

the tinting element is changed to blue or orange, the same quantities will be combined as in those furnished in the above examples.

In No. 1 the shades are blended in equal proportions, hence there is no tint preponderating in the resultant mixture, which is a species of brownish grey, neat in composition, and one that is useful in textile designing. Black predominates in Mixture II., resulting in the production of a more appropriate shade than that formed by No. I. for autumn and winter cloths. Referring to No. III.—white is the chief element, hence a medium compound shade is acquired: somewhat pinky in appearance, owing to the entrance of white and scarlet into the blend, but still the whole is toned and increased in depth of composition by the admixture of black. It is, on account of its richness, more suitable for yarns for dress fabrics than for heavy goods for men's wear. The same remark applies to Mixture No. IV., in which red is the preponderating hue. But this is a bright and cheerful colouring, and one that makes an excellent fancy yarn. These reddish-grey mixtures all form valuable shades for winter styles, as they are decidedly cheerful and warm in aspect, and produce a kind of pattern both bright and comfortable in character.

Grey, in conjunction with yellow, forms a species of drab mixture, which finds appropriate use in the manufacture of summer textures. Taking the same order of mixing as furnished in the red greys, the following results are obtained:—

V.	VI.
1 part of black.	2 parts of black.
1 „ white.	1 part of white.
1 „ yellow.	1 „ yellow.
VII.	VIII.
2 parts of white.	2 parts of yellow.
1 part of black.	1 part of black.
1 „ yellow.	1 „ white.

The equal quantities constitute quite a drab blend. In this example there is first the association of the black and white

elements constituting mid grey, which receives additional lustre from co-mixture with yellow, which tinges the whole composition a drabbish olive. An agreeable variation may be made by employing a bright tan in the place of yellow. On allowing the black element to preponderate, as in No. VI. blend, a much darker result is attained, one, however, in which the olive cast is preserved, though the bulk of the composition is dark grey. A pleasing mixture ensues when white (No. VII. blend) is made the maximum element. It is soft and bright in colouring, and of extensive utility in the production of fancy yarns and fine worsted textures. Perhaps when yellow is the main shade (No. VIII. blend) the cast of the mixture assumes a too ochre-like aspect, but the yarn resulting from this composition has nevertheless its specific province in woven design.

Black and white mixed with blue form a valuable series of mixtures, more or less applicable to all classes of fancy goods. When the quantities of the several shades are equal (1 part black, 1 white, 1 blue), the mixture formed is of a peacock blue tone, streaked with grey. This mixture may be applied both as a fancy and as a ground shade, according to the texture being produced. Increasing the black (2 parts of black, 1 white, and 1 blue) results in the formation of a dark bluish grey, applicable to a large variety of fabrics. By giving preponderance to the white (2 parts of white, 1 black, and 1 blue), a slatish blue grey is obtained, which, in combination with certain brown mixtures, is capable of forming elegantly coloured patterns. When the blue element is the principal hue (2 parts of blue, 1 black, and 1 white), the mid grey, constituting one-half of the compound, assumes a mellow, quiet blue tone, making a mixture specially appropriate for goods, in which cheerful but soft colouring is an important feature of the design.

It is evident, from these examples, that a wide field of colouring is opened up in the admixture of black and white with the primary colours. In the illustrations considered, only four sets of proportions have been dealt with, but by multiplying these it will be obvious that an endless diversity of results, even with these five shades—black, white, red, yellow, and blue—can feasibly be acquired. But when it is taken into account that

other hues besides those named are used in combination with black and white, it will at once be seen that the possibilities of this preliminary method of combining colours for textile work are largely increased. The subject cannot be followed further than the secondary colours at this stage: these, in conjunction with the primary combinations just described, will give a fairly comprehensive view of the styles of compound shades obtained in practice by this system.

In the first place, allusion may be made to the admixture of orange with black and white. Should the quantities be equal (1 part black, 1 white, and 1 orange), a drabbish grey is produced, a degree warmer in hue than if yellow were the colouring factor. On doubling the quantity of the black element (2 parts black, 1 white, and 1 orange) a greyish olive mixture tinged with a reddish tone is formed; while a light fawn mixture is produced if the white preponderates (2 white, 1 black, and 1 orange). A tannish grey composition, suitable for fancy yarns, results from the proportionate quantities being 2 parts of orange, 1 part of black, and 1 part of white.

Green, when associated with black and white on this system, does not constitute mixtures well adapted for yarns for fabrics of a heavy description, but yields compounds useful in the decoration of dress and other thin textures. These blends partake of a species of mellow, mingled, greenish grey. Such blends are more pleasing to the eye in woven fabrics than solid green, possessing a softer, quieter, and a more satisfactory tone. Beginning with white, black, and green, equally compounded, a mixture is obtained that may be appropriately described as a slatish green, the grey element imparting to the blend a rich mellow cast. By increasing the black factor (2 black, 1 white, and 1 green), the slatish tone is augmented, because it is due to the association of this shade with the green element of the blend. As black is, in this instance, the principal shade, the mixture, while mellow and greenish, is decidedly deep and full in tone. The employment of white as the leading shade (2 parts of white, 1 black, and 1 green) yields an interesting combination between a pea and a slate green. If the yarn made from this mixture, were associated in the same pattern with

that resulting from blend No. III. of the red series, an exquisite assortment of tints would be obtained. It is by blending the yarn product of one combination with that of others that attractive colourings are arrived at. When the proportions are 2 parts of green, 1 part of black, and 1 part of white, the compound has too greenish a cast to be of extensive use in textile designing, hence this mixture is chiefly used in the form of a fancy or lively thread.

Allusion has now only to be made to the purple-grey combinations. First, when the proportions are 1 part of black, 1 part of white, and 1 part of purple, a distinctly purple grey is produced, owing to the extraordinary potency and diffusiveness of this secondary. Making black the predominant factor, a more useful compound from a textile standpoint is acquired; perhaps slatish in cast, but, nevertheless, warm and cheerful in tint. Should white preponderate, a pure slatish grey, just tinged with the warm, lustrous hue of purple, ensues. These two last combinations, in addition to the mixture resulting from compounding 2 parts of purple, 1 part of black, and 1 part of white, are chiefly useful in the form of fancy threads. If purple is employed in grey mixtures, for tweeds, and other medium and heavy textures, it must be in lesser proportions than here given, indeed on the principle indicated in the examples supplied in Paragraph 66.

Many other colours besides the primaries and the secondaries are blended with black and white in the production of mixture yarns, but the illustrations that have been treated of, will enable the reader to arrive at methods of combining other tints or shades, than those supplied in these mixtures—the most useful of all compound shades—namely, light, medium, and dark greys.

69. *Two-Colour Mixtures.*—Next to the series of blends obtained by combining black or white with another colour, mixtures resulting from associating two colour elements are the most commonly produced. In addition to being the least costly of all fancy mixtures, into which black and white are not imported, they are neat, simple, and elegant in composition. Examples are given in Nos. 7, 8, and 9, Plate XIII. The first is compounded

of 3 parts of bright brown and 2 parts of lavender; the second of 4 parts of claret and 1 part of gold; and the third of 3 parts of tan and 1 part of drab. In mixtures of this class, one shade should always be chosen for constituting the bulk of the compound; and this, of course, should be of such a character as to be suitable for application to fabrics intended for wearing purposes. Turning to these examples, it will be seen that shades of this kind have been adopted as the principal factors, for in one instance, dark brown is the body colour, in another claret, and in the third instance, tan. So that this law of using a comparatively mellow and unostentatious colour for the bulk of the combination has, in this type of mixtures, almost universal application. Alluding specially to the brown-and-lavender blend, the object here has been to secure an intermingled shade of rather more than medium depth. Both colours are prominent, yet they constitute quite a new shade of recognized utility in textile manufacturing. In the claret-and-gold mixture, claret largely predominates, and imparts depth and body of tone to the resulting compound. The function of the gold-coloured fibres is essentially to brighten and freshen the whole. The last example is quite a distinct species, having no common elements with the two preceding, beyond the fact that it only contains two factors of colouring, tan and drab. As these shades are more or less allied in hue, the mixture acquired by combining them is slightly wanting in diversity of tinting; yet it is a style of blend admirably adapted for producing fancy yarns for light goods in woollen materials. Two shades of brown, blue and slate, and olive and drab, similarly blended, would all form creditable mixtures. Some of the Bannockburn blends only contain two colours, though apparently full of variety of tinting. The peculiar nature of the wool fibre substantially contributes to the richness and elegance of these two-colour compounds.

70. *Multi-Shade Mixtures.*—The general principles of the art of blending have now been explained, and it is not needful to treat extensively of the remaining kinds of mixtures. By the aid of further illustrations, the methods of combining any reasonable number of colours in the constitution of “stock” for fancy yarns, may be indicated. First, consider the claret-brown

blend given in No. 10, Plate XIII., and composed of 4 parts of claret, 1 part of drab, and 1 part of gold. The colours combined not only harmonize when mixed, but also when separated. If any one of the colours were removed, the combination would be incomplete, showing the perfect union of the tints selected. Should four colours be blended, increased freshness and lustre of combination may be acquired, as is instanced by No. 11, which consists of 4 parts of black, 2 parts of drab, 1 part of scarlet, and 1 part of white. As in the previous example, a dark shade is here employed for the bulk of the mixture, the other tints combining to impart brightness to the whole colouring. The touch of scarlet is very appropriate, giving warmth and tone; the drab is useful as a filling-in factor, while the black and the white give that general mellowness which characterizes the whole blend. Another example, No. 12, of a dark description is a compound of three colours, blended thus:—

2 parts of purple.  
 1 part of orange.  
 $\frac{1}{2}$  a part of warm slate or smoke colour.

The orange should be verging on scarlet, and the purple possess a claret-like hue. A pleasing mixture is thus acquired, one in which the distinguishing features are mellowness and beauty of tone, combined with warmth and richness of composition. Purple and smoke colour are utilized in furnishing that peculiar varied tinting that constitutes the main element of the mixture, while the orange introduced affords brilliance, bloom, and warmth of hue. Other combinations are as follows:—

## DARK BLENDS.

I.	II.
4 parts of brown.	4 parts of brown.
2 „ light brown.	1 part of sage.
1 part of lavender.	1 „ scarlet.

## III.

6 parts of maroon.  
 1 part of medium green.  
 1 „ scarlet.  
 1 „ bright blue.

## MEDIUM BLENDS.

I.	II.
4 parts of brown.	4 parts of claret.
2 „ light olive.	3 „ white.
2 „ white.	1 part of gold colour.

## III.

8 parts of black.
2 „ white.
3 „ orange.

## LIGHT BLENDS.

I.	II.
4 parts mid brown.	2 parts of brown.
1 part of drab.	2 „ white.
1 „ white.	1 part of fawn.

## III.

4 parts of chocolate.
5 „ white.
2 „ orange.

71. *Twist-Yarn Mixtures.*—Recurring to the three great classes of mixtures defined at the beginning of this chapter, twist-yarn mixtures were included in the second group. For many reasons they are not so extensively produced as raw-material mixtures: thus, they are more costly; they do not generally yield such elegant effects; and they lack that brilliance of colouring so universally characteristic of the latter description of mixtures. The twist used for this purpose includes two-, three-, and four-ply yarns, and curl, knop, cloud, and other fancy threads. Black and white twist mixtures in woollen, worsted, and cotton goods are extremely common. A more marked, and perhaps more streaky class of effects, is obtained by using these yarns than by employing mixture threads. If the twists were of the cloud kind, real spangles, more or less elongated, of black and white shades would be formed in the woven fabric; whereas if curl twists were adopted, loops of black and white would be irregularly spread over the surface of the cloth. Generally, the most elementary weaves are used in the construction of these

goods, such as the plain make, and the common four-end and six-end twills. In worsteds, large quantities of these mixtures are made, the finest of these threads yielding a satisfactory species of intermingled colouring.

72. *Marls*.—A series of grey and coloured mixtures obtained by the second method of blending (Class C, Par. 55) is illustrated in Plate XIV. These yarns show the principle of obtaining a marl mixture worsted thread, after combing and drawing, or in the operation of roving. An intermediate style of mixture is thus produced between that due to blending coloured slivers in drawing, and that due to folding or twisting two or more coloured yarns into a compound thread. The blending of the coloured elements is not, on this system, so complete as by the first method; nor yet are the specks of colour so distinct as in mixture yarns obtained in twisting. “Marls” made in this way are combined in stripe and check patterns with similar mixture yarns developed by doubling or folding.

The proportionate quantities of black and white in Series A and A', and of black and a colour in Series B, B' are as follows:—

## PLATE XIV.

## MARLS, SERIES A AND B.

Specimen I.	= 1 black thread twisted with 1 marl thread = 25% white or colour and 75% black.
„ II.	= „ „ „ „ = 50% „ „ 50% „
„ III.	= „ „ „ „ = 75% „ „ 25% „
„ IV.	= 1 marl = white or colour 25% and black 75%; twisted with 1 marl thread = 25% white or colour and 75% black.
„ V.	= 1 white thread twisted with 1 marl thread = 25% white or colour and 75% black.
„ VI.	= „ „ „ „ = 50% „ „ 50% „

## MARLS, SERIES A1 AND B1.

Specimen I.	= 1 marl thread = white 25%, black 75%; twisted with 1 marl thread = white 25%, black 75%
„ II.	= „ = „ 50%, „ 50%; „ „ = „ 25%, „ 75%
„ III.	= „ = „ 50%, „ 50%; „ „ = „ 50%, „ 50%
„ IV.	= „ = „ 75%, „ 25%; „ „ = „ 50%, „ 50%
„ V.	= „ = „ 75%, „ 25%; „ „ = „ 75%, „ 25%
„ VI.	= 1 white thread twisted with 1 marl thread = white 75%, black 25%.

In Nos. I. to V., Series A' and B', each yarn is composed of two marl threads twisted together, but No. VI. consists of a white thread twisted with a marl; and in Series A and B, Nos. I., II., and III. are composed of a marl and black: No. IV. of two marls, and Nos. V. and VI. of a marl and white.

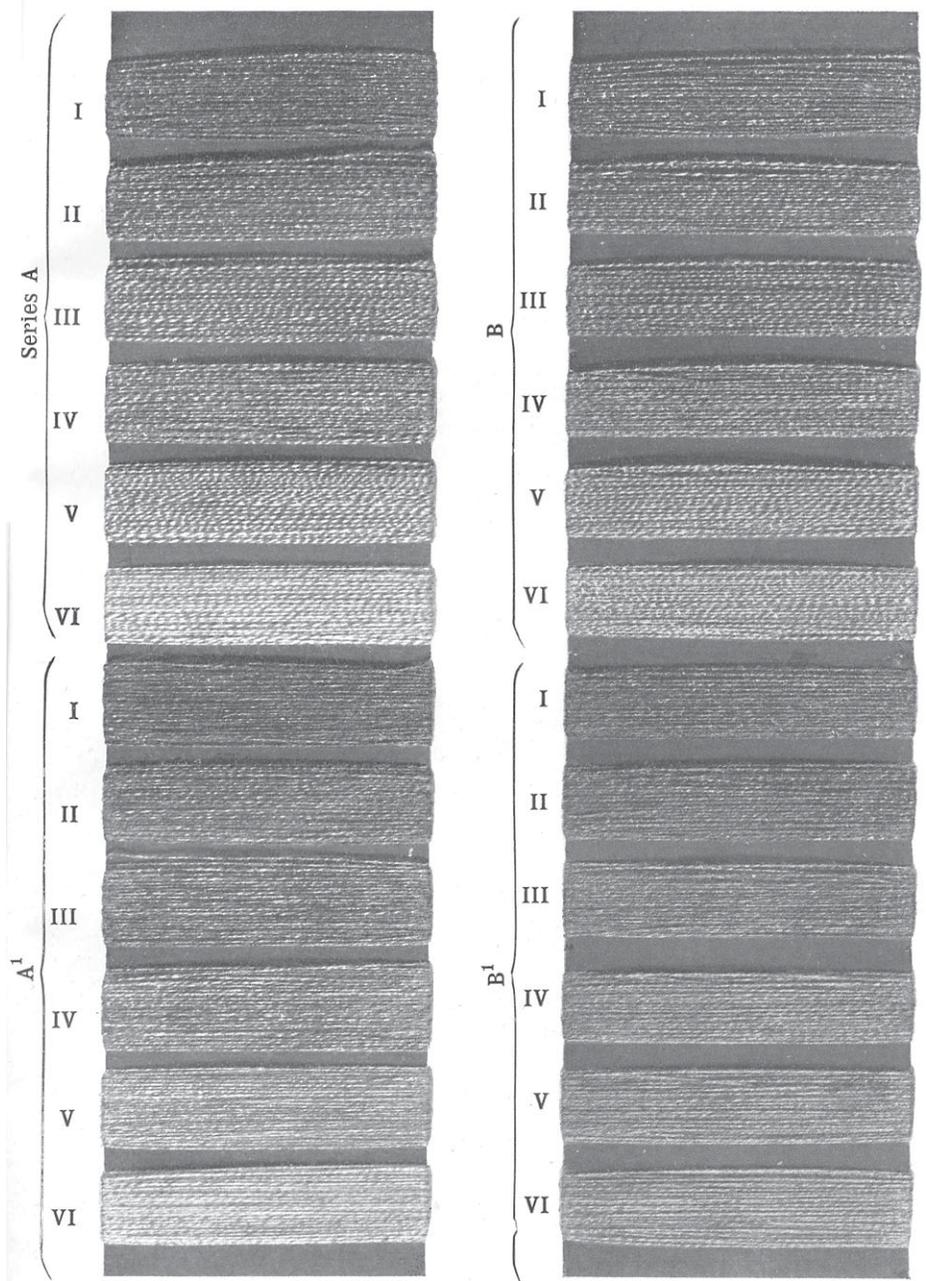


Plate XIV  
SPECIMENS OF "MARL" YARNS

73. *Weave Mixtures*.—These are least manufactured of any of the three classes of mixtures. They result from intermingling self-coloured yarns in the loom. Plain and other elementary weaves are alone suitable for producing these effects. It is usual to have the warp of one colour, such as grey, and the weft of two or more colours; or the warp of two or more colours, and the weft of one. In neither of the two foregoing classes of mixtures could anything approaching a repetition of effect be traced in the woven sample, whose surface is invariably one mass of mottled tinting. For an analysis of the principles on which these patterns are acquired, the reader is referred to *Woollen and Worsted Cloth Manufacture*.

## CHAPTER VI.

### ELEMENTS OF TEXTILE COLOURING—STRIPES.

74. Colours applied to Textiles on Various Systems—75. Types of Woven Colouring—76. Single Weave Colourings—77. Colour in relation to Backed, Double, and Compound Cloths—78. Colour applied to Single-make Figured Fabrics—79. Fancy Shades applied to Backed and Double Weave Combination Designs—80. Colour in Designs in which the Figures are produced by the Weft Yarns—81. Figured Effects obtained by Warp Colouring—82. Colour in Textiles Figured by both Warp and Weft Yarns—83. Pattern Design—84. Styles due to Colouring only—85. Stripes—86. Checks—87. Mixtures—88. Figures—89. Classes of Striped Patterns—90. Hairlines—91. Compound Hairlines—92. Stripes composed of Longitudinal and Transverse Lines—93. Stripes composed of Two Colours—94. Stripes composed of Three or more Colours—95. Irregular Stripes composed of Black and White Yarns—96. Irregular and Indefinite Stripes in Two Colours—97. Irregular Stripes—Shades in Two Colours—98. Shaded Stripes in Two Colours—99. Irregular Stripes containing several Colours—100. Shaded Stripes in several Colours.

74. *Colours applied to Textiles on Various Systems.*—There are numerous methods of introducing colours and fancy shades into woven patterns. According to the kind of fabric being produced, the nature of the materials composing it, and its structural arrangement, the scheme of colouring practised varies. Suitings, trouserings, mantlings, dresses, vestings, shawls, rugs, carpets, and other important typical textures, are all coloured on distinct principles. Worsteds are not treated in a colour sense precisely on the same system as woollens, nor silks as cottons. Simple weaves allow of more varied colouring than diagonals and other intricate crossings; figured designs of a floral or geometrical character, than those resulting from combining several small weaves; single-make than double- and treble-make patterns; ordinary decorative fabrics, than plushes and lenos, and so on. Yet there are some principles of textile colouring common to all species of woven design. Certain methods of

grouping yarns in elementary plans of interlacing warp and weft yield, under all conditions, the same style of effects. As a well-known combination of lines makes the key pattern, so in textile designing there are methods of classifying and uniting shades which cannot but produce one form of pattern. While in subsequent chapters it will be needful to specialize and indicate the complex modes of colouring practised by the weaver, here the general principles of the art will be simply expounded.

75. *Types of Woven Colourings.*—All varieties of textile colourings may be classified under two great heads, which are capable of subdivision, as in the Table appended.

## TABLE VII.

## ILLUSTRATING THE TYPES OF WOVEN COLOURINGS.

## I. COLOUR IN SIMPLE AND FANCY WEAVES.

(A) *Single-make Cloths.*—Woollen, worsted, cotton, linen, and silk textures, in plain, twilled, mat, sateen, corkscrew, leno, diaper, and other weaves.

(B) *Backed, Double, and Compound Cloths.*—Effects produced principally for men's wear, in both woollen and worsted yarns; also rugs, travelling maudes, winter mantlings, and blankets.

## II. COLOUR IN FANCY AND FIGURED PATTERNS.

(A) *Single Fabrics.*—Stripes, checks, and drafted patterns for dresses, mantlings, ulsterings, blouses, and other textures.

(B) *Backed, Double, and Combination Patterns.*—Woollen and worsted patterns for men's garments; shawls, mantlings, rugs, "Kidder," Scotch, and other carpets; also damasks and decorative fabrics.

(C) *Figured Patterns Coloured in the Weft.*—Vestings, dresses, matelasses, and cords.

(D) *Figured Patterns Coloured in the Warp.*—Spotted and figured styles of various descriptions in simple and complex makes, fancy dress patterns, mantles, plushes, velvets, astrachans, and carpets.

(E) *Patterns in which the Figure is developed by both Warp and Weft Colouring.*—Silk and worsted robes, and elaborately ornamented patterns in an endless diversity of textures and materials.

76. *Single-Weave Colourings*.—The single-make cloths, named in Group *A* of the first class of coloured effects, are textures not only single in structure, *i.e.*, not backed, but composed of one weave of a simple character. Here some of the most elementary types of textile colouring occur. Many of the patterns produced in these weaves are due to the arrangement of the shades of the warp and weft. They form a species of woven design which is purely technical in construction. The artistic knowledge requisite to their origination is exercised in the selection and combination of colours. As regards the elements which give the pattern its form or outline, these are solely of a technical nature, and relate to dexterity and ingenuity in the invention of novel plans of cloth construction, and of applying to such makes those schemes of colouring which will most effectively develop their structural composition. This class of textile pattern may be described as Woven Colour Design, for it is one in which the all-important principle consists in devising new systems of shade arrangement and distribution. When considering pattern as obtained in simple weaves, this feature of design is the most prominent for examination. Scotch tweeds, as well as various classes of fancy woollens for suitings, trouserings, and flannels, some styles of cotton fabrics, and a considerable diversity of worsted, silk, and linen fabrics, are examples in this style of pattern. The more or less complex nature of these textiles is determined by the intricacy of the weave employed, and the plan of grouping the shades. Irregular makes or crossings, such as diagonals, fancy twills, diamond and broken weaves, are more difficult to treat with colour than simple twills and hopsacks. The comprehensiveness of this type of textile colouring will be evident when it is mentioned that in the plain weave, and the cassimere twill, there is practically no limit to the variety of patterns obtainable in stripes, checks, diagonals, small figures, mixtures, spotted, and other styles.

77. *Colour in relation to Backed, Double, and Compound Cloths*.—The fabrics named in Section *B* of Part I. of Table VII. are much more intricate in structure than those alluded to in the previous paragraph, and hence require greater technical skill in colour treatment. As these cloths are multi-ply in the weft,

in the warp, or in both warp and weft, they can only be economically and advantageously coloured when their build or structure is thoroughly understood. The yarns employed in the composition of the face pattern have to be kept distinct from those forming the back of the fabric, and *vice versa*. Frequently, the colouring of the face forms a different style from that on the back, in which case a combination of at least two principles of colouring takes place.

The range of patterns in these makes is very diversified, but it is confined to a somewhat limited class of goods, as indicated in the Table. Winter fabrics for men's and women's wear are the principal goods to which these weaves are applied, so that for climatic reasons light and fancy patterns are only exceptionally in demand, a fact which somewhat simplifies the application of colour to these styles. Some heavy tartan travelling rugs and wraps are also constructed in this type of weave. In the ordinary backed textures composed of one make on the face, the patterns are mostly of a simple stripe or check arrangement, but in rugs and heavy cloths elaborate and complex blends of shades obtain.

78. *Colour applied to Single-make Figured Fabrics.*—These form the A Group of textures given in Part II. of the Table. In addition to the effect in this instance due to association of colours, there is design or pattern produced by a combination of weaves differing in structure or build, and moreover in appearance in the woven fabric. The weaves may be arranged to form stripes, checks, and figures. The classes of goods to which these designs are applied are numerous, including trouserings and coatings in woollen and worsted yarns, fancy dress goods, mohair, silk, and other classes of mantlings, ulsterings, silk handkerchiefs, cotton textures, and decorative fabrics. The principles involved in this type of textile designing comprise the application of colour in the development of simple weave effects, and its introduction into designs composed of several weave elements to give precision and smartness of figuring. Before colour can be suitably applied here, its effect on the elementary crossings must be clearly apprehended. The designs containing various makes, such arrangements of fancy shades have to be used as will

emphasize exactly the several parts of the whole style, and not result in the suppression of some sections and in too bold a development of others. The larger the number of weaves entering into any single design, the greater the intricacy of colour application. When colour, in relation to the *A* Group of fabrics in the first section of the Table, is understood theoretically and practically, its functions and scope in this branch of designing may be readily mastered.

79. *Fancy Shades applied to Backed and Double Weave Combination Designs.*—Winter goods of a figured order for apparel are included in Group *B* of the Figured Patterns. This class of textiles also comprises some styles of shawls, mantlings, and rugs. Many types of striped trouserings, in which two double makes occur, come within the scope of this useful group of textiles. Generally, if the method of colouring is simple, the combination of weaves is diversified; but should the latter only comprise a few elements of weaving, more complex schemes of colouring are requisitioned. This order of patterns, moreover, includes certain species of textile effect not producible by having recourse to any other principle of weaving, but those appertaining to double-cloth combinations. Regarding the style of figuring feasible, it may be either elementary or elaborate in arrangement. Every description of ornamentation can be developed, from the simplest rectangular pattern to the most fantastic and complex blend of floral and other forms. It is this feature of this principle of design and colouring which makes it useful in the production of various kinds of reversible fabrics—textures figured and wearable on both sides, such as shawls, Austrian blankets or rugs, and carpets. Yet while the application of colour to these designs may yield these elaborate loom productions, the same scheme of colouring applied to the identical type of weave designs, may give such patterns as obtain in fancy trouserings, suitings, mantlings, and ulsterings of infinite variety of style. The structure and weave composition of these fabrics, and modes of gaining effects in them by colour, will be explained in detail later.

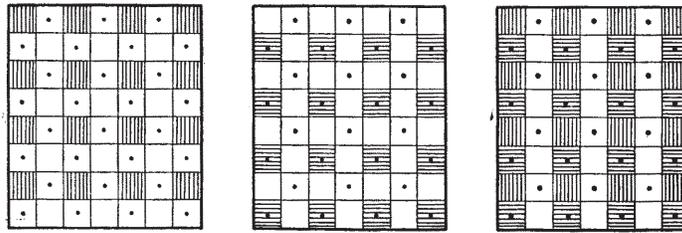
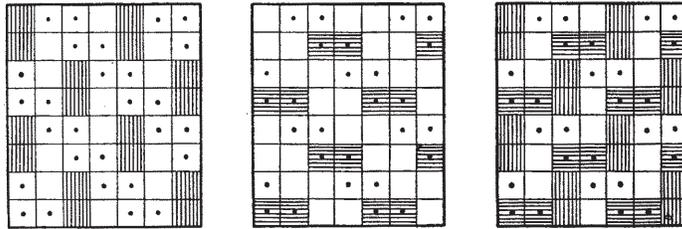
80. *Colour in Designs in which the Figures are produced by the Weft Yarns.*—In Group *C* the Textiles mentioned are vestings,

dresses, matelasses, and curl fabrics. This is an interesting type of weave design in which colour is of great utility in developing the integral parts of the figures composing the pattern. Warp yarns in these goods are only of secondary importance, the figured elements of the styles being solely the product of the weft yarns. These are, therefore, of various shades, while the warp is generally, although not necessarily, of one colour. Strictly speaking, these fabrics may be several fold in the weft, but they are invariably single in the warp. The extreme fancy character of the textures to which this principle of designing and colouring is applicable, is indicative of its scope. It is specially useful in fancy vesting styles, and is absolutely essential to the construction of one important class of matelasses, and also invaluable in the weaving of some kinds of curl cloths made for mantlings.

81. *Figured Effects obtained by Warp Colouring.*—This is the reverse of the preceding principle of intertexture. All the fabrics enumerated in Class *D* are constructed on this system. They have one weft and several warps, the number of the latter varying according to the multiplicity of colours forming the pattern. Warp colouring is applicable to an extensive variety of fabrics. Commencing with the simplest type first, this system of colouring plays an important part in spotted designs, or patterns in which the distinguishing feature is a series of spots or minute specks of bright colours. These effects appear in suitings, mantlings, dresses, and cotton goods, including fabrics for small-ware purposes. Very elaborate dress styles are also figured by several sets of warp colourings. Here the weft is a sort of binding agent, uniting into one compact and firm fabric the various elements of warp colouring. Velvets and figured plushes, comprising astrachans and pile goods made in imitation of animal skins, in addition to Brussels, Axminster, and velvet-pile carpets, owe their design composition to the employment of two or more layers of warp threads.

82. *Colour in Textiles Figured by both Warp and Weft Yarns.*—This is the most comprehensive of all classes of textiles to which colour is related. The most elaborate patterns made in the loom, and the most costly, are the product of combining both warp

and weft colouring. It is quite evident, on consulting Table VII. of the different types of textile colouring, that, in theory, the *E* Group of fabrics results from combining the systems of weaving included in Groups *C* and *D*, but, in practice, as subsequent analysis will demonstrate, other details of designing and colouring are involved in the execution of this class of fabrics than those here comprised. As this species of colouring finds expression in all the types of figured woven effects specialized in the above mentioned styles of fabrics, it is useless to

FIG. 5.—*A, B, C.*FIG. 5.—*D, E, F.*

attempt further classification. These styles are intricate in build and unique in principles of intertexture. Usually, they are neither purely double, nor yet purely single in construction, but embrace schemes of designing and colouring, such as may only be mastered by those who previously study the former fabrics to which colour is applied, and which are named in Table VII.

83. *Pattern Design.*—This style of pattern results solely from the methods of grouping fancy warp or weft yarns, or both these elements of textile fabrics. It may be appropriately designated “Colour” to distinguish it from “Weave” design;

for, if the colours are removed from such patterns, all effect is destroyed. Colour here yields both the form of the design and the beauty of the style. No type of textile designing is more extensively utilized than this, for the styles resultant are characterized by neatness and by great utility. Pattern design relates not only to the artistic grouping or blending of shades, but to their arrangement. The latter is a factor which has to be suited to the build of the weave. The same plans of colours are capable of yielding quite distinct effects in two different weaves. Fig. 5, *A*, *B*, and *C*, and Fig. 5, *D*, *E*, and *F*, demonstrate this important principle of textile colouring. The weaves (marked □'s for weft) are plain in Fig. 5, *A*, *B*, *C*, and  $\frac{2}{2}$  or cassimere twill in Fig. 5, *D*, *E*, *F*. The effects of different marks in the sketches, and also the methods of warping and wefting, or the order of colouring, are stated in the following Table:—

TABLE VIII.  
ILLUSTRATING THE EFFECTS ON THE PLAIN AND  $\frac{2}{2}$  TWILL WEAVES OF THE CHANGING OF THE ORDER OF WARPING AND WEFTING.

Section.	Warp.	Weft.	Effect in Sketches.
<i>A</i> and <i>D</i> Fig. 5	1 thread grey 1 ,, white	White	□'s = white warp over white weft. ▣'s = grey ◻ = white weft over grey and white warps.
<i>B</i> and <i>E</i> Fig. 5	White	1 pick grey 1 ,, white	□'s = white warp over grey and white wefts. ▣'s = grey weft over white warp. ◻'s = white ,, ,,
<i>C</i> Fig. 5	1 thread grey 1 ,, white	1 pick grey 1 ,, white	□'s = white warp over grey weft. ▣'s = grey warp over white weft. ◻'s = white weft over white warp. ▣'s = grey weft over grey warp.
<i>F</i> Fig. 5	1 thread grey 1 ,, white	1 pick grey 1 ,, white	□'s = white warp over grey and white wefts. ▣'s = grey ◻'s = white weft over grey and white warps. ▣'s = grey ,, ,,

The arrangement of the yarns in the examples is the same, but the weave structures are dissimilar. The plain make so

determines the crossing of the warp and weft yarns, that the white picks always float under the grey threads and over the white threads, while the grey picks always float under the white and over the grey threads, hence the solidity of the respective lines of colour is uninterrupted, and a pattern produced of a simple stripe order. Coming to the twill weave, it distributes the colours differently. Each pick floats over and under two threads at a time, so that the picks at every interlacing cover, or are covered, by both a grey and a white thread. Let it now be shown what is the result of this. Supposing the first thread and pick to be grey (Fig. 5, *F*) and the second thread and pick white, then, if the effect of the interweaving of the first pick is traced, it will be obvious how it forms part of the minute diagonal pattern sketched in Fig. 5, *F*. This pick floats over a grey and a white, and then under a grey and a white thread, so that a small transverse line of grey is formed equal in length, not to a float over *two*, but *three* threads, for although the extent of the weft float is two, yet the grey thread adjoining it enlarges it in effect to three. Next take the second pick. It floats over the second and third threads, and, being white, makes a transverse line of this shade of similar dimensions to the preceding pick, because the fourth thread in the warp is white, and in the texture is added to the two-weft float. If picks three and four are examined, it will be noticed that they give like results, only the positions of the small lines of colours are moved one thread in each case to the right, causing the diagonal effect in the fabric to move to the right. Analyzing the first and second threads, it will be seen that they make short vertical lines, equal in length to flushing over three picks in succession. Take the first thread, which is grey: it is depressed on the first pick, being covered by the grey pick, then up twice; the second thread is also down on the first pick, then down on the second pick, being covered by the white weft, and afterwards elevated over picks three and four, forming a float of white of the same size as if the thread had flushed over three succeeding picks.

These illustrations show how the structure of the weave modifies the effect of the colours. This relation of weave to colour, as regards systems of arranging fancy shades, is one of

the technical elements of textile colouring. Weaving principles cannot be ignored; they must always be considered, as they are capable both of destroying or of beautifying a set of colours.

Pattern design also relates to the invention of novel methods of grouping fancy threads, or to the assortment and distribution of the several colours in both warp and weft. Independent of the somewhat subtle question of harmony of tints which has to be considered here, such schemes of blending warp and weft threads of appropriate colours have to be devised as will give various styles in the same order of colourings and the same weave. By a modification of the plan of combining the yarns great variety of pattern may be obtained. Even when limited to this mode of producing pattern in the loom, novelty and force of style is feasible. The simplest alteration in the grouping of the threads frequently gives quite a new cast to the design. There are three features of Pattern Design that are intimately associated with the character of the pattern originated: I. the selection of appropriate shades; II. their classification and arrangement as to quantity; and III. the invention of such a plan of combining these colours in the fabric as will be in accordance with the construction of the weave or design composing the cloth.

84. *Styles due to Colouring only.*—The patterns produced wholly by varying the plan of associating colours in textiles may in a general sense be grouped under four heads, viz., Stripes, Checks, Mixtures, and small Figured Effects. These designs obtain in a large variety in all kinds of materials.

85. *Stripes.*—Treating of each description of style analytically, stripe patterns may be primarily examined. They consist of bands or lines of different shades, varying in width, running lengthways of the fabric, that is, in the direction of the warp. The distinctive characteristic of a stripe is its line-like composition. All patterns of this order are nothing more than a blend of lines of divers shades and of various dimensions, extending from end to end of the piece. For trouserings, suitings, and some styles of dress and mantling cloths, no form of pattern is better adapted. The prominence of the several bands of colour, their solidity and distinctness, or their intermittent character and subdued or toned aspect, are all qualities depending on the structure of the fabric

and its weave composition, which will be subsequently noticed. If the pattern in striped styles is principally a warp product, the weft is only a supplementary feature of the design, being employed, firstly, to bind the warp ends together and thus form a wearable fabric; and, secondly, to constitute an appropriate groundwork on which the warp colourings may be correctly developed. Proper emphasis of the colours composing the stripes is acquired by employing a suitable shade of weft, and by adopting that system of crossing or weaving which will, in addition to yielding the requisite strength and firmness of fabric, sufficiently interfere with the continuity of the fancy shades introduced into the warp. Stripes are of various dimensions and arrangements. Some are mere lines, and no wider than the diameter of the threads employed; others are many inches broad. One colour may be so introduced as to form bands of different widths. Thus, if brown and black were the colours at command, they could be so combined as to give styles of several descriptions in which the bands of the respective shades would always be of corresponding widths; or they might be combined on such a principle as to form sets of stripes of variable sizes. To a considerable extent, the character of these patterns is governed by the class of texture in which they appear. Instances of this occur in the various fabrics produced in the loom. Generally, for example, stripes for trouserings are not wide, but of small and medium sizes, and soft and neatly toned in colouring. For ulsterings, dresses, and mantlings, much broader effects, more elaborate in arrangement, and of greater force of colouring, are required. In cotton blouses, small styles are the most valuable, but in cotton fancies for dresses there are no definite limits to the width of the stripes and to the intricacy of the plan of colouring.

86. *Checks*.—These may be considered as forming the second great class of patterns in which colour is the all-important element. Of course reference is only made at this time to that type of check in which the weave is a simple factor. No allusion is made to, or consideration taken of, weave compounds which of themselves will form a species of check. The checks now being examined are those resulting from adopting the same or a

similar order of weft as warp colouring. In other words, if the arrangement of warp yarns were 10 threads of black and 2 threads of white, the weft would be the same, forming a solid square of black, surrounded by a skeleton square of white. The term "check" is suggestive of the appearance of these styles and of the scheme of their construction. The warp colourings, however complicated in arrangement and diverse in composition, to produce a perfect check must be crossed or "checked," as the operation is technically called, in precisely the same manner and by exactly the same shades in the weft. The plaids on Plates V. and X. are typical examples of the principles of checking. Here it is evident that each set of colours in the warp when woven with corresponding shades of weft forms a square of colour perfectly solid. The blue threads of warp and weft make blue checks; the green, squares of this colour; and the black and yellow also checks of these shades. The size of the check is determined by the mode of grouping the yarns, the coarseness of the texture, and the thickness of the yarns of which it is composed. Many of the principles of woven colouring applicable to stripes also apply to checks, which strictly speaking are patterns striped both in transverse and lineal directions.

87. *Mixtures*.—The mixtures implied here may be defined as small all-over effects in which the various colours used are so fully co-mingled that the particular part played by any one colour is not observable. They require the most mellow treatment of all coloured styles. Nothing of a loud character succeeds, nor appears attractive in these textures. Mellow, smart, and choice combinations are desired. The pattern should present not so much a patchy, as a rich and tinted appearance—every colour utilized in its formation associating with its neighbours to compose one indefinite blend of minute effects. To produce styles of this order no single colour should be distinct and louder than the rest, nor be allowed to intrude on the eye more than another—complete harmony of colouring and uniformity of tone are absolutely essential. But one shade more pronounced in tint or more powerful in hue—being of a deeper intensity than its associates—is sufficient to destroy the beauty of the whole combination. This being the case, the system of mixing the

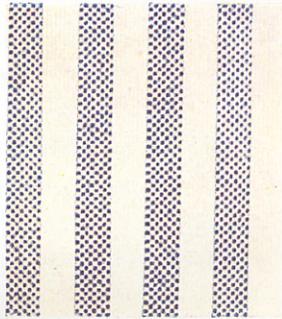
several shades must be such that all colours will be equally emphasized; for evidently lack of equality in the prominence of the various colour elements amalgamated, destroys the essential character of these useful and valuable styles.

Mixtures obtain principally in woollen yarns, whose fibrous surfaces are well adapted for mixing the hues combined thoroughly, and without producing a fabric in which the colours form patches or spangles of variable sizes and shapes. All mixture effects are minute in character, and are produced for suitings, dress fabrics, etc. In softness and mellowness of tinting, these are not comparable with similar styles resulting from using mixture yarns, but they form such an important description of woven pattern as to deserve specific analysis.

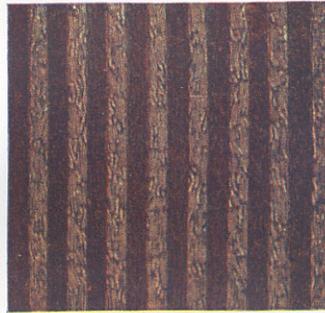
In Donegal (Pattern 1, Plate XXVI.) and other extreme fancy mixtures, specks of bright colour are obtained in the yarn, which give richness of character without that complete mixing of fibres which is the ordinary style of blend.

88. *Figures*.—Necessarily these are very minute in dimensions and limited in form. Perhaps they might be also appropriately designated spotted patterns, but as the figures are of definable shapes, and are arranged on various bases, the former term appears the more suitable. This species of colouring is applied to cotton and woollen and worsted fabrics. Invariably the weaves are of an elementary grade. In these, neat and minutely figured styles are developed in considerable variety. Thus in the plain weave alone, several distinct patterns are obtainable; while in the celtic, or mat, and in the cassimere and six-end twills somewhat more broken-up figuring is acquired, which for some makes of cloths is preferable to designs consisting of pronounced and decided forms.

89. *Classes of Striped Patterns*.—All kinds of striped patterns may be comprised in two classes, namely, Regular and Irregular styles. In the former (Fig. 11, *A*, and Fig. 12, *A*) the bands of colours, however numerous they may be, are of equal widths, but in the latter (Figs. 11 and 12, *B*, *C*, *D*, etc.) they vary to an indefinite extent. The several species of stripes resulting from blending colours will be treated of as follows:—



1



2



3

Plate XV

REGULAR STRIPES

1 and 2. Two-Colour Patterns

3. Four-Colour Pattern

I. REGULAR STRIPES.

- (a) Hairlines.
- (b) Stripes of two colours.
- (c) Stripes of three or more colours.

II. IRREGULAR STRIPES.

- (d) Patterns of two colours.
- (e) Patterns of three or more colours.
- (f) Shaded patterns composed of several colours.

FIG. 6.

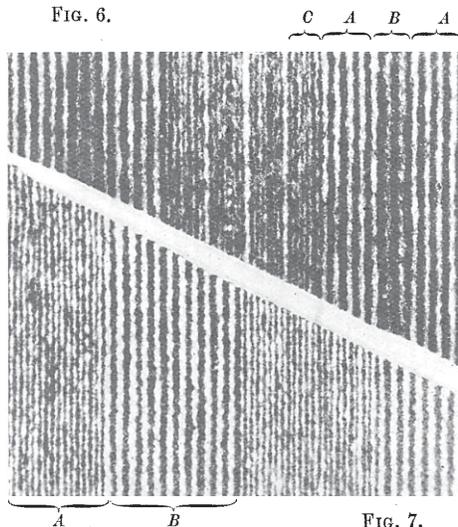


FIG. 7.

90. *Hairlines*.—These are the smallest striped patterns produced. The real hairline is composed of two colours, and is made extensively in woollen and worsted materials, but is also produced in cotton and other yarns. Standard hairlines are produced in the plain weave, prunelle,  $\frac{3}{1}$  twill, and the five-end sateen: also in mat and specially-constructed weaves. In the prunelle, three-line, in the  $\frac{3}{1}$  twill, four-line, and in the five-end sateen, five-line, or five-colour patterns are producible.

91. *Compound Hairlines*.—These consist (1) of two or more widths of lines with each grouped in series, of which Figs. 6 and 7, and Figs. 8 and 9 are types; (2) of hairline stripes combined

with fancy and irregular effects. Figs. 6 and 7 are both woven in the broken  $\frac{3}{1}$  twill, the former being coloured two-and-two in section *A*, 2 black, 2 twist in section *B*, and one-and-one in section *C*, the broad line of white being formed by grouping three white threads together. Fig. 7 is a compound of one-and-one and two-and-two warping, making the respective stripes *A* and *B*, which might be of any width and grouped together in various forms.

Fig. 8 is developed in mat weaves, arranged to produce two-

FIG. 8.

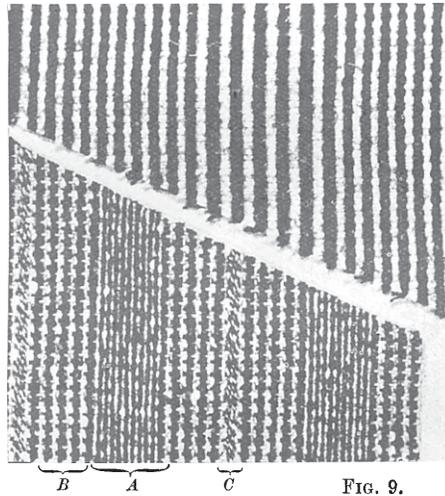


FIG. 9.

and-two and four-and-four stripings, grouped as sketched. Fig. 9 is a compound of hairline effect, one-and-one warping in the broken  $\frac{3}{1}$  twill, section *A*, and of two-and-two warping in the  $\frac{2}{2}$  twill, section *B*, with a fancy twist stripe, *C*, on the latter.

92. *Stripes composed of Longitudinal and Transverse Lines.*—This pattern—sketched in Fig. 10—is a derivative of the common single-cloth hairline. It is due to changing the positions of the colours in relation to the intersections of the weave. Analysis of the fabric shows that in Sections *A* the light threads float *over* the light picks and the dark threads *over* the dark picks; whereas in Parts *B* the opposite rule obtains, viz., the light

threads float *under* the light picks and the dark threads *under* the dark picks. As a consequence, the lines of colours in *A* are vertical, while those in *B* are horizontal. This arrangement of pattern is entirely due to the system of warp colouring, which is as follows:—

1 thread of grey.	}	<i>A</i> .
1 „ white.		
1 „ white.	}	<i>B</i> .
1 „ grey.		

The weft is 1 pick of white and 1 pick of grey throughout the pattern. Now as the plain weave has been employed, and is arranged to allow the white and grey threads in *B* to be crossed

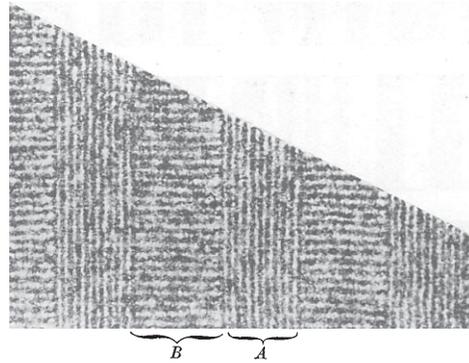


FIG. 10.

or covered by corresponding picks, it causes the same threads in *A* to float over the respective picks, producing this useful form of stripe, which is applicable to similar goods as those for which particulars are supplied in the preceding paragraph.

93. *Stripes composed of Two Colours.*—These are included in the elementary colour effects. A minimum amount of technical skill is requisite to their construction. The art of producing patterns of this description is confined to the selection and adjustment of appropriate shades. An illustration in the Regular order of stripes is given in No. 1, Plate XV. It is an Oxford shirting, the order of colouring being thus:—

<i>Warp.</i>	<i>Weft.</i>
16 threads of white.	All white.
16 „ blue.	

Such shades and tints as the following would form good patterns: No. 6, Plate IV., and white; No. 10, Plate IV., and white; and Nos. 12 and 16, Plate VI., and white. In each case white should be used for weft.

This class of pattern is largely applied to woollen and worsted textures. No. 2 on Plate XV. is an example. This style has

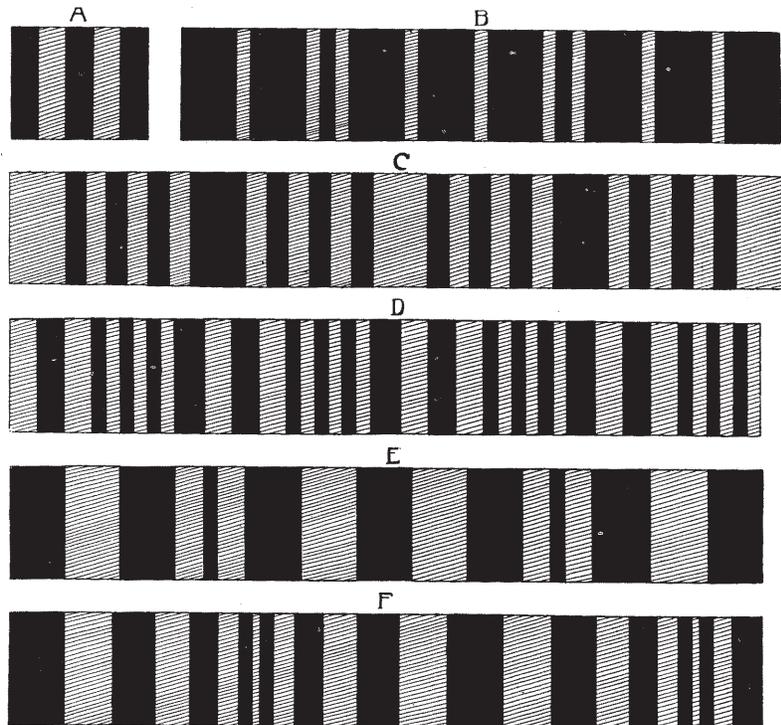


FIG. 11.—Stripe Patterns in Two Shades.

been produced in the five-end doeskin and has a dress-face finish. The arrangement of colours is:—

*Warp.*

10 threads of 20 skeins olive.

10 „ „ „ light olive.

*Weft.*

20 skeins olive.

Without multiplying illustrations, it will be evident how con-

siderable diversity of styles is attainable on this system by varying the width of the stripes and the colours employed.

Specimens of Irregular stripes in two shades are given in Fig. 11, *B, C, D, E, F*, consisting of lines of different sizes in two shades. It will be seen from these that the method of grouping the lines, as well as the dimensions, determine the form of pattern produced.

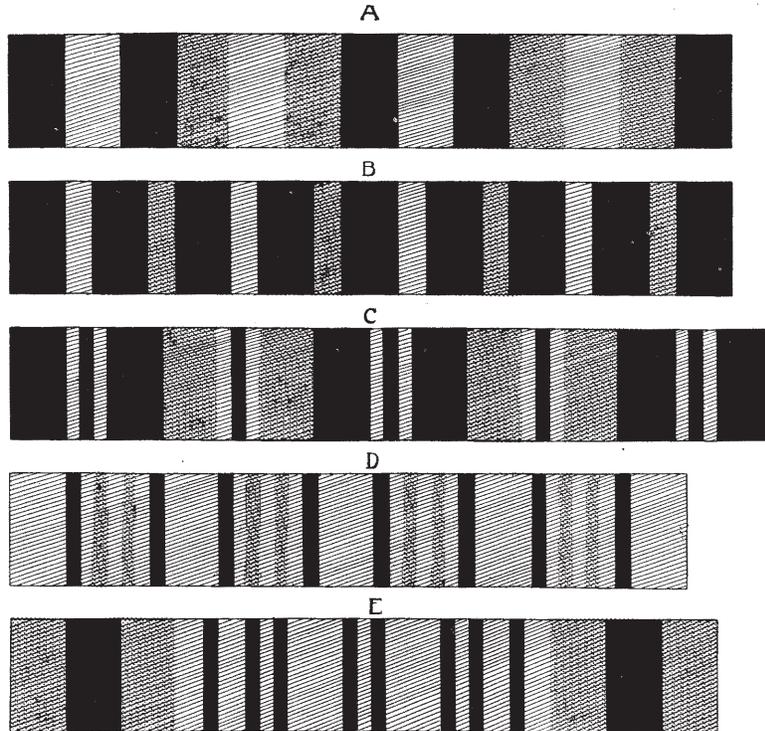


FIG. 12.—Stripe Patterns in Three Shades.

94. *Stripes composed of Three or More Colours* (Fig. 12, *B, C, D*, and *E*).—As a larger number of shade elements enters into this kind of stripe than that just described, it follows that the patterns are somewhat more intricate in composition. Yet, as the weaves used are invariably of the simplest type, and the widths of the stripes of different shades in the patterns may be the same, little technical complication occurs in their production. One illustration will sufficiently indicate the nature of this type (Regular stripes) of woven colouring, No. 3 on Plate XV. Four shades are present in this fabric—blue, tan,

slate, and crimson. The dark blue runs against all the shades and in this way an appropriate ground is produced on which the various shades may be developed. If slate were made the ground colour a totally different pattern would result; by changing the positions of the shades in this manner, a considerable range of styles is producible. These coloured examples and the forms of pattern in Fig. 12, show that this principle of colouring admits of extensive diversity of composition.

95. *Irregular Stripes composed of Black and White Yarns.*—

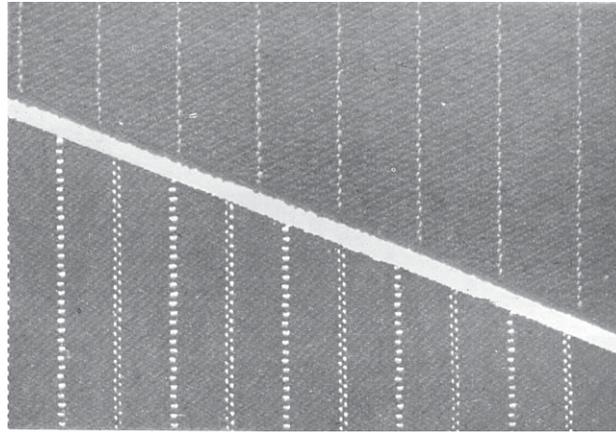


FIG. 13.

These patterns are far more diversified in construction than regular styles. Even when limited to the use of these shades, a great variety of design arrangement may be practised. The line stripe effects (Fig. 13) are woven in warp-face weaves, such as the ten-heald buckskin (Fig. 13A) and weaves of the cord and corkscrew type. The warp colouring for the upper pattern is—

38 threads of 2-fold 60's black worsted,  
 2 „ fine white silk, or worsted and silk twist,

the weft being a dark shade. Of course, any other two shades might be employed, *e.g.*, Nos. 1 and 3, Plate IV., and No. 13 and No. 15, Plate VI.

As illustrative of the different effects that may be obtained in

the same shades, Fig. 14 may be compared with the previous styles. It is a pattern over an inch in width, and composed of bands of three sizes. There are, first, bands *A*, containing twelve threads each; then bands *b*, containing six threads each; and, lastly, the small lines of white of two threads each. There are twelve white stripes: eleven stripes *b*, and one stripe of *A*, in each repeat of the pattern. Both this style, and those in Fig. 13, are of a decided character.

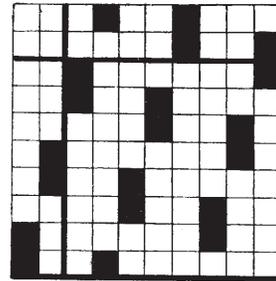
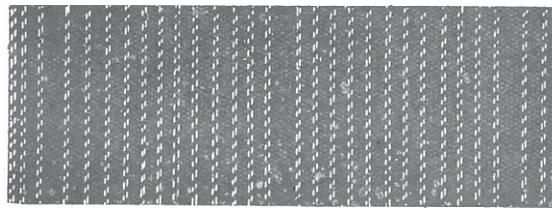


FIG. 13A.

Another type is that given in Fig. 14A. The dark grey, the grey, and the check lines of grey and white, all vary in size. There are, therefore, three types of effect; the centre stripe *A* has a dark line on each side adjoining the check stripe *B*; then follow stripes of grey and dark grey, gradually decreasing in size to line *C*, this being the order adopted on either side of the centre or leading stripe *A*. In one



A A b b b b b b b b b b b

FIG. 14.

sense, this pattern is on the graduated principle of combining lines of different widths, and working in two colours at each change. Stripes in three shades may also be formed on the same base.

96. *Irregular and Indefinite Stripes in Two Colours.*—No. 1, Plate XVI., is, in one particular, constructed on a similar principle to the last illustration, for it contains a series of small stripes, nine in number, which in combination form one broad band; and then follows a small band of brown, each repetition of which determines the size of the pattern. It is a style

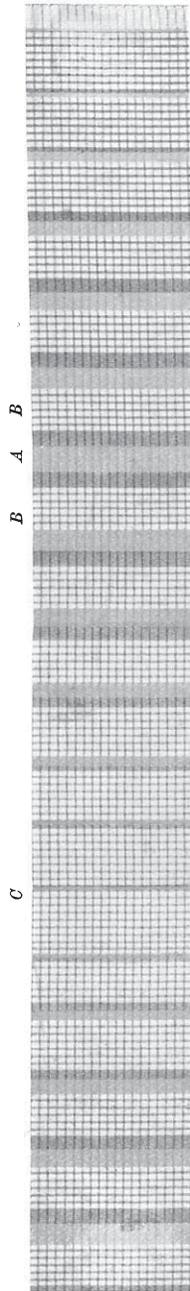


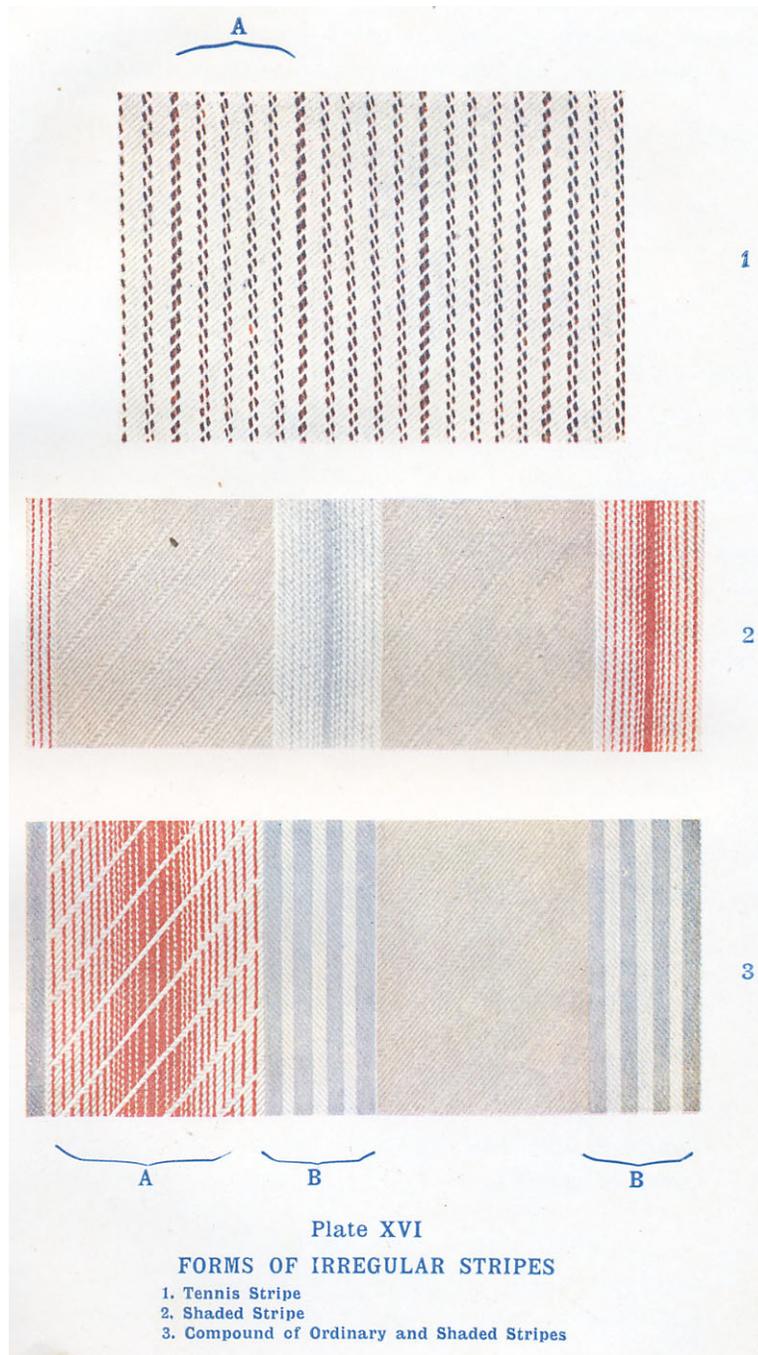
FIG. 14A.

adapted to lawn tennis trouserings, flannels, and cotton fabrics. Though there is a marked contrast in the shades, yet the design is somewhat mellow and subdued. The arrangement of the warp colours is—

6 threads of white.	}	For
1 thread of brown.		
1 „ white.		
1 „ brown.		
6 threads of white.	}	36 threads.
3 „ brown.		

The occurrence of the three threads of brown after each forty-two threads causes the pattern to appear nearly an inch wide. If the centre end of these three threads were changed to white, the whole pattern would be like the part bracketed *A*; showing what a small item may modify the character of such styles. The white thread between the browns imparts the indefinite cast to the stripe. If this were removed the design would be pronounced and decided in arrangement. Indefinite stripes invariably result from distributing the colours in minute quantities in the fabric.

97. *Irregular Stripes—Shades in Two Colours.*—The principle of shading by colour yields a very useful range of woven patterns. These obtain in fancy dress fabrics, ulsterings, cottons, and, in small styles, in trouserings; just as shades are acquired in black and white in sketching, they may be produced in fabrics in any two colours by softly gradating one into the other. Generally an ordinary twilled weave is employed, and two colours of warp yarns, one of which must be dark



and the other of a light shade. Thus, a shaded stripe of blue may be produced in the Venetian twill by grouping blue and white threads together, according to the plan given below:—

4 threads of blue cotton.	1 thread of blue cotton.
1 thread of white „	4 threads of white „
3 threads of blue „	2 „ blue „
2 „ white „	3 „ white „
2 „ blue „	3 „ blue „
3 „ white „	2 „ white „

This forms a lightened shade of blue. If black were used, a darkened shade of this colour would ensue. Any two colours of the same hue, but of different intensities, such as dark brown and medium brown, drab and light drab, when arranged on this principle, produce effective patterns.

98. *Shaded Stripes in Two Colours.*—Two excellent styles shaded on this system are supplied in Nos. 2 and 3, Plate XVI. The former consists of broad bands of fawn, and small bands of scarlet and white, and blue and white shades. The order of warping being—

4 threads of colour (red or blue).	4 threads of colour.
1 thread of white.	1 thread of white.
3 threads of colour.	1 „ colour.
1 thread of white.	1 „ white.
3 threads of colour.	2 threads of colour.
1 thread of white.	1 thread of white.
2 threads of colour.	2 threads of colour.
1 thread of white.	1 thread of white.
2 threads of colour.	3 threads of colour.
1 thread of white.	1 thread of white.
1 „ colour.	3 threads of colour.
1 „ white.	1 thread of white.
	1¼ inches of fawn.

Next, consider No. 3, Plate XVI., a style containing a shaded stripe of more than an inch in width. While the principle of construction is the same as in the preceding example, it is

more intricate in arrangement, and comprises a larger group of threads. It is as follows:—

Blue and white stripe, Section *B* of No. 3, Plate XVI.

8 threads of blue.	}	For	
8 „ white.			56 threads.

Shade of red, Section *A* of No. 3, Plate XVI.

5 threads of white.			
1 thread of red.			
4 threads of white.			
1 thread of red.			
4 threads of white.			
1 thread of red.			
3 threads of white.	}	For	
1 thread of red.			16 threads.
2 threads of white.	}	For	
1 thread of red.			12 threads.
1 „ white.			
1 „ red.			
1 „ white.			
1 „ red.			
1 „ white.			
2 threads of red.	}	For 12	
1 thread of white.			threads $\ggg$ — <i>C</i>
3 threads of red.	}	For	
1 thread of white.			16 threads.
4 threads of red.			
1 thread of white.			
4 threads of red.			
1 thread of white.			
4 threads of red.			
1 thread of white.			
5 threads of red.	}	$\ggg$ — <i>D</i>	
1 thread of white.			
4 threads of red.			
1 thread of white.			
4 threads of red.			
1 thread of white.			

3 threads of red.	}	For	
1 thread of white.	}	16 threads.	
2 threads of red.	}	For	
1 thread of white.	}	12 threads.	
1 „ red.			
1 „ white.			
1 „ red.			
1 „ white.			
1 „ red.	}	For 12	
2 threads of white.	}	threads	→ E
1 thread of red.	}	For	
3 threads of white.	}	16 threads.	
1 thread of red.			
4 threads of white.			
1 thread of red.			
4 threads of white.			
1 thread of red.			
5 threads of white.			

Section *B* of No. 3, Plate XVI.

8 threads of blue.	}	For	
8 „ white.	}	56 threads.	
1¼ inches of drab.			

By this arrangement an elaborate shade is formed in two colours in Section *A*. It commences with a maximum degree of white, which gradually diminishes until a maximum quantity of red is acquired, when a similar decrease of red and an increase of white occurs, until the maximum white quantity is again reached. An analysis of the plan of colouring may explain how the softly-toned result has been produced. This commences with a 5 of white, then follows a 4 of white, and subsequently 3, 2, and 1 of white. Meantime the red has remained unaltered. At *C* a change takes place. Now the red begins to augment in quantity, while the white factor is invariable, consisting of one thread only. The red starts at this point *C* with 2, then 3, 4, and 5 in succession. Here the maximum intensity of this hue is reached. (See *D* in the order of colours.) From *D* to

*E* the red factor of the shade decreases, and from *E* to the end of the pattern the white increases. While the gradation of tinting in this pattern is complete, both sides of the shade are exactly symmetrical.

This style of striping might be adopted in fine cotton, silk, and worsted fabrics; other colours than those appearing in the illustration being of course employed.

99. *Irregular Stripes containing Several Colours.*--In this class of stripe are included many of the neatest patterns woven. Such stripes are generally mellow in colouring, and ingeniously diversified in arrangement. A number of shades may be combined, but the patterns should always be characterized by softness of tone.

This scheme of textile colouring is so important that further illustrations will be considered, two styles in dark, and two in light colours. Patterns 1 and 2, Plate XVII., show subdued stripings applicable to tweeds and similar fabrics, and in which there is diversity of line and of colour. No. 1 has a broad stripe *A*, on which there are lines of red, with the bulk of the stripe consisting of one-and-one colouring, and a second stripe *B*, of light olive. The warping and wefting are—

<i>Warp.</i>													
White .	.	1	}	26	{	1	1	1	1	1	1	}	24
Black .	.	1	}		{	-	1	1	1	-	1	}	
Red .	.					-	1	-	-	-	1	-	
Olive .	.					-	-	-	-	-	-	-	4

<i>Weft.</i>				
Black	.	.	38	7
Red	.	.	1	1

from which it will be seen that there are four colours with three types of stripes, the large stripe, the single-thread stripes in red, and the small stripe in light olive.

Pattern 2 is more diversified, and consists of the following warping and wefting:—

	<i>Warp.</i>																			
Green and } white twist	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
White . . .	1	1	1	-	-	-	-	-	-	-	-	-	-	-	1	1	1	-	-	-
Slate . . .	-	-	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-
Silk . . .	-	-	-	-	-	-	1	1	1	-	-	-	-	-	-	-	-	-	1	1
Orange and } white twist	-	-	-	-	-	-	-	-	-	1	1	1	-	-	-	-	-	-	-	1
Fawn . . .	-	-	-	-	-	-	-	-	-	1	1	1	-	-	-	-	-	-	-	1
Red . . .	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-

Twice.

	<i>Weft.</i>	
Black . . .	98	1
Red . . .	1	1

In the warp alone there are no less than seven colours, grouped to give harmony, as well as richness of style. Red, orange, and green twist are used, but no one colour has greater prominence than another; though the white silk threads form a feature of the pattern, the other colours blend and tone into each other. There is intermingling of colouring and of shades blending together, but the stripe characteristic is prevalent.

No. 2, Plate XVIII., is a style in silk in which five varieties of lines are combined, the ground being white, stripe *A*, with two widths of lines of heliotrope, *B* and *C*; lines in green, *D*, and in pink, *E*. The diversity of lines adds to the richness of the pattern. Had they been equal in size, there would have been stiffness of form and want of harmony of colour. The green and the pink would have been too pronounced in tone, but by adapting the width of the stripe to the brightness of colour, harmony and contrast are maintained.

No. 1, Plate XVIII., is still richer in colouring and in variety of stripe. There is, first, the simple striping of crimson and white in a series of lines, section *A*, with edging colour of gold of similar width. This is one pattern in itself, but in order to combine it with the second stripe *B*, without colour impinging upon colour, there is down either side dividing lines in white. Stripe *B* consists of four sizes of lines in addition to the white, in pale blue, pink, gold, and sage green. Again, there is variety of line with diversity of hue, the sizes of the stripes having been well worked out in proportion to the brightness of hue.

In such examples as Nos. 1 and 2, the style of striping has two applications: first, in other colours of the same depth and degree of contrast as those in the patterns, and second, in lesser or larger quantities of each colour, maintaining the same relative proportionate sizes of the lines.

100. *Shaded Stripes in Several Colours.*—Another system of shading, besides that already illustrated, consists in employing several shades of yarns of the same hue. For instance, to form a brown shade by this method, at least three or five tones—the larger the number the better, and the more complete the gradation—of this colour would be required, such as very dark, dark, medium, light, and very light brown. Each shade should be continued for a suitable number of threads, taking them in succession, and running from dark to light, and *vice versâ*. But to obtain diversity of colouring in shaded styles economically, other methods are adopted besides this. An illustration in which the two methods are combined is given in No. 3, Plate XVIII. This is a compound of colours which gives shading in two varieties: first, that formed in the broad band *A*, in which there is a gradation from fine pink and deep maroon lines at the edges to lines increasing in width to the centre; and, second, the shaded stripe in green with fawn edges. The style is similar in principle to Pattern 3, Plate XVI., with the shading in section *B* more graduated, the green warp running from a pale green at the edges to a deep green in the centre. In section *A* the shading is due to the change in the grouping of the colours, and in *B* to the use of several tints of colour. The colour contrasts are in tone in stripe *A*, and also in *B*, and in hue between *A* and *B*, the whole pattern possessing harmony of colouring.

## CHAPTER VII.

### CHECK PATTERNS.

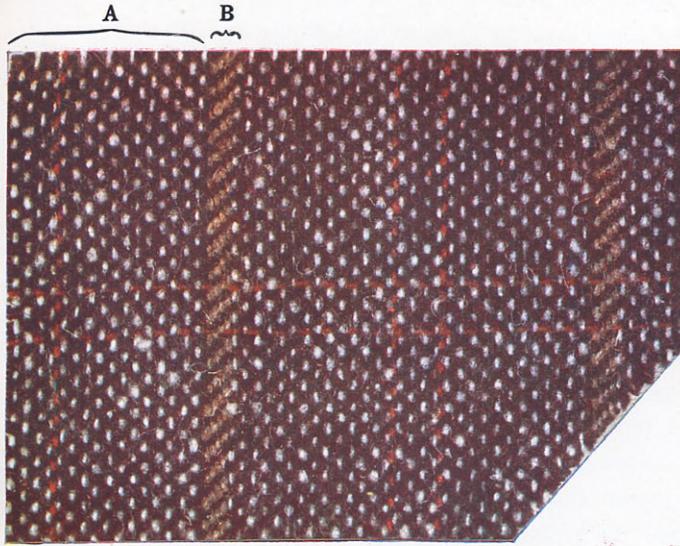
101. Utility of Check Styles—102. Principles of Checking—103. Several Styles of Checks. CHECKS COMPOSED OF TWO COLOURS—104. Forms of Checking in Two Shades—105. Common Check—106. Modification of Common Check—107. Check consisting of Two Sizes of Squares—108. Pattern composed of Solid Squares and of an Over-check—109. Counter-change Check—110. Compound Checking—111. Gradated Check—112. Broken Check in Two Colours—113. Basket Check. CHECKS COMPOSED OF THREE OR MORE COLOURS—114. Principle of Checking with Three Colours—115. Ordinary Three-shade Check—116. Set Check—117. Compound Checking in Three Shades—118. Counter-change Check in Three Shades—119. Interchanging Check—120. Counter-change with Over-check. SHADED AND IRREGULAR CHECKS—121. Shaded Check in Black and White in Cassimere Twill—122. Shaded Check in Two Colours due to using Designs composed of Various Weaves—123. Irregular and Mixture Checks—124. Fancy Broken Check—125. Examples in the Colouring of Tartans—126. Types of Tartans—127. Two-colour Plaids—128. Three-colour Plaids—129. Four-colour Plaids—130. Five-, Six-, and Seven-colour Plaids.

101. *Utility of Check Styles.* — Checks form one of the commonest types of patterns developed in woven goods. They obtain in all species of colouring, such as subdued and tempered shades, and bright and lustrous tints. They are characterized by diversification of arrangement, outline, and dimensions. As a rule, the check styles appearing in cotton, silk, and worsted yarns are clearer in pattern than those produced in woollen fabrics, which are frequently more or less indistinct and intermingled in composition. Possibly no form of design or method of grouping shades is more extensively worked than that of checking. It affords scope for novelty of pattern construction. Figured goods occasionally possess a checked surface of mellow colouring, on which the floral or geometrical design is distributed. Not infrequently this check groundwork enhances the fabric and pattern in which it occurs, giving diversity of surface to the

former, and developing with suitable precision the integral parts of the latter. But in addition to this principle of textile design being utilized in figured fabrics according to the system indicated, it is adopted in the construction of a wide series of styles. Shawls, mantlings, shirtings, flannels, suitings, coatings, dress fabrics, and other classes of textiles are coloured with this description of pattern. For dress materials and shawls, tartan and plaid checks are produced in a great variety of shades and systems of blending; in tweeds, ulsterings, and Irish homespuns, somewhat loud and broad checkings are applied, generally soft in colouring. When suitings and coatings are considered, the checks are usually small in size and neat in colour.

Checks vary in size and form from minute squares to patterns consisting of solid squares of colour several inches in a repeat; and from compact rectangular spaces of colour to intermingled line patterns, but which still form a decided square or check design.

102. *Principles of Checking.*—There are many systems of checking, yet there are some principles of construction common to every class of check pattern. For example, whatever plan of colourings obtains in the warp, in order to make a perfect check the same set of colourings must be employed in the weft. This is the ordinary method of checking; it is the crossing of the warp shades with corresponding weft shades which constitutes the square or check divisions. All checks are formed of rectangular spaces of colours. Such designs may be defined as compositions of squares of various sizes of distinct shades fitting into each other to form a complete pattern. When producing these styles, the first work to be accomplished is the arrangement of the warp threads, which will determine the plan of the check. Supposing this to be, for instance, the pattern given in Fig. 14 on page 111, then, in order to convert it into a check, the same order of wefting as warping would require to be adopted, which would yield a large check of black—formed by the eight ends of this shade in the warp and weft—filled in with a series of outline checks of white surrounding solid squares of black; or consider the tartan plaid given on Plate X. It is a plaid comprising in each repeat several sets of checks or square divisions. First, there are the line checks of yellow, lavender, dark green,



1



2

Plate XVII  
FANCY TWEEDS

and white; second, the squares of blue; third, the squares of scarlet; and fourth, the main checks of green. These various squares are so combined as to make a perfect pattern, or one in which each rectangular space neatly fits into the squares of colour with which it interchanges. In producing such a fabric, the system of colouring the warp is primarily determined as indicated, the wefting being a counterpart of it; though not necessarily so, because the idea is rather to maintain the clear squares of colour than precisely the same number of shots or picks as threads per inch.

It will be obvious that on this principle any form of check may be acquired; for by colouring, say, the shaded stripes given on Plate XVI. in the weft as in the warp, shaded checks would result. There is, however, one technicality to be considered, which adds to the intricacy of this kind of pattern construction, namely, the weave of the fabric. So long as the weaves employed, float the warp and weft equally and regularly on the respective sides of the fabric, the same balance of colouring is acquired in both the direction of the warp and weft; but should the weave bring more warp than weft, or more weft than warp, on to the face, then whichever factor predominates, it will be impossible to obtain a check style in which both the warp and the weft colouring will be equally pronounced. If, for instance, Fig. 13 were changed into a check, in order to obtain the same precision of white colouring across as lengthways of the piece, some alteration in the structure of the weave would be necessary. This will be evident on consulting Fig. 13A, the plan of the weave of this striped fabric. It will be observed that this weave floats  $\frac{4}{5}$ ths of the warp to  $\frac{1}{5}$ th of the weft on the face; hence, if it should be used as here given, and the same order of colouring practised in the weft as in the warp, the white lines in the weft would be less distinct on the face than on the back of the cloth, for they only cover one thread out of five. To get a similar prominence of white in the weft as is seen in the warp of the fabric, the weave would have to be extended to twenty threads and picks, and the 19th and 20th picks modified in such a manner as to bring  $\frac{4}{5}$ ths of the weft to  $\frac{1}{5}$ th of the warp on the face of the texture. When, as in common twills and other

simple weaves, there are equal quantities of warp and weft yarns appearing on both sides of the fabric, no difficulties of this kind arise in converting a stripe into a check pattern.

There are various kinds of "broken" checks in which the combination of warp shades is made to appear like a check by weaving it with some order of weft colouring which, while forming a series of transverse lines of colour, will develop the fancy yarns in the warp which constitute the main element of such patterns. These, as well as other recognized types of checking, which are particularly effective in the woven fabric, and illustrative of the general principles of this class of textile colouring, will now be described.

103. *Several Styles of Checks.*—Check patterns may be classified under three heads, as follows:—

- I. Checks composed of Two Colours.
- II. Checks composed of Three or more Colours.
- III. Shaded and Irregular Checks.

A considerable range of patterns is obtained in two shades; if the principles of checking with two shades are fully mastered, the more advanced species of check designs in which a large variety of colours obtains, will be readily understood. Indeed, it may be said that checks of three or more colours are elaborations of two-shade patterns. When a diversity of colours is employed, it does not follow that large quantities of each shade are used, but as a rule two shades compose the general cast of the pattern, while the additional hues are so many brightening factors. The art of checking consists in the skilful application of two or more shades, so that several useful schemes of grouping the threads in such patterns may be considered separately.

Intermingled and irregular checks are composed of square spaces of colour lacking clearness of character, and are useful for tweeds and certain classes of worsted goods.

#### CHECKS COMPOSED OF TWO COLOURS.

104. *Forms of Checking in Two Shades.*—These are illustrated in Figs. 15 to 23 inclusive. The illustrations furnished are typical of the different systems of combining two shades in

making check patterns. The forms of checking are, strictly speaking, unlimited. Beginning with the smallest check, consisting of two ends of a dark and two ends of a light shade alternately, the forms increase in intricacy and dimensions until patterns of several inches in size, and comprising several types of checking, are acquired.

105. *Common Check*.—The commonest form of check is given in Fig. 15. It results from arranging the warp and weft threads as follows:—

8	or any number of threads of black.
8	" " " " white.

Of course the number of threads of each colour, as well as the shades, may be varied. This style of check is worked in shep-

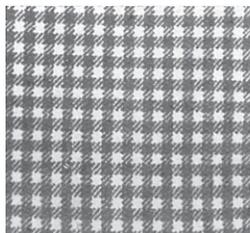


FIG. 15.

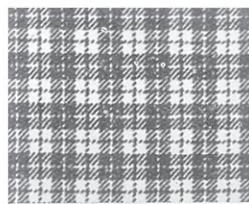


FIG. 16.

herd plaids and in other patterns, and in all kinds of materials. The weaves generally employed are plain, cassimere twill, and mat, each make giving suitable clearness to the colours.

106. *Modification of Common Check*.—Fig. 16 shows how, by a simple variation in the order of colouring the common check, it may be changed in character. This modification destroys the stiffness of the pattern. The plan of colouring in this example is as follows:—

8 threads of black.	8 threads of white.
2 " white.	2 " black.
8 " black.	8 " white.

An outline check of black is thus arranged to divide the squares of white into four sections, and an outline check of white to similarly divide the squares of black. It is a neat and useful form of pattern. Though only consisting of two shades, it com-

prises five effects, namely, solid squares of black, white, and squares of black and white equally mixed; and also of outline checks of black and white. Other colours besides those in which it is sketched are used in great variety, and it is a style applied with satisfactory results to rugs, shawls, dresses, cottons, woollens, and worsteds, being altered in size in the several fabrics according to the degree of loudness required.

107. *Check consisting of Two Sizes of Squares.*—Another valuable form of check, and one that is extensively utilized, is that in Fig. 17. It is a combination of two sets of squares of different sizes; it is given in the most elementary form, the plan of colouring being twelve threads of black and six threads of white, but it is rarely employed without being subjected to

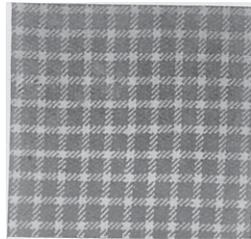


FIG. 17.

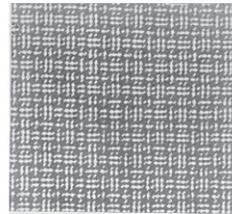


FIG. 18.

various modifications. Some of these modifications may be alluded to. In the first example, the large checks of black, and also of white, are bisected. This is done without increasing the shade, as follows (Fig. 18):—

5 threads of black.	2 threads of white.
2 „ white.	2 „ black.
5 „ black.	2 „ white.

In this way, the stiffness of the pattern is removed and a check obtained on the same base, but containing fuller variation of construction. Secondly, the square of black might be warped and woven thread and thread, while the square of white should remain solid, making a pattern suitable for flannel shirtings. One further modification to which this style is subjective, consists in bisecting the square of black or of white, but preferably the former, because it contains the largest number of threads.

108. *Pattern composed of Solid Squares and of an Over-check.*—An over-check is a small line of colour forming a skeleton square, filled in with solid squares of several shades. This base—illustrated in Fig. 19—is employed in dress fabrics, shawls, and ulsterings, and, in small effects, in suitings and mantlings. The yarns are arranged—4 threads of black, 2 threads of white, 4 threads of black, 10 threads of white, 10 threads of black, and 10 threads of white. The characteristic feature here is that only every alternate square of black is bisected, causing the small line of white which divides it to form an over-check equal in size to four of the black or white squares. This outline or skeleton check contains one solid square of black, four squares of white, and four squares of black and white twilled. It is a plan of check-

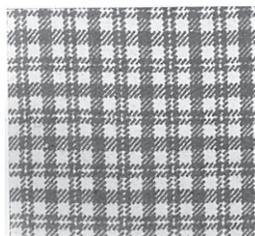


FIG. 19.

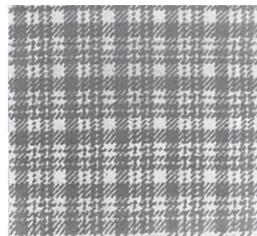


FIG. 20.

ing well adapted for plaids produced in two shades, and in such colours as blue and white, black and red, tan and medium blue (Nos. 2 and 7, Plate IV.), and lavender (No. 10, Plate IV.), and lilac (No. 16, Plate VI.). Fig. 19 is but a modification of the common check supplied in Fig. 15; for if the over-check were removed it would be reduced to precisely the same pattern. To obtain a change in this style, one of the squares of white is bisected with fine lines of black, leaving one black and one white check perfectly solid, but dividing one of the white checks into four equal sections. The order of colouring in such an instance would be thus (Fig. 20):—

10 threads of white.	4 threads of white.
10    "    black.	4    "    black.
4     "    white.	2    "    white.
2     "    black.	4    "    black.

This modified arrangement of Fig. 19 is one that is adopted in making this description of check in larger numbers of threads than here given, say twenty threads instead of the tens, and the other numbers similarly doubled. Patterns of these dimensions are mostly produced in bright or delicate colours for fabrics in fine worsted and cotton yarns.

109. *Counter-change Check*.—A counter-change check is a pattern in which the several sets of squares are exactly reversed; thus, in Fig. 21, the checks included in the bracket 1 are just the opposite in shade, but of the same size, as those grouped in bracket 2. It will be noticed that the principal square of black has one square of white at each corner, while the principal square of white has one small square of black at each corner,

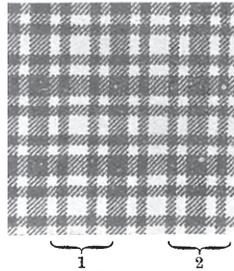


FIG. 21.

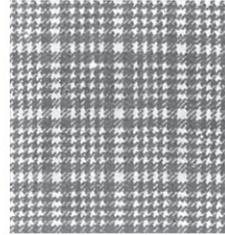


FIG. 22.

forming the counter-change which gives this species of checking its designation. The arrangement as here given, obtains development in various materials. It is modified in size according to the fabric to which it is applied. The colourings may be grouped as below :—

8 threads of black.	8 threads of white.
8 „ white.	8 „ black.
16 „ black.	16 „ white.

The style lends itself to numerous schemes of modification, but two or three can only be named. Firstly, bisect the large squares of black with small lines of white, and the large squares of white with fine lines of black; secondly, divide the small squares of the respective shades with black and white lines; and thirdly, combine these two systems of alteration.

110. *Compound Checking*.—This is one of the most useful

