

colour harmony and design tone which gives the artistic quality of good carpeting or floor decoration.

Pattern development in Eastern felts is acquired in two ways : (1) by block printing, and (2) by felting the colour ingredients, consisting of portions of selected dyed wool, into the nūmūd in the operation of fulling. Printing is the more modern method, and enables any style of ornament to be applied to the surface of the felt. A defect of this practice is, however, lack of permanency in the colour and design elements, the printed figuring being

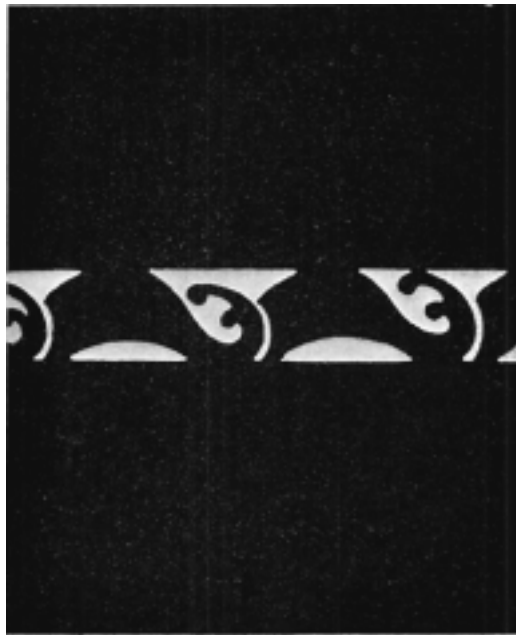


FIG. 30.

liable to wear off, as it is an effect not worked with or through the carpet.

Formerly, the Persian worker adhered strictly to the second principle of manufacture, which is still characteristic of the best nūmūds. It affords considerable latitude in decorative treatment without looming complications, and admits of the production of a carpeting in which the design features are as durable as the felt structure. Figs. 30 and 31 are suggestive of the styles of simple border effects applicable on this principle of construction. Assuming the ground shade of the nūmūd to be light brown or yellow ochre—standard colours—then the pattern might be

developed in blue, red, green, or white, according to the strength of colour contrast and quality of colour tone desired. In the early stages of felting, the pattern is outlined on the brown ground, and a layer of carded and selected coloured wool applied, following the lines of the ornament. These are next felted into the substance of the carpet; and, in adding further spreadings of camel-hair, wool, or other class of fibre to the ground sections, corresponding spreadings are added of the specially dyed wools to the design sections, the compound process of material application and of fulling being continued until the carpet is of the requisite thickness and compactness of make.

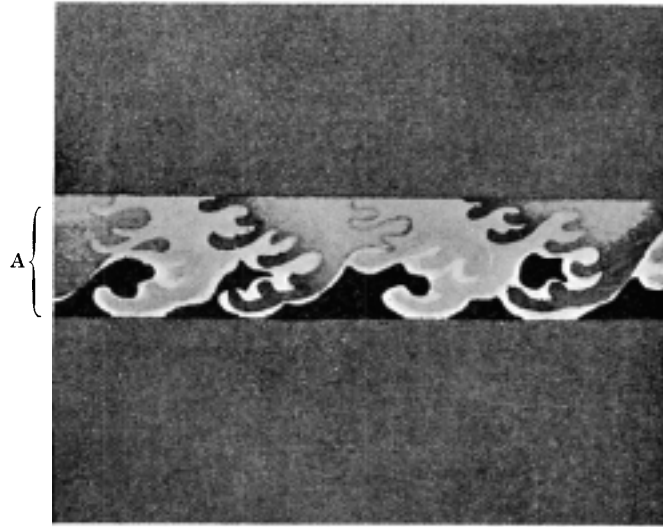


FIG. 31.

Two or more material colourings are more difficult of insertion than material of one shade, but the routine of work is similar. Fig. 31 may be taken as illustrative of the scheme of procedure adopted, the decorative band A being composed of black and several tones of grey and white. As in the preceding example, an initial layer of the material of the ground shade is first formed, then the materials of the respective coloured parts in the pattern applied, following with successive feltings and spreadings of the coloured wools to the completion of the carpet. The more varied and minute the details in the design, the greater the care and skill needed in acquiring clearness of style delineation. With the ornament elaborated, the colour practice should be simplified and *vice-versâ*.

It should be observed that in this class of carpeting, as also in hand-woven pile carpets, sharp outlines in figuring are not generally attempted, being of secondary artistic value. What is sought is the subtle, toned blending of one group of forms with another expressed in appropriate colours. For such design characteristics the nūmūd carpet is specially adapted. Possessing a woolly surface, destitute of warp and weft intersections, sharp and well-defined ornamental features are discarded in its manufacture. On the other hand, it affords exactly the quality and nature of surface on which to develop mellow colour toning and varied, but simple, decorative elements.

A feature which ordinarily renders felt floor covering unserviceable is the readiness with which it displays foot-marks, stains, and dirt of any kind. Even for rooms in which there is only a moderate amount of treading and passing to and fro, many of the shades in which it is made should be avoided, and, moreover, in mingled colours of the khaki variety, it too readily becomes soiled for general purposes. Two schemes of manufacture are practicable by which these drawbacks can be very considerably obviated, namely, that of ornamenting the surface of the felt on the Persian system described, and that of blending coloured materials producing mottled or mixture shades. By felting inlaid patches of dyed fibres into the nūmūd, a distinct style of carpet results with some of the properties of a pile-woven structure. There is an absence of the firmness due to weaving, but the carpet is sound and the pattern is sufficiently developed. Some skilled hand labour is obviously involved in its production. Felting is not so expeditiously done as in the continuous system adopted in Western factories, but the superior utility and beauty of the carpeting formed compensate for the extra work bestowed on its manufacture. Design development by this method is not so costly and complicated as in the loom employing wiring apparatus for the formation of the pile. Felting into the carpet an inlay of coloured wools, after the plan of a given design, is a simpler scheme of technical work than to produce the design by weaving. This will be understood by comparing the two systems in relation to an elementary type of ornament, preferably composed of detached figures at some considerable distance apart. First, assume it had to be woven in a velvet pile carpet, then the design would, in the usual manner, be drafted on to the point paper, the cards stamped, and the pile warp yarns arranged in their respective frames according to the colour scheme. Weav-

ing by wiring for the pile development is comparatively a slow operation, the wiring requiring to be done alternately for the ground and figured sections, securing or binding each series of pile threads, after the insertion of the wires, into the foundation of the carpet by the fast-interlacing ground picks.

In the felt method of production the carpet would be made in lengths of a suitable width dimension, and no mechanism would be utilised in developing the design structure. Thus, having prepared the first layer of loosely felted fibres, the pattern would be inlaid in the colours of wool selected, such as Turkey red for ground and medium blue figuring. It would be advantageous to stencil or block out the pattern on the ground layer of felt in the first instance, and to add afterwards the coloured patches of wool, applying pressure in doing so, while both the felt and the wool are in a moist condition.

The quality and wearing properties of felt carpeting are primarily obtained from the class of material used, and secondly from the practice in manufacture. Regarding the material, all animal fibres possess a disposition to felt when saturated with moisture and subjected to compression. The requisite is a material of sound staple, whether wool or hair. Evenness of filament tensility is of paramount importance. The finer growths of wool of the merino variety felt the most readily and in the highest degree, but are less applicable to felt carpeting than wools of a coarser fibre. They are not only too costly for the purpose, but yield a texture too soft and clothly in appearance and character. Crossbred and the thicker-fibred wools are preferable, while, in the lower grades of felt production, shoddy, and goat and cow hair are employed. Materials of different values are also blended in certain proportionate quantities for giving various sorts of manufacture. These, after being intercrossed and mixed and formed into layers spread one over the other, are felted into a composite piece. The combined work of preparation and fulling is, as previously stated, independent of the work of spinning and weaving; yet the actual product may be as level, compact and firm as cloths obtainable in the loom by the interlacing of threads of warp and weft.

The Eastern system of hand carding and of fulling by tramping the material thus prepared is accurate in principle and results, but altogether inadequate to the expanded requirements of the present-day felt manufacturing industry.

PROCESSES OF CARDED-FELT MANUFACTURE

Felt manufacture, by machinery, is divisible into four progressive stages: (1) Preparation by teasing, and running through the fearnought if necessary; (2) carding; (3) hardening; and (4) fulling. The operations are distinct in character, scope, and object. Blending, for quality, is effected in the preliminary opening work done in teasing and fearnoughting; the formation of the "batt" or lap of filaments of the requisite density, uniformity, and homogeneity, is produced in carding; firmness and adhesiveness of fibrous structure are developed in hardening; and, finally, "clothiness" and strength of piece are obtained in fulling.

It is unnecessary here to enter into the nature and function of the operation of carding, but it is essential to point out that the result, as to evenness of carded lap, is as important, if not more so, as in carding for condensing and spinning. Clusters of unopened or partially separated fibres, and inequalities of any kind, become at once evident in a faulty hardened stuff. The character of the felt is really made here. Hardening and fulling do not remove but develop and fashion irregularities.

For open, loose-stapled materials, and the lower grades of felts, one carding engine need only be employed, single- or double-cylinder in construction, and fitted with Blamire's lap former or the batt frame, according to the class of manufactures being carried out. Two machines are, however, requisitioned in the production of the medium and better class cloths, the scribbler (comprising breast and two cylinders) in such sets being provided with automatic feed and Blamire's delivery apparatus, and the carder (one or two cylinders) with lap feed and batt-frame. The standard widths of the machines, as made by Messrs. Platt Bros. and Co., are 72 in. and 84 in.; but, for carpets, the scribbler may be constructed up to 120 in. on the card wire.

The method of delivery, which prepares the sheet of material for the hardening process, is important. It consists in applying to the carding engine, as seen in Fig. 32, a batting machine or frame, constructed by Messrs. Wm. Bywater, Ltd. The feed sheet of this frame overlaps the delivery lattice or table of the carder as indicated at D, the usual fly comb being applied to the latter for doffing purposes. The sheet of the frame is 40 to 50 yards long and girthed or bound at the edges with leather, running within grooves or guides of the frame, and maintaining the canvas

sheet level and at a uniform degree of tautness throughout its traverse round the rollers E, in the machine. If otherwise, streakiness and waviness are manifest in the hardened product, which the operation of fulling is incompetent of obliterating or concealing. This sheet proceeds, when the machine is in motion, to gather up an additional lap at each successive passage over the delivery lattice of the carder, until a "batt" of the required substance has been formed, when it is broken off and run on to roller H, in which condition it is removed to the "hardener." The standard length of each batt is 40 yards, but the frame can be devised to give 50 or 60 yards measurements if required. Weight and thickness of piece are primarily determined in this operation. Assuming, for example, that each yard of the feed sheet, A, conveys 1 lb. of material into the machine, and there is, in the operation, a draft of 3, then six laps combined on the

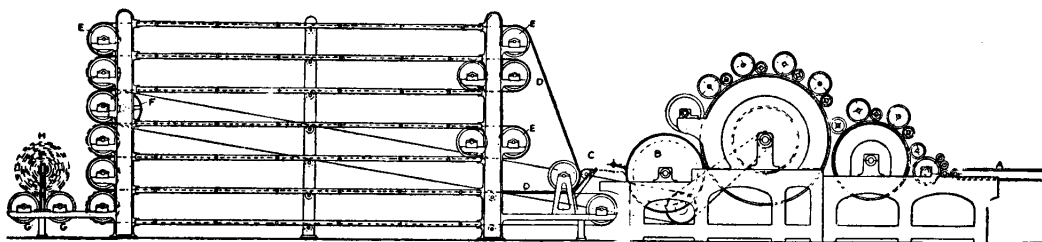


FIG. 32.

"batter" would give $40 \times 6 \div 3 = 80$ lbs., or a lap of 40 yards weighing 2 lbs. per yard.

A piece of felt, like a spun yarn, is thus formed, in the first instance, by the process which separates the filaments of the wool or hair from each other, simultaneously imparting to them a condition adapted and conducive to recombination after a fixed system. Lap after lap is produced on the carder, and united on the batt frame, in conformity with the construction of a sheet of material of a definite length and thickness, ready for the stiffening and solidifying work of the roller or table "hardener." It is in this latter process that preliminary felting, producing textural substance and fibrous adhesiveness, is performed.

Carding, in felt manufacture, has two specific functions independent of the actual work of lap formation, namely, the fashioning of a piece of fibrous material of definite quality and composition, and the acquirement of blends of coloured materials, in suitable proportions, for making "fancy" or "mixture" shades, diversified in colour, tone, and intensity.

When manufacturing for "quality" it is essential that the carding machines employed contain the requisite component parts to afford adequate wire clothing, or operating surface, for the complete disentanglement or opening of the staples of the different materials, and for the straightening and mixing of the fibres to form a composite sheet of carded stuff. This must be of the consistency and adhesiveness of composition shown in Fig. 33. Analysis and magnification may be competent of distinguishing the different classes of filaments combined, but, as a partially manufactured product, each variety of material

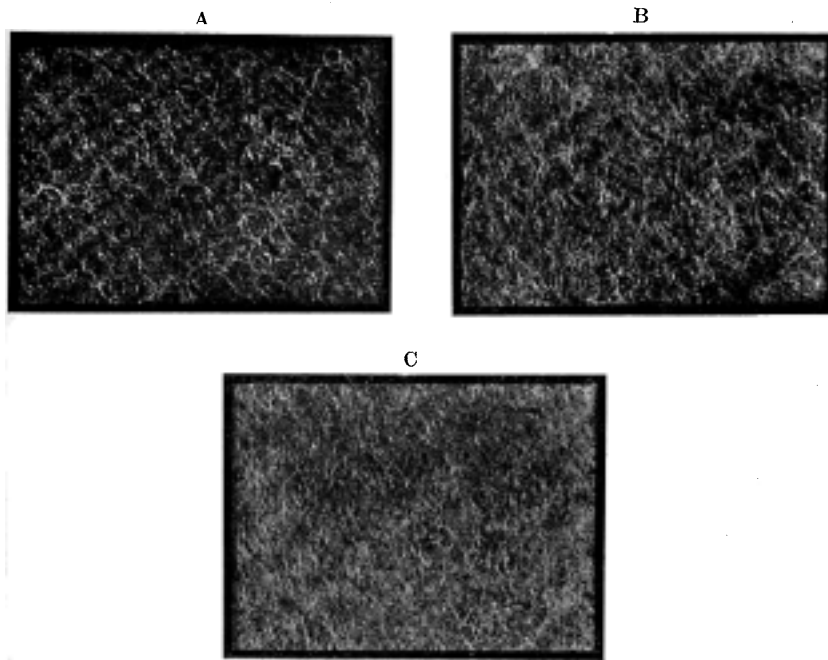


FIG. 33.

must compose its proportionate share of the whole, being equally and uniformly distributed throughout the entire "lap" or "carding."

For carpets, medium and coarse wools and several varieties of hair are used, also shoddies, mungos, and the lower grades of crossbred noils. East India, Shetland, Black-face, and similar wools, with variable proportions of hair, are applicable to the inferior classes of felt, possessing thickness and substance but being comparatively deficient in fineness and softness.

It is essential to blend materials of corresponding carding

properties. Extremes in length of staple and diameter of fibre are to be avoided, as yielding imperfect practical results. If, for example, wool and shoddy are selected, they must be of a like quality—that is, of a similar fibrous nature. A strong-haired East India wool would not, in carding, behave in the same manner as a moderately fine mungo. Each material would be too distinctive in character to mingle evenly. Such a grade of wool would, however, combine homogeneously with military-blanket shoddies, or strong crossbred noils; giving, in the first instance, a fuller, denser quality to the carding due to the shoddy; and, in the second instance, a relatively more “clothly” felt than producible by using East India wools alone.

Knowing the price of the blend required, the finished properties of the felt to be manufactured—softness, wearing strength, density, and colour tone—have to be primarily considered. These must be rendered possible in the materials utilised. For the better varieties of carpet felts, medium qualities of crossbred fleeces may be blended with the coarser sorts of the finer grown wools. Firmness, combined with springiness of felt structure, are important. In a measure the amount of felting or fulling practised determines the first of these characteristics, but only strictly in proportion with the strength and durability of staple of the materials employed. Similarly, a certain degree of “spongy” resistancy could be given to the felt product by using a sound mungo in place of the fine grade wool, but it would lack the “springy” compactness characteristic of a felt manufactured of the blend of wools named. Soundness of staple and fulling property are necessary in the materials employed, to develop a carpet durable in the wear, and possessing structural substance combined with elasticity of surface under the pressure of treading.

When hair is blended with wool, as in the coarser felts, the latter should have a thick fibre and free, open lock or staple; otherwise, in the carding work, the hair is more readily prepared and intermixed than the wool, and the result is an unevenly formed sheet of filaments. Blending of materials thus differing in physical features may be facilitated by first treating the wool, that is, the staple more difficult to card, in the teaser and fearnought. This routine separates and opens the clusters of fibres, and reduces the staple of the wool to a suitable condition for freely mixing with the less matted material with which it is blended. By practising this system of treatment, the scope for the combination of materials dissimilar, in their

natural state, in carding qualities may be considerably increased. An accepted principle is that, if the carding operation of the fibres composing the blend can be successfully performed, the subsequent work of "batt" making, hardening, and fulling may also be satisfactorily carried out.

Colour blending, due to the admixture of two or several materials of similar or dissimilar qualities and of different colour tones, constitutes an important source of "fancy" shade production. The nature and utility of the process are understood and extensively practised in the Cheviot tweed industry, and also in Botany worsted yarn manufacture; but, in the making of felts for carpets, it has not yet obtained the technical consideration its commercial value demands. No phase of textile colouring is richer in the facilities which it affords for diversity and freshness of tinted result. The relative quantities in which the different dyed materials may be compounded in producing a new colour shade are only restricted by the gamut of dyed colours available.

As applied to carpets, the work is performed in accordance with two practices in colour blending, namely :

(a) Blending for the production of mixture shades based on mathematical formula, and resulting in shades systematically graded in tone.

(b) Blending for the production of mixture shades differing in colour ingredients, but of a like depth of tone or tinting.

Considering the first practice, shades A, B and C (Fig. 33) are typical of an elementary blend in neutral grey, being composed respectively of 75, 50 and 25 per cent. of black wool and of 25, 50 and 75 per cent. of white wool. The scale of tones is, in actual manufacture, extended to six, nine, or more shades, and forms a basic scheme of gradation to be followed in the production of other varieties of mixture shades of this class. A bright colour, say, purple, green, or orange, may be added to give "bloom," but it should be a constant and not a variable quantity—such as 3 per cent., 5 per cent., or 7 per cent.—of each mixture in the series.

This method of blending is applicable to (1) admixtures of the primary, secondary, and tertiary colours with white or a light tint of each colour; and (2) to combinations of dark and light shades of either analogous or contrasting hues—*e. g.* brown and light brown or brown and pale green; blue and light lavender or blue and pale fawn; green and light green or green and pale pink, etc. It is equally adapted to the production of tint grada-

tions by combining medium shades with white or medium shades with light tints—*e. g.* tan and white or tan and very pale green; heliotrope and white or heliotrope and lilac; sage-green and white or sage-green and very pale lavender, etc. Having fixed the scale of proportions—that is, of tone or tint gradations—formed in neutral greys, this must be strictly adhered to in each colour compound. It follows that to secure accurate toning or gradation the dark, medium, and light colours employed in each class of mixture produced, must be of corresponding intensity and depth of hue. To disregard this controlling principle destroys the value of the standard base in giving mixture shades correctly and uniformly graduated from the extreme dark to the extreme light shade in each mixture.

The second scheme of blending defined affords increased latitude in the use of colour units in each variety of shade. It is not here a question of developing graduated mixtures—dark, medium, light, etc.—composed of the same colour ingredients, but of producing a diversity of shades consisting of different hues combined in like proportions, and of each shade in the range being of a corresponding strength and quality of colour tone. Mixtures A and A¹ are, for example, of a similar tone but differ in hue and in colour ingredients, being formed thus :

A.

5 parts of medium drab,
5 " " light drab,
5 " " pink, and
5 " " pale blue green.

A¹.

5 parts of smoke grey,
5 " " lavender,
5 " " rose colour, and
5 " " fawn.

Here the colour units and component parts of the two blends are identical. Correct tones, with the necessary variation in the hue of the felt, are acquired by having the corresponding shades in each mixture of a like colour depth. In these arrangements the ground shades—drab and light drab in A, and smoke and lavender in A¹, are of one tone intensity, and the same law applies to the tinting colours, pink and pale green in A, and rose and fawn in A¹. Blend A yields a mingled drab shade of felting tinted with pink and green, and Blend A¹ a bluish grey shade tinted with rose colour and fawn.

The following colour admixtures indicate the practice applicable in making darker shades of felt manufacture :

TABLE V.—PRODUCTION OF MIXTURE SHADES IN FELTS.

COLOUR.	SHADE (1).	SHADE (2).	SHADE (3)	SHADE (4).	SHADE (5).	SHADE (6).
<i>Units.</i>	<i>Blue-green,</i> tinted with Russet.	<i>Brown,</i> tinted with Green.	<i>Olive,</i> tinted with Blue.	<i>Green,</i> tinted with Blue and Russet.	<i>Red Brown,</i> tinted with Blue and Green.	<i>Blue,</i> tinted with Russet and Green.
Medium green . . .	45%	10%	45%	60%	20%	20%
„ blue . . .	45%	45%	10%	20%	20%	60%
Russet brown . . .	10%	45%	45%	20%	60%	20%

On this principle of dyed-material admixture three colour units are made to give six different shades of felt each of a like depth of tone. In examples (1), (2) and (3) two of the colours in the group are combined in equal quantities, with one of the colours used for tinting purposes; but in examples (4), (5) and (6) one colour forms the base of the mixture, with the two remaining colours used as tinting ingredients. Other ranges of shades are acquired on this basis, first, by varying the ratio in which the colour units are blended; second, by employing colour units of different hues or tones; third, by introducing into the mixtures a small percentage of rich bright colouring; and fourth, by adding black or white to impart a greyish tone to the shades.

Blending and carding for felt quality, colour shade, or for quality and shade composition are followed by “hardening.” Up to this process the routine of felt carpet manufacture is preparatory in character, and coincident in method and principle with the treatment of fibrous materials for woollen yarn spinning. The adhesive consistency of the carded sheet or “batt” is the mechanical result of opening the staple of the wool, and of the re-arrangement and re-combination of the fibres. Felting is not induced in this preliminary work, and the lap of fibrous material formed is without tensile strength or firmness. Hardening imparts both these properties and also gives a cloth-like texture. Strictly, it is the first operation of manufacture which utilises the felting characteristics of the wool or hair, combined in the formation of the loose layer of carded fibres. In the work, moisture, heat, pressure, and friction are applied, producing a felting “condition,” but in such a way that the length and width of the “batt”

are practically unaffected. Either one or several "batts" are treated together by passing them separately or in combination, in a damped state, between pairs of rollers with steam-heated rollers at definite intervals. The friction necessary is acquired by giving a compound rotary and transverse reciprocating motion to the upper series of rollers. Linen sheets—one of which is used for damping—act as conveyers, and also protect the soft, delicate, fleecy composition of the batt from being disturbed by the friction applied in felting, and from strain in passing it from the batt-stand to the piece end of the machine.

Two classes of mechanism are employed—the "roller" and the "table" or "flat" hardener. They differ, as will be shown,

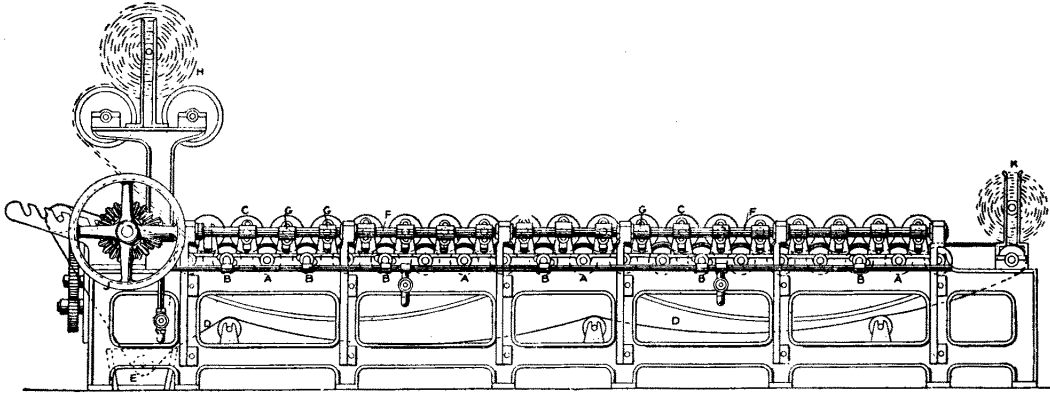


FIG. 34.—BYWATER'S CONTINUOUS OR ROLLER HARDENER.

in principle of construction, in action, and in system of manipulation, but have corresponding results.

Fig. 34 is a sectional illustration of Bywater's continuous or "roller" hardener. It is constructed with fourteen lower iron rollers and six steam-heated copper rollers, and with nineteen top wooden rollers which have both a rotary and oscillatory movement. As many as six batts or laps of wool, or other fibre, may be hardened simultaneously and separately, or formed into one thick piece. From half to a yard of material, according to the quality of the laps and the amount of felting required, is passed through the machine per minute. While the substance of the hardened piece may be regulated by the number of laps combined, the thinnest to thickest qualities of "cloth" may be treated.

Rollers A are the carriers, and rollers B the steam-charged heaters, the upper series of rollers acting as pressure and friction

surfaces. Parts F and G are respectively the eccentric shaft and saddle for producing the oscillating movement, the degree of which is mechanically determinable.

The batt, on leaving the lap roller H (these rollers H vary in number with the several laps run into one piece or separately treated), passes, in conjunction with a section of the endless linen sheet, from the water trough E, between the upper and lower sets of rollers of the machine as seen by the thick layer of material, forward to the piece roller K (the number of which also corresponds with the number of individual pieces produced at one process). The wet linen sheet imparts moisture, and the steam rollers B the requisite degree of heat, which, in combination with the slight squeezing pressure applied, and the oscillating action of the top set of rollers, generates felting, yielding a hardened piece. The linen sheet D returns, over a roller fixed in the same

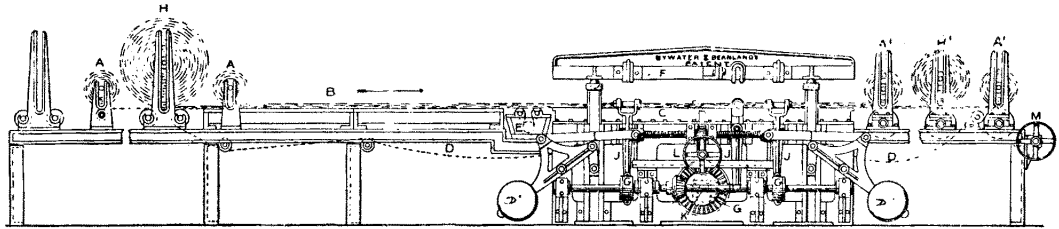


FIG. 35.—BYWATER'S TABLE HARDENER.

stand as K, to trough E, the operation being continuous from the beginning to the completion of the length of the batt.

In Bywater's "table hardener," Fig. 35, felting in lengths, though automatically controlled, is intermittent in action. This will be understood by following the routine in the treatment of four batts for the production of four separate hardened pieces. In addition to the endless damping and carrying sheet, four supplementary sheets are now requisitioned for dividing the batts from each other during felting and hardening. These having been wound, free from creases or wrinkles and evenly tensioned throughout, on to rollers similar to A, one sheet, that nearest to the table B, is drawn through the machine. A second sheet is taken from the next roller, followed by a third and a fourth from consecutive rollers. It is important to note that it is absolutely essential, in order to ensure uniformity and accuracy in working the layers of material, that the length of each sheet, when stretched to a level degree of tightness, should perfectly coincide with the operative length measurement of the machine.

This preliminary routine accomplished, the top plate F of the felting table, having been mechanically lifted, is heated with steam, and a portion of the endless sheet D passed forward to the delivery carrier under the piece roller H¹ near to wheel M. Taking four batt rollers from the batting frame, they are fixed in the stands H (only two shown) in front of table B. The first or front batt is now placed on the surface of the sheet D, the machine being run to advance the material for a few feet, following with a second batt, and again operating the machine to convey it a similar distance to the first batt, and then proceeding in a like manner with each sheet and batt in the series until the five sheets (including the endless damper D) and the four batts have been run over table B, and on to rollers A¹, H¹ and A¹. Steaming having occupied three or four minutes, the batts are prepared for hardening, the heated top plate F is automatically raised, and they travel on to the surface C, when the plate is lowered and felting commences. This is caused, mechanically, by the oscillating motion of D¹, which is eccentrically actuated; and, chemically, by the action of the steam and moisture on the fibrous materials. The period of hardening is determined by the setting of the time wheel which starts the mechanism for raising the upper table F, and for winding up the lengths of hardened batts on to the piece rollers or beams.

This machine, which is automatic throughout, is adapted for the felting and hardening of carded materials composed of pure wool and other animal fibres, and also of wool and cotton unions for the lower grades of carpeting.

FULLING OPERATION

The hardened and compacted carded batts are not yet in a suitable condition for use as a carpet material. The piece is too soft and pliable in texture, being readily tearable and lacking solidified adhesiveness of fibrous composition. As regards the qualities of durability and tensile strength, it is not comparable with a loosely-woven product. Under moderate stretch it may be elongated and drawn into a shapeless length of material, varying in degrees of thickness with the application and distribution of the force applied. To impart cloth-like characteristics—tensility, firmness, and wearing property—it is therefore subjected to the operation of fulling. Three descriptions of machines are employed, the stocks, the milling machine, and the combined

machine, consisting of the series of "crushing" parts of an ordinary milling machine, and of a set of stocks automatically controlled.

Fulling stocks have been used in some rudimentary form of construction from early times in the shrinkage of Eastern felt carpet manufactures, and they were employed in this country in cloth milling prior to the invention of the milling machine. In principle of action they are more favourable to level or uniform felting than the "roller" and "cuttling" compressions which comprise the routine of fulling in the milling machine. This arises from two causes, (1) the hardened piece is treated in the "rolled" or "balled" form and not in extended folds or in a "rope" condition; and (2) whereas the stock feet or fallers are lifted mechanically, or by a number of tappets, they drop on to the piece by gravity: this ensures that the force of compact augments as felting proceeds. The bulky quality of the piece slightly subsiding in the process, the "drop" or traverse of the fallers increases in a corresponding measure to the amount of felting effected. It will be observed that the operation is one of pounding or hammering. The piece "ball" of hardened material, satisfactorily impregnated with soapy solution, is placed in the trough or bowl of the machine, so shaped that at each successive impact of the fallers with the piece, the latter turns or moves round for some degrees. This movement is essential for distributing the felting action equally throughout the whole length of the material.

Felting in the milling machine is, mechanically, an entirely different routine, but chemically, that is so far as the action of the soap on the carded fibres is concerned, it is the same in nature and in results as in the stocks. In the ordinary type of milling machine, felting is effected at five separate positions, namely, (1) in passing through the divisions in the knocking-off board, (2) betwixt the vertical guide rollers, (3) in the neck or throat, (4) between the upper and lower crushing rollers, and (5) in the cuttling box or trough. The thickness of the piece and the number of pieces run in a "draft" or as one, determines in some measure the amount of pressure, and therefore the felting influence on the material in running through the knocking-off board and the neck, and also the degree of contraction induced by the pieces folding or cuttling in the bottom of the machine.¹

¹ *Finishing of Textile Fabrics*, Beaumont. Published by Scott, Greenwood and Son, London.

Milling proper chiefly takes place in sections (3), (4) and (5), that accomplished in (1) and (2) being of a supplementary and corrective nature. The guide rollers, the flanged and crushing rollers, and the upper hinged lid of the trough, are each capable of mechanical adjustment. Thus, the first may be spaced as to distance from each other or regulated as to the squeezing pressure they apply to the pieces; the horizontal crushing rollers are under spring or weight and lever action; and the lid of the spout may be weighted according to the amount of felting to be attained on the length of piece. It should be noted that, in these essentials, milling by machinery possesses advantages over milling by faller or by automatically driven stocks; for felting on this system may, as required, be done principally on the width or length of the carpet, or to the same or a corresponding extent in both directions.

The felted pieces, if made in the grey or natural shade of the materials, are, after washing-off and straightening and drying on the tenter, dyed, rinsed, re-tentered, brushed or raised slightly, and topped on the cutting or cropping machine. Hot pressing may be practised, but cold pressing or weighting may give the evenness and smartness of surface required. In the case of material-dyed felts, including felts in mixture shades, the operation of milling is followed by washing-off and thorough rinsing, tentering, mild raising, cutting, pressing and possibly steaming. After milling, the quality of the pieces—smoothness and solidified structure—is improved by blowing with steam. This consists in winding the pieces, under tension, on to a perforated roller and forcing live steam through the felt. The process is effected by treating the pieces first from the beginning or head end and allowing them to cool or set when blown, and next treating from the reverse or tail end in the same manner.

Ordinary felt carpetings, being produced by restricted mechanical operations, are chiefly made in solid and mixture shades. Minus the use of yarns and the schemes of fabric interlacing due to weaving, the range of textural construction and decoration is strictly circumscribed. Adapted as the felted product is as a floor covering, it does not, as seen in the actual processes of machine manufacture, offer much latitude for pattern development. In carding, by devising mechanism for regulating and distributing the coloured sorts of material on the feed table of the machine, striped and patchy forms of effect may be produced. Fig. 36 is a specimen, one-twelfth of the original size, in which the streaky

lines are obtained in this way, and the dark specks in the fulling operation. Both features are variable in dimensions and in colour at will, but each class of detail is more or less indefinitely fashioned. That this should be so is not necessarily a detriment, as this kind of textural pattern is designed to have a nondescript appearance, though rich and varied in colour tinting. The specimen may be regarded as suggesting the possibilities in carding, with the invention of automatic feeding arrangements which would deposit the tinted materials, from separate receivers, on to the travelling lattice of the carder in a fixed grouped order. As the carded sheet of fibres is transferred direct from the carder

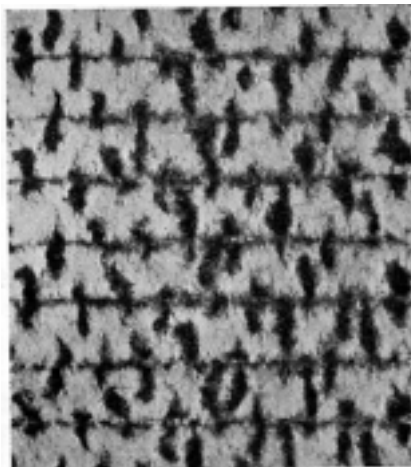


FIG. 36.

to the batting frame—Fig. 32—this classification of the fibres would be preserved in the course of material preparation for felting, and it would be little disturbed in the latter process. This example also shows that, without interrupting the work of milling by the removal of the pieces from the machine for the manual application of coloured patches of fibre, as described in reference to the specimens in Figs. 30 and 31, certain descriptions of surface design, though faintly defined, are possible in felt manufactures.

In resorting to printing and embossing any variety of ornament becomes practicable; but, as pointed out, the results do not satisfactorily sustain the effects of the hard wear to which carpeting is put. Simple decorative styles of the types illustrated in

Figs. 37 and 38 and printed in single- or multi-colouring, are applied. The felted pieces are made in solid shades, and the pattern, in the case of Fig. 37, printed in one colour either in tone or in hue

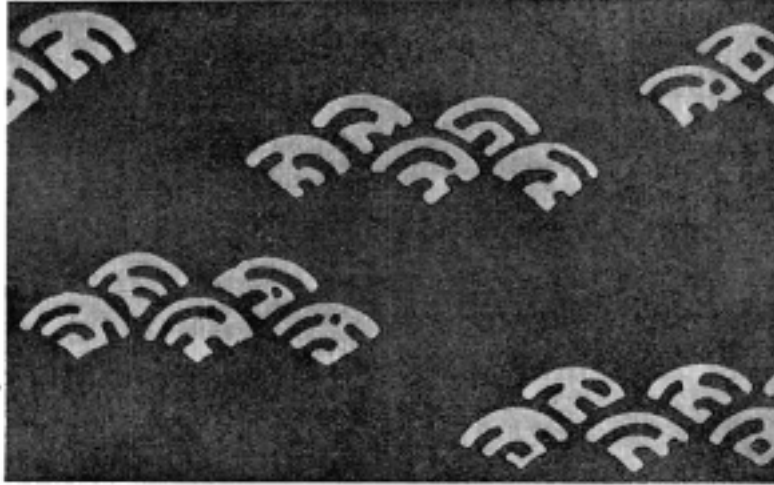


FIG. 37.

contrast with the shade of the felt. Designs worked out in a number of colours require as many printings as colour tones used. The example in Fig. 38 is of this category. With the felt manu-

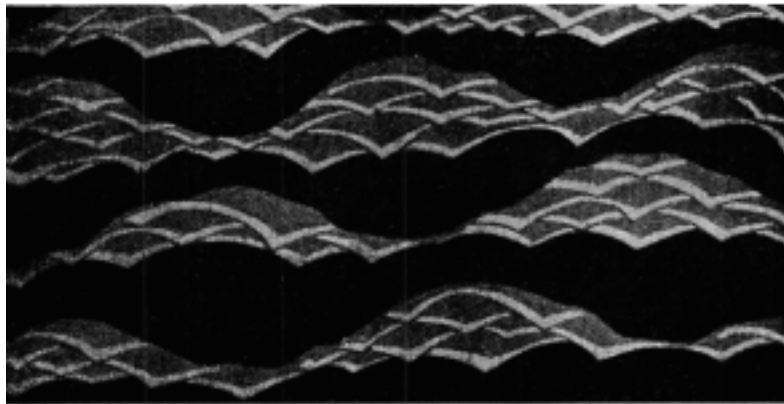


FIG. 38.

factured in a medium shade of slate-grey, the design elements may be printed in black, red, white, green and blue. A common practice consists in making the designs so that they may be in the full or in a reduced number of colours. Thus the cost and

processes of printing of this style are amenable by eliminating the blue and the white, that is two of the demarcation or line tones in the photographic reproduction, enabling the essential ornamental parts of the design to be acquired in the felt by three-process printing.

Examples in simple border designs of the character adapted to either "carded" or "woven" felts, are shown at C¹ to C⁷, Figs. 39 and 39A. They are drawn to $\frac{1}{8}$ scale. Sketch C¹ is a small freehand type of detail line grouped, C² an elementary leaf form, C³ a mingled spotted band, C⁴ a neat ornate feature arranged diagonally, C⁵ a waved diamond structure, C⁶ a face-to-face pattern, and C⁷ a geometric form with central part neatly diversified in detail. More decorative types of ornament are also used; but, with the felt for the centre of the rug or carpet made with a plain surface, the neater the border design both in form and colour the more æsthetic the toning of the made-up floor covering. Colour harmony and simplicity of pattern style in the bordering are the results to be attained. For the application of this class of patternwork mixture shades offer advantages, especially when the shades are built up on the plan indicated in Table V, as all the shades included in the series are linked with each other in colour hue. Employing, for instance, shade (1) for the carpet felt and shade (2) for the ground of the border felt, then the figuring might be developed either in shade (1) or in any desirable shade in the series, but in using shade (1) there is no break in the colour toning of the centre and border felt.

On these lines, the sketches illustrated are, therefore, producible in such mixture-shade assortments as those specified below :

TABLE VI.
MIXTURE SHADES FOR BORDERED FELTS.

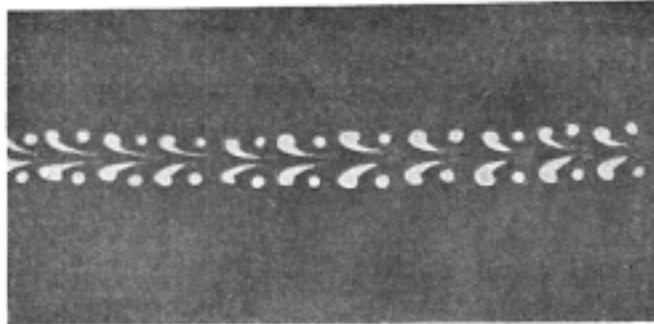
A.	B.	C.	
<i>Centre of Carpet or Rug Felt.</i>	<i>Ground of Border Felt.</i>	<i>Figuring of Border Felt.</i>	
Mixture Shade :	Mixture Shade :	Mixture Shade :	Table V.
(1) Blue-green.	(2) Brown.	(1) Blue-green.	„
(2) Brown.	(3) Olive.	(2) Brown.	„
(3) Olive.	(1) Blue-green.	(3) Olive.	„
(4) Green.	(5) Red-brown.	(4) Green.	„
(5) Red-brown.	(6) Blue.	(5) Red-brown.	„
(6) Blue.	(4) Green.	(6) Blue.	„

Or the mixture shades for A and B may be transposed, with the shades in C as in the transposed B series, or with the figuring developed in distinct shades from those in A and B.

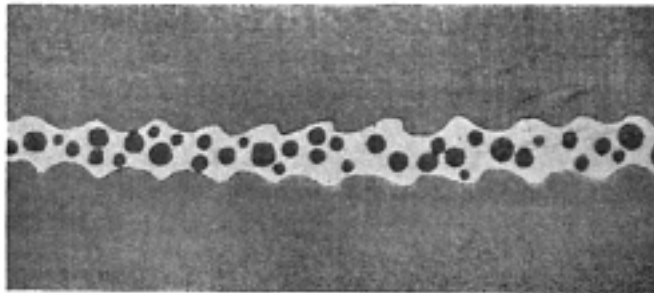
C¹



C²



C³



C⁴

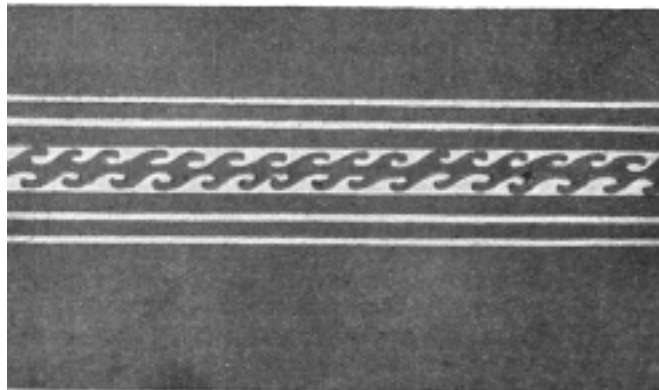


FIG. 39.

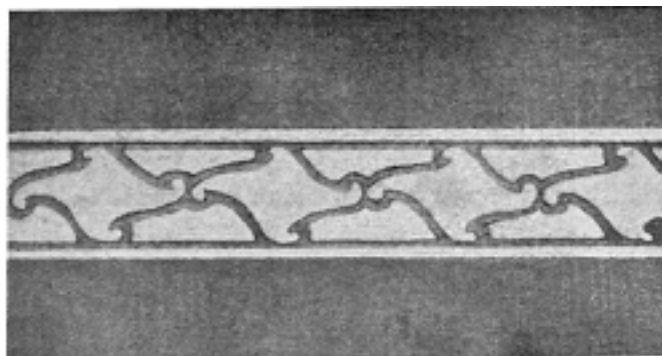
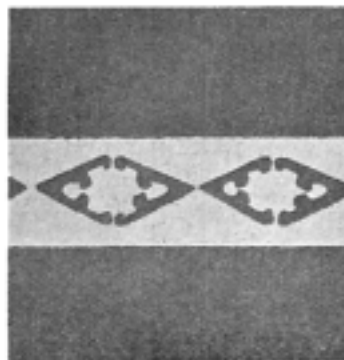
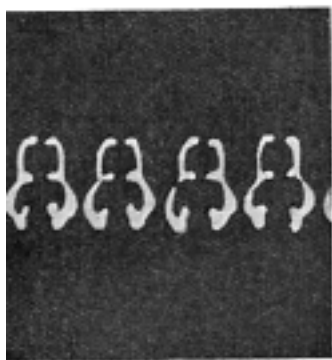
C⁵C⁶C⁷

FIG. 39A.

WOVEN FELTS

Woven-felt carpets, *i. e.* textile structures formed in warp and weft and heavily milled—as a result of the systems of looming practised—may be varied in ornament and in colour composition to a much greater extent than carded felt manufactures. Weaving principles and technicalities render this feasible. Design limitations are mainly governed by the build of the loom employed, and by the schemes of fabric structure applied. Materials, counts of yarn, and economic factors have also a restrictive influence. They do not necessarily curtail pattern delineation, but impose conditions as to methods of manufacture.

The kind of carpeting producible by the combined operations of weaving and felting is capable of extended development and application. It is one in which weaving affords scope in decorative style, and in which shrinkage imparts wearing utility and

softness of surface. In these respects it is superior to an unfelted structure.

These woven felts are either plain or decorative in make. The object in manufacture is to acquire a reversible carpet equally wearable on both sides and in which, as far as appearance and use are concerned, only the woollen materials are observed. This is practicable in compound weaves, double or triple in the warp and weft, and two- or three-ply in the weft and single in the warp. In a sense, any description of ordinary plain or twilled woven carpeting, made of coarse woollen yarns, may be felted; thus, a class of woven felt, varying from $\frac{3}{16}$ to $\frac{5}{8}$ of an inch in thickness, is manufactured in these weaves, but it is, on account of the spinning and weaving involved, more costly to produce than carded felts of a like substance. It is, however, stronger in the build than the latter, being made of folded yarns in the warp

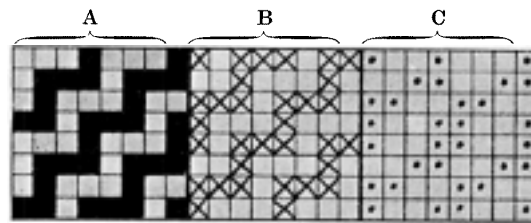


FIG. 40.

and firmly interlaced in weaving, in addition to the firmness it acquires in the process of milling. Examples in loom setting for this style of production are as follows :

A.—PLAIN-WOVEN FELT

Warp : 5 fold 16 skeins. Woollen.
10's reed, 1 end in a dent.
Weft : As warp, with the folded yarn loosely twisted.
10 picks per inch.

B.— $\frac{2}{2}$ TWILL-WOVEN FELT

Warp : 2 fold 8 skeins. Woollen.
8's reed 2's.
Weft : $3\frac{1}{2}$ skeins. Woollen.
16 picks per inch.
Contraction in Milling : In A 25 to 30 per cent., and in B 35 to 40 per cent.

The fact that these manufactures are single in structure implies that they are made in either a mixture shade obtained in blending

and carding, or a solid colour developed in piece dyeing. Hence the use of compound weaves in the construction of reversible felts, which are made in woollen yarns (shoddy, noils, wool, etc.) and in cotton warp and woollen weft, giving "all-wool" and "union" felts respectively. For the all-wool variety, double

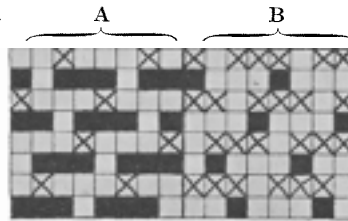


FIG. 41.

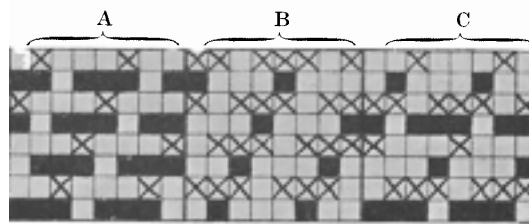


FIG. 42.

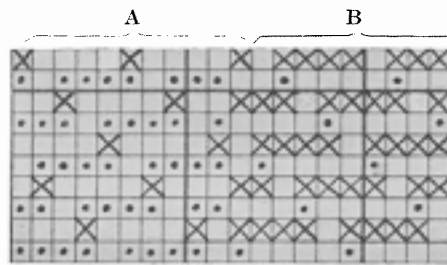


FIG. 43.

plain makes,—A and B, Fig. 44—arranged one thread face and one thread back, or two threads face and one thread back in both warp and weft, are used; and for the union variety the weaves A in Figs. 41, 42 and 43, arranged one pick face and one pick backing. The practice adopted in the manufacture of plain as well as decorative felts, in each of these weave structures,

will be explained in relation to the looming particulars stated below :

TABLE VII

WOVEN-FELT MANUFACTURES

A.—*Woollen-Yarn Felts*

Example I, Plan A, Fig. 44

Warp : 1 thread of 2 fold 8 skeins. Woollen, shade 1, *e. g.* red.
 1 " " " 8's reed 2's. " " 2, *e. g.* blue.
Weft : 1 pick of 4 skeins. Woollen, shade 1, *e. g.* red.
 1 " " " " " 2, *e. g.* blue.
 16 picks per inch.

Example II, Plan B, Fig. 44

Warp : 1 thread of 2 fold 16 skeins. Woollen, shade 1, *e. g.* green.
 1 " " " 10 " " " 2, *e. g.* tan.
 1 " " " 16 " " " 1, *e. g.* green.
 8's reed 3's.
Weft : 1 pick of 8 skeins woollen. Shade 1, *e. g.* green.
 1 " 5 " " " 2, *e. g.* tan.
 1 " 8 " " " 1, *e. g.* green.
 21 picks per inch.

B.—*Union Felts. Two-ply in the Weft*

Example I, Plan A, Fig. 41

Warp : 2 fold 15's cotton.
 10's reed 2's.
Weft : 1 pick of 3 skeins. Woollen, shade 1, *e. g.* crimson.
 1 " " " " " 2, *e. g.* fawn.
 30 picks per inch.

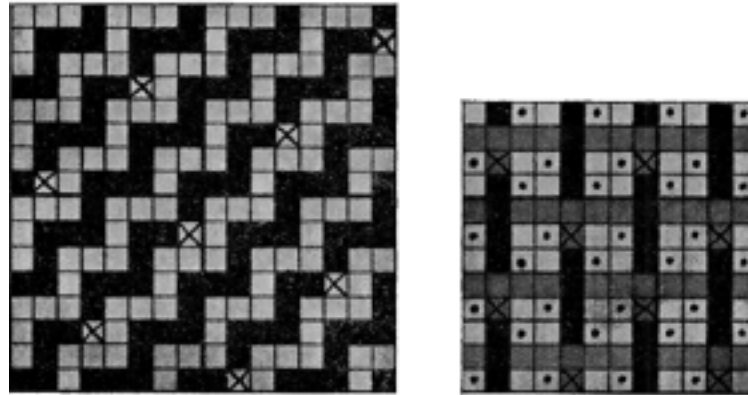
Example II, Plan A, Fig. 43

Warp : 2 fold 20's cotton.
 12's reed 2's.
Weft : 1 pick of 4½ skeins. Woollen, shade 1, *e. g.* deep orange.
 " " " " " 2, *e. g.* deep purple
 36 picks per inch.

It will be noted that the setting is variable and also the counts and quality of the yarns; but in each looming practice the warp threads in the union felts require to be of an adequate thickness and tensility to sustain the heavier filling yarns, while the latter should be of such a fibrous consistency as to yield a substantial fabric in which the cotton is perfectly concealed. To effect this, and also the production of a reversible carpeting, it is essential that, in union settings, there should be approximately double the number of picks as threads per inch, with the weft yarns several times thicker than the yarns used in the warp.

The contraction in milling should be from 15 to 20 per cent. in piece width with the addition of 10 to 15 per cent. in piece length in the woollen goods, but practically no shrinkage warp way in the unions. This measure of felting removes all traces

of the warp and weft intersections and develops a fibrous nap or cover on both sides of the fabric, so that after trimming on the cropping machine, it resembles a carded felt. The woollens are sounder in the make and of a better wearing durability than the unions, the two manufactures differing in structure and in yarn composition. The two types of weave applied, and the methods of warping and wefting tabulated, suggest these features. In Examples I and II in woollen-yarn felts, the double-plain weaves A and B, Fig. 44, give a red over a blue, and a green over a tan fabric, the two single textures of the compound cloth being stitched together at the points marked in \boxtimes 's in the weaves. Examples I and II in the union felts also give a fabric with the



A

FIG. 44.

B

upper and lower surfaces identical in formation though dissimilar in colour, namely, crimson and fawn in Example I and orange and purple in Example II; but the fabric consists of two layers of weft yarn bound one to the other by the warp yarn which is common to both.

On examination it will be seen that the several weave units differ in principle of arrangement. The double-plain makes—A and B, Fig. 44—are constructed in two ways, that in A producing a two-ply fabric of an equal number of threads per square inch in its upper and lower texture, but that in B a compound fabric in which the upper texture contains twice the number of threads and picks as the lower texture. To balance this inequality in the two single textures, the yarns used in the backing are proportionately thicker than those used in the face texture. Plans A in Figs. 41 and 43 differ in another respect, that is, in inter-

tion of sections A and B, are identical in Figs. 41, 42, and 43, but the plans in Figs. 41 and 43 yield the more perfect cover, and do not show a twilled characteristic in the carpet, which is quite visible in the fabric in the loom in the weaves given in Fig. 42. With the weaves modified and arranged as at C, Figs. 40 and 42, the two colours of yarn are intermingled and a mixture shade produced of the same quality on each woven surface.

TABLE VIII.

RUG AND MAT STYLES--WEAVABLE IN SHAFT MOUNTINGS

Methods of Design Construction.

<i>Symbol Equivalents.</i>		<i>Warping and wefting.</i>
I. Woollen—Fig. 45.		
Each square marked in—		
■'s = 16 threads	and picks of Weave A, Fig. 40.	As in Example I in A, Table VII.
Toned grey = 16	„ „ „ B, „ 40.	
Tinted grey = 16	„ „ „ C, „ 40.	
II. Union—Fig. 45.		
Each square marked in—		
■'s = 24 threads	and 48 picks of Weave A, Fig. 42.	As in Example I in B, Table VII.
Toned grey = 24	„ „ „ B, „ 42.	
Tinted grey = 24	„ „ „ C, „ 42.	
I. Woollen—Fig. 46.		
Each square marked in—		
■'s = 8 threads	and picks of Weave A, Fig. 40.	As in Example I in A, Table VII.
Toned grey = 8	„ „ „ B, „ 40.	
Tinted grey = 8	„ „ „ C, „ 40.	
II. Union—Fig. 46.		
Each square marked in—		
■'s = 12 threads	and 24 picks of Weave A, Fig. 42.	As in Example I in B, Table VII.
Toned grey = 12	„ „ „ B, „ 42.	
Tinted grey = 12	„ „ „ C, „ 42.	
I. Woollen—Fig. 47.		
Each square marked in—		
■'s = 12 threads	and picks of Weave A, Fig. 40.	As in Example I in A, Table VII.
Tinted grey = 12	„ „ „ B, „ 40.	
II. Union—Fig. 47.		
Each square marked in—		
■'s = 15 threads	and 30 picks of Weave A, Fig. 43.	As in Example II in B, Table VII.
Tinted grey = 15	„ „ „ B, „ 43.	

Design, in these classes of woven felt carpeting, is acquired by the combination of the plans described. First, they are employed in the production of geometric and other elementary forms of pattern in dobbie looms; and, second, of decorative styles in Jacquard mountings. Illustrations of the drafted patterns are given in Figs. 45, 46, and 47, and of the decorative styles in Fig. 49. The former are for simple rugs, mats, or carpet

spreads, according to the sizes in which they are made. They are of the bordered type in Figs. 45 and 46, and of the geometric drafted type in Fig. 47. All are weavable in a limited number of shafts or heddles. Only sectional parts of the designs are shown in the two former. To complete these, in looming, section C, centre, would be repeated for the necessary number of times and followed by sections A¹, B and A in Fig. 45, and by sections B¹, A¹, B and A in Fig. 46. The design in Fig. 47 is complete in itself, but in practice it might be extended by repetition or by the addition of lines in plain colouring at each end of the rug.

The sketches are drawn to the scale of each small square being equivalent to one or more repeats of the weave units applied in their production in the loom. Typical methods of developing these, and similar pattern bases, are given in Table VIII, p. 117.

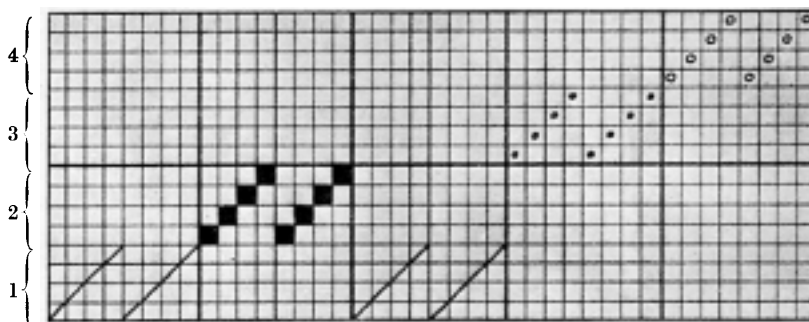


FIG. 45A.

Each sketch is, in these particulars, worked out in yarns and settings suitable for woollen and union rugs. In the former, both width and length shrinkage are practised in the fulling process, but only width shrinkage in the latter. The system of design construction may be explained by reference to Figs. 45A and 45B, the healding draft (section) and looming plan for Fig. 45. The lines of detail numbered 1, 2, 3 and 4 represent, according to arrangement I in Table VIII, 16 threads, so that the units A are equal to 32 threads and picks, units B to 64, and units C to 256; or the whole sketch in the loom occupies 384 threads and picks. In arrangement II (union) the same units would contain 576 threads and 1152 picks; but, as in this setting there are 48 picks and 24 threads per inch, the proportionate measurement of the unit details is retained in the transference of the sketch to the woven fabric.

The numerals on the top of Fig. 45 show the order of drafting the groups of 16 threads for forming the details in lines 1,1, 2,2, 2,2, 1,1, 3 and 4. These are arranged consecutively on the shafts bracketed 1, 2, 3, and 4 in Fig. 45A. The whole draft would also contain groups of 16 threads each for lines 3,3, 3,3, 4,3, 4,4,4,4, 3 and 4 drawn respectively on the sets of shafts correspondingly numbered. The looming design—Fig. 45B—in agreement with the healding draft and also with the sketch and the data given in Table VIII for the same, consists of the simple or “type” units in the sketch, that is, of sections 1, 2, 3 and 4 reduced to the size of the elementary weave in which each is formed. This results in the weaving plan (Fig. 45B) consisting of 16 threads (= 4 type units in the sketch), but in its being composed of the full number of picks in a repeat of the pattern as shown in the illustration. According to this rule, as the sketch in Fig. 46 is composed of five units (= single lines of 1, 2, 3, 4 and 5), it is weavable, in the use of four-thread weaves, on 20 shafts, and that in Fig. 47, composed of four units, on 16 shafts. The total number of picks in the looming plan not only varies with the number of effect units in the design but also with the fabric structure. Woollens are commonly woven on the square as to threads and picks per inch, but unions with more picks than threads as indicated in the settings for these carpets in Table VII. The symmetry and proportions of the pattern are preserved in transferring the sketch on to

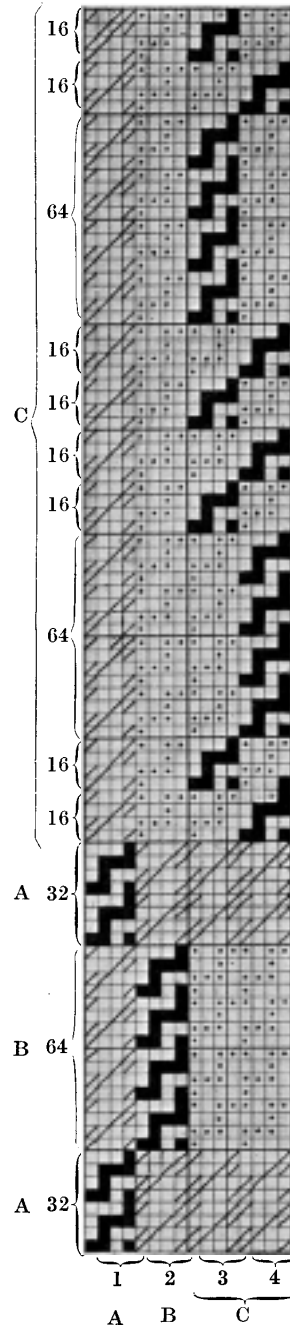


FIG. 45B.

point paper by selecting paper ruled in the ratio of the warp and weft setting of the fabric such as 8×12 , 8×16 , etc.

The dimensions of the rugs in the loom are determined by the number of units of effect in the design, the number of ends and picks of which each is formed, and by the loom setting. Taking Figs. 45, 46 and 47 in the settings and thread groupings specified in Table VII, the sizes of the woven rugs are ascertained thus :—

TABLE IX.

FELTED WOVEN RUGS.

Fig.	No. of Threads	Threads	Woven Rug.
	Effect	per	Width. Length.
	Units.	Unit.	per
Fig. 45.			
I. Woollen.	$8 \times 16 \div$	$16 = 8'' \times 2$ (borders) = $16''$	$16 + 24. 16 + 56$
Centre	$= 16 \times 16 \div$	$16 = 16'' \times 1\frac{1}{2}$ repeats in width = $24''$ $16'' \times 3\frac{1}{2}$ repeats in length = $56''$	$= 40'' \times 72''$
Fig. 45.			
II. Union.			
Each border	$= 8 \times 24 \div$	$20 = 9\frac{3}{4}'' \times 2$ (borders) = $19''$	$19 + 23\frac{3}{4}. 19 + 47\frac{1}{2}$
Centre	$= 16 \times 24 \div$	$20 = 19'' \times 1\frac{1}{4}$ repeats in width = $23\frac{3}{4}''$ $19'' \times 2\frac{1}{2}$ repeats in length = $47\frac{1}{2}''$	$= 42\frac{3}{4}'' \times 66\frac{1}{2}''$
Fig. 46.			
I. Woollen.			
Each border	$= 22 \times 8 \div$	$16 = 11'' \times 2$ (borders) = $22''$	$22 + 16. 22 + 48$
Centre	$= 32 \times 8 \div$	$16 = 16''$, one repeat in width = $16''$ $16'' \times 3$ repeats in length = $48''$	$= 38'' \times 70''$
Fig. 46.			
II. Union.			
Each border	$= 22 \times 12 \div$	$20 = 13\frac{1}{2}'' \times 2$ (borders) = $26''$	$26 + 24. 26 + 57$
Centre	$= 32 \times 12 \div$	$20 = 19\frac{1}{2}'' \times 1\frac{1}{4}$ repeats in width = $24''$ $19\frac{1}{2}'' \times 3$ repeats in length = $57''$	$= 50'' \times 83''$
Fig. 47.			
I. Woollen.			
Design	$= 64 \times 12 \div$	$16 = 48''$ in width $48'' \times 1\frac{1}{2}$ repeats (Sections A and B) in length = $72''$	$48'' \times 72''$
Fig. 47.			
II. Union.			
Design	$= 64 \times 15 \div$	$20 = 48''$ in width $48'' \times 1\frac{1}{2}$ repeats (Sections A and B) in length = $72''$	$48'' \times 72''$

Allowing 20 per cent. width contraction and 10 per cent. length contraction on the woollens and 25 per cent. width contraction on the unions, the approximate sizes of the commercial rugs would be :—

Fig. 45	Woollen	$32'' \times 65''$	Union	$34'' \times 66''$
"	46	" $30'' \times 66''$	"	$38'' \times 88''$
"	47	" $38'' \times 65''$	"	$36'' \times 72''$

Sketches of the type illustrated allow of the centre features of the rug being extended either in width, length, or in both width and length as desired. The patterns, being draftable, are

composed of a small number of units of effect, as in C, Fig. 45, formed of the two units numbered 3 and 4, and in C, Fig. 46, of the three units numbered 3, 4 and 5. Such units may be differently grouped to give other pattern types, or other units may be combined as in A, B, and C, Fig. 45B; but the pattern type selected and used in the design becomes the unit scale for

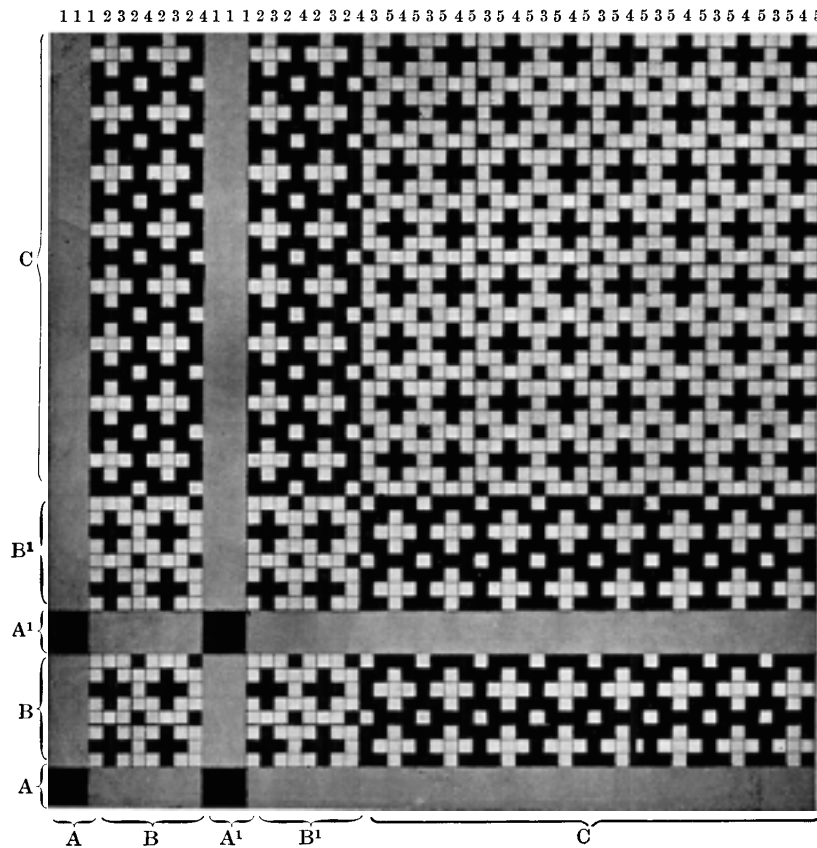


FIG. 46.

repetition purposes. It is the number of units in a repeat of this " effect " or " motive " (namely, eight in section C, Fig. 46) which is the factor to take into account in modifying the central part of this class of rug design. The alterations made therein must coincide with the ends and picks used in constructing the motive, which are governed by the weave structure applied in its development. If, for example, plans A and B, Fig. 40, were employed, each unit in the motive would be formed in multiples

to form rectangular spaces varying in size, in Fig. 46 small stars and square patches, with the stars in the centre C in one shade and in the border in a second shade. Such " motives " may be conveniently devised on point paper, as in sketches A, B and C, Fig. 48, when each single square or symbol is, as explained in reference to Figs. 45, 46 and 47, taken to be the equivalent of a

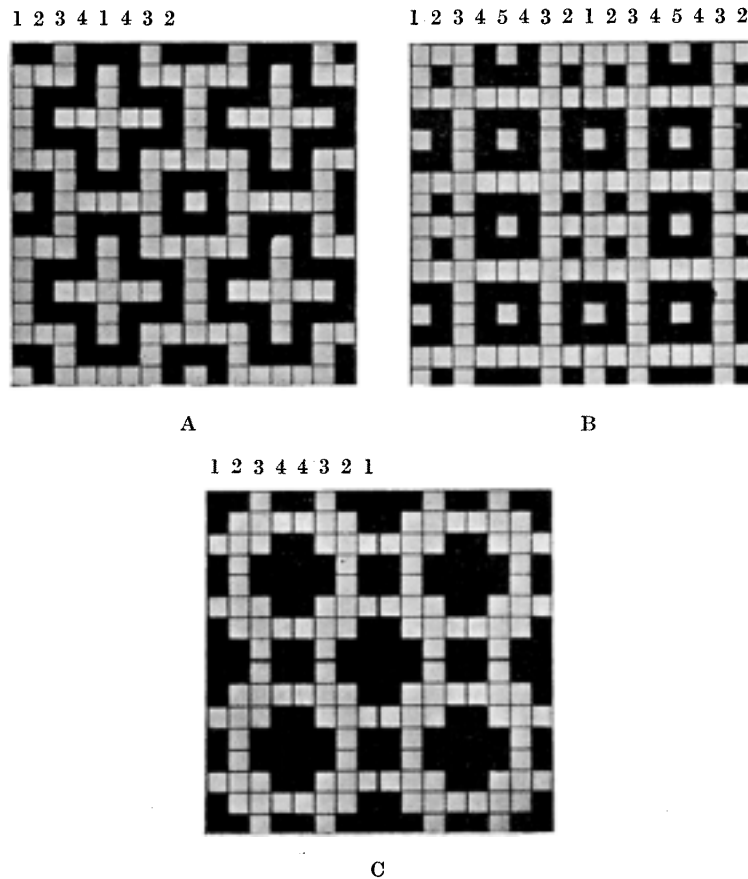


FIG. 48.

prescribed group of threads and picks. These sketches show that common design structures are usable for this object, sketch A being arranged on the star base, B on the rectangular, and C on the spotted base. It is essential, however, in preparing the sketches that not more than five or six units should be combined. Ordinarily, twenty-four shafts for 4-shaft weave compounds, and twenty-five shafts for 5-shaft weave compounds (*e. g.* plans

A and B, Figs. 41 and 43) should not be exceeded, which restricts the line units in the motives for both border and centre patterns to the above numbers.

The economic class of rug style obtained by designing on this system will be understood by considering the effects of the settings and colourings given for the examples in Table VII. With the use of two shades—applied in both warp and weft in the woollen, but in the weft only in the unions, the rugs contain three colour effects, due to two varieties of the elements in the pattern being woven in solid colours, with a third variety of the elements woven in an intermingled tone of colouring. In addition, patterns are acquired in the border and centre respectively, contrasting in structure and in detail composition, and with each description of pattern composed of well-pronounced form types. These characteristics are emphasised in working out the sketches to the fabric scale, or in the production of the rugs, which increases the proportions of the various effects and develops them in distinctive colour tones. Fig. 45, for example, makes, in the woollen setting, a rug in which the effects marked in black in the sketch are woven in red, those in tinted grey in blue, and the lines in toned grey in red and blue intermixed or in a purple hue. Fig. 46 gives a rug—union setting—with the star details in the centre C in crimson and the same features in the border in fawn, with the grey lines developed in the two colours intermingled. In Fig. 47—woollen setting—the ground of the rug is woven in red and the figuring in blue, with the colours transposed from ground to figure on the reverse side of the rug.

The size of the different decorative elements, in the actual rug production, is proportionate to the thread grouping and the fabric setting. By these factors the single square units in Fig. 45 are transformed into effects of one inch in size in the woven but unfelted rug manufacture (method I, Table VII), those of four units into effects of four inches, etc.; in Fig. 46—woollen setting—the star features and also the lines A in toned grey are made to measure three inches in width, and the bands B eight inches; and the design in Fig. 47 is, by the same practice, extended to the full width of the rug. These dimensions are suggestive of the style of large patterns, geometric in arrangement, possible in both rugs and carpets in dobbie looms of a requisite weaving capacity, and in the combination of the weave structures defined.

For figured and decorative styles the Jacquard loom is necessary. When this is employed the woven felt principle of manu-

facture admits of the use of the various forms of ornament applicable to designs developed in two shades of yarn. Both the woollen and the union methods of fabric construction are practised. The carpet specimen in Fig. 49 is made on the latter system. It shows that by employing the two-ply weft weaves in Fig. 41, using A for the ground and B for the figuring, the pattern forms may be clearly delineated. In a sense these suffer in sharpness

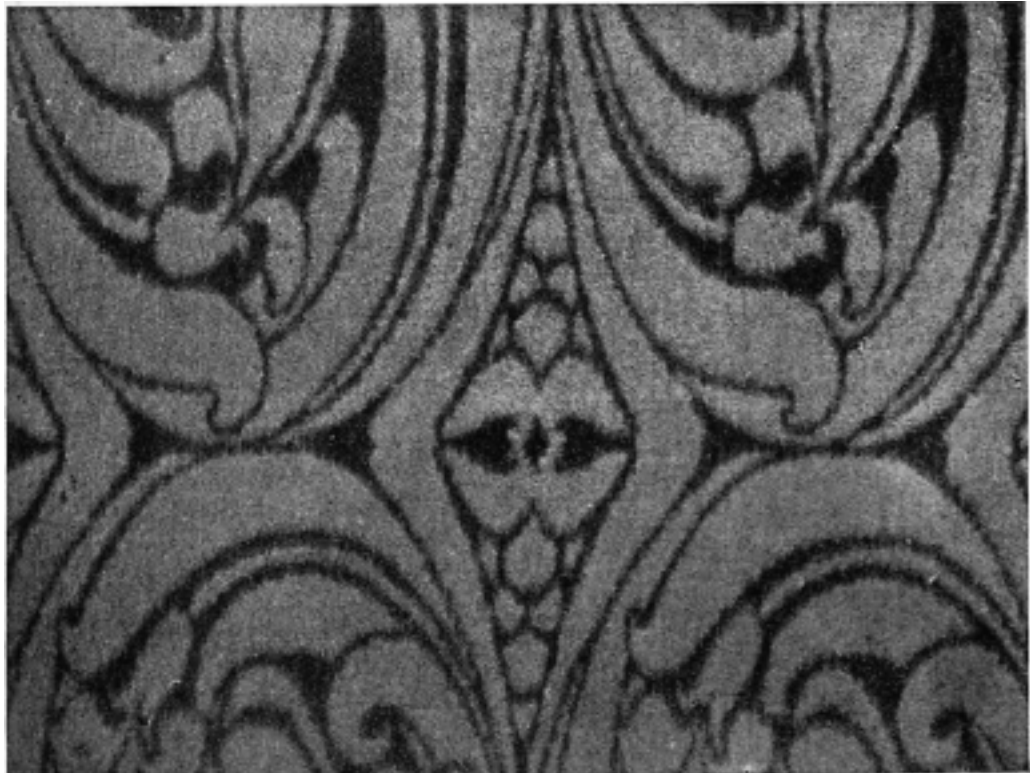


FIG. 49.

of outline in felting, but gain in softness of tone. The cotton warp yarns interlacing with the two shades of weft yarn—dark and medium blue green in the carpet—are perfectly concealed by the 25 per cent. of width contraction practised in fulling, and the carpet has the appearance and surface property of an all-wool product.

Such carpet manufactures are reversible in colour, pattern and in all surface characteristics, being equally wearable on one

side as the other. The full fibrous nap acquired on the two sides of the carpet is a consequence of felting. This nap is made to resemble the pile produced in weaving by raising the carpet piece in a damp condition on each surface and from end to end. To render the nap permanent in composition, the piece, after raising, should be replaced for a brief period in the milling machine, and to level and even the nap the carpets should be finally "topped" on the cropper. A short, dense nap being the desideratum, strong-fibred materials of a medium length of staple require to be used in the manufacture of the woollen yarns. The application of wools too long in the staple results in the filaments being spread on the surface instead of being made to project from the foundation of the carpet. Felting knits the yarns and the fibres of which they are composed one with the other into a compacted form, and raising, when practised, lifts the fibres into a vertical pile relation without disturbing their setting in the carpet structure.

CHAPTER IV

KIDDERMINSTER, SCOTCH AND INGRAIN MANUFACTURES

Meaning of these Terms—Fast-Woven Carpet Structure—Double- and Multi-Ply Weaves—Structural Variations—System of Carpet Construction—Designing and Weaving Principles—Standard Textural Units—Ordinary Type of Manufacture—Colour Practice and Delineation of Decorative Forms—Pattern Effects due to Weave Structure and Colour Arrangement—Four Varieties of Double-Plain Weaves Combinable—Colour Schemes—Application of Colour and Weave to Design—Centre-Warp Weaving Practice—Three-Ply Warp and Weft Structures—Centre-Warp Weaves—Three-Ply Weaves and Carpet Construction and Design—Warping and Wefting Orders—Stair Carpet Example—Depth of Colour Contrast—Positive and Primary Colours—Yarn Groupings—Mingled Colour Toning—Colouring in the Weft Yarns—Colour Development of Border Designs and Art Squares—Tone, Hue, and Tone and Hue Contrasts—Colour Checking in the Carpet Ground—“Kidder” Loom.

“KIDDER,” “Scotch,” or “Ingrain” carpets were originally an English manufacture, having been first produced in Kidderminster, from which town the correct designation is derived. Ingrain is an Americanism. The Scotch term is applied somewhat promiscuously, but may, as a rule, be taken to denote that the carpet has not been made in Kidderminster factories. The three terms are synonymous in technical significance, defining a class of carpet consisting of yarns spun from strong-haired wools, and double-plain woven. In principles of construction and weaving it closely resembles the common varieties of textures formed in the loom, being, in this respect, in marked contrast with the several grades of pile-constituted carpets, developed in idea and in surface characteristics from the hand-tufted vertical-warp, Eastern production.

The fast woven scheme of interlacing practised is a primary element of the “Kidder” structure. Whereas, in all descriptions of pile carpets the foundation of the fabric is composed of a group of yarns supplementary to the yarns combined in the formation of the pile features, in this build of carpet each series of yarns—warp or weft—appear successively on the face and on the reverse side of the texture. From this structural factor, and also from the pattern being the converse in colour composition on the

respective surfaces, the term "reversible" is strictly applicable to the ordinary classes of "Kidder" manufactures. The carpet may be designed, coloured and constructed to be usable on both sides, but with the shades in the ground sections and decorative details, exactly transposed, as seen in Figs. 50 and 53.

Double- or multi-ply weaves are essential in acquiring both the carpet structure and the design development. Single-make crossings—plain, twilled diaper and mat—are used in the weaving of jute carpets, in which the yarns are of a thick, coarse, strong

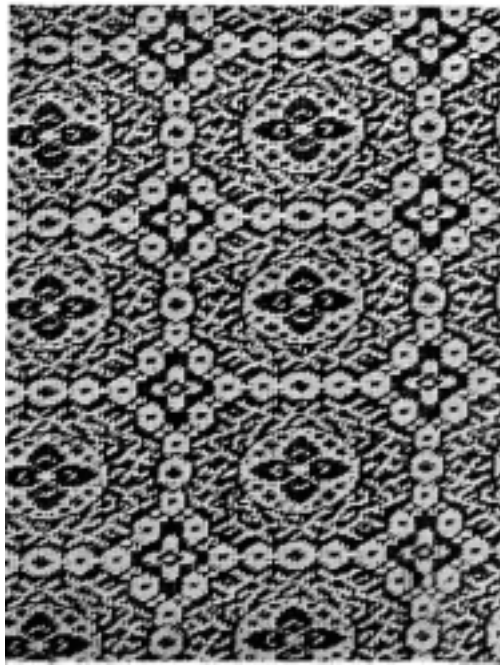


FIG. 50.

character; but single weaves are not adapted to carpets manufactured of woollen, worsted and similar yarns. Durability, substance and firmness of fabric structure would not, in such weaves, be obtainable. For these reasons, compound weaves two- or several-fold in construction, and plain interlaced, are employed. The carpet resultant is formed of double or triple layers of textures of corresponding thicknesses, spread one over the other, and regularly stitched or bound into one compact fabric in the operation of weaving. Another advantage of the double- or treble-cloth system is found in the production of the design

elements, consisting of geometric or conventionalised floral forms. With a single-weave unit, striped and checked patterns may be acquired by the colour arrangement of the warp, weft, or warp and weft threads. More than this in the nature of decorative treatment is not practicable if a fabric is woven plain throughout; and any departure from this rule in carpet weaving would not be satisfactory, as a structure of irregular wearing strength in different sections would be produced by combining dissimilar weave units for the purpose of attaining pattern definition. The degree of textural soundness dependent upon the gradation in the schemes of intersection applied would vary from the fast-woven to the comparatively loose-woven sections.

Diversity of weave structure, which is responsible for pattern origination in many classes of loom work, is discounted in carpet manufacture. Diversity of fabric build is, however, applicable, providing the whole surface of the carpet is of the same textural composition and quality. In woollen warp and weft "Kidders," with the "reversible" feature also to be attained, both sides of the woven manufacture are required to be identical in weave formation. Three principal schemes of construction have been developed, namely, (1) the two-ply or common type; (2) two-ply with centre or "stuffing" warp threads forming the interior of the carpet, and binding the upper and lower cloths together, but not used in either the ground or figured parts of the carpet; and (3) three-ply structures, in which three sets of warp and weft yarns are employed, each set making a separate texture which may, as required in the weaving of the pattern, appear successively on the face, in the centre, and on the back of the carpet. Type (1) is the simplest in looming and in manufacture. Type (2) possesses an advantage in giving fulness or body to the compound structure, and in firmly and evenly binding the two plain cloths of the carpet to each other: for the additional central warp yarns utilised render a uniform system of stitching feasible, whereas in type (1) this is only effected by interchanging the relative positions of the two fabrics in the production of the carpet. Type (3) is the most satisfactory principle of intertexture. It provides improved facilities for pattern work and colour treatment, and also for the construction of a thick, heavy variety of manufacture.

Each type represents a distinct principle of design, scheme of colour technique, and a specialised system of loom mounting; and is, moreover, capable of a number of detail modifications, yielding useful derivative styles in actual practice.

Treating of the first type or principle, weaves A and B, Fig. 51, are commonly employed, applying unit A to the ground and unit B to the figuring, or *vice versa*. Now, as each of these plans of intertexture results in a two-fold plain-built fabric, weave A having the odd threads and picks in the face texture and the even threads and picks in the underneath structure, and weave B having the two series of threads and picks in the reverse order in the respective fabrics, face and back, it will be obvious that should the yarns in the warp and weft be arranged 1 red and 1 blue, the first of these weaves would produce a red cloth over a blue cloth, and second weave a blue cloth over a red cloth. Therefore, should each blank space in Fig. 52 correspond to four threads and picks—one repeat of weave A—and each marked space to a similar number of ends and shots of weave B, and the same order of warping and shuttling were followed, on one side

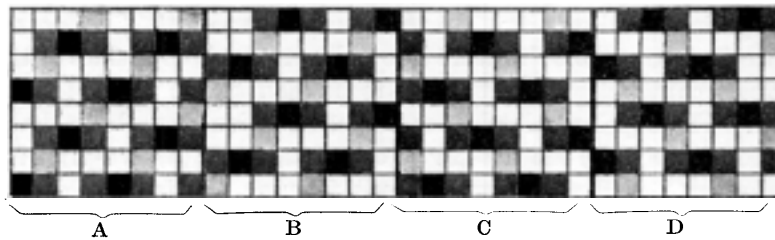


FIG. 51.

of the carpet the figure—black in the illustration—would be in the blue shade, and the ground—grey effect in the design—would be in the red shade, with the positions of the colours in both the pattern and the ground transposed on the under side of the production.

This example is suggestive of the designing principles involved. Technically they are not of an intricate character, due to the fabric structure being a fixed quantity. Yarn counts and setting are also limited in range, such as two-fold 4's worsted warp and weft with 24 ends and picks per inch, or for a finer grade of manufacture two-fold 8's or 10's with 28 or 30 threads and picks; and for a woollen carpet of a thicker and fuller construction two-fold 9 or 10 skeins—coarse crossbred wool—in 20 or 22 ends and picks per inch. It will be made clear that these restrictions in fabric build, and in yarn and setting factors, do not detract from the latitude for design treatment as regards decorative style, or the diversity of effects of a textural kind, including the

range of pattern features composed of geometric forms and of modified weave units, and producible in either the development of the ground or figuring.

One sound and effective practice in textile design is to discover, by experiment and analysis, the species of minute or smaller types of pattern possible in weave and colour effects applicable

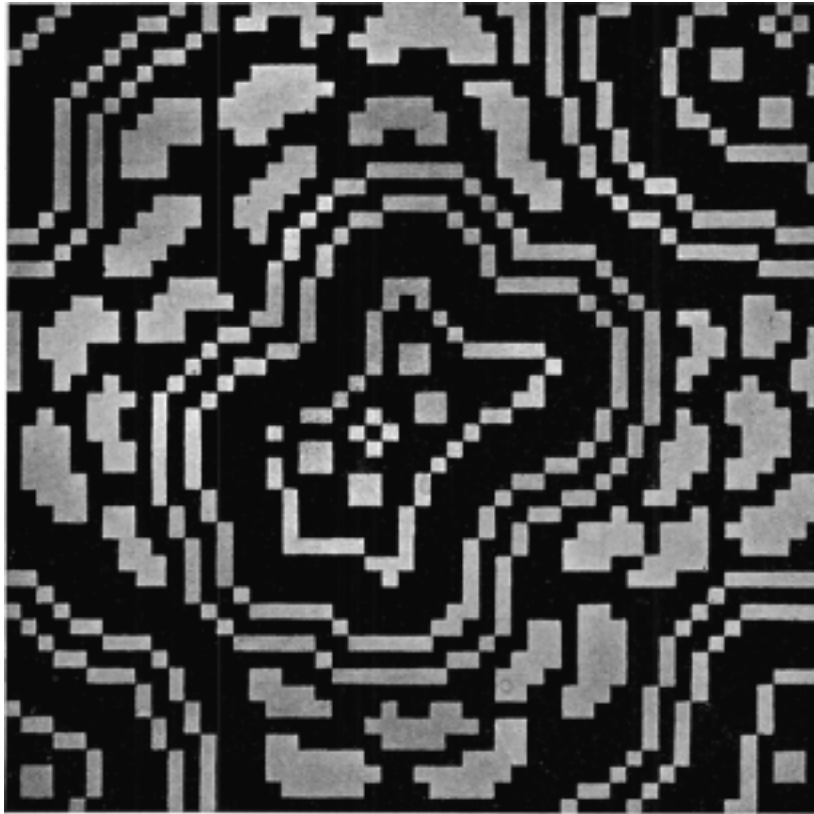


FIG. 52.

to the variety of fabric to be constructed. In one sense, there are simply two textural units—A and B, Fig. 51—adaptable to this build of carpet, and but one system of warping and shuttling, namely, end-and-end and pick-and-pick. Both are, however, subjective to a number of elementary changes, important rather in the varied aspect they impart to the colour tone of the carpet than in any modification in colour technique. Here it is a question of explaining and describing the nature and principle of the

intermediate groups of styles obtained by using these double-plain makes, suitable by their structural formation for lending a correct delineation of patterns consisting of pronounced and of detailed elements.

Ordinarily it is evident that the standard variety of wool-yarn "Kidder" is a manufacture in which the figuring is woven in one shade—Fig. 50—and the ground in a second shade or colour. But should the yarns in the warp and weft be arranged on such systems as—

(a).
 1 thread and 1 shot of shade 1
 1 " " 1 " " 2
 1 " " 1 " " 1
 1 " " 1 " " 3

(b).
 1 thread and 1 shot of shade 1
 1 " " 1 " " 2
 1 " " 1 " " 3
 1 " " 1 " " 4

the figuring on the right side of the carpet would in (a) be woven in shade 1 and the ground in shades 2 and 3, and in (b) the

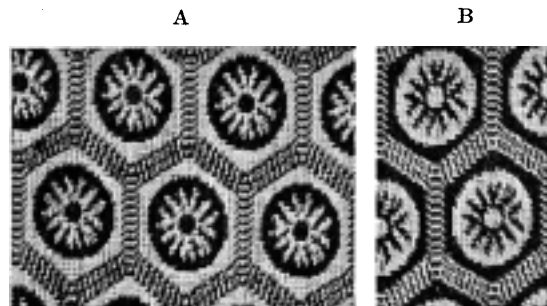


FIG. 53.

figuring in shades 1 and 3 and the ground in shades 2 and 4. Moreover by varying the weave types combined other textural effects are producible. An example of this character is illustrated in Fig. 53. It, and also Fig. 50, have purposely been woven to a reduced scale and in black and white yarns, and in the one-and-one order of colouring, to render them effective in the photographic reproductions. Section A, Fig. 53, shows the design development on the face, and section B the design scheme on the back of the carpet. The commingled line detail and features constitute the intermediate grade of pattern work between the two series of pattern elements woven in black and white shades. In the

combination of weaves A and B two threads and two picks form the minimum number feasible for the correct interchanging of the upper and lower textures or of the two groups of warp and weft yarns applied. If the weave structure had been three- instead of two-ply, then three threads and three picks would have been the weave unit of textural transposition. The pattern details in Fig. 53 are the result of combining weaves A and B in sections of two threads and picks in accordance with the varied plan of effects observed in the illustration. Such minute elements may be diversified in size, and arranged in solid lines in vertical order, or successively in horizontal and vertical order; but, on whatever basis devised, they should not interfere with the clear delineation of the principal or leading features of the design. In addition to line compositions, broken or intermixed, small spotted effects, and minute checkings, are generally the least destructive of the true and clear development of the complete pattern style. The idea is to produce a distinctive groundwork effect, but one which, in detail and in colour tone, will contrast identically with each type of design elements, that is, with those woven in the darker or in the lighter shade of yarn.

It is now understood that with two shades of warp and weft yarns, and by combining weaves A and B, Fig. 51, a two-ply fabric structure is acquired in which the two sides of the carpet are the reverse of each other in colour tone, and that pattern production is dependent upon the interchange in position of the respective textures. As a method of looming, in its simpler form, it obviously only admits of the ground of the woven manufacture being woven in one, and of the figured sections in a second solid shade, unless some principle of intermingling the two effects is practised in certain parts of the design, as in the groundwork of the pattern illustrated in Fig. 53.

Analysing the plans A, B, C, and D, Fig. 51, at once unravels the textural construction usable, and demonstrates the character of the pattern effects obtainable in this class of carpet by colour arrangements based on the thread-and-thread grouping. The black marks in each weave represent the plain-woven face, and the light grey marks the plain-woven backing texture. The medium grey marks indicate backing threads depressed on face picks, so that all the marked squares in the plans denote weft shots covering warp threads. Colouring the warp (scheme I) one grey and one tinted white, and the weft one toned grey and one tinted grey, yields the detail types sketched in Fig. 54, namely:—

Weave A, Fig. 51=Section A', Fig. 54, or a grey warp crossed with a toned grey weft texture over a texture woven in stained white and light grey yarns.

Weave B, Fig. 51=Section B', Fig. 54, or a stained-white warp crossed with tinted grey weft texture over a texture woven in grey and toned grey yarns.

Weave C, Fig. 51=Section C', Fig. 54, or a stained-white warp crossed with toned grey weft texture over a texture woven as at D'.

Weave D, Fig. 51=Section D', Fig. 54, or a grey warp crossed with a tinted grey weft texture over a texture woven as at C'.

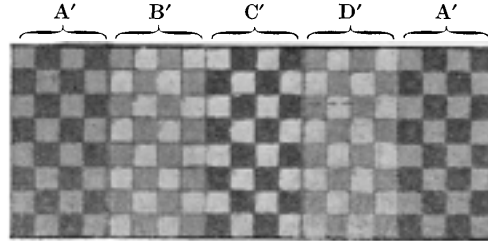


FIG. 54.

Changing the order of colouring (scheme II) to one end of grey, one tinted white, one grey, and one end of dark grey in the warp, and to one shot of toned grey, one grey, one toned grey, and one shot of black in the weft, produces the pattern units seen in Fig. 55, which are described below:—

Weave A, Fig. 51=Section A², Fig. 55, or a grey warp and toned grey weft texture over a texture woven as at B².

Weave B, Fig. 51=Section B², Fig. 55, or a texture composed of tinted white warp and grey weft lines, alternating with dark grey warp and black weft lines, over a texture woven as at A².

Weave C, Fig. 51=Section C², Fig. 55, or a texture composed of tinted white warp crossed with toned grey and of dark grey warp crossed with toned grey, over a texture woven as at D².

Weave D, Fig. 51=Section D², Fig. 55, or a texture composed of grey warp crossed with grey weft and of toned grey warp crossed with black weft, over a texture woven as at C².

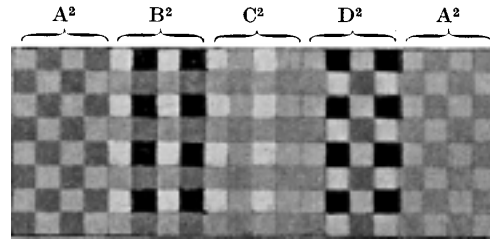


FIG. 55.

The pattern types acquired in the four forms in which double plain weaves are combinable, arranged in weave A one face and one backing and in B one backing and one face in both warp and weft, in C one backing and one face in the warp and one face and one backing in the weft, and in D one face and one backing

in the warp and one backing and one face in the weft, are represented in the colour sketches described. They comprise the effects which may be blended with each other in the tone gradation of the carpet, and also in the production of the figuring. By combining shades of warp and weft yarn differing in degree from each other in tone depth, the interlacings of the plain make in both schemes I and II are traceable in the fabric, and an interesting colour quality is imparted to the carpet. Moreover, the four types of weave effect possess the characteristics of eight minute pattern features, due to the difference in tone between the shades of the warp and weft threads. Thus, it follows that whereas with weaves A and B, when woven in end-and-end and shot-and-shot colouring in two identical warp and weft shades, the ground and figure are formed in solid colours, by introducing into the shuttling two analogous shades to those used in the warping but of a dissimilar depth of hue, each section of the surface of the fabric—ground and pattern—is composed of a mingled or mixture shade; and the reversing of the effects from the face to the back, while yielding the same textural features, is distinguished by a special shade tone, varying in quality with the degree of contrast between the two shade units combined.

Considering these technicalities of intertexture in their practical application, the following further methods of colouring will be dissected in relation to the decorative style in Fig. 56 :—

SCHEME III.—WARP AND WEFT.

One thread of shade 1, *e. g.* red brown.
 " " 2, *e. g.* medium blue.
 " " 1, *e. g.* red brown.
 " " 3, *e. g.* tinted or lavender blue.

SCHEME IV.—WARP AND WEFT.

One thread of shade 1, *e. g.* deep greenish grey.
 " " 2, *e. g.* deep orange grey.
 " " 3, *e. g.* pale greenish grey.
 " " 4, *e. g.* pale orange grey.

Assume, first, weave A, Fig. 51, to be applied to the ground, and weave B to the ornamental features of this specimen, then, by using colour scheme III, the groundwork of the carpet would be developed in a solid shade—red brown—and the figuring in a mingled tone of blue and lavender. Second, in applying scheme IV., both the ground and the design elements would be woven in chintzed colouring, the former in deep and pale greenish grey, and the latter in deep and pale orange grey. Substituting a green shade for the second thread of red brown in scheme III., and a bluish grey for the second thread of deep greenish grey in

scheme IV., would result in two important modifications. In the first place, a contrast in hue is introduced into the ground colouring of each example; and, in the second place, the pattern units are changed from mingled to minute effects. The latter characteristics would be more subdued in definition in scheme III. than



FIG. 56.

in scheme IV., for the red brown and green shades should correspond in tone depth, whereas the deep greenish grey and bluish grey would distinctly differ in this quality. Each method of shuttling would give the figuring in mixed tones of analogous colours.

Retaining the systems of warping, several variations may be

made in the shuttling, of which the following are suggestive examples:—

WARPING.—SCHEME III.

- Wefting* A=1 red brown, 1 tinted white, 1 red brown and 1 lavender.
 „ B=1 tinted red, 1 blue, 1 red brown and 1 lavender.
 „ C=1 red brown, 1 green, 1 light red, 1 lavender.
 „ D=1 red brown, 1 blue, 1 light tan, 1 tinted green.

WARPING.—SCHEME IV.

- Wefting* A¹=1 pale greenish grey, 1 pale orange grey.
 „ B¹=1 deep greenish grey, 1 deep orange grey.
 „ C¹=1 pale greenish grey, 1 pale orange grey, 1 deep greenish grey and 1 deep orange grey.
 „ D¹=1 deep greenish grey, 1 pale orange, 1 pale greenish grey and 1 deep orange grey.
 „ E¹=1 pale greenish grey, a deep orange grey, 1 deep greenish grey, and 1 pale orange grey.

The colour or pattern units producible by these weftings on warping practices III and IV are tabulated below. They have special reference to the design in Fig. 56, but also apply to all varieties of carpet ornament obtained by combining weaves A and B in Fig. 51.

TABLE X.

FABRIC EFFECTS DUE TO ORDERS OF WARPING AND WEFTING IN ALL-WOOL YARN “KIDDERS.”

Order of Warping.	Order of Wefting.	Textural effects in the ground and figured sections of the Carpet, Fig. 56.
III.	A.	Ground developed in a solid shade—red brown—and figure in lavender blue lines, alternating with intermingled lines of blue warp crossed with white weft.
III.	B.	Ground in lines of red brown, alternating with mixed lines of red brown warp, and tinted red weft; figure in solid blue and solid lavender lines.
III.	C.	Ground as in B; figure in lavender lines, alternating with mixed lines of blue warp crossed with green weft.
III.	D.	Ground in lines of red brown, alternating with mixed lines of red brown crossed with light tan; figure in lines of blue, alternating with mixed lines of lavender crossed with tinted green.
IV.	A ¹ .	Ground in lines of pale greenish grey, alternating with lines of deep greenish grey, crossed with pale greenish grey; figure in lines of pale orange grey, alternating with lines of deep orange grey crossed with pale orange grey.
IV.	B ¹ .	Ground in lines of deep greenish grey, alternating with lines of pale greenish grey crossed with deep greenish grey; figure in lines of deep orange grey, alternating with lines of pale orange grey crossed with deep orange grey.
IV.	C ¹ .	Ground in deep greenish grey crossed with pale greenish grey and pale greenish grey crossed with deep greenish grey; figure in deep orange crossed with pale orange, and pale orange crossed with deep orange grey.
IV.	D ¹ .	Ground in lines of deep and pale greenish grey in alternate order; figure in a mixture effect of deep orange and pale orange grey.
IV.	E ¹ .	Ground in a mixture effect of deep and pale greenish grey; figure in lines of deep and pale orange grey in alternate order.

The two varieties of effect are in each instance reversed from figure to ground and from ground to figure on the respective sides of the carpet.

Each colour unit is capable of modification by other orders of shuttling than those enumerated, but it is essential that the tinted quality of the design, as of the groundwork, should possess unity of tone, and that the derivative textural elements should sufficiently differentiate in composition and effect as to give clearness of form delineation. Harmony of colouring is also a primary characteristic, whether due to combining analogous or contrasting shades. The theory of selecting two tones of the same colour for the ground, and two tones of a different colour for the figured



FIG. 57.

features, works out satisfactorily. Colour balance is facilitated by following this scheme of shade combination. The principle involved in practice is exemplified in scheme IV., in which the deep greenish and deep orange grey, and the pale greenish and pale orange grey yarns correspond in depth of tone and develop a suitable degree of hue contrast. When substituting dissimilar weft shades from those used in the warp, both these colour attributes—namely, tone analogy and harmony of colour hue in the two sets of yarns combined—should be considered. Shuttling, for example, the warping arrangement in scheme IV., 1 pick of deep reddish grey, 1 pick of deep bluish grey, 1 pick of pale reddish grey, and 1 pick of pale bluish grey, would result in harmony of colour tinting, providing the grading or toning of the weft shades agreed with the toning of the shades in the warp.

Limiting the colouring to the one-and-one arrangement, the figuring may be woven in two contrasting shades, and the ground in a mottled effect due to the weave units employed. Thus a mixture groundwork is producible in end-and-end and pick-and-pick warping and wefting, by using weave C, Fig. 51, which is a

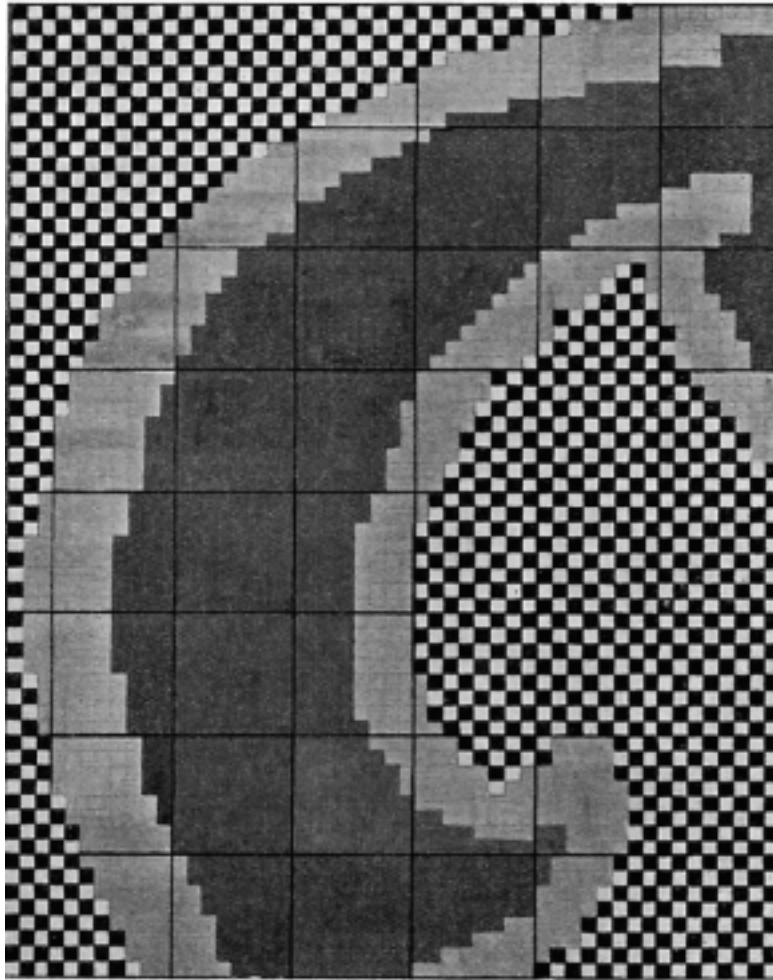


FIG. 58.

cross structure between weaves A and B, giving the 2nd and 4th threads on the face and the 1st and 3rd picks, and the 1st and 3rd threads and 2nd and 4th picks on the back. To illustrate this principle of construction, the style in Fig. 57 is a carpet pattern weavable, say, in tan and fawn yarns, with the light

figuring developed in the fawn and the dark figuring in the tan yarns. This involves the ground sections—marked in black and tinted grey, Fig. 58—being formed in a third effect, in which the two shades are intermingled. Hence, if weave A, Fig. 51, is applied to the dark grey, weave B to the light grey, and weave C to the ground portions of the sectional design, Fig. 58, as prepared for the loom of the parts lettered A, A, and B, C, Fig. 57, the dark details would be produced in tan, the lighter features in fawn, and the groundwork in the two colours, plain interlaced, as illustrated.

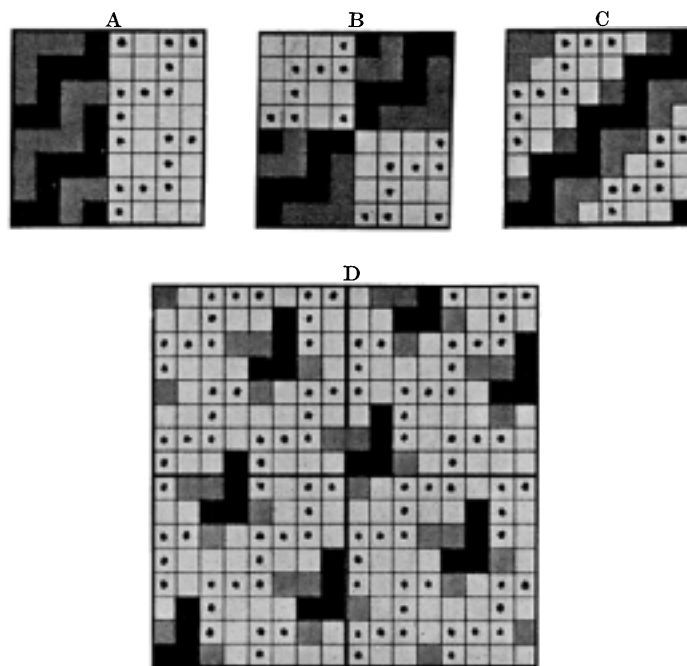


FIG. 59.

This would be the colour composition of the upper side of the carpet in the loom, but on the reverse side the tan and fawn shades would be transposed, causing the dark grey figuring in the looming design to be formed in fawn, and the light grey in tan, with the shades similarly blended in the ground sections.

The mosaic type of pattern in the ground is also variable, when restricted to the use of two colours, by combining plans A, B, and C, Fig. 51. Striped and line effects are acquired by grouping the weaves as in Fig. 59A, checks as in Fig. 59B, diagonals and small twills as in Fig. 59C, and spotted effects as

in Fig. 59D. The character of these detail patterns should agree with the clear development of the decorative style. They may be diversified in breadth as in form, and result in the two shades being equally intermingled on both sides of the fabric as in plans A, B, and C, or in one shade predominating as in plan D. The three former give a similar emphasis to the design effects on each surface of the carpet, but weaves of the class illustrated at Fig. 59D are capable of modifying the whole value and quality of the colour scheme. Using this plan, for example, in the ground of Fig. 58 and plans A and B, Fig. 51, in the dark and light portions, andweaving with toned red and pale green yarns, arranged one-and-one, would develop the dark parts of the figuring in red and the light parts in green; but, on one side of the carpet the ground would be in the red tone spotted with pale green, and on the opposite side in pale green spotted with the toned red shade.

“Kidder” and Scotch carpets, as compared with those of a pile formation, lack density and fulness of surface qualities. They are also deficient in these respects when contrasted with felted manufactures. This is due to their plain-woven structure. Pattern details and colour composition are satisfactorily emphasised by the weave units, but the even, firm build of the fabric is not characteristic of that elasticity to the tread offered in the wear of other types of carpet productions. To remedy these defects in some particulars, and also to add to the durability of construction, two principles of loom-work are practised. In the first place, a wadding or stiffening warp is introduced, and, in the second place, the carpets are made three-ply in construction. By the first method similar textural features, as to design development and colour treatment, are acquired as in the standard or original scheme of weaving, with the addition of a supplementary set of warp yarns somewhat thicker in counts, and of a coarser material, than the yarns of the figuring warp. This extra or centre warp does not appear on either surface of the carpet. It necessitates the use of two chain beams, one for the “stiffening” and the other for the ordinary warp threads used in the making of the fabric. No changes are required in the shuttling, this technicality coinciding with the wefting variations applied in the two-ply scheme of manufacture.

Weave elements of a different order have, however, to be selected for the ground and figuring, namely, those illustrated in A and B, Fig. 60. The threads and picks marked in light and

dark grey in section A, and in toned and dark grey in section B, form the face and backing textures. Assuming the warp to be arranged one thread light shade, one centre, and one thread medium shade; and the weft to be one light and one medium yarn, in A a plain light-shade texture would be woven over a plain medium-shade texture, and in B the two textures would be transposed. The centre threads—being dotted on the face picks and left blank on the backing picks—are depressed when the face weft interweaves, and lifted when the backing picks interweave, in both sections A and B, causing them to pass between the two fabrics. This feature is more distinctly observed in Fig. 61, a sketch of the interlacing of the yarns in the compound plan, Fig. 60. The picks and threads 1, 4, 7, etc., in the part lettered A, form a plain face over a plain backing texture, the latter being composed of picks 2, 4, etc., and threads 3 and 6, etc.

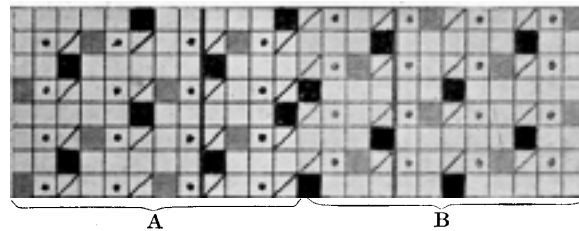


FIG. 60.

Similarly, the even picks and threads 3 and 6, etc., in the part lettered B, form a plain fabric in the dark shade of yarns over a plain fabric in the light shade of yarns. There is no displacement of the centre threads occasioned by the interchanging of the light and dark-grey textures. They may, therefore, be strictly defined as wadding warp, having no function in either the ground or figured effects of the carpet, beyond that of adding to its substance, durability and firmness. When, however, larger areas of one set of yarns are woven in the ground or in the composition of the design, these central warp yarns may be advantageously utilised for binding or stitching purposes.

Three-ply "Kidders" are a compound of three separate plain fabrics, woven as one, and consisting of three series of warp and weft yarns, which are used, throughout the construction of the carpet, in making a face, a centre, and a backing cloth. Each structure may, as required, be employed on the face or on the

under side of the carpet, but one of the three textures is, in all parts of the woven product, intermediately placed. Obviously this scheme of manufacture yields a more substantial build and superior grade of carpet than the two-fold principle, or the centre-warp arrangement just described.

If the weaves C, D, and E, Fig. 62, are examined and compared with the fabric structure, Fig. 63, these technicalities will be understood. The light, medium, and dark shades intersect with similar yarns in the warp and weft, arranged one, one and one, and represent correspondingly plain-woven textures. The diagonally-marked squares signify centre threads depressed on face picks, and the dotted spaces backing threads depressed on both the face and centre wefts. Stated in another form, when the *face* picks interweave, the centre and backing warps are lowered, and the *face* warp forms a plain interlacing; when the *centre* picks interweave, the face warp yarns are lifted, and the backing warp yarns are depressed; and for the *backing* picks the face and centre threads are raised. By this method of weave construction, the face threads and picks produce an upper plain cloth, the centre threads and picks an intermediate plain fabric, and the backing warp with the backing weft a lower plain structure, each separate and distinct, as sketched in Fig. 63. The binding of these textural units into one carpet manufacture is effected by the interchanging of the relative positions, but not the relative sequence of the three fabrics. Thus, on further dissecting the weave elements in Fig. 62 the textural layers occur in the following orders, and produce, with the colouring arranged—one light, one medium, and one dark shade—the fabric structures specified below:—

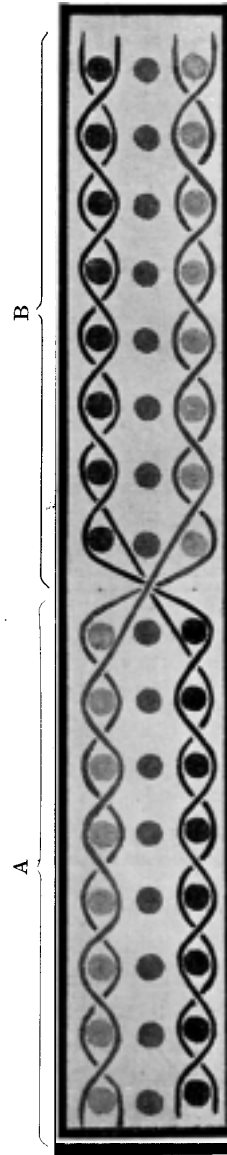


FIG. 61.

WEAVE C.

1st and 4th threads and picks = Face fabric, light shade.
 2nd and 5th threads and picks = Centre fabric, medium shade.
 3rd and 6th threads and picks = Backing fabric, dark shade.

WEAVE D.

1st and 4th threads and picks = Centre fabric, medium shade.
 2nd and 5th threads and picks = Backing fabric, dark shade.
 3rd and 6th threads and picks = Face fabric, light shade.

WEAVE E.

1st and 4th threads and picks = Backing fabric, dark shade.
 2nd and 5th threads and picks = Face fabric, light shade.
 3rd and 6th threads and picks = Centre fabric, medium shade.

Referring to Fig. 63, in which C', D', and E' correspond to plans C, D, and E, Fig. 62, it will be seen how each texture

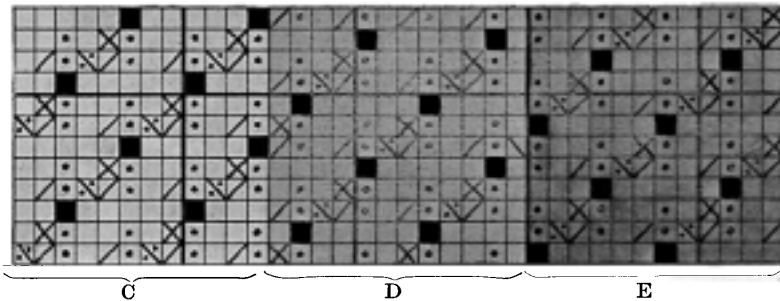


FIG. 62.

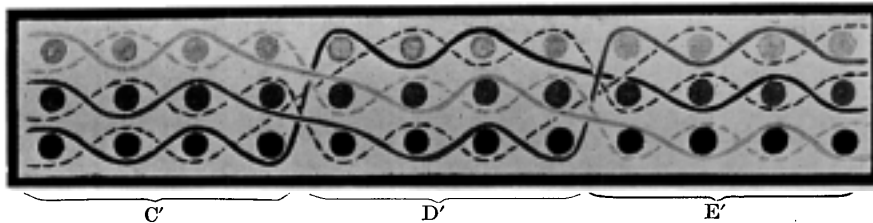


FIG. 63.

occupies in succession the top, middle, and bottom layer in the compound structure. This interchange of fabric position is determined by the weave formula. Colour order necessarily remains constant, being fixed by the warping and wefting scheme. Weave arrangement is the variable factor, for in plan C, Fig. 62, the threads and picks are grouped 1 face, 1 centre, and 1 back; in plan D, 1 centre, 1 back, and 1 face; and in plan E, 1 back, 1 face, and 1 centre. The transposition of the yarns forming each texture is synonymous, in result, to an interchange of the colour

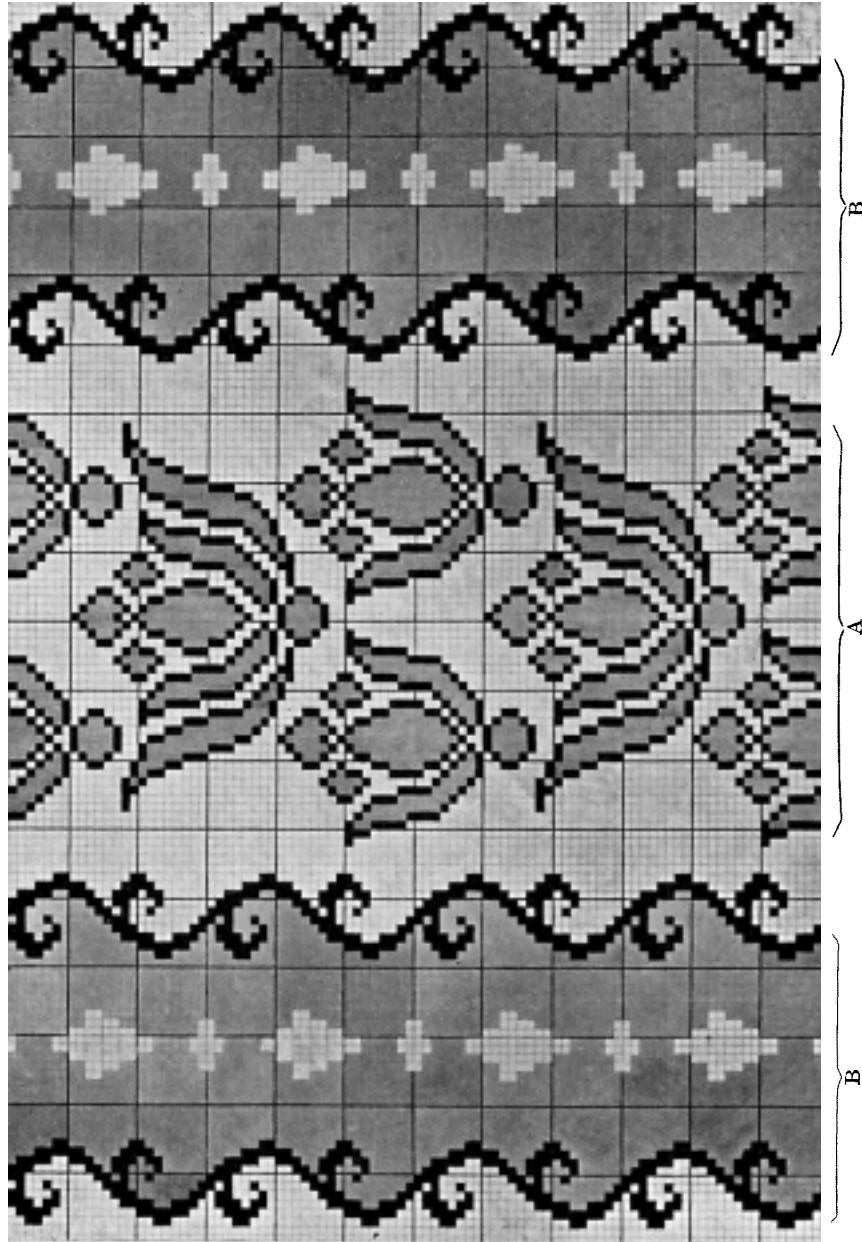


FIG. 64.

shades as regards the production of the pattern style. To illustrate this practice, allusion will be made to the stair carpet design in Fig. 64, in which parts B are the border and part A the centre-feature. Arranging the yarns one red, one blue and one green in both the warping and wefting, and applying weave C, Fig. 62, to the light grey ground and spotting, weave D to the decorative details in very dark grey, and weave E to those sketched in medium grey would produce a reversible carpet coloured on the respective surfaces thus :—

Upper side : Ground in A in red; outline features in blue; figured forms in green.
 „ Ground in B in green; outline features in blue; spotting in red.
Reverse side : Ground in A in green; outline features in red; figured forms in blue.
 „ Ground in B in blue; outline features in red; spotting in green.

Colour contrast would, by this scheme of weave combination, emphasise the border and centre pattern characteristics. It is a common practice to transpose the shades applied to the ground and to parts of the figuring in the two sections of the carpet, when the design types for the centre and the border are of a detail character or of a similar variety. But with the ornament in sections A and B differing in elemental features and in structural plan, the ground colouring should not, as a rule, be changed. Retaining the same shade in the border as in centre of the carpet is, in such diversified decorative schemes, helpful in acquiring tone unity, and also in linking the two species of pattern selected into one composite style.

In the “Kidder” group of carpets, strong colour contrasts are not so satisfactory as in pile structures. Such colour contrasts suffer in æsthetic value. In employing red, blue and green of the purity of tone applied to Axminster, Brussels, hand-tufted and velvet pile carpets, in a yarn-face build of fabric as obtains in Kidderminster manufactures, the elements of the design would be too sharply defined. Harshness instead of mellowness of colour tone would be produced. Hues of this brightness and intensity are not so well adapted to carpet structures in which the yarn formation and interlacings delineate the pattern details, as to carpets in which the ends of the fibres composing the yarns are utilised for this purpose. As the former result in a clear, “bare” surface, and the latter in a dense fibrous surface, the two varieties of carpets they typify require specific colour treatment. When rich, positive colours are combined in the Kidder variety, the several hues selected should be intermingled in the warping and

wefting schemes. Thus, in applying pure red, green, blue, orange and purple, the yarn groupings stated below are illustrative of the colour principles to be practised :—

I.—ARRANGEMENT OF YARNS.

Warp.	Weft.
1 end of red.	1 pick of red.
1 " blue.	1 " blue.
1 " green.	1 " green.
1 " tinted red.	1 " toned red.
1 " tinted blue.	1 " toned blue.
1 " tinted green.	1 " toned green.

II.—ARRANGEMENT OF YARNS.

Warp.	Weft.
1 end of red.	1 pick of tinted red.
1 " blue.	1 " " blue.
1 " green.	1 " " green.
	1 " toned red.
	1 " " blue.
	1 " " green.

III.—ARRANGEMENT OF YARNS.

Warp.	Weft.
1 end of red.	1 pick of tinted red.
1 " blue.	1 " " blue.
1 " green.	1 " " green.
1 " tinted red.	1 " toned red.
1 " blue.	1 " " blue.
1 " green.	1 " " green.
1 " red.	
1 " tinted blue.	
1 " green.	
1 " red.	
1 " blue.	
1 " tinted green.	

The effect of such arrangements is to produce the pattern and ground sections of the carpet in mingled colouring. Each pattern element would be formed, in the first practice, in red and tinted red, in green and tinted green, or in blue and tinted blue. Two tones of a colour give softer and more varied coloured toning than a solid colour. They also impart greater richness of tinting to the carpet surface than by the use of one colour dyed approximately to the same hue and tone as that resulting from the admixture of two or several yarns dyed separately and warped and wefted together on the principle indicated. In the second arrangement the bright colours in the warp are crossed with tones and tints of the same colour hue; that is, the red warp yarns are interwoven with toned and tinted red, the blue warp yarns with toned and tinted blue, and the green warp yarns with toned and tinted green. This enhances and also mellows each colour ingredient in the carpet without rendering the pattern types

murky or indistinct in development. The third arrangement consists in combining, in the warp, colours in their standard purity of hue with colours admixed with white or black, as red intercrossed with toned and tinted red yarns, blue with toned and tinted blue yarns, and green with toned and tinted green yarns.

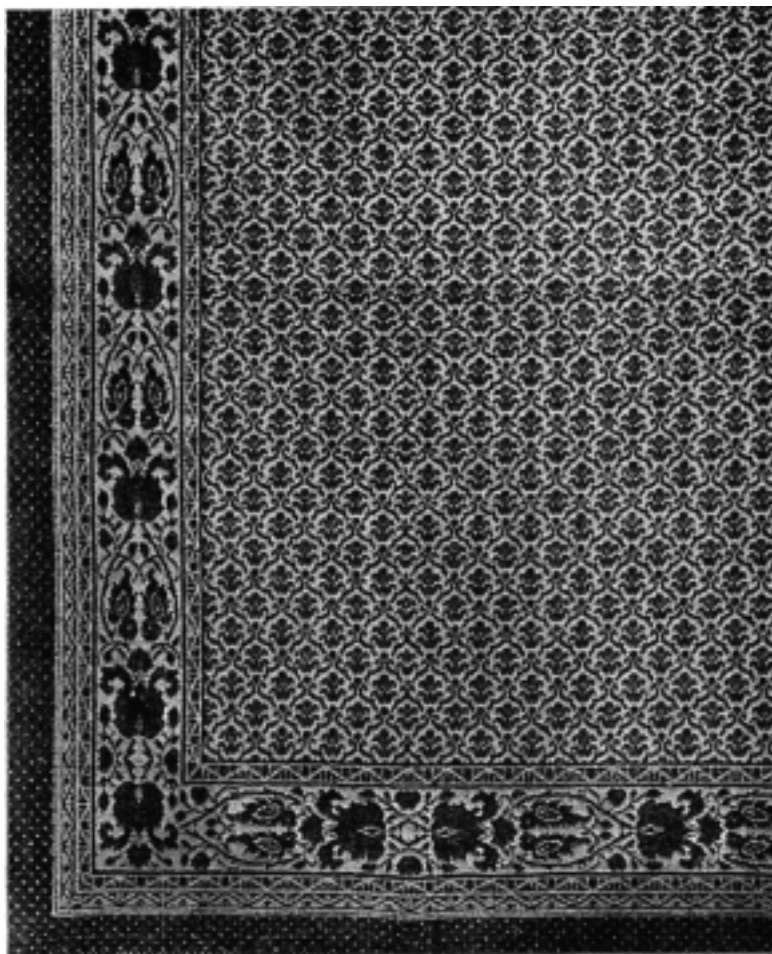


FIG. 65.

This gives the composition of the several coloured features in the woven product formed thus :—

Red features composed of one unit of pure red, two units of toned and two units of tinted red.

Blue features composed of one unit of pure red, two units of toned and two units of tinted blue.

Green features composed of one unit of pure red, two units of toned and two units of tinted green.

The excess units in each colour ingredient of the tinted and toned hue are caused by the system of shuttling from which the pure colours are omitted.

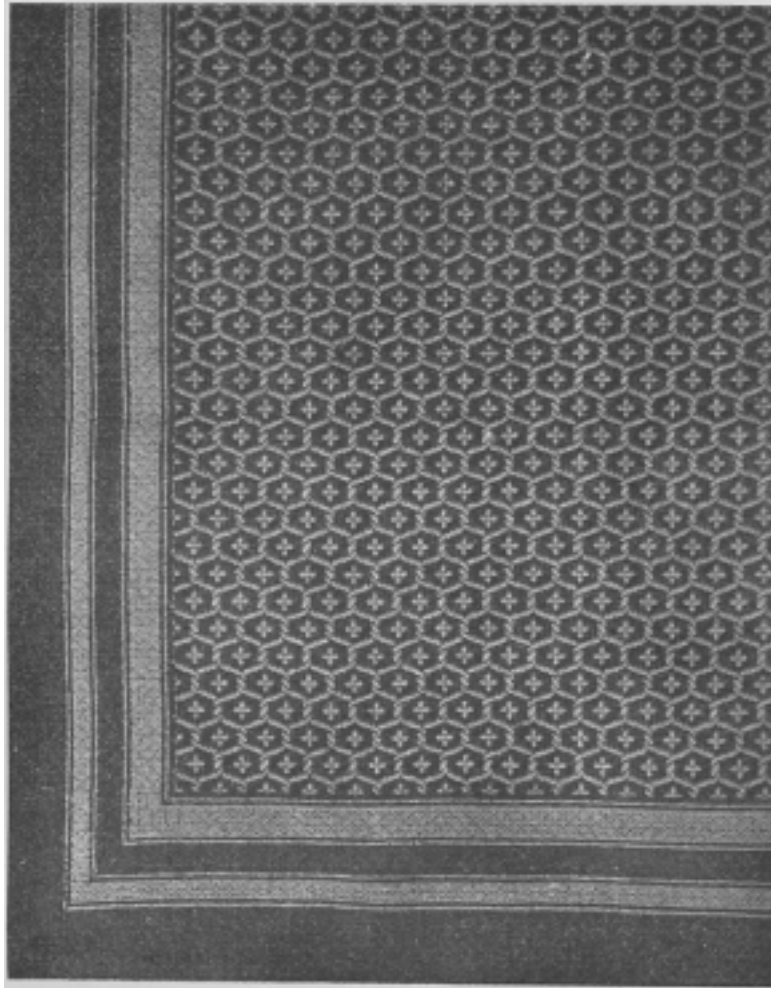


FIG. 66.

These and corresponding colour arrangements are applied when the warp, as well as the weft, yarns appear equally in the surface of the carpet. In manufactures in which the warp yarns are used for "binding" rather than for figuring purposes, the colour toning requires to be obtained by varying the order of shuttling on the principle illustrated in Figs. 65 and 66. The

former is a two-ply and the latter a three-ply manufacture. The warp yarns in each are worsted and the weft yarns woollen and thick in counts. A range of colourings applicable to Fig. 65 comprise such orders of shuttlings as—

(1)	1 shot of green	and 1 shot of deep blue.
(2)	1 " blue	" 1 " light blue grey.
(3)	1 " drab	" 1 " light fawn.
(4)	1 " pinky drab	" 1 " light pinky drab.
(5)	1 " crimson red	" 1 " light crimson red.
(6)	1 " blue	" 1 " light reddish grey.

Two tones—deep and light—of the same colour may be used, or two colours in contrasting hues, as in orders (1) and (6); or, for improving the colour quality of either the figured or ground portions of the carpet, a light and dark tone of colour may be used in the figuring with one colour tone in the ground by shuttling in the following manner—

	(7).		(8).
	1 shot of red.		1 shot of deep green.
	1 " blue.		1 " fawn.
	1 " light red.		1 " light fawn.
	1 " blue.		1 " fawn.

A feature to be acquired in the colouring is the effective delineation of the design types in combination with tinted harmony in the carpet surface. Each of the above colourings results in the border and centre of the "art" square being distinctive in character and neat in colour quality. With the use of these shuttling yarns weaving in regular sequence, a thicker and firmer make of carpet is produced, and also one better diversified in colour composition. Such weftings as those given below are practised in weaving this style of "Kidder," having been applied in producing a "range" in the style shown at Fig. 66.

(1)	1 shot of blue,	1 shot of green,	and 1 shot of drab.
(2)	1 " drab,	1 " fawn,	" 1 " brown.
(3)	1 " grey,	1 " heliotrope,	" 1 " green.
(4)	1 " light fawn,	1 " green,	" 1 " crimson red.
(5)	1 " light drab,	1 " fawn,	" 1 " tan.
(6)	1 " light maroon,	1 " pinky red,	" 1 " drab.
(7)	1 " grey,	1 " purple blue,	" 1 " green.

These examples, and also Figs. 50, 53, 56 and 57, show the description of decorative design feasible in this grade of carpet manufacture. Usually in the set squares the centre is woven in a definite type of ornament, with the border plain in colour, as in Fig. 66, or somewhat more elaborate in pattern than the centre, as in Fig. 65.

The sketches given in Figs. 54 and 55 in the colour effects applicable in the weaving of the ground and decorative features in "Kidders" were mainly explanatory of the use of two or more yarn shades in selected weave structures. They suggest the principles of carpet build and methods of warping and wefting common to the various classes of these manufactures. The value

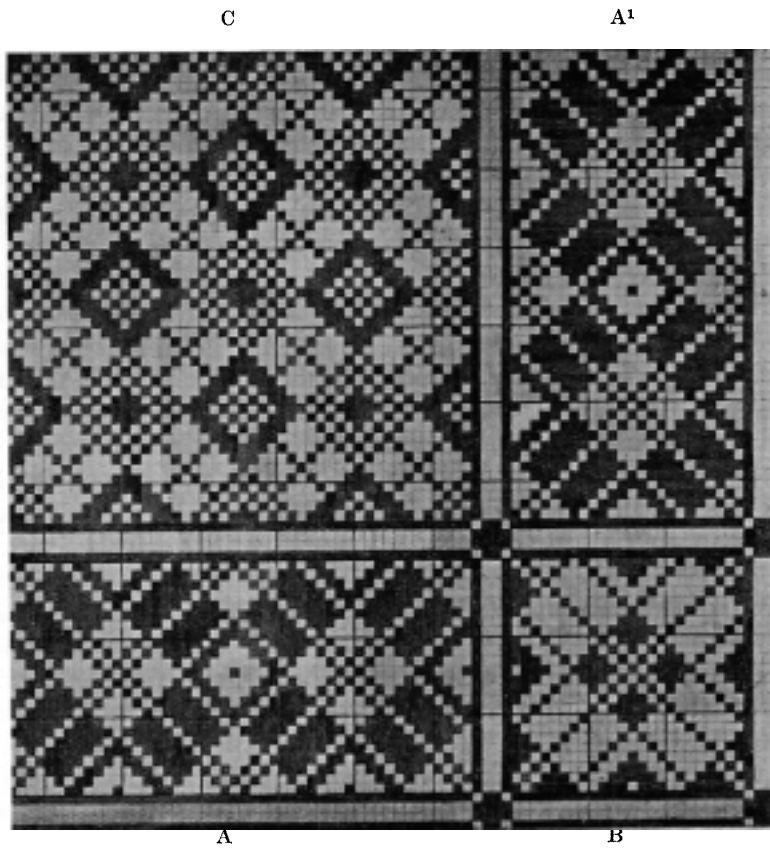


FIG. 67.

of these colour effects and of colour interchange may now be shown in the production of bordered patterns.

The example in Fig. 67 is composed of the two geometric types of design—constructed on a weave base—lettered A and C. As a result of forming the small diamond details in A in dark grey and in tinted grey in B, and the twilling parts in tinted grey in A and in dark grey in B, the cross-border style differs in appearance from the centre features. To acquire the varied quality of design expression, each square in the example corre-

sponds to a multiple of four, six, eight or twelve threads and picks in the actual carpet plan, and the warp and weft yarns are arranged one thread of a dark and one of a light tone, applying weave A (Fig. 51) to the dark sections and weave B of the same illustration to light sections in the looming plan for parts A, B, and C of Fig. 67.

From this explanation it will be understood that, in simple or elaborate design types, it is feasible, in double make or reversible Kidder and Union carpets, to obtain by interchanging the yarn shades two distinctive styles of pattern, producing the corner and cross borders of the woven manufacture in one and the same pattern, but with the figuring and ground in the former in the *dark* and the *light* shades, or *vice versa*. When this useful scheme of construction is followed an additional design structure should be employed, as in part C in this example, for the centre of the carpet. It is important that a decorative type should be selected for this purpose harmonising in style and technique with that utilised in the borders. It is not, however, essential that it should be of the same dimensions. For developing contrast in ornamental treatment, the centre design may be either smaller or larger than the pattern applied to the border section; but it should, as a rule, be a multiple of the latter, such as half, double, or quadruple scale. The style and composition of the border figuring, as well as the character of the decorative effects required, have to be taken into account. Referring to the specimen, if it should be enlarged six- or eight-fold, the border becomes an effective variety of ornamentation in the carpet, but well diversified in detail types, so that a somewhat less pronounced pattern is rendered suitable for the centre, and this either woven to the same or a reduced scale. If the latter is done, the centre would be a less marked feature of the production than the border, and to a more apparent degree than in Fig. 67; but this again, as will be indicated below, might be modified by the system of colouring applied. As this class of carpet manufacture is made principally for bedroom wear, neatness, combined with simple but fresh decorative treatment, and especially brightness and harmony of colour tone, are the features desired.

Having, therefore, acquired the design scheme, the question of colouring is of primary consideration. A common practice is to employ two colours, either analogous or differing in hue. The former results in tone and the latter in hue contrast. Other and more diversified schemes of tinting include the use of one

shade or colour for the figuring and two tones for the ground, or two colours—tones or hues—for both ground and figuring, as explained in describing Figs. 65 and 66. Subdued striping and checking in the ground of the carpet may be added by inserting bright-toned yarns at fixed intervals in the warping and shuttling plans. This is ordinarily restricted to the ground, with the idea of preserving the continuity of the figuring or pattern ornament. These several principles of colouring will be better understood from the following examples :—

I.—EXAMPLES IN TONE CONTRASTS.

A.—*Warp and Weft.*

1 thread medium green (No. 3, Plate VI., C.W.D.¹).
 1 " sage " (No. 6, " ").

B.—*Warp and Weft.*

1 thread deep heliotrope (No. 15, Plate VI., C.W.D.).
 1 " light " (No. 18, " ").

II.—EXAMPLES IN HUE CONTRASTS.

C.—*Warp and Weft.*

1 thread yellow brown (No. 2 F, Plate XII., C.W.D.).
 1 " purple blue (No. 2 I, " ").

D.—*Warp and Weft.*

1 thread blue grey (No. 2 A, Plate XII., C.W.D.).
 1 " green grey (No. 2 D, " ").

III.—EXAMPLE IN TWO TONES IN THE GROUND.

E.—*Warp and Weft.*

1 thread red brown (No. 6 H, Plate XII., C.W.D.).
 1 " bluish grey (No. 4 × B, " ").
 1 " olive green (No. 6 × F, " ").
 1 " bluish grey (No. 4 × B, " ").

IV.—EXAMPLE IN TONE AND HUE CONTRASTS.

F.—*Warp and Weft.*

1 thread warm brown (No. 6 G, Plate XII., C.W.D.).
 1 " purplish grey (No. 3 × J, " ").
 1 " yellowish green (No. 6 E, " ").
 1 " blue green (No. 3 C, " ").

V.—EXAMPLE IN TONE AND HUE CONTRASTS AND CHECKING LINES IN THE GROUND.

G.—*Warp and Weft.*

G 1.

1 thread tinted green	(No. 5, Plate VI., C.W.D.).	} For 192 threads and picks.
1 " " blue	(No. 11, " IV., ").	
1 " " purple	(No. 17, " VI., ").	
1 " " orange	(No. 10, " VI., ").	

G 2.

1 " " green	(No. 4, " VI., ").	} For 16 threads and picks.
1 " " blue	(No. 11, " IV., ").	
1 " " purple	(No. 16, " VI., ").	
1 " " orange	(No. 10, " VI., ").	

¹ *Colour in Woven Design*, Beaumont.

Considering, first, the application of schemes A and B to Fig. 67, the ground of the carpet would, in the centre, as in the borders, be in medium green or in deep heliotrope, and the figuring (printed in black) in either sage green or in light heliotrope. The carpet, being reversible, would show the position of the shades transposed in both the ground and the figuring on the underside—a colour relation obtaining in each of these warping and wefting examples. In the second place, the yellow-brown in scheme C contrasts in hue with the purple-blue, and the blue-grey in D with the green-grey. Both these hue couplets are of a like depth of tone, whereas in A and B the contrasts acquired are due to a disparity in the tone depth of the medium and sage green and the deep and light heliotrope. Additional tinted qualities enter into the composition of example E; the ground is woven in red-brown and olive-green of a corresponding colour tone, but distinctive in colour hue, and yielding a third colour contrast in association with the bluish-grey in the figuring. This method of coloured-yarn grouping produces a mingled shade effect in the ground of the carpet, but leaves the design details clearly woven in one tone of colour. It also provides for the interchanging of the two species of tinting in the border and centre respectively, should the order of warping and shuttling be planned in such a way that in the border corners the arrangement is as specified, but for section C, Fig. 67, to commence with one thread of bluish-grey, and following with one thread of olive-green, one of bluish-grey, and one thread of red-brown.

Scheme F subdues the pattern development in all sections of the carpet, for here the ground in parts A, B, and C (Fig. 67) is a chintz of warm brown and yellowish-green, and the figuring a chintz of purplish-grey and blue green; so that, providing the differences between the design style in the border and in the centre were severely defined on the principle referred to above, this scheme of colour practice would have a neutralising quality and tend to link the two pattern elements together. Checking colours are introduced into scheme G. Tones of the primary and secondary colours have been combined as suggestive of the method of obtaining, in the ground on one side and in the figure on the reverse side of the carpet, indistinct rectangular or checking lines of colour. The quality of the hues of the yarns combined admits of deeper tones of colouring being applied to the ground of the designs in the sections of the warping and wefting lettered G², than in the larger parts of the colour order, lettered G¹.

In weaving double-plain make reversible carpets either an ordinary or a special Jacquard mounting may be employed. In the latter, the comberboard is divided into four sections, each receiving one-fourth of the harness cords. These sections are capable of being operated, in shedding the warp, in a similar manner to four heddles or heald shafts. The machine is so constructed that it contains two lifting blocks, which are actuated alternately. In the one nearest the cylinder, the uprights (cords or wires) give, without cards on the cylinder, warp threads lifted, whereas the uprights in the rear block give, under like conditions, warp threads depressed.

Each harness cord is knotted immediately above the divisions in the comberboard, so that the raising of its sections has the effect of lifting the warp threads. Comberboard sections 1 and 2 are secured by connecting wires to the rear block and sections 3 and 4 to the front block of the Jacquard machine. Hence the lifting of the blocks in successive order has the following results on the shedding of the warp :—

- (1) Raising of the rear block (all uprights lifted) and comberboard section 1=a shed of 1 thread up, 1 down, and 2 threads up.
- (2) Raising of the front block (all uprights depressed) and comberboard section 3=a shed of 2 threads down, 1 up, and 1 thread down.
- (3) Raising of the rear block (all uprights lifted) and comberboard section 2=a shed of 1 thread down and 3 threads up.
- (4) Raising of the front block (all uprights depressed) and comberboard section 4=a shed of 3 threads down and 1 thread up.

The warp threads being drawn through the comberboard divisions in 4-end sateen order, or threads 1 on section 1, threads 2 on section 3, threads 3 on section 2, and threads 4 on section 4, this system of shedding corresponds with that of a double-plain plan.

With the carpet structure thus produced by the Jacquard and comberboard action apart from the cards, the preparation of the designs and the card stamping are simplified. The figured forms only require to be sketched in colour on the point paper. As no weaves are applied to the looming design, the portions drawn in colour are stamped in the cards and the uncoloured portions left blank.

CHAPTER V

PATTERNWORK IN UNIONS

Union Carpets—The Habberley—Dissection of Two- and Three-Ply Structures—Effects due to Shuttling—Point-paper Preparation of Designs and Card Stamping—Economy in Coloured-Yarn Units—Multi-Ply Unions—Weave and Colour Schemes—Formation of Textural Elements—Methods of Pattern Development—Weave Application—Practices in the use of Three-Ply Weaves—Design Bases—Ordinary Weave Base—Weave Type of Pattern and Methods of Shuttling—Retention of Intersection Features in Scale Enlargement—Transposition Design Types—Relation of Weave Unit to Carpet Design—Selection and Grouping of Weft-Yarn Shades—Standard Systems of Patternwork based on Weave Motives—Reversible Character of the Designs—Designing Practice in Utilising Weave Motives—Sateen Principle of Patternwork—Types of Design framed on Sateens—Examples in Figure Construction and Arrangement—Distinctive Qualities of Ornament framed on Sateen Schemes of Intertexture—Coloured-Yarn interchange in Pattern Production—Ornament formed on Basic Plans of Weave—Decorative Weave Base—Striped Compositions—Figured in Line or Striped Effects—Inverted Weave Compounds and Design Structure—The Employment of Elementary Weaves in Constructing Decorative Patterns—Compound-Weave Principle of Designing—Colour-Tone Differentiation—Application of Decorative and Compound Weave Designs—Geometric Base—Floral and Plant Forms of Ornament.

UNION carpets vary both in weave structure and in yarn composition. They may be of the “Kidder” style of design and colouring, or made in thick yarns and heavy builds of fabrics in simple pattern forms, or in solid shades to be adaptable for stair, corridor and surround floor covering and decoration.

An example, known as the “Habberley,” with a cotton warp and bi-fibred weft yarn of “Kidder” description, is illustrated in Fig. 68. This is a cheap class of carpeting produced in art squares from $2\frac{1}{2}$ to 4 yards in width and length and constructed in such weave units as those seen in Figs. 51 and 60. As in all-wool yarn manufactures, the designs are woven in different weftings, the following being a typical order and applicable to this example:—

WEFTING I

1	shot of bi-fibred	green yarn, 50 per cent. cotton and 50 per cent. wool.
1	”	” pale green yarn.
1	”	” green yarn.
1	”	” grey yarn.

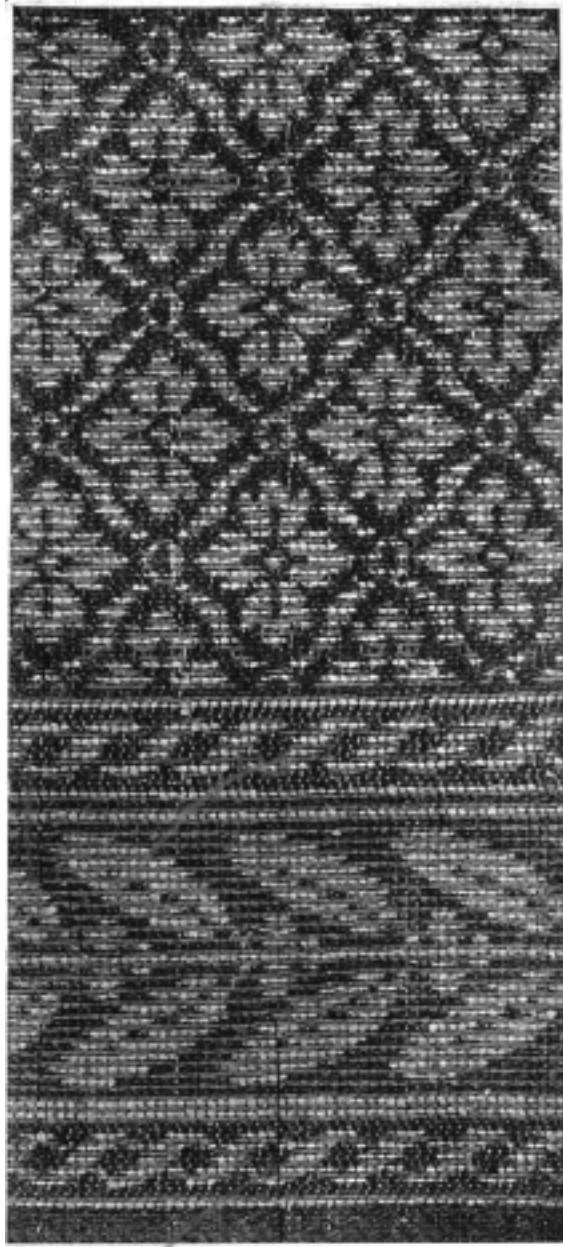


FIG. 68

WEFTING II

1 shot of bi-fibred blue yarn.
 1 " " pale blue yarn.
 1 " " blue yarn.
 1 " " lavender yarn.

WEFTING III

1 shot of bi-fibred brown yarn.
 1 " " light brown yarn.
 1 " " brown yarn.
 1 " " fawn yarn.

WEFTING IV

1 shot of bi-fibred deep heliotrope yarn.
 1 " " medium " "
 1 " " deep " "
 1 " " pale " "

WEFTING V

1 shot of bi-fibred deep red yarn.
 1 " " red yarn.
 1 " " deep red yarn.
 1 " " tinted red yarn.

While, however, these colours of weft yarn are thus employed, the carpet is only two-ply in structure. It follows that the ground of the fabric is woven in a solid shade—*e. g.*, in these weftings in green, blue, brown, deep heliotrope or deep red—and the figuring in two colours, pale green and grey, pale blue and lavender, light brown and fawn, etc.



FIG. 69.

Another practice consists in combining three reversible two-ply weaves, *a*, *b* and *c*, Fig. 70, and in using *a* and *b* for the decorative parts of the design and weave *c* for the ground, and in wefting pick-and-pick in two shades. The pattern in Fig. 69 (drawn to one-twelfth of the original scale) is producible in this way, or in

three-ply weft plans. For the former, weave *a*, Fig. 70, would be applied to the dark sections of the sketch when transferred on to the point paper, weave *b* to the grey sections, and weave *c* to the uncoloured sections. By wefting one pick blue and one pick green the decorative types would be woven in blue and green respectively and the ground of the carpet in the two shades intermingled. Secondly, by employing plans *d*, *e* and *f*, Fig. 70A, namely, *d* to the features in black, *e* to those in grey, and *f* to the ground, and wefting one pick red, one pick tinted red, and one pick greenish grey, the figuring would be developed in red and tinted red on a greenish-grey ground.

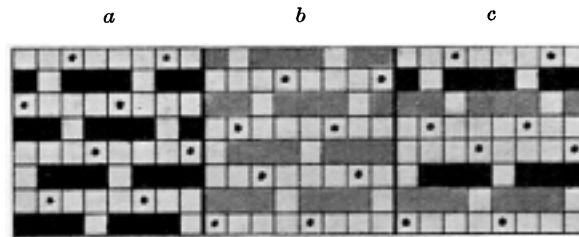


FIG. 70.

The three-ply union carpet is firm in the make and of a better wearing quality than the two-ply production. The additional weft used in the manufacture, combined with a supplementary or third weave element, improves the structural strength and soundness of the carpet. As in the two-ply principle of construction, both sides of the fabric are similarly woven. They also coincide in effect and in appearance, but differ in colour. Between the two broken weft-twill textures, composed of the same warp yarns, a central and plain-woven fabric is formed. Running through each integral section of the carpet, this centre texture adds to the substance and tensile property of the compound structure.

Dissection shows that the carpet consists of three distinct layers of weft, each passing successively over the other and yielding three separate textures. Hence the removal, first, of the face or upper layer of weft yarn leaves a *two-fold* cloth, plain face and swansdown weft twill back; second, the removal of the central picks leaves a *two-fold* twill fabric woven $\frac{1}{3}$ on the face and $\frac{3}{1}$ on the back; third, the removal of the third series, or backing picks, leaves a *two-fold* fabric with a $\frac{1}{3}$ twill face and plain back; fourth,

the removal of the face and centre picks leaves a *single* warp-face swansdown twill texture; and fifth, the removal of the centre and backing picks leaves a *single* make fabric with a weft surface.

In the production of the carpet, the plain-woven texture is hidden, and does not, as a consequence, have any influence on the development of the pattern features. Its function in each weave structure—*d*, *e* and *f*, Fig. 70A—is to impart fastness of fabric build. On examining these weave units it will be seen that the plain interlacing picks in plan *d* are 2, 5, 8 and 11; in plan *e*, 3, 6, 9 and 12; and in plan *f*, 1, 4, 7 and 10; or that, considering the three plans together, each pick in the twenty-four threads of the sectional example is successively plain in construction. Every pick in the compound design is also broken weft twill

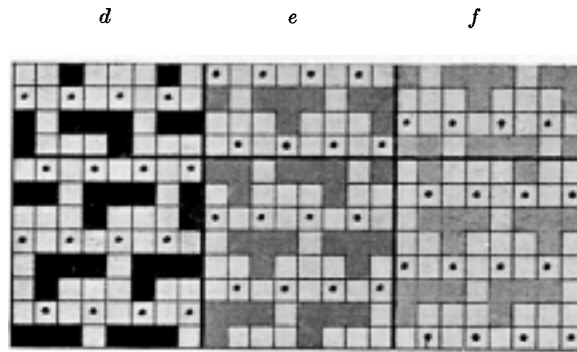


FIG. 70A.

on the *face* and broken weft twill on the *back* of the structure in turn, as indicated below:—

Swansdown weft-twill <i>face</i>	=	plan <i>d</i> ,	picks 1, 4, 7 and 10
" " "	=	" <i>e</i> ,	" 2, 5, 8 " 11
" " "	=	" <i>f</i> ,	" 3, 6, 9 " 12
Swansdown weft-twill <i>back</i>	=	plan <i>d</i> ,	picks 3, 6, 9 and 12
" " "	=	" <i>e</i> ,	" 1, 4, 7 " 10
" " "	=	" <i>f</i> ,	" 2, 5, 8 " 11

From these analyses it will be understood that while one-third of the picks in each plan interweave plain, one-third give a weft broken twill on the *face*, and the remaining third a weft broken twill on the *back*; so that, in combining the three plans, each pick in the compound series is consecutively used in the formation of the *face*, *centre*, and *underside* of the carpet. To illustrate the effect of this, assuming, for example, the plans to be grouped in striped form as in Fig. 70A, and the wefting to be

one shot blue, one orange and one green, then the woven features produced would be those defined in the following table.

TABLE XI.—EFFECTS OF THREE-PLY WEFT WEAVES SHUTTLED IN THREE SHADES OF YARN

Order of Wefting.	Picks.	Fabric Effects.
1 shot blue	1, 4, 7 and 10	Weave <i>d</i> = weft face, blue
1 „ orange	2, 5, 8 „ 11	„ <i>d</i> = plain centre, orange
1 „ green	3, 6, 9 „ 12	„ <i>d</i> = weft back, green
	1, 4, 7 and 10	Weave <i>e</i> = weft back, blue
	2, 5, 8 „ 11	„ <i>e</i> = weft face, orange
	3, 6, 9 „ 12	„ <i>e</i> = plain centre, green
	1, 4, 7 and 10	Weave <i>f</i> = plain centre, blue
	2, 5, 8 „ 11	„ <i>f</i> = weft back, orange
	3, 6, 9 „ 12	„ <i>f</i> = weft face, green

That is, in weave *d*, Fig. 70A, a stripe of blue over a stripe of green with an orange centre; in weave *e* a stripe of orange over a stripe of blue with a green centre; and in weave *f* a stripe of green over a stripe of orange with a blue centre.

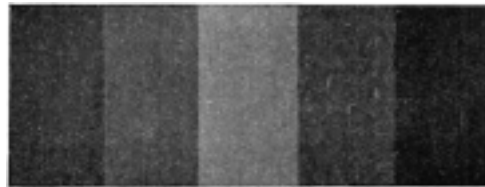


FIG. 71.

In further illustration of this scheme of intertexture, take the plans to be arranged in the order of eight threads of weave *d*, eight of weave *e*, eight of weave *f*, eight of weave *e*, and eight of weave *d*; then, if woven one pick of black, one pick of grey, and one pick of light grey, the effect in the fabric would be that sketched in Fig. 71, with light-grey stripes under the lines of black, grey under the light grey, and black under the lines of grey. A reversible pattern, as to shade and weave characteristics, is thus obtained, and suggests the application of three-shade effects to the weaving of patterns in which the figuring is composed of two colours, and the ground spaces of a third colour. With the two ply weaves—*a*, *b* and *c*, Fig. 70—it is only practicable to employ two colours of weft, one applied to the ground, and the second to

the development of the decorative forms in the design. In this construction—Fig. 70A—there is additional scope for colour treatment, as also in counts of yarns and carpet structure. The method of work consists in sketching on the point paper the pattern to be woven in three flat shades. Using the design in Fig. 72, it would be prepared for card stamping, as illustrated in sectional plan in Fig. 73. Each weft line of the paper corresponds to three picks in actual weaving, so that in cutting the cards the operations for each pick of the full design would include three cards stamped as in Table XII.

TABLE XII.—METHOD OF CARD STAMPING FOR THREE-PLY WEFT UNION CARPETS

Fig. 73. Picks.	Cards.	Order of Card Cutting. (Weaves <i>d</i> , <i>e</i> , and <i>f</i> , Fig. 70A).
1	1	Stamp in the order of the 1st pick of weave <i>d</i> on the dark grey; the 1st pick of weave <i>e</i> on the medium grey; and the 1st pick of weave <i>f</i> on the light grey.
1	2	Stamp in the order of the 2nd pick of weave <i>d</i> on the dark grey; the 2nd pick of weave <i>e</i> on the medium grey; and the 2nd pick of weave <i>f</i> on the light grey.
1	3	Stamp in the order of the 3rd pick of weave <i>d</i> on the dark grey; the 3rd pick of weave <i>e</i> on the medium grey; and the 3rd pick of weave <i>f</i> on the light grey.
2	4	Stamp in the order of the 4th pick of weave <i>d</i> on the dark grey; the 4th pick of weave <i>e</i> on the medium grey; and the 4th pick of weave <i>f</i> on the light grey.
2	5	Stamp in the order of the 5th pick of weave <i>d</i> on the dark grey; the 5th pick of weave <i>e</i> on the medium grey; and the 5th pick of weave <i>f</i> on the light grey.
2	6	Stamp in the order of the 6th pick of weave <i>d</i> on the dark grey; the 6th pick of weave <i>e</i> on the medium grey; and the 6th pick of weave <i>f</i> on the light grey.
3	7	Stamp in the order of the 7th pick of weave <i>d</i> on the dark grey; the 7th pick of weave <i>e</i> on the medium grey; and the 7th pick of weave <i>f</i> on the light grey.
3	8	Stamp in the order of the 8th pick of weave <i>d</i> on the dark grey; the 8th pick of weave <i>e</i> on the medium grey; and the 8th pick of weave <i>f</i> on the light grey.
3	9	Stamp in the order of the 9th pick of weave <i>d</i> on the dark grey; the 9th pick of weave <i>e</i> on the medium grey; and the 9th pick of weave <i>f</i> on the light grey.
4	10	Stamp in the order of the 10th pick of weave <i>d</i> on the dark grey; the 10th pick of weave <i>e</i> on the medium grey; and the 10th pick of weave <i>f</i> on the light grey.
4	11	Stamp in the order of the 11th pick of weave <i>d</i> on the dark grey; the 11th pick of weave <i>e</i> on the medium grey; and the 11th pick of weave <i>f</i> on the light grey.
4	12	Stamp in the order of the 12th pick of weave <i>d</i> on the dark grey; the 12th pick of weave <i>e</i> on the medium grey; and the 12th pick of weave <i>f</i> on the light grey.

Proceeding with picks 5, 9, etc., of Fig. 73, like 1; picks 6, 10, etc., like 2; picks 7, 11, etc., like 3; and picks 8, 12, etc., like 4.

As a result, shuttling one dark, one medium, and one light grey, the upper surface of the carpet would be identical in shade assortment with that seen in the sketch—Fig. 72—but on the reverse side the ground would be medium grey, the dark figuring light grey, and the medium figuring dark grey. Or, wetting one pick of Indian red, one pick of tannish orange, and one pick of sage green, the ground of the carpet in weaving would be green, the dark grey sections in the plan—Fig. 73—red, and the medium grey, orange. Reversed, the carpet would have, in this shuttling, an orange ground with sage green under the red, and red under the tannish orange figuring.

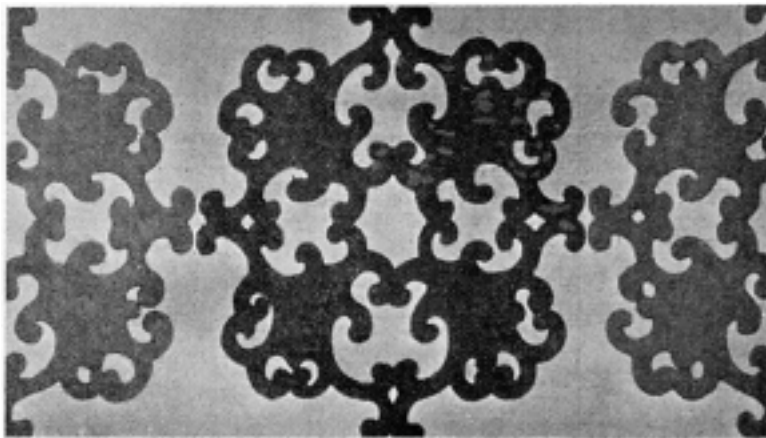


FIG. 72.

Interchange of colour relation, possible in this class of carpet manufacture, facilitates the production of decorative pattern in which the component elements are variously tinted. Though in each modification practised the same three shades are combined, the tone and aspect of the carpet are completely altered. Economy in colour units is feasible with latitude in pattern rendering or development. At the same time, no alteration in colour harmony and contrast is involved; but it will be understood that a shade occupying the ground position in one production and an integral part of the design in another, results in important changes in the scheme of shade distribution, which influence the whole colour composition of the carpet. Referring to this example, in which red, orange, and green are applied to Figs. 72 and 73, it will be apparent that the pattern characteristics and colour

features will differ with the allocation of the shade units thus : (1) Green ground and red and tannish-orange figuring; (2) tannish-orange ground and red and green figuring; and (3) red ground and green and orange figuring. Technically this principle of varying the order of shade distribution in the production of the carpet is applicable to all classes of two- and multi-ply weft union structures. It is valuable, as shown, in acquiring in one

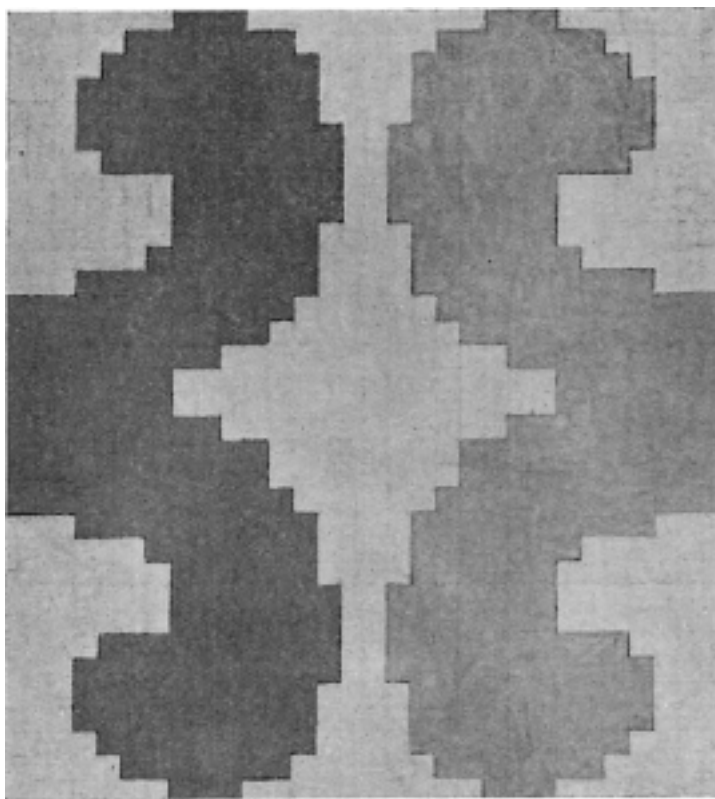


FIG. 73.

description of design and in one series of coloured yarns, by a simple rearrangement of the shuttling, diversity of style in the manufactured product.

This variety of weave structures—Figs. 70, 70A, 74 and 75—provides ample scope for the application of different schemes of weft colouring. Weaving technology enters into the shade composition developed. A uniform build of carpet is obtained by combining weave elements derived from a 3-and-1 ordinary

or broken twill principle of intertexture, which determines the positions in the pattern of the shades employed in shuttling. With three shades of weft, six tinted effects, all distinctive in character, are producible on each side of the fabric. Such diversity of colour treatment is due to the intermingling of the wefts in the construction of the weave plans. In a sense, the scheme of design involved is mechanical in method of origination, the manner of grouping the picks—face, centre and back—in the weaves, prescribing the colour features of the pattern in the order of shuttling followed. These points will be better understood on analysing the weaves illustrated in Figs. 70, 70A, 74 and 75 in relation to the two systems of wefting for which they are adapted, namely, 1 pick of shade A, 1 pick of shade B, and 1

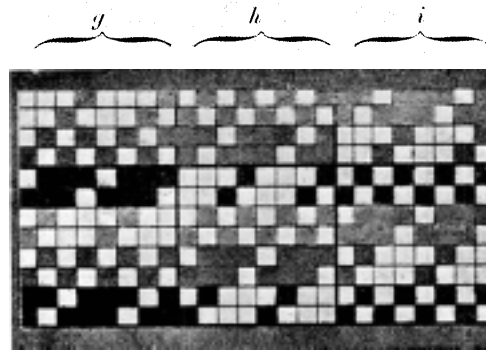


FIG. 74.

pick of shade C; and 2 picks of shades A, B and C in succession. Assuming the shades to be black, grey, and light grey, the plans in Fig. 70A, as already explained, yield the three-stripe effects sketched in Fig. 71, but in the second order of shuttling—three two's—the chintzed stripe effects seen in Fig. 76. This requires some explanation. The difference in the principles of intertexture, or in the grouping of the three sets of picks—black, grey and light grey—of which the weaves *d*, *e* and *f*, Fig. 70A, and *g*, *h* and *i*, Fig. 74, or *j*, *k* and *l*, Fig. 75, are composed, is the cause of the two styles of shade effects formed in Figs. 71 and 76. As it is impracticable to unite two systems of shuttling in weaving the same line of fabric, the alternative practice consists in using weaves which will group the three shades applied in the several colour transpositions included in the one-one-and-one, and the two-two-and-two orders of wefting; that is to say, what is not feasible by shuttling may be accomplished in plan construction.

Thus, the weave units in Fig. 70A are arranged 1 pick face, 1 pick centre, and 1 pick backing, but in Figs. 74 and 75, 2 picks face, 2 picks centre, and 2 picks backing. It follows that by wefting Fig. 70A, 1 black, 1 grey, and 1 light grey, and Fig. 74, 2 black, 2 grey, and 2 light grey, the stripings formed consist in sections *d* and *g* (Figs. 70A and 74) of a black line on the face and a light grey line on the back; in sections *e* and *h* of a grey line on the face and a black line on the back; and in sections *f* and *i* of a light grey line on the face and a grey line on the back. Similarly, if the first

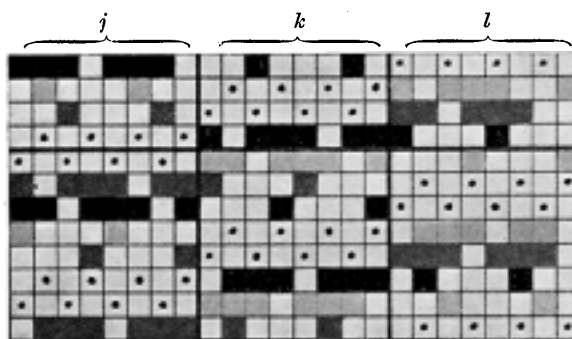


FIG. 75.

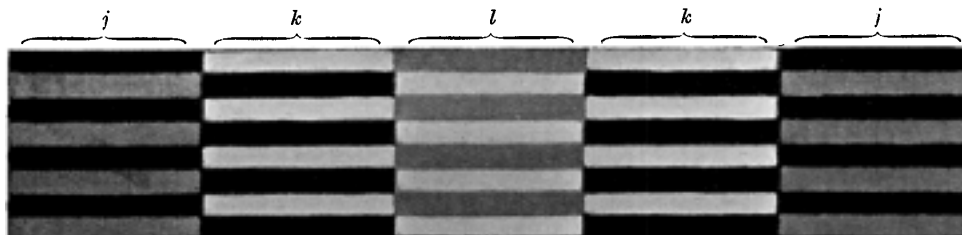


FIG. 76.

of these weftings is applied to Fig. 74 and the second to Fig. 70A, the intermingled stripe compositions drawn in Fig. 76 are produced. Hence both styles of colour effects (Figs. 71 and 76) are weavable in the plans combined in Figs. 70A and 74. Applying, for example, the three-odd pick shuttling to Fig. 75, intermingles the black and grey on the face and the grey and light-grey on the back as shown in section *j*; the black and light grey on the face and the black and grey on the back in section *k*; and the grey and light grey on the face and black and light grey on the back in section *l*; giving the effects on the face sketched at *j*, *k* and *l*, in Fig. 76.

Understanding how the several textural elements are formable

in Figs. 71 and 76, by using Figs. 70A and 74 or 75, and wefting 1 black, 1 grey, and 1 light grey, it will be obvious that, if a pattern comprises as many as six distinct decorative features, they may be severally developed by combining three shades of weft and plans *d*, *e* and *f*, Fig. 70A, and *g*, *h* and *i*, Fig. 74. It is not, however, the usual practice to combine the six possible effects, but to select the types most suitable for developing detail contrasts and design style. A common method is to work out three sections of the pattern in solid shades, and a fourth section in chintzed colouring, which may be done in two ways, first, by combining the three weave units in Fig. 70A with one of the weave

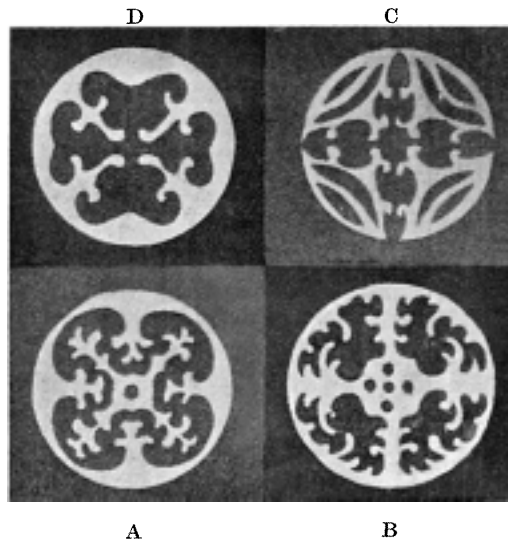


FIG. 77.

units in Fig. 74, and wefting one-one-and-one; and second, by combining the three weave units in Fig. 74 or 75 with one of the plans in Fig. 70A, and wefting two-two-and-two.

The application of this scheme of weave combination and of three-shade weft colouring may be shown in reference to Fig. 77. This sketch is for a block style of pattern with interesting types of geometrical figuring in sections A, B, C and D. As reproduced it is weavable in three colours, applying weaves *d* and *e* to the ground parts of the carpet and weave *f* of Fig. 70A to the ornament printed in white, in which arrangement any three shades of weft are combinable. Various modifications may be made in the development of the design in the loom without increasing the number of colours employed. Changing, for instance, the weave

elements applied to the component parts of the style gives the following methods of construction :—

I.—The development of the white figuring in one colour, the ground sections of A and C in a second colour, and the ground sections of B and D in a third colour.

II.—The development of the figured sections in one simple colour, and the ground sections in A and C in one tone of mixture shade, and the ground sections B and D in a second tone of mingled colouring.

III.—The development of the figured sections in A and C and in B and D in different shades, and the ground chintzed throughout.

IV.—The development of the ground in two solid colours, and the figuring in two mixture shades.

These four schemes of weaving and colouring sufficiently emphasise the scope in design treatment this principle of fabric structure affords. Restrictive and economical in coloured yarn units as a result of applying, in the methods typified, not more than three shades, and these introduced in the shuttling, it admits of the varied systems of production applicable in the use of the weave plans comprised in Figs. 70A and 74 or 75.

The weaves to combine in acquiring the pattern definitions indicated, and the colour qualities of the carpet produced—wefing 1 blue, 1 russet brown, and 1 fawn—are stated in detail in Table XIII :—

Obviously, by the use of other weave combinations than those specified in the Table the development of the style may be further elaborated. The characteristics of the pattern are, however, well diversified in these typical examples, both in colouring and weave application.

Summarised, the systems of design construction defined include the following features: In scheme I.—weft *a*—the checked base as well as the figured details are equally emphasised in colour contrast yarn. Tone-upon-tone shades would not give satisfactory definition to the several features of the design. The decorative forms in such colours would be somewhat blurred, instead of being clearly brought out, as in Fig. 77. Scheme II. renders it feasible to weave the ground spaces in A and C (Fig. 77) in a different shade of intermingled colouring from the ground spaces in B and D, with the figuring in one solid colour. It is a useful method of production when combining two shades in the same tone equally contrasting with a third colour in hue, as, for example, blue and lavender for the former,

TABLE XIII.—EXAMPLES IN WEAVE APPLICATION TO THREE-PLY UNION CARPET DESIGNS

Methods of Production.	Order of wefting.	Weave units. (Figs. 70A, 74, 75.)	Colour effects in the Carpet. (Design, Fig. 77.)
I.	(a) 1 blue 1 brown 1 fawn	Plan <i>d</i> for the figured sections. Plan <i>e</i> for the ground sections in A and C. Plan <i>f</i> for the ground sections in B and D.	Blue figuring, brown ground in A and C, and fawn ground in B and D.
	(b) 1 brown 1 fawn 1 blue	As above.	Brown figuring, fawn ground in A and C, and blue ground in B and D.
	(c) 1 fawn 1 blue 1 brown	As above.	Fawn figuring, blue ground in A and C and brown ground in B and D.
II.	(a)	Plan <i>d</i> for the figured sections. Plan <i>k</i> for the ground sections in A and C. Plan <i>l</i> for the ground sections in B and D.	Blue figuring, with a mixture of fawn and brown for ground sections in A and C, and of brown and blue for ground sections in B and D.
	(b)	As above.	Brown figuring, with a mixture of blue and fawn for ground sections in A and C, and of fawn and brown for ground sections in B and D.
	(c)	As above.	Fawn figuring, with a mixture of blue and brown for ground sections in A and C, and of blue and fawn for ground sections in B and D.
III.	(a)	Plan <i>d</i> for the figured sections in A and C. Plan <i>f</i> for the figured sections in B and D. Plan <i>k</i> for the ground sections in A and C. Plan <i>j</i> for the ground sections in B and D.	Blue figuring in A and C and fawn figuring in B and D; with a mixture of brown and fawn for ground sections in A and C, and of blue and brown for ground sections in B and D.
IV.	(a)	Plan <i>e</i> for the ground sections in A and C. Plan <i>f</i> for the ground sections in B and D. Plan <i>k</i> for the figured sections in A and C. Plan <i>j</i> for the figured sections in B and D.	Brown ground in sections A and C; and fawn ground in sections B and D, with a mixture of fawn and brown in the figuring in A and C, and of blue and brown in the figuring in B and D.

and fawn for the latter. In the carpet, the ground sections—using the weaves selected—in A and C would consist of lavender and fawn intermixed, and in B and D of blue and lavender, and the figuring in blue. Another group of contrasts is produced by the application of scheme III. Here the ornamental features are formed in two colours, those characteristic of A and C contrasting in hue with those characteristic of B and D, but both developed on mixed ground shades. Scheme IV. is the reverse of scheme III., giving the figuring in intermingled shades and the ground sections in solid colours, the two systems illustrating the utility of this principle of designing in the production of carpets in which either surface presents a wearable quality of pattern, both as regards colour composition and decorative style.

The technicalities of the structures examined do not necessarily restrict the schemes of ornament utilised; but, as each weave unit—see Figs. 70, 70A, 74 and 75—is complete on four threads and eight picks in the case of two-ply carpets, and on four threads and twelve picks in the case of three-ply carpets, the most satisfactory joinings of the weaves are formed, in developing the sectional parts of the patterns, when the weaves are divided centrally, *i. e.* in two threads and in four or six picks. If this rule is not followed, it may involve modifying the plans on the edgings of the figuring to effect correct and uniform fabric construction and design definition. The greater the number of units combined, the more attention should be given to the accurate fitting of the several weaves, by detail alterations in their interlacings, at the points in the design where combination takes place. Single thread and pick movement in outlining the figuring is not strictly practical. Clearer style development and more perfect carpet manufacture result from using “intersection moves” corresponding with the number of threads and picks occupied by the weave units combined. Should this method of plan-making not be adopted, the weaves are treated, on the extremities of the figured sections, as is done in other classes of decorative designs composed of a number of weave elements of different structural formation, and in which either a special intermediate weave is employed, or the weaves forming the pattern are adjusted in relation to each other. But in these carpets it is preferable to acquire loom design preparation (1) by selecting types of ornament adapted to the weave principles, and (2) by dividing the weave elements, in application to the looming plans, in the multiples suggested.

While the ornamental schemes applicable include geometrical and conventionalised floral forms, naturalistic design compositions are inappropriate. But it will have been observed from the examples considered that, when minute effects are selected, clearness of definition is obtained by working out the styles on an enlarged scale. The object of this is to facilitate, as indicated above, correctness of weave joinings in changing from one species of decorative detail to another. From this it will be concluded there are typical varieties of decorative pattern fitted to this scheme of weaving, namely, styles consisting of design features which do not appreciably suffer in character and textural representation by outlining in pairs of threads and sets of four or six picks. Decoratively, this does not imply limitations in pattern treatment beyond those present in carpet designing in general. It does, however, suggest the value, and utility of design types composed of simple decorative forms.

The following are examples of the design bases for which two-ply and three-ply weave plans are specially adapted :—

- (1) Decorative weave base.
- (2) Compound weave base.
- (3) Decorative (Geometric or Floral) base.
- (4) Drafted base.

Designs of the first category are purely technical in origin, principle and in method of construction. As a rule, “weave” elements are simply considered as principles of intertexture. Of some of the commoner “crossings”—twills, mats, ribs, etc.—this is the purpose for which they are chiefly applied. Yielding distinctive fabric structures, they are commercially utilised in different counts of yarns and settings. But “weave” design has also a decorative quality and relation to the appearance of the woven texture. To the purely decorative carpet designer, this latter significance may not be at once apparent, as he is mainly concerned in “weave” as a system of carpet construction. The pattern value of a plan of warp-and-weft interlacing, as a basis of ornament, requires some exposition. In practice (1) weave units are taken as the structural schemes of the ornate compounds to be acquired. Here all design features result from the elaboration of the plan on which the intersections are contrived. These may be as diversified in arrangement, order of distribution, and in methods of combination as geometric forms are variable in constructiveness and grouping. That they are limited in compass, being prescribed by the multiple of threads and picks on which

they are devised, is a restrictive rule which applies more to the dimensions than to the diversity of the weave types resultant. With eight or ten threads and picks, a large range of pattern is producible, and the increase of either the threads, the picks, or both threads and picks, amplifies the source of "weave" or design structures.

Examples of units constructed on the "transposition," the "sateen," the "diamond," and the "interlacing" schemes of intersection will make these points clear. Suggestive "weave" plans of the first variety are illustrated in Figs. 78 to 83 inclusive. On the base of Fig. 78, the pattern represented in Fig. 78A has been obtained. This, and all other weave types, however

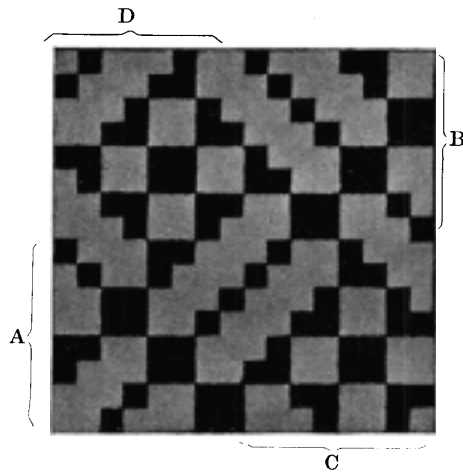


FIG. 78.

diversified and extended by duplication of the warp and weft intersections, when woven in two contrasting shades yield facsimiles, on the fabric scale in which they are produced, of the interlacing plans from which they have been derived.

Using a light shade of warp and a dark shade of weft, the effects in the texture of Fig. 78A would exactly coincide with those in the weave base, but the effects in white in the plan would be developed in the light shade in the fabric, and, similarly, the effects in black in the weave would consist of the dark shade in the texture. Other principles of work have, therefore, to be practised to render the weaves serviceable in design origination. On the point paper they form pattern "motives," and as such they may be extended and converted into decorative styles. In this relation, each unit is usable in the construction of designs acquired in

compound schemes of intersection. Thus, taking the class of carpets being studied, the effects in the weave base are producible in three distinct colours, and, as pointed out in reference to Figs. 70, 70A, 74 and 75, also in an intermingled shade or blend of any two of the three shades shuttled in consecutive order in the making of the carpet. Limiting the development to a four-shade design—Fig. 78A—then the weave units *d*, *e* and *f*, Fig. 70A, and *g*, Fig. 74,

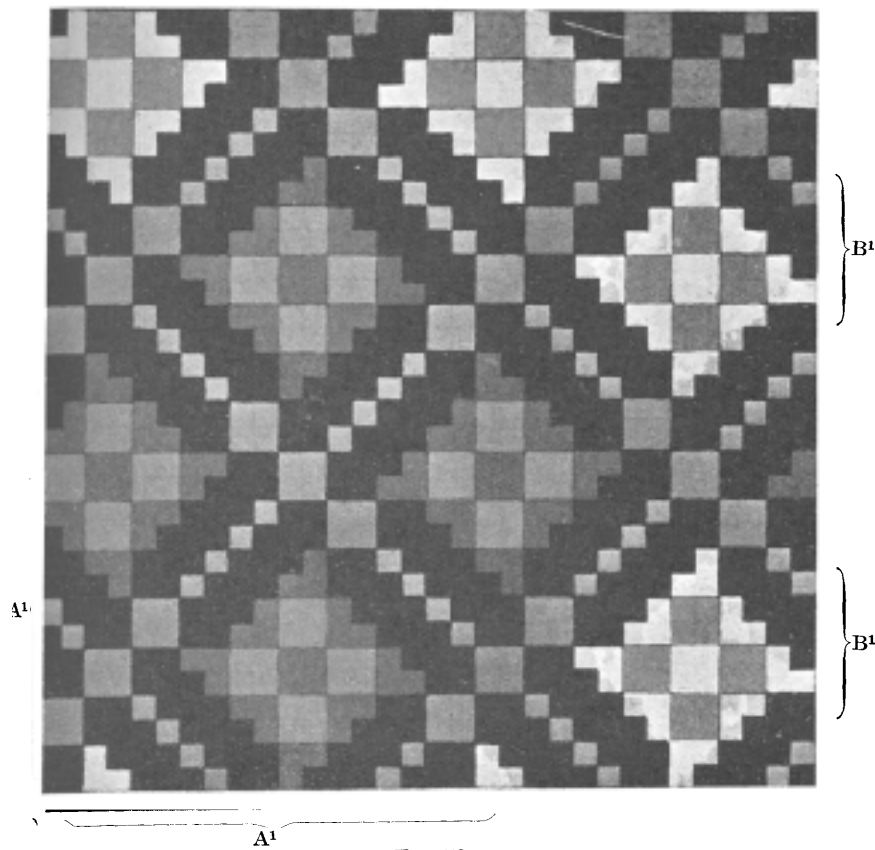


FIG. 78A.

would be combined. The design, as sketched, is one-fourth the scale of the looming plan, so that each square denotes four threads and six picks in the carpet. Applying units *d*, *e* and *f* to the black, grey, and white sections, and *g* to the light grey sections, and weaving 1 black, 1 grey, and 1 white would develop the light grey features in Fig. 78A in a mixture of the two greys, but the remaining features in the shades seen in the design.

It should be pointed out that the type of weave units selected

and the scheme of colouring applied are the chief factors in developing the pattern. This will be appreciated on further comparing Figs. 78 and 78A. Clearly, the elements in the pattern are the same as those in the weave base, but differently coloured. The white details in section B¹ of Fig. 78A correspond to the black details in Fig. 78. The same types are sketched in grey—Fig. 78A, section A¹—with the light types in Fig. 78 printed in black throughout both A¹ and B¹, Fig. 78A.

The whole style is a compound of two varieties of pattern. If produced in three shades, either the white sections would be

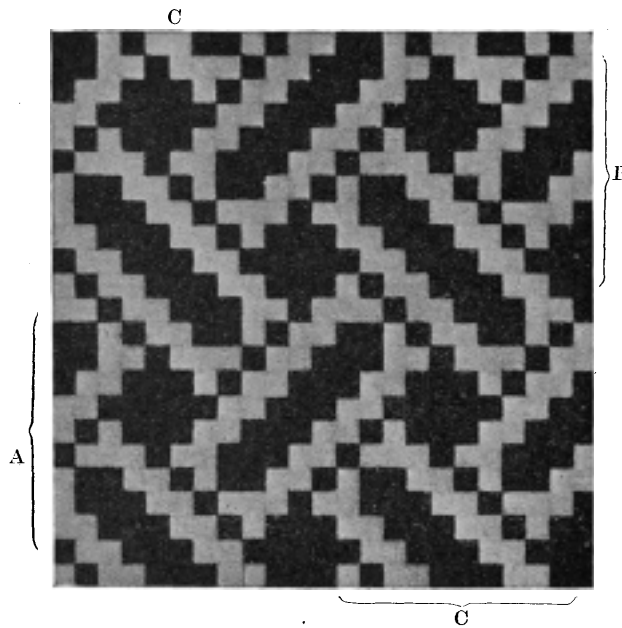


FIG. 79.

changed to grey, or the grey sections to white. Section A¹ represents the result with the white eliminated. The introduction of a fourth shade makes it feasible to interchange the colour development of the diamond figures as illustrated in A¹ and B¹ respectively, so that four of these spots, woven in grey and light grey, alternate with four spots woven in grey and white. As a consequence of this method of colouring, the formation of the pattern is doubled, and a new character is given to the weave motive. It is a principle of design enlargement and modification, which applies to other examples of this description of weave structure.

Figs. 79 and 80 are two simple illustrations of design motives formed on the 12×12 transposition weave base. The twilled sections are reversed in Fig. 79, causing the motive to repeat on 24 threads and picks, though strictly constructed on the smaller number. Two systems of procedure are practised in utilising these motives in pattern origination. First, the scale of the weave units is enlarged, completing them, in these examples, on 48×48 , 60×60 , or 96×96 ; second, each intersection in the weaves is taken as denoting a multiple of threads and picks of the structural

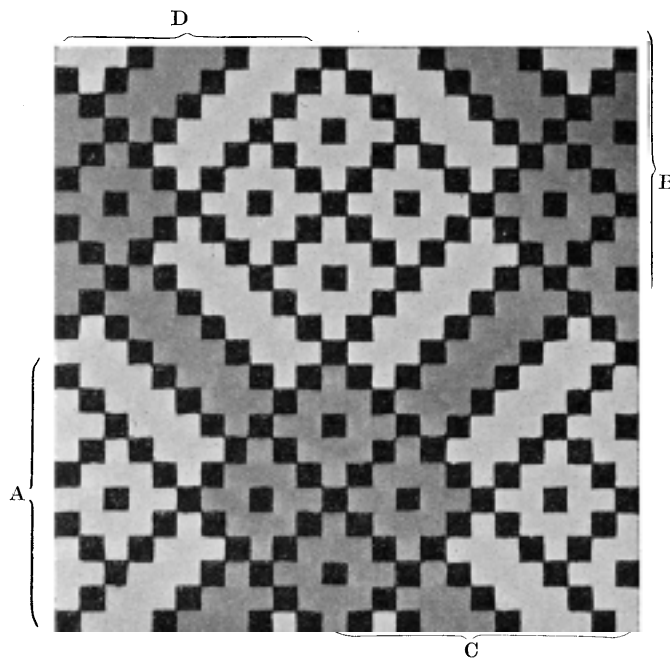


FIG. 80.

weaves combined in the production of the carpet, say, 8×16 in units a, b, c , Fig. 70, or of 8×24 in units d, e and f , Fig. 70A. By the first method, a weave type is duplicated or re-duplicated several times in dimensions without modifying the intersection "move," that is to say, Figs. 79 and 80 would be extended to 96 or 192 ends and picks, and be used in this form as the base of the new design, each intersection being equal, in the enlarged base, to four or eight threads and eight or sixteen picks of the plans in Fig. 70. By the second method, the weave unit may not be increased, or it may, in the case of a small base, be simply duplicated, and the intersections followed in making the looming

design as integral multiples of one or more repeats of the structural plans, such as 4×8 , 8×16 , 12×24 , etc. Assuming each interlacing to be equivalent to a structural weave unit of 8×16 , the patterns produced from Figs. 79 and 80 would repeat on 96 threads and 192 picks, the ratio of the warp and wefts in the weaving of the carpet obtaining design balance.

The first principle gives the more accurate reproduction of the weave motive, retaining the exact intersection scale in the delineation of the pattern elements. The second principle amplifies the intersection moves and results in proportionately broader design characteristics.

Alluding further to Figs. 78 to 83, the transposition characteristics of the bases are differently formed and arranged. In Fig. 78, sections A and B, and C and D interchange in check structure, a feature traceable in the looming pattern, Fig. 78A. One principle of construction is followed in the several illustrations, as may be proved by comparing the elements in parts A and C with those in parts B and D, of which each motive is composed. The combination of the different groups of intersections produces the distinctive styles of effect observed. Those used in Figs. 79 and 82 contrast in design framework with those applied to Figs. 80, 81 and 83. Thus the leading features in Fig. 79 oppose each other in cross-formation with the lozenge spots filling in the intermediate spaces; but in Fig. 80 the transposing of the effects yields *en bloc* a diamond-shaped figure. Still, the methods of origination are, in the main, identical in principle. Certain intersection types are selected in both forms of examples for the composition of section A. These are transferred on to section B, next applying the details for completing the two sections, and lastly filling in parts C and D. Style character and design structure are acquired and determined in the origination of the effects comprised in A, which will be seen if the examples are dissected. Considering Figs. 82 and 83, sections A resemble each other in the element marked in black and consisting of three weft floats. The starting and terminating points of the effects are dissimilar, and also the plan followed in developing sections B. The demarcation line is repeated in the same direction in Fig. 83, but reversed in Fig. 82, and, to complete the pattern, the two series of lines are transposed in developing parts C and D. Repetition of these effects, and duplication of them, in transposing, result in the diamond-shaped design seen in Fig. 83. Similarly the single process of transposition, employed in the framing of Fig. 82, results in a rhomboidal

style of pattern. In each, the "key" feature having been placed, the details, added in working out the base, are made to coincide with its outlines. Hence, in the first of these illustrations the demarcation spots are surrounded with oblong figures in grey, and in the second example, the rectangular spaces formed are developed in interlacing types conforming with the diamond structure of the "motive."

It will be understood that the larger the area of threads and picks which a base occupies, the more varied in character and arrangement the intersection features. On the 12×12 base (Fig. 79) 144 intersections are possible; on the 16×16 (Figs. 78 and 82)

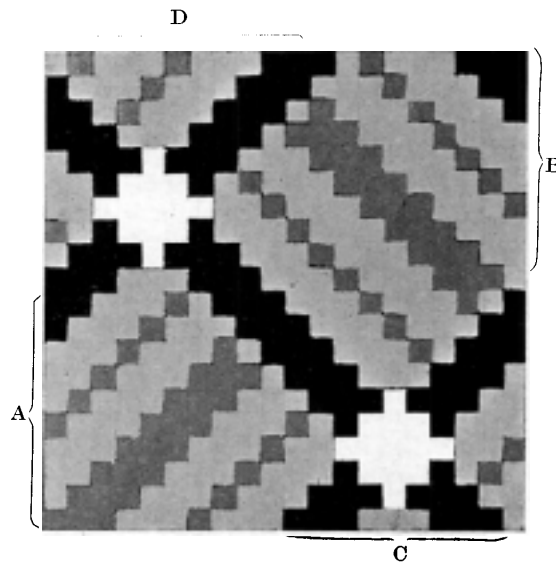


FIG. 81.

256; on the 20×20 (Figs. 81 and 83) 400. Latitude in the methods of planning and of grouping the intersection details is proportionate to the multiple of threads and picks usable in the origination of the "motive." Comparing the examples in this respect, it will be evident that, as the area of the base extends, the fuller and more pronounced the design type produced. Each unit, however, whether on the smaller or the larger base, is a complete form of pattern, and capable of being treated variously in applying it to carpet designs weavable in three solid colours, and one or two intermingled or chintzed shades.

Patterns 78A and 81A are suggestive of the style of ornamentation this group of weave units may be utilised in developing.

The technicalities underlying the construction of Fig. 78A have been indicated. Those relating to Fig. 81A are of a similar character, but also require to be examined. The connection between the weave unit (Fig. 81) and the design (Fig. 81A) as it would appear in the carpet will at once be followed. It is a four-shade composition, the grey, or fourth shade, being obtained by blending, in shuttling, say, the dark grey and the white yarns.

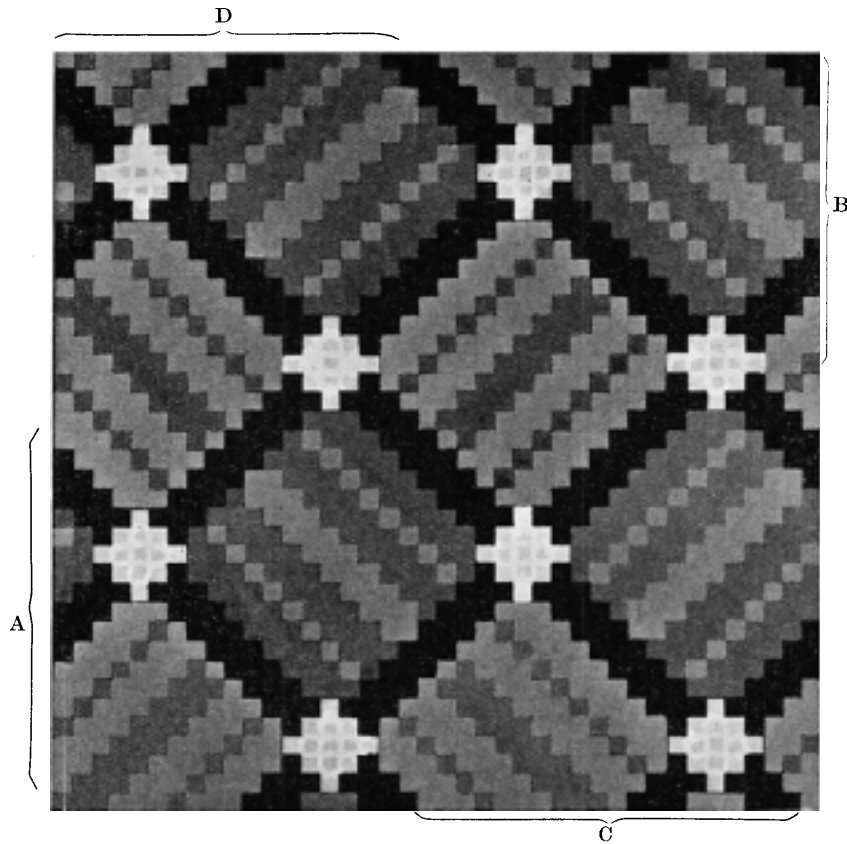


FIG. 81A.

Taking the colours to be red (= black in the pattern), blue (= dark grey), and light tan or fawn (= white), and picking in consecutive order, and developing the respective sections of the design in the structural units *d*, *e* and *f* (Fig. 70A) and *h* (Fig. 74), then the light grey portions would consist of a mixture shade composed of red and fawn. Applying the weave in multiples of four or eight threads, in card stamping, would give a pattern repeating on 160 or 320 threads, approximately 10 or 20 inches in size.

When selecting and arranging the colours for looming, the relative emphasis of the different portions of the pattern has to be taken into account, otherwise the figure representation will not coincide with that in the sketch. Changing, for example, the positions of the light tan and blue in this illustration would cause the dark grey features to be woven in tan, the light grey in blue, and the white features in a *mélange* of red and blue. In the method of weaving and colouring suggested, the effects in the motive, Fig. 81, in black, and the diamond spots in white, are treated as the principal and basic elements of the pattern, allowing for variations in the production of the remaining sections. Four of these, in Fig. 81A, are formed in the lighter grey shade and four in the darker grey; and, in addition, the twilling of corresponding but transposed parts of the design is reversed. Interchange of colour application and in the weave elements, as illustrated, amplifies the dimensions of the style, and renders the scheme of construction more varied in tone and effect than adhering to the precise reproduction, on an enlarged scale, of the "motive" in its original form.

A number of typical methods of colouring, and of design extension, applicable to this group of weave units as pattern bases (Figs. 79 to 83) are stated in Table XIV.

All the patterns are reversible in appearance and structure. The two-shade example, Fig. 79, is producible in the two-ply weaves, as also Figs. 82 and 83, but to construct the latter examples in three solid shades, the three-ply weaves are combined as shown in the particulars of manufacture given in the table. Fig. 80, when made in colour scheme (a), in tones of heliotrope, is suitable for a bedroom carpet; and in scheme (b), in two tones of brown, with the lighter shade contrasting in hue with the shade of green applied to the white figuring in the "motive," is adapted for any ordinary floor decoration. Both schemes (a) and (b), when utilised in the weaving of this type of design base, result in the principal parts of the pattern being developed in the medium tone of weft with the detail intersections (black in the plan) in the dark or deep colour. Only one four-shade weft pattern is supplied, that illustrated in Fig. 81. Greenish shades of grey are used in (a) and bluish shades in (b), graduated in tone; but the relation of the dark and light shades to the pattern features is reversed, so that the design representation, in the former, corresponds with that in the sketch, but in the latter, the dark features are woven in the lighter, and the light features in the darker shades.

TABLE XIV.—STANDARD SCHEMES OF DEVELOPING TRANSPOSITION WEAVE
“MOTIVES” FOR UNION “KIDDERS”

Weave units in motives.	Design scale, structural weave multiple and pattern repeat.	Colour scheme.	Carpet pattern.
Fig. 79.	Scale : 48 × 48. Weaves : <i>a</i> and <i>b</i> . Fig. 70. Pattern repeat : 192 threads.	(<i>a</i>) Black sections equal red brown. Grey sections equal olive brown. (<i>b</i>) Black sections equal green. Grey sections equal blue.	(<i>a</i>) Black figuring in red brown, and grey effects in olive brown. (<i>b</i>) Black figuring in green and grey effects in blue.
Fig. 80.	Scale : 192 × 192. Weaves : <i>a</i> , <i>b</i> , <i>c</i> Fig. 70. Pattern repeat : 192 threads.	(<i>a</i>) Black sections equal deep heliotrope. Grey sections equal medium heliotrope. White sections equal light heliotrope. (<i>b</i>) Black sections equal claret brown. Grey sections equal medium claret brown. White sections equal medium green.	(<i>a</i>) Black figuring in deep helio, grey in medium helio, and white effects in pale helio. (<i>b</i>) Black figuring in claret brown, grey in medium claret brown, and white parts in medium green.
Fig. 81.	Scale : 160 × 160. Weaves : <i>d</i> , <i>e</i> and <i>f</i> , Fig. 70 <i>a</i> , and <i>h</i> , Fig. 74. Pattern repeat : 256 threads.	(<i>a</i>) Black sections equal deep greenish grey. Dark grey sections equal medium greenish grey. Grey sections equal greenish grey. White sections equal light greenish grey. (<i>b</i>) Black sections equal light bluish grey. Dark grey sections equal bluish grey. Grey sections equal medium bluish grey. White sections equal dark bluish grey.	(<i>a</i>) Black effects developed in deep greenish grey, dark grey in medium greenish grey, grey figuring in greenish grey, and white in light greenish grey. (<i>b</i>) Black effects in light bluish grey, dark grey in bluish grey, grey figuring in medium bluish grey, and white in dark bluish grey.
Fig. 82.	Scale : 96 × 96. Weaves : <i>d</i> , <i>e</i> and <i>f</i> , Fig. 70 <i>a</i> . Pattern repeat : 320 threads.	(<i>a</i>) Black sections equal brownish drab. Grey sections equal deep sage green. White sections equal sage green. (<i>b</i>) Black sections equal blue. Grey sections equal Indian red. White sections equal deep Indian red.	(<i>a</i>) Black figuring in brownish drab, grey in deep sage green, and white in sage green. (<i>b</i>) Black figuring in blue, grey in Indian red, and white in deep Indian red.
Fig. 83.	Same as Fig. 82.	Black sections equal pale red. Grey sections equal pale blue. White sections equal light fawn.	Black figuring in pale red, grey in pale blue, and white in light fawn.

This kind of colour interchange is practicable in shuttling, and does not necessitate any modification in the preparation of the design for the loom. Providing a colour *mélange* has been formed which yields satisfactory harmony, and also gives effective pattern contrasts, then the system here illustrated of developing the figuring in the dark and light tones is applicable. Regarding Fig. 82, the dark colour in schemes (a) and (b) is applied to the transposed sections, sketched in black, with the deep and intermediate shades interchanging in the grey and white features.

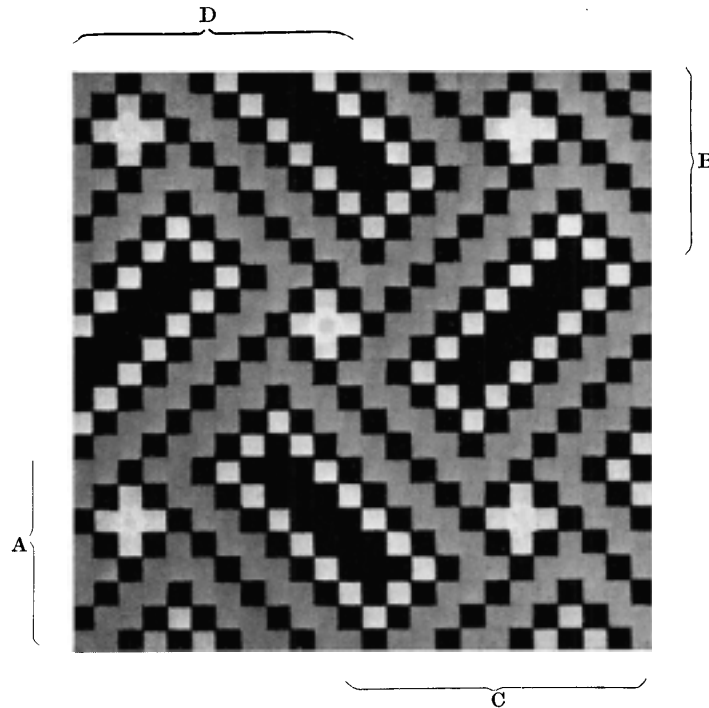


FIG. 82.

The principle is suggestive, and may be further elaborated by reversing the positions of the brownish drab and the sage green in (a), and the blue and red in (b). By employing the colourings as tabulated, the “basic” effect, in grey in the “motive,” is produced in deep sage green and red in the respective weftings; and the details printed in white, in the lighter tone of green in (a) and in the deeper tone of red in (b).

In the references to Fig. 78A it was pointed out that by interchanging the positions of the grey and white wefts, the unit base was, in the weaving of the pattern, quadrupled in size. It is in this sense that the reversing of the relative places of the wefts, in the

woven structure, may be rendered effective in remodelling the pattern composition. The principle is valuable in this variety of carpet designing, being applicable to three- and four-shade decorative styles composed of dark and light colours. Shade contrast is essential to the proper accentuation of the changes produced in the pattern. To transpose the positions of two shades of a like tone does not necessarily elaborate the design base, as

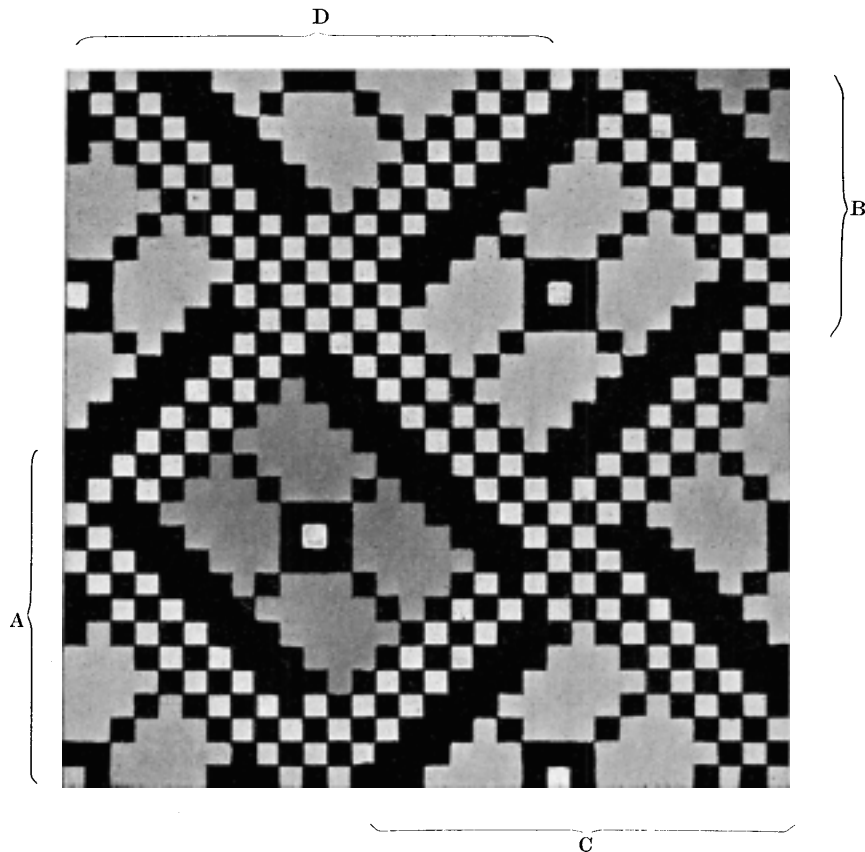


FIG. 83.

invariably transpires when light and dark colours are interchanged. The results acquired are not due to any alteration in the order of shuttling, but to the method of applying the structural weave units in card stamping.

The practice, in thus utilising a weave unit, consists in repeating the "motive" for a number of times on the point paper, to allow of the requisite positions being formed for the colour interchanges. In this instance four repeats are made. Should three

colours interchange in position, or should the interchange of colour be applied to more than one group of figure elements, such a number of repetitions of the basic unit is essential as to comprise all the factors of the pattern successively and uniformly transposed. Having contrived these, it is a problem of developing each integral colour effect in its correct weave multiple, as already explained.

Sateen motives are constructed on geometric and mathematical principles. Each regular type of sateen divides the area of threads and picks of which it is composed, into a number of equal rectangular spaces corresponding with the number of intersections in the weave. Sketches A to H, Fig. 84, are suggestive of this basic scheme of plan formation and of figure distribution. They give the spaces into which a square is divisible by the intersection points in the five, seven, eight, nine, ten, eleven, and twelve-thread sateens. These points may be readily found: Divide the square into as many sections as there are threads or picks in the sateen, and on the latter mark the sateen weave, drawing lines through the intersections as shown. The intervals (that is, the number of picks from one intersection to another) from point to point being equal, the sides of the rectangular spaces coincide. Such distances forming a prime fraction of the pattern or weave, the employment of the sateen base in the origination of design motives imposes an even and systematic distribution of detail effects combined.

It should be observed that, as two or more sateens may be constructed on the same base, the divisional form and grouping, but not the number, of the spaces are variable, as illustrated in Fig. 84; but as there are not many distinct weave units applicable as "prime" or "move" numbers, always two, and frequently four, give corresponding divisional results. Whatever prime number be selected in planning the sateen, there is a second number complementary to it: therefore one that affords the same geometric scheme, but with the spaces differently grouped.

The five, eight and ten-end sateen bases are commonly applied because they form, geometrically, a similar series of divisions both ways of the design and with the sectional spaces or figures the same distance apart, and this equality of distribution and grouping obviates any particular line of effects or spaces being super-accentuated in the repetitions of the weave design. In the case of the seven, nine, eleven, and similar types there are more rows (see D and F, Fig. 84) of divisional spaces in a vertical than in a transverse direction, causing the spaces to be more compactly

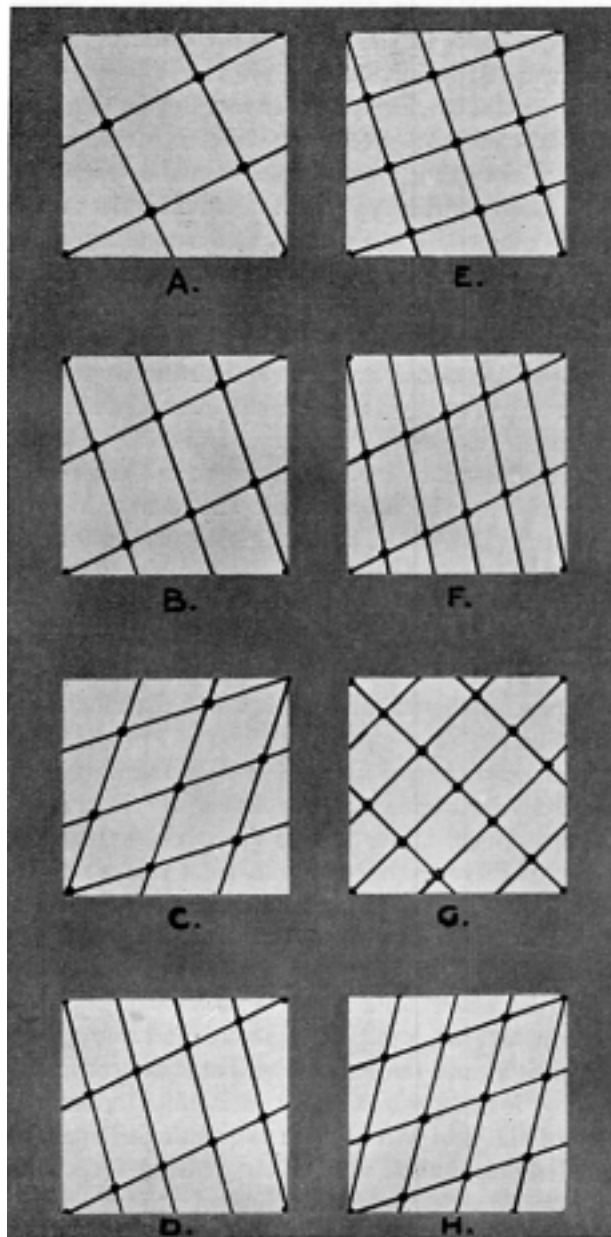


FIG. 84.

related in the length than in the width of the fabric. Row-like formation is detrimental to the composite character and regular appearance of the detail features in either the weave or the pattern. The six-end sateen, Fig. 90, is imperfect in this respect, yet it is frequently used on account of the varied types of design of which it forms the base. Thus, the weave results in two series of geometric divisions, three twilling in one and three in a contrary direction. As the third intersection point in each series is centrally placed, it provides for the base being used for weave motives with one set of elements, formed on the central points, differently arranged and composed from the elements contrived on the remaining intersections. Moreover, as the centre points, or divisions in the geometric form, are equi-distant from each other, regularity of weave or motive construction is obtained in which the presence of serial rows of effects is not apparent.

The principles defined will make it clear that the designs derived from the elaboration of this variety of weave motive will differ in composition and style from those described in reference to transposition weave units. As regards evenness of decorative treatment, in acquiring pattern in which the ornate elements are uniformly combined and also evenly distributed over the surface of the carpet, both bases are equally serviceable and adaptive in constructiveness. In figure arrangement and variety of form the transposition scheme dealt with is the more restricted in scope. Obviously, several of the spaces in A to H, Fig. 84, might be differently developed and coloured, or, as will be explained and illustrated, the intersections in the weave bases, which the spaces represent, may be utilised in the construction of distinct types of effects. One set of design elements is elaborated on the first base by repetition and transposition; here, several figure types are combinable in systematic order or mathematical relation, and the pattern is variable throughout its structural composition.

Two elementary examples may, in the first place, be analysed, Figs. 85A and 86A. The former is constructed on the five-thread sateen motive sketched in Fig. 85 and the latter on the four-end unit represented in Fig. 86. Portions of Fig. 85A consist of enlarged sateen intersections only, and other portions of the spots marked in black and grey. By reversing the positions of the spotted and sateen sections as illustrated, a striped pattern is developed. The "motive" obtained is of the simplest variety, but as seen from Fig. 85A it may be rendered more diversified in character by the method of colouring practised. If woven in two shades of weft—

two-ply construction—the ground of the pattern might be an intermingled shade with the spottings in parts A and B alternately produced in the two colours employed. Combining, for example, brown and blue wefts and using the structural units in Fig. 70, developing the design on 80 or 160 threads, the ground would be

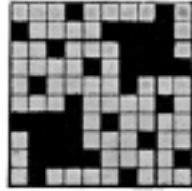
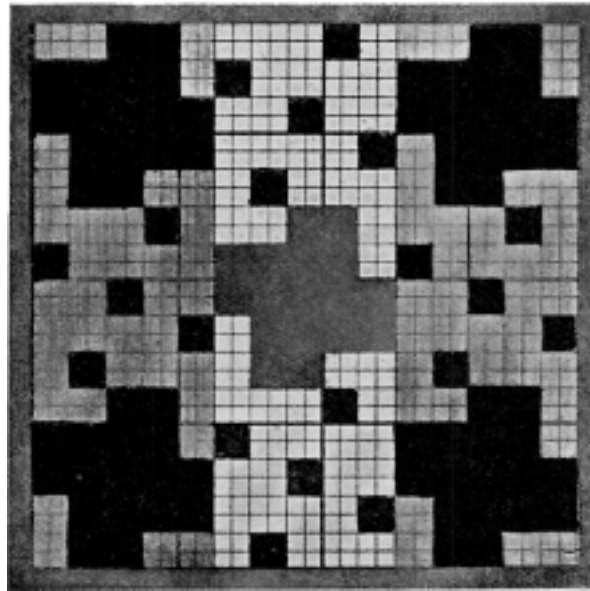


FIG. 85.



A

B

A

FIG. 85A.

a mixture shade. An equal degree of emphasis is given to the features of the pattern in both stripings when this system of weave and colour application is followed, with the spottings in A woven in brown and those in B woven in blue.

Assuming next that three wefts are used—brown, blue and green—and that the carpet is three-ply, combining the plans in Fig. 70A, the ground shade would be green and the colours of the

spottings unaffected. To acquire the style illustrated, and by shuttling 1 red, 1 fawn, 1 lavender, plan *d* would be applied to the black sections, *e* to the light grey, *f* to the white, and *g*, Fig. 74, to the grey. The black spottings would, as a result, be developed in red, the grey in a mixture shade of red and fawn, the light grey ground in fawn, and the white ground in lavender. Other sateen bases—*e. g.*, the five, six, and eight—are similarly extended and applied, the type of the small spots being varied and also that of the principal decorative details, changing them to a figured character by enlarging the scale of the pattern.

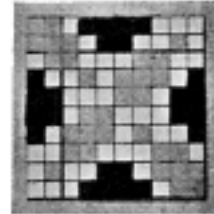


FIG. 86.

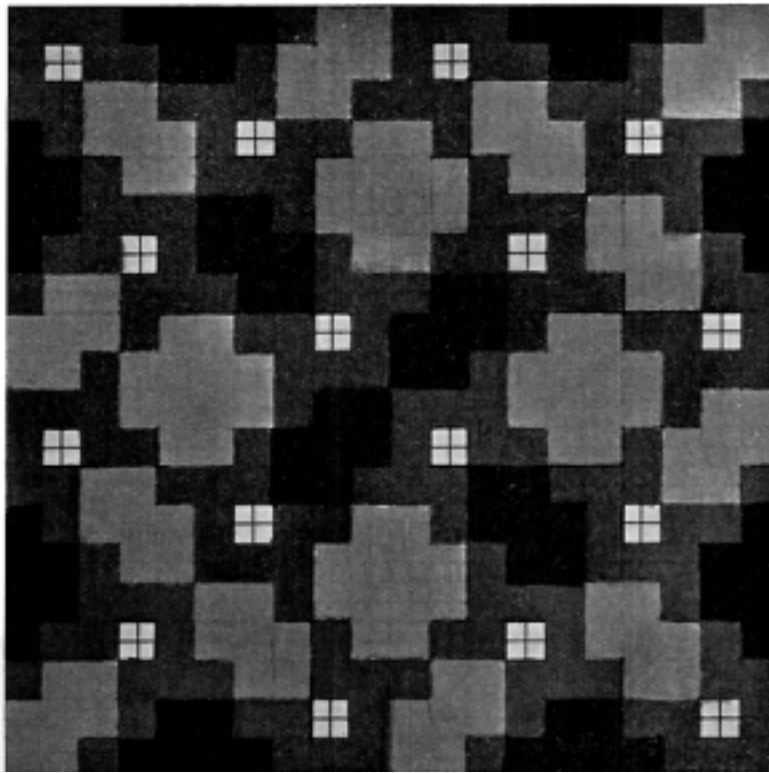


FIG. 86A.

The basic structure of Fig. 86A is the four-thread swansdown, Fig. 87, from which the weave motive Fig. 86 has been derived. Fig. 87 is not strictly a sateen base, which has been defined as a

plan with adjacent interlacings at equal distances from each other and occurring at intervals of at least one thread or pick, following the order in which they are counted. Still, as this, the only form of sateen producible on four threads, was not considered in relation to transposition designs of which it is the fundamental type, its use and application in this class of pattern work may now be examined. From the illustration it will be observed that there

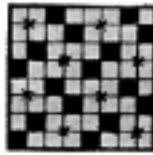


FIG. 87.

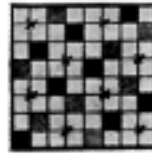


FIG. 88.

are small irregular spaces of several threads and picks formed betwixt the intersection points. The elements in black in Fig. 86 coincide to the intersection points in Fig. 87, and the remaining effects to one method of utilising the spaces intervening. All the simple sateens may be similarly treated. A specimen of the five-end sateen thus extended and producible in two or three shades and varieties of spotting is illustrated in Fig. 89.

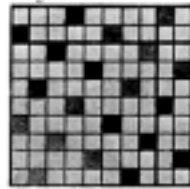


FIG. 89.

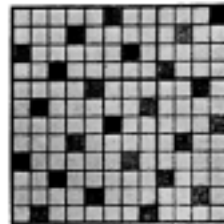


FIG. 90.

The six-end base with the ground one shade and the spottings in two colours, Fig. 90, is also sketched. With the application of different intersection types, these elementary structures improve as schemes of decorative design construction. Their value as bases of figure distribution deserves to be incidentally noted, as it shows the accuracy of this weave base in relation to pattern origination. Ornate forms may be substituted for the interlacing units, and the plan of the sateen selected serves as the method of design arrangement and structure. For example, by

doubling the four-end base, as in Fig. 88, and taking each intersection as equivalent to one figure, the simple pattern scheme outlined in Fig. 91 is the result.

But in this connection the interlacing points in the plan are made to form the base of a "weave" design, so that by extension and the combination of additional intersection elements, the pattern in Fig. 86 is devised on the base of Fig. 87. This "motive," by the same procedure as that already explained in regard to the origination of designs on the transposition "weave" base, is elaborated into the pattern type sketched in Fig. 86A.

The four distinctive elements of this class of example are (1) the scale on which the weave units are developed; (2) the system

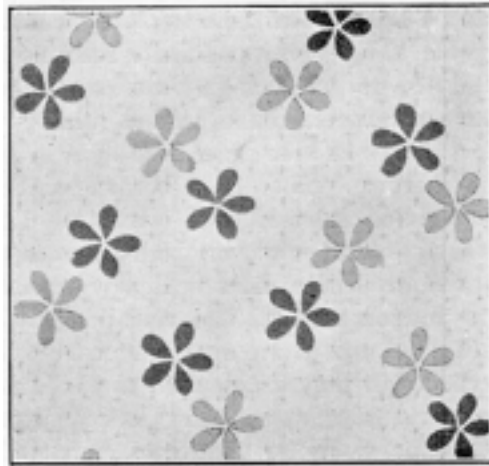


FIG. 91.

of colour interchange practised; (3) the diversity of pattern composition required; and (4) the effective delineation of each type of detail in the motive. In the first place, the scale of the weave base may be simply duplicated—as in Fig. 86A, based on Fig. 86—and, in the second place, the scheme of colouring may quadruple the size of the design resultant, so that assuming each element to correspond to a multiple of four threads in the carpet, a repeat of the pattern would contain 160 threads, that is, 10 (threads in weave motive, Fig. 86) \times 4 (threads in union weave structure) \times 4 (effect of colour scheme). A more pronounced and effective scheme of construction, however, is to reduplicate the sateen, or colour motive of which it forms the base, and take each thread in this enlarged design as representing four threads of the structural

weaves employed in preparing it for the loom. Diversity of style composition is an important factor. It obtains in some degree in the motive, Fig. 86, being noticeable in the groups of effects in white, grey, and black; but these are more distinctly developed by practising an order of shuttling which transposes the minute figures, four effects in black being set across four similar effects in light grey, and four spots in grey, grouped in diamond formation, interchanging with four spots in black, with the white spotting in the groundwork. The clear delineation of the elements combined is partially due to the degree of contrast in the shades and partially to the system of developing the different effects in the light grey and black. Assuming each square in the design to represent 4 threads and 12 picks and wefting 1 shot of blue green, 1 red, and 1 light brown, and applying weaves *d*, *e* and *f*, Fig. 70A, to the black, light grey and white sections of the design, and weave *g*, Fig. 74, to the dark grey sections, the carpet in the loom would have a mixture shade ground (blue green and red) with the black features in blue green, the light grey in red, and the white in light brown. The design bases described have been shown to be rendered interesting in structure and varied in formation by the system of colour or shade interchange practised. Decorative weaves are distinct from ordinary weaves. They give more elaborate and ornamental bases of design. The weaves treated of in Figs. 85 and 86 are obviously usable in decorative pattern origination, but they are devised to yield, in their simple form, correctly-woven fabric structures. As a consequence they do not provide the same scope for the development of ornamental characteristics as "weave" designs, in which the production of a texture is secondary to the acquirement of decorative qualities. This description of weave plan may be diversified to any degree, if the base on which it is contrived should be symmetrically composed. It follows that, whereas the former weave types are restricted in design elements by the primary consideration of making a firm or sound texture, the latter styles, being independent of the production of the fabric, afford freer facilities for detail and general pattern embellishment.

Colour interchange or inter-mutation, that is, the formation of the integral features of the pattern in different shades as required, enhances the decorative value of this style of design as a whole. It has been pointed out in the exposition of the hand-tufted variety of pile carpets, that richness and diversity of pattern are mainly acquired by colour distribution; but, while in such carpets the

colour units may be inserted with a minimum amount of repetition, in the structures now being examined the comparative smallness of the dimensions of the design, and the uniform recurrence of elements which mechanical production imposes, limit the range of colour interchange as of colour application.

Yet, with the use of three or four shades, decorative weave bases may be elaborated. This may, in the first place, be demonstrated by taking a simple pattern devised on twenty

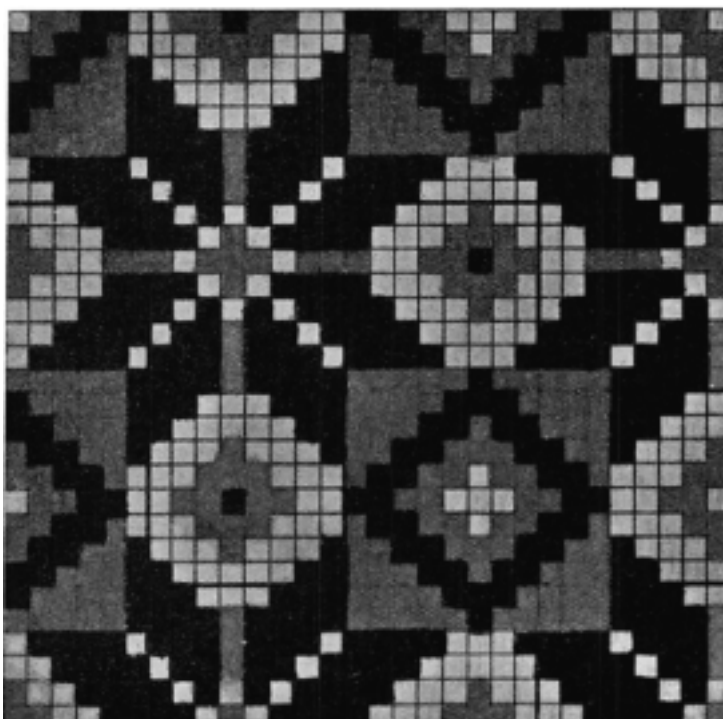


FIG. 92.

threads and picks (Fig. 92), which is not intended to form a firm scheme of interlacing for the purpose of giving a fabric structure, but to be suitable for utilisation as the base of a design weavable in the plans given in Figs. 74 and 75, and by regarding each thread and pick as equivalent to four and eight in the weaving of the carpet. Using three shades—black, grey and white—in the illustration, it will be observed that the relative positions of the colours in developing the style—Figs. 92 and 93—entirely change the character and form of the pattern. In Fig. 92 the cross and

diamond features are more distinctly brought out than in Fig. 93, with a more subdued tone of detail definition in the latter than in the former composition.

In the origination of the basic plans or design schemes, three factors are important, namely (1) a diversified system of interlacing; (2) a varied order and distribution of the pattern elements or features; and (3) effective contrasts in both the principles of interlacing and the decorative details combined. These

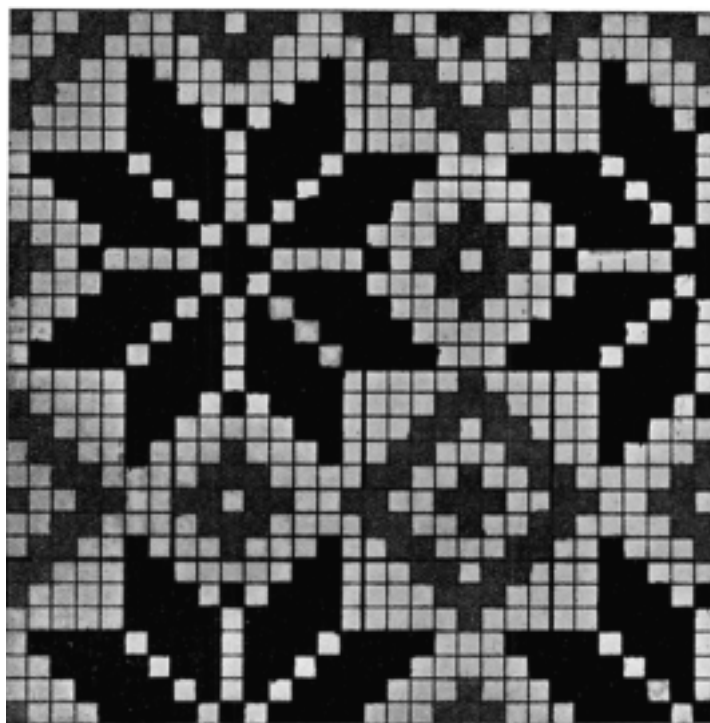


FIG. 93.

technicalities are distinguishable in small-scale patterns as in designs of a larger size. This is evident in the effect sketched in Fig. 94. The various features are less pronounced than in Fig. 92. The style exhibits, on account of the minute elements of which it consists, the value of diversifying the order and grouping of the interlacings in developing pattern style and emphasis. Enlarging the scale of the plan—Fig. 94A—and colouring the ground sections (white in Fig. 94) medium grey, the lozenge figure in black, and the lacing weave intersections in light grey, impart

to the design some of the qualities it would present in the carpet. But further duplication would cause the lines or bars and rectangular spaces to possess a still broader character, and result in more pronounced contrasts in the form and blending of the several types—interlacings and figure elements—of which the design base is composed.

With a larger scheme of construction, as in Fig. 95, there are other means of producing distinctiveness in the pattern characteristics and in the intersection types. Not only are the main spottings in this example clearly accentuated, but the diamond features are also varied in method of line development. Pro-

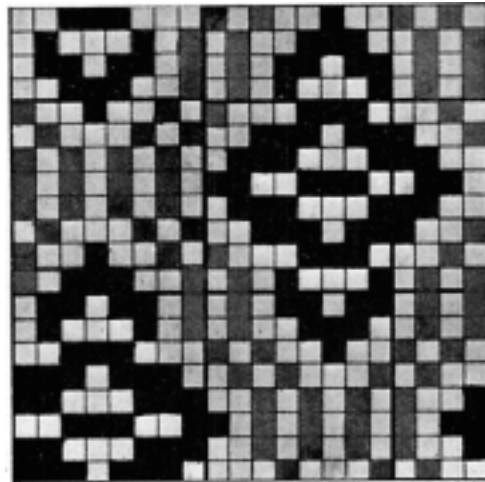


FIG. 94.

duction in colour makes these points more apparent. Though the diamond shape is used in sections A, B, C and D in the basic scheme, yet each type of effect is framed in special interlacing lines. The stronger forms are produced in A and B, those in A being more varied in detail. Either of these effects, when enlarged and woven in two shades on the system of the union carpet, makes an interesting decorative element; but, by reversing the colours combined, or employing the deeper or darker colour for the parts represented in light grey in A, and the lighter, or more subdued colour for corresponding parts in B, increased freshness of tone in both sections is obtained. Further, by treating the details in C and D on the same colour principle, the several features of the style are likewise additionally emphasised.

To accomplish this, four colours should be selected, two for the effects in A and B, two for those in C and D, weaving the line features E in a mixture shade of the lighter and darker lines of wefts. Should, however, only three colours be employed, as illustrated in Fig. 95, it is still feasible to acquire distinctiveness of tone in all the detail types in the pattern. Applying, for example, the darkest shade to the intersection or demarcation lines in C, D,

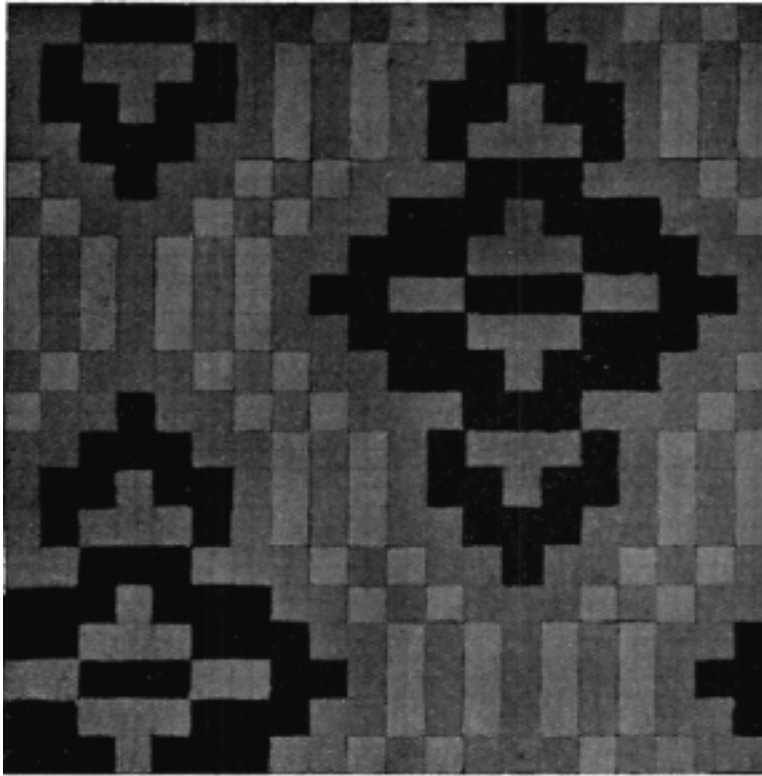


FIG. 94A.

and E, the second shade to the parts indicated in the sketch, and the third shade to the remaining portions of the design, renders these results practicable. The whole pattern, as thus formed, is singularly suggestive of the utility of line diversification—as a product of schemes of interlacing—when combined with suitable ornamentative types, in the acquirement of geometric styles varied in composition and schemes of colouring. Each intersection used in the sample should equal at least four threads in the carpet.

Decorative weaves, less diversified or complex in the plan of the intersections than those described, also constitute useful design bases. Two such examples are reproduced in Figs. 96 and 97. It will at once be noticed that, as compared with Figs. 94 and 95, they lack variety of detail, due to the use of a lesser number of intersection principles and the distinctive effects they

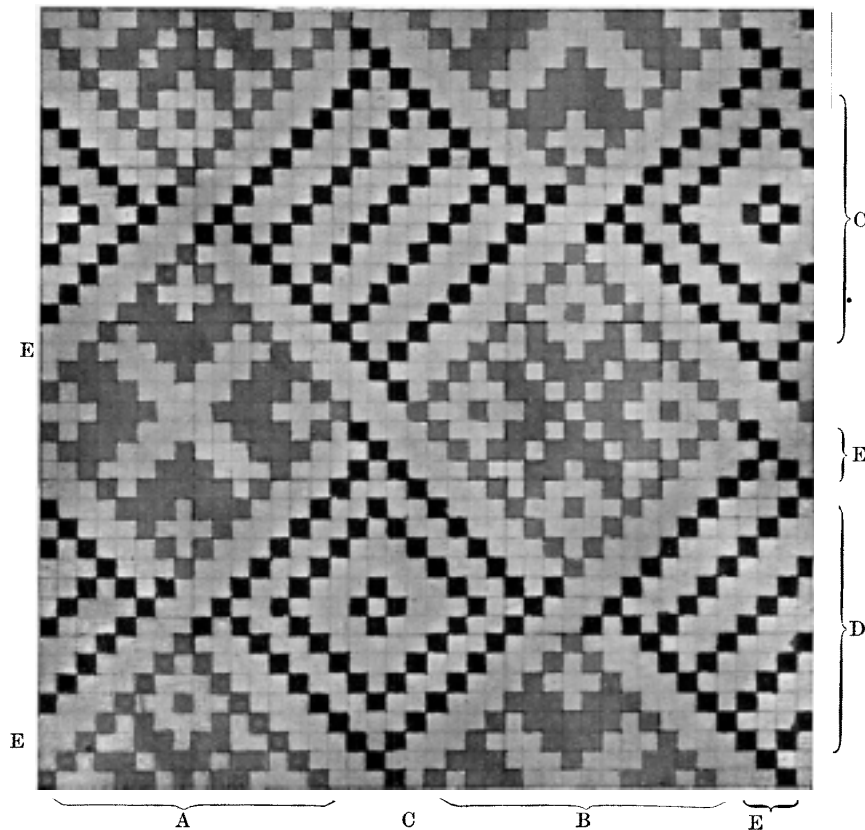


FIG. 95.

yield. But it will also be seen that each illustration forms a symmetrical and well-constructed design unit. As such, with a suitable scale of enlargement and methods of colour treatment, the bases may be developed into useful carpet patterns. One method of developing both examples—Figs. 96 and 97—consists in shuttling in three shades and using the three plans in Fig. 70A. The size of the patterns should be increased to give a repeat of 12 ins. square in a set of 18 ends and 54 picks per inch; or each

intersection in Figs. 96 and 97 would represent 8 threads and 24 picks in the loom-prepared or point-paper design.

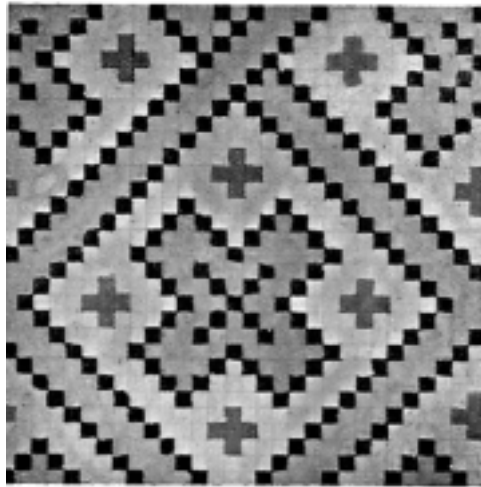


FIG. 96.

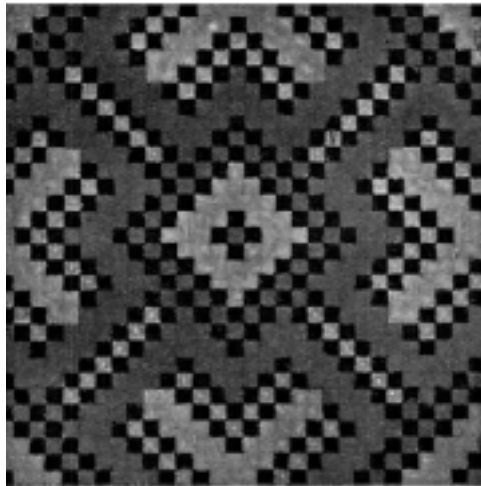


FIG. 97.

Striped compositions derived from weave and colour elements form an important group of pattern studies. Primarily they are specially adapted for stair carpets in which the centre, border and edges are composed of different yarn shades and decorative

details. To a limited extent they are also produced in carpets for other descriptions of floor covering.

They also admit, in two- and three-ply unions and all-wool yarn "Kidders," of the decorative forms being developed in parallel lines—Fig. 98—that is, the grouping of the sets of ornamental types in line-like relation. The design principles are based on the blending of straight lines in two or more colours of similar or dissimilar widths, as explained in regard to Fig. 71. For the production of the style in Fig. 98, it is only necessary to draw

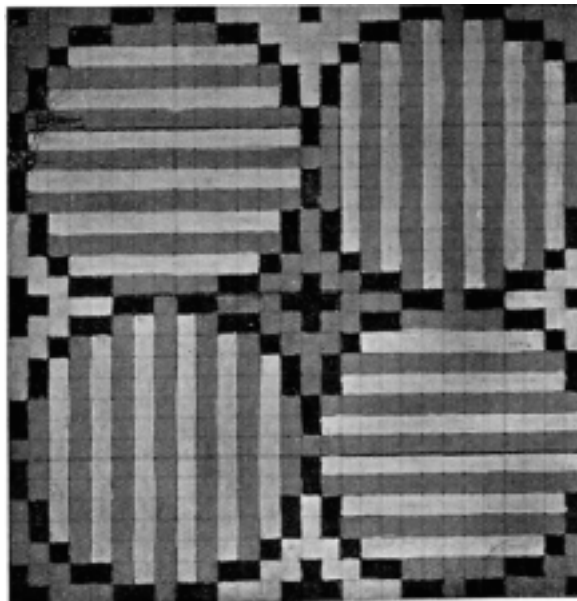


FIG. 98.

the design in colour on 4×12 point paper (scale 256 threads \times 768 picks), and apply weaves *d*, *e* and *f*, Fig. 70A, to the respective sections in light grey, medium grey and black, with each vertical line in the sketch corresponding to 8 threads, and each transverse line to 24 picks in the loom. This example shows that the lines may be diversified and grouped to accord with a given type of ornament. The lines are also variable in width and in system of grouping as required in the weaving of any particular form of striping.

Such stripings are suggestive of the elemental bases on which weave-compounds for design motives are arranged, inasmuch as they show how, in the first place, it is a problem of determining

the proportionate dimensions and geometrical plan of the different stripe units combined.

Having fixed these factors, the weave structures are selected and arranged to give the design base. Here, as in the styles of pattern analysed in which weave elements are, by a process of elaboration, employed as design principles, it is essentially a question of devising and constructing an effective compound of interlacing effects—that is, one in which the various weave units are distinctive in formation and yet in which structural harmony is a paramount feature. Contrast in the intersection details is an indispensable quality associated with the acquirement of a definite scheme of design. It is not so much the number of weave elements used—though these, when varied and interesting

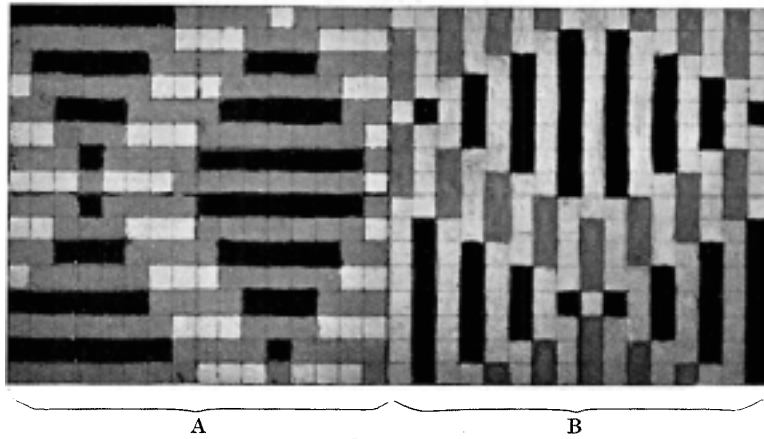
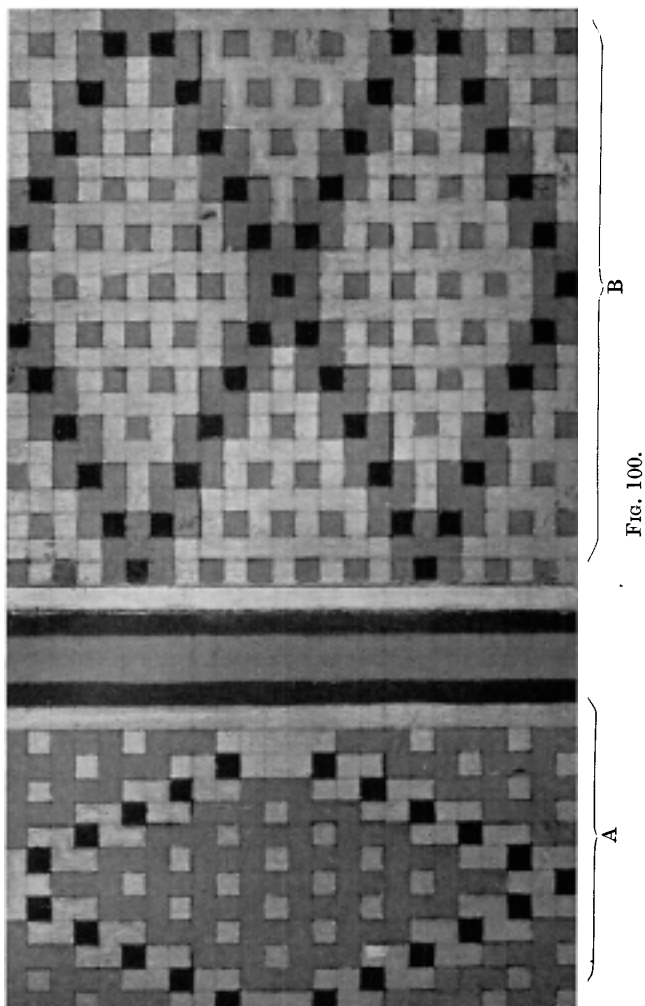


FIG. 99.

in structure, are valuable in giving richness of style—as the fitting into a decorative pattern form of characteristic schemes of interlacing.

The first practice consists in using one weave type. This practice is illustrated in Figs. 99, 100 and 101. By a process of inversion or of turning the basic plan round, and of combining the original with the revised weave, a striped style of pattern is the result. This method of work is followed in both Figs. 99 and 100. Sections A, in each design, constitute the fundamental scheme of intertexture applied. Clearly it must be of such a structure and character that, when inverted, it will give a new type of effect. Thus, in these examples the pattern features in parts A contrast with those in parts B. The former are intended as the border and the latter as the centre of the carpet. Elaboration, due to shade

or colour application, and enlargement to the requisite scale in working out the idea for the loom, would emphasise the technical details comprised. Transposing the relation of the shades in the weaving for the production of the effects in A and B is done to attain greater diversity of pattern composition. Interchanging



of the two plans from the centre to the border and *vice versa* is also feasible, and with satisfactory results in the carpet design. Solid lines of colour, varying in width, may be inserted between the styles, as shown in Fig. 100.

Another method of procedure is to select a simple twilled weave



FIG. 101.