and to use this in the construction of a definite form of figure. If this is intended to be applied on the principle described, that of inverting the pattern for the centre of the carpet, it should be of a geometric shape corresponding to the lozenge or rhomboid, or of a greater length than width. Fig. 101 is typical of a twilled plan thus elaborated. In this instance, the intersection scheme utilised in making the diamond figuring is entirely a consequence of the mathematical order practised in modifying the direction of the thirteen-shaft twilled base seen in Fig. 101A. Comparing the intersection groups in the two illustrations will make this apparent, for both consist of five weft, three warp, two weft, and three warp. Each intersection order represents a line of colour, and therefore determines the degree of emphasis the features it forms will possess in the full design developed in the carpet. The

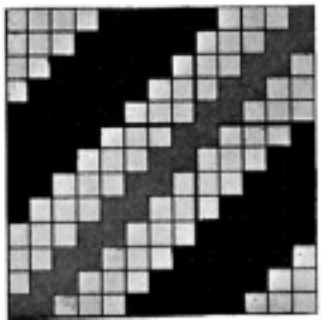


FIG. 101A.

FIG. 102.

weave structure, when thus understood, shows the relative accentuation, whatever the scale of enlargement followed in drawing out the design, of each species of effect it is employed in developing. Appreciating this practical principle, the twilled bases best adapted for this class of pattern construction are those in which the intersection schemes are well defined. If these should too closely resemble each other in dimensions, the derivative plan is likely to be monotonous in tone and character. No particular group of features will be sufficiently distinctive to give style, quality and definition. The intermingling of the shades in the weaving of the carpet caused by the frequent and uniform size of the interlacings in such weaves, is not only detrimental to, but destructive of, the development of the salient and characteristic elements in the design scheme.

To originate patterns on this basis some varied type of figure

is drafted in outline as in Fig. 102. The thicker lines in the sketch are then taken as the larger, and the finer lines as the smaller intersections in the twilled weave. On this system the draft plan for Fig. 101 was in the first instance prepared, and the twill in Fig. 101A next adapted to coincide with the diversified outlines in the figuring by moving the interlacings to the right and to the left in succession.

Judging from the character and appearance of Fig. 101 as prepared in two tones of grey and black, some idea may be formed of the changes production in colour would effect in developing the pattern to the requisite looming scale. Applying three shades such as light orange, medium red, and deep green, the methods of weaving in the carpet would comprise :—

(1) The construction of the black sections in the illustration in deep green, the grey sections in light orange, and the light grey sections in medium red.

(2) The black parts in light orange, the grey in deep green, and the light grey in medium red.

(3) The black sections in medium red, the grey in light orange, and the light grey in deep green.

Each system would accentuate different features of the patterns, making it feasible, if the designs were transposed in the border and centre of the carpet, to employ one of the three colour schemes in the former and a second scheme in the latter, and yet to limit the weft colouring to the use of three shades of yarn.

The analysis made of weave structures, as bases of decorative stripe and border designs for union carpets, has been so far restricted to forms of pattern built up on one type of weave or scheme of interlacing. Extending this system of pattern construction to the grouping together of two or several textural units in producing a " motive " suggests another class of designing, and one which is, by reason of the simple elements of which it is framed as by the diversity of ornamental details it affords, specially adapted to the " Kidder " and union grade of carpet manufactures.

The salient features and structural characteristics of the " compound-weave " variety of pattern will now be considered. All varieties of " motive " or design type obtainable on this base are the result of combining, in parallel relation, distinctive weave units on the systems illustrated in Figs. 103 and 104. The first of these specimens is a composition of the textural elements of the three plans seen in sections A, B and C. As outlined in black—defining the weave effects comprised—the pattern appears

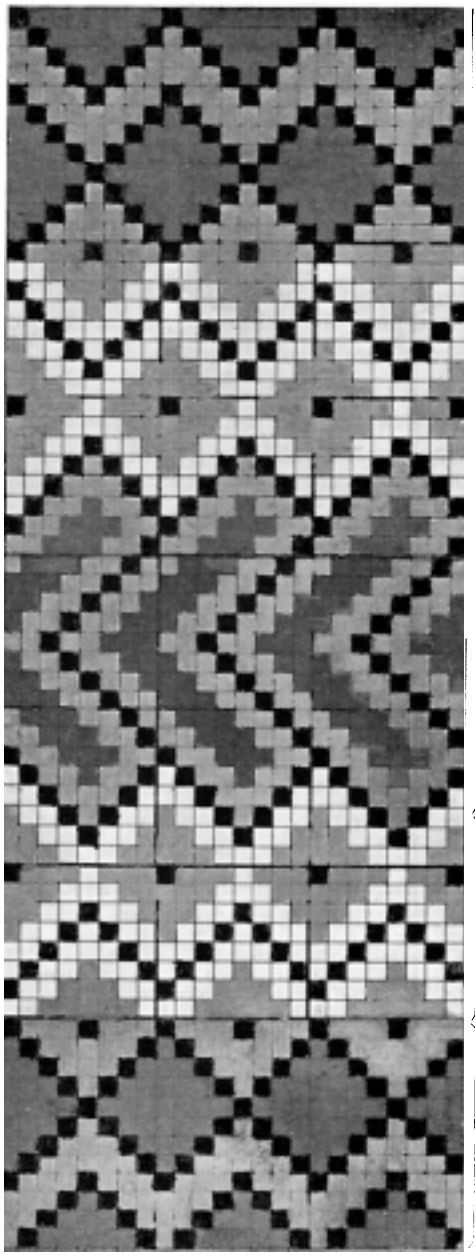


FIG. 103.

somewhat deficient in tone and in detail features; but the method of arranging the elements in striped order, combined with the scheme of shade application practised, converts the design structure into an interesting style of decoration.

To develop this example satisfactorily in the loom, four tones of colour are needed. Inter-changing these produces the diamond figures in sections A and B in dark grey and light grey, and the wave lines in B in white, with those in the centre of the triangular forms in C in light grey. A modification which further elaborates the last section consists in weaving the ground in each successive figure in black, grey and white, and the angled twill feature forming the central part of the figuring in the respective stripings, in white, black and grey. An important branch of the art of developing this type of pattern is that of planning the system of shade sequence—a practice offering scope in transferring the designs to the carpet production. By colour differentiation each technicality in the compound weave motive should be so accentuated that the minute form details, due to the various intersection plans, are distinctly developed in the fabric.

It will be observed that the weave principles combined in this example—Fig. 103—are not particularly diversified in character. They are, however, so arranged and distributed in sections A, B and C as to yield four varieties of geometrical form, namely, diamond spotting, longitudinal and transverse wave lines, and the triangular-shaped patterns in part C. The effective blending of these motives in striped formation is a principal cause of the design qualities acquired. The example is illustrative of the fundamental points to be observed in the origination and construction of this variety of pattern, namely, (1) the value of arranging the intersections in the weave units to produce definite or precise figure types; (2) the influence of detail contrasts in the plans combined; (3) the proportionate relation the respective units should bear to each other; and (4) the utility of colour principles in developing design elements and style in such schemes of pattern arrangement.

In comparison with this example, Fig. 104 may be examined. It contains two schemes of interlacing, that in section A giving rhomboid shapes transposed, and that in section B derived from a modified warp cord. Taking the former as the motive for the centre, and the latter as the motive for the border design of the carpet, each plan would be duplicated to the correct scale, that is, one intersection representing a group of 4 or 8 threads on the

point paper and developing in the weaves in Fig. 70. Enlargement emphasises the detail characteristics, and also the difference in the style features of the two sections of the pattern. Whereas, in Fig. 103, the weave types are not, as explained, specially dis-

Fig. 104.

tinctive in arrangement, in this instance they are in strong contrast, having no common base of construction. Still, the two species of effect produce harmony of style composition as combined and tinted. This quality is ensured by the scheme of colouring used in the expression of the different interlacing

features. Unless the tones and tints applied thus link the several motives together, when the basic weave structures are so dissimilar in character, the resultant designs in the carpet are liable to appear incongruous in style. Applying, however, the shades judiciously in the production of each weave type, so that the qualities of

TABLE XV.—EXTENSION AND COLOURING OF DECORATIVE AND COMPOUND-WEAVE BASE OF DESIGN

Fig. Nos.	Structural Scheme.	Scale of Enlargement.	Weft Colouring.
92. Types printed in tinted grey. ,, ,, ,, grey. ,, ,, ,, black.	*Two-ply :* Weave *c*, Fig. 70. ,, *b*, ,, ,, *a*, ,,	Each intersection in Fig. 92 equals 12 threads and 24 picks.	1 shot of shade 1 1 ,, ,, 2
93. Types printed in tinted grey. ,, ,, ,, grey. ,, ,, ,, black.	*Two-ply :* Weave *a*, Fig. 70. ,, *c*, ,, ,, *b*, ,,	Each intersection in Fig. 93 equals 8 threads and 16 picks.	1 shot of shade 1 1 ,, ,, 2
94A. Types printed in tinted grey. ,, ,, ,, grey. ,, ,, ,, black.	*Three-ply :* Weave *d*, Fig. 70A. ,, *e*, ,, ,, *f*, ,,	Each intersection in Fig. 94A equals 8 threads and 24 picks.	1 shot of shade 1 1 ,, ,, 2 1 ,, ,, 3
95. As Fig. 93.	As Fig. 70.	As Fig. 93.	As Fig. 93.
96. As Fig. 94A.	As Fig. 70A.	As Fig. 94A.	As Fig. 94A.
97. Types printed in tinted grey. ,, ,, ,, grey. ,, ,, ,, black.	*Three-ply :* Weave *d*, Fig. 70A. ,, *e*, ,, ,, *f*, ,,	Each intersection in Fig. 97 equals 8 threads and 24 picks.	1 shot of shade 1 1 ,, ,, 2 1 ,, ,, 3 1 ,, ,, 4 1 ,, ,, 2 1 ,, ,, 3
99. Types printed in tinted grey. ,, ,, ,, grey. ,, ,, ,, black.	*Three-ply :* Weave *d*, Fig. 70A. ,, *e*, ,, ,, *f*, ,,	Each intersection in Fig. 99 equals 16 threads and 48 picks.	1 shot of shade 1 1 ,, ,, 2 1 ,, ,, 3
100. Types printed in tinted grey. ,, ,, ,, grey. ,, ,, ,, black.	*Three-ply :* Weave *d*, Fig. 70A. ,, *e*, ,, ,, *f*, ,,	Each intersection in Fig. 100 equals 8 threads and 24 picks.	As in Fig. 99.
103. Types printed in white. ,, ,, ,, tinted grey. ,, ,, ,, grey. ,, ,, ,, black.	*Three-ply :* Weave *d*, Fig. 70A. ,, *e*, ,, ,, *g*, ,, 74. ,, *f*, ,, 70A. *Two-ply :*	Each intersection in Fig. 103 equals 8 threads and 24 picks.	1 shot of shade 1 1 ,, ,, 2 1 ,, ,, 3
104. Types printed in tinted grey. ,, ,, ,, grey. ,, ,, ,, black.	Weave *a*, Fig. 70. ,, *c*, ,, ,, *b*, ,,	Each intersection in Fig. 104 equals 8 threads and 16 picks.	1 shot of shade 1 1 ,, ,, 2
104. Types printed in tinted grey. ,, ,, ,, grey. ,, ,, ,, black.	*Three-ply :* Weave *d*, Fig. 70A. ,, *e*, ,, ,, *f*, ,,	Each intersection in Fig. 104 equals 8 threads and 24 picks.	1 shot of shade 1 1 ,, ,, 2 1 ,, ,, 3

two motives prove complementary to one another, enhances the structural units in the formation of a well-balanced design.

Here, as in the preceding illustration, the black intersections in part A, and the black and grey in part B, show the weave principles utilised. As a rule, such intersection marks should correspond with the features in the pattern woven in the more pronounced tones of colour, because they determine and delineate

the design scheme. Changing the positions of the shades in such a manner that the effects printed in black would be woven in the light tint, and those in light grey woven in the dark tone, would completely alter the appearance, but not the technical and characteristic plan of the design.

In suggestion of the methods of transferring a number of the examples described, of designs formulated on a decorative or

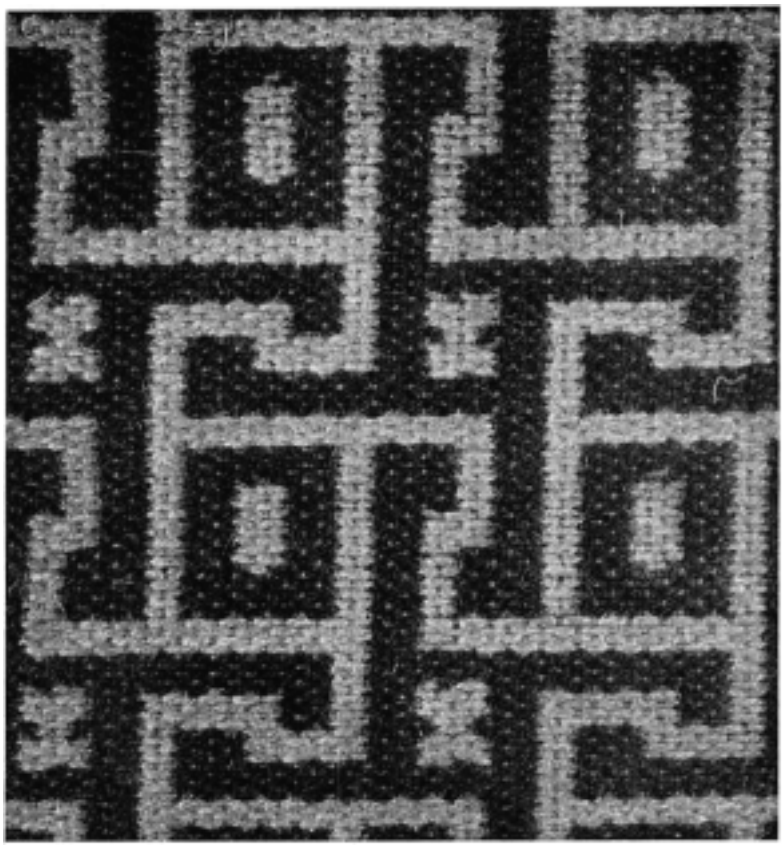


FIG. 105.

compound-weave base, technical data for this purpose are supplied in Table XV on p. 206.

The order of weft colouring supplied for Fig. 97 is applicable to each example consisting of three-ply weaves. It produces in this instance the tinted grey sections of the design in two shades —1 and 4—which should, as a rule, be of the same hue, but differentiated in tone depth. The scale of the point-paper pattern is of course governed by the capacity of the harness looms employed,

but it is preferable that a scale should be selected which allows of complete and not fractional repeats of the weave units being combined.

Several of the examples are adapted for either two- or three-ply manufactures, as shown in the two sets of particulars tabulated for Fig. 104. The two-ply structure develops two of the design features in solid shades and the third type of figuring in a mixture

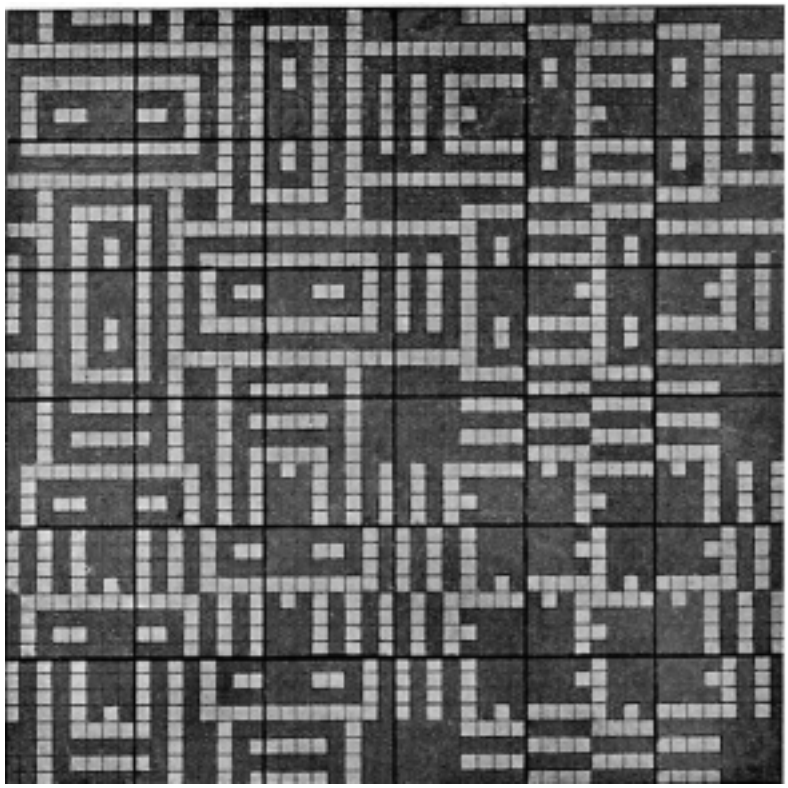


FIG. 106.

shade. The distinction between the two systems of construction, as applied to Fig. 104, is that in the two-ply arrangement the tinted grey details would be woven in shade 1, the black details in shade 2, and the grey details in shades 1 and 2 intermingled, whereas in the three-ply arrangement each class of detail would be woven in a different shade of yarn.

The geometric design base is partially illustrated in certain of the decorative weave motives of design examined, but it also

includes other and more ornamental forms of design, such as that shown in Figs. 97 and 77. Freely sketched ornamental forms are used as in the design examples in Figs. 105 and 106. The former —the "Romsley" carpet—is based on the "key" type of figuring, and the latter on the grouping of rectangular forms in outline and in solid shades. The weaves for the "Romsley," which are also applicable to Fig. 106, when drafted to the carpet scale, are shown in Fig. 106A. They are two-ply weft plans, the binding threads, marked in x's, stitching in regular order with the two shades of weft, s^1 and s^2. In weaving 1 shot of black and 1 shot of grey yarn, section A of the plan would be produced in black and section B in grey, so that the work of designing consists in drawing the pattern to the required size on the ruled paper in colour, when, in card stamping, one of the weaves is applied to the figuring and the other weave to the ground. The intersection

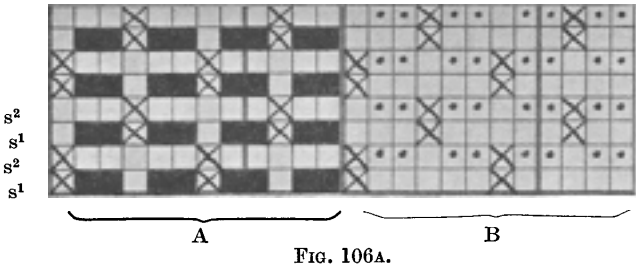


FIG. 106A.

units in Fig. 106, in transferring it on to the looming paper, should be taken as even multiples of plans A and B in Fig. 106A. This example is illustrative of the system practised in devising certain geometrical forms and of placing them at right angles one with the other, and, for the purpose of imparting structural tone and character to the whole pattern scheme, of combining these with other forms developed in black.

Plant and floral forms, unless severely conventionalised in treatment, are not particularly in keeping with patternwork for these structures. The types of weaves and yarns employed, as well as the fabric build, are of such a character as to render the carpets unsuitable for delicate and intricate styles of design. The studies in Figs. 56 and 57 (Chap. IV) illustrate the curvilinear forms combinable, as the example in Fig. 69, an eight-end sateen plan of figure arrangement, suggests the variety of form composition developable in three shades of yarn. The decorative features in Fig. 49 are based on plant forms and those in Fig. 91

on floral forms; but in each design the natural details are so freely varied as to result in species of ornament weavable in cotton-warp and woollen-weft carpets.

The border style of the art square in Fig. 68 is fashioned on leaf structures and the centre figuring on a mathematical base;

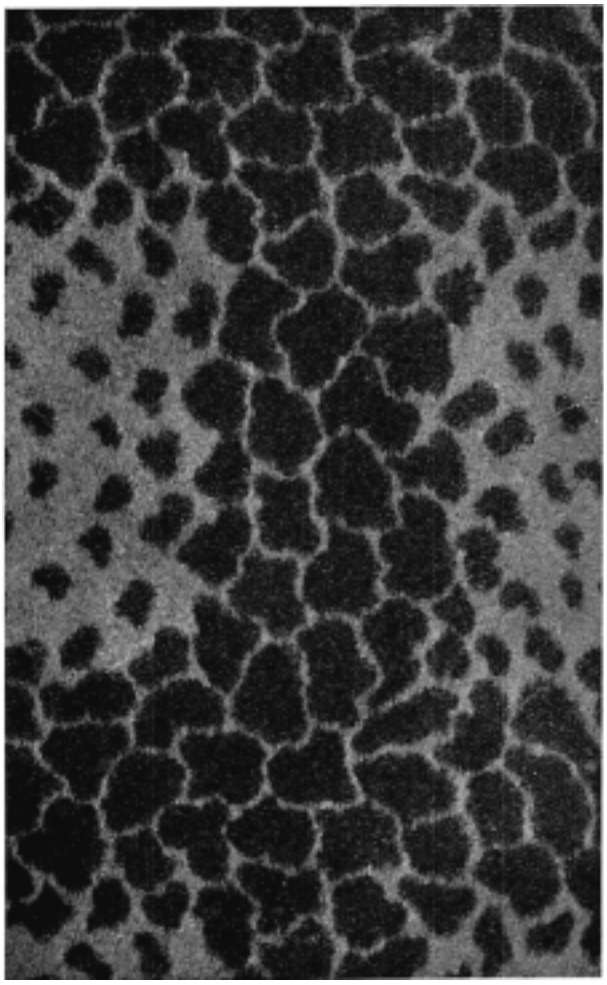


Fig. 107.

while the border and centre of the carpet in Fig. 65 are respectively composed of figured types derived from plant details. These, and the preceding examples, indicate the paramount idea in the origination of ornament of a geometric or plant variety adapted to this grade of carpeting, namely, the acquirement of designs simple and compact in structure, flat in surface tone, but

distinctive in character and in plan of figure arrangement and grouping.

Irregular styles of woven design are also applied to both woollen and union " Kidder " manufactures. Not presenting involved technicalities in the looming, the carpets comprise principles of textural work peculiarly fitted for the production of design structures in which suggestive rather than realistic ornament is intended. The example in Fig. 107 is typical of the nondescript character of this class of pattern. Figures of different shapes and dimensions are used in an apparently confused order, though strictly such figures are grouped together in a prescribed relation and on a fixed system.

The woven style, as illustrated, is not broad enough in effect. By employing thicker yarns and a more open carpet setting, obtaining a pattern of 20 in. to 24 in. in width, the correct quality of detail development would be acquired. The different forms are blended with each other to produce a rectangular type of design. Other geometric bases are also utilised, including the rhomboidal, the cuniform, the octagonal and the spherical. Ordinarily the patterns consist of decorative elements adapted for being inverted in shade or colour on the respective sides of the carpet.

CHAPTER VI

CARPETS WEAVABLE IN TAPPET AND DOBBIE LOOMS

Carpet Production in Heald-Shaft Mountings—Pattern and Fabric Characteristics—Solid-Colour Carpets—Methods of Looming—Constructive Principles—Wadded Weave Units—Bi-fibred Yarn and Woollen Yarn Structures—Striping in Weave and Colour—Drafted Stripes—Detail Styles—Designing—Examples in Straight Healding—Point and Double-Point Drafts—Pick Grouping in Looming Plans—Point-Draft Patterns—Converting Motive Plan into Compound Design—Extension of Healding Draft—Application of Single Design Types to Centre and Border by Shuttling Practice—"Whitley" Carpet Structure—Jute Manufactures—Angle and Herring-bone Patterns—Diaper, Diamond and Lozenge Effects—Colour Striping—Dutch Printed Carpets.

THE different structures of "union" and "Kidder" or plain-surface carpets, with the various modifications to which they are subjective in practice, have been described in detail. In treating of woven-felted manufactures examples were given in drafted styles of pattern; but no explanatory reference has yet been made to the forms of design obtainable in "Kidder" and similar builds of fabric other than those produced in Jacquard or harness mountings, though it will be understood that pattern schemes, adapted to shaft-shedding mechanism, and applicable to carpets, may, as in ordinary types of woven textures, be made in tappet and dobbie looms. Union carpets, especially in the simpler forms of design, are technically suited for construction by heddle weaving. That this has not hitherto been more extensively done is due to the fact that distinctly figured patterns have been considered as the styles of textile ornament desired. If the border of the carpet were plain in character, the centre was figured, or both sections of the carpet as in Figs. 65 and 67, were alike decoratively treated. With an educated appreciation of pattern style consisting of small effects, and weavable in heald shafts, this view is changing, and a new class of carpet surface decoration is being evolved. There are many varieties of patternwork, appropriate in colour scheme and in design composition to "unions" and "Kidders," producible in dobbie mountings, as, for example, the geometric types of

ornament derived from weave bases, and the more diversified styles of pattern which may be acquired by drafting.

In addition, the carpet fabric is structurally varied so that carpets differing in quality and thickness are woven in tappet looms in solid shades or in " reversibles " (also " tapestries " —cut and uncut pile—treated of in Chapter VII), and other makes more complex in plan of interlacing, in dobbie looms. These are constructed in such weaves as those given at *a*, Figs. 41, 42

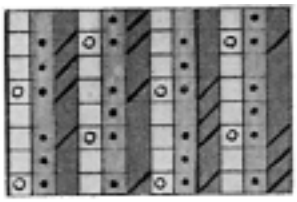


FIG. 108A.

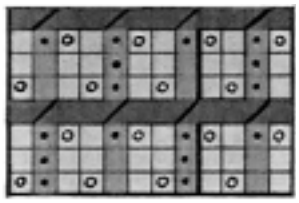


FIG. 108B.

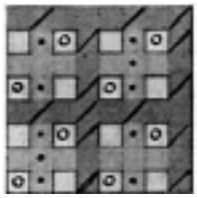


FIG. 108C.

and 43, at *a* and *b*, Fig. 44 and at Fig. 108, A, B, C. Plain manufactures of this category include—

(1) Carpets two-ply in the weft.
(2) ,, three-ply ,, ,,
(3) ,, two-ply in both warp and weft.
(4) ,, three-ply ,, ,, ,,
(5) Two-ply in structure and wadded in the warp, weft, or in both warp and weft.

The methods of looming followed are modified in yarn counts and quality and in setting with the grade of carpeting intended and its application; economy in cost is a governing factor, but thickness of fabric is also a primary consideration. Such carpets are used for borders, corridors and similar purposes, and require to be of a structure and yarn composition in keeping with the kind of decorative carpet to which they are applied. The systems of weaving appended are suggestive of the orders of warping and wefting practised in the weaves specified, but are variable with the weight of the carpet per square yard and the

materials of which it is woven, all-wool, cotton and wool, and admixtures of wool, hair, and other fibres.

TABLE XVI.—PLAIN-COLOURED CARPETS: CONSTRUCTIVE PRACTICES

I.—TWO-PLY IN THE WEFT

A.—*Warp.* Weave *a*, Fig. 70

2 fold 10's cotton.

A.—*Weft*

1 shot of 2½ skeins woollen or bi-fibred yarn, shade 1.
1 ,, ,, ,, ,, ,, shade 2.
or all one shade of shuttling yarn.
24 threads and 24–28 shots per inch.

A¹.—*Warp.* Weave *c*, Fig. 70

As above.

A¹.—*Weft.*

2 shots of 3½ skeins woollen or bi-fibred yarn, shade 1.
2 ,, ,, ,, ,, ,, shade 2.
or all one shade of shuttling yarn.
24 threads and 32–36 shots per inch.

II.—THREE-PLY IN THE WEFT

B.—*Warp.* Weave *d*, Fig. 70A.

As above.

B.—*Weft.*

1 shot of 3 skeins woollen or bi-fibred yarn, shade 1.
1 ,, ,, thick cotton (centre).
1 ,, ,, 3 skeins woollen or bi-fibred yarn, shade 2.
or all one shade of shuttling yarn.
18 threads and 36–40 shots per inch.

III.—TWO-PLY IN BOTH WARP AND WEFT

C.—*Warp.* Weave A, Fig. 44

1 thread of 2 fold 3½ skeins woollen or bi-fibred yarn, shade 1.
1 ,, ,, ,, ,, ,, ,, shade 2.
or all one shade of yarn.

C.—*Weft*

Same as warp.
12 threads and shots per inch.

C¹.—*Warp.* Weave B, Fig. 44

1 thread of 2 fold 5 skeins woollen or bi-fibred yarn, shade 1.
1 ,, ,, 2 fold 2½ ,, ,, ,, ,, shade 2.
1 ,, ,, 2 fold 5 ,, ,, ,, ,, shade 1.
or all one shade of yarn.

C′.—*Weft.*

Same as warp.
16 threads and shots per inch.

IV.—TWO-PLY IN BOTH WARP AND WEFT, WITH CENTRE WARP

D.—*Warp.* Weave, Fig. 108A

1 thread of 2 fold 3 skeins woollen or bi-fibred yarn, shade 1.
1 ,, ,, 2 fold 1½ ,, ,, ,, ,, shade 2.
1 ,, ,, thick cotton (centre).

D.—*Weft*

1 shot of 2 fold 3 skeins woollen or bi-fibred yarn, shade 1.
1 ,, ,, ,, ,, ,, ,, shade 2.
or all one shade of yarn in warp and weft.
15 threads and 10–12 shots per inch.

V.—Two-Ply in the Warp and Weft, with Centre Weft

E.—*Warp.* Weave, Fig. 108B

1 thread of 2 fold 5 skeins woollen or bi-fibred yarn, shade 1.
1 „ „ 2½ skeins „ „ „ „ shade 2.
1 „ „ 2 fold 5 skeins „ „ „ „ shade 1.

E.—*Weft*

1 shot of 3 skeins woollen or bi-fibred yarn, shade 1.
1 „ „ 2½ „ „ „ „ shade 2.
1 „ „ 3 „ „ „ „ shade 1.
1 „ „ thick cotton (centre).
or all one shade of yarn in warp and weft.
16 threads and 20 shots per inch.

VI.—Two-Ply in Warp and Weft, with Centre Warp and Weft

F.—*Warp.* Weave, Fig. 108C

1 thread of 2 fold 3 skeins woollen or bi-fibred yarn, shade 1.
1 „ „ „ 1½ „ „ „ „ shade 2.
1 „ „ „ 3 „ „ „ „ shade 1.
1 „ „ thick cotton (centre).
or all one shade of yarn.

E.—*Weft*

Same as warp.
15 threads and shots per inch.

The weave structures here quoted with the exception of those in Figs. 108 A, B, C, have been examined. The dark grey lines in A represent centre warp threads, in B centre picks of weft, and in C centre threads and picks. Plan A is arranged in the *warp* 1 thread face, 1 thread backing, and 1 thread of centre yarn; and, in the *weft*, 1 shot face and 1 shot of backing yarn; plan B 1 thread face, 1 thread backing, and 1 thread face in the *warp*, and 1 shot face, 1 shot backing, 1 shot face, and 1 shot centre in the *weft*; and plan C 1 thread face, 1 thread backing, 1 thread face, and 1 thread centre in both *warp* and *weft*. Other methods of applying the centre yarns are feasible, such, for example, as six threads and picks of the double-plain weave to one thread or shot of centre warp or weft in plans A and B, and larger multiples of threads and picks of double-plain with one or two threads and shots of centre yarn than in plan C. Each of these three weaves results in a carpet of a plain-woven character, but in examples I and II in Table XVI, and also in plan A, Fig. 44, and in the three-ply make in Fig. 109, the carpets have a weft-formed surface. The last plan is used in

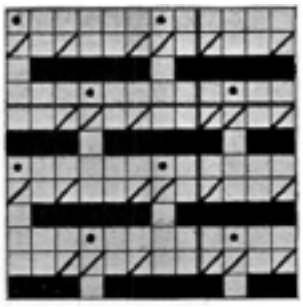


Fig. 109.

the manufacture of the " Boudoir " carpet of which a specimen is reproduced in Fig. 109A. It is wefted 1 shot of 2-fold 5's crossbred worsted yarn, 1 shot of 8 skeins bi-fibred yarn or the equivalent

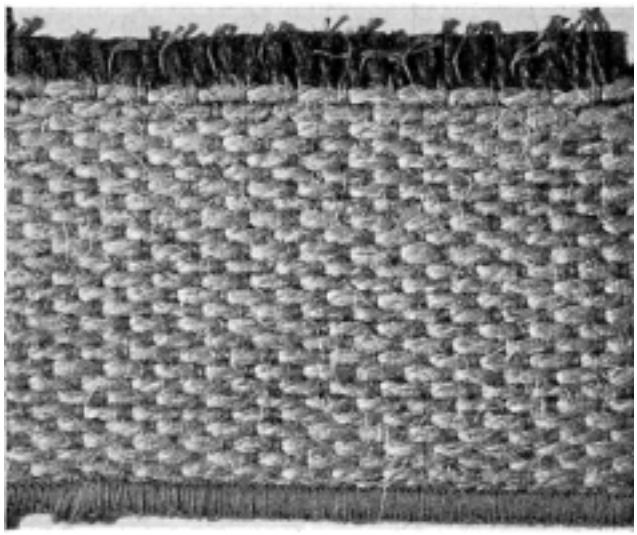


FIG. 109A.

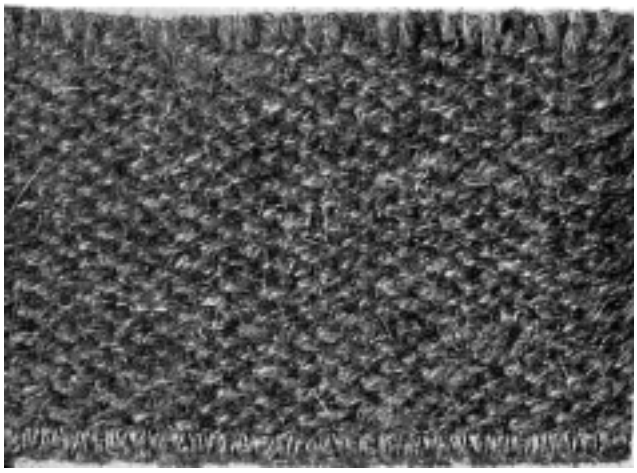


FIG. 109B.

counts in cotton, and 1 shot of 2-fold 5's worsted. The warp of the fabric is arranged 1 thread of 2-fold 30's cotton (binder), 1 thread of thick cotton (wadding) and 1 thread of binder, with 18 to 20

threads and 24 picks per inch. This carpet is one of the firmest and heaviest produced. Thick all-wool or bi-fibred yarn fabrics of the class shown in Fig. 109B are woven in single weaves, *e. g.* the 2-and-2 twill cutting in 2 picks in the weft. For these manufactures strong-fibred wools (coarse Cheviot quality) are selected and close weaving is practised, using such yarns as 2-fold 4 skeins for warp and 2-fold 10 skeins for weft with 9 to 11 threads and 12 to 15 picks per inch.

The reversible weave types are employed, as shown in Table XVI, in producing carpeting in solid shades or differently coloured on the two sides. They are, in addition, combined in making striped, checked and border patterns of the class illustrated in Figs. 45, 46 and 47. It is a problem of grouping the weaves after a given scheme of design, and of shuttling, in the multi-ply weft structures, in accordance with the type of weaves selected, and, in the double weaves, of colouring in both warp and weft on the systems applicable to " Kidders." Assuming the weaves *a*, *b* and *c*, Fig. 70, and *d*, *e* and *f*, Fig. 70A, to be arranged in stripe order, they would, when wefted pick-and-pick in two shades in the former, and in three shades shuttled one, one and one in the latter, give the subjoined line patterns :

(1) *Weft :* 1 shot brown, 1 shot green

A stripe of	24	or other number of threads of weave				*a*,	Fig. 70	= Brown surface and blue back.
„	48	„	„	„	„	*b*,	„	= Blue surface and brown back.
„	24	„	„	„	„	*a*,	„	= Brown surface and blue back.
„	48	„	„	„	„	*c*,	„	= Intermingled shade, brown and blue, on both sides.

(2) *Weft :* 1 shot olive, 1 shot green, 1 shot dark blue.

A stripe of	32	or other number of threads of Weave				*d*,	Fig. 70A	= Olive surface and blue back.
„	64	„	„	„	„	*e*,	„	= Green surface and olive back.
„	24	„	„	„	„	*f*,	„	= Blue surface and green back.
„	64	„	„	„	„	*e*,	„	= Green surface and olive back.
„	24	„	„	„	„	*f*,	„	= Blue surface and green back.

The dimensions of the several lines are variable to any degree, as also the methods of line grouping. All such striped patterns, being obtained by combining three four-shaft weaves, are producible in twelve heald shafts. For the two stripings named, the healding practice would consist in (1) drawing threads 1 to 24 on shafts 1, 2, 3 and 4, threads 25 to 72 on shafts 5, 6, 7 and 8, threads 73 to 96 on shafts 1, 2, 3 and 4, and threads 97 to 144 on shafts 9, 10, 11 and 12; and in (2) drawing threads 1 to 32 on shafts 1 to 4, threads 33 to 96 on shafts 5 to 8, threads 97 to 120 on shafts 9 to 12, threads 121 to 184 on shafts 5 to 8, and threads 185 to 208 on shafts 9 to 12. The looming plan for striping (1) would be composed of 4 threads of weave *a*, 4 of weave *b*, and 4 threads of weave *c*, Fig. 70, and that for striping (2) of 4 threads of weave *d*, 4 of weave *e* and 4 threads of weave *f*, Fig. 70A.

In acquiring detail decorative patterns three designing practices may be adopted. First, the practice in which the patterns are weavable in straight-drafted warps and producible in 24 or 32 heddle mountings; second, the practice of constructing the designs on the diamond base by healding the warp either "single-" or "double-point"; and third, the practice of elaborating a simple form of effect by enlarging the proportions of its integral parts—as illustrated in reference to Figs. 91, 92 and 93—and the practice of drafting designs on standard types of weave structures.

The first practice comprises the origination of the smaller varieties of style, which are more or less mingled in pattern definition and in decorative detail. Two examples are supplied in Figs. 110 and 111. Both are constructed with the idea of being woven, as in the figured unions, in two colours, but of producing a carpet in three shade tones. Thus in pick-and-pick wefting, such as 1 shot dark red and 1 shot dark green, the features in white in the designs, as now understood, would be red on one side and green on the reverse side of the carpet; the sections in light grey in dark green on the upper and red on the under surface; and the sections in dark grey in the illustrations, in red and green intermingled on both sides of the structure. Each example is weavable in a 32-shaft loom. Fig. 110 forms a diagonal or fancy-twilled pattern, and Fig. 111 a zigzag-shaped figure, developed in the mixed colouring, with the ground decorated with small diamond and rectangular spots alternating with each other.

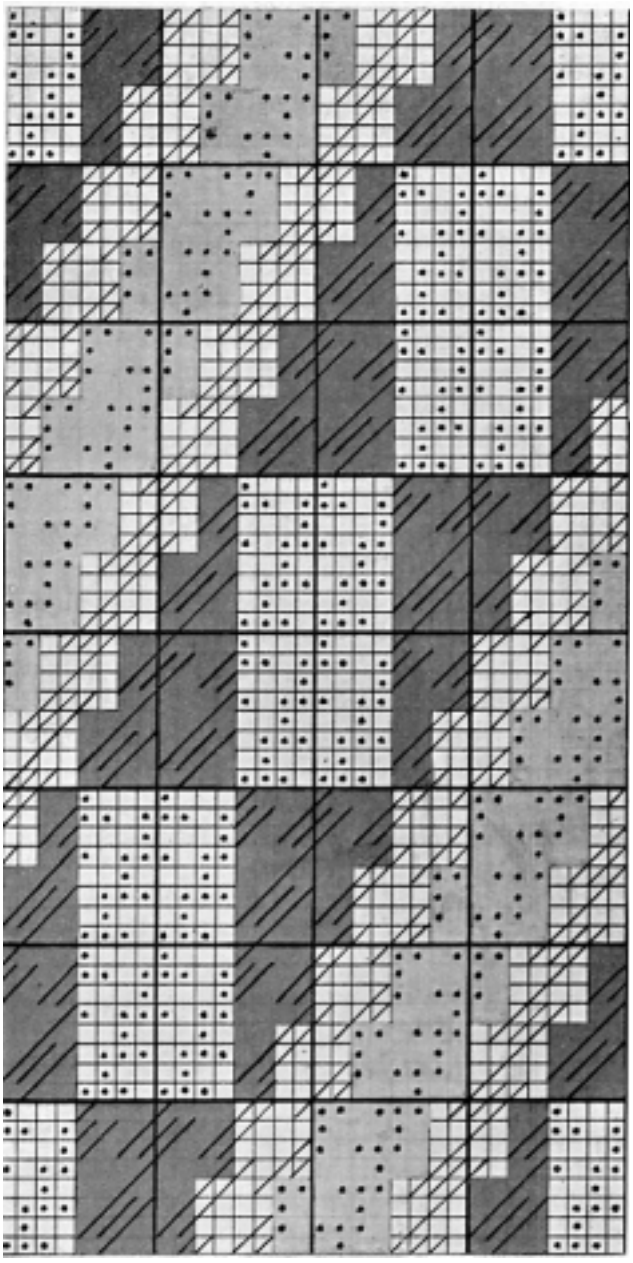


FIG. 110.

In designs of this class, composed of detail effects, and with one series of these produced in the carpet in a mixture shade of the two colours of weft yarn applied, it is advantageous, unless the figured units preponderate, to select the ground for the mixed tinting, weaving other elements of the pattern in the solid shades. This practice links the different effects together in the formation of an evenly-balanced design. It is also feasible to have each species of detail woven in a distinct shade by combining the three-ply weave structures illustrated in Figs. 70A; but, considering the few threads and picks which it is possible to employ for the several sections of patterns weavable in 32 or 36 shafts, it is, as a rule, preferable to use two- rather than three-ply plans in their development.

The construction of designs of this order is a question of working out a regularly repeating compound of effects, moving in multiples of at least two threads and four picks. Such multiples may be extended and varied, but not diminished in any particular part of the pattern. Thus, the light-grey twilled sections—Fig. 110—observe a constant two-thread and four-pick displacement; but, in the dark grey sections the picks move in 4's or 16's; while the interchange in the oblong sections, in white, observe " moves " of eight threads in the warp and sixteen picks in the weft. Similar sets of variations in weave interchanging are noticed in Fig. 111, the dark grey spaces comprising ten threads and twenty picks, but all other details moving in 2's in the warp and in groups of 4, 8, 12, 16, and 20 picks in the weft, according to the pattern scheme. In practice accuracy of style origination is ensured by devising a basic plan in the ordinary way, that is, by combining single and multiple intersections. The warp " move " selected for the enlarged design determines the dimensions of the plan. Taking twenty-four shafts as the working number, structural plans on six or twelve threads are suitable, with thread moves, in the extended design, of four or two; or, in a 32-shaft mounting, the basic units may be on eight or sixteen ends, with corresponding intersection " moves " in the warp. The displacements in the picks may, however, be indefinitely enlarged, but in multiples of two, providing they are to fit with the warp and weft setting of the carpet. Taking the setting to be twenty-four threads to forty-eight picks, or twenty-four threads to thirty-six picks per inch, then, if the design is to be symmetrically woven, the " moves " in the warp in the former are doubled in the weft;

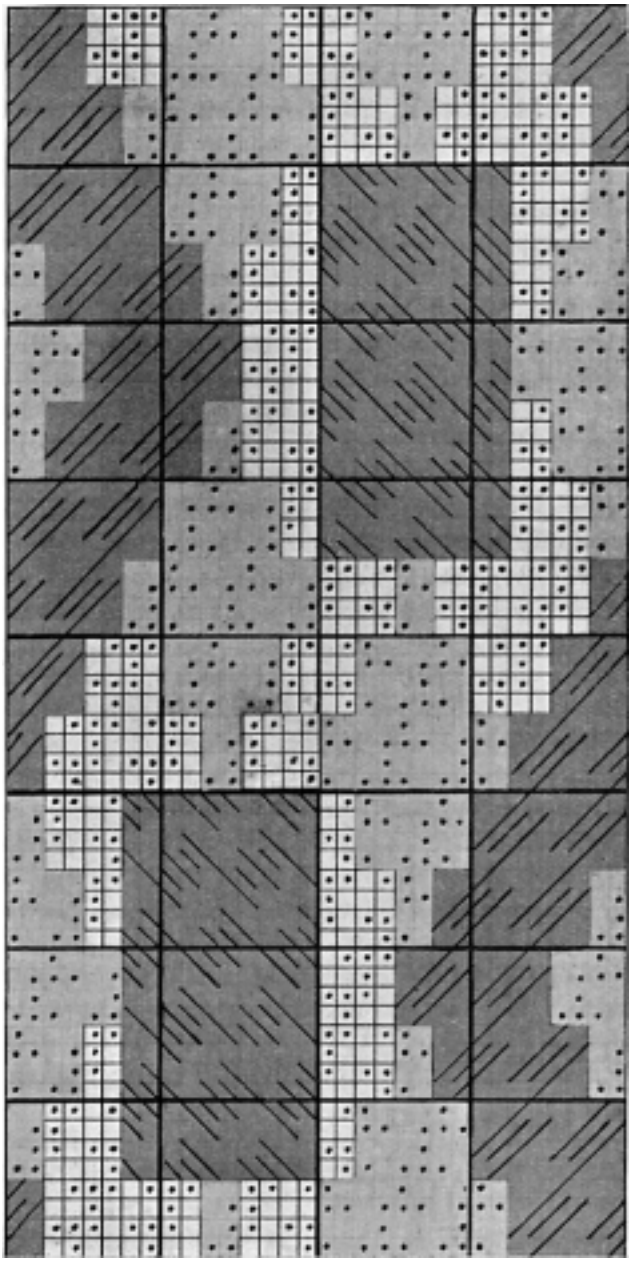


FIG. 111.

but in the latter each " move " of eight threads represents a " move " of twelve picks, and in proportionate ratio throughout the pattern constructed.

A useful method of acquiring further diversity of carpet style in this restricted weaving range consists in employing a plain-tinted border, using the design scheme for the centre of the carpet; or reversing the positions of the two effects. Thirty-six shafts being in most dobbies the limit, only four remain for this purpose, should the designs occupy thirty-two threads, as in Figs. 110 and 111. When this is the case, the plain-tinted section—either border or centre—may be coloured on two principles: first, produced in a different shade on each surface, and, second, produced in a mixture, or chintzed shade on both sides, due to the pick-and-pick shuttling and the mingling of the two colours of weft used. Providing eight or twelve shafts were available for, say, the border, and twenty-four shafts for the centre, the design element would be reduced, but the border effect might be in small lines or checks of colour. To do this, the weaves, *a*, *b*, and *c* in Fig. 70 would be combined. Employing the two former and arranging them in one instance four and four in the warp, and, in a second instance, four warp and eight weft of each plan grouped together in transposed order, would give minute striped and checked patterns respectively. Either would be applicable to the border section, and only add eight shafts to the twenty-four selected for the centre designs. Allocating twelve heddles to the details weavable in the border enables the three weaves to be also grouped on these bases, producing line and checked patterns in the two weft shades, as well as in inter-mixed colouring. By drafting, as indicated, these several effects could be diversified in size, and ordered as to plan of repetition as desired; but in these examples it has been assumed that the system of healding is strictly confined to straight-warp drawing.

For explaining the principles of originating pattern obtainable by " point " and " double-point " healding, reference will be made to Figs. 112 and 112A and to the looming scale sectional plan in Fig. 112B. The basic design results from threads 1 to 8 inclusive in Fig. 112 and the system of warp drafting sketched in Fig. 112A. These threads are successively twilled in sectional groups of four and eight to the right and left. The threads marked × in the draft determine the position in the pattern at which the point or apex of the larger and

smaller diamond-shaped features are formed; or where the reversing of the effects comprised in the elemental threads—1 to 8 in Fig. 112—takes place. Examining the healding plan—Fig. 112A—gives the following transitions of these threads in the formation of the design:

Threads	1	to	7	in draft	=	warp ends	1	to	7	healded to the right in shafts				1 to 7.
,,	8	,,	5	,, ,,	=	,, ,,	8	,,	11	,, ,,	,,	,,	,,	8, 7, 6, 5.
,,	4	,,	7	,, ,,	=	,, ,,	12	,,	15	,, ,,	,,	,,	,,	4, 5, 6, 7.
,,	8	,,	2	,, ,,	=	,, ,,	16	,,	22	,, ,,	,,	,,	,,	8, 7, 6, 5, 4, 3, 2.
,,	1	,,	4	,, ,,	=	,, ,,	23	,,	26	,, ,,	,,	,,	,,	1 to 4.
,,	5	,,	2	,, ,,	=	,, ,,	27	,,	30	,, ,,	,,	,,	,,	5, 4, 3, 2.
Repeat	1	,,	7	,, ,,	=	,, ,,	1	,,	7	,, ,,	,,	,,	,,	1 to 7.
	8	,,	5	,, ,,	=	,, ,,	8	,,	11	,, ,,	,,	,,	,,	8, 7, 6, 5.
	4	,,	7	,, ,,	=	,, ,,	12	,,	15	,, ,,	,,	,,	,,	4, 5, 6, 7.

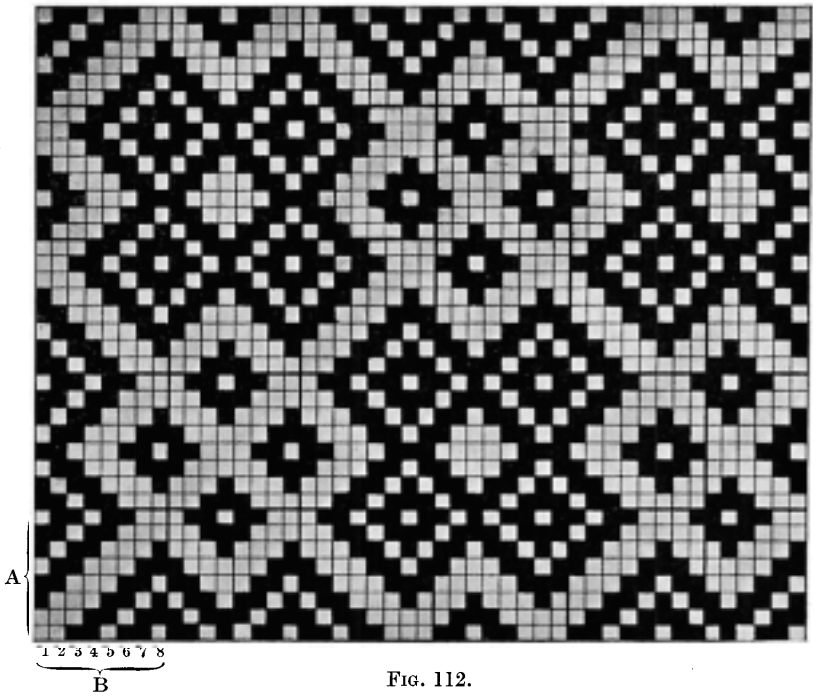


FIG. 112.

This completes a repeat and a half of the draft. A half section is added in the design, Fig. 112, to show the effect of the continuation of the pattern type. Threads 1, 8, 4 and 5 are the reversing points. If only one order of " pointing " had been practised, as at positions 1 and 8, an ordinary type of design would have been produced; but by " double-pointing " and in sets of eight threads to the right, four to the left, four to the right, and four to the left, two varieties of diamond figuring are constructed. The two principles of drafting here illustrated

apply in harness drafting in the origination of decorative styles of design.

Further analysing Fig. 112 it will be apparent that the picks of the design are reversed in twilled direction by the same method as the threads, which is accounted for by the figuring being acquired from an elementary weave, intersecting 3 warp, 2 weft, 1 warp, and 2 weft, or the threads and picks lettered A and B in the example. Changing the weave to 3 warp, 3 weft, 1 warp and 1 weft, or some similar order, and following the scheme of drafting and of pick transposition, would yield other varieties of design. From which it will be understood that with a modification in the number of threads, picks or both threads and picks of which the basic weave is composed, as also with an alteration in the order of warp and weft interlacing of a given plan and in the order of healding, this system of pattern development is capable of being elaborated.

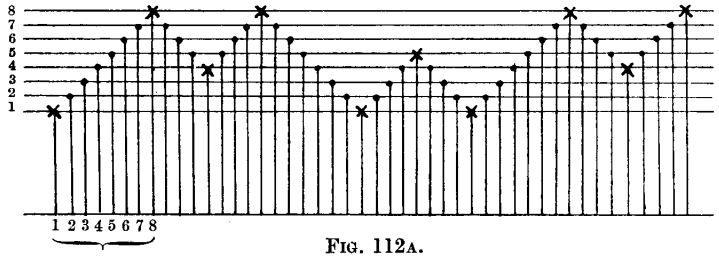


FIG. 112A.

It is, in the form shown in Fig. 112, applicable to single-make carpets of the jute description, with the designs weavable on four, six, seven or eight shafts; but in utilising the patterns thus originated in double-plain and union carpets, the intersections correspond to multiples of threads and picks in the weave of the carpet. Using, in this instance, the double-plain make, each intersection of part A, B, in Fig. 112, becomes equal to four threads and picks, hence the number of shafts for producing this effect requires to be multiplied by four, which implies that to construct the design in a " Kidder " fabric thirty-two shafts would be necessary. Moreover, the order of drafting the design, both in the threads and picks, is likewise quadrupled, yielding a pattern occupying one hundred and twenty ends and shots, instead of thirty, as in Fig. 112.

A section of the figuring thus enlarged to scale is illustrated in Fig. 112B, for which the full healding draft is specified below :

Threads	1	to	32,	drawn	straight	on	shafts	1	to	32.
,,	33	,,	36,	,,	,,	,,	,,	25	,,	28.
,,	37	,,	40,	,,	,,	,,	,,	21	,,	24.
,,	41	,,	44,	,,	,,	,,	,,	17	,,	20.
,,	45	,,	64,	,,	,,	,,	,,	13	,,	32.
,,	65	,,	68,	,,	,,	,,	,,	25	,,	28.
,,	69	,,	72,	,,	,,	,,	,,	21	,,	24.
,,	73	,,	76,	,,	,,	,,	,,	17	,,	20.
,,	77	,,	80,	,,	,,	,,	,,	13	,,	16.
,,	81	,,	84,	,,	,,	,,	,,	9	,,	12.
,,	85	,,	88,	,,	,,	,,	,,	5	,,	8.
,,	89	,,	108,	,,	,,	,,	,,	1	,,	20.
,,	109	,,	112,	,,	,,	,,	,,	13	,,	16.
,,	113	,,	116,	,,	,,	,,	,,	9	,,	12.
,,	117	,,	120,	,,	,,	,,	,,	5	,,	8.

Comparing the extended part of the plan and the draft with Figs. 112 and 112A will explain the technical procedure adopted. The design enlargement may be considered first. Here twelve threads and picks of Fig. 112, by moving in units of four in place of in single intersections, are seen to comprise forty-eight threads and picks of the carpet structure. The grey sections in Fig. 112B correspond to the details printed in black in Fig. 112. On both the grey and white portions the double-plain weaves have been dotted, so that, providing the warp and weft yarns were arranged 1 black and 1 white, the pattern in the fabric would be identical in character with that sketched in Fig. 112, when woven in a white warp and black weft. Such differences as might be observed in the fabrics are traceable to the group " moves " in the threads and picks in the design construction in the latter, and to the single thread and pick intersections in the former, and may be compared to the differences in the qualities and structure of a design produced in thick yarns and open setting in one fabric, and in fine yarn and close setting in a second fabric.

Referring, secondly, to the extension of the healding draft as described above : this produces, in using a reduced design consisting of thirty-two threads and planned as in part C in Fig. 112B, a similar type of pattern to that obtained with the first eight threads in Fig. 112 and the healding draft in Fig. 112A. Each thread 1 to 8 in Fig. 112 is represented in the draft for Fig. 112B by sets of four threads.

Designs marked out on this principle may be applied to both the centre and border of the carpet, and yet a distinction made in the two features by changing the methods of warping and shuttling as explained in reference to Fig. 67. Assuming, for example, that the same pattern and drafting schemes, such as those illustrated, were used in the full width of the carpet, and that a bordered style were required. Obviously this could not be

effected by having one portion of the patternwork woven in a light tone, a second in a medium, and a third in a dark tone. What is not feasible on thirty-two shafts, with a design extending over the whole series of heddles, is to be acquired by modifications in the order of coloured yarns in the warping and wefting. To

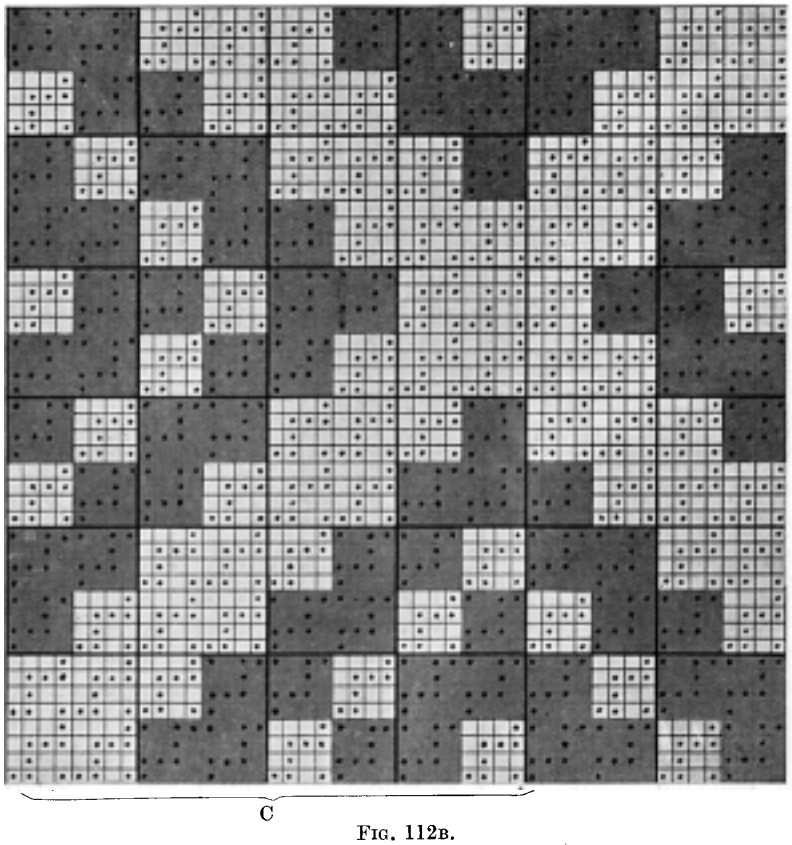


FIG. 112B.

explain, the scheme of colouring applicable may be taken as follows :

Warp

1 thread of medium shade } Corner B and border A^1 as in Fig. 67, but com-
1 ,, ,, light shade } posed of the design in Fig. 112B.
1 ,, ,, ,, ,, } Centre C and border A as in Fig. 67, but com-
1 ,, ,, medium shade } posed of the design in Fig. 112B.

Weft

1 thread of medium shade } Corner B and border A as in Fig. 67, but com-
1 ,, ,, light shade } posed of the design in Fig. 112B.
1 ,, ,, ,, ,, } Centre C and border A^1 as in Fig. 67, but com-
1 ,, ,, medium shade } posed of the design in Fig. 112B.

As a result of this arrangement, the ground in the centre C of the carpet would be in the medium shade and the pattern details in the light shade, with the effects in the two shades reversed in the corner section B. In the borders A and A^1 the shades of warp and weft would be intermingled, for in A the medium weft yarn would cross the light warp yarn and the

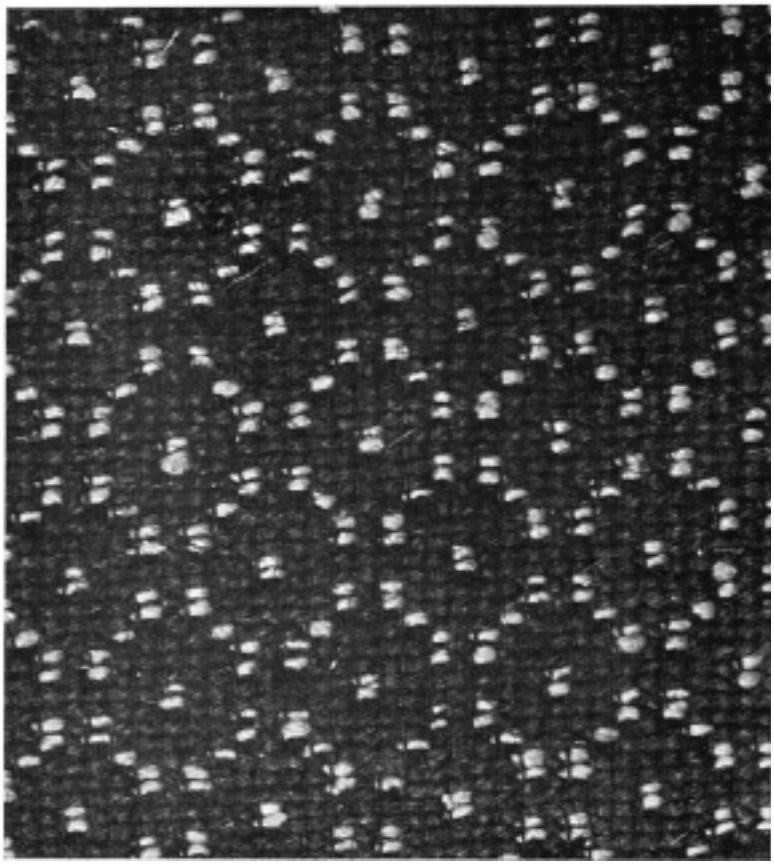


FIG. 113.

light weft the medium warp yarn, and in A^1 the light weft would cross the medium warp yarn and the medium weft the light warp yarn. This would cause the design units in the two borders to be similarly developed but less distinctly accentuated than in sections B and C of the carpet. This method of obtaining art-square and bordered manufactures from one type of design possesses the advantage of giving units of style in the several

sections of the carpet—centre, corners and borders—in two or more yarn shades by a simple transposition of the dark and medium, or deep- and light-toned warp and weft threads.

The third practice of drafting for acquiring carpet designs in shaft mountings consists in combining on a striped, angled, spotted or geometric base, different weave elements. The patterns thus originated should, as in the example in Fig. 112, be symmetrical in structure, and applicable to the ordinary grades of carpet manufacture. It is necessary that they should be arranged with a view to the multiple of heald shafts in which they are producible. From the looming plan and the healding draft, the design and full drafting plan, enlarged to the scale of the carpet setting and the weave units employed, are prepared on the lines described in reference to Figs. 112 and 112B.

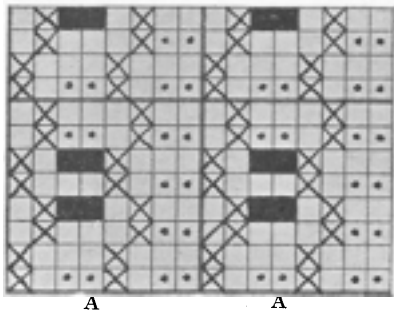


FIG. 113A.

Styles of the character in Fig. 113 are also made by combining a restricted number of effects in different geometric forms of the description illustrated in Fig. 48, A, B and C. The fabric of this particular example—the "Whitley" union—consists of the weave plan in Fig. 113A with the threads A spotted with the weft to give the pattern features, the shuttling being 1 shot ground and 1 shot colour. As the plan of interlacing repeats on a small number of threads, the addition of the effects on threads A can be made in such a way that the designs may be drafted on to a limited series of heald shafts.

Jute carpets are produced in plain, twill, angled twill and diaper weaves, and also in the terry pile structure. Being of this elementary type of construction they are extensively woven in tappet looms. Pattern is acquired by drafting, by the method of arranging coloured yarns in the warp, and by printing. Stripings are formed in twill and mat weaves used separately

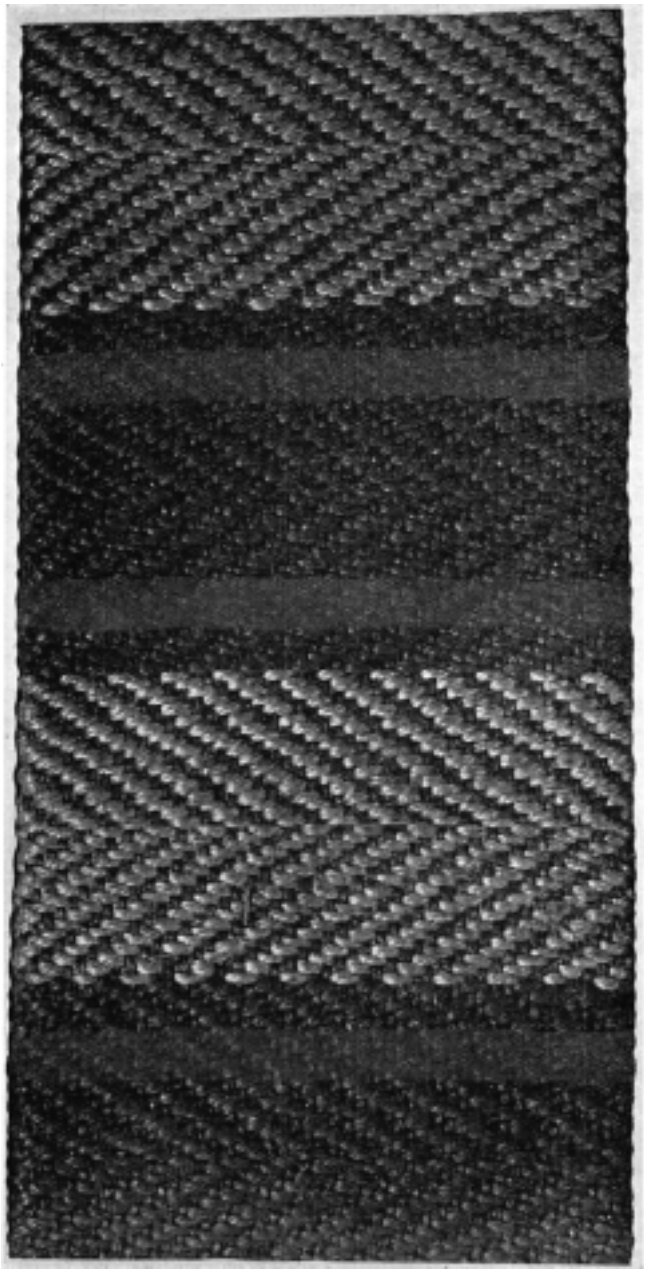


FIG. 114.

or in combination. Fig. 114 is a specimen of the angled twill or herring-bone character, developed in the 2-and-2 twill by drafting 21 threads to the right and to the left alternately, and warping 42 threads of fawn yarn, 4 threads of red, 5 threads of green, 24 threads of red, 5 threads of green, and 4 threads of red. Variations of this pattern base are readily acquired without changing the looming plan. All that is involved is a rearrangement of the healding and colouring practice.

As jute is a vegetable fibre which dyes satisfactorily, coloured yarns are freely used in the warp in the production of striped styles. Two examples of a standard variety are shown in Figs. 115 and 116, the orders of warping for which are :

FIG. 115.

3 threads of purple blue.
12 ,, ,, crimson.
3 ,, ,, deep purple.
3 ,, ,, red.
3 ,, ,, deep purple.
3 ,, ,, maroon.
9 ,, ,, red.
3 ,, ,, maroon.
3 ,, ,, deep purple.
3 ,, ,, red.
3 ,, ,, deep purple.
12 ,, ,, crimson.
3 ,, ,, deep purple.
24 ,, ,, mingled yarn.
3 ,, ,, deep purple.
3 ,, ,, red.
3 ,, ,, crimson.
3 ,, ,, deep purple.
3 ,, ,, crimson.
3 ,, ,, red.
3 ,, ,, deep purple.
24 ,, ,, mingled yarn.

FIG. 116.

12 threads of crimson.
3 ,, ,, deep purple.
3 ,, ,, mingled yarn.
3 ,, ,, deep purple.
1 thread of bright green.
1 ,, ,, crimson.
1 ,, ,, bright green.
1 ,, ,, pale green.
1 ,, ,, mingled yarn.
1 ,, ,, pale green.
4 threads of light fawn.
1 thread of yellow.
2 threads of light fawn.
1 thread of yellow.
4 threads of light fawn.
1 thread of pale green.
1 ,, ,, mingled yarn.
1 ,, ,, pale green.
1 ,, ,, bright green.
1 ,, ,, crimson.
1 ,, ,, bright green.
3 threads of deep purple.
3 ,, ,, mingled yarn.
3 ,, ,, deep purple.
12 ,, ,, crimson.
2 ,, ,, blue.
1 thread of bright crimson.
2 threads of blue.
2 ,, ,, sage green.
1 thread of fawn.
2 threads of sage green.
2 ,, ,, blue.
1 thread of bright crimson.
2 threads of blue.

} Repeat twice.

In the first of these warpings there are three distinct tones of yarn plus the yarn in mingled tinting, and in the second some nine differently-dyed yarns plus the yarns composed of various colours. The reed setting in Fig. 115 is sufficiently close to conceal the weft yarns, but in Fig. 116 the interlacings of the shots of the weft are visible, particularly in the sections of the design in which the yarns of a lighter tone occur.

The larger lozenge forms in this specimen consist of four, the medium forms of three, and the smaller forms of two threads drafted in two directions. With five thread units differing in

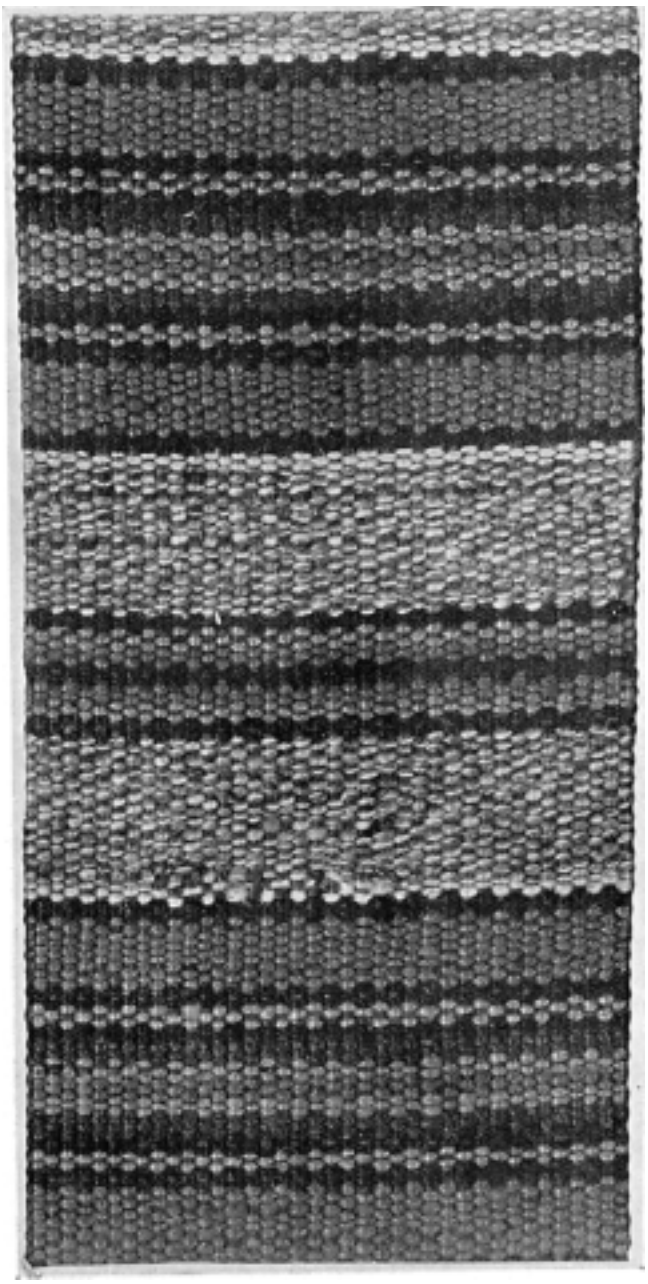


Fig. 115.

FIG. 116.

order of intersection, and by varying the healding plan of the warp, several types of detail are producible, including diamond, zigzag and other forms of textural figuring. Such designing principles are adapted to pronounced and vivid colouring applied to jute carpeting, in which the features of the patternwork are made distinct by interlacing the bright-coloured yarns in the warp with a deep tone of shuttling yarn.

Dutch printed carpets are of a decorative quality though plain in the make. The ground of the fabric is formed in shaded or other fancy stripes, such as a shaded band in three or five tones of brown combined with a striping in mingled colouring and a shaded band in three or five tones of green. On the pattern thus woven, the figured design, of a floral or geometric structure, is printed in colour tones and tints blending with those in the warping. This class of carpet is close set in the reed and firmly wefted, with the warp concealing the weft threads.

CHAPTER VII

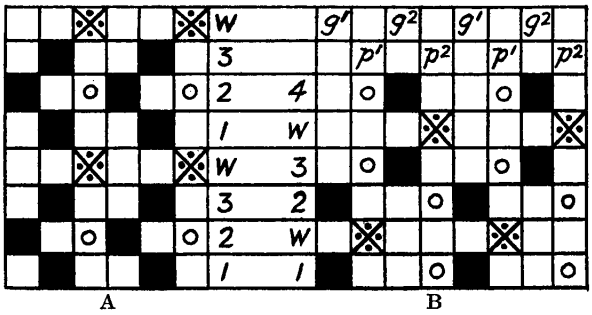
BRUSSELS. TAPESTRY

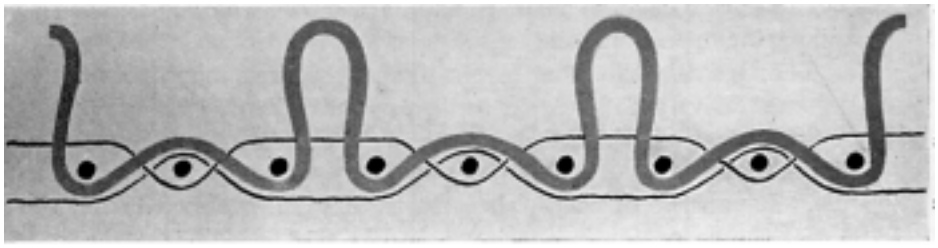
Terry Pile Fabric—Brussels Pile—Wearing and other Features of Looped Pile—Worsted Yarn in Pile Structure—Terry and Brussels Pile Fabrics Compared—Foundation and Stuffing Chains—Three-Frame Carpet—Reed Setting—Harness and Heddle Mounting—Order of Looming for Six-Frame Carpet—System of Warp-thread Drawing-in and Sleying—Cycle of Weaving Movements—Design Preparation—Colour Variations possible in Design Production—Structural Analysis of Six-Frame Figured Design—Effects of Jacquard and Shaft Mechanism—Card Stamping—Practical Carpet Designing—Design Scale—Carpet Quality—Function of Stuffing or Wadding Yarns—Differentiations in Pile Structure—Surface Flexibility—Pile Compactness—Weaving Data for Specimens—Structural Comparisons—Colouring Principles—Examples in Designing Methods and Practices—Filling and Border Designs—Theory and Practice in Design Construction and Colouring—Frame Planting or Setting for Extra Colours—Decorative Composition of Border and Filling Styles of Design—Linking-up of Pattern Types—Interchange of Ground Colours in Decorative Elements in Border Designing—Widths of Colour Lines and of Figured Bands in Borders—Symmetry of Style—Colour Schemes as Typified in Examples—Contrasts in Colour Hue and Tone—Moresque or Twist-Yarn Effects—Admixed Tinting in Design Development—TAPESTRY—Methods of Design Production—Yarn and Fabric Printing—Size of Yarn Drum and Scale of Design—Hanking, Winding, Setting and Looming—Carpet Structure and Weaving—Loop and Velvet Pile—Constructive Practices—Binding of the Pile Tufts—Pile Durability—Printed-Yarn Specimen in Velvet Pile—Analysis of Design and Colour Scheme—Seamless Square Example in Loop Pile—Methods of Developing Decorative Style—Latitude in Colouring and Designing.

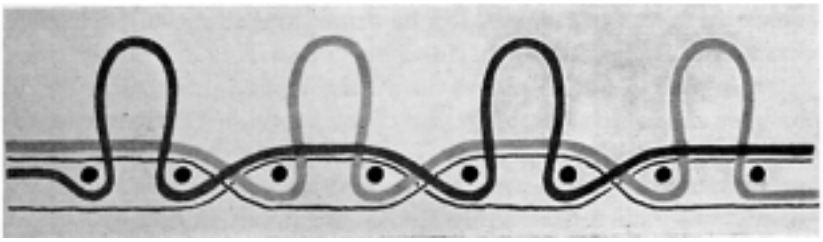
THE Brussels carpet is a compound fabric structure, consisting of three layers of yarns, namely, worsted for the pile surface, cotton or jute for the centre, " filling " or " stuffing," and cotton for the foundation. These are interwoven with linen weft, which binds the pile, stuffing and ground threads into a firm fabric, and makes, with the foundation yarns, the back of the carpet. Structurally, it is derived from the common looped or terry pile texture weavable in the elementary plans A and B, Fig. 117, which yield the pile surface effects seen in sketches C and D. In the illustrations, the ground threads are lettered g^1 g^2, the pile threads p^1, p^2, and the wires W, with the picks in numerals. The pile yarns are bound into the cloth proper by the shots of weft passing over them on each side of the loops, and by interlacing with the picks in regular order when not used in forming the looped features. The loom mounting includes

two or four shafts for the ground warp, and one shaft for the pile in A and two shafts in B, with the ground and pile warps on different chain beams to allow of their being separately tensioned.

Obviously the results obtained, as regards the formation of a looped pile in a satisfactory build of fabric, are identical with







D

FIG. 117.

those in the Brussels carpet; but the texture is light in the make, whereas the carpet is firm in structure and a heavy variety of manufacture. It is strengthened and also increased in thickness by the use of an additional series of warp yarns, known as the stuffing chain, and by the use of multi-ply yarns in the pile, and of thick, strong yarns in the foundation.

To produce any variety of pile fabric in which foundation and pile warps are combined, the two sets of threads require to be differently tensioned, and, in the case of figured pile goods, the pile threads must of necessity be individually tensioned or run off separate spools. This is the practice in weaving Brussels and Wilton carpets. The spools of yarn are placed in a large creel made of sections or "frames" fixed behind the loom. Ordinarily each "frame" contains spools of one sort and colour of yarn. The "frame" of the carpet, as will be shown, relates to the character of the decorative surface produced, for each frame signifies a possible line of colour in the woven design. The number of spools in a frame determines the width of the carpet and the pile units in a single transverse row of a repeat of the pattern. In shedding the warps, only the spool yarns pass over the wires, which, in Wilton and other velvet-pile carpets, have a knife at one end, so that on being withdrawn they cut the loops, but in Brussels pile, the wires, having no such knife attachment, on being withdrawn leave the loops intact.

The Brussels pile, whether in plain or figured manufactures, is comparatively deficient in resiliency and in softness, but it is of that structure which develops the pattern features and colour toning distinctly. In the latter sense it is superior to the velvet pile. It consists of small, short loops of yarn, grouped in lines across the carpet as in specimen A, Fig. 118, which is a cheap variety of Continental production in which the central yarns are made of cotton. The number of loops or pile units per square inch varies from 36, as in example A, to 100, as in the closer and better makes of fabrics. The thickness of the pile yarns is variable with the ratio of the loops in the pile, being the greater in the looser grade of carpets for the purpose of acquiring covering efficiency. With the looped or turned over surfaces of the yarn forming the pile, the sides of the threads are exposed and resist the friction in the wear, in contrast with the ends of the threads and the filaments of which the threads are formed, which constitute the surface of all classes of velvet-pile carpets.

The wearing quality of the looped pile is good, and, though the carpet stains and marks readily, it may also be easily kept free from dust, being, in this particular, distinctly a sanitary floor covering. As a type of pile carpet it is less liable to accumulate dirty matter than the Axminster, the Wilton, or the hand-tufted productions. In the use of the latter the dust,

etc., has a tendency to become embedded between the filaments of the pile, whereas in the Brussels the dirty particles form on the rounded loops of the yarns, from which they may be

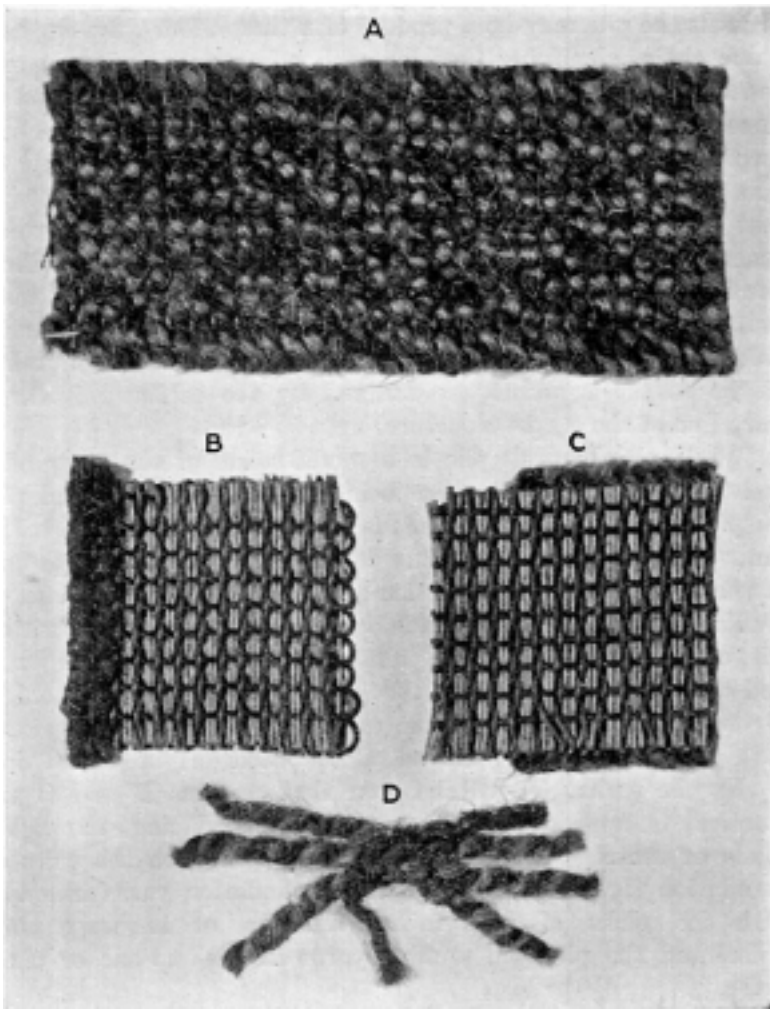


FIG. 118.

A = Surface.
B = Surface with the pile yarns removed.
C = Back.
D = Pile yarns.

removed by effective surface sweeping. Moreover, there is not that depth and closeness of pile for the matter to penetrate as in the velvet-pile structure, so that, in sweeping, the actual ground of the carpet, as well as the pile, is more or less cleansed.

The quantity or weight of worsted pile yarn in a given area of carpet increases with the quality of the manufacture. This is reduced to a minimum in the example in Fig. 118, where only one series of pile yarns is employed; but in other grades of Brussels the pile may be a product of a three-, four-, five- or six-frame chain, signifying that for each pile yarn showing in one line of the carpet there are two, three, four or five worsted threads respectively beneath. The number of the frame of the carpet is, therefore, an indication of its worsted yarn composition and also of its quality. It must, however, be understood that any particular number of frames is not necessarily synonymous with the number of colours in the carpet. Any one frame, in which the spools of pile yarn are mounted, may contain two or more colours of yarn, but these will appear in different width portions of the design; and the " frame " number of the carpet is strictly determined by the colour units in a warp line of the carpet structure.

While the Brussels pile is a modification of the terry pile, each type of woven structure being formed of ground and pile warp yarns, with the pile threads interlacing regularly with the shots of ground weft, they differ in the binding of the loops and in the inclusion, in the formation of the Brussels, of the filling or stuffing threads. These threads occupy an intermediate position between the odd and even picks and between the pile yarns and the lower evolutions of the ground threads. Specimen A, Fig. 118, shows the pile of the carpet, B the ground structure with the pile threads removed, C the back of the carpet and D the pile yarns. It will be seen that sections B and C are identical in appearance and in plan of interlacing, the light-shade or centre yarns filling in the space between the pairs of foundation threads and picks. The foundation yarns intersect with the picks of weft in two-and-two or in warp cord order, and the pile and stuffing yarns in one-and-one or plain order.

The same principle of intersection obtains when each line of pile is composed of several colours, as in three-, four-, five- and six-frame carpets. For a three-frame fabric the three-pile threads would pass over the same wire together, which might be done in weaving an unfigured carpet with each row of pile developed in three colours, but it is not an actual condition in weaving decorative designs. The idea of the pile yarns being in different shades of yarn is to select the one for the pile in

coincidence with the pattern, and for the remaining two pile yarns to pass under the colour pile threads floating over the wire. The first pile thread is brought over three successive wires, with two threads underneath, then the second pile thread forms the pile with the first and third immediately below, and lastly the third pile thread is used for the pile with the first and second threads for a yarn base. Clearly, as the number of basic pile threads or worsted threads under each pile unit is increased, the yielding and elastic property of the carpet to the tread will be improved. They act as a support to the pile and as a wool-fibre yarn filling between the pile and the stuffing yarns and the foundation threads and picks.

Whatever number of threads form one unit of pile, they, with the ground and centre threads, pass through one reed of the sley. The number of stuffing ends is variable with the thickness they are required to give to the carpet, but as a rule they are reduced to two or one in the fine and better classes of carpet. The unfigured Brussels and the tapestry, looped or velvet pile, are producible in heddle mountings, but the decorative manufactures are woven in a compound harness and shaft mounting, with the shafts (three in number—two for the foundation chain and one for the stuffing chain) placed immediately in the rear of the harness. The heddles for the ground chain threads are operated by Woodcroft tappet mechanism, and the heddle carrying the stuffing threads by the comberboard, which is also actuated up and down by tappet gearing. When this takes place what is termed the double shed is formed in the warps, that is, an upper and lower shed, the first for the wire, and the second for a shot of ground weft. The practice in drawing-in the ends of the different warps into the mails of the harness and the shafts for a six-frame carpet is as follows :

One thread, ground chain, through the mail of heddle 1 (nearest the harness).
" " " " " " 2
One or more threads, stuffing chain, through the mail or mails of heddle 3.
One thread, from frame 1 = colour 1, through mail 1 of the harness.
" " " " 2 = " 2, " " 3 " "
" " " " 3 = " 3, " " 5 " "
" " " " 4 = " 4, " " 7 " "
" " " " 5 = " 5, " " 9 " "
" " " " 6 = " 6, " " 11 " "

This complete group of threads is entered into split 1, and all similar groups of threads are entered into the odd splits of the reed. For split 2, and all the even splits in the sley, the order of drawing-in proceeds thus :

One thread, ground chain, through the mail of heddle 1.
„ „ „ „ „ „ 2.
One or more threads, stuffing chain, through the mail or mails of heddle 3.
One thread, from frame 1 = colour 1, through mail 2 of the harness.
„ „ „ „ 2 = „ 2, „ „ 4 „ „
„ „ „ „ 3 = „ 3, „ „ 6 „ „
„ „ „ „ 4 = „ 4, „ „ 8 „ „
„ „ „ „ 5 = „ 5, „ „ 10 „ „
„ „ „ „ 6 = „ 6, „ „ 12 „ „

These rules are observed in the healding and reeding of other grades of carpeting—three-, four- and five-frame. The cycle of weaving movements which result in the build of the fabric and in the production of the looped pile comprises :

A.—The first or *single* shed in which shaft 1 is lifted and shafts 2 and 3, with the whole of the harness depressed, for the crossing of the 1st ground shot of weft.

B.—The second or *double* shed in which shaft 1 is lifted, also the harness by the raising of the comberboard and shaft 3, with shaft 2 depressed, for the formation of the *bottom* shed, across which the 2nd ground shot of weft is passed; and the lifting of the selected pile threads for the figuring by the Jacquard machine, producing the *top* shed, into which the wire is inserted.

C.—The third or *single* shed with shaft 2 lifted, and shafts 1 and 3 and the whole of the harness depressed, for the passage of the 3rd shot of ground weft.

D.—The fourth or *double* shed, in which shaft 2 is lifted, also the harness by the raising of the comberboard and shaft 3, with shaft 1 depressed, for the formation of the *bottom* shed for the shuttling of the 4th ground shed; and the lifting of the selected pile threads, according to the design, by the Jacquard machine, producing the *top* shed for wire insertion.

Before the perfecting of the double-deck type of shedding mechanism, the duplicated weaving changes, B and D, necessitated separate sheds being formed in the warp for picks 2 and 4 and also for inserting the wires. The mechanical system of work by which the fabric is made independently of the Jacquard action, greatly simplifies the drafting of the designs. It is only essential to show the pattern on the ruled paper in colour, or on the principle seen in Fig. 119. This is a section of a five-frame figure. In practice, the designs are painted in body colour and in the colours in which they are intended to be woven, or at least in such a way as to typify the decorative quality of the ornament and the carpet style. The artist's colour scheme may be modified, or the same design may be produced in different groups of colours, or it may be totally changed in tinted composition by rearranging the frame colours. For example, in this sectional plan, there are five colour units with black as the ground shade of the carpet. To change the positions of the light grey and black in the weaving of the design would obviously recast the pattern without altering the design

ornament; and similarly if other colours (= frames) in the pattern were interchanged, its ornamental tone and quality would be varied.

The technicality may be better explained by taking the actual colours in which the design (section) in Fig. 119 was woven, namely, light fawn, fawn, red, green and blue, with the carpet structure composed as specified below:

Order of Looming

2 threads of 3/7's grey cotton (ground chain).
1 thread of 4/12's „ „ (stuffing chain).
1 thread of three-ply 2/20's light fawn worsted (pile, frame 1).
1 „ „ „ „ fawn worsted (pile, frame 2).
1 „ „ „ „ red worsted (pile, frame 3).
1 „ „ „ „ green worsted (pile, frame 4).
1 „ „ „ „ blue worsted (pile, frame 5).
9 dents per inch, 8 threads in a dent and with 256 splits in $\frac{3}{4}$ width of carpet.
Weft: 6 lea linen.
18 ground shots and 9 wires per inch.

In Fig. 119 the effects printed in black correspond to blue in the carpet, those in light grey to light fawn, those in medium grey to fawn, those in dark grey to red, and those printed in star symbols to green. The transposition of the black and tinted grey shades would, therefore, cause the ground of the carpet to be produced in light fawn and the principal parts of the figuring in blue. Such a change in the allocation of the blue and light fawn pile yarns would yield, without altering the design, a fresh description of carpet surface. By transposing, in a second instance, the dark and light grey shades in the example, the outlining of the diamond feature would be developed in red instead of in fawn, and the details and figuring in dark grey would be changed from red to light fawn in the carpet. Third, the transposing of the green (= stars in Fig. 119) and the red (= dark grey in the design) would develop the edging of the main figure in red instead of green, and the demarcation lines of the interior of this figure in green in place of red. Both the two latter rearrangements would impart a new quality to the pattern style, but of a less severe character than that on changing the position of the light and dark colour tones in the design.

For experiments to be successful by this practice, the colours combined must harmonise and contrast one with the other satisfactorily, however grouped, for it means that any two of the five colour units may be brought into juxtaposition in the

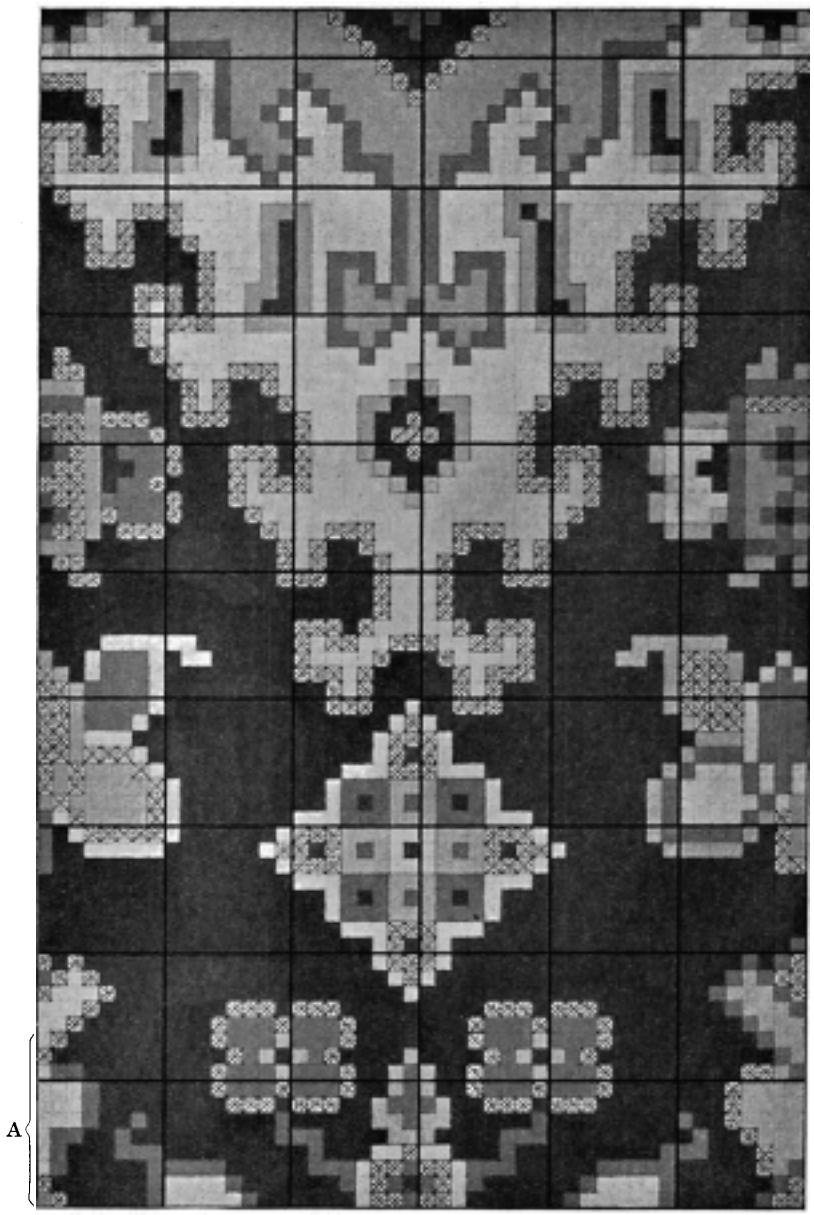


FIG. 119.

development of the decorative details of the design. In the colour scheme used, the green and red, the light fawn and red, the fawn and light fawn, the blue and green, the red and fawn, and the light fawn and blue are thus effectively associated in the original design, and this renders them interchangeable in relation on the principles described.

As pointed out, the weave plan is not taken into account in preparing the decorative design for card stamping, inasmuch as this is provided for by the shedding mechanism of the loom. What this implies is apparent from the complete textural plan of the twelve threads and picks lettered A in Fig. 119. These are equivalent, as shown in Fig. 120, to 96 threads, 24 shots, and 12 wires in the actual carpet. The foundation ends and picks are marked in ⊠, the stuffing ends in ⊡, and the pile threads in tinted grey, grey, toned or dark grey, black and ⊠. In this structural plan, picks 1 and 3 coincide with the fundamental shedding transitions A and C, and picks 3 and 4 to the *bottom* sheds in the warps in the shedding transitions B and D defined. Such picks, as explained, work in 2-and-2 warp cord order with the foundation ends g^1 and g^2, with picks 1 and 3 passing under the pile and stuffing threads and picks 2 and 4 passing over such threads, binding them thereby into the body of the carpet. The order of interlacing, which determines the formation of the *top* sheds in the pile warp simultaneously with lower divisions in the warps for picks 2 and 4, is indicated on the lines W^1 and W^2 in the illustration. How this order is acquired in weaving, or how the design prepared in colour is transferred on to the carpet surface, will be evident on comparing the picks 1 to 12 in part A of Fig. 119 with corresponding lines lettered W in Fig. 120. Taking the first three shots in the former they read :

Shot 1 = 4 threads marked in black, 1 in tinted grey, 2 in ⊠'s, 1 in toned grey, 2 in ⊠'s, 1 in tinted grey, and 1 thread in black.
Shot 2 = 3 threads marked in black, 1 in toned grey, 1 in tinted grey, 1 in ⊠'s, 1 in toned grey, 1 in black, 1 in toned grey, 1 in ⊠'s, 1 in tinted grey, and 1 thread in toned grey.
Shot 3 = 1 thread marked in black, 3 threads in toned grey, 1 in tinted grey, 2 in ⊠'s, 1 in toned grey, 2 in ⊠'s, 1 in tinted grey, and 1 in toned grey.

Lines W^1, W^2 and W^3 are so marked that they would through the cards, stamped as per these shots in the design, effect the lifting of the pile yarns in groups P^1 to P^{12} (= threads 1 to 12 in section A of the looming design) thus :

Wire W^1, Fig. 120 =

Pile ends in black	lifted in pile yarn			groups P^1, P^2, P^3 and P^4	= 4 black pile loops.
,, end in tinted grey	,,	,,	,,	group P^5	= 1 tinted grey pile loop.
,, ends in ⊠	,,	,,	,,	groups P^6 and P^7	= 2 ⊠ pile loops.
,, end in toned grey	,,	,,	,,	group P^8,	= 1 toned grey pile loop.
,, ends in ⊠	,,	,,	,,	groups P^9 and P^{10}	= 2 ⊠ pile loops.
end in tinted grey	,,	,,	,,	group P^{11}	= 1 tinted grey pile loop.
black ,, ,,	,,	,,	,,	,, P^{12}	= 1 black pile loop.

Wire W^2 =

Pile ends in black	lifted in pile-yarn			groups P^1, P^2, P^3	= 3 black pile loops.
,, end in toned grey	,,	,,	,,	group P^4	= 1 toned grey pile loop.
,, ,, tinted grey	,,	,,	,,	,, P^5	= 1 tinted grey pile loop.
,, ,, ⊠	,,	,,	,,	,, P^6	= 1 ⊠ pile loop.
,, ,, toned grey	,,	,,	,,	,, P^7	= 1 toned grey pile loop.
,, ,, black	,,	,,	,,	,, P^8	= 1 black pile loop.
,, ,, toned grey	,,	,,	,,	,, P^9	= 1 toned grey pile loop.
,, ,, ⊠	,,	,,	,,	,, P^{10}	= 1 ⊠ pile loop.
,, ,, tinted grey	,,	,,	,,	,, P^{11}	= 1 tinted grey pile loop.
,, ,, toned grey	,,	,,	,,	,, P^{12}	= 1 toned grey pile loop.

Wire W^3 =

Pile end in black	lifted in pile-yarn			group P^1	= 1 black pile loop.
,, ends in toned grey	,,	,,	,,	groups P^2, P^3 and P^4	= 3 toned grey pile loops.
,, end in tinted grey	,,	,,	,,	group P^5	= 1 tinted grey pile loop.
,, ends in ⊠	,,	,,	,,	groups P^6 and P^7	= 2 ⊠ pile loops.
,, end in toned grey	,,	,,	,,	group P^8	= 1 toned grey pile loop.
,, ends in ⊠	,,	,,	,,	groups P^9 and P^{10}	= 2 ⊠ pile loops.
,, end in tinted grey	,,	,,	,,	group P^{11}	= 1 tinted grey pile loop.
,, ,, toned grey	,,	,,	,,	,, P^{12}	= 1 toned grey pile loop.

Should other picks in the lettered section of the design be examined, they would be found to agree in colour arrangement with the sequence of lifting the coloured pile threads in the serial groups of pile yarns in the structural plan. As, for example, shot 7 in section A of Fig. 119 and wire W^7 in Fig. 120, both of which introduce the medium grey pile threads, not utilised on wires W^1, W^2 and W^3, and represent 3 pile loops in ⊠, 2 in black, 1 in tinted grey, 3 in toned grey, 1 in tinted grey, and 2 in black. Applying the coloured yarns stated as used in the weaving of the carpet, the effect of W^1 would be to produce 4 pile loops in blue, 1 in light fawn, 2 in green, 1 in red, 2 in green, 1 in light fawn and 1 in blue; of W^2 3 pile loops in blue, 1 in red, 1 in light fawn, 1 in green, 1 in red, 1 in blue, 1 in red, 1 in green, 1 in light fawn, and 1 in red; and of W^3 1 loop in blue, 3 loops in red, 1 in light fawn, 2 in green, 1 in red, 2 in green, 1 in light fawn, and 1 pile loop in red.

From this synthesis of twelve threads and picks in A of Fig. 119, and of the automatically governed shedding scheme, it is plain that the latter forms a fabric groundwork on which the required variety of decorative pattern, woven in looped pile, is developed as a consequence of the manner in which the cards are stamped and of the action of the Jacquard machine. Card stamping is rendered a straightforward operation. The coloured pile threads, from the different frames, are so drawn into the harness as to be respectively controlled by special needles in the machine, and are accordingly stamped in the order in which the colour units occur across each wire shed of the design.

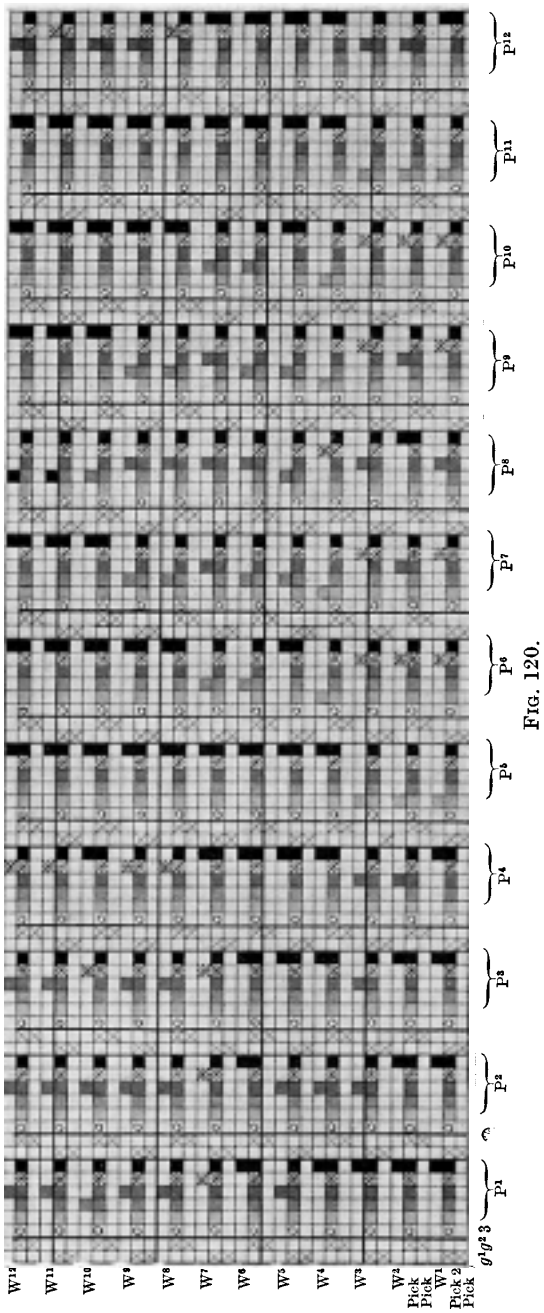

W12
W11
W10
W9
W8
W7
W6
W5
W4
W3
W2
Pick
Pick
W1
Pick 2
Pick
g1g2 3
P1
P2
P3
P4
P5
P6
P7
P8
P9
P10
P11
P12

FIG. 120.

Practical carpet designing on this system consists in transferring the decorative sketch on to the ruled paper in a prescribed scheme of colours. The pattern being solely due to the method of forming the pile loops in the manner shown, there are no textural elements to manipulate and adjust as in the origination of other varieties of figured fabrics, such as brocades and tapestries. The approved sketch is executed on the point paper in the three, four or more colours in which it is intended to be woven. Each small square in this paper corresponds to one pile thread and one pile loop in the carpet surface. Literally each warp line in the prepared design includes the several pile threads in the total "frames" employed, and each line of squares across the design includes, as previously noted, the possible number of pile loops in the width of the carpet. The designs are drawn to the scale of the Jacquard capacity as understood by the number of needles for working the pile ends of each frame. With 234, 256 or 260 threads per frame, the patterns are drawn on these numbers of vertical lines of small squares on the point paper, for giving one repeat of the design across the carpet, $\frac{3}{4}$ of a yard wide. Each colour unit in the design has its counterpart in pile yarn in the loom mounting, and this counterpart works in unison with its complement of ground and stuffing threads and of foundation shots. Thus, in the structural scheme in Fig. 120, each colour symbol in Fig. 119 is observed to include in the carpet construction 5-pile threads—1 selected for the pile loop and 4 remaining inoperative—1 stuffing thread and 2 picks of ground weft. The coloured or card stamper's design is, therefore, the decorative style pure and simple, showing the effect in colour on the pile surface and representing the sequence of lifting the pile threads for the insertion of each wire, but it is systematically linked with the weaving of a definite type of carpet structure.

Carpet quality is primarily determined by the class of pile yarns used. Their "counts" and "ply," and the sort of wool employed in their manufacture, affect the character, softness, closeness and durability of the pile. The "frame" of the carpet is also an indication of the carpet value and its structural soundness. The larger the number of frames or threads in each group of pile yarns, the greater, as a general rule, the weight of wool fibre in the composition of the carpet. Actual carpet thickness and substance may be acquired by the "counts" and number of the stuffing ends to each unit of pile. As the friction in the

use of the carpeting is on the surface, thickness thus obtained does not materially add to its wearing efficiency. The real function of the stuffing yarns is to yield a heavy, strong type of fabric. In the inexpensive Brussels pile in Fig. 118, there are three stuffing ends, made of 2's cotton, to one end of 2-ply $1\frac{1}{2}$ skeins carded pile yarn; in the carpet woven in the design sectionally illustrated in Figs. 119 and 120, there is only one stuffing end—4/12's cotton—to five ends of 3-ply 2/20's worsted. Two such carpets must differ greatly in pile structure apart from any difference in the quality of the wools used—coarse Shetland in the former and fine Australian crossbred in the latter—in making the respective pile yarns. In the first of these examples the whole of the wool-fibre ingredient is visible on the pile surface, and in the second one-fifth of this ingredient, with the remaining four-fifths concealed and embedded in the surface structure.

The resiliency and flexibility of the pile are dependent on the yarn of which it is composed, and, in a measure, on the layer of pile yarns under the pile loops. If such loops are only supported by the unyielding stuffing and foundation threads they are readily worn down and flattened. The pile is improved in elasticity, or in the property to recover its normal condition, by the wool-fibre yarns on which it is bedded. The inactive pile threads are an important element in the build of the carpet. They form a layer of worsted threads, which varies in compactness with the frame of the fabric, between the stuffing and ground threads and the rows of pile loops. The more weight of wool filament, or the more worsted threads, this layer contains, the better the grade of the carpet. This may be shown by referring to the loom setting for Fig. 119. The pile yarns applied are equivalent to $3\frac{1}{3}$ worsted counts, approximately $\frac{1}{36}$ of an inch in diameter. There are 45 threads, 9 in the pile and 36 in the pile-yarn layer, so that this layer forms a wool-fibre cover over the stuffing-chain threads. Though only a small fraction of an inch in thickness, it adds to the softness of the tread of the carpet, and to the quality of the pile surface. In an ordinary three-frame structure, into which no "dead" worsted threads (*i. e.*, filling and not figuring yarns) are inserted, the underneath layer of pile threads is reduced in closeness, and, as a consequence, does not improve the carpet structure to the same extent as in five- and six-frame manufactures; while in a pile resting on the stuffing chain, as in the specimen in Fig. 118, though

made of thick, strong yarn, the carpet is deficient in treading property.

The number of pile loops per square inch of the carpet surface also affects the carpet structure and value. As these diminish in number the pile suffers in density and fulness. In A, Fig. 118, there are only 36 as compared with 81 per square inch in a carpet as per the setting for Fig. 119. The better makes of production are woven with a similar number of wires as sets of pile ends per inch, though a common practice consists in having one-eighth, one-ninth, or one-tenth less units of pile yarn than wires to the inch. Reducing the wires tends to detract from the soundness of the carpet structure, in addition to being detrimental to the pile quality. For the specimens illustrated in Figs. 121 and 122 and on Plates IV and V the weaving data are :—

4-Frame Brussels. Fig. 121.

Order of Looming.

2 threads of 3/7's cotton, ground chain.
2 „ 8 lb. jute (= lb. per spindle of 14,400 yards), stuffing chain.
1 thread of 2-ply 3-fold 16's worsted, silver grey pile. Frame 1.
1 „ „ „ „ medium silver grey pile. Frame 2.
1 „ „ „ „ strawberry pile. Frame 3.
1 „ „ „ „ black pile. Frame 4.
8 splits per inch, 8 threads in a split.
214 unit pitch of carpet design.
Weft : 6's linen.
18 shots and 9 wires per inch.

4-Frame Brussels in Five Colours. Fig. 122.

Order of Looming.

2 threads of 3/7's cotton, ground chain.
2 „ 8 lb. jute, stuffing chain.
1 thread of 2-ply 3-fold 16's worsted, drab pile. Frame 1.
1 „ „ „ „ green or blue pile. Frame 2.
1 „ „ „ „ red pile. Frame 3.
1 „ „ „ „ black pile. Frame 4.
Frame 2 is set or planted 10 spools of green and 8 spools of blue, starting and finishing the setting with 5 spools of green.
9 splits per inch, 8 threads in a split.
256 unit pitch of carpet design.
Weft : 6's linen.
18 shots and 9 wires per inch.

5-Frame Brussels. Plate IV.

Order of Looming.

2 threads of 3/7's cotton, ground chain.
2 „ 4/12's „ stuffing chain.
1 thread of 3-ply 2/18's worsted, fawn pile. Frame 1.
1 „ „ „ „ olive pile. Frame 2.
1 „ „ „ „ sage green pile. Frame 3.
1 „ „ „ „ terra cotta red pile. Frame 4.
1 „ „ „ „ blue pile. Frame 5.
9½ splits per inch, 9 ends in a split.
256 unit pitch of carpet design.
Weft : 6's linen.
22 shots and 10 wires per inch.

5-FRAME BRUSSELS. PLATE V.

Order of Looming.

2 threads of 3's cotton, ground chain.
1 thread of 8 lb. jute, stuffing chain.
1 thread of 4-fold worsted twist yarn, composed of 1 end of 2/24's black, 1 end of 2/24's drab, 1 end of 2/24's yellow green, and 1 end of 2/24's light red, making the " marl " pile. Frame 1.
1 thread of 3-ply 2/18's worsted, green pile. Frame 2.
1 ,, ,, ,, ,, gold pile. Frame 3.
1 ,, ,, ,, ,, red pile. Frame 4.
1 ,, ,, ,, ,, black pile. Frame 5.
9 splits per inch, 8 threads in a split.

Weft : 6's linen.
18 shots and 9 wires per inch.

The softest or most elastic pile in these three examples is that of the carpet on Plate V, and the closest pile that of the carpet on Plate IV. The gauge of the wire—·055—is the same for the examples in Fig. 121 and on Plate IV, so that the depth of the pile in each corresponds, but in the five-frame production there are 110 pile loops per square inch as compared with 72 in the four-frame carpet.

While some differentiation is feasible in the depth of the looped or Brussels pile, it is only varied in this respect to a minute degree as contrasted with the velvet or Wilton pile. The production, however, of this variety of pile with wires of a somewhat larger size (·10 in the last example) results in a carpet of an improved wearing and treading surface, or one more elastic in the pile, providing the carpet is firmly set and woven and the pile yarns are of a proper ply and thickness to yield filament density in the pile loops. It is a factor which counts in judging the grade of manufacture, because the deeper the pile the greater the length and weight of worsted yarn in the carpet, whether consisting of three or four frames.

What is defined as the " marl " pile in the weaving data for the specimen on Plate V is also termed a " moresque " effect. The employment of twist yarns for this purpose adds to the cost of production. Other methods are also adopted for acquiring mingled colour tinting in the carpet surface. Using, for example, in prescribed parts of the design, two instead of one pile yarn in a split or pile-yarn unit, develops a species of intermixed colouring. It may be provided for in preparing the design by reckoning each series of small squares on the point paper, on which the effect is to be produced, as equal to two pile threads. These are coloured as desired by combining any two of the yarn shades in each group of pile yarns. For developing a mingled

colour ingredient in this way, in particular elements of the design in Fig. 121, either the black and the strawberry or the strawberry and grey yarns might thus be combined in forming single pile

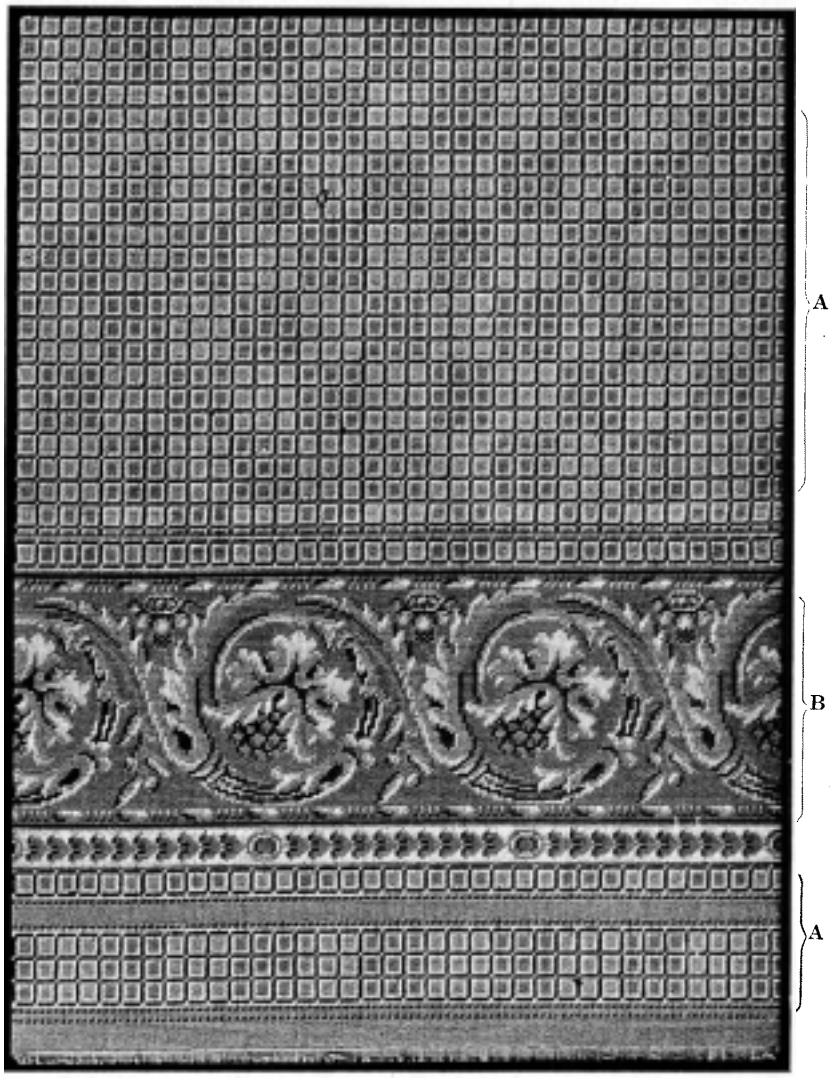


FIG. 121.

loops. In card cutting, two such threads would be read as separate pile ends, but stamped to be lifted together over the same wire in weaving. A closer approach to the genuine moresque is obtained by amalgamating frames mounted with reels of three-

ply 2-fold worsted yarns with frames mounted with reels of ordinary 2-fold yarns of a suitable thickness, both in solid colours, and by arranging for the admixture of two of the latter yarns in the formation of individual pile loops in fixed sections of the pattern. Neither practice is synonymous in result to the intermingled tinted effects due to twisting two, three, or four coloured yarns into one pile thread on the system indicated, in the warping order, for the five-frame carpet specimen on Plate IV.

The principles of designing, colouring and manufacture which enter into the production of the Brussels carpet will be further explained by reference to the examples for which the looming particulars have been specified. They comprise three border styles and a " body " style of carpeting. Fig. 121 is woven in four colours of pile yarns, with the pattern in the field of the carpet formed on a checked or rectangular base. This pattern is simple and severe in structure and in contrast with the free and graceful forms combined in the border design.

The colour tones—two in silver grey, one in black and one in strawberry red—are adapted, as employed, to the effective development of the decorative types in the bordering, partially expressed in relief but without resorting to the practice of shading. Style monotony, liable to be caused by the repetition of rigid geometric forms, is avoided in the ground pattern of the carpet by the spacing or dividing lines in black and light grey, which also lend force to the alternating groups of squares in red and grey. The red shade imparts a warm tone to the colour scheme. Blue or green of certain hues thus used with grey would contrast satisfactorily, but would leave the carpet colouring cool in quality and wanting in richness of tint.

Theoretically, the designs for the field and border are two varieties of ornament, but in the carpet surface they constitute one decorative composition. Each design is so planned and tinted as to be complementary to the other. Unity of style is acquired by the system of colour blending, and by the inclusion, in the structural arrangement of the border, of sectional features of the patternwork common to the ground design.

In all compound designing, consisting of field and border ornament respectively, this rule should be observed of linking up the two species of decorative treatment. Though distinctive in form units and in basic plan, it is essential that the different pattern types should be naturally fashioned into one structural whole. The method of distributing the colours combined con-

tributes to this being done, but the result is strengthened when certain of the decorative features are used in both the field and border designs of the carpet, as in the example under consideration.

Two such decorative styles of work are capable of being efficiently linked together by the use of coloured lines, or lines woven in yarn shades common to each style of design. Thus the field and border patterns—A and B, Fig. 121—are, in the first place, rendered relative in toning by the lines in grey, red and black; that is, in the coloured yarns forming the pile in the checked features in A and in the decorative features in B. In the second place, they are more fully co-ordinated by the constructive plan and arrangement of the bordering, which comprises the following varieties of line and bands of effect.

BORDER STYLE. FIG. 121.

(1) A line in red.
(2) A line in silver grey.
(3) A checked band with the squares in red and grey.
(4) A parti-coloured line in red and black.
(5) A small decorative band.
(6) The main decorative band.
(7) A small decorative band.
(8) A second small decorative band.
(9) A row of rectangular spaces.
(10) A line in silver grey.
(11) A parti-coloured line in red and black.
(12) A stripe in grey.
(13) A parti-coloured line in red and black.
(14) A line in silver grey.
(15) Rows of rectangular spaces, three in width, in red and grey.
(16) A line in silver grey.
(17) A parti-coloured line in red and black.
(18) A stripe in grey, 2 rows of pile.
(19) A parti-coloured line in grey and black.
(20) Margin in grey.

The border design must in all cases fit with the repeat or repeats of the centre figuring, both in colour arrangement and in decorative composition; and it follows that each form of pattern requires to begin and finish with such fractional repeats that, in sewing length to length of carpet, the figuring joins correctly. The practice, in developing the decorative elements, is confined to the use of the coloured yarns employed. By frame " planting " or " setting," that is, dividing up a frame into two or three kinds of spools of yarn, the tinted features in the design may be varied. This is done in the third frame of the colour scheme for Fig. 122, which consists of green and blue spools arranged 5, 6 and 5. Planting diversifies the colour units in the carpet without increasing the number of frames. It gives the appearance of a five-frame colouring to a four-frame

PLATE IV.

BRUSSELS CARPET

production, or of a six-frame colouring to a five-frame, and so on. Thus, in certain lines of the ornament in Fig. 122, the colours combined are red, deep blue, drab and green, and, in other sections, red, deep blue, drab and medium blue. Skilful planting enables different or corresponding parts of the figuring to be woven in special colours, and this both enriches the colour quality of the carpet and emphasises the decorative style.

Regarding border patterns in general, they should be characterised by symmetry of construction. The several sectional divisions of which they are composed should contrast in width measurement and in decorative details, as in Figs. 121 and 122. Proportionate ratios may be followed, such as 8 or 6 inches in the principal band of ornament, 4 or 3 inches in the intermediate lines of pattern, and 2 or $1\frac{1}{2}$ inches in the stripings, with the divisional coloured lines in 4, 3, 2 or 1 row of pile. Diversity in colour and in decorative type is also essential. The first results from interchanging the positions of the coloured yarns in the weaving of the figured features. For example, in the broader bands the ground may be in the darker and the decorative effects in the medium and lighter tones; in the intermediate width of band, the ground in the lighter and the figuring in the medium and darker tones, with the more minute pattern forms in the smaller bands, in a medium shade, and the ground in a third colour tone. These points are well exemplified in Figs. 121 and 122. In the latter, the salient border design, C, consists of the more pronounced variety of ornament, the band D of a lesser type of pattern, and the bands E of more detail features; while the colour schemes follow the principle of developing the ground and figuring in the respective bands in different shades.

The specimen in Fig. 121 is a suggestive study in the practice of acquiring ornamental quality and contrast in the Brussels pile, the firm, clear structure of which tends to impart a degree of severeness and hardness to the pattern toning. Especially is this observed in the application of coloured yarns in contrasting hues. Here, however, three of the shades selected are in tone, differing in depth of tone and not in hue contrast with the red colour with which they are associated. Three such shades render it possible to develop the decorative types clearly and in relief, yet in such a manner as not to possess a light and shade appearance, which, as a rule, should be obviated in carpet designing. Flatness of tone in the ornament is important in view of the object to be attained, that of a decorative surface suitable for

floor embellishment. In band B of this illustration certain of the leaf forms are produced in light silver grey, with the blades of different leaves in medium grey and the veins in black. The structural lines of the figuring and also of the stems are developed in the three shades, grouped in couplets, such as two tones of grey, black and light grey, and black and medium grey. Each pattern element is forcibly brought out in strict keeping with its function in the complete plan of the design. Other colour tones, *e. g.*, three greens or three browns with a contrasting colour hue such as olive or blue, and similarly graded in depth as the shades in this example, are applicable to this designing practice.

The decorative style and colour scheme of the carpet in Fig. 122 are of a different order from that examined. Here the five shades of yarn are so arranged and distributed in the ornament, both of the field and the border, as to give a *mélange* tone of colouring. No particular colour unit is prominently visible, the carpet possessing a reddish aspect, tinged and mellowed in quality with blue and green. The geometric forms combined, and the structural scheme of the design, will be subsequently considered. At present, the transitions in colour admixture or grouping in the production of the varied patternwork, and the basis on which the border is framed, are the subjects for analysis. Taking the wave bands in the centre design, they are woven in black on a drab ground, with the decorative types they circumscribe edged in red, and with the divisional lines in green and blue. The ogee ornament has a red ground in contrast with the colours in the diamond-shaped and lozenge figures it contains. These figures have a black outline with the interior detail in drab, red, green, and blue—the general colour composition of the diamond features contrasting with that of the lozenge types.

The bordering—18 inches wide, including black margin—comprises the following lines of colour and decorative stripings :—

BORDER STYLE. FIG. 122.

1. A line in drab.
2. A line in black.
3. A parti-coloured line in red and black.
4. A parti-coloured line in blue and green.
5. A line in black.

E. A decorative band—1½ inches wide—with drab ground.

6. A line in black.
7. A parti-coloured line in green and blue.
8. A line in drab.

E¹. A small decorative band—½ inch wide—with black ground.

9. A line in drab.
10. A double line in red.
11. A line in drab.

C. Principal decorative band—7 inches wide—with drab ground in smaller and red ground in larger figures.
12. A line in drab.
13. A double line in red.
14. A line in drab.
Repeat E^1.
15. A line in drab.
16. A parti-coloured line in green and blue.
17. A line in black.
E. A decorative band—1½ inches wide—with drab ground and the successive figures woven in red and green grounds respectively.
18. A line in black.
19. A parti-coloured line in green and blue.
20. A line in red.
21. A line in black.
D. A decorative band—2 inches wide—with outlines of both types of figuring in drab, but the rectangular forms having a red ground and drab centre, and the lozenge forms a black ground with detail in drab and green.
22. A line in black.
23. A line in red.
24. A parti-coloured line in green and blue.
25. A line in black.
F. A small decorative band—1 inch wide—with drab ground. Edge in black.

It has to be noted in reference to this border style that (1) the ground shade is drab in bands C and E and black in E^1; and (2) that for the purpose of emphasising the figuring, when two or several ornamental types are used, the colour constituents of the respective types are varied in arrangement; as, for example, in the smaller and larger decorative units in band C, the first being edged with black and having a drab ground, with the arms of the cross in red; and the second having a red ground, changed to black in the rectangular spaces, with the detail effects in drab, green and blue. In band E the longer figure has a drab ground and the shorter figure a green and blue ground, with the detail in each woven in black and red. The fretwork ornament in section E^1 is produced in blue and green in accordance with the setting of the yarn spools in frame 2 in the looming order; while in band D each variety of ornament is outlined in drab and developed on a black ground, the X-shaped figures being in drab with a red centre and their companion figures in blue and green with drab detail. The principles of design and colour obtaining in the construction and development of the centre and border patterns in this example are common to the weaving of the various classes of decorative styles of pile carpets, whether Brussels, Wilton or Axminster in structure.

Three of the colours—red, sage green and olive—are of a similar tone depth in the example on Plate IV. The blue imparts colour bloom and the fawn definition to the details in the ornament. The colour quality of the carpet surface is, however,

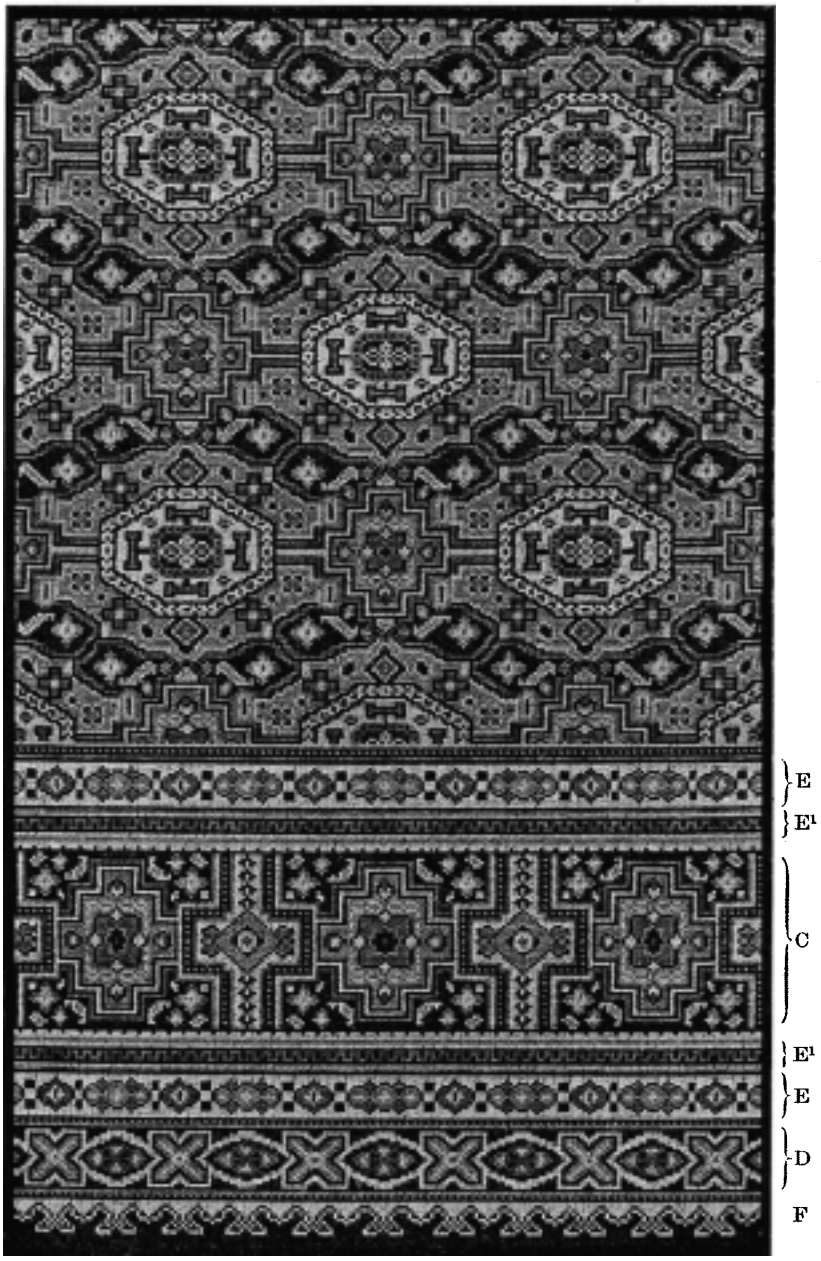


Fig. 122.

emphatically uniform in toning, the mellow contrast in the yarn shades being subservient to this object. The ground of the design in the " body " of the carpet is in terra-cotta red in contra-distinction to the chief colour, blue, of the broad decorative band in the border. In principle, the ornament throughout is partly geometric in structure, and partly a combination of conventional floral and leaf forms. The outer forms of the central figuring are in fawn and olive, with inner details similarly tinted on a blue ground, and with a middle feature woven in green and red. The decorative types, by which this figuring is surrounded, have the central form in green and blue outlined in red, and the petal-like details in blue outlined in fawn, with the leaf elements developed in the five colours in, approximately, equal quantities. In the warp line of the chief central ornament, the star-shaped figures are outlined in blue, olive and red. They contain a number of trefoil leaflets in blue lined with olive, and an interior detail in green and blue with red edging. The complementary figure to the latter, with a circular inner form, has its petals produced in fawn and blue tinted with green, and its middle portion in green and red, with the vandyked edging of the whole figure in olive and blue.

The border design is in contrast, in ornament and in colour association, with the pattern in the field of the carpet. The ornamental types are more clearly defined and of a more pronounced character, with blue as the ground shade in the principal decorative band. It is constituted thus :—

BORDER STYLE. PLATE IV.

1. A line in fawn.
2. A double line in green.
3. A line in red.
4. A marginal line in blue of decorative band D.

D. A decorative band—$1\frac{3}{8}$ inches wide—with *blue* ground, with simple leaf forms in red and olive; and pendant forms in red and fawn, with bud feature in red, green, and olive.

5. A line in blue.
6. A line in red.
7. A marginal line in fawn of decorative band E.

E. A decorative band—$2\frac{1}{8}$ inches wide—with *fawn* ground, and closely compacted figuring consisting of (1) features in olive with touches of green, and blue centre with red defining line; (2) of forms in red outline, with leaves in olive and fawn, and buds in red and olive; (3) of ornament with stems in red and green, and leaves in olive and green toned with blue; and (4) of rosette features with blue petals edged with red, also red spot edged with blue and olive.

8. A double line in fawn.
9. A line in blue.
10. A marginal line in red of decorative band F.

F. A small decorative band—1 inch wide—with *red* ground, and detail units in green and olive, and also in fawn and blue.

11. A line in green.
12. A double line in olive.
13. A parti-coloured line in olive and red.
14. A parti-coloured line in red and blue.
15. A marginal line in blue of the decorative band C.

C. Principal decorative band—7½ inches wide—with *blue* ground, composed of a centre type of figure, with intervening ornament, in which the vandyked edging is in fawn and red. The interior section of this figure is outlined in blue toned with green, with decorative details in red outlined with fawn. The upper portion of the basic forms of the figure are developed in fawn edged with blue, and the lower portion of such forms edged with red.

16. A parti-coloured line in red and blue.
17. A parti-coloured line in olive and red.
18. A double line in olive.
19. A marginal line of the succeeding decorative band in red.
    Repeat decorative band F.
20. A double line in red.
21. A line in blue.
22. A double line in green.
23. A line in red.
24. A marginal line in fawn of decorative band G.

G. A decorative band—2⅔ inches wide—with *fawn* ground, with figuring in blue, fawn and green, edged with red.

25. A line in red.
26. A double line in green.
27. A line in red.
28. A marginal line in blue, of decorative band H.

H. A decorative band—1½ inches wide—with *blue* ground as in bands C and D, and with clear detail ornament in red, fawn and green.

29. A double line in red.
30. A marginal line, in green, of decorative band I.

I. Small decorative band—1 inch wide—with green ground and in colour contrast with other decorative bands, suitably defining the marginal part of the border.

31. A line in red.
32. A double line in blue.
33. A line in fawn.
    Edging in red.

Each colour, in this fine quality of five-frame Brussels, is used for ground purposes in the effectively-arranged border style. The decorative bands C, D, and H, in which blue thus occurs, have a deeper colour quality than the figured lines F and I; while the bands with a fawn ground lend brightness of tone to the whole border composition. The interchange in the basic colour on this principle, should naturally link up the ornamental types. The colour units in each should be so employed and distributed as to effect this purpose. As in Figs. 121 and 122, the decorative forms, in this specimen, are in keeping with the width measurement of the different bands, yet in harmony with each other and with those making the centre design. These form fundamental elements in the origination of styles of ornament in which the border pattern is intended to be complementary, in decorative and colour type, to the pattern in the body of the carpet.

The specimen on Plate V. is a study in floral ornament of a

PLATE V.

BRUSSELS CARPET WITH "MARL" PILE

conventional description. The pile of the carpet is $\frac{3}{16}$ of an inch in depth and particularly full in filament structure, the pile yarns having been freely delivered from the spools in the weaving process. The groundwork is rendered interesting in character by producing it in two short lengths of line and in green and gold. A mingled tint is thus derived which provides a sixth colour unit, leaving the black, green, red, gold and the moresque yarns for combination in the development of the figuring. The ornament is flat in tone, with the different leaf and floral forms clearly delineated. Such delineation is due to three technicalities, namely, (1) contrast in the yarn shades; (2) practice in colour grouping; and (3) use of a mingled colour effect in the field of the carpet. Regarding the first technicality, the gold, red, and green differ in hue but correspond in tone, so that the features in which they are severally used may be similarly enforced by the use of black; while the four-fold twist yarn (see Looming Order), by being largely associated with gold, suitably defines the forms in which these two yarns occur. Second, the colours are grouped in mass or in detail to accord with the pattern units. Thus, in the blades of the leaves and the larger petals of the flowers, free patches of green and gold are employed; but in the close-petal flower, and in the middle portion of the floral forms, the colour tones are combined in single and double rows of pile. Third, the mingled ground colouring contrasts to the same degree with the features woven in gold and green, to a fuller degree with those in red which constitute the lesser parts of the ornament, and to the fullest degree with outlining features in black. In pile weaving, as developed in machine-made carpets, shaded elements are possible, but the object in this study, as also in carpet designs generally, is to express the decorative forms in clear but flat toning. This is apparently done by varying, as in this and other specimens examined, the principle of pile weaving, controlling the assortment of the colour ingredients to fit with the ornamental scheme.

Tapestry

The tapestry carpet may be either loop or cut pile on the surface, known as Brussels and Velvet-Pile tapestries respectively. The design features, in both grades of manufacture, are a product of printing, or of dyeing and printing, the pile yarns either before or after weaving. First, such yarns are printed collectively the required colours, correctly spaced throughout the length of

the threads to harmonise with the design scheme, before looming; secondly, the yarn loops of the woven carpet are thus printed; thirdly, the yarns are dyed a body shade and made into the carpet, and, on the colour of pile so derived, the pattern is afterwards printed; and, fourthly, specially-prepared or mordanted yarns are used which resist or attract the action of certain colouring matters, so that in single or two process dyeing a species of ornament is developed which may be complete in itself or be supplemented, particularly in the border sections of the carpet, by printing. In each method, the design is due to practices and routine distinct from weaving. Ordinary tappet looms with wiring motions, instead of Jacquard looms, may be employed, which effects great economy in production. The system also offers advantages in colour and decorative treatment, in so far as this is variable to an almost unlimited degree, being only restricted by the number of printings or equivalent processes carried out. The preparatory operations involved are, however, numerous and complicated, and necessitate highly-systematised practice and skilful attention to technical detail.

Originally, the yarns were separately block printed. The printers' task was simplified, and the results attained rendered more reliable and exact, by the inventions of Richard Whytock of Edinburgh in 1832. These led to the design and construction of the machinery employed in the modern yarn-printing trade. The machine, on which the actual printing is done, consists of a large drum or smooth-faced roller, the printing pulley and carriage, the colour box, and the mechanism for controlling the sequential but intermittent action of the printing rollers and the drum. The yarn is wound on the drum under a regulated tension. Immediately beneath the drum is the colour box, in which the printing pulley traverses from side to side as it prints or paints the yarn. The colour is in solution, being composed of the colouring ingredients and of a thin flour paste, and of such a consistency as to adhere to and penetrate through the yarn structure. The rotary movement of the drum is in absolute conformity with the colour lengths of yarn to be printed and with the spacing of the coloured yarn lengths, that is, in the relative distance of one colour unit from another as prescribed by the design. The yarn drums are usually 30 inches wide, but vary from 18 to 72 inches in width, and from 12 feet to 40 feet in circumference, and capable of containing 700 to 1200 rounds of the same thread laid side by side.

For printing purposes the sizes of the drums are designated in "scrolls" or "types" which equal lines of colour in the design, a "scroll" representing a traverse of the printing pulley across the yarn drum. The sizes in use include drums of 216, 324, 432, 648, 864, and 1072 scrolls. In employing a 648 scroll drum and in printing a design containing 216 wires, one revolution of the drum is equivalent to three repeats of the design. The intermittent rotation of the drum is regulated by the operative in accordance with the index in the "scale board," which is vertically divided into as many columns as there are repetitions of the pattern in the total number of "scrolls" in the drum, and ruled transversely into printing divisions corresponding with the rows of colour in the design. The section of the design dealt with at one time is, in process of printing, placed alongside the "scale," so that rows 1, 2, 3, etc., of the former accord with lines 1, 2, 3, etc., of the latter. With the colours in the pattern cream, fawn, red and blue, the yarn would first be printed in cream or the lightest colour, and in such lengths as this colour occurs in the successive rows of the design. This done the printer proceeds to his second drum while the "fillers" perform the work of "scraping," which equalises the colour ingredient applied and also cleanses the yarn. Next follows the printing in fawn, then in red, and lastly in blue, with the scraping process after each printing.

The units of colour thus produced in the yarns, corresponding with the coloured loops in the pile, are necessarily proportionately elongated with the difference between the woven and the warp length. Approximately, eight loops or wires per inch in the carpet take up three inches of yarn, and the measure of take-up in the weaving fixes the printed unit length, giving, in such a carpet setting, a print line in the yarn of $\frac{1}{3}$ or $\frac{3}{8}$ of an inch for each loop of pile.

The printed yarns are stripped from the drums in hanks which are numbered to indicate the threads they severally form in the pattern. After "stripping," the hanks of yarn are steamed, rinsed, hydro-extracted, and stove-dried. They are now in a fit condition for winding, which is done on double-head bobbins —these being also consecutively numbered for setting and beaming. For this work the bobbins are arranged in a creel, following the design order, from which the yarns pass through a sley, the lower and upper part of a clamp, over the "setting" table (on which they are examined for pattern accuracy), thence

through the parts of a second clamp, and a second sley on to the warp beam for looming.

The tapestry carpet, whether loop or velvet pile, consists of ground, stuffing and pile warps, a standard arrangement for each split of the reed being—

2 threads of 2-fold 7's cotton = 2nd and 3rd shafts.
2 or 3 threads of 16 to 18 lb. jute
1 thread of 2-ply 2-fold 12's worsted } = 1st shaft.

with 216, 210, 176 and 162 splits, according to the grade of manufacture, in 28½ inch sley, and woven with about 6's linen, and with 16 shots and 8 wires per inch.

The healds on the first shaft carry a double mail, the pile threads passing through the upper eyelet, and the stuffing-chain threads through the bottom eyelet, which is sufficiently long to admit of the shaft being actuated for lifting the pile warp without raising the centre or stuffing threads.

The weave structure of the looped pile tapestry is similar to that of the Brussels, and that of the cut pile tapestry similar to that of the Wilton carpet. The tapestry is a single pile fabric, being made of one series of pile yarns delivered off a chain beam, and not a compound pile fabric like the Brussels or Wilton, with the sets of pile yarn delivered off spools. All the worsted yarn employed in its manufacture is visible on the surface, and each pile thread in the warp is lifted for the insertion of each wire. The thread units per row of pile may be as compact as in the multi-ply pile production, but each row of pile consists, throughout the surface of the carpet, of the same series of pile yarns.

The wires used in producing the velvet pile have a knife at one end, so that on a wire being withdrawn from the warp it cuts the loops. The loop pile may wear flat or bare, but it remains part of the carpet structure; the cut pile is, on the other hand, more liable, in the use of the carpet, to be removed from the surface, especially if each tuft is only bound by one ground shot into the carpet structure, and rests on the threads of the stuffing chain. In the "three-shot" practice of shedding each tuft is crossed by two foundation shots. In a third type of structure, also "three-shot," the tufts are interlaced by single shots of ground weft, with the threads of the ground chain crossed by two picks under the stuffing warp, which gives the last arrangement inverted.

The fastness of the pile is affected by the closeness of the weaving, and also by the structure of the pile yarns. With such

FIG. 123.

yarns composed of two or three threads of 2-fold worsted, they provide the requisite filament density for imparting a satisfactory carpet surface both in regard to appearance and wearing property. By passing the ground shots exactly over the centre of the tufts, they bind and hold them firmly in their woven position. When one row of tufts is forced into close contact with another, the disposition for the fibres of the cut threads to leave their consolidated relation is reduced to a minimum. To intersect them with three shots is a mixed advantage if the number and yarn quality of the rows of pile is inadequate to cover fully the ground structure. It has the effect of fastening them more securely in the carpet surface, but the shots are, in such a case, liable to be exposed in the stretch and friction applied in the wear of the carpet. The points to observe in obtaining a full and permanent velvet-pile tapestry are (1) close wefting with 8 or 9 wires per inch; (2) effective binding of the tufts with the foundation picks; (3) employment of the correct counts and ply of pile yarn; and (4) a short, firm structure of tuft, which is dependent on the size of the wire used and on the three technicalities defined.

Tapestry carpets are produced in squares of 9 to 12 feet wide and in piece goods. Both types of manufacture are elaborate in design and colour composition, implying considerable cost in yarn preparation, printing and dyeing. Two styles of fabric are illustrated in Figs. 123 and 124, the first, velvet pile—made for the Egyptian—and the second, loop pile—for the home market. Fig. 123 is a design measuring $27 \times 40\frac{1}{2}$ inches. Produced with eight wires per inch it contains 324 ($40\frac{1}{2} \times 8$) rows of pile, and the yarn is printable on a 648 scroll drum, one revolution of which would equal two repeats of the pattern. The cut-pile surface is specially adapted for imparting softness of colour tone, and a white or light-tinted ground for exhibiting the quality of hue in analogous or contrasting colours. In using a number of colour units differing in tint and tone depth, a neutral ground shade should be selected, *e. g.*, cream or ivory white, or, as in this specimen, the natural colour of the wool in the worsted pile yarns. It is essential that this colour should harmonise with, and clearly define, each printed colour applied to the yarns for the development of the ornamental features of the carpet.

Yarn and fabric printing, by adding to the colour range of the carpet style, makes the task of the colourist increasingly involved. It is not, in this variety of designing, a question of combining three, four, five, or six colours, but of literally any

number, and of procuring, in their combination, clearness of pattern type, and colour distinctiveness and balance. In Fig. 123, and in many descriptions of printed surface ornament, the diversity of tinting is such as to be quite impossible of production by weaving processes, or by any other decorative practice than that of printing. The unique flexibility of the yarn-printing scheme is illustrated in this study, in which each ornate effect is developed in several colour tones. The subsidiary leaf forms are printed in green and fawn, deep and pale red, and in three tones of blue. The larger leaves are still more varied in colour composition, being outlined in deep blue, and in purple and green, and having the interior portions developed in three qualities of blue, with the lower sections in deep cream, blue, green, purple, lavender, heliotrope and crimson. Other leaf types are rendered in (1) two tones of blue green and two tones of yellow green; (2) green and fawn; (3) green and crimson; (4) deep and pale red; and (5) crimson and olive. The floral and bud elements are severally distinguished in tinted type by being printed in such colours as deep blue, fawn and warm brown; fawn, crimson and green; and three tones of fawn combined with two tones of green. The stem and branch features in the style are similarly diversified in colour toning, for, in their formation, two tones of light brown are used centrally with green and lavender for edging purposes, three tones of olive, and three tones of purplish blue—deep, medium and light in shade.

With such latitude in colour admixture as obtains in this specimen, the designs require to be skilfully executed on point paper, and demand careful and accurate printing and also "setting" in arranging the yarns for beaming. Colour running or displacement blurs the pattern details, and destroys the symmetry of the design. Some slight running of the colours, in the printing on the surface of the yarns of such a range of tints, is almost unavoidable. This may, however, be rendered less detrimental in result if the hues of the different colours combined strictly harmonise. A crimson tint may, for example, be produced by the unintentional admixture of blue and red, of peacock blue from the admixture of green with blue, and of ochre by the running of fawn into olive, but these, and similarly formed accidental tints, occurring chiefly on the edging of the figuring, may, in certain instances, prove colour features of value in the style. In other instances, this sort of colour bleeding induces crude colour contrasts; so that it is, as far as practicable, to be

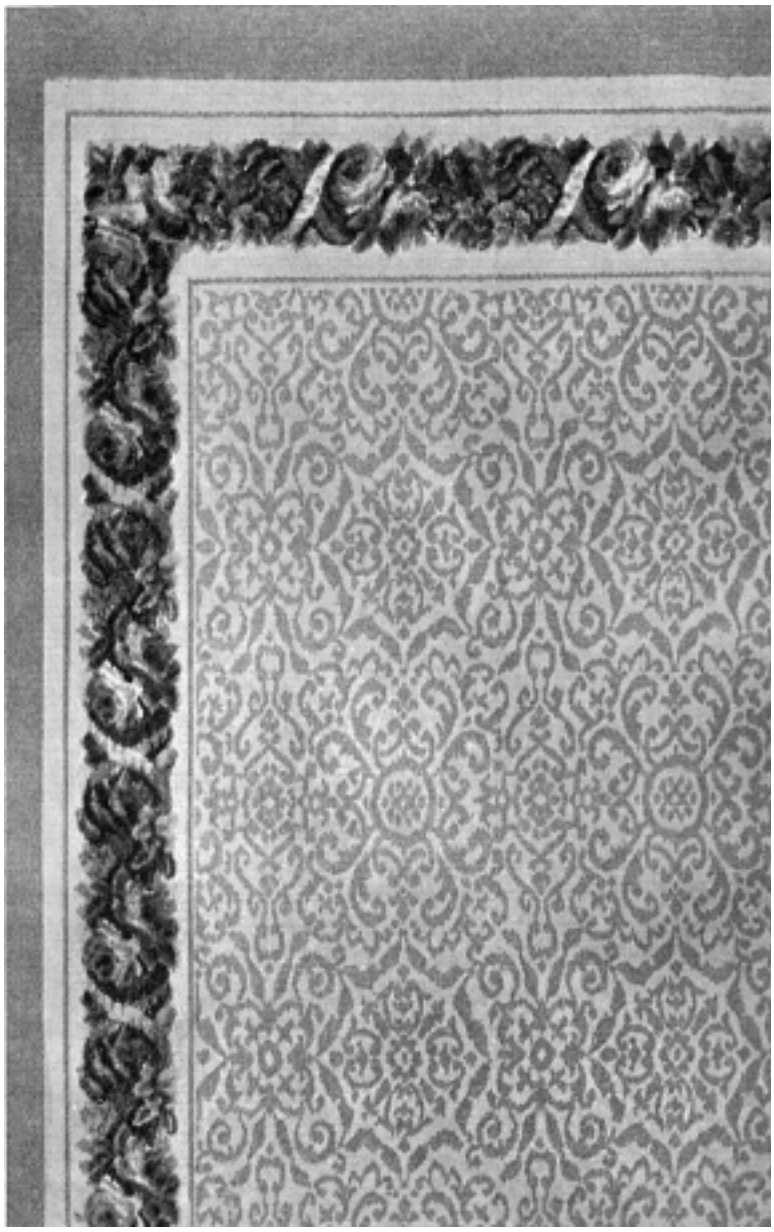


FIG. 124.

prevented. In any case it is advisable, first, that such colours should be used in the origination of the pattern which, if bleeding takes place, will give a resultant tint of a standard and not of a nondescript quality; and, secondly, that, in working out the designs on the scale paper, colours of satisfactory admixing properties should be placed in contiguity with each other.

Fig. 124 is a specimen of a tapestry carpet in which the pile yarns are dyed a body shade, namely, a light tone of grey, blue or fawn. The first process of printing—after weaving—produces the pattern in a darker tone in the filling and the dark bands in the borders. By successive printings, the floral design in varied tinting, which makes the border style proper, is acquired. The carpet is suggestive (1) of how closely a tapestry may be made to resemble a Brussels manufacture in pile structure and in design features; and (2) of the degree in which the dyer's and printer's arts are successfully applied in acquiring decorative style on a pile surface.

CHAPTER VIII

WILTON AND CUT-PILE CARPETS AND RUGS

Structural Characteristics of Velvet-Pile Manufactures—Chenille Axminster—Tufted Axminster—WILTON VARIETY OF PRODUCTIONS—Weaving Principles Common to Brussels and Wilton Carpets—Essential Differentiations between the Two Types of Manufacture—Schemes of Intertexture—Two-Shot and Three-Shot Wiltons—Wiring—Setting Scale—Pile Quality—Yarn Type—Fibrous Materials and their Influence—Comparison with Eastern Practices in Material and Yarn Selection—Pile Length—Short and Long-Pile Carpets—Technicalities affecting Pile Structure and Wearing Efficiency—Productive Data—Three-frame Examples—Size of Wire—Woollen-Yarn Pile—Border Planning—Carpet Squares—Function of Colour in Designs Slender in Ornate Features—Field and Border Patterns—Border Example composed of Four Varieties of Ornament—Turkey Style of Manufacture—Standard Red, Green and Blue Colouring—Five-frame Wiltons with Thirteen Rows of Pile per Inch—Pile Compactness and Density—Weaving Accuracy—Worsted-Yarn as Compared with Woollen-Yarn Pile—Use and Efficiency of Multi-Ply Yarns—Constructive Particulars of Fine Wiltons—Durability of Pile Surface—Ornament in Fine-Wilton Squares—Construction of Wilton Squares—Specimen in Tone-upon-Tone Colouring—Harmony and Unity of Field and Border Variety of Ornament—Employment of Divisional Lines of Colour in Border Styles—Diversity in Width of Border Types—Border Specimen with Design Units woven in Contrasting Colours—Cinema Wiltons—Fineness of Tufted Rows—Partially Shaded Ornament—Decorative Strength and Symmetry—Shades of Ground and Figuring Yarns—Continental Wilton—Designs Varied and Active in Type—VELVET CARPETS—Wilton and Velvet Manufactures Compared—Tournay Velvet in Body Carpet—Dissection of Ornamental Scheme—Application and Development of Strong Decorative Forms—Practices in Colour Delineation—Colour Location—Saxony Velvets—Depth, Fineness and Closeness of Nap—Yarn Counts in Saxonies—Ornate Distinctiveness and Tone—Application of Mixture-Shade Yarns—Wilton Rugs, Example in Design and Colouring—Cut-Pile Rugs as Substitutes for Skin Rugs—Structure and Weaving Principles.

THERE are three varieties of velvet or cut-pile carpets, namely, the Wilton, the Chenille Axminster, and the Machine-tufted Axminster. In surface features they are similar but differ in the system of design development, in the structure of the pile, and in methods of manufacture. The Wilton is the earlier type. It is related, in weaving construction, to the velvet, the plush, and all other cut-pile fabrics. Like the Brussels, it is weavable in the Jacquard loom. The Chenille Axminster is acquired, firstly, by making a "fur" yarn coloured in the order of the

integral sections of the pattern style to be woven, and, secondly, by inserting such " fur " yarn into a carpet structure in an ordinary loom, geared and mechanically adjusted to give a carpet make of fabric. It is, therefore, a carpet resulting from two distinct systems of work, that of chenille yarn formation and that of carpet weaving. The Machine-tufted or Royal Axminster is also a compound manufacture. In the first place, the pile tufts, or yarns of which they are composed, are prepared in accordance with the design scheme; and, in the second place, these tufts are, in weaving, bound by the shots of weft into the ground of the carpet.

The Wilton and Chenille-pile systems of production are of English origin, while the Machine-tufted system is an American weaving invention, introduced into this country in 1878.

Wilton Variety

The term Wilton strictly applies to a close, short, cut-pile description of carpet, with the pile varying in depth from ·133 to ·1875 of an inch. The weaving principles by which it is manufactured are common to a number of velvet-pile carpets in which the pile ranges from ·25 to ·5 or ·3125 of an inch in length. Structurally, such carpets resemble the Brussels production. They are woven in the same class of loom mounting, and formed of a similar series of warp yarns arranged on a like system in the harness and shafts, with the pile threads delivered off spools. They are consequently classed as three-, four-, five- or six-frame Wiltons or velvets. The essential difference between their character and surface quality as compared with the Brussels is due to the pile being cut instead of uncut. This difference changes, in some instances, the method of binding the pile yarns and therefore modifies the weave plan of the carpet. The schemes of warp and weft interlacing adopted in producing the Wilton, and also in making what are commercially designated " velvet " carpets, such as the Tournay example in Fig. 133 and the Saxony specimens in Figs. 134, 135 and 136 are shown in the sectional drawings in Figs. 125 and 125A.

These drawings represent the two-shot and the three-shot principles of carpet construction. Fig. 125 is the ordinary Brussels-pile manufacture with the loops cut to form a nap of filament. In modern practice this method is frequently utilised, as it results in some economy in weaving and provides for the

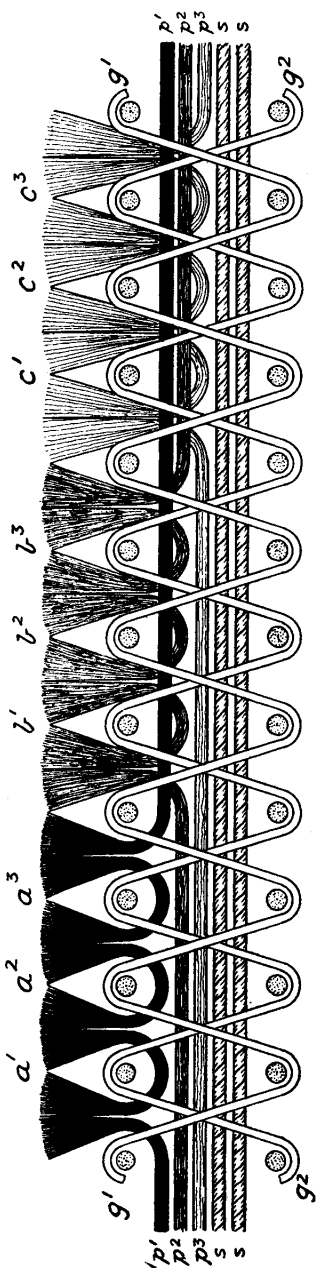


FIG. 125.

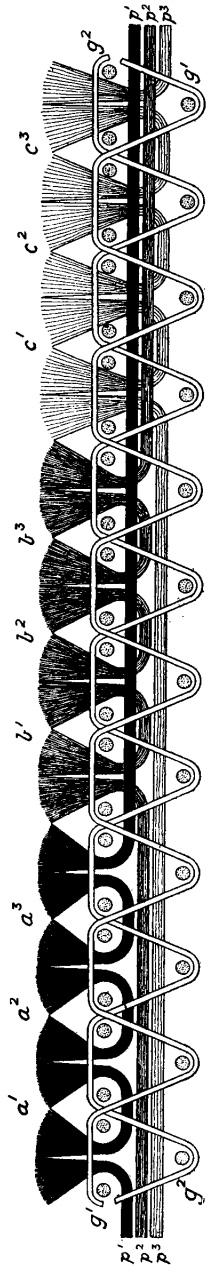


FIG. 125A.

pile tufts being forced by the reed into close contact with each other, which is not so readily effected in the three-shot system of weaving shown in Fig. 125A. Still, the latter has the advantage in producing a faster pile structure. It will be seen that, in Fig. 125 the tufts are only bound by single shots crossing over them centrally, such shots also interlacing with ground threads g^1 and g^2 which further binds the tufts into the carpet foundation. It is better, as regards the construction of an efficient wearing pile, that the tufts should be equally formed into the fabric on either side, or as illustrated in the cross section of the three-shot Wilton in Fig. 125A. This practice secures each row of pile tufts, as observed at a^1, a^2, a^3, b^1, b^2, b^3, and at c^1, c^2 and c^3, being covered by the first and third and by the fourth and sixth shots in the shedding scheme, with the second and fifth shots interweaving with the ground chain threads below the pile and stuffing yarns.

In Fig. 125A corresponding letters refer to similar threads as in Fig. 125 g^1 and g^2 being the foundation ends and p^1, p^2 and p^3 the pile yarns, with the circles representing the ends of the shots of weft. Following the course of the threads in Fig. 125A, thread g^1 passes over shots 1, 2 and 3 and under shots 4, 5 and 6; and thread g^2 under shots 1, 2 and 3 and over shots 4, 5 and 6. The pile threads, when not used in producing the velvet nap, extend between the upper and lower series of shots as in Brussels carpets. The sketch being of a three-frame Wilton, there are three sets of pile yarn—p^1, p^2 and p^3—for giving the three varieties of pile tufts sketched in black, toned grey and in grey..

The sheds for shots 2 and 5 are the double-deck sheds in which wiring takes place. This is done as in loop pile weaving, but the knife at the ends of the wires, on the latter being automatically withdrawn, cuts the rows of loops as in the tapestry velvet carpets referred to, changing them into tufts of yarn. The fibres in the yarns immediately spread laterally and cover the space between the binding shots or the surface of the ground of the carpet. With the build of cut and uncut pile carpets being in the essential features identical, the designs producible in one structure are weavable in the other, providing the rows of pile per inch in the two structures should correspond, but the practice is for the velvet pile to be more closely wired than the loop-pile manufacture.

The average setting in the Brussels has been seen to be 9 or 10 rows, but in the finer makes of Wilton 11 to 13 rows per inch

are the rule. Either yarns of a pure worsted structure or yarns of a carded quality are usable in the pile, one giving a brighter tone and the other a softer tone of velvet, that is, a velvet to a degree fuller in filament units owing to the higher percentage of short fibre in the yarn. In a general sense it may be said the more the yarn approaches the woollen structure the denser in filament quality and the deeper the colour tone of the velvet.

Pile quality and softness are definable by pile density and length. The better the make of the carpet, the more compact the filament composition of the pile. Yarn counts and ply affect this, as also does the closeness of the weaving. In regard to the former, the yarn counts have necessarily to be of a diameter measurement to admit of the requisite number of the pile ends per inch as governed by the frame of the carpet, but obviously there is some latitude for variation in the yarn thickness in a given carpet setting, *i. e.*, dents per inch. As the yarn is diminished in size it reduces the weight of fibre and the multiplicity of filament units per square inch in the pile; and in the ratio with which it accords with the maximum thickness of thread admissible, it increases the weight of fibre and filament units per square inch in the velvet surface. In other words, the pile quality—textural tone, treading softness and filament fulness—suffers with the reduction of the yarn diameter and improves with the enlargement of the same within the prescribed ends weavable in a split of the reed.

The class and nature of the fibrous material used in spinning the pile yarns also require to be taken into account. If this is comparatively coarse in staple, the pile deteriorates in filament closeness. The finer-grown Australian and New Zealand cross-breds in worsteds and merinos in woollens, possessing tensile strength and elastic property, prove of the greater efficiency in giving a well-compacted velvet surface. Yarns may be of the correct counts, but, without due regard being had to the average smallness of diameter of the individual fibres in the wool, mohair, camel-hair or other material of which they are composed, the pile is liable to be thin in texture. Assuming two yarns, both of the same circumferential area, one consisting of fibres of $\frac{1}{500}$ to $\frac{1}{850}$ of an inch in diameter and the other of fibres of $\frac{1}{1800}$ to $\frac{1}{2500}$ of an inch, they would give different varieties of pile; in carpets of the same structure each pile surface would consist of a similar number of thread units, but that derived from the application of the yarn spun from the finer wool would contain

some three to four times more filament units than that formed of the yarns made of the coarser wool.

Eastern carpet weavers have acted upon these principles from early times. In Chapter I it is made clear what pains they exercise in selecting the finest-grown wool, camel-hair, etc., and in constructing yarns of the correct size, fulness and softness, for the superior grades of carpets. Analysis of oriental ancient and modern manufactures shows that the Persian weavers have systematically studied the class of fibre and type of yarn for developing a pile of the right property. The threads are loosely spun, dense in filament, and of a size in thickness corresponding with the set of the carpet. What is requisite in material and in yarn structure to obtain the best results as to colour tone and treading quality in the hand-tufted carpet or rug, is equally requisite in obtaining trueness of character in the velvet pile of machine-made productions.

Pile length is a factor which allows of considerable variation in manufacturing practice. As the length is increased, the pile more closely approximates in some instances to that procurable in the vertical loom. This, however, does not imply that carpets in which the pile is a small fraction of an inch in depth are correspondingly deficient either in velvet fineness or covering. On the other hand, in the thirteen-row tufts per inch Wilton, with a pile length of ·145 of an inch, the velvet surface is equally dense in filament—yarn counts and materials of which they are spun being suitably adjusted—as in carpets of a like setting with a pile depth of ·25 or ·5 of an inch. But the two carpets differ in softness and in surface flexibility, inasmuch as in the first variety the comparative shortness of the pile brings the tread in the wear near to the foundation of the carpet, whereas in the second variety the greater length with which the pile projects from the foundation precludes the immediate approach of the tread in the wear to the structural part of the carpet. Pile length is, therefore, an important feature in producing wearing efficiency and treading resistance and resiliency. The thicker the pile layer—composed of the more costly fibre in the carpet—the better, in some respects, the carpet manufacture; yet thickness is not tantamount to pile quality as understood by thread and filament composition. Some of the finest Persian carpets—Kirman, Tabriz, Kamanshah and Sehna—are light and flexible in the make, with the nap not more than $\frac{3}{16}$ of an inch in length, but owing to the number of tufts per square inch, and the choice

grade of wool fibre of which the yarns are spun, carpet value and richness result. Similarly in the closely-woven Wilton with a nap of a like *length* consistency, and made of yarns composed of merino wool, the pile, as to smoothness and compactness, is of the finest quality.

It is now clear that the technicalities which affect the structure and value of the pile covering in Wilton and velvet-pile carpets comprise (1) close weaving, as determined by the rows of pile tufts per inch; (2) yarn counts relative to the set of the carpet, that is, the circumferential area of the pile yarn being such as to render each pile tuft an efficient pile covering in the space it occupies in the surface of the carpet; (3) yarn quality as determined by the fineness of the fibre used in the production of the pile yarn—the ratio of filament fineness fixing the ratio of filament units in a given diameter of yarn, and therefore in a single pile tuft; and (4) pile length, the ratio of which prescribes the thickness of the velvet pile covering of the carpet.

The analytical study of a number of typical specimens will render these features in pile formation, as well as other principles in the manufacture and design of these carpets, more evident. The examples selected for examination include (*a*) three-frame Wiltons of the carded yarn quality; (*b*) five-frame, Turkey style; (*c*) five-frame, fine make carpet square; (*d*) five-frame, cinema carpets; and (*e*) five-frame, continental manufacture.

The weaving data for the three-frame manufactures are as follows :—

FIG. 126.—*Order of Looming.*

1 threads of 3-fold 7's cotton, ground chain.
2 ,, 8 lb. jute, stuffing chain.
1 thread of 2-fold 8's woollen, black. Frame 1.
1 ,, ,, ,, ,, crushed strawberry red. Frame 2.
1 ,, ,, ,, ,, blue, with cream or fawn as a planting colour. Frame 3.
8 splits per inch, 7 threads in a split.
214 unit pitch of carpet.
Weft : 8 lb. jute.
18 shots and 9 wires per inch.

FIG. 127.—*Order of Looming.*

2 threads of 3-fold 7's cotton, ground chain.
2 ,, jute, stuffing chain.
1 thread of 2-fold 8's woollen, dark blue or black. Frame 1.
1 ,, ,, ,, ,, fawn, with gold as a planting colour. Frame 2.
1 ,, ,, ,, ,, peacock blue. Frame 3.
8 splits per inch, 7 threads in a split.
214 unit pitch of carpet.
Weft : 8 lb. jute.
18 shots and 9 wires per inch.

The wires used are ·155 of an inch deep, giving a short variety of pile, which is mellowed in colour quality by the carded structure

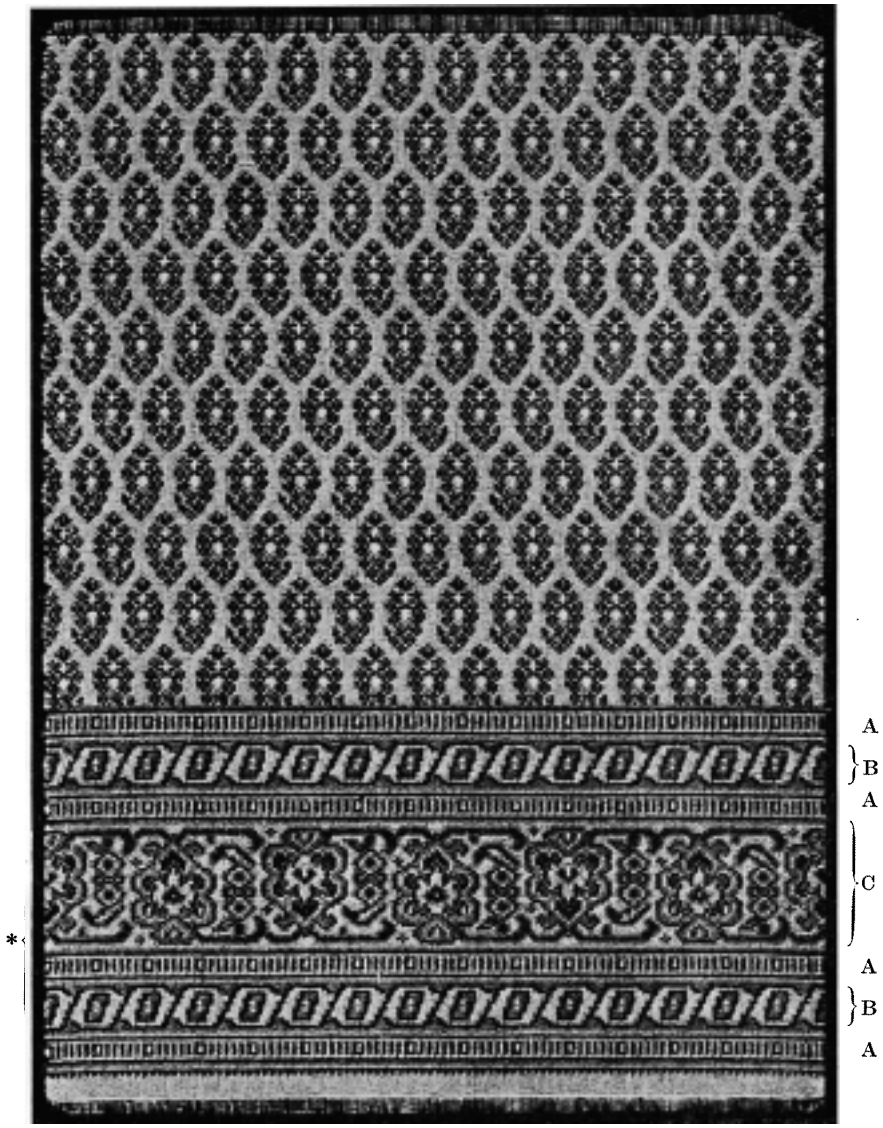


Fig. 126.

* The piece bracketed is enlarged to full scale in Fig. 174.

of the pile yarn. The velvet is not particularly full in the nap, as the yarn used is moderately fine for the setting of 8 splits

and 9 wires per inch. This equals 9 threads per inch in the rows of pile, and 72 tufts of yarn in each square inch of the carpet surface, with each unit thread in each tuft approximately $\frac{1}{30}$ of an inch in diameter. The carded yarn is effective in rendering the filament ingredients in the tufts diffusive in character, so that the tufts impart a degree more fulness to the nap than if worsted yarn of a like count had been used.

The original of Fig. 126 has a crushed strawberry red ground with the figuring in both the field and border of the carpet mainly woven in black and blue. The cream planting colour imparts tone and freshness to the design, specking the pattern forms expressed in the black and medium blue shades. The ornament in the field is in contrast and yet in harmony with that applied to the border. The two varieties of ornament typify the strength of design structure obtainable in this class of carpet by the skilful use and arrangement of simple pattern elements. The diversity of decorative features in the border stripes, and the method of grouping bands of different widths in solid colours and in figured effects, form important principles in determining the quality of this and similar styles of carpet ornamentation.

The border scheme comprises :—

1. A line in blue lavender.
2. ,, black.
3. ,, blue lavender.

A. A decorative line—1 inch wide— with strawberry red ground with rectangular figures and vertical lines in black, specked with cream or fawn colour.
Repeat 1, 2, 3.

B. A decorative band—2½ inches wide—with red ground, and figuring in black and blue, with the rectangular forms spotted with fawn.
Repeat 1, 2, 3.
,, A.
,, 1, 2, 3.

C. Main decorative band—4½ inches wide—red ground; figuring, arranged on the turnover base, developed in black and blue relieved by touches of fawn.
Repeat 1, 2, 3.
,, A.
,, 1, 2, 3.
,, band B.
,, 1, 2, 3.
,, A.
,, 1, 2, 3.
Edging in strawberry colour.

The example in Fig. 127 is somewhat more elaborate in decorative style. The ground of the original carpet is a peacock blue, with the figuring in fawn, gold and dark blue or black. The design for the field is constructed on the centre principle of

structure; and is illustrative of the practice in providing comparatively broad spaces of colour in the ground on which to display the pattern types. With these types varied but slender in

FIG. 127.

character, as in the field of this specimen, such ground spaces, woven in a soft tone of colour, render colour tinting the prevailing feature in the surface ornament. In ornate styles

in which the stem and other decorative details are more or less incoherently grouped, the colour tones, and the methods of their application, should, as done in this specimen, link one element with another, and also give brightness and unity of composition to the whole design scheme. Planting or extra colours, in certain frames, are employed for this purpose. When the object is to retain and not to modify the colour toning by the insertion into the design of "extra" or "planting" colours, such colours should be of a similar hue to those used in the figuring. Here, for example, in sectional parts of the design, gold takes the place of fawn, touching up and relieving the system of ornate expresson in both the field and border of the carpet.

The peacock blue in the ground of the former runs through the border, forming certain intermittent lines with the dark blue and the colour on which the decorative features are woven in the bands A, B, C and D. The border style comprises four species of ornament, that of the small features in A, of the leaf and geometric forms in B, of the broader ornate forms in C, and of the detail patternwork in D, and is composed thus :—

1. A line in dark blue.
2. ,, fawn.
3. ,, dark blue.
4. An intermittent line in dark blue and peacock blue.
5. A line in peacock blue.
6. ,, dark blue.
7. ,, fawn.

A. Decorative band—1 inch in width—with diamond types in dark blue and linking types of ornament in fawn on peacock blue ground.

8. Line in fawn.
9. A line in dark blue.
10. ,, peacock blue.
11. An intermittent line in dark blue and peacock blue.
12. A line in dark blue.
13. ,, fawn.
14. ,, dark blue.

B. Decorative band—$1\frac{3}{4}$ inches in width—semi-Arabic in style, with peacock blue as the ground shade and fawn and dark blue as the figuring shades.

15. A line in dark blue.
16. ,, fawn.
17. ,, dark blue.
18. An intermittent line in dark blue and peacock blue.
19. A line in dark blue.
20. ,, fawn.
21. ,, dark blue.
22. ,, peacock blue $\frac{1}{2}$ inch in width.
23. ,, dark blue.

C. Main decorative band—6 inches in width—in which the conventional floral forms are woven in fawn and dark blue, and the irregular leaf forms in dark blue and peacock blue, with fawn as an interior base colour, but with peacock blue running in the ground space intervening the two types of figuring.

Repeat 23 to 15.
„ B.
„ 14 to 8.
„ A.
„ 7 to 1.

D. Small decorative band—1 inch in width—with ornament developed in dark blue and fawn. Marginal edging in blue.

This example, and that in Fig. 126, are illustrative of the medium grade of Wilton manufacture. A lower grade is made in inferior yarns and with $7\frac{1}{2}$ to $8\frac{1}{2}$ wires per inch, and also in a 214 unit pitch of carpet. Better grades are produced with woollen yarn for pile in 236 and 256 pitch with four or five frames. An example of this description is shown on Plate VI., a five-frame structure, Turkey style of design, and loomed as below :—

Order of Warping and Healding. Specimen on Plate VI.

2 threads of 2/7's cotton.
2 „ 8 lb. jute.
1 thread of 2/8's woollen, dark blue. Frame 1.
1 „ „ „ purple blue. Frame 2.
1 „ „ „ vermilion red. Frame 3.
1 „ „ „ green. Frame 4.
1 „ „ „ buff. Frame 5.
9 threads in a split, 8 splits per inch.
236 unit pitch of carpet.

Weft : 8 lb. jute.
9 wires per inch.

As in the two preceding specimens, the woollen yarn contributes to the quality of the pile, which is close and full in filament and a degree longer in the nap than in Figs. 126 and 127, the size of the wire used being ·255. This carpet, in the vermilion red, leaf green, deep blue and purple blue shades applied, with red in the ground, is rich in colour hue and tone. The red colour is of the depth and brilliancy which distinguish hand-woven Turkey carpets. The leaf green, which is introduced in pronounced quantities into the chief ornamental figuring seen in half section on each side of the specimen, is a contrasting colour of the red and a complementary colour of the two shades of blue.

The design is planned on a base, like Figs. 121 and 122 and the example on Plate VII., to be applicable to the construction of carpet squares of different dimensions, but always in width measurement in multiples of 2 feet 3 inches. Only a section of the pattern is shown. In weaving the left-hand border a section of the field is formed which corresponds with and completes the decorative features on the left of the specimen, and similarly in weaving the right-hand border a section of the field is formed which corresponds with and completes the decorative features on the right of the specimen. For larger " squares " one or more

sections seen in the illustration are woven and fit in a like manner with the two borders. The length of the square in each system of construction is determined by the number of the repeats of the design in the field.

The pattern type is of the broad, pronounced cast of ornament in keeping with the standard Smyrna, Oushak and Yuprac red and blue Turkey manufactures, in which the ornate and colour style is frequently relieved by the development of detail elements in an orange or a warm buff shade. This colour in the example tones equally with the red and blue shades, and, as such, is a linking colour unit in the scheme of surface decoration.

In addition to the lines of colour in red, blue and deep blue, and of intermingled lines in blue and red in the border, there are several decorative bands measuring from half an inch to six inches in width in which the ground shade is either red or green. These include (1) a small-width band, with a red ground and the ornament in dark and medium blue; (2) a band of 2 inches wide with a green ground and the figuring in red, buff and the two tones of blue; (3) a band of $1\frac{1}{2}$ inches wide with a red ground and the ornate elements in blue shades; (4) a principal band of 6 inches wide with a red ground, linking up the border scheme of colouring with that in the field of the carpet, with the ornament developed in blue, green and buff shades; and (5) a band of $3\frac{1}{4}$ inches wide with a green ground with the decorative forms woven in red, blue and buff.

The two subsequent examples, that on Plate VII. and the border style in Fig. 128, are typical of the finest variety of Wilton manufacture. In both these carpets there are thirteen rows of pile yarn per inch and nine and a half splits per inch in the reed, with each split containing five pile, two ground, and two stuffing yarns. The size of the wire used in each weaving is ·145, yielding a pile of about $\frac{1}{8}$ of an inch in length. Such is the filament density of the nap that on bending over the carpet surface only a slight part of the foundation fabric becomes visible, whereas in the lower grades of production this test reveals the cotton and other yarns employed in making the ground of the carpet. The number of pile tufts per square inch in each specimen is 124 or equal to 248 ends of multi-ply yarn. Considering that this consists of 3-ply 2-fold 14's and of 3-ply 2-fold 12's worsted (= $2\frac{1}{3}$'s and 2's counts) the result is a very close, compact, firm nap, with each thread unit in each pile tuft $\frac{1}{30}$ to $\frac{1}{32}$ of an inch in diameter.

PLATE VI.

WILTON CARPET

The particulars of construction for the respective specimens are :—

Order of Looming, Fine Wilton Square. Plate VII.

2 threads of 3-fold 8's cotton, ground chain.
2 ,, 3-fold 4's ,, stuffing chain.
1 thread of 3-ply 2/14's worsted, deep blue. Frame 1.
1 ,, ,, ,, ,, medium blue. Frame 2.
1 ,, ,, ,, ,, deep fawn or buff. Frame 3.
1 ,, ,, ,, ,, medium fawn or buff. Frame 4.
1 ,, ,, ,, ,, light fawn or buff. Frame 5.
9 threads in a split, 9½ splits per inch.
256 unit pitch of carpet design.
Weft : 3-fold 8's cotton.
13 wires and 26 ground shots per inch.

Order of Looming, Fine Wilton Border. Fig. 128.

2 threads of 3-fold 8's cotton, ground chain.
2 ,, ,, 4's ,, stuffing chain.
1 thread of 3-ply 2/12's worsted, black. Frame 1.
1 ,, ,, ,, ,, flat tone of crimson red. Frame 2.
1 ,, ,, ,, ,, lavender blue. Frame 3.
1 ,, ,, ,, ,, deep fawn. Frame 4.
1 ,, ,, ,, ,, light fawn. Frame 5.
9 threads in a split, 9½ splits per inch.
256 unit pitch of carpet design.
Weft : 3-fold 8's cotton.
13 wires and 26 ground shots per inch.

Accuracy in weaving, and the use of multi-ply pile yarns of the correct unit thread counts and made of a suitable quality of wool, are the essentials in the production of these high-class goods. The worsted thread structure is selected as giving a brighter tone of surface to the nap than yarns of the woollen structure. The wool should be of a fine crossbred variety, as possessing a degree more lustre than wools of the merino character, and as yielding a yarn of improved elastic and tensile property. Treading on such carpets has little perceptible effect on the pile : it neither flattens nor suppresses it, but leaves the filaments projecting in a vertical line from the ground structure. It is so elastic and stable in formation as to resist pressure without undergoing any alteration in appearance or tone. In hard wear the pile is necessarily gradually diminished in length, but it continues to conceal the yarns in the back of the carpet so long as the nap is not totally disintegrated. These properties of durability and tensility of pile surface are due to three causes : first, the closeness of the pile tufts to each other, being, in the weaving of the carpet, literally compressed into actual and permanent contact with each other, so that one row of tufts supports and sustains the adjacent rows; second, the yarn type, loosely twisted in the folding but firmly spun in the single

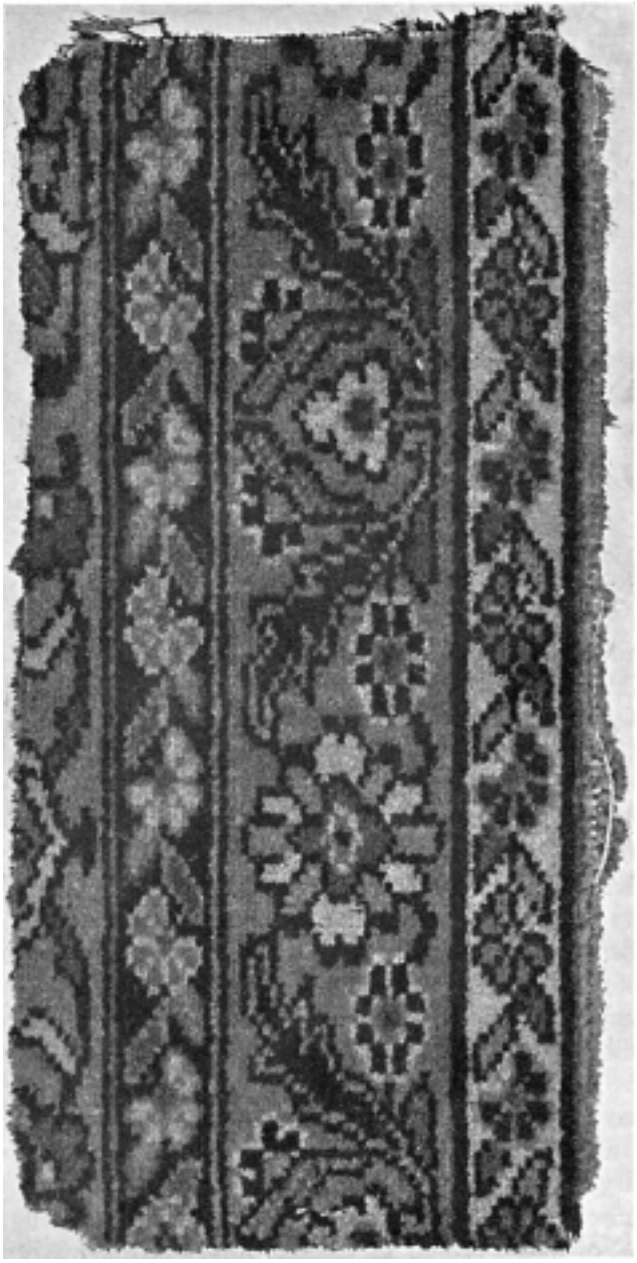


Fig. 128.

threads; and, third, the flexible and tensile efficiency of the staple of the wool used.

To employ 2-fold 4's yarn, giving an equivalent size of thread as 3-ply 2/12's worsted, would not produce the same density and elasticity of nap, nor one of a corresponding covering nature. It would possess a similar quantity of filament but be defective in diffusiveness of character and in surface fulness. The multi-ply thread consists of two ends of 12's worsted folded into one yarn, and of three ends of the latter twisted together, or of six strands of 12's yarn, and these six strands of fibre, when the tufts are cut, spread over the foundation yarns of the carpet, as seen in the sectional drawing in Fig. 125. Should, however, a like thickness of yarn, composed of only two thread units, be substituted for this multi-ply yarn, it would, in the cutting of the tufts, form two ends of pile each consisting of two threads, as compared with six threads in each end of pile in the system of pile yarn construction indicated.

While the two specimens do not materially differ in scheme of manufacture, they differ in design and in colour composition. The former is for a Wilton square and the latter a Wilton border style. That on Plate VII. is woven in colour tones, three shades of fawn and two shades of blue, and that in Fig. 128 in colours contrasting in hue, namely, in black, blue, red, and light and deep fawn.

The ornament in both examples is English in character. It is pronounced in tone, clearly defined, and precise and symmetrical in arrangement. There is no intricate blending of the structural lines of the figuring, each ornate feature is distinctive in drafting and in colour expression. Design strength and unity are evident in viewing either sectional parts of the pattern or the whole ornamental scheme. Analysing the two types of work separately, in the first—Plate VII.—a full section of the style is given. For completing the "square," the borders and their complementary decorative units require to be added by the practice explained in reference to the example on Plate VI.

The left-hand border showing the corner design for Plate VII., and also the part of the figuring which fits with the side of the field design, forms the illustration in Fig. 129. In a "square" 2 yards 9 inches wide, on this basis of sectional construction, one repeat of the design occupies the whole of the field. In the portion of the figuring in which the lighter shade of fawn is applied to the ground, the pattern forms are woven in medium and deep fawn

edged with dark blue; while in the portion of the figuring in which deep fawn makes the ground shade, the pattern forms are woven in light and medium fawn with their marginal lines in blue. On the dark blue ground the edging lines of the ornament are formed in light fawn. In this way several practices in pattern outlining and definition are combined. The interchange of the shades in the ground and in the figuring equalises the colour toning. Moreover, with the ornamental units thus developed, apart from the effective principle of design drafting, the ground colouring is rendered a conspicuous quantity in the full decorative scheme.

Tone-upon-tone colouring is adapted to this principle of patternwork. There are no extreme colour or form contrasts to contend with. Either the fawn or blue shades may be transposed from ground to figuring and the colour register yet be kept constant. The blue shades are complementary in hue to the fawn shades, which makes it feasible to apply the dark or medium blue to the figuring, to marginal lining or to the ground, and to use the dark, medium and light fawns for similar purposes, with the attainment of colour balance in all parts of the design.

Softness of colour tone is the salient feature of this practice in shade blending and in design composition. Two green and three brown shades, or two olive and three blue shades, similarly graded in tone to the colours in the example, are also combinable by the same methods. Neither in the pattern forms thus developed, nor in the colour contrasts acquired, is there any approach to hardness of effect, yet the sectional parts of the decorative ornament are clearly delineated in whatever shade units they are produced. Contrasts in tone differentiate from contrasts in hue inasmuch as they are more subdued in quality. It is essential, however, in their application to observe (1) that the degrees in tone depth are equal to distinguishing the pattern forms from each other; and (2) that the simple hue contrast—*i. e.*, blue and fawn—which obtains in the five or six colours combined should be of a complementary nature.

The border style in the carpet—Plate VII.—harmonises in decorative type and in colour development with the design in the field. It consists, first, of a band of minute pattern details in dark blue or fawn; second, of a band of more pronounced pattern elements in medium blue lined with dark blue alternating with figuring in light and medium fawn shades on a deep fawn ground; third, of a band of an intermediate grade of ornament

PLATE VII.

FINE WILTON CARPET

also in the two shades of fawn on blue; fourth, of a repetition of the first band; fifth, of a band 7 inches wide composed of conventional and geometric units in the three fawn shades and medium blue on a dark blue ground; and of repetitions of the fourth, third, second and first decorative bands making a border, with the addition of the divisional lines in blue and fawn, $17\frac{1}{2}$ inches in depth.

In the effective Wilton border example in Fig. 128 light fawn is the ground shade in band A, tempered crimson red in band B, and black in band C. Divisional lines, in black, are used for separating bands A and B, and in black and deep fawn for separating bands B and C, with lines in red and black between band C and the field of the carpet. The variation in ground colour in the respective decorative bands necessitates the ornate features in each being differently treated as to colour toning. Thus in band A the simple floral details are successively developed in black edged with red, and in red edged with black, with the leaf forms in fawn and blue lined with black. In the main band B—$2\frac{1}{2}$ inches wide—the petal forms are alternately woven in light and in deep fawn, also outlined in black. The central part of the chief floral unit is produced in blue, light fawn, black and red, and the lesser and intermediate floral effects in black, with marginal lines in fawn and the centre spotting in blue, black and red. The larger leaf forms in this band are woven in black with intermediate delineating lines in deep fawn, and with the smaller leaves in blue, and in deep fawn and blue outlined in black. On the black ground in band C the detail floral features are tinted in fawn and red relieved with spottings in blue, and the leaflets in blue with deep fawn edging. The colour shades in five-frame carpets are limited to four for figuring work, but this specimen shows that by transferring certain colours from the ground to a decorative position and *vice versa*, the tinted style of the design may be enhanced and also increasingly diversified. In addition it illustrates that, by thus changing the colour of the ground, the pattern elements in each line of the border may be forcibly differentiated from each other in colour ingredients and quality. As a consequence of this system of colour combination, two series of colour contrasts are formed, first between the ground shades of the decorative bands A, B, and C; and second between the shades applied to the three varieties of figuring.

Two examples in cinema Wiltons are given in Figs. 130 and

FIG. 129.
A, enlarged to full scale in Fig. 173.
Border of Plate VII.

FIG. 130.

131. They are both five-frame carpets with a pile of approximately $\frac{1}{8}$ inch in depth produced in 2-ply 3/14's worsted, and with cotton yarns for ground and filling. The dark grounds, frequently black, used in these carpets emphasise the velvet quality of the manufactures, the nap being fine and compact, containing ten rows of pile yarn to the inch, and with nine sets of pile yarn in the same space, yielding a pile of ninety tufts (= 180 ends) per square inch. The idea in these productions is twofold, to obtain (1) a ground surface rich and velvet-like in formation, and (2) a style of ornament of a bold and highly decorative character. Both these results are typified in the specimens. In Fig. 130, the figuring is woven in grey tones and presents a shaded effect, appearing to be carved into the carpet surface. The stem and scroll forms proceed in natural and flowing order from a rounded well-drafted structural branch, and, being shaded by the suitable combination of the dark, medium, and light tones of pearl grey, are strong and decided in outline and in moulding. The convoluted leaf forms are similarly treated as to colour toning. Symmetry, unity and force of figuring are sought and attained. No involved and intricate details are attempted but rather the construction of pattern types which at once attract and sustain visual interest.

Fig. 131 is somewhat more floral in style, though it is also a composition of broad curvilineal forms, worked into one continuous scheme of surface decoration. Again, soft and graded colour tones are employed in the figuring, namely, brown and fawn shades on a black ground, with the more floral features woven in medium brown and touches of yellow, and the leaves and petals of the flowers in three shades of fawn. In such positions in the design as the yellow is introduced, this colour takes the place of the medium brown shade, being a " planted " colour and running through the carpet in the sectional parts of the figuring in which it is used, for lifting the colour hue of the ornament.

Both these specimens are suggestive of the full decorative designs special to this class of Wilton, and also of the clear, sharply delineated pattern forms obtainable in Wilton pile when a degree of shading by the blending of colour tones, differing in shade depth, is practised.

The Continental type, Fig. 132, is a lower grade of manufacture, having nine rows of pile tufts and nine sets of pile threads of 3-ply 2/16's worsted yarn per inch, with a pile length of $\frac{1}{8}$ inch. Though it may be described as nondescript in design character,

FIG. 131.

it is an interesting study in the employment of the pile yarn in producing various ground effects resembling ordinary weave elements. Thus, the ground in section A is of the transposed twill type, in the rectangular spaces, B, in horizontal lines of the warp cord type, in C of an intermingled weave structure, and in D of a small scroll type. Such textural elements, when suitably assorted and applied, impart a measure of attractiveness to the groundwork of the carpet, and also lend different degrees of emphasis to the figuring developed thereon.

The example is a five-frame Wilton with black, red, green, drab, and black and gold twist yarns in the pile. Each yarn gives a distinctive quality to the ground and the figured quantities in which it is used. The drab shade—sections A and A^1—forms a prominent portion of the integral parts into which the whole design is divided. On this shade the ornate elements are woven in black, red, green and in twist yarn. The red ground sections yield an intermediate tone of colouring between the drab and the green, on which the figuring is produced in black, gold and green. The drab-coloured features, *e. g.* section E—stand out distinctly on the black ground and in strong contrast with those woven in gold, green and red. On the green surface—*e. g.* part F—the red and black pattern types are softer in toning, being still further subdued in this ground shade when developed in black and gold twist yarns, as in G.

The design is too active and conglomerate in ornate units and also in arrangement. Certain technical features possess merit, but the geometric and angular spaces of which the ground surface is made up tend to irritate: whereas the primary object in all varieties of carpet decoration should be to acquire diversity of style, both in form and colour, which involves a sense of visual satisfaction and interest. The colour tones and contrasts, as well as the ornate types, separately and collectively, should suggest mental inquiry, in which respect the Eastern designer and weaver have attained pre-eminent success.

Velvet Variety of Carpet

This variety of carpet corresponds with the Wilton in method of weaving and in construction, but differs from the latter in pile length and density and also in richness of colour aspect. In the shorter grades of velvet manufacture, of which the Tournay velvet in Fig. 133 is an example, the pile is not more than $\frac{3}{16}$ inch

Fig. 132.

in depth, but in the Saxony velvets it varies from $\frac{5}{16}$ to $\frac{9}{16}$ inch. For the Tournay production, a five-frame design with " planted " colouring, there are ten rows of pile and ten sets of pile yarn to the inch, but in the longer pile productions in Figs. 134, 135, 136 some nine rows of pile and nine sets of pile yarns per inch. The yarn used for the pile also differs in ply and in counts with the style of carpet, that in Fig. 133 being 3-ply 2-fold worsted as in the Wiltons considered, that in the specimen in Fig. 134 approximately 3-fold 6's worsted, and that in the specimens in Figs. 135 and 136 3-fold 8's worsted, in each instance loosely twisted to allow of the ends of the threads, on the cutting of the pile tufts, presenting clustered strands of filament.

The distinguishing characteristic of each of these builds of carpet is the density and compactness of the pile surface, literally comparing in this feature with a closely set silk velvet. Bending of the carpet on the pile side does not expose the foundation yarns, as in the Wilton and the Brussels. These are completely hidden from view however the surface is examined. The weight of pile fibre the foundation structure has to carry renders it vital that it should be firmly woven and made of thick strong linen, or cotton yarns.

Another feature, as contrasted with the ordinary Wilton, peculiar to these costly manufactures is their remarkable firmness and resiliency of pile or nap. This yields to the tread, but is so pliable and springy in formation that on pressure being removed the pile at once resumes its normal upright position. It follows that in wearing durability, and also in flexibility of nap, the carpet satisfactorily compares with the hand-tufted production. Being automatically woven it is not so diversified in design and colour style, but in regard to strength and wearing efficiency, as well as quality of pile, it is a structure which competes with the vertical warp made type of carpet fabric. There is not that liability to variation in the evenness of the pile surface which one finds in the average Eastern weavings, and the pile is not infrequently firmer, if not better built up; for while the pile tufts are not tied or knotted to the ground warp threads, nor yet looped round them, they are fastly bound into the foundation of the carpet by the ground shots of weft which interlace with such threads and also cross over the pile yarns as shown in the sectional drawings in Figs. 125 and 125A.

As the length of the pile increases, the pile threads are thicker in circumference and of greater tensile strength. This is impor-

tant if the pile is to continue permanently vertical in the use of the carpet. Long-pile fabrics are made for rugs in imitation of skin rugs, but in these the pile is more or less liable to be suppressed and flattened in places, and this takes place without any serious detriment to the appearance and serviceability of the rug, but in the instance of the velvet carpet it is imperative that the pile should, under the conditions of wear, remain absolutely in vertical line. To obtain these results there requires to be, first, close setting and weaving as to the number of threads and shots per inch in the foundation and as to the number of wires or rows of pile yarn per inch in the carpet surface; and, second, the pile yarns require to be of a structure and thickness to secure their retaining the original upright grouping assigned to them in the production of the carpet.

Fig. 133 is an illustration of a closely-woven velvet carpet with a brilliant crimson ground, and with an inset running stem and leaf pattern developed in a paler crimson shade. This inset design is mellow in tone contrast, and relieves the broad spaces of colouring in the ground of the carpet. A full repeat of the ornate style measures 58 to 60 inches in length. It consists of a subsidiary and of a principal central figure, and of the figures in sections at the sides of the specimen lettered A and B, and also of the medallion figures seen between the larger pattern types. The design is singularly illustrative of the broader varieties of ornament so well adapted for production in velvet pile. Though a five-frame manufacture, eight colours are employed in the figuring, namely, two crimson reds, sage green, blue, deep or grass green, fawn or buff and gold. This is rendered feasible by the plan on which the ornate elements are drafted, which provides for the use of planting colours in the development of their integral features.

The bold, pronounced stem and leafwork are outlined in blue with a sage-green intermediate band and crimson in the middle portion. It connects the figures with each other, but does not continue through the ground surface. Where it is visible the ornament is woven in fawn, blue, and sage-green with its interior sections in the crimson reds. In other parts of the design, deep green and maroon take the place of the blue and sage-green. Examining each species of decoration separately shows that the practice of colour planting in certain frames of the pile yarns enables the different types of patternwork to be produced in special colour groupings, and this adds to the strength of the

FIG. 133.

A, enlarged to full scale in Fig. 176.

ornament, whether individual parts thereof or the whole design are considered. Taking the subsidiary central decoration unit—12 inches wide and 13 inches long—it possesses a green centre edged with maroon, with the floral effects at the base woven in maroon and sage-green, edged with fawn, on a crimson ground. The lobes of the ornament are produced in blue with the rim sectors in sage-green lined with fawn, and the apex details in gold with a sage-green margin, with the basic forms of such details developed in maroon. Adjacent to this shade, as used in the ground of the lower part of the figure, are striping lines in deep green. The medallion figure below this secondary central ornament is formed in a crimson ground, with alternate petals in sage-green having a fawn rim tipped with maroon, and in a maroon ground also having a fawn rim but tipped with crimson and green. The upper medallion figure has a green centre lined with fawn, with petals alternately woven in maroon on a crimson ground, and in sage-green edged with fawn.

The ornament lettered A^1 (7 inches by 13 inches) on the right of the illustration is developed thus: ground of the shield striped in maroon, green and blue, with interior form, having a maroon margin, in crimson, gold, fawn and green; and the leaf forms within the shield in (1) a maroon surface, fawn margin and crimson outlines, and in (2) a crimson surface, having a margin in maroon and outlines in fawn with green details. The decorative elements at the top of the figure are delineated in small square patches of sage-green and fawn with marginal lines in fawn and maroon. The larger leaf and floral types encircling the shield, are woven respectively in fawn and blue on a sage-green ground, and in crimson on a blue ground; with the intermediate or sector leaves in a crimson ground with sage-green and blue edging lines. The leaf forms at the bottom of the figure are developed in sage-green with blue edging, and also in sage-green with maroon outlining, with demarcation or emphasising lines in fawn. Ornament A^2 is the counterpart of A^1, and is produced in like colour combinations with, however, the ground of the shield striped in maroon and green shades in place of in green and blue.

In ornament B, at the bottom right-hand corner of the specimen, the ground of the central feature is woven in maroon and green, with the bud and leaf details in crimson, fawn and gold. The pattern forms of the more ornate outer sectors have a blue ground edged with fawn, with their floral details in crimson, fawn and sage-green. The larger ornate sectors have a sage-

green ground, in contrast with the blue in the ground of the smaller sectors. The upper and lower elliptical features have also a sage-green ground, edged respectively with deep green, maroon and fawn, and with blue. The ornament proceeding from these features is delineated in fawn, sage-green, and maroon shades.

The elaborated ornament, forming the chief central figure in the design—some 17 inches wide and 16 inches in length—has a sage-green ground in the outer sections and a maroon ground in its interior decorative types. The ornate quality of the latter is emphasised by having a fawn margin. The lesser pattern elements are woven in crimson lined with maroon, with middle details in gold and side details in crimson similarly tinted at the edging. A sage-green ground is applied to the rosette form at the base of the figure, the spotting in which is developed in gold colour. On the other hand, the extreme central ornament has a gold-coloured surface on which the design features are developed in crimson and fawn. The leaf details, issuing from the lower portion of the figure, are woven in sage-green on a deep green ground in the parts thereof to the left, and in a maroon ground in the parts to the right, with the floral units in crimson, sage-green, maroon and fawn. The vandyked extremities of the whole figure are produced in blue and fawn marginal lines with the interior parts in sage-green. The ornamental features within the vandyked edging are developed in fawn and blue, and the basic form of the figure in gold with elemental parts in maroon, fawn, and crimson.

The example is suggestive of the effectiveness of colour location in the transference of design on to a pile carpet surface. Providing a single ornate type of figure were selected and variously developed as to colour units, it might be rendered by this practice diversified in structure. But with the figure units each distinctly drafted, the alterations in colour development give a decorative style replete in structural quality and character. In Fig. 133 certain sections of each description of ornament are woven in colour contrasts, as in the combination of green and maroon, blue and fawn, sage-green and gold, crimson and sage-green; others in colour tones, as in the combination of maroon and crimson red, deep and pale crimson, gold and fawn; and others in subdued blue and tone contrasts, as in the features produced in blue and green. This Tournay velvet is typical of carpet designing consisting, after the decorative style has been drafted and planned, in colour selection, arrangement and application.

The specimens in Figs. 134, 135, and 136 are examples in

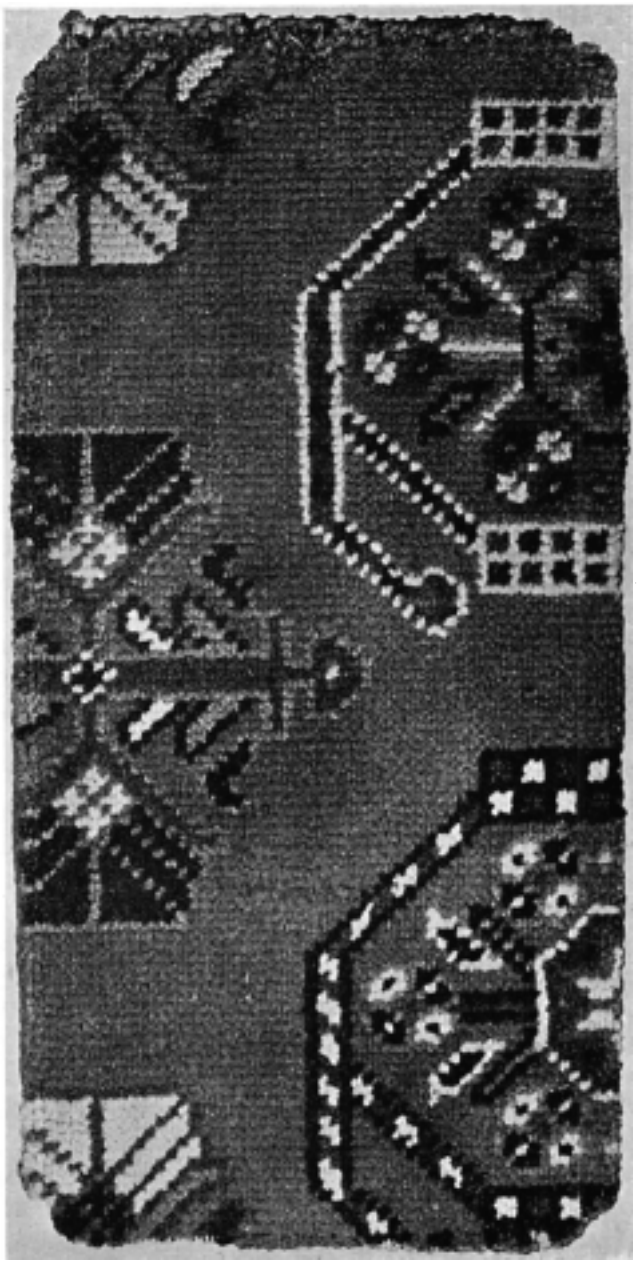


FIG. 134.

Saxony or the longer variety of " velvet " carpet. The pile length is $\frac{4}{16}$ inch in Fig. 134, $\frac{5}{16}$ in Fig. 135 and $\frac{7}{16}$ in Fig. 136. Each carpet has $9\frac{1}{2}$ splits and 9 wires per inch of 2-ply 3-fold 8's or 10's worsted, giving 85 tufts of yarn per square inch of carpet surface. The diameter of the yarn in Fig. 134 is practically $\frac{1}{30}$ inch, making a possible thirty threads per inch if laid in parallel relation and in contact with each other. Being five-frame carpets, there are five pile threads in a split or $47\frac{1}{2}$ ends of pile yarn per inch, only nine of which are employed in the pile, leaving a layer of thirty-eight threads, each with a working diameter of $\frac{1}{30}$ inch, underneath the pile, which substantially covers the foundation structure. With each pile tuft possessing two ends, there are 170 ends—compact clustered strands of fibre—in each square inch of pile. The nap is, therefore, particularly full and dense in filament. This filament is of sound tensile strength and elasticity, consisting of evenly-grown Australian crossbred wool. Both the yarn counts and structure, and also the quality of the wool of which it is spun, contribute to the firmness of the pile and to its wearing utility and flexibility. A shorter and finer staple of wool would produce a more " foody " worsted yarn, but one less lustrous and likewise of inferior springiness when made into the carpet nap. The pile woven in such a fine wool yarn would present an increased number of filament units, but the pile would, in the wear, be more liable to be compressed.

In this grade of Saxony velvets the design and colour element may be as clearly delineated as in Wiltons, or the designs may be developed in mingled or broken colour tones. Figs. 134 and 135 are illustrative of the former practice in pattern construction, and Fig. 136 of the latter practice. The distinctiveness of the ornament in the first two examples is due to the strength of the colour contrasts and system of colour grouping in defining the integral features of the design, and also to trimming the nap, by cropping, after the carpets are woven. Fig. 134 is composed of red, blue, green, buff, and drab pile yarns. It has a crimson red ground with the external decorative forms in ornament A outlined in drab or light fawn, and the decorative forms in ornament A^1 outlined in blue. Both ornaments, A and A^1, correspond in form units and arrangement, but differ in colour composition. Figures B and B^1 are also identical in structure, but the practice in colour development again gives two species of surface decoration, the outer or side wings of ornament B being woven in blue and buff, and those of B^1 in drab and green.

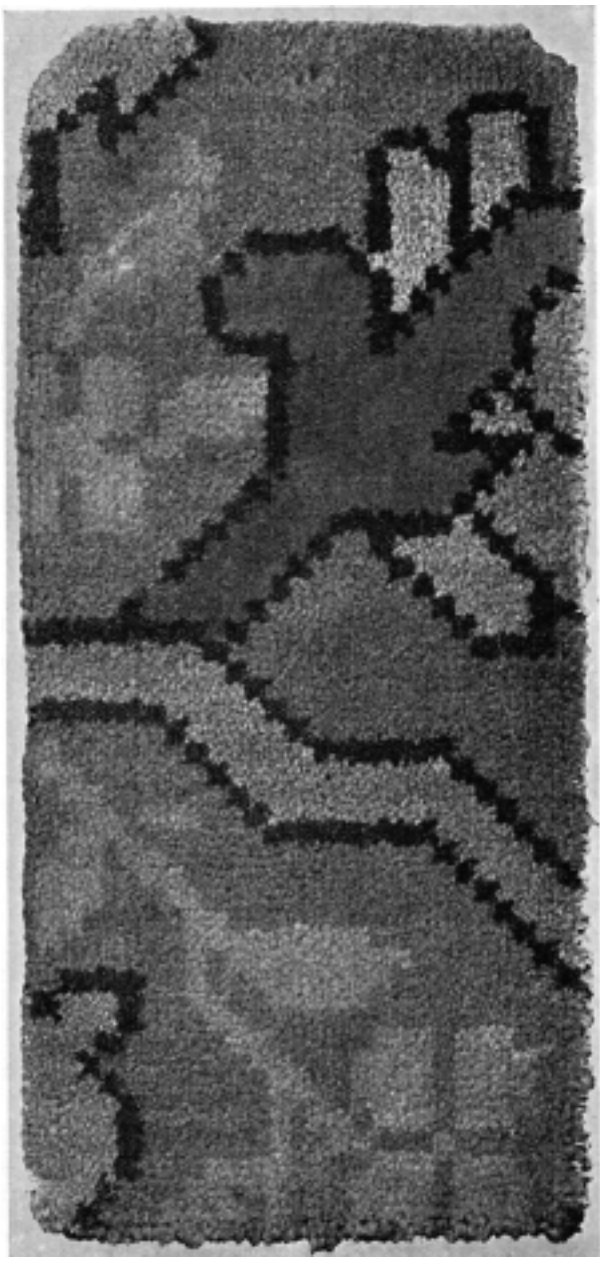


Fig. 135.

The pile yarns in Fig. 135 consist of deep and toned red in the ground which has an inset figure in the paler red, of black for the ornate outlines, and of buff and slate green for the figuring. For the mottled-coloured style in Fig. 136, the pile yarns are in black, red, green, buff and drab. The velvet quality of the pile is specially appropriate for developing this variety of pattern-work. Should, in this description of colouring, still more subdued decorative treatment be intended, tone upon tone shades may be employed, with a contrasting colour of yarn in the ground, as, for example, a deep blue ground with the ornament woven in warm brown, tan, and two shades of fawn, or a deep green ground, with the ornament in maroon, crimson and two tints of rose pink. A further method of work comprises the use of mixture shades of yarn in the pile, of which the following are shade combinations :—

MINGLED DECORATIVE STYLES. EXAMPLES IN MIXTURE-SHADE PILE YARNS.

A.

	Mixture.	
Deep	yellow brown, No. 6XG.	"*Colour in Woven Design*," Pl. XII, for ground.
Medium	,, ,, No. 4XG.	,, ,, ,, ,, for figuring.
Medium	,, green, No. 4XF.	,, ,, ,, ,, ,,
Light	,, ,, No. 1XF.	,, ,, ,, ,, ,,
Tinted	,, brown, No. 2XG.	,, ,, ,, ,, ,,

B.

	Mixture.	
Deep	purple, No. 9 I.	"*Colour in Woven Design*," Pl. XII, for ground.
Medium	red brown, No. 5 H.	,, ,, ,, ,, for figuring.
Light	,, ,, No. 8 H.	,, ,, ,, ,, ,,
Light	blue green, No. 8 C.	,, ,, ,, ,, ,,
Tinted	purple, No. 8 I.	,, ,, ,, ,, ,,

Such mixture yarns impart a specific colour tone to the pile, one singularly varied in tinted hue and in tinted contrasts.

RUGS

The Wilton and velvet-pile principle of carpet weaving is largely applied in rug manufacture. An example of this kind—27 inches by 54 inches—in Wilton pile is reproduced on Plate VIII. It is a five-frame fabric, being composed of black, red, olive, light fawn and blue-grey pile yarns, with red as the prevailing colour tone in the rug. The border—6 inches wide—consists of (1) a small band of fine detail woven in olive and red with divisional lines in black; (2) a small band with a black ground and the figuring in blue-grey, fawn and red; and (3) a broader band—3 inches

PLATE VIII.

WILTON PILE RUG

FIG. 136.

wide—with certain of the star forms in blue-grey edged with black and detail units in olive and red, and of other forms in fawn, blue-grey and red also edged with black. The well-defined framing of the field of the rug consists of minute rectangular pattern types coinciding in colour toning with the outer strip of the border.

The border ornament and also the ornament in the field—15 inches by 42 inches—of the rug is geometric in plan and in structure. Both constitute forcible, effective schemes of design in which the ornate elements are distinctly delineated by colour tone and colour contrast, and by the manner in which each species of decorative treatment, small or broad in character, is differentiated from another in the weaving practice adopted. The chief and central figure has a fawn ground, with its outer ground space in black. The ornamental types of which this figure is formed are woven in the olive shade with the transverse line in red and black marginal lines. The star features in this parallelogram are produced in fawn, with the two vertical crosses at the sides in blue-grey, fawn and black. In contrast with this, the larger decorative unit in the field of the rug, the adjoining upper and lower elliptical types of patternwork have a red ground with part of the ornament in fawn edged with black and part in blue-grey similarly edged. The triangular forms are in the same colouring, but the binding or looped forms of the middle bar are woven in the olive and black shades. The corner ornament of this portion of design has a red ground with effects in fawn, black, blue-grey and olive. The colouring of the top and bottom ornamental features harmonises with that of the centre figuring.

The four parallelogram forms on each side of the field have each a fine detail border of the character forming the surround of the rug, and each has a red-coloured ground with the pattern elements woven in olive, blue-grey and fawn. The rectangular forms between the centre and the adjoining octagonal figures have divisional sections in blue-grey and red, and their ornate effects produced in olive, fawn and black on a blue-grey ground; while similar forms, connecting the upper and lower half-section figures with the adjoining octagonal figures in the same line of the rug, have a red ground and the pattern types developed in black, olive and fawn.

It is, in this class of design, the system of grouping the several decorative units into different geometric forms, coinciding in shape and spacing with each other, and the practice of colour

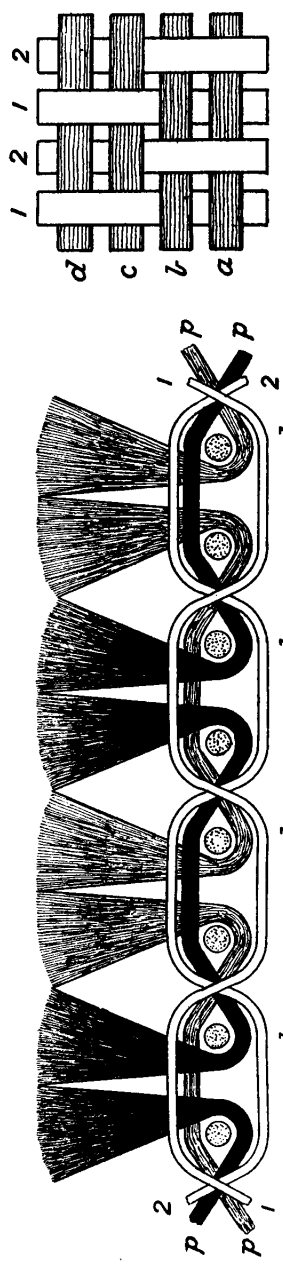


Fig. 137.

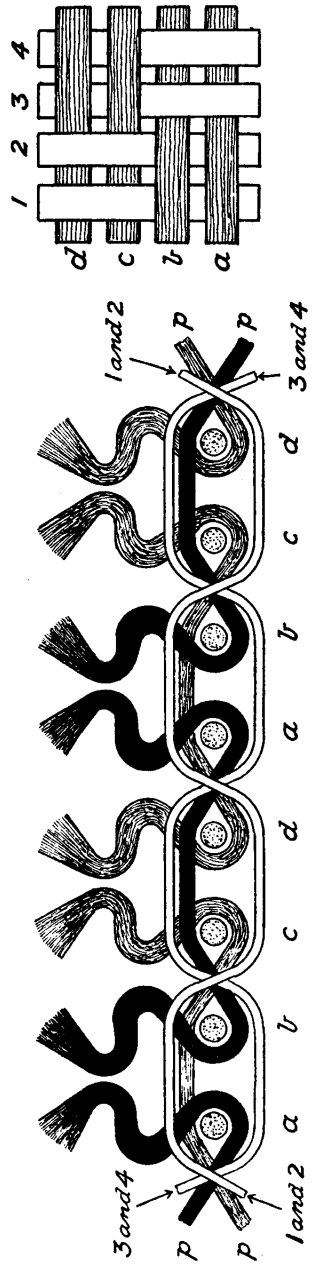


Fig. 137A.

interchange in the weaving of these, which give a characteristic style of manufacture.

For producing a pile quality with some of the features of skin rugs and mats, mohair yarns are used. The rugs have a subground or backing made in thick, coarse-fibred woollen yarns and in a plain, cord or mat weave. In Figs. 137 and 137A are given sections and ground plans of two structures. In both cases p represents the pile threads. The foundation of Fig. 137 is single warp (1, 2), and double weft (a, b, c, d); for Fig. 137A a 2-and-2 hopsack weave is used for the foundation, 1, 2, 3, 4, being the warp threads, and a, b, c, d, the weft.

CHAPTER IX

CHENILLE AND MACHINE-TUFTED AXMINSTERS

Varieties of Axminster Weavings—Comparison of the Methods of producing Decorative Styles in Axminster, Brussels, and Wilton Carpets—Jacquard and Axminster Figuring Principles—Axminster and Hand-Tufted Pile Characteristics—Carpet Build—CHENILLE OR WOVEN-FUR-YARN AXMINSTERS—Invention and Features of the Chenille Type of Manufacture—Structure and Formation of Chenille Webbing—Production of Webbing to Scheme of Design Colouring—Chenille Mat Example—Cutting and Preparing Chenille Yarn for Carpet Weaving—Practices in Inserting Fur Yarn into Carpet—Foundation Structure of Carpet—Binder, Catcher, and Stuffer Yarns and their Functions—Healding and Reeding—Types of Chenille Carpet Manufactures—Plain-Woven Chenille Reversibles—Round or Circular Fur Yarn—Twilled-make Reversible Rugs—Construction of Fur Yarn and Quality of Carpet Pile—Figuring Scope in Chenille Axminsters—Colour Range—Design Examples in Double-Pile Rugs—Density of Pile Units in Carpet Surface—Ratio of Colour Units in Fur Yarn and Design Scale—Multi-Colour Rug Specimen—Field and Border Designing—Persian Style of Fine-Woven Chenille Rug—Depiction of Leaf, Flower, Bird and Animal Forms in Rug Surface—Setting Schemes—ROYAL AXMINSTERS OR MOQUETTES—Utilisation of Pile Yarns in Surface Effects—Production of Pattern Units on Yarn Spools—Design Draft and Spool Preparation—Colour and Pile Features—Constructive Principles—Axminster Specimens—5/8 Stair Example, Chinese in Design Style—Fine-make Border Structure—Toned and Tinted Hues—Design Composition—Body Style of Pattern—Circular Scheme of Decoration—Seamless Axminsters—Analytical Comparisons of Axminster Pile Structures—Heavy Variety of Axminster—Variableness of Design and Colour Units in Axminster Weaving—Diversified Ornament in Field and Border Patterns—Ornate Forms in Geometric Designing in Five Shades—Multi-colouring in Diamond Type of Pattern—Distinctiveness of Colours in Axminsters and Colour Practice—Weave Construction of Axminsters—Technical Data—Axminster Looms—Weaving Operation—Pile-Yarn Insertion from Spools—Cutting of Pile-Yarn—Tuft Insertion by Nippers or Grippers—Jacquard Mechanism for Actuating Pile-Yarn Carriers.

AXMINSTER carpets and rugs, as briefly explained in the preceding chapter, include two distinctive classes of manufacture. Both the chenille and tufted varieties of Axminster are decoratively treated without the aid of Jacquard mechanism. These pile carpets are so constructed that they are capable of being ornamented independently of changes in the warp shedding for figuring purposes. In this they differ from Brussels and Wilton productions and also from other styles of woven fabrics. To