



FRANKLIN INSTITUTE LIBRARY

PHILADELPHIA

Class 677 Book B384c Accession 86.67 2

ARTICLE V.—The Library shall be divided into two classes; the first comprising such works as, from their rarity or value, should not be lent out, all unbound periodicals, and such text books as ought to be found in a library of reference except when required by Committees of the Institute, or by members or holders of second class stock, who have obtained the sanction of the Committee. The second class shall include those books intended for circulation.

ARTICLE VI.—The Secretary shall have authority to loan to Members and to holders of second class stock, any work belonging to the SECOND CLASS, subject to the following regulations:

Section 1.—No individual shall be permitted to have more than two books out at one time, without a written permission, signed by at least two members of the Library Committee; nor shall a book be kept out more than TWO WEEKS; but if no one has applied for it, the former borrower may renew the loan. Should any person have applied for it, the latter shall have the preference.

Section 2.—A FINE OF TEN CENTS PER WEEK shall be exacted for the detention of a book beyond the limited time; and if a book be not returned within three months it shall be deemed lost, and the borrower shall, in addition to his fines, forfeit its value.

Section 3.—Should any book be returned injured, the borrower shall pay for the injury, or replace the book, as the Library Committee may direct; and if one or more books, belonging to a set or sets, be lost, the borrower shall replace them or make full restitution.

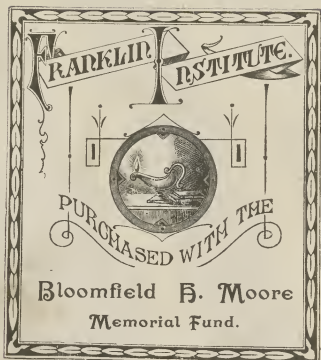
ARTICLE VII.—Any person removing from the Hall, without permission from the proper authorities, any book, newspaper or other property in charge of the Library Committee, shall be reported to the Committee, who may inflict any fine not exceeding twenty-five dollars.

ARTICLE VIII.—No member or holder of second class stock, whose annual contribution for the current year shall be unpaid or who is in arrears for fines, shall be entitled to the privileges of the Library or Reading Room.

ARTICLE IX.—If any member or holder of second class stock, shall refuse or neglect to comply with the foregoing rules, it shall be the duty of the Secretary to report him to the Committee on the Library.

ARTICLE X.—Any Member or holder of second class stock, detected in mutilating the newspapers, pamphlets or books belonging to the Institute shall be deprived of his right of membership, and the name of the offender shall be made public.

50/5
48004-
502



Bloomfield B. Moore
Memorial Fund.

5

2.50
pmm

COLOUR IN WOVEN DESIGN.

THE
SPECIALISTS'
SERIES.

COLOUR IN WOVEN DESIGN.

BY

ROBERTS BEAUMONT,

MEMBER OF THE SOCIETY OF ARTS, PROFESSOR AND DIRECTOR OF THE TEXTILE
DEPARTMENT OF THE YORKSHIRE COLLEGE, LEEDS.

*Author of "Woollen and Worsted Cloth Manufacture";
of Articles on Designing and Manufacturing
in the "Textile Recorder," etc.*

WITH THIRTY-TWO COLOURED PLATES AND
NUMEROUS ORIGINAL ILLUSTRATIONS.

LONDON :

WHITTAKER & CO., PATERNOSTER SQUARE.

NEW YORK :

D. VAN NOSTRAND COMPANY, 23, MURRAY, AND
27, WARREN STREETS.

1890.

CONS

TS

1475

B37

1890

7

THIS WORK IS RESPECTFULLY DEDICATED

BY THE AUTHOR TO

OBADIAH NUSSEY, Esq., J.P.,

*Chairman of the Textile and Dyeing Departments of the
Yorkshire College since their inauguration, and
Honorary Member of the Worshipful
Company of Clothworkers of
the City of London,*

As a slight recognition of his zealous and successful efforts to found in Leeds a well-equipped Institute for the advancement of British Textile Industries, and also in remembrance of the ardent, constant, and influential support he rendered to my late and widely-respected father during the time he was Professor of Designing, Weaving, and Cloth Manufacturing at the Yorkshire College.



PREFACE.

THREE years ago the first edition of my work on "Woolen and Worsted Cloth Manufacture" appeared, and in the preface of the book I observed that should it be satisfactorily appreciated I would write other treatises on specific branches of textile designing and weaving.

Partially in fulfilment of this promise, and partially because I have frequently been requested by designers, manufacturers, and students who have attended my lectures on textile colouring at Leeds, Huddersfield, and other places, to prepare a text-book on the application of colours to woven fabrics, this volume has been written, which, to use the hackneyed prefatory phrase, *is intended to meet a long-felt want.*

Though there are several useful works on Colour—to wit, those of Chevreul, Rood, Benson, Hay, Field, Maxwell, and Guichard—dealing with its scientific phases, yet they can scarcely be said to lend that kind of help to the student of applied design that is needed; hence the necessity of this handbook, which is the first treatise published professing to treat exclusively of the colouring of woven styles.

During the last fifteen years various efforts have been made to teach textile designing and manufacturing systematically, and to specify the principles which underlie the origination of pattern in the loom. What to some extent was previously haphazard work, inasmuch as there were no schools for teaching textile technology, and those apprenticed in the mill were generally allowed to glean information as

best they could, has now become an exact science. Colouring, however, though practically of primary importance in design, has not been so efficiently taught as some branches of textile manufacturing. The object of this book is, therefore, to supply as far as possible a complete scheme of textile colouring, and to demonstrate the methods of applying fancy shades to all descriptions of woven manufactures.

Referring briefly to the plan of the book: In the early chapters the pigment and light theories of colour are succinctly expounded, and also the attributes and qualities of colours, and the laws of contrast and harmony. Subsequently the technicalities characterizing woven colour combinations are analyzed *in extenso*.

As the initiatory method of introducing tints and shades into fabrics consists in blending raw materials of divers colours, the art of mixing to obtain artistic mingled compositions is at the outset fully considered. This part of the subject is possibly of the first importance to those engaged in designing fancy tweeds and kindred classes of woollen goods.

After having treated of the combination of shades in "blending," reference is made to the principles of developing simple patterns by amalgamating warp and weft yarns. The various kinds of stripe, check, mixture, and figured effects, and the tinting of all types of single, backed, and double cloths, of combination patterns, of fabrics figured in the warp, in the weft, and in both warp and weft, are all treated of at length. Woollen, worsted, cotton, and silk fabrics, and the specific styles of colouring applicable to each, have also obtained detailed notice.

The numerous illustrations—comprising woodcuts and coloured plates—should enhance the value of the book, and add to its use and intelligibility.

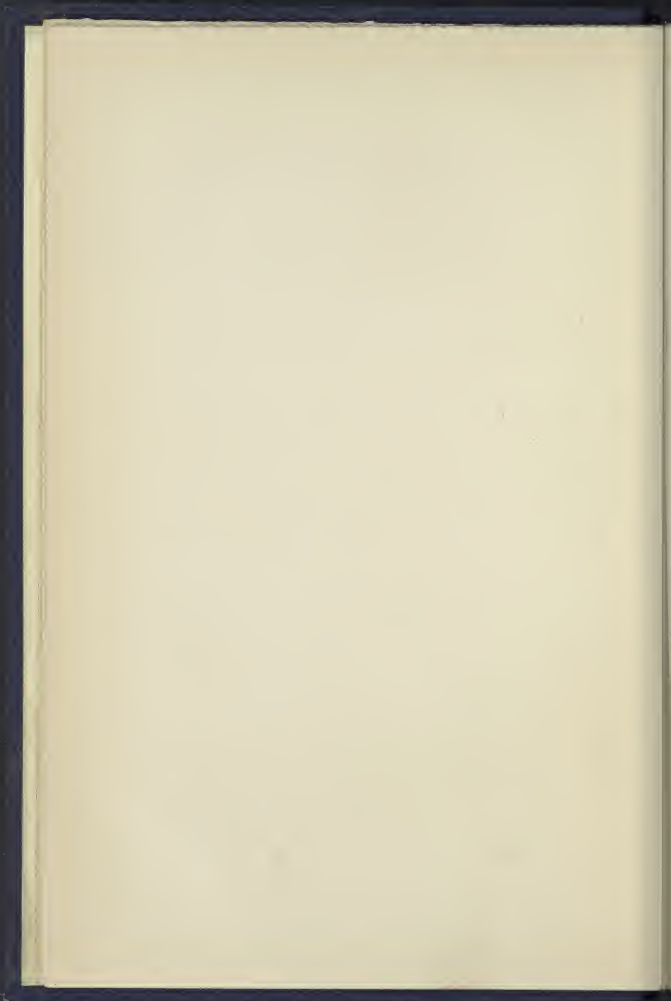
Many of the patterns printed on the plates have been

woven at the Yorkshire College under my supervision, and are now published for the first time ; while the other figures, with the exception of a small number which has appeared in the "Textile Recorder" in articles I have written for that journal, and which the Editor has kindly permitted me to use, have been specially prepared for this book. It need scarcely be observed that the coloured illustrations are unique, being exact representations of the woven textures.

I have pleasure in acknowledging my indebtedness to my publishers, who have literally done all in their power to meet my wishes in the execution of the plates of woven samples.

R. B.

Leeds, *Sept.* 1890.



CONTENTS.

	PAGE
Preface	vii—ix

CHAPTER I.

THEORIES OF COLOURING.

1. Elements of Woven Pattern—2. Occurrence and Utility of Colour in Loom Products—3. Treatment of Colour in Relation to Textiles—4. Methods of Using Colours in Textiles—5. What is Colour?—6. Analogy between the Phenomena of Light and Sound—7. Analysis of Light—8. Utility of Prismatic Experiments—9. Schemes of Colouring—10. Spectral and Pigment Colours compared—11. Classification of Colours—12. Compound Colours—13. The Three Constants of Colours—14. Temperature of Colours	1—25
---	------

CHAPTER II.

ATTRIBUTES OF COLOURS.

15. Utility of a Knowledge of the Qualities of Colours—16. Qualifications of the Textile Colourist—17. Functions of Pure Colours in Design—18. Red: its Characteristics—19. Methods of Modifying Colours—20. Derivatives of Red: their Qualities and their Province in Textiles—21. Blue: its Properties and Uses—22. Derivatives of Blue and their Application to Woven Textures—23. Shades and Tints of Blue mixed with Shaded and Tinted Reds and Yellows—24. Methods of Obtaining Well-balanced Colourings—25. Uses of Blue in Twist Yarns—26. Points in the Application of Blue and Red to Textiles Summarized—27. Attributes of Yellow—28. Province of Yellow in Woven Fabrics—29. Derivatives of Yellow—30. Secondary Colours—31. Green: its Attributes and Derivatives—32. Tints of Green—33. Orange: its Shades and Tints—34. Purple	26—55
---	-------

CHAPTER III.

CONTRAST AND HARMONY.

35. Colours Affected by Association—36. How Colours are Changed by Juxtaposition—37. Table Showing the Effects of Colour Association on Primary and Secondary Hues—38. Contrast—39. Helpful and Harmful Contrasts—40. Examples in Contrast—41. Economic Contrasts—42. Two Kinds of Contrasts—43. Polychromatic Contrasts—44. Mono-chromatic Contrasts—45. Toned and Tinted Contrasts—46. Comparison of Contrasts by Shade and Contrasts by Colour—47. Shaded and Tinted Compositions—48. Primary Contrasts Modified with Black and White—49. Successive and Simultaneous Colour Effects—50. Methods of Neutralizing the Effects of Strong Colour Contrasts—51. Colours in Relation to Light and Dark Grounds—52. Harmony—53. Principles of Harmony 56—85

CHAPTER IV.

MIXTURES.

54. Varieties of Mixture Patterns—55. Elements of Mixture Colouring—56. Importance of Pure Materials—57. Several Classes of Mixtures Compared—58. "Blend" Mixtures—59. Blends of Wools and Pigments Compared—60. Modes of Testing Compositions of Colours—61. Mixtures composed of Two Shades—62. Compounds of Two Colours in which White is used—63. Illustrations in Mixtures composed of White and a second Colour—64. Mixtures composed of Black and another Colour—65. Grey Mixtures—66. Bloomed Greys—67. Coloured Greys—68. Two-Coloured Mixtures—69. Multi-Shaded Mixtures—70. Twist Yarn Mixtures—71. Weave Mixtures 86—117

CHAPTER V.

ELEMENTS OF TEXTILE COLOURING—STRIPES.

72. Colours applied to Textiles on Various Systems—73. Types of Woven Colouring—74. Single Weave Colourings—75. Colour in relation to Backed and Double Cloths—76. Colour applied to Single-Make Figured Cloths—77. Fancy Shades applied to Backed and Double Weave Combination Designs—78. Colour in Designs in which the Figures are produced by the Weft Yarns—79. Figured Effects obtained by Warp Colouring—80. Colour in Textiles

Figured by both Warp and Weft Yarns—81. Pattern Design—82. Styles due to Colouring only—83. Stripes—84. Checks—85. Mixtures—86. Figures—87. Classes of Striped Patterns—88. Hair-lines—89. Stripes composed of Longitudinal and Transverse Lines—90. Regular Stripes composed of Two Colours—91. Regular Stripes composed of Three or more Colours—92. Irregular Stripes composed of Black and White Yarns—93. Irregular and Indefinite Stripes in Two Colours—94. Irregular Stripes—Shades in Two Colours—95. Shaded Stripes in Two Colours for Bed Ticks—96. Irregular Stripes containing several Colours—97. Shaded Stripes in several Colours 118—149

CHAPTER VI.

CHECK PATTERNS.

98. Utility of Check Styles—99. Principles of Checking—100. Several Styles of Checks. CHECKS COMPOSED OF TWO COLOURS—101. Forms of Checking in Two Shades—102. Common Check—103. Modification of Common Check—104. Check consisting of Two Sizes of Squares—105. Patterns composed of Solid Squares and of an Overcheck—106. Counter-change Check—107. Compound Checking—108. Gradated Check—109. Broken Check in Two Colours—110. Basket Check. CHECKS COMPOSED OF THREE OR MORE COLOURS—111. Principle of Checking with Three Colours—112. Ordinary Three-shade Check—113. Set Check—114. Compound Checking in Three Shades—115. Counter-change Check in Three Shades—116. Interchanging Check—117. Counter-change with Over-check. SHADED AND IRREGULAR CHECKS—118. Shaded Check in Black and White in Cassimere Twill—119. Shaded Check in Two Colours due to using Designs composed of Various Weaves—120. Double-shaded Check in Three Colours—121. Irregular and Mixture Checks—122. Fancy Broken Check 150—183

CHAPTER VII.

SIMPLE COLOURINGS.

123. Simple and Compound Colourings—124. Regular Simple Colourings—125. One-and-One and Two-and-Two Systems—126. Figured Styles in Common Weaves and One-and-One Colouring—127. Utility of the One-and-One Principle in Figured Textiles—128. Three-and-Three Colouring—129. Four-and-Four Arrange-

ment—130. Four-and-Four Method applied to Fancy Weaves—	
131. Six-and-Six and Eight-and-Eight Schemes—132. Six-and-	
Six Colouring in Various Crossings—133. Three-Odd-Thread	
Arrangement—134. Various Three-Shade Patterns—135. Simple	
Colourings composed of Four Shades—136. Irregular Simple	
Colourings—137. Irregular Patterns of Two Shades—138. "Irre-	
gulars" composed of Three Shades—139. "Irregulars" composed	
of Four Shades	184—223

CHAPTER VIII.

COMPOUND COLOURINGS.

140. Compounds—141. Compounds composed of Three Types of	
Elementary Colouring—142. Results of combining Simple Colour-	
ings—143. Compounds and Weave Combinations compared.—144.	
Utility of a Practical Acquaintance with the Woven Effects of	
Simple Colourings—145. Compound Patterns subjective to the	
Nature of the Fabrics Manufactured—146. Types of Compounds—	
147. Compounds composed of Two Simple Types—148. Patterns	
composed of Two Types and Three Shades—149. Styles of Four	
Shades containing Two Simple Types—150. Styles composed of	
Three Simple Types—151. Irregular Compounds	224—256

CHAPTER IX.

FANCY SHADES APPLIED TO SPECIAL DESIGNS.

152. Colour applied to Special Makes—153. Colouring of Cork-	
screws—154. Modified Corkscrews—155. Fancy Woollen Weaves	
—156. Granite Effects—157. Diagonals—158. Diagonals composed	
of Plain and Double Plain Makes—159. Stripe and Check Colour-	
ings on Diagonals—160. Methods of Colouring Fancy Weaves for	
Cottons—161. Gauze Textures—162. Systems of Colouring Gauzes	
—163. Imitation or Mock Gauzes—164. Colour in relation to Rib	
Styles	257—285

CHAPTER X.

COLOURING OF COMBINATION DESIGNS.

165. Principles of Colouring Weave-Combinations—166. Ex-	
amples in Colouring Compound Designs—167. Main Points in	
applying Shades to Combinations of Crossings—168. Species of	
Drafted Patterns—169. Designs composed of Two Prunelle Twills	

—170. Drafted Designs composed of Two Four-Shaft Weaves—
 171. Style composed of Prunelle and Cassimere Twills—172. Com-
 binations composed of Two-, Six-, Seven-, Eight-, and Nine-Shaft
 Weaves—173. Drafted Designs composed of Three or More
 Weaves—174. Fancy Stripe Combinations—175. Irregular Woollen
 Combinations—176. Cotton Stripes—177. Colouring of Trouser-
 ings containing Three Weaves of Varied Construction—178. Com-
 pound Stripe Patterns containing Four Weaves . . . 286—312

CHAPTER XI.

SPOTTED EFFECTS.

179. Varieties of Spotted Fabrics—180. Spots due to Specific
 Systems of Weaving—181. Swansdown Twill Spotted—182. Spots
 composed of Two Broken Swansdown Weaves—183. Weave-Spot-
 ting produced by both Extra Floats of Warp and Weft—184.
 Irregular Spotted Stripes and Checks—185. Spots developed by
 Extra Warp Threads—186. Fabrics Spotted with Weft—187. Mat
 Weaves Spotted—188. Corkscrew Weave with Extra Spotting Pick
 —189. Spotted Diagonals—190. Warp and Weft Spots compared
 —191. Spotting in both Warp and Weft—192. Advantages of the
 Warp and Weft Methods of Spotting—193. Yarns used for
 Spotting—194. Spotted Effects in Ordinary Weaves . . . 313—342

CHAPTER XII.

COLOURING OF DOUBLE WEAVES AND REVERSIBLES.

195. Principles of Double Cloth Colouring—196. Styles of
 Colour Effects obtained in Double Weaves—197. Double Plains—
 198. Classification of Double Plain Stripes—199. Double Plain
 Stripes in Two Shades—200. Two-Shade Stripes Warped Irregu-
 larly—201. Styles in Three Colours—202. Double Plains com-
 bined with other Weaves—203. Intermingled Double Plain Com-
 positions—204. Reversibles—205. Methods of Colouring Double
 Plain Reversibles—206. Colouring of Figured Designs containing
 Double Plain and other Weaves—207. Reversibles arranged Two
 and One—208. Double Twills 343—369

CHAPTER XIII.

FIGURED TEXTILES COLOURED IN THE WARP.

209. Methods of Colouring Figured Fabrics—210. Special Ele-

ments of Ornamental Woven Design—211. Art and Technique—212. Styles of Figured Fabrics Coloured in the Warp—213. Cotton Quiltings for Vests—214. Ornamental Characteristics of Quilting Designs—215. Attributes of Plush Fabrics—216. Origin of Velvet Weaving—217. Velvets, Compound in Structure—218. Two Classes of Plush Fabrics—219. Warp Plushes—220. Methods of securing the Pile—221. Analysis of the Process of Velvet or Warp Plush Weaving—222. Colouring of Warp Plushes and Figured Velvets—223. Brussels and Tapestry Carpets compared—224. How the Pattern is developed in Brussels—225. Structure of Brussels Carpets 370—392

CHAPTER XIV.

WEFT-COLOURED FIGURED FABRICS—CURL TEXTURES.

226. Warp and Weft Colouring compared—227. Classes of Designs Coloured in the Weft—228. Designs in which the Pattern is a product of the Ground Weft—229. Extra-Weft Styles—230. Vestings—231. Vestings with one Extra Weft—232. Two-Cover Vestings—233. Four-Cover Styles—234. Two-Cover Mantlings—235. Three-Cover Mantlings—236. Double-Weft Reversibles—237. Warp and Weft Coloured Figuring—238. Curl Fabrics—239. Curls, Textiles of the Astrakhan Group—240. Four Types of Curled Effects—241. Curls obtained by Wires—242. Process of Weaving Curls produced by Wires—243. Curls formed by the Weft in which the Warp is Cotton—244. The Weave of Weft Curls—245. Structure of the Fabric—246. Operation of Cutting after Weaving—247. Figured Curled Fabrics—248. Curls developed by Milling—249. Points of dissimilarity in the various Builds of Curled Textures—250. Two kinds of Curls developed by Milling—251. Spiral Threads used for Warp—252. Variety of Pattern in Spiral-Warp Curls due to Colour—253. Stripes in Curls—254. Checked Curl Effects—255. Cotton Warp Curls—256. Twist-Yarn Cotton Warp Curls—257. Backed Weave for Curled Cloths—258. Essential Characteristics of Cotton Warp Curls due to Milling—259. Examples in Designs for Cotton Warp Curls 393—433

Index 434

ERRATUM.

Page 20. On the 17th and 21st lines omit "yellow"; and read "three" primaries instead of "five" on the 20th line.

LIST OF COLOURED PLATES.

- I. Prismatic colours.
- II. Primary, secondary, and tertiary colours, according to the pigment theory of colouring.
- III. Shades and tints derived from the primaries red, yellow, and blue.
- IV. Figured cotton fabric.
- V. Tartan check.
- VI. Shades and tints derived from the secondaries.
- VII. Figured woollen tweed for dressing gown.
- VIII. Specimens 1 and 2. Examples in contrast.
Specimen 3. Scrap of Japanese ornament.
- IX. Specimen 1. Contrast by shade in brown.
Specimen 2. Contrast by tint in lavender.
Specimen 3. Combination of primary colours, and of black and white.
- X. Specimen 1. Figured pattern.
Specimen 2. Red and green check.
- XI. Light, medium, and dark mixtures, composed of two, three, and four colours.
- XII. Specimen 1. Blue and white cotton stripe.
Specimen 2. Velvet finished doeskin stripe.
Specimen 3. Striped dress fabric.
- XIII. Specimen 1. Fine worsted stripe in brown and white.
Specimen 2. Shaded stripe for bed ticking.
Specimen 3. Large shaded stripe for bed ticking.
- XIV. Specimen 1. Worsted stripe with brown ground.
Specimen 2. Light-coloured worsted stripe.
Specimen 3. Fancy woollen stripe.
- XV. Specimen 1. Fine basket check.
Specimen 2. Maroon and green check.
Specimen 3. Small shaded check.
- XVI. Shaded check obtained by combining eight-shaft weaves arranged on a sateen base.

- XVII. Specimen 1. Check with dark ground.
 Specimen 2. Broken check with light ground.
 Specimen 3. Mixture check made of twist yarns.
- XVIII. Figured design composed of cassimere twill.
- XIX. Specimens 1 and 2. Fancy woollen checks.
 Specimen 3. Gauze stripe.
 Specimens 4 and 5. Worsted rib patterns.
- XX. Specimens 1, 2, and 3. Fancy woollens, drafted designs.
- XXI. Specimen 1. Two- and three-ply twists.
 Specimen 2. Cloud yarns.
 Specimen 3. Curled yarns.
 Specimen 4. Gimp and other fancy twists.
- XXII. Specimen 1. Fancy tweed in which knop and cloud yarns appear.
 Specimen 2. Figured mantling with cotton-twist knop yarns for warp, and woollen weft for ground.
- XXIII. Cotton quilting with knop yarns for figure in various colours.
- XXIV. Specimen 1. Double plain stripe in two shades.
 Specimen 2. Double plain stripe with diagonal band.
 Specimen 3. Double plain and corkscrew stripe.
 Specimen 4. Figured reversible pattern in two shades for shawls or mantlings.
- XXV. Specimen 1. Double plain stripe in dark and light slate consisting of several sizes of lines.
 Specimen 2. Double plain stripe in which the bands are of different dimensions.
 Specimen 3. Double plain stripe in four colours.
 Specimen 4. Double plain stripe in three colours.
 Specimen 5. Drafted double plain, diamond pattern.
- XXVI. Specimen 1. Woollen mantling or rug. Wet raised in finishing.
 Specimen 2. Woollen or worsted mantle, striped pattern.
- XXVII. Figured tweed curtain.
- XXVIII. Specimen 1. Striped pattern figured by the warp threads.
 Specimen 2. Style of quilting fabric originally made for vestings.
- XXIX. Specimen 1. Figured plush. Coloured one thread of brown, and one thread of bright drab in the

- warp. The ground is cut pile and the figure loop pile.
- Specimen 2. Figured plush in various colours with sateen ground.
- XXX. Specimen 1. Cotton dress figured in the weft. Ground weave warp buckskin.
- Specimen 2. Fancy vesting with worsted ground and silk spots.
- Specimen 3. Dress pattern figured in the weft.
- Specimen 4. Five-cover vesting.
- XXXI. Specimen 1. Vesting with corkscrew ground.
- Specimen 2. Mantling pattern of the pine-figure class.
- XXXII. Specimen 1. Two-cover mantling.
- Specimen 2. Warp and weft figured style.
- Specimen 3. Silk pattern.

LIST OF ILLUSTRATIONS.

	PAGE
Fig. 1. Beam of light passing through a prism	9
Fig. 2. Design for prismatic experiments	14
Fig. 3. Lambert's contrivance for mixing colours	18
Fig. 4. Sketch of rug pattern	54
Fig. 5. Simplest stripe producible	126
Fig. 6. Simplest form of coloured diagonal	127
Fig. 7. Stripe composed of longitudinal and transverse lines	135
Fig. 8. Buckskin stripe	137
Fig. 8a. Ten-heald upright twill	138
Fig. 9. Stripe effect in black and white	140
Fig. 10. Most elementary form of check	156
Fig. 11. Modification of common check	156
Fig. 12. Check composed of two sizes of squares	156
Fig. 13. Elementary type of over-check	156
Fig. 14. Counter-change check	160
Fig. 15. Compound check	160
Fig. 16. Gradated check	160
Fig. 17. Common three-shade check	165
Fig. 18. Set check	165
Fig. 19. Compound check in three colours	165
Fig. 20. Counter-change check in three shades	170
Fig. 21. Interchanging check	170
Fig. 22. Counter-change, with over-check	170
Fig. 23. Compound shaded check	174
Figs. 24 and 25. Parts of a shaded check design	178, 179
Figs. 26 and 26a. Plain weaves	188
Figs. 27 and 27a. Twills	188
Figs. 28, 28a, and 29b. Effect of two-and-two colouring in the common twill	189
Fig. 29. Effect of two-and-two colouring in the four- shaft mat	190

	PAGE
Fig. 30. Figured design composed of plain weaves	192
Fig. 31. Pattern obtained in plain fabric	193
Fig. 32. Figured pattern obtained in common twill by colouring thread-and-thread	194
Figs. 33, 33a, and 33b. Patterns produced in three-and-three colouring in the six-end twill	196
Figs. 34, 34a, and 34b. Patterns produced in four-and-four colouring in the four-shaft twill	198
Fig. 35. Four-and-four colouring in the mat weave	198
Fig. 36. Four-and-four colouring in a diamond weave	199
Fig. 36a. A diamond weave	199
Figs. 37 and 37a. Stripes in six-and-six colouring	200
Fig. 37b. Check in six-and-six colouring	201
Fig. 38. Check in eight-and-eight colouring	201
Fig. 39. Broken check coloured six-and-six	202
Fig. 39a. Broken rib weave	202
Fig. 40. Star check	203
Fig. 40a. Angled stripe	203
Fig. 41. Pattern due to colouring the plain weave one, one, and one	205
Fig. 42. Check pattern obtained by three-odd thread scheme of colouring	206
Fig. 42a. Six-shaft twill check	206
Fig. 43. Two, two, and two colouring in the six-end twill	207
Fig. 44. Three, three, and three colouring in the six-end twill	208
Fig. 45. Swansdown stripe	210
Fig. 46. Swansdown weave	210
Fig. 47. Four-shade check in cassimere twill	211
Fig. 48. Four-shade check in the six-end twill	211
Fig. 49. Four-shade check in the Mayo	212
Fig. 49a. Mayo weave	212
Fig. 50. Small effect in the five-end twill	214
Fig. 50a. Five-end twill	215
Fig. 50b. Four-and-two colouring in the mat weave	215
Fig. 51. Intermingled style in the five-end twill	215
Fig. 52. Check in a broken mat weave	216
Fig. 52a. Broken mat weave	216
Fig. 53. Small star check	217
Fig. 53a. Eight-shaft crape weave	217
Fig. 54. Check in eight-end diagonal	218
Fig. 54a. Eight-end diagonal	218

	PAGE
Fig. 55. Small three-shade pattern	218
Fig. 56. Minute check	219
Figs. 57 and 58. Three-shade patterns	219
Fig. 59. Twelve-shaft fancy twill	220
Fig. 60. Pattern produced in the twelve-shaft twill	220
Fig. 61. Check pattern in fancy twill	221
Fig. 62. Four-shade pattern in the Mayo	221
Fig. 63. Shaded check in four colours	222
Fig. 63a. Sixteen-shaft diagonal	222
Fig. 64. Compound check, consisting of thread-and-thread and two-and-two colourings	225
Fig. 65. Compound check, consisting of three schemes of colouring	230
Fig. 66. Stripe composed of four-and four and eight-and- eight colourings	233
Fig. 67. Stripe composed of two schemes of colouring woven with black weft	236
Fig. 68. Compound check consisting of four-and-four and eight-and-eight colourings	238
Fig. 69. Compound stripe in three shades	239
Fig. 70. Compound check in three shades	240
Fig. 71. Stripe in three shades composed of six-and-six and three-and-three colourings	243
Fig. 72. Same stripe as fig. 71, with black weft	244
Fig. 73. Check in three shades composed of the same colour- ings as fig. 71	245
Figs. 74 and 75. Compound stripes in four shades	246, 247
Fig. 76. Compound check in four shades	248
Figs. 77 and 78. Compound stripes containing three types and composed of three shades	249
Fig. 79. Compound check containing three types and com- posed of three shades	251
Fig. 80. Irregular compound stripe	252
Fig. 81. Irregular compound check	252
Fig. 82. Stripe composed of irregular and regular types	255
Fig. 83. Check composed of irregular and regular types	255
Fig. 84. Corkscrew stripe	259
Fig. 85. Irregular corkscrew	261
Fig. 86. Angled-stripe pattern in three shades	262
Fig. 87. Intermingled woven effects	263
Fig. 88. Small check design	263

	PAGE
Fig. 89. Weave design for granite pattern	267
Fig. 90. Diagonal pattern	269
Fig. 91. Diagonal pattern composed of double and single plain weaves	271
Fig. 92. Design for preceding pattern	271
Fig. 93. Spotted sateen stripe	272
Fig. 94. Wave design	273
Fig. 95. Gauze pattern	275
Figs. 96 and 98. Gauze weaves	277
Fig. 97. Healding draft for gauze	277
Fig. 99. Fancy gauze	278
Fig. 100. Design for mock gauze	281
Fig. 101. Stripe trousering design	283
Fig. 102. Rib design	285
Fig. 103. Pattern coloured two-and-one and composed of prunelle and cassimere twills	291
Fig. 104. Reduced design for fig. 103	292
Fig. 105. Healding draft for fig. 105	293
Fig. 106. Indistinct diagonal pattern	291
Figs. 107 and 108. Reduced design and healding draft for fig. 106	294
Fig. 109. Reduced design composed of cassimere twill	296
Fig. 110. Healding draft for fig. 109	297
Fig. 111. Stripe pattern composed of six-shaft weaves	298
Fig. 112. Weave design for fig. 111	299
Fig. 113. Fancy healding draft	300
Fig. 114. Reduced design for fig. 114, composed of four four-shaft weaves	301
Fig. 115. Fancy woollen weave design	302
Fig. 116. Cotton stripe design	304
Fig. 117. Trousering stripe composed of four weaves	306
Fig. 118. Stripe design composed of diagonal weaves	307
Figs. 119 and 120. Trousering combinations	308, 309
Fig. 121. Figured cotton stripe	310
Fig. 122. Twill stripe with warp spots	315
Fig. 123. Pattern for fig. 122	316
Figs. 124 and 125. Spotted designs with crow twill ground	316, 317
Figs. 126, 127, 128, 129. Spotted designs composed of broken crow weaves	318, 319
Fig. 130. Spotted design with plain ground	322
Fig. 131. Warp and weft spotted design	323

	PAGE
Fig. 132. Spotted check design	325
Fig. 133. Warp-spotted design	328
Fig. 134. Corkscrew, spotted	330
Fig. 135. Mat weave, spotted	332
Figs. 136 and 137. Corkscrew with spotting picks	333
Fig. 138. Spotted diagonal	334
Fig. 139. Double spotted twill	335
Fig. 140. Double plain stripe design	349
Fig. 141. Double plain stripe design with diagonal	350
Figs. 142, 143, 144, and 145. Striped double plains	352, 353, 354
Fig. 146. Corkscrew and double plain design	355
Fig. 147. Reversible double plain weave	356
Figs. 148, 149, and 150. Sections of reversible figured designs	358, 360, 362
Fig. 151. Section of reversible pattern arranged two-and-one	365
Fig. 152. Reversible double-twill design	368
Fig. 153. Portion of design for a pattern figured by the warp	376
Figs. 154 and 155. Section of quilting designs	377, 378
Fig. 156. Diagram of plush fabric	385
Fig. 157. Weave for multi-coloured plush	388
Fig. 158. Section of Brussels carpet	391
Fig. 159. Section of figured design coloured by the weft	397
Figs. 160 and 161. Parts of figured design with extra weft	399, 400
Fig. 162. Vesting design with rib ground	402
Fig. 163. Vesting design with corkscrew ground	403
Fig. 164. Vesting design with diagonal ground	404
Fig. 165. Section of vesting pattern in five colours	407
Fig. 166. Section of two-cover mantling design	408
Fig. 167. Section of three-cover mantling design	409
Fig. 168. Plan of threads in reversible rugs	411
Fig. 169. Weave for rugs	411
Fig. 170. Bordered rug design	413
Fig. 171. Section of design coloured in both warp and weft	415
Fig. 172. Plan of threads in curled fabric woven with wires	417
Figs. 173, 174, and 175. Sections of curl textures	419, 421, 422
Fig. 176. Diagonal pattern with curl spot	423
Fig. 177. Weave for backed curl fabric	429
Fig. 178. Striped curl	430
Fig. 179. Design for striped curl	430
Fig. 180. Sketch of a large curl pattern	431
Fig. 181. Design for cotton-warp curl	432

COLOUR IN WOVEN DESIGN.

CHAPTER I.

THEORIES OF COLOURING.

1. Elements of Woven Pattern—2. Occurrence and Utility of Colour in Loom Products—3. Treatment of Colour in Relation to Textiles—4. Methods of Using Colours in Textiles—5. What is Colour?—6. Analogy between the Phenomena of Light and Sound—7. Analysis of Light—8. Utility of Prismatic Experiments—9. Schemes of Colouring—10. Spectral and Pigment Colours compared—11. Classification of Colours—12. Compound Colours—13. The Three Constants of Colours—14. Temperature of Colours.

1. *Elements of Woven Pattern.*—Weave, Combinations of Forms, and Blends of Colours, are the three primary elements of textile design. They enter, either separately, or in conjunction with each other, into every species of loom effect. Weave relates specifically to the build or structure of the fabric, and is an indispensable factor in any type of cloth, whether plain, twilled, or ornamental in character. It may be defined as the system or plan of crossing the warp and weft yarns which constructs the fabric. In some makes of textiles weave is merely a simple principle of interlacing which produces a compact, substantial texture, being entirely subordinate in effect to other constituents of the style, such as colour, and decorative design resulting from intricate adjustments of form and figure. Though weave may thus be regarded in textile designing as generally being a constructive and not an ornamental component of

the pattern, yet there are numerous examples in which it possesses both these characteristics. Textures of this description are neither embellished with figure nor colour, and therefore derive their design from the structural plan employed in the process of weaving. Schemes of intercrossing that give these results are devised in such a manner as to form in one operation an even and firm cloth, decorated with a type of pattern that usually consists of minute parts, but which is pronounced and decided in composition.

Combinations of Forms, on the other hand, have no relation whatever to the structural or architectural arrangement of the fabric. The sphere of form in woven design is not constructive, nor even utilitarian, but in the amplest sense ornamental. It is surface decoration obtained by amalgamating, on defined principles, linear and curvilinear lines. Even in the development of figured patterns, in which this element of design plays an important part, weave is a useful factor. Ornament, comprising combinations of geometrical and floral figuring, is liberally applied to various types of loom textures, including styles for ladies' robes, dresses, mantlings, silk goods, damasks, and quilts; and Brussels, Kidderminster, velvet pile, and other carpets. It is almost an invariable law for both weave and colour to be introduced into this kind of textile decoration; hence the importance of first acquiring a knowledge of these principles of woven pattern before attempting to apply elaborate ornament to the surface of a loom product.

Colour, the third element of all classes of designing, is very differently related to textile effects from either Weave or Form. Its specific province is to brighten and improve the qualities of the design due to the two latter principles. While in decorative arts generally it imparts boldness, unity, and richness of tone to the ornament resultant, in textiles it may be either the main constituent of the pattern or the developer of its integral parts. Any discarding of

the use of fancy or coloured shades would diminish the elegance of design, impoverish its appearance, and all but annihilate some branches of woollen industry.

2. *Occurrence and Utility of Colour in Loom Products.*—

It is only necessary to anatomise woven design to trace the extensive use of colour in textiles. Commencing with woollen fabrics, in every class of these cloths, whether tweeds, flannels, and light textures for ladies' robes, or thick figured mantlings, rugs, wraps, and shawls, it forms one of the main characteristics of the pattern. In the first three of these textures colour is the distinguishing element of the style. To remove it from such fabrics would result in a complete erasure of all design or ornament. Whether the pattern be stripe, check, figure, or intermingled effect, it obtains its outline and detail from the method of colouring adopted. But colour is not confined to woollens, it is also an important factor in design produced in worsted, silk, cotton, and jute yarns. There is in worsteds a larger diversity of weave design than in woollen, or carded-yarn textures; but still colour is very extensively employed to develop the effects due to Weave and Form, and also to impart a cheerful and lustrous appearance to the cloths. Patterns in dress fabrics, shirtings and other articles, made entirely of cotton, are frequently mere combinations of fancy shades; while, if the fabrics composed of silk and jute materials are considered, including—in silk—ties, handkerchiefs, and various kinds of matelasses; and—in jute—simple carpets, mats, and coarse rugs, it will be discovered that the colour element of the design largely predominates. This brief summary of the cloths in which fancy shades are used shows that colouring, and the combinations of colours, in all branches of woven products embellished with design, are the elements which give tone and character to the styles. Though the cloths produced may be soft to the touch, substantially made, uniform in

structure, and skilfully finished, yet a lack of brightness and elegance in colouring so powerfully detracts from the merit of the pattern that these qualities, in themselves, are not sufficient to give the fabric an attractive appearance—particulars which demonstrate the importance of choice and tasteful colouring in designs produced by the loom. Evidently colour has a twofold part to play in the development of woven effects: for it may, firstly, be the sole constituent of the pattern; and, secondly, a supplementary element which affords precision and beauty to the composition of the design.

3. *Treatment of Colour in Relation to Textiles.*—Though, to a considerable extent, the principles of colouring are similar in all types of decorative design—harmonious blending and contrasting combinations possessing like qualities in whatever materials they obtain—still there are several reasons why some of the recognised canons of the science of colours are inappropriate, if not inapplicable, when textiles are the media of development. Foremost of these is the technical difficulties which arise in the employment of colour in woven pattern. There is not the same facility nor means for its application here, as in the treatment of ordinary surface decoration. The make of the cloth, and the principles of its structure, determine the system of distribution; while the general aspect of the entire body of colouring varies according to the nature of the materials employed. If the same colourings which appear harmonious, neatly toned, and cheerful in arrangement in a velvet pile carpet, were reproduced in a silk texture, many points of dissimilarity would be noticed in the general effect obtained, though the tint and hue of the shades combined might be identically the same in the respective fabrics. Why is this? Are not the apparent modifications in the colourings—for such they appear when thus compared—due, first, to the difference in the nature

of the materials composing the textures; second, to the dissimilitude of their structural character; and, third, to the distinct principles of weaving practised in their production? The pile of the carpet—full, erect, and compact—gives breadth, force, and richness to the colours; whereas the fine and bare texture of the silk article imparts a more precise effect to the shades, causing the whole blend to possess an aspect which, while harmonious, lacks that desirable quality of bloom so characteristic of the pile production. It is clear, therefore, that colour in textiles requires to be studied as a special art. Its functions and effects in woven goods are so various and distinct from what they are in ordinary decorative work, that it can only be effectively treated when the nature of textile materials, and the diverse structural arrangements of woven goods, are considered. In a word, there are not only recognised principles of woven design which have no place in purely ornamental art, but also schemes and laws of colouring which simply apply to the development of pattern in woven fabrics. Any exposition, therefore, of the theory and practice of colouring, to be useful to the textile technologist, must be given in relation to the varied technicalities of the weaver's craft.

4. *Methods of Using Colours in Textiles.*—Colour is not always applied to woven textures on the same system. The method of utilisation depends upon the composition of the design to be woven, and on the structure of the cloth it is intended to produce. There are fabrics in which the colour element is so compact and decided that the effect obtained is somewhat similar to the results noticed in ordinary surface decoration. Take, for example, silk textures of a ribbon class, in which, by skilful workmanship and exact sketching, any floral form may be developed with a delicacy of toning and correctness of delineation that cannot be improved upon, even though the crayon

and the brush should be employed. But this is not a common, because not a useful, species of designing and colouring. Carpets and tapestry fabrics illustrate other principles of employing fancy shades. Bold and effective treatment is very essential in these articles. The structure of some types of carpets very materially affects the character of the colourings. In Brussels and tapestry for instance, the loop or pile of the carpet which forms its distinguishing feature, prevents that solidity and compactness of colouring noticeable in the silk ribbon or dress material. If the same design and blend of shades introduced into a Kidderminster or Scotch woollen carpet were subsequently applied to a Brussels production, they would be entirely changed in appearance; for there is no common principle of intertexture in the respective articles. On submitting cotton, silk, wool, and worsted goods to inspection, colour is found to have a different tone or cast in each fabric. Fancy colours in cottons, while decidedly firm and clear in effect, are non-lustrous, raw and dull in toning. Silk colourings, on the contrary, possess both compactness and brilliance; woollen colourings have a unique depth and saturation of hue characteristic of the material employed in the manufacture of wool goods; while worsted colourings are bright, definite, and smart in appearance.

These differences are due to the physical properties of the several fibres. Thus, a filament of silk is almost transparent, and shines like a smooth glass rod when light falls upon it; that of wool is solid and opaque in the centre, but its exterior consists of a multitude of semi-transparent scales, which, when of large dimensions and uniformly arranged—as in the best qualities of Lincoln and Leicester wools—reflect light with a minimum amount of dispersion, and impart to the woven material a lustrous aspect. Cotton has no such partially transparent ensheathment. Its downy surface absorbs light freely, while

what is reflected is so broken up, that the colour resultant is impoverished in saturation and brightness. To clearly apprehend the extent to which the nature of the raw material is capable of changing the tone or character of colours, compare three plain woven crimson textures made of silk, wool, and cotton respectively. The first literally shines. Lustre, brilliance, and richness are the elements of its colouring. Though thus bright, it lacks that fulness and depth of hue which appertains to the wool production, whose millions of filaments, closely compounded, and all tinted alike, possess a peculiar bloom and weight of colouring not to be found either in the silk or cotton article. Lastly, consider the crimson calico. How deficient in warmth and richness it seems to be, after examining the woollen and silk textures! It is not only dull in tint, but actually possesses a raw and deficient character. So important is this relation of the material to the species of coloured effect produced in textiles, that it will require subsequent analysis.

The various methods of employing fancy shades in patterns obtained in the loom may be briefly summarised as follows:—

- I. In mixture cloths, for suitings, coatings, &c.
 - a. { By combining or blending various colours of materials.
 - b. { By combining several classes of twist threads.
- II. In plain, twilled, mat, and fancy weave designs, for trouserings, coatings, suitings, jackets, dresses, costumes, flannels, shirtings, &c.
 - a. { By introducing colours into the warp, forming stripes.
 - b. { By introducing colours into the weft, producing spotted patterns.
 - c. { By introducing colours into both warp and weft, giving checks, broken styles, &c.

III. In figured designs for dresses, mantlings, vestings, shawls, rugs, modes, carpets, tapestries, &c.

- a. { By using one or several series of extra warp yarns.
- b. { By using one or several series of extra weft yarns.
- c. { By using one or several series of extra yarns in both warp and weft.

Each of these systems is capable of further sub-division; but, as here given, they represent the principles of colouring the general classes of woven designs.

5. *What is Colour?* To answer this inquiry another question must be suggested, namely, What is light? Though light is not absolutely indispensable to the production of colour, yet, under ordinary conditions, the two are co-existent. Diversity of hue may be made evident to the mind by mere mechanical or electrical agitation of the optic nerve in a totally darkened room. Even if pressure is applied to the eye in a chamber from which all light has been excluded, a rapidly-changing series of fantastical shapes of distinct shades are produced. Of course such an experiment is only of practical utility so far as it demonstrates that colour is due to the excitement—however slight and gentle—of the sensitive tissue forming the retina of the eye. Light is the understood medium by which all colours are made visible; though, strictly speaking, there is no colour apart from ourselves. According to the undulatory theory of colour, objects competent of illumination possess the power, in a greater or lesser degree, to reflect light in tiny waves or undulations, which, travelling to the eye at the rate of 186,000 miles a second, excite the optic nerve and transmit to the mind a colour sensation. As the circular wavelets resulting from the dropping of a stone into a sheet of water, cease not to undulate till the ripples proceeding from the centre of agitation reach the land limits, so a source of light propagates vibrations in the luminiferous ether, which are re-transmitted by the

objects they strike to the eye, when, according to their different lengths, they evoke certain colours. In accordance with this theory the minute atoms composing a candle, lamp, or gas flame, being in a state of active vibration, when they come in contact with bodies radiate and rebound, many of them in the process becoming incapable of exciting vision, others suffering in intensity and amplitude, while others are subject to but slight modification. All luminous objects have the property of reflecting the waves affecting

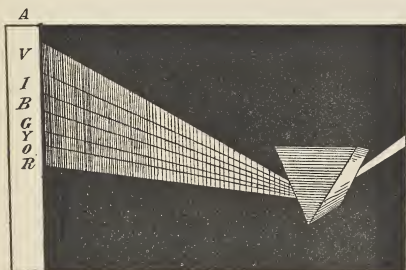


Fig. 1.

their surfaces, but non-luminous bodies—such as black—are incompetent of emitting undulations that convey any coloured appearance to the mind. Consider for instance the phenomena to which colours are due in a woven fabric. Suppose a pattern contains black, white, green, orange, and scarlet colours. Each of these shades possesses power to absorb, or power to reflect the rays of light by which they are made visible. Beginning with the black sections of the cloth, they derive their blackness from an incapacity to reflect, to any perceptible degree, the light falling upon them;

in other words, they are black because they absorb but do not transmit light. On the other hand, the white portions are such on account of possessing the power to reflect, but not to absorb, those particles of light which reach their surfaces. In the cases of green, orange, and scarlet the processes of absorption and transmission are somewhat more intricate. Those parts of the design coloured green absorb all rays but those which constitute this hue, and these they reflect. Similarly with the orange and scarlet sections—the former neutralises all light with the exception of those rays which produce orange; while the latter neutralises all rays but those constituting scarlet, and these are emitted. These data show that the varied colouring of an article results from the reflection of certain constituents of light, or from those rays which are transmitted by, and not from those rays which are exhausted in the texture of the cloth.

6. *Analogy between the Phenomena of Light and Sound.*—Evidently the colour of an object is determined by three factors: the nature of light, the physical properties of the materials on which light falls, and on the powers of the observer's eye. These facts are obvious to all. Change the light from brilliant daylight to common gaslight, and a many-coloured fabric undergoes numerous modifications. That colour also varies according to the nature of the object tinted is, moreover, plain. A woollen fabric is dyed blue, or scarlet, by making it a reflecting medium of either the blue, or red, constituents of light. Coming to the eye, its importance as the conveyer of coloured sensations to the mind has already been demonstrated. If deficient, a perfect conception of tints is impracticable. Unfortunately, there are those who are either wholly, or partially, colour-blind. The range of coloured sensations in such individuals is not complete, hence they are incompetent to discriminate the differences between certain colours. Such, indeed, is the important part played by the eye in the perception of tints,

that colour may be correctly defined as a sensation imparted to the mind by the optic nerves which, as previously shown, are susceptible to, and may be acted upon, by the infinitesimal waves of light as they are emitted from luminous bodies. The amplitude of the undulations resultant determines the colour visible. Thus, when these waves travel in lengths of $\frac{1}{34000}$ part of inch they produce red, but if reduced to $\frac{1}{41000}$ part of an inch the colour excited is orange. As the lengths of the vibrations are diminished, yellow, green, blue, indigo, and violet colours are obtained in succession. Just as the pitch of a musical instrument depends upon the duration and celerity of the waves it enunciates, so the colour of an object is subjective to the length of the undulations transmitted. This analogy between the phenomena of sound and light has led some ingenious colourists to attempt a scheme of colours based upon similar laws as musical harmony. Sound is said to increase in intensity as the amplitude of the vibration of each particle of the air is augmented, and in like manner the brightness of colour is increased as the waves emitted are longer, or it becomes more brilliant in the same proportion as the amplitude of each vibration of the ether is enlarged. Further, sound is more acute as the wave lengths producing it are decreased in duration, that is to say, a diminution in the vibration adds to the acuteness of the sound resulting, and inversely. How closely these phenomena coincide with those producing colour, will now be evident. As already pointed out, the intensity of any given hue is dependent on the length of the undulations reflecting it; red, for instance, is excited by comparatively long waves, and corresponds to a deep sound, while blue, indigo, and violet are produced by waves of decreasing lengths, and correspond to sounds of increasing acuteness.

7. *Analysis of Light.*—By a simple and inexpensive ex-

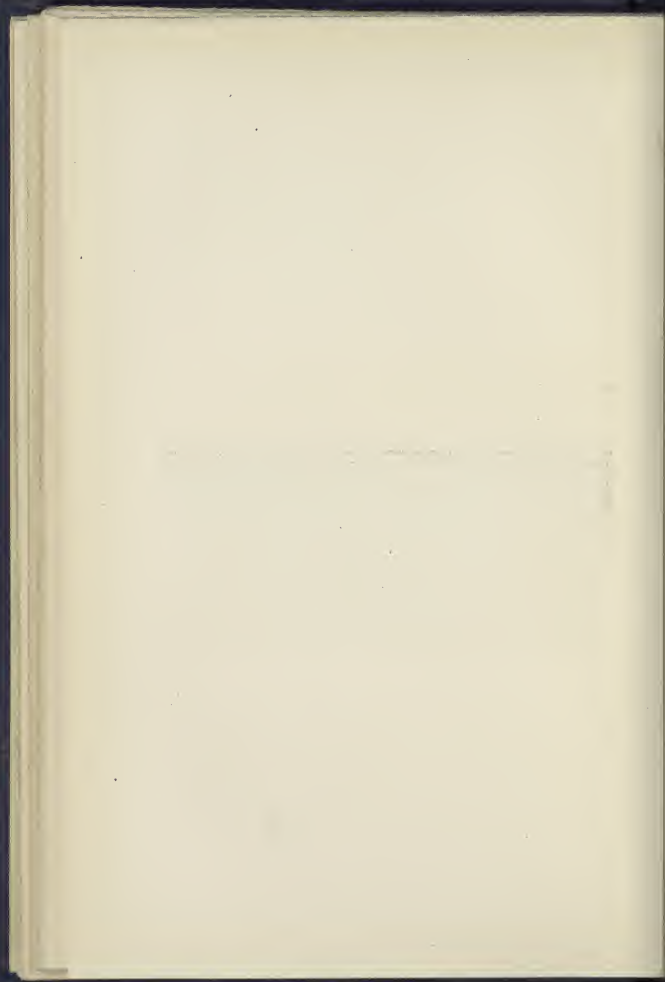
periment it is feasible to acquire some useful knowledge of the solar spectrum or of the composition of white light. Take a prism and so fix it in a darkened room as a ray of light may pass through it. This will give an analysis of light which, although white when all its rays are combined, is found to be compounded of seven distinct classes of colours. The image thus obtained may be compared to a slice off the rainbow, with which it corresponds in every particular.

Thus, when a pencil of sunlight passes through a prism horizontally fixed, as in fig. 1, it is bended considerably out of its path, and thereby decomposed, producing on the opposite screen A, not a streak of white light, but a charming series of pure colours. In the intervals between each hue there is every variety of tint of which they are severally susceptible. Red, for example, passes through a diversity of tinting into orange, which in turn graduates into yellow; when parcels of green, blue green, blue, indigo, and violet occur in succession, which are all softly toned into each other. What strikes the observer of this splendid compendium of colours—which composes the solar spectrum—is the purity and intensity of each hue, and the perfect harmony and contrast which characterise the whole combination.

A second and a somewhat more handy mode of decomposing light is as follows: Place a piece of black cardboard, about an inch wide and a few inches in length, on a perfectly white ground, and view it through the refractory edge of a prism. If this experiment is correctly made, a result will be obtained corresponding to Plate I. The edge nearest the spectator produces the violet, blue, and green side of the spectrum, while the opposite edge gives yellow, orange, scarlet, and intense red,—these two series of spectrum colours of distinct qualities being divided by a narrow band of black. Coldness is the distinguishing characteristic



PLATE I.



of the violet side, and warmth that of the red side ; in the upper portion of the spectrum are found the intense, ostentatious hues, while in the lower portion are the colours of a subdued, retiring nature. Yellow and green are beautifully toned. The former passes from a yellowish orange into a pure, bright tint, which is softly shaded off into white. Green, on the front edge of the black object, is similarly graduated in hue, but as the band of this colour is not so broad as the yellow strip its shadings are not so extensive ; still, it imperceptibly changes from deep into pale green, and diminishes in intensity until it disappears in white light. One feature of this experiment will at once be observed, namely, the brilliance and richness of coloured lights when compared with corresponding colours obtained by pigments or dye substances. Bloom, depth, and purity of hue characterise the former ; but however the latter are produced, they seem, in comparison, to be lacking in fulness, intensity, and brightness.

8. *Utility of Prismatic Experiments.*—Experiments with the prism should frequently be made, as they afford profitable and suggestive exercises in colour combinations. Seeing that the results of these experiments are richer by far than those obtained by pigments, and always harmonious in tone, they are calculated to enhance appreciation for pure and lustrous colouring. For the purpose of successful manipulation of prismatic experiments, and of viewing in a telling manner the effects that may by this means be produced, a piece of black velvet or cloth should be employed, and patterns cut out of white cardboard placed on it, and then the design thus arranged examined through the prism. The more ingenuity exercised in pattern origination, the more pleasing the combinations resultant. Fig. 2 is furnished to illustrate the class of designs best adapted for this work. Form and arrangement should be of the most elementary kind, and the whole pattern clear

and pronounced, in order to allow of a complete development of the colours formed on the respective edges of the various figures. Intermingled, diminutive patterns, always give confused and indistinct effects, which completely baffle analysis.

On the other hand, broad and large designs yield decidedly lustrous colourings, which the experimenter may feasibly dissect, and which teach lessons in shade arrangement, harmony, and contrast, of the highest utility in pattern production.

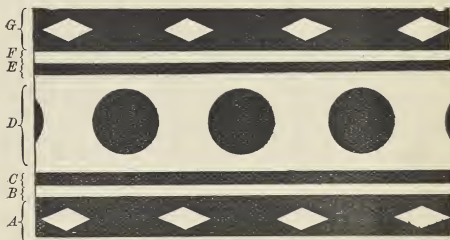


Fig. 2.

When the pattern supplied in fig. 2 is viewed through the refractory angle of a prism at a distance of about two feet, and about three times larger than here sketched, it forms a splendid assortment of colourings and tinted effects. Any description of this charming experiment, however concise and clear, can only afford a vague idea of the real appearance of the pattern when prismatically examined. Still, to assist the reader to make the experiment accurately himself, a detailed analysis is given. Treating of the different sections of the pattern systematically, the

edge of BAND A, nearest the spectator, should be considered first, which commences with pure green, running through blue, purple, deep violet, and crimson. The crimson results from the violet rays of this edge blending with the intense red rays of the edge of Band A, furthest from the spectator.

SMALL LINES B AND C. The former begins with crimson, which successively changes into scarlet, orange, and yellow, a small strip of white separating these colours from those of Band C, which consists of various tints of green and orange.

DIAMOND FIGURES OF BAND A. The front edges of these are tinted with scarlet, orange, and yellow, and the opposite edges with various shades of green.

CIRCLES OF BAND D. First, as to the edges nearest the observer. These are exquisitely coloured with emerald green and grass green. It will be noticed that the green in this section of the pattern is distinct in tint from that produced by the front edge of Band A, being, as stated, more grass- than sea-green. Its peculiar tint results from the orange rays of the upper edge of Band C intermingling with the green rays of the circles. As the centre of the circles are approached, green is succeeded by blue, purple, and black. Second, as to the distant edges of the circles. At these points red, crimson, scarlet, and orange—the latter colour graduating imperceptibly into yellow—all occur. It is notable that the yellow hue is somewhat dingy, being adulterated with other colours. Compare it, for example, with the yellow resulting from the extreme edge of this diagram. Its dulness and impurity are due to certain colours intermingling with it. Thus, the space between the extreme edge of the circles and Band E is so limited, that the yellow rays of the circular objects combine with the green rays of the latter, and, as a consequence, the yellow suffers in purity and luminosity.

BANDS E, F, AND THE FRONT EDGE OF G. These, very closely resembling strips B, C, and A, require no description.

EXTREME EDGE OF BAND C. * Here the red side of the spectrum is seen in all its intensity and lustre; it begins with deep red, which gradually verges into orange, and the latter into yellow.

This simple experiment demonstrates the value of prismatic results. All colourists should study shade combinations through these media. Analysis of the unique colourings obtained in this manner increases the acuteness of the faculty of discrimination of the brilliance and depth of hue of individual colours. Though, in practice, the textile designer has to deal exclusively with pigments and dye substances, yet the intensity and beauty of the combinations resulting from the decomposition of light are so novel and suggestive, that all desirous of cultivating aptitude for harmonious colourings will be at pains to multiply experiments of this class, which afford a true conception of what constitutes harmony and contrast in colours.

9. *Schemes of Colouring.*—There are two important theories of colours—the Light Theory and the Pigment Theory. The former deals with the phenomena of colours, demonstrates the attributes of light, and expounds the laws which control the modification of the intensity, hue, and tone of colours. It teaches, as already indicated, that when light passes through varied media it is deflected, or broken up, producing several kinds of lights. This process is termed dispersion. When analysing the physical changes to which the colourings in the woven fabric alluded to in Paragraph 4 were due, it was shown how certain shades are made visible. All coloured bodies have the properties of exciting oscillations in the luminiferous ether of different lengths, and these give colours of known tints. What is called daylight is simply light resulting from a co-mingling of all possible lengths of vibrations. Speaking briefly, according to the Light Theory, the coloured aspect of any texture is dependent on its powers to extinguish certain

undulations and reflect others; that is to say, a crimson fabric is such because it extinguishes all undulations of light but those which, when emitted, produce this colour. Let this fact be further demonstrated. If a sample of red cloth is placed in the red portion of the spectrum it will appear more brilliant and intenser in hue; but should it be placed in the violet section it will be changed into black. What are the reasons for this? In reality the change from red to black is determined by an alteration in the light. The red fabric when viewed in daylight neutralizes all colours contained in this light—namely, yellow, orange, green, blue, indigo, and violet—but red, the rays of which it collects together and reflects. Now, having changed the light from white to violet, the fabric becomes black; because, though it emits the parcel of red rays a violet light contains, yet these rays are so few that they fail to excite any coloured sensation. These varied phenomena are theoretically of the highest importance; but as they have few practical applications, the Pigment Theory of colouring has many able exponents. It is invariably adopted in the applied arts, and deals with colour as an active element in decorative design. Scientifically it is no more a correct scheme than the Light Theory is applicable to the industries or to the mixing of paints; but, in obtaining effects with pigments, its results are as reliable as those got by combining the spectral colours. In a word, it is *the* Theory of Colouring which can be worked out in practice. According to its teaching every possible shade and hue of colour may be obtained by mixing red, yellow, and blue together in variable proportions, and, of course, by toning and tinting with white and black. Thus, yellow and blue give green; yellow and red, orange; and red and blue, purple.

10. *Spectral and Pigment Colours Compared.*—For a long time it was assumed that mixtures of lights and pigments produced analogous results. Lambert is credited with being

the first to discover and prove that the colours due to these two causes were rarely identical, and frequently widely dissimilar. His method of doing this is so simple that we reproduce it. Two coloured wafers, A and B, fig. 3, were placed on a black surface, and a piece of ordinary glass, *g*, fixed vertically. It was found that when blue and yellow were thus simultaneously seen, the rays reflected by them did not, when co-mingled, give green, but a whitish-coloured sensation. This fact was also independently discovered by Plateau, and subsequently elaborated by Helmholtz, who

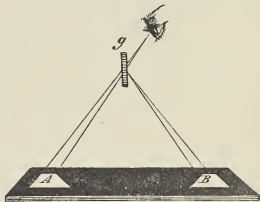


Fig. 3.

pushed his inquiries into the spectrum itself, and by blending their lights obtained precious and valuable results. Green, when mixed with red, instead of giving a brownish or greenish grey as with pigments, was also found, like blue and yellow, to constitute white light. It is remarkable that when three or several spectral tints are combined, they do not give an entirely new colour, but only fresh varieties of those hues resulting from mixing two tints. On turning to paints it is found that a mixture of chrome yellow and ultramarine blue, in variable quantities, form different tints of green. Microscopic examination of this compound does not reveal the separate particles of yellow

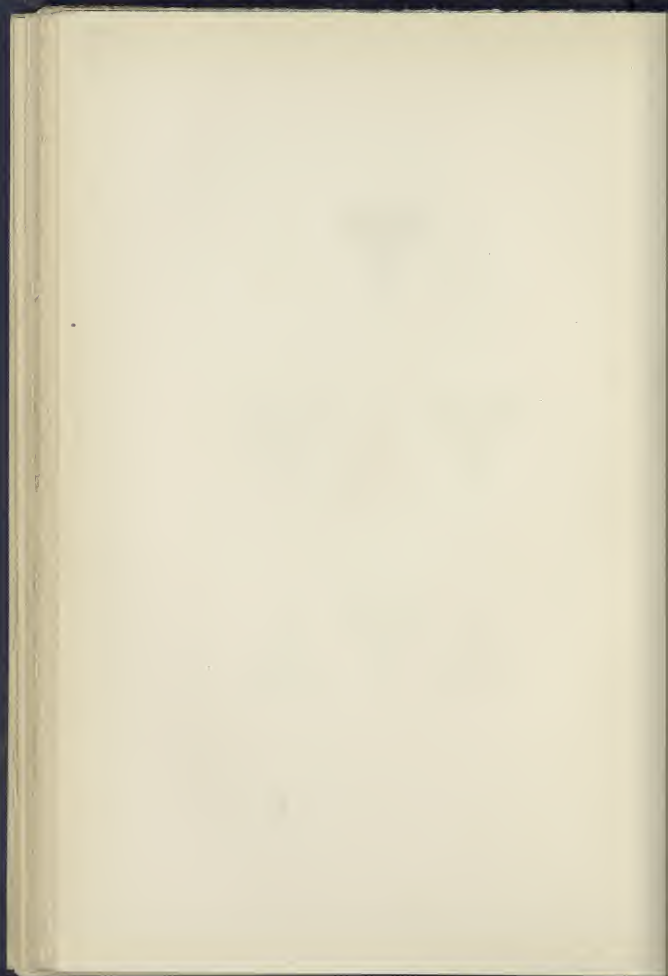
and green pigments entering into the combination, but simply a greenish hue. The explanation of the origin of this tint is as follows: White light penetrating two layers or series of minute particles of coloured paints undergoes a twofold process of absorption; in the green surface the yellow constituent absorbs the green and violet, while the blue constituent absorbs the red, orange, and yellow hues of the spectrum; some of the green rays are also neutralized, but not so completely as other rays enumerated. Seeing that green is the only colour which remains after this double absorption, a yellow and blue pigment compound gives a green tint. So that the resultant colour when two pigments are combined is that hue which remains partially intact after each has subtracted its quota of tints from the spectrum of white light. On the other hand, when lights are mingled, the process is not one of subtraction but of addition. Taking for illustration the crimson seen in Band A of fig. 2, when viewed through the prism, it results from an admixture of purplish blue with red rays. Hence the real and obvious distinction between spectral and pigment combinations is that the former are invariably additions, while the latter are subtractions. Knowing this it will at once be evident that the colours obtained by these two methods can seldom exactly coincide, and must often be as different as imaginable.

11. *Classification of Colours.*—All colours are divisible into two distinct classes—simples and compounds. Simple colours cannot be split up into other hues than their own; in a word, they are individual colours. Compounds, being the results of combining two or more tints, may be decomposed and reduced to their constituent parts. The seven colours of the spectrum are all simples. This may be shown by employing a pair of prisms intercepted by a movable screen. The light passing through the first prism is decomposed and produces the spectrum on the

screen, which is gradually lowered to allow the colours, one by one, to pass through the second prism, where, though refraction occurs, the several tints remain unaltered. This experiment conclusively proves, that as the spectral tints cannot be decomposed, they are simple or primitive colours. It is possible, however, by combining the spectral colours, to get a variety of hues; for example, red and bluish-green produce yellow; and red, yellow, bluish-green, and indigo produce white; but neither of these tints, as just explained, when separately considered, can be so treated as to give other colours than those which have obtained for them their characteristic designations. The writers on the Pigment Theory of colouring are all agreed as to the selection of the simple colours; but scientists have, in treating of this subject, chosen several sets of hues as primaries. Maxwell, for instance, who is supported by Benson, takes red, yellow, bluish-green and indigo as primary colours, and certainly a very extensive assortment of shades can be obtained by combining pure lights of these hues. Helmholtz's theory comprises five primaries or simples, namely, red, yellow, green, and violet. When the subject of colour is considered with a view to its practical application to the arts, it is needful to base all combinations on Newton's scheme—elucidated by Chévreul, Hay, Field and others—that red, blue, and yellow (Plate II., Nos. 1, 2, and 3) are simple colours, and all others the resultants of mixing them in variable quantities. According to the phenomenon of light, red and bluish-green, as stated above, give yellow; but in pigments they form a purplish citron, while yellow here is a simple colour, and green a compound one. In actual manipulation with pigments the older theory thus affords more immediate and exact results. Many of the mixtures obtained by this system are diametrically opposed to the laws of physics; but as the object of a treatment of colours in their relation to art and industrial productions is purely



PLATE III.



technical and practical, the subject must be studied in such a manner as to assist in the improvement of the artistic merit of woven design. For technical purposes it is therefore only feasible to deal with colour as it changes, according to the pigments combined; hence red, yellow, and blue will be regarded as primaries, because, when mixed with each other and with black and white, every possible shade of colour may be obtained.

12. *Compound Colours.*—These are of two classes—secondaries and tertiaries. The secondaries—green, orange, and purple (Plate II., Nos. 4, 5, and 6), are composed of two primaries, while the tertiaries—russet, citrine, and olive (Plate II., Nos. 7, 8, and 9), are composed of two secondaries. Orange and purple produce russet or reddish brown; orange and green produce citrine or greenish olive; and green and purple, olive. On reducing these shades to their simple elements it is found that they are each composed of three primaries, with one predominating and giving tone or character to the colour. Russet, for instance, contains a double portion of red, for red is a constituent of both the orange and purple which enter into its composition; citrine contains a double portion of yellow, and olive a double portion of blue.

The hue or tone of a compound colour is determined by the proportionate quantities of the primaries combined in its production. For example, to procure a bluish-green, blue must be the predominating and yellow the subordinate colour; while, on the other hand, to obtain a yellowish-green, yellow would be the predominating and blue the subordinate colour. Reddish or yellowish orange is got by increasing the red or yellow constituents of this colour; and bluish or reddish purple, by increasing the blue or red components of this secondary. This affords some idea of how colours are modified and multiplied *ad infinitum*. Taking the three secondaries and subjecting

them to similar treatment, quite an extensive diversity of shades will be found to result. Beginning with russet, which, as given in No. 7, on Plate II., is composed of two parts red, one part yellow, and one part blue, it will be obvious that by varying these proportions quite a new series of hues will result. By increasing the red constituent the warmth of the colour is intensified; by increasing the yellow the reddish aspect is neutralized; while an increase of the blue would add to its depth and saturation. Similar results are obtained by modifying the constituents of the other primaries. Thus citrine—composed of two parts yellow, one part blue, and one part red—may be changed to a yellowish, bluish, or brownish citrine, according to the quantity of yellow, blue, and red entering into its composition. As to olive, which consists of two parts blue, one part red, and one part yellow, it varies from a deep olive-green, brownish olive, to a yellowish olive-green, as the blue, red, and yellow constituents are increased.

The tertiary shades are the most useful colours employed in textile design. They are generally used for the ground of the fabric, while the secondaries and primaries are utilized in enhancing the brightness of the pattern.

13. *The Three Constants of Colour.*—It is important to be able to discriminate three points with regard to the nature of colours. First, as to their *Purity* or saturation. This is determined by comparing them with the spectral hues, which are taken as a standard and which are alone pure. In this way the amount of white or foreign light a colour contains may be estimated. If a piece of paper is painted vermilion and placed across the red end of the spectrum, it will be seen to be deficient in purity. Emerald green and ultramarine blue papers, when compared with their respective sections of the spectrum, are found to be similarly defective. By mixing white light with the spectral tints they may be so adulterated as to correspond with, or

match, those obtained by the use of pigments. Artificial colours are never perfectly pure—they always contain some measure of foreign element, which can only be correctly determined by bringing them in contact with the colours of the solar spectrum. A second constant is *Luminosity* or *Intensity*. This characteristic depends on the degree of light a colour reflects, or on the amplitude of the vibrations it produces. Yellow, orange, and red represent the most luminous, and green, blue, and violet the least luminous end of the spectrum. It will be evident that it is possible to have two or more colours of the same degree of purity, but of different degrees of brightness. Two scarlets might both contain the same proportionate quantities of colour and of white light, and yet be dissimilar, simply on account of one being more intense in hue than the other. To match the two colours, the more luminous one would require to be exposed to a dull light, or the less luminous to a bright light. The third constant is that special property which is due to a definite refrangibility of light, producing the colour proper. Green and red may be exactly of the same purity and brightness, but they are different in tint, because each is produced by a distinct refrangibility of rays.

14. *Temperature of Colours.*—The temperature of the spectral colours is not uniform. It augments from violet to red. Sir William Herschel, by exposing thermometers to the several tints of the solar spectrum, determined the temperature of each colour, and proved that, proceeding from the most refracted or violet end of the spectrum to the least refracted or red end, there is a successive increase of heat. Besides luminous rays, the sun emits a mass of invisible but potent calorific rays. Herschel, pushing his thermometers beyond the visible red and violet rays, discovered the presence in the spectrum of ultra red rays of intense heat, and ultra violet rays of a less heat. The solar spectrum may therefore, scientifically speaking, be

described as consisting of three distinct sections: First, of the ultra and invisible red rays; second, of the luminous rays red, orange, yellow, green, blue, and violet; and third, of the ultra and invisible violet rays. Though it is thus evident that each spectral colour has a different temperature, yet it cannot be assumed on this basis that a red fabric will possess a greater degree of heat than a blue fabric composed of the same materials; because all rays penetrating a coloured body are not luminous, and yet, whether luminous or non-luminous, they possess heating properties. Were the rays absorbed by a coloured surface only luminous, then it would be possible, by estimating the extent of absorption, to determine the tinted temperature of the article. But the bulk of radiation from any luminous body consists of invisible calorific rays, regarding which colour teaches absolutely nothing. A fact that has to be taken into consideration is, that a body may be highly susceptible to one class of rays, but insusceptible to other classes. As it is generally known that black garments are more effective retainers of solar heat than white garments, it may be pointed out why this is the case. White cloths absorb the invisible rays, but reflect the mass of luminous rays which constitute solar light. Black or dark cloths, on the other hand, not only retain the dark rays which penetrate them, but also the visible rays; and hence they are just that degree warmer than white fabrics of the same structure and material, as the difference in the influx of temperature due to the absorption of luminous as well as invisible rays. Professor Tyndall shows that if a white cloth were spread over the snow it would even act as a shield to the latter instead of assisting it to thaw. Snow, which is ice in a powdered form, absorbs the dark rays with greater avidity than a white fabric; and, as both the particles of snow and the threads of the texture reflect the luminous rays poured upon them, the snow would melt sooner without the cloth

than with it. Indeed it would be found that in a short time the cloth would occupy quite a prominence—the snow not covered by it thawing more rapidly than that over which it is spread. Should a black fabric of similar material be next placed on sunned snow it would produce the very opposite results. Absorbing the luminous as well as the dark rays, it retains more of the sun's heat than the snow, which rapidly melts under it; while the surrounding and uncovered snow remains comparatively unthawed and icy. Both the white texture and the snow are powerless as regards the luminous rays emitted by the sun; the myriads of fibres composing the former receive no warmth from them, nor can the ice-like atoms of the latter be melted by them. They, in a word, can only be changed by the dark rays. On coming to the black-surfaced texture, there are different conditions to be taken into account. It is both an absorber of the invisible and of the luminous rays, consequently dark materials not only attract but retain more of the sun's heat than light materials. More than this cannot be stated with certainty about the warmth-yielding qualities of woven textures of various colours.

CHAPTER II.

ATTRIBUTES OF COLOURS.

15. Utility of a Knowledge of the Qualities of Colours—16. Qualifications of the Textile Colourist—17. Functions of Pure Colours in Design—18. Red: its Characteristics—19. Methods of Modifying Colours—20. Derivatives of Red: their Qualities and their Province in Textiles—21. Blue: its Properties and Uses—22. Derivatives of Blue and their Application to Woven Textures—23. Shades and Tints of Blue mixed with Shaded and Tinted Reds and Yellows—24. Methods of Obtaining Well-balanced Colourings—25. Uses of Blue in Twist Yarns—26. Points in the Application of Blue and Red to Textiles Summarized—27. Attributes of Yellow—28. Province of Yellow in Woven Fabrics—29. Derivatives of Yellow—30. Secondary Colours—31. Green: its Attributes and Derivatives—32. Tints of Green—33. Orange: its Shades and Tints—34. Purple.

15. *Utility of a Knowledge of the Qualities of Colours.*—In order to apply colour artistically to woven goods one must be conversant with the properties and powers of the various shades textile technologists are called upon to manipulate and arrange. More is requisite than a mere acquaintance with the technical details which lay at the basis of successful work in the construction of sound, utile, and ornamental textures; this knowledge must be supplemented by trained skill in the blending of fancy shades, and in the origination of novel and elegant schemes, or methods, of colouring woven fabrics. Weaving acumen must be seconded by competency to amalgamate, and to distribute, on textile surfaces colours of various hues and intensities. Exact knowledge of the nature and function of colours, and of the laws which determine harmonious

mixing, is an indispensable desideratum in textile designing. Strictly speaking, it is of paramount importance for the originator of patterns produced by the loom to display in his work a reliable conception of the province of colours in woven effects, as for a manufacturer to have regard to the chemical composition, mechanical structure, and clothing qualities of the materials he blends in the formation of his stock. Just as it is needful, in blending wools and other materials, to take into account the nature of the fibres employed, so in colouring textures the attributes of individual shades require to be carefully considered.

16. *Qualifications of the Textile Colourist.*—One of the primary qualifications of a good colourist is natural aptitude for his work. To adequately appreciate and enjoy harmony of mixing in colours, the eye of the observer must be competent of conveying to the mind a correct impression of the *ensemble* of shades visible. Capacity to discriminate between congruous and inharmonious combinations of colours depends, in a word, as largely on the physical constitution of the eye as the power to detect harmony or discord in music depends on the sensitiveness of the ear. Two things seem to be requisite—intuitive and acquired taste for colours, combined with practice in textile combinations. Yet these alone are not sufficient. They may enable one to judge of the purity of colours, or of the relative difference between two separate hues; but this species of discrimination, however acute, does not constitute that kind of appreciation for harmony of tinting which makes it impossible for a designer to produce incongruous blends of colours. Another quality besides those named is therefore needful. It may be said to be partially, if not wholly an intuitive talent, for it is often displayed in the works of those who possess but slender knowledge of the so-called laws and theories of colours. There must, in a word, be a taste or genius for colouring. Such is the perfection in

which some minds possess this natural discriminative power for colours that the most exquisite blending and toning of shades are exhibited in their productions. Artists and designers of this class are a law in themselves. Natural talent is the source of their inspiration. Unfortunately all do not possess this intuitive and inestimable faculty, hence the utility of a systematic treatment of colours in relation to their application to woven manufactures. To those who lie between the colour-blind and the natural colourist a disquisition on the laws and arrangement of shades becomes essential and helpful. As a capacity for music may be developed by training, so a power for colouring may be augmented by studying harmony and contrast, and the general principles of the science as they relate to the development of tinted patterns in the loom; consequently, though culture may not create that richness of conception exercised by those who have an intuitive bent for harmonious assortments of hues, yet it may result in producing a passable, if not a proficient colourist, and is, moreover, calculated to direct even the naturally talented to a judicious selection and use of materials.

17. *Functions of Pure Colours in Design.*—Before treating of the characteristic attributes of the principal and most potent colours, namely, red, blue, yellow, green, orange, and purple, it is needful to allude to the province of these tints in various types of woven decoration. Some designers so rarely use such hues, unless tempered with either white or black, that they seem to entertain an idea that they can only be made to yield strong and harsh contrasts. Certainly this is likely to be the case if they are not combined with due regard to intensity and quantity of hue, the methods of distributing the several colours, and the relative effect they have on each other in the woven fabric. Bright colours should always be applied to textures for the purpose of imparting tone and character of pattern.

Though, generally, they do not form the bulk or groundwork of the style, yet they should give a sort of additional lustre and bloom to the design. What such hues are to decorative and pictorial art—an indispensable beautifying element—they are to loom productions when skilfully employed. There are not, so far as the principles of colour blending are concerned, different laws determining the application of tints to the canvas and the woven fabric. Those hues which possess harmonious properties in the picture will be congruous in the loom production—it is not in the tints themselves, but in the media of development that a dissimilarity of treatment is called for. Recognizing this fact, we may learn much concerning the function of pure colours in textiles from consulting works of fine art. For example, here is a suggestive and instructive principle of Turner's: a mixture of blues and tinted whites—in textile phraseology, *stained* whites—helped by pale, cool green; and the whole enlivened by a point of rich, brownish crimson. Minus the crimson a combination of this description would be wanting in bloom and appear washy and pale; for the contrast and richness of tone this *melange* of tints possesses is mainly due to the appropriate use of this warm and cheerful colour. So it is, or should be, with the majority of patterns in which the primary colours enter, their lustre and attractiveness being attributable to these potent and effective hues. Hence, one of the first functions of decided and bright tints in textiles is to convey bloom and elegance to the design and enrich the general tone of the colouring.

Tawdry and showy colourings in which the primaries appear result more from the system of combination adopted than from any excessive brightness of the shades. No one would say that the Paisley shawl or the real Turkey carpet are tawdry, and yet these fabrics often comprise the most brilliant shades producible in the dye vat. In the former

texture, in addition to a play on certain figures which are generally unique in arrangement and ingeniously grouped, there is a depth and fulness of tinting that seems to possess all but a permanent freshness. As to the Turkey carpet, it contains a very large diversity of colours, and mostly of a bright character, but still the general effect is pleasing and cheerful. To what are the congruity of tone and richness of colouring due in these textures? This law is observed in their composition: the quantity of each colour used depends entirely on the position it occupies in the pattern and on its intensity and quality; while the several shades are so blended that when the carpet or shawl is viewed in its entirety the whole possesses a neutralized bloom. This is the general effect sought after in tweeds and all classes of fancy fabrics. Patterns in which certain colours are more prominently developed than others are seldom appreciated. If such powerful tints as scarlet, blue, gold, green, crimson, and orange are applied to a woven design—though decidedly stronger in hue than the shades forming the bulk of the fabric—while tingeing the pattern with an agreeable freshness of tone they should not be allowed to unduly attract the eye. The use of fine twist yarns very largely facilitates the production of congruous combinations in which bright colours play a prominent part in the composition of the pattern. By employing these threads the colours may be neatly broken up, in which form they do not produce that continuity of effect which necessarily results from the use of self-coloured yarns. The secret of effective colouring with pure tints lies, however, in a proper distribution of the shades combined, incongruity of effect being as largely due to defective balancing of colour as to injudicious and distasteful combinations; in a word, there is much dependent on the arrangement and distribution as well as on the selection and blending of shades in pattern origination.

In addition to thus acting as the brightening factors of woven design, these colours are also used in some classes of textures as ground shades. For instance, they are the principal tints employed in dress fabrics of a Scotch clan class, certain kinds of shawls, silk neck-ties, handkerchiefs and wraps; but generally in worsted and woollen textures they are used sparingly, and more for giving lustre to a sombre mixture of colours than as the main constituents of the patterns. When introduced into these goods they are distributed in small particles throughout the texture, or in some cases, as in vestings, they are so manipulated as to form compact spots or figures. Pure colours have therefore two distinct functions in textile patterns: first, they constitute a kind of supplementary colouring which imparts lustre and intensity of hue to the style to which it is applied; and, second, they may be the only, or the principal shades comprised in the design.

18. *Red: its Characteristics.*—Red (No. 1, Plate II.) is designated a simple or primary colour in both the light and pigment theories of colouring. Of all tints it is the most showy, brilliant, and gorgeous. Intense red is so powerful that when used in large quantities it neutralizes the effect of adjacent hues. On this account its distribution in textiles should always be accomplished in accordance with the depth of the other tints entering into the style; that is to say, its intensity as well as its quantity must be varied in the same proportion as the general colouring of the pattern is diminished or augmented in tone. An otherwise neatly tinted pattern may be readily destroyed by using too strong a red or too large a quantity of this tint. Yet red is decidedly one of the most useful colours at the command of the decorative designer and the textile producer. Whether employed as a pure or as an adulterated tint, it is of extensive utility in textile designing. When judiciously applied, it adds brightness and cheerfulness to woven effects. Its

true sphere in textiles is to impart freshness. Red in these compositions is the great brightening or cheering hue. Just a dot in some cases is sufficient to relieve the monotony and sombreness of the mixture. In applying red tints to worsted and woollen fabrics, they should seldom occur in patches or in continuous lines of a check arrangement, but they should be more or less intermittent in effect. It should be borne in mind that in these cloths it is not loudness or showiness, but neatness of style, that is sought after, yet the quality of brightness must not be lacking. In the form of twist yarns, reds and scarlets can be made to produce exactly the general toning required. This mode of applying these tints is particularly well adapted for cloths of a cheviot and tweed description. Worsteds require different treatment. One method of introducing reds into these goods consists in using silk yarns, and simply bringing them on to the surface of the cloth to form a bright spot or minute line of colour. As to silk, cotton, and some kinds of linen textures, this primary plays a considerable part in their decoration, being used in larger quantities and more liberally displayed in patterns composed of these materials than in the ordinary run of woollen and worsted fabrics.

Being such a potent and ostentatious colour, it is of great utility in the blending process of manufacturing, when several shades of materials are compounded to produce a mixture yarn. Some of the most elegant blends of this class contain particles of scarlet wools, which, in whatever form they occur, give tint and character to the combination of which they form a part. An endless variety of tints and shades results from mixing red in variable quantities with black or white, and also an extensive range of hues from combining it with other colours. Indeed, probably pure red is not so liberally used in decorative work as these its derivatives. Thus, it unites with yellow and

blue in the production of orange and purple, which are called its melodizing tones. Should a small quantity of yellow be added to red it gives scarlet, while the addition of a small quantity of blue produces crimson. The richness and luminosity of the scarlet are determined by the proportion of yellow added; and the depth of the crimson by the amount of blue entering the mixtures. Both in scarlets and crimsons a considerable diversity of hues is obtainable. Before, in fact, either of these colours are produced, red undergoes a beautiful series of gradations of tint. In the rose there is displayed to perfection all the various modifications in tint and shade to which this important colour is susceptible. Scarlets, crimsons, maroons, russets, and browns are all hues employed by the weaver that obtain their prevailing tint from this primary.

19. *Methods of Modifying Colours.*—All pure colours, such as red, blue, yellow, orange, green, and purple, may be subjected to three kinds of modification: first, they may be darkened in tone; second, lightened in tint; and third, completely changed in hue. If, for example, black is mixed with red in various proportions, it produces *shades* of this colour, while an admixture of white with red yields different *tints* of red. To alter the hue it is necessary to blend it with some other colour, such as blue, when various shades of full-toned crimsons result. In blending, and also in the arrangement of colours in the warp and weft of the woven fabric, the phenomena underlying the changes producible in the tone and tint of a colour have to be taken into consideration. Black and red wools when scribbled together give a dark brown or reddish-brown mixture, according to the quantities of the respective shades entering into the combination; on the other hand, if white and red wools are blended, a mixture of a pinkish character is obtained. Hence it is clear that the same principles which determine the alteration in the shade, tint,

or hue of a colour when pigments are combined also regulate the results due to mixing several colours of textile fibres.

Strictly speaking, white and black cannot be designated colours, being merely representative of the principles of light and darkness, and acting, in the multiplication of shades and tints, as the great modifiers of colour. Such is their province in the rôle of colour production. In design they are indispensable in mellowing certain combinations of hues, and in giving precision and clearness to specific sections of a pattern. As ground shades they are also useful. All light colours appear bright and distinct on black surfaces; while deep, full colours, such as blues, purples, and reds, appear intense and blooming on white materials. So that by a proper use of these shades it is possible, in the first place, by the process of mixing them with bright colours, to produce new and novel hues; and, in the second place, by introducing them into the warp and weft of the pattern, to impart agreeable smartness and lustre to the various colours employed.

20. *Derivatives of Red: their Qualities and their Province in Textiles.*—By the derivatives of a colour are signified those shades and tints which result from mixing it with various quantities of white or black. Those obtained from red are both numerous and important, being specially useful in the production of woven effects. They comprise both ground and fancy hues. First, in the category of the derivatives of this primary, are those shades produced by toning it with black. A few typical specimens of these are given in Nos. 1, 2, and 3, Plate III. The brightest shade (No. 3) is compounded of 3 parts of red and of 1 part of black; the medium shade (No. 2) of equal quantities of red and black; while in the dark brown (No. 1) black preponderates, the proportions being 1 part of red to 3 parts of black. Three richer shades of brown than these would be difficult to produce. All may be used as ground colours,



1



2



3



4



5



6



7



8



9



10



11



12



13



14



15



16

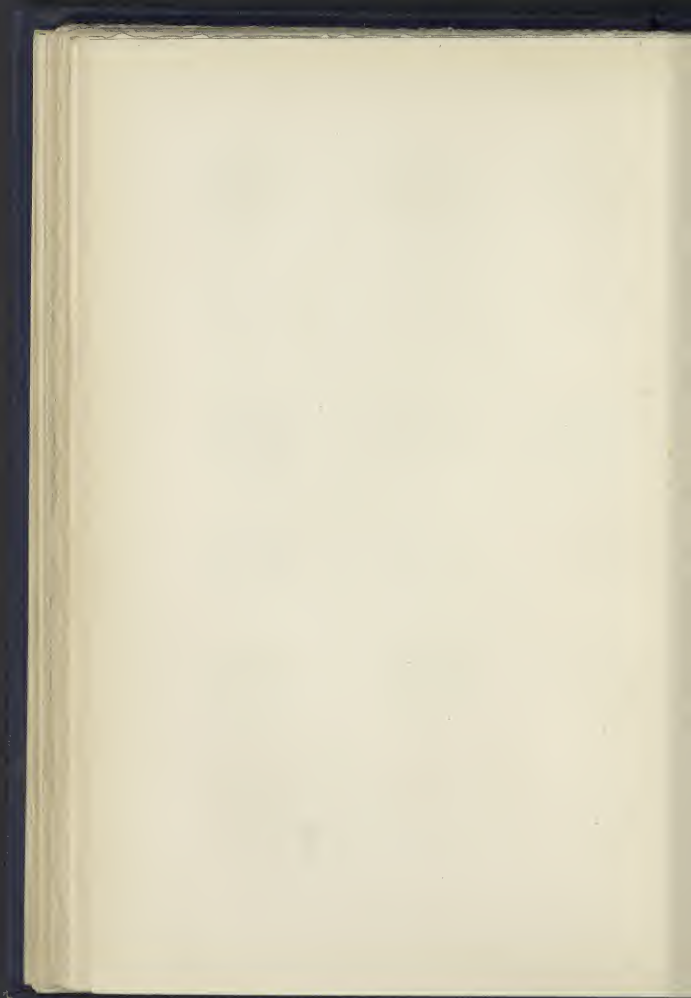


17



18

PLATE III.



but the two latter are the most appropriate for this purpose. Shade 3 is, however, frequently employed with good results in dress fabrics for the foundation of the texture. Some excellent colourings ensue from their combination. The two extremes—Shades 1 and 3—when brought together in the same style give a softly-toned pattern. A less pronounced contrast ensues from a mixture of Shades 1 and 2, or Shades 2 and 3. In combinations of this order there should usually be a larger quantity of one colour element than another. Another method of amalgamating these shades consists in introducing all the three of them into one pattern. For example, if twelve threads of Shade 1, eight threads of Shade 2, and four threads of Shade 3, were woven together and checked over in the weft by a similar arrangement of yarns, a very neat design would be obtained. It might be totally changed by taking four threads of Shade 1 instead of twelve, and twelve threads of Shade 3 instead of four. In the former style the dark brown would preponderate, but in the latter the light brown, the quantity of the medium hue being the same in each instance. Probably these illustrations are sufficient to demonstrate the utility of these shades and the systems on which they are amalgamated in pattern construction.

Turn next to the tints furnished in Nos. 4, 5, and 6 on Plate III. Brilliance and intensity of tone characterize these hues, making them highly adapted for imparting lustre and richness to design. Like the colour from which they obtain their specific tint, they are ostentatious and potent in effect. While the Shades given in Nos. 1, 2, and 3 are all darker in tone than the original red, these tints are lighter on account of the entrance of white into their composition. Thus they are made up as follows:—

Tint 4, Plate III.—1 part of red and 3 parts of white.

Tint 5, „ „ —2 parts of red and 2 parts of white.

Tint 6, „ „ —3 parts of red and 1 part of white.

Bright tints of this kind are extensively used in figured weaving, as in the manufacture of vestings, silk neck-ties, dress fabrics, and trimmings. Sometimes in the latter description of textures they form the bulk of the texture. In the ordinary run of woollen and worsted cloths they are, however, only sparingly employed, and that in the form of twist yarns. Amongst the varieties of twists which can be produced by combining two or more of these shades and tints of red, the following are selected as suggestive illustrations:—

- I.—One thread of Shade 1 twisted with one thread of Tint 4, Plate III.
- II.—One thread of Shade 1 twisted with one thread of Tint 6, Plate III.
- III.—One thread of Shade 2 twisted with one thread of Tint 5, Plate III.
- IV.—One thread of Shade 3 twisted with one thread of Tint 4, Plate III.
- V.—One thread of Shade 1; one thread of Shade 3; and one thread of Tint 4, Plate III, twisted together.

Each of these compound yarns, in worsted, woollen, or cotton materials, is capable of contributing largely to the beauty of woven pattern.

Another section of manufacturing in which these derivatives are called into requisition is in the blending process, or in the production of fancy mixture yarns; but this subject will be discussed at length in a subsequent chapter.

21. *Blue: its Properties and Uses.*—Blue (No. 2, Plate II.) is one of the most valuable colours used by textile designers. In dark shades it is utilized for the ground of patterns; in medium shades it is employed for melodizing and toning purposes; while bright blues—lustrous and full of bloom—convey freshness and force of colouring to those styles in the composition of which they have a part to play; so that this primary has three dis-

tinct functions in the province of textile designing. In each of these spheres it will be indicated what its properties are as a colour, and the relation it sustains to other shades with which it may be combined. Previous to treating of these particulars, it is desirable to explain its general attributes.

Unlike red, which is decidedly a warm colour, blue is cold and retiring. These qualities distinguish it from yellow, orange, red, and kindred shades, all of which produce a sensation of warmth. Being closely allied with darkness, it is very diffusive—resembling in this respect black and purple—and is indistinct and neutral in a declining light, but strong and brilliant in a bright light; hence, when applied to light grounds, it is not only pronounced in hue, but is quite distinct from other shades, while on a dark or black surface it is both mellow and lustrous in effect. Another characteristic it derives from its close alliance with darkness is a tendency to disappear sooner than any other colour, but purple, by distance. This latter quality is availed of in the production of certain patterns in which it is desirable that some sections should appear partially in the shade and yet possess a definite outline.

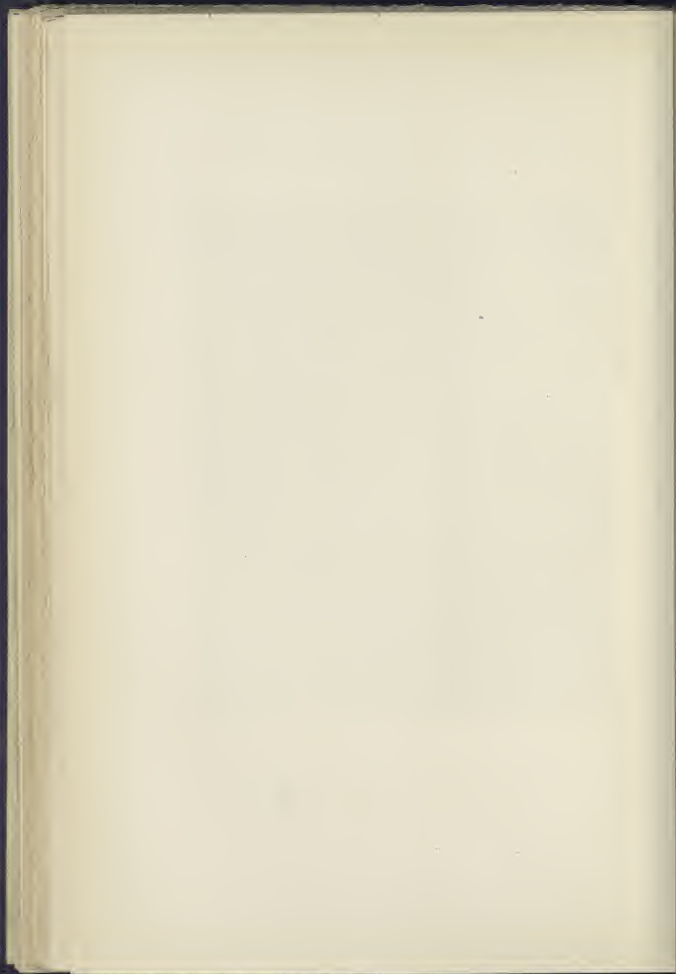
Its property of coldness makes it a very useful shade for subduing the inelegant redness of some colourings; for it in some degree neutralizes the warm hue of the browns, maroons, russets, or other shades forming the pattern in which red is the prevailing tint. This does not, however, indicate that red and blue harmonize; on the contrary, whenever these two colours are associated in large quantities, the resultant composition is somewhat incongruous, but that when combined with browns and russet olives, or shades in which the red tint is assimilated by the quantity of black they contain, blue can be made to yield excellent coloured effects. Pure blue, like pure red, is not so largely

used as its derivatives, still it has a place in textile designing. This is principally as a fancy yarn, when it gives freshness and bloom to the pattern. It is also employed as a ground tint in the manufacture of fine silk fabrics, and as the figuring colour in certain makes of fancy worsteds.

22. *Derivatives of Blue and their Application to Woven Textures.*—If blue is mixed with black, shades of an indigo character result; but, if mixed with white, peacock blues, lavenders, and pale blues are formed. Some few examples in both these types of derivatives call for analysis. From the series of dark or shaded blues three examples have been selected, namely, those supplied in Nos. 7, 8, and 9, Plate III. The first consists of 1 part blue and 3 parts black; the second (No. 8) of 2 parts blue and 2 parts black; and the third (No. 9) of 3 parts blue and 1 part black. The first shade is of a genuine indigo character, being a very useful colour for piece-dye goods, as well as for the grounds of fancy fabrics. By studying this method of mixing, it will be observed how a pure and intense colour may be gradually darkened in shade, or—if white is added—gradually lightened in tint, until it closely resembles black or white, as the case may be. This system of varying the tone of a colour makes it feasible, by a proper assortment of hues, to produce a complete darkened or lightened shade either in stripes or checks in woven goods. Take, for example, the three blues given in Nos. 7, 8, and 9 on this Plate. If these are amalgamated according to the scheme appended, a perfectly shaded blue check will result, which in worsted, woollen, or cotton yarns will constitute an agreeable pattern. First, take eight threads of Shade 7, next eight threads of Shade 8, and lastly eight threads of Shade 9. Let the warp thus arranged be crossed with similar quantities of the respective shades, and checks of these several blues will be formed in the fabric. An adoption of this plan of colouring produces checks of equal



PLATE IV.



proportions of the different shades; but, if needful, these might be easily got in various dimensions, say, for instance, the darkest check about three-quarters of an inch in size, and the remaining two checks half an inch.

A few of the principal tints of blue, got by mixing this primary with white in the same proportions as the shades just described were produced by mixing it with black, are given in Nos. 10, 11, and 12, Plate III. The white they contain has given them a softened and mellowed tone, having neutralized that forcible and striking attribute which characterizes pure blue. On comparing them with the original colour from which they result (No. 2, Plate II.), the extent to which white is competent of subduing and mellowing bright hues with which it is blended will be evident. Tints of this class are used in various ways in designing. Some charming styles in silk handkerchiefs are producible by the exact depth of hues seen in the illustration—these weights of colours forming congruous and evenly-balanced patterns. They are also largely employed in cotton textures. One example of this type of combination is furnished on Plate IV. This is a sketch of a dress fabric made of cotton yarns. The warp is light blue—Tint 10, Plate III—and the weft a deeper blue, or Tint 12. The neatness of this style is largely due to the soft but clearly apparent contrast between the tints of the warp and weft yarns.

23. *Shades and Tints of Blue mixed with Shaded and Tinted Red and Yellow.*—In those styles in which blue is employed for ground purposes, indigo shades are invariably used. Blue, however, is not a foundation colour that admits of much diversity of tinting. To succeed in its application to the grounds of patterns, an extensive range of browns, olives, and greys should be called into requisition. With shades of the olive class it gives the most marked contrasts. This is due to yellow being the prevailing tint of this compound hue. But it also mingles harmoniously with certain

tints of grey and brown. Patterns in which these shades are arranged as in the following Tables, in woollen, worsted, and cotton yarns, illustrate the methods of combining blue effectively and artistically with different shades and tints of red and yellow. In Table I. the combinations of shades are included; but in Table II. will be found the tints of red, blue, and yellow. The colours are given in groups of six threads, and would, providing the arrangements appended were carried out in the weft, produce a series of clearly developed check effects.

TABLE I.

(a) Shades of Blue and Red (Plate III.).

Ex. 1. Dark shades.

Black preponderating.

6 threads of dark blue (Shade 7).

6 " " brown (Shade 1).

Ex. 2. Medium shades.

Black and Blue, and Black and Red equally mixed.

6 threads of mid blue (Shade 8).

6 " " brown (Shade 2).

Ex. 3. Lightish shades.

Blue and Red preponderating.

6 threads of toned blue (Shade 9).

6 " " light brown (Shade 3).

(b) Shades of Blue and Yellow (Plate III.).

Ex. 1. Dark shades.

Black preponderating.

6 threads of dark blue (Shade 7).

6 " " olive (Shade 13).

Ex. 2. Medium shades.

Black and Blue, and Black and Yellow equally mixed.

6 threads of mid blue (Shade 8).

6 " " olive (Shade 14).

Ex. 3. Lightish shades.

Blue and Yellow preponderating.

6 threads of toned blue (Shade 9).

6 " " olive (Shade 15).

TABLE II.

(a) *Tints of Blue and Red (Plate III).*

Ex. 1. Very light tints.

White preponderating.

6 threads of pale lavender (Tint 10).

6 " " salmon (Tint 4).

Ex. 2. Light tints.

Blue and White, and Red and White equally mixed.

6 threads of lavender (Tint 11).

6 " " bright salmon (Tint 5).

Ex. 3. Deep tints.

Blue and Red preponderating.

6 threads of bright tinted blue (Tint 12).

6 " " " red (Tint 6).

(b) *Tints of Blue and Yellow (Plate III).*

Ex. 1. Very light tints.

White preponderating.

6 threads of very pale yellow (Tint 16).

6 " " pale lavender (Tint 10).

Ex. 2. Light tints.

Blue and White, and Yellow and White equally mixed.

6 threads of lavender (Tint 11).

6 " " pale yellow (Tint 17).

Ex. 3. Deep tints.

Blue and Yellow preponderating.

6 threads of bright tinted blue (Tint 12).

6 " " " " yellow (Tint 18).

24. *Method of Obtaining Well-balanced Colourings.*—From these Tables it will be evident that if the shade of blue is modified, that of the combining colour is also changed. Unless this rule is strictly adhered to, the arrangement adopted will give incongruous results. It is only a certain depth of blue that harmonizes with a corresponding depth of brown and olive; if one predominates over the other, the amalgamation becomes deficient and displeasing to the eye. For example, if Shades 1 and 9 and Tints 4 and 12 were blended, the resulting combinations would not be so complete and mellow as if Shades 1 and 7 and Tints 4 and 10, as in the Tables, were amalgamated. The reason for this is that, in the first instance, a shade of red in which black preponderates is combined with a shade of blue in which blue preponderates; while, in the second instance, a tint of red in which white preponderates is associated with a tint of blue in which blue preponderates; whereas, to produce a perfect balance of colour—that is, providing the quantities of the respective colours are equal—it is necessary for the shades or tints combined to contain exactly the same quantities of black and white, as in the combinations of Shades 1 and 7, and Tints 4 and 10 of Plate III.

In none of the combinations given in the Tables is there a lack of harmony; indeed, considering the principle on which they have been obtained, this is almost impossible. Thus, take Ex. 1 in Table I. Here dark shades of blue and brown are

associated. In both colours black preponderates; that is to say, the former is composed of 3 parts of black and 2 parts of blue, and the latter of 3 parts of black and 2 parts of red. Providing the primaries blue and red (Nos. 1 and 2, Plate II.) harmonize, these shades, which are their derivatives, will also mix well together. The best test to which they can be submitted is to view them side by side. If slips of these shades are thus combined, they will not appear incongruous and harsh in tone, but possess a soft and mellow aspect, and in this consists the true characteristics of all harmonious colourings. As the tints are worked out on the same system as the shades, they are also capable of forming tasteful assortments. In order that this important element of congruous colour effects may be clearly understood, let Ex. 1 of Table II. be also briefly examined. Such a combination cannot but yield an agreeable pattern. Whether these tints are blended in the wool or in the yarn, the resulting mixture is sure to be satisfactory. This arises from the weight or depth of colour of the respective tints being identical; in other terms, the intensity of the tinted red is precisely the same as that of the tinted blue. In summer dress stuffs, lawn tennis flannels, fabrics for trimmings, silks, and extreme fancy goods, this blend of tints is invariably pleasing to the eye. Equally harmonious results may be arrived at by combining tinted red (No. 4) with tinted yellow (No. 16), or tinted blue (No. 10, Plate III.) with tinted yellow. In each of these compounds delicacy of tint and mellowness of hue are the prevailing qualities.

25. *Uses of Blue in Twist Yarns.*—Having now treated of blue as a ground colour, and also as a shade for blending with other hues to tone down a style or subdue its coloured aspect, it only remains to indicate its utility as a colour for twist yarns. It is a very valuable shade for this purpose. As it is a bright but not a showy colour, it is particularly suitable for fancy two- or three-ply yarns. Twists in which

red, yellow, or orange are used have a tendency to overpower the general colouring of the pattern in which they appear, but this is not the case in fancy yarns in which blue is the principal colour. Such twists, while conveying lustre and freshness to the design, in no wise detract from its beauty of colouring, though that may be of a comparatively subdued character. The following are a few examples in two-ply yarns in which blue threads are the main elements: black and blue; white and blue; brown (No. 1) and tinted blue (No. 10); dark blue (No. 7) and tinted red (No. 4); blue and yellow; dark blue and shaded red (No. 3, Plate III.); and mid blue and white.

26. *Points in the Application of Blue and Red to Textiles Summarized.*—The analyses which have been made of the parts played by blue and red in woven designs have demonstrated that, whenever primary colours are applied to textile fabrics in their purity and natural intensity, it is comparatively in small quantities. Breadth and expanse of colouring are not so largely the resultants of these colours as of their derivatives. Brilliance and potency of hue make the application of primaries in extensive patches to textile surfaces undesirable; in a word, these qualities limit their use as ground or foundation colours. Still, in dress fabrics, bright blue, red, and yellow have all an important rôle. Mantlings, shawls, wraps, and travelling rugs also provide scope for a liberal use of these shades; but in treating designs with colour for cloths of a coating and trousering class, subdued and indefinite tints are the most appreciated and prove the most useful. Red and blue are specially capable of imparting tone and newness of aspect to the fabric. When an agreeable assortment of ground shades has been devised, by a judicious and skilful use of these hues cheerful results may be assured. The groundwork of the pattern should always receive priority of attention—the intensity and strength of the bright colours depending

on its propensities. Should the foundation of a pattern prove strong and harsh, the addition of green or blue will, in some cases, give it a mellow character; or should it lack brightness, then red, orange, or yellow, if applied in small quantities and properly distributed, will relieve the heaviness of the colouring and impart the requisite freshness of aspect. Success in the use of pure colours is determined by the quantities in which they occur, and by the nature of the shades with which they are associated. Bright red, however sparingly employed, if applied to a mixture of brown or russet shades, cannot but form an incongruous colouring; but if applied to an assortment of shades in which soft-tinted blues and greens are conspicuous, both harmony and contrast of composition would result.

27. *Attributes of Yellow.*—This colour (No. 3, Plate II.) is generally understood to be emblematical of purity and brightness. It is the most luminous tint in the spectrum. Purple is its complementary and contrasting hue. Intense yellow—rich, bright, and cheerful—has the same relation to light or whiteness as blue has to the principle of darkness. It lacks the radiant, ostentatious quality of red and the retiring, mellow characteristic of blue, but possesses unique vividness and lustre. Luminosity and brilliance of hue materially limit its application to textile design; yet it has a sphere which no other colour can occupy. Thus, in patterns in which white yarns and light or delicate shades are liberally employed, it is one of the most important fancy colours it is possible to introduce into the cloth. Mingled with such shades, it loses a degree of that prominence and individuality of tint which characterizes it when applied to goods possessing dark and sombre grounds.

Another quality of this primary deserving specific note is its exceptional vividness—no colour being comparable with it in this particular. Orange possesses this attribute largely, but is not so active as positive yellow. Its charac-

teristic lightness of hue causes it to be indistinct and more or less absorbed on white or light-shaded grounds, and also clear, decided, and conspicuous on black or dark surfaces. Hence it is found that when yellow is blended with light and medium greys, slatish drabs, and lavenders, its property of lustre suffers in intensity; whereas, if it is applied to dark blue, dark brown, or black materials, its vivid and luminous attributes are forcibly distinguished. When these modifications which this and other bright colours undergo, according to the qualities of the several shades with which they may be combined, are clearly understood, the possible effect of their application to any pre-arranged scheme of ground colours may be estimated. Obviously there are three factors to be carefully considered when employing primary hues: first, the nature of the contrast resultant when the colours are added to light materials; second, when applied to medium-toned grounds; and third, when worked in textures composed of dark yarns. Yellow is diffused and diminished in conspicuity on the first, is localized and intensified on the last, whereas it is only modified in a small degree when associated with shades of a medium depth.

28. *Province of Yellow in Woven Fabrics.*—Pure yellow is but sparingly used in textile designing. In tweeds and worsteds it is combined, to a limited extent, with other shades in the construction of fancy twists. Thus it is the principal colour in the following two- and three-ply yarns: black and yellow; blue and yellow; indigo blue and yellow; dark grey and yellow; black, purple, and yellow; black, mid grey, and yellow; and black, red, and yellow. When used in this form it frequently adds lustre and freshness to an otherwise sombre style. It possibly gives the best results in tweeds, where the fibrous nature of the texture helps to minimize its excessive brightness. Yellow is also applied as a self-coloured yarn to certain styles of

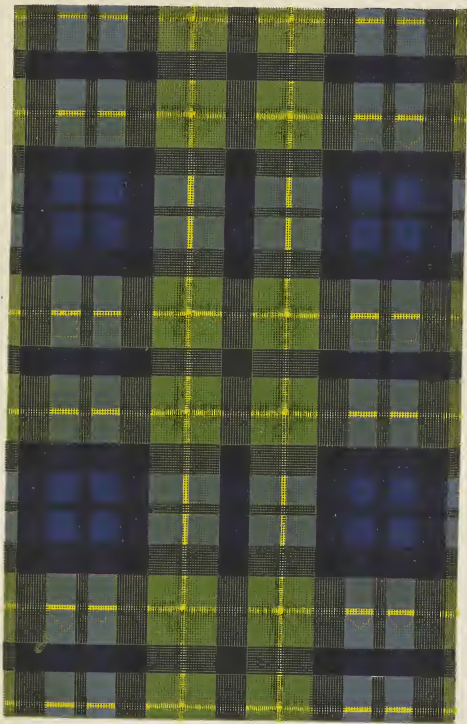


PLATE V.

Date	Description	Debit	Credit	Balance
1880				
Jan 1	Balance			
Jan 15	...			
Jan 30	...			
Feb 15	...			
Feb 28	...			
Mar 15	...			
Mar 31	...			
Apr 15	...			
Apr 30	...			
May 15	...			
May 31	...			
Jun 15	...			
Jun 30	...			
Jul 15	...			
Jul 31	...			
Aug 15	...			
Aug 31	...			
Sep 15	...			
Sep 30	...			
Oct 15	...			
Oct 31	...			
Nov 15	...			
Nov 30	...			
Dec 15	...			
Dec 31	...			

check patterns for woollen travelling modes, shawls, and thin worsted dress stuffs. An example of a plaid pattern of this description is given on Plate V.

The arrangement of threads in both warp and weft for such a check or plaid, when applied to dress materials, is as appended :—

	8	threads of green,
16	”	black,
16	”	blue,
4	”	black,
16	”	blue,
16	”	black,
16	”	green,
4	”	yellow,
16	”	green,
16	”	black,
16	”	green,
4	”	yellow,
8	”	green.

If the same scheme of shades were utilized in the production of Scotch modes or shawls, the checks would require to be considerably enlarged.

The part played by the yellow yarns should be specially noticed. But for these threads the pattern would be flat and unattractive. Their erasure would cause the squares of green to appear dull and heavy. They enliven and brighten the whole plaid. Here, moreover, yellow has been skilfully applied. Such a series of shades as enter into the composition of this fabric would possess a vulgar aspect if yellow had been introduced in large quantities. The method of application largely affects the competence of this primary to contribute to the beauty of the colouring. While in this illustration it only constitutes a comparatively small portion of the pattern, yet it is one of the principal elements of the colouring. Large quantities of yellow rarely give elegant

or even passable results. No colour is more capable of destroying harmony; and yet no colour is more potent of imparting freshness and tone to this style of check arrangement when introduced with technical skill and ingenuity into the texture.

29. *Derivatives of Yellow.*—These are both numerous and important. When blended with blue, as previously explained, numerous shades of green are formed, comprising myrtle green, sea green, emerald green, and grass green, all of which vary in tint according to the intensity of the bluish and yellowish elements entering into their composition. Yellow with red, on the other hand, yields a considerable assortment of scarlets and oranges. Yellow with white gives delicate tints of a straw, lemon, and primrose class (see Nos. 16, 17, and 18, Plate III.); while with black it forms many valuable shades of an olive character, such as those supplied in Nos. 13, 14, and 15 on the same Plate. If it should be mixed with grey, it produces various tints of drab; so that this primary is a very useful colour for blending with other hues in the production of compound shades.

30. *Secondary Colours.*—The attributes and functions of the primaries in textiles have now been defined; the secondaries—*i.e.* colours resulting from mixing two primaries—next call for specific description. They possess quite distinct properties from those hues of which they are composed. Compared with the simples red, yellow, and blue, they lack intensity and strength of hue. Still, they are very potent colours, and as a consequence only yield harmonious combinations when judiciously employed. As a rule, the stronger and the intenser a colour, the greater the skill required in its association with other shades. To use the secondaries in large quantities with success, some practice in textile colouring is essential.

Of these compound shades, orange is the most ostentatious, being tinged with red; purple is the most blooming,

possessing depth and fulness of hue; and green is the most retiring in tone, and also the most refreshing to sight. Each colour is extensively used in woven manufactures; the methods of application depend, however, on the nature of the texture being fabricated. In silk ribbons, neck-ties, and handkerchiefs they are not unfrequently used in their original purity; and they are also applied, in limited quantities, to cotton and flannel shirting styles, linen vestings, and fancy worsted shawls; but when employed in the ordinary types of woollens and worsteds, they are somewhat subdued by mixing with white or black, or they may form one of the threads in a fancy twist yarn. It will be advantageous to consider the qualities and capabilities of each colour separately.

31. *Green: its Attributes and Derivatives.*—This is one of the most useful secondary colours (it is given in No. 4, on Plate II.). Spectrally, or in the Light Theory of Colouring, it is a primary tint; but it is already understood that, according to the Pigment scheme, green is not a simple, but a compound colour resulting from the admixture of the pigment yellow with the pigment blue. Greens may also be obtained by the same process in the dye vat. Thus the texture or material may primarily be treated with the blue colouring matter such as indigo, and subsequently with the yellow dye-ware such as weld or old fustic.

In Nature green is the most extensively distributed colour, but in the decorative arts, unless previously adulterated, it has not a wide application. As a colour it combines the qualities of its component hues—blue and yellow—for it is at once mellow and cheerful. When associated with the various shades and tints of red, harmonious and contrasting combinations ensue. Amongst the shades used in textiles derived from this secondary are myrtle greens, olive greens, slate greens, and dark greens. Colours of this description are very useful in textile work, and

woven design would suffer substantial impoverishment if they were expunged from the weaver's palette.

Should green be used in its spectral purity, it is only applied to extreme fancies, and then chiefly employed as an extra, spotting, or figuring yarn; in tweeds and worsteds, however, it forms an appropriately coloured yarn for twisting with other threads of such shades as will neutralize a degree of its intensity, individuality, and lustre. In fact, green is considered to be one of the most useful colours for twisting purposes employed in textile designing: such twists as black and green, scarlet and green, and white and green all illustrating its utility in the production of fancy yarns for goods of a tweed description.

Derivatives of green, due to its admixture with black, comprise a fair diversity of medium and dark shades which are largely employed as ground colours, and also for piece-dyed textures both for gentlemen's and ladies' wear. Three examples in such shades are furnished in Nos. 1, 2, and 3, Plate VI. In the first, black is the preponderating element, but in the third green is the prevailing hue. With the red browns given in Nos. 1, 2, and 3 on Plate III., they form perfect contrasts. The most pleasing combinations are those in which the greenish derivatives are blended in equal quantities with the reddish browns as follows: dark green (No. 1, Plate VI.) with dark brown (No. 1, Plate III.); mid green (No. 2, Plate VI.) with mid brown (No. 2, Plate III.); and shaded green (No. 3, Plate VI.) with light brown (No. 3, Plate III.). An endless variety of striped and checked patterns in wool, worsted, and cotton materials is got by combining these shades on the lines just indicated. Some excellent ground twists result from combining dark brown (No. 1, Plate III.) and shaded green (No. 3, Plate VI.); dark green (No. 1, Plate VI.) and light brown (No. 3, Plate III.); and mid green (No. 2, Plate VI.) and mid brown (No. 2, Plate III.).



1



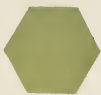
2



3



4



5



6



7



8



9



10



11



12



13



14



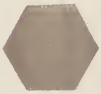
15



16

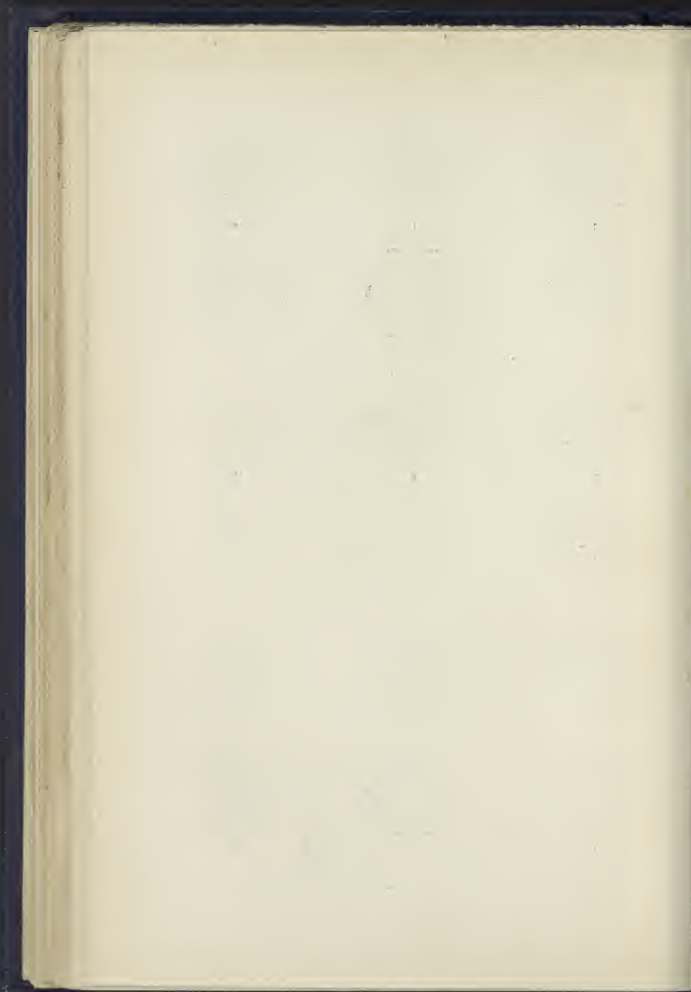


17



18

PLATE VI.



32. *Tints of Green.*—The admixture of green with white results in the formation of tints of a pea-green type. (See Nos. 4, 5, and 6, Plate VI.) These blend harmoniously with the tinted reds given on Plate III. For example, the pea-green of No. 4, Plate VI. when blended with the whitish pink of No. 4 of Plate III., the pale green of No. 5, Plate VI. with the rose colour of No. 5, Plate III., and the tinted green of No. 6, Plate VI. with the tinted red of No. 6, Plate III., all form beautiful and lustrous contrasts. Tint amalgamations of this class are popular in silk textures, in which articles they give exquisite coloured effects. As the tints of the respective couplets perfectly balance, being of the exact depth of hue, they invariably constitute mellow and choice combinations. Though these brilliant tints are not extensively employed in fancy woollen and worsted fabrics, still there are some classes of these textures in which they are used for ground purposes. One illustration of this kind is supplied on Plate VII. It is a species of tweed intended for mantlings and modes, designed by the late Professor John Beaumont, and originally produced at the Yorkshire College. The twilled ground of the fabric is of the emerald green tint given in No. 4, Plate VI., while the spotting yarns are two-ply, including tan and white, and crimson and white twists. The white element of the colouring serves a twofold purpose: first, it neutralizes and subdues the intensity of the crimson and tan threads; and, second, it imparts precision and lustre to the mottled figuring. The style forms, in its entirety, an excellent amalgamation of shades, and one in which both harmony and contrast of colouring are at once distinguished. Obviously there are instances in which these greenish tints may form the bulk of the coloured sections of the pattern, and yet elegant and harmonious shades be obtained.

33. *Orange: its Shades and Tints.*—Next to red, orange

(No. 5, Plate II.) is the most intense, showy, and potent of colours. In attributes it is closely allied to both red and yellow, of which hues it is composed. Orange is more luminous, but less intense than pure red, and is warmer, but not so lustrous in hue as spectral yellow. Its potency of tint causes it to suffer little impoverishment either in lustre or intensity from juxtaposition with certain shades; indeed, it generally retains its brilliance and conspicuousness whatever may be the character of its environment. With colours of a reddish or yellowish hue it undergoes the amplest degree of modification; but with blues and greens, and also with their derivatives, its depth and beauty are not perceptibly diminished. Whether distributed on dark or light surfaces, it stands out with marked lustre and freshness, and hence is one of the most appropriate colours for imparting brightness of aspect, or for giving to any combination of shades, lacking these important qualities, a rich and blooming appearance.

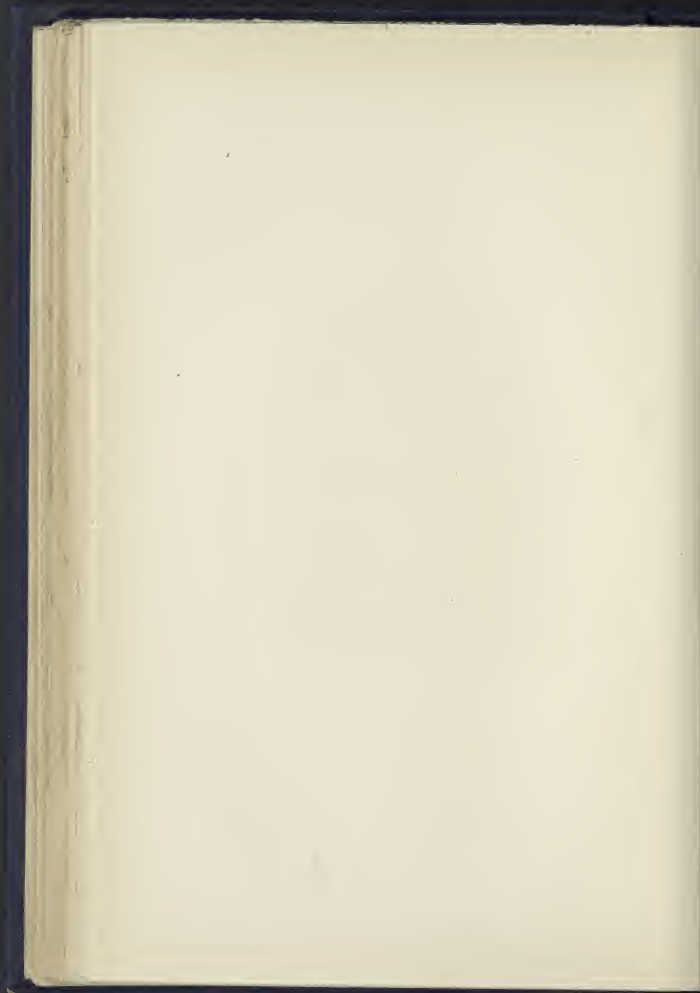
Shades of orange (Nos. 7, 8, and 9, Plate VI.) are what may be designated brownish olives, possessing warmer attributes than the shades derived from yellow, but wanting that strength and richness of hue characterizing the russet browns resulting from an amalgamation of red with black. As ground colours they are of extensive utility to the textile colourist. With shades of green they form perfect complementary combinations, as the following examples will illustrate:—

- I. Dark brownish olive (No. 7) with dark green (No. 1, Plate VI.).
- II. Mid brownish olive (No. 8) with shaded green (No. 2, Plate VI.).
- III. Light brownish olive (No. 9) with mid green (No. 3, Plate VI.).

Where these pairs of shades are used, whatever the form of the pattern, mellow colouring must ensue. These shades



PLATE VII.



also combine satisfactorily with the dark and deep blues given in Nos. 7, 8, and 9 of Plate III.

From the orange tints furnished in Nos. 10, 11, and 12, Plate VI., it will be noticed that by mixing white with this secondary salmon and gold colours are obtained. They are useful in making twist threads, and are also employed to a considerable extent in silk yarns in the manufacture of vestings, spotted textures, neck-ties, and high-class fancies. Elegant styles result from combining them with either tints of green or blue.

34. *Purple*.—This colour (No. 6, Plate II.), was highly esteemed by the ancients. Doubtless its unparalleled saturation and mellowness of tone affected its selection by them as the colour which most emphatically represents dignity combined with costliness. Purple apparel made, as in the days of antiquity, of fine silk threads, must have possessed a rich and gorgeous aspect. There is no colour comparable with it as regards depth of hue and saturated lustre. One attribute in which it differs from all its contemporaries is its amplitude of body, which increases in proportion as the colour is searchingly viewed, prolonged examination seemingly adding to its intensity and beauty. Its characterizing qualities are softness, bloom, depth and richness of tone. Analytically considered, it is a composition of the warm and the cold, the lustrous and the retiring, and the showy and the quiet elements of the spectrum, namely, of red and blue.

Unfortunately, it only yields congruous combinations with a limited range of shades, and these generally belong to the derivatives of yellow. Purple and pure yellow form a very pronounced contrast—an admirable illustration of which obtains in the common pansy. In this flower the deep but lustrous tone of the purple opposes the luminous and pure hue of the yellow. From this natural combination of these tints it is possible to learn with what

class of colours purple will form the most effective and congruous contrasts. These are shades in which yellow preponderates, such as tans, light olives, and olive browns. To impart bloom and richness of aspect into combinations of drabs, olives, and similar shades, purple, in conjunction

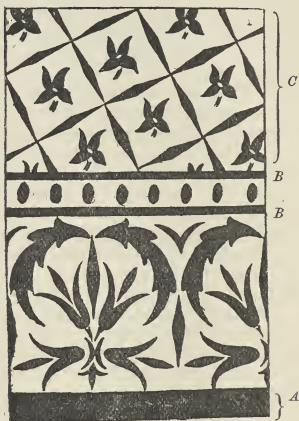


Fig. 4.

with white, may be advantageously employed. Some excellent bordered rugs and travelling modes are produced in which this hue is one of the principal colour constituents. Fig. 4 is an example of a rug design of this type. The small flowers and other figuring composing the centre *C* should be of a deep purple, and the ground tannish olive (Shade 8,

Plate VI.); but, as these fabrics are reversibles, on the opposite surface a tan figure and a purple ground would be formed. Band *A* should be solid tan, and bands *B* of solid primrose (Tint 18, Plate III.). The colours for the border would be tan for ground and primrose or straw for figuring. Tannish olive is arranged to run through the whole rug in order that a connection or affinity between the border and the centre may be maintained. When making bordered articles, it is very important to prevent the centre from being distinct or separate in appearance from the border, causing the latter to resemble a part that has, on subsequent consideration, been attached to the former. The border and the centre should form a complete whole, and each should be the necessary adjunct of the other.

Coming to the derivatives of purple, these, in tints, are somewhat sparingly employed. Occasionally they are applied to dress fabrics, but are rarely used in textures for gentlemen's wear. The examples given in the tints and shades of this colour, in Nos. 13 to 18, Plate VI., inclusive, show that its admixture with white produces hues of a lilac class—recently they have been fancifully designated “crushed strawberry”—and with black, hues of a deep indigo blue character. Materials dyed alizarin blue possess a similar purplish bloom as these shades, being warmer and redder in tone than the pure indigos they are dyed to imitate.

Though purple and its resultants are not largely employed along with other colours in the construction of fancy patterns, yet they are of vast utility in the blending department of a woollen factory, where their exceptional qualities of bloom and fulness are turned to valuable account.

CHAPTER III.

CONTRAST AND HARMONY.

35. Colours Affected by Association—36. How Colours are Changed by Juxtaposition—37. Table Showing the Effects of Colour Association on Primary and Secondary Hues—38. Contrast—39. Helpful and Harmful Contrasts—40. Examples in Contrasts—41. Economic Contrasts—42. Two Kinds of Contrasts—43. Poly-chromatic Contrasts—44. Mono-chromatic Contrasts—45. Toned and Tinted Contrasts—46. Comparison of Contrasts by Shade and Contrasts by Colour—47. Shaded and Tinted Compositions—48. Primary Contrasts Modified with Black and White—49. Successive and Simultaneous Colour Effects—50. Methods of Neutralizing the Effects of Strong Colour Contrasts—51. Colours in Relation to Light and Dark Grounds—52. Harmony—53. Principles of Harmony.

35. *Colours Affected by Association.*—Without any actual modification of the tone of a colour, resulting from tempering it with other tinted elements, its intensity of hue may be apparently changed by placing it in contiguity with other colours. Hitherto the process and effect of colour adulteration have alone been considered, when it was indicated how hues are varied in saturation, that is, weakened or darkened in tone in proportion to the quantity of black and white entering into their composition; but the behaviour of colours in juxtaposition, which materially affects the harmony of association of tints, still remains to be demonstrated. Change of hue originated by the laws of contiguity is both varied and subtle. Trained and skilful colourists realize some difficulty in determining the precise nature of the alteration, but its amplitude is

none the less evident. That the attributes of colours are somewhat modified when the hues with which they are blended are varied, is an essential principle of shade combinations. If, for example, a series of small scarlet spots were woven on black, grey, and white grounds in succession, the tints of the hue of the scarlet, when the several fabrics were compared, would prove to be different in each sample, though the same scarlet yarn were employed in the production of the respective textures. Cutting away the grounds and comparing the spots from each on a common surface would show that identically the same scarlet had been used in the three fabrics: yet so apparent is their dissimilarity of tint that a casual examination would pronounce them distinct shades. Thus on the black surface the spots gain intensity and lustre; on the grey they appear murky, dingy, and destitute of that characteristic freshness one is accustomed to associate with red figuring; whereas on the white surface the spots are bright, but evidently pale and washy as compared with their contemporaries on the black ground. On varying the colour of the spots a different set of modifications ensues. Taking blue as the spotting colour, the black ground neutralizes a degree of its bloom and brightness; on the grey it suffers in lustre, but retains its precision of tint; while it increases in richness and fulness of tone on the white fabric. Continuing this idea: if a batch of red threads were interspersed in a white warp a degree of their fiery quality would be absorbed by the coolness of the white threads with which they are amalgamated; but should similar yarns be introduced into a black warp, a marked augmentation in the intensity of the red would be observed, because of the powerful contrast thus created between the sombreness of the black and the rich brightness of the red; a contrast which, if the quantity of the red is large, is sufficient to give a copper-coloured cast to the black threads with which

it is in immediate contact. A law of colours is, that if the fancy or lively shade is lighter than the ground colour it will increase in brightness of tone; but if, on the other hand, the "fancy" is darker than the general tinted surface on which it is distributed, it will suffer in saturation. Moreover, if two colours, such as light and dark olive, were arranged together in the same warp, the former would appear lighter and the latter darker than they really are. This illusory alteration is entirely attributable to contrast. Colours of contrasting qualities and tones suffer two modifications when juxtaposed; first they alter in depth of tint, and second in nature of hue. When yellow and blue yarns are woven together each is subject to this two-fold change produced by contrast; first as to tone, the yellow becomes brighter and the blue deeper; second as to hue, each is tinged with the complementary colour of its companion; in other words, the yellow obtains an orangish and the blue a purplish tint. If red and yellow were similarly associated the former would assume a purplish and the latter a greenish cast; if red and blue, the red becomes pinkish and the blue becomes greenish.

36. *How Colours are Changed by Juxtaposition.*—It is a generally accepted principle of colours that when two surfaces of different shades are placed in contiguity, each is changed as though it had been mingled with the complementary of the other. Chevreul relates an incident, in his *Treatise on Colours*, which so clearly sets forth this important rule that it may be related here. Certain merchants requested a firm of manufacturers to ornament red, violet blue, and blue woven stuffs with black spots or figures. When the goods were produced the merchants complained that the spots were not black, as ordered, but that those on the red fabrics were tinged with green, on the violet with dark greenish yellow, while those developed on the blue were toned with a chocolate or coffee-coloured shade.

Chevreul, in order to prove that the spots were perfectly black, covered the separate grounds with white paper, when it was at once discovered that the changes in the colours of the figures were entirely due to the contrast ensuing between the black shades and the respective grounds on which the spots had been arranged. All this conclusively shows that colour is a modifier of colour, and hence those hues which possess bloom and richness of tone on one species of coloured surface may be murky and inelegant on another. Evidently this principle manifoldly increases the complications of harmonious colouring. It is an excellent plan to combine the shades primarily in the precise order in which they are intended to occur on a black surface. Classification in this way enables the colourist to estimate at a glance, without putting the pattern into the loom, the general tone of the shades he proposes to amalgamate.

37. *Table Showing the Effects of Colour Association on Primary and Secondary Hues.* — The Table appended, which indicates the alterations in hue in the primary and secondary colours when united in pairs, will possibly be of some utility to the combiner of fancy shades. Obviously, the same law which governs the changes in bright colours also applies to the association of tertiary and other compound shades, only the effects of contrast in these instances lack emphasis.

COMBINATIONS OF PRIMARY COLOURS.

EFFECT OF CONTRAST.

- Assumes a bluish cast, or appears pinkish.
 Assumes a greenish cast.
 Assumes a scarlet cast, or approaches orange.
 Assumes a greenish cast, the complementary of red being green.
 Apparently increases in luminosity, lustre, and saturation.

COLOUR.

- I. { Red.
 { Blue.
 II. { Red.
 { Yellow.
 III. { Yellow.
 { Blue.

COMBINATIONS OF PRIMARY AND SECONDARY COLOURS.

- Lustre and fulness of hue emphasized.
 Coolness and softness of hue emphasized.
 Becomes slightly scarletish.
 Becomes slightly greenish.
 Becomes purplish.
 Becomes yellowish.
 Both colours gain in lustre and potency, on account of forming a perfect or complete contrast.
 Both hues increase in brilliance.

- IV. { Red.
 { Green.
 V. { Red.
 { Purple.
 VI. { Red.
 { Orange.
 VII. { Yellow.
 { Blue.
 VIII. { Orange.

COMBINATIONS OF SECONDARY COLOURS.

- Somewhat scarletish.
 Somewhat purplish.
 Becomes reddish.
 Becomes yellowish.
 Becomes slightly greenish.
 Becomes slightly yellowish.

- IX. { Orange.
 { Green.
 X. { Purple.
 { Green.
 XI. { Purple.
 { Orange.

OBSERVATIONS.

In small quantities sometimes a useful mixture, but not elegant if in liberal spaces. Bright and cheerful, but very potent.

Yellow and blue being contrasting colours, they suffer but very slight change in hue from association—one colour in such combinations affords precision to the qualities of the other.

As these are complementary colours the same rule applies to their union as to Combination III.
 This is an inelegant combination.

No. VII. forms a very warm and potent blend.

Orange and green produce a strong contrast.

No. X. is not a satisfactory combination. Purple and orange, when pure, make an effective combination.

A common law of Chromatics is that the general effect of combining colours is to cause the separate hues associated to be more emphatically dissimilar in character. Thus, when orange and red are combined, the former does not become reddish or the latter orangish, but the red seems to approach purple and the orange to assume a greenish cast. Complementary colours—*i.e.* those farthest apart in hue—are the least affected by association, as is evidenced by the results of such contrasts as red and green, blue and orange, and yellow and purple. An illustration may elucidate this primary principle of colour combinations. If a striped fabric were composed of bands of rose (Tint 4, Plate III.) and lavender (Tint 10, Plate III.) colours, one tint would help to give prominence to its neighbour, because they strongly contrast with each other. On the other hand, if the same rose tint were combined with straw or primrose (Tint 16, Plate III.) then the individuality of the separate colours would suffer, for being similar in character, they would neutralize each other's attributes, and each would impinge on its neighbour. Hence, if in colouring textiles, it is required to preserve the intrinsic attributes of a shade, it should be affiliated with such colours as will differ most decidedly from it in hue and other qualities; whereas, if it is sought to change, by the law of contrast, any particular shade, it should be brought into contiguity with potent colours more or less allied to it in tone and hue.

38. *Contrast*.—What is termed "Contrast" is that principle or quality of tints which produces a change in their lustre, depth, saturation, and hue, when in immediate contact with each other.

Contrast may be explained by considering the effect of black and grey yarns in a woven style to which white is subsequently added. There is contrast in the pattern before the white is introduced, but it lacks precision and

force. The addition of white imparts lustre to the grey, and fulness of tone to the black. Correctly speaking, neither the black nor the grey are changed by the white; they are as it were developed by it. White, in this instance, has the same function as in shaded drawings, in which clearness and boldness are given to form and outline by increasing the dark element of some parts and the light element of others. What may be designated a Tempered Contrast originates when a quantity of grey intervenes in a mixture of black and white. In the shading of a round surface this kind of contrast, in neutral tints, is developed to perfection, undue harshness of effect being neutralized by the gradual toning of black into white; but in the shading of angular objects the sudden transitions from the extreme light to the extreme dark end of the scale of shades, supply excellent illustrations of the characteristics of Decided Contrasts. A pattern composed solely of black and white yarns is full of this kind of contrast, but by adding grey a toning element is introduced which produces a mellowed or tempered combination. Decided or hard contrasts, resulting from the use of positive colours, are exactly the reverse of softly graduated ones; they are inartistic, inelegant, and deficient in that touch of softness which constitutes admirable colouring: on the other hand, toned contrasts possess richness and mellowness of character. The former are necessarily the most emphatic and striking, even as oratory overloaded with extravagant gestures is frequently the most effective; but their very excessive force mars their beauty. The works of the barbarian are full of decided and positive colours; while those of the cultured craftsman are embellished with mellow tints. Contrasts obtained by combining pure colours are often harsh and irritating, and even offend the laws of æsthetics. Red and blue, for example, form a strong and hard colouring, but when toned with black or white, and then

blended, they give a soft and mellow result. This will be evident by combining the following derivatives of these primaries: dark brown (Shade 1, Plate III.) and dark blue (Shade 7, Plate III.), and rose pink (Tint 5, Plate III.) and blue lavender (Tint 11, Plate III.). On account of the colours in these cases being either shades or tints, they produce mellow or tempered and not harsh or pronounced contrasts. This style of colouring is highly appreciated in textile fabrics, and should be elaborated in all branches of woven design, as it is capable of giving the largest variety of æsthetic and novel effects.

39. *Helpful and Harmful Contrasts.*—Colours may either be impoverished or enriched by contrast. Yellow, for instance, when associated with green, suffers in purity and in intensity; whereas yellow in combination with blue augments in luminosity and lustre. A Harmful Contrast may be defined as a blend of shades in which the individual colours lack force and brilliance. If the colours of such a mixture are isolated, they are severally enhanced in purity and beauty of tint. In a Harmful Contrast the several hues appear to neutralize and diminish each other's qualities: the whole being contrary to the laws of economic chromatics. Contrasts of this kind may contain an immense variety of tints and yet be destitute of elegance; for the discord their several elements create may be aptly compared to the jarring performance on a musical instrument out of tune. All combinations of colours are therefore not pretty. Mere haphazard admixtures are not capable of yielding harmonious results. Instances might, of course, be quoted where such colouring has seemed successful, but being based on the precarious and unstable conditions of chance, its practice ought to be entirely discarded. While caprice, fashion, and the canons of æsthetics may prescribe the associations of colours popular in successive seasons, the principles and results of con-

trast, when developing textile effects, must be intelligently considered.

Coming to Helpful Contrasts, the colours entering into their arrangement are provided with those associates as are best calculated to cause the individual tints to glow with more than natural brightness and intensity. The quality of "fitness" of the several colours for each other's companionship is forcibly distinguished in a contrast of this type; for each shade contributes to the harmony and completeness of the whole combination. The colours may not be virtually rich as so many distinct hues; indeed, if examined separately, they may even lack depth and saturation of tint, and possess a washy or pale appearance; but they improve by combination with other shades, gaining in lustre, elegance, and delicacy of toning. A helpful or beneficial contrast is therefore a blend of shades in which both harmony and richness of tone prevail, although the colours may be neither intense nor saturated. Instead of the hues in such a contrast neutralizing each other's qualities and producing *in toto* a distasteful and incongruous combination, they unite to constitute bloom, force, and strength of colouring; in short, each shade lends lustre and freshness to its associates.

40. *Examples in Contrasts.*—On Plate VIII. and in Nos. 1 and 2, two illustrations in contrast are given to indicate how coloured elements may increase or diminish one another's elegance in association. In No. 1 of this Plate the two ground colours, pale blue and straw, form a passable contrast, but the small lines of scarlet impart harshness of effect to the whole stripe. This colour is evidently too potent and lustrous for its neighbours. Its very strength of hue is here out of place, and an indication of its unfitness as the brightening factor of this blend of shades. Providing only three colours were allowable in this composition, then to prevent the scarlet from being too prominent, it should be softened or



1

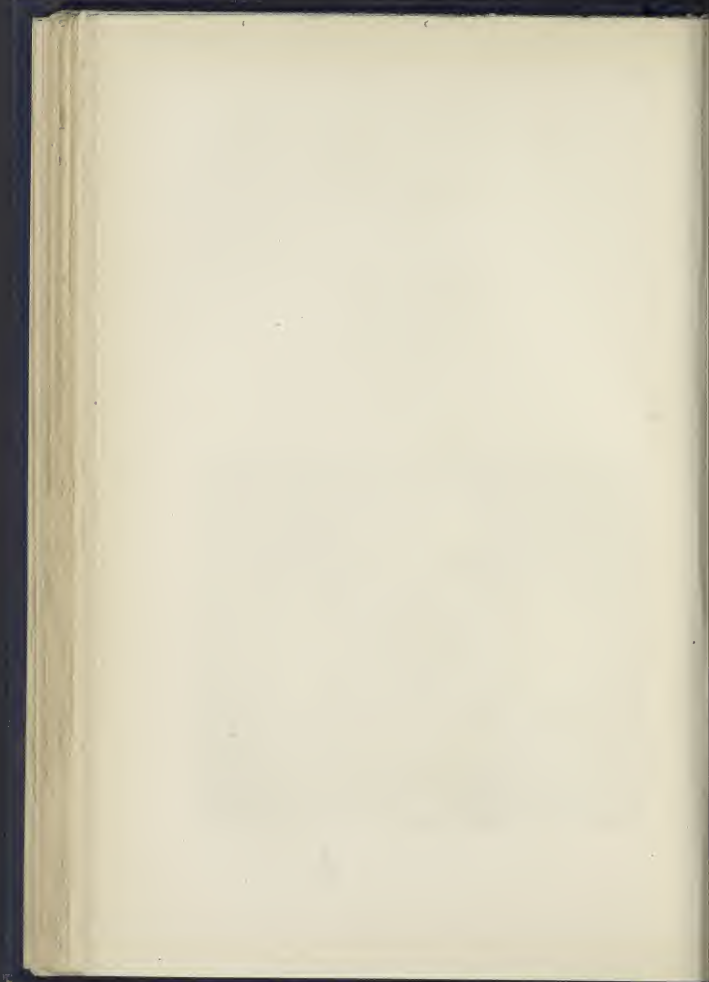


2



3

PLATE VIII.



tempered as in the succeeding illustration, No. 2, Plate VIII. While in this latter example the pale blue and straw remain the same, yet the mellowing of the scarlet into a rose tint produces a stripe of colourings in which each element, being of similar depth of tone, is equally prominent and effective. This is the kind of contrast that is the most elegant, and in which the several colours assist to develop the beauty of each other's hues. Comparing these illustrations further, it is obvious that in No. 1, Plate VIII., the red characteristic always strikes the eye with greater emphasis than its contemporaries, in a measure, virtually overpowering them; on the other hand, in No. 2, each shade having the same power to excite the colour nerves of the retina, there is a balance and efficiency of colour at once mellow and lustrous. The slight hardness of tone in No. 1 does not arise from any want of beauty in the separate colours, but from the relative undue strength and vividness of the lively shade of scarlet. Providing this hue were replaced by green, a complete harmful contrast would ensue; for green, while detracting from the lustre of the pale yellow or straw, would also harmonize indifferently with the lavender or tempered blue. From these illustrations it will be evident that in an efficient blend of colours all hues contribute to the attractiveness of the complete *ensemble*; but in a harmful contrast one or more colours may subtract from the lustre of adjacent hues, and so strongly impinge upon their less intense and more tempered associates as to partially neutralize their effect.

41. *Economic Contrasts*.—Closely allied with Harmful and Helpful associations of colours are Economic Contrasts, which comprise the production of the most effective styles with a minimum variety of hues. It does not follow because a pattern contains an infinite diversity of shades that it will be exquisite and attractive; it is more likely to be extravagantly gorgeous and probably vulgar. Just as it fre-

quently happens that the most permanently beautiful patterns result from the simple but unique methods of amalgamating forms, so by the artistic arrangement of a few choice colours excellent contrasts may be produced. To multiply the diversity of hues in any combination without any marked increase of beauty is a pure waste of tinting power, and is calculated to be more detrimental than beneficial to the style obtained. An economic method of colouring consists in blending shades or tints of the same colour, and freshening or brightening the style by resorting to the use of "extras" or "fancies." To practise economy in shade combinations, the first care should always be to obtain an appropriate complement of ground shades: if these produce perfect harmony and possess a rich, though subdued bloom, but few bright colours will be necessary to impart the requisite freshness and lustre to the style. On the other hand, an indifferent selection of foundation hues virtually implies the employment of an increased range of fancies to tone, strengthen, and brighten the contrasts. The principles underlying economic colouring will be evident as the general science of textile chromatics is more fully expounded.

42. *Two Kinds of Contrasts.*—All types of colour combinations may be included under two heads: namely, Mono-chromatic and Poly-chromatic Contrasts. The former comprise all species of contrasts due to a diversity of tint or shade in one colour; the latter comprise all kinds of contrasts arising from combining two or more distinct colours. The strongest and most effective colourings occur in poly-chromatic contrasts; while soft, subdued, and gradated toning are largely characteristic of one-coloured contrasts. Blends of scarlet and green, yellow and blue, and orange and purple are colour couplets which illustrate the principles of contrast due to a diversity of hues; but blends of two shades of brown, blue, or slate form contrasts belonging to the mono-chromatic class. In textile designing

both these types of colouring obtain extensive application. They are frequently present in the same pattern, for the same style may contain contrasts in shade as well as contrasts in hue. For example, if two shades of brown, forming the bulk of a pattern, are brightened by extra threads of scarlet and blue, its colour elements are a co-mixture of both kinds of contrasts defined above.

43. *Poly-chromatic Contrasts.*—A unique and suggestive illustration of this species of colour arrangement is given on Plate VIII. in No. 3. It is a scrap of textile ornament, borrowed from a Japanese work on decorative fabrics, found in a Buddhist temple. A more vigorous combination of colours, possessed of greater potency and lustre, it would be difficult to conceive. With such chromatic science have the various hues been associated that each retains, unaffected, its individual strength and vivacity. Considering that this entire group of forms contains no fewer than seven colours, in addition to black and white, and that the ground shade is a deep, full-bloomed purple, the lustre of the separate hues is exceptional and a quality of the design calling for minute analysis. Purple, as a rule, is a shade that, in virtue of its potency, alters all colours with which it may be mingled that are in any way akin to it, such as greens, blues, and reds; but it forms strong and decided contrasts with yellow, orange, and their derivatives. It becomes, therefore, an interesting inquiry, why in this blend of hues green and blue lose none of their freshness and saturation. The method of arranging the colours, or the plan of combination—comprising the couplets scarlet and orange, deep and pale greens, and deep and pale blues—supplemented by the ingenious touches of black and white, are elements at the base of the extraordinary colour emphasis characterizing the entire pattern. For the purpose of making the sequent analysis as lucid and instructive as possible,

one of the four triple-leaved conventional forms surrounding the central diamond figure may be isolated, and its colourings alone considered; for each of these not only comprises every kind of hue entering into the design, but also illustrates the system of colour-mingling adopted throughout the entire figure. Starting with the minute spots of scarlet—they are contingent, on one side, with the purple ground: and, on the other side, with the small curved stripes of orange. If the eye is allowed to single out and rest upon these scarlet sections where they are in contiguity with the purple, it will be noticed that the scarlet gains a crimsonish hue; but such is the subtlety of this plan of colour arrangement that this experiment is extremely difficult to perform. Perforce the optic nerves take simultaneous cognizance of the whole series of hues—a feature of the pattern which markedly contributes to the freshness of the individual colours. As a result of the incompetency of the eye to view the colours separately, and also on account of the method of arranging the same, green at once associates itself in the mind of the observer with scarlet, and orange with pale green and deep blue. The inexorable law of contrasts brings the complementary colours in affinity, and, as a consequence, develops perfect strength and fulness of hue. Impingement of colours is by this means avoided, and each hue is made, by virtue of opposite qualities, to develop the beauty of its immediate associates.

The white edging of the leaves prevents the purple ground from affecting the purity of the pale blue, and also imparts clearness of outline to the ornament in general.

The lessons to be learnt from this colouring may be summarized as follows: First, pure complementary colours when juxtaposed do not neutralize, but develop, one another's qualities; second, that by an appropriate use of

white and black, as agents for separating colours, kindred hues—*e.g.*, in this illustration, purple, blue, and green—may be arranged to produce a helpful and attractive contrast; and third, a medium shade of green gives lustre to scarlet, while palish green and deepish blue are perfectly complementary to orange.

Some useful ideas may be gleaned from this example in Contrast for textile purposes. Thus, if small figures composed of the tints, as arranged in one of the conventionalized leaves of this design, were arranged on a sateen system in a style for fancy vestings, an elegant pattern might be produced. It is suggestive in other ways. Ideas for cotton stripes or checks of a flannelette class may, for example, be obtained from it. Stripes of the blue shades here given, placed on a white ground, and brightened with a few threads of the orange hue, would form harmonious colouring. Again, a fabric of a dress-stuff description, in which the same arrangement of tints is observed, but the colours softened or tempered with black, could be very appropriately embellished with this system of tinting. In such an instance scarlet would be replaced by dark brown (Shade 1, Plate III.); orange by reddish olive (Shade 9, Plate VI.); mid green by deep green (Shade 2, Plate VI.); pale green by toned green (Shade 3, Plate VI.); blue by dark blue (Shade 7, Plate III.); and pale blue by toned blue (Shade 9, Plate III.). It is evident from this group of shades that such a brilliant blend of hues as that composing the design given in No. 3, Plate VIII. may be turned to useful account; for in this instance it has been made to form the base of a new scheme of adjusting a number of dark colours highly suitable for a dress-stuff style. Of course it will be noticed that the substitutes assorted are all related in hue to the pure colours of the specimen of contrast which has suggested them; hence it follows that if the original colouring is characterized by balance of tone and harmony, the

resultant blend of shades must possess similar qualities mellowed and tempered in intensity.

One further thought on this plan of colour-mingling should be alluded to. In the foregoing example in shade-deduction from a combination of bright hues, dark colours have been used; but it is equally feasible to appropriate tints as follows: rose (Tint 6, Plate III.) for scarlet; pinkish orange (Tint 11, Plate VI.) for orange; pale blue (Tint 11, Plate III.) for blue; lavender (Tint 10, Plate III.) for light blue; pale green (Tint 5, Plate VI.) for green; and very pale green (Tint 4, Plate VI.) for light green. This series of tints, when associated with suitable quantities of white, might be applied to textiles with good results, more especially if the system of grouping given in No. 3, Plate VIII. were adopted. Illustrations, based on this interesting specimen of colour amalgamation, have been multiplied because they indicate how useful "hints" in harmonious colouring may be gleaned from an apparently extravagant though elegant arrangement of hues.

44. *Mono-chromatic Contrasts.*—This kind of colour contrasts is extensively applied to all classes of decorative work. Nature abounds with elegant and suggestive illustrations of the principles of these colourings, a few of which may be described. Amongst flowers and plant forms which exhibit contrasts in reddish hues the rose and a stem of forced rhubarb are particularly good. Take the rose first. What a beautiful delicate series of red tints it contains, and how mellow and exquisitely rich are its finely gradated contrasts! There is an entire absence of harshness or even tendency to hardness of tinting in its colour composition. Ruskin, writing on gradation of hues, observes: "The victorious beauty of the rose as compared with other flowers depends wholly on the delicacy and quantity of its colour-gradations, all other flowers being either less rich in gradation, not having so many folds of leaf, or less

tender, being patched and veined instead of flushed." A stem of rhubarb also contains an infinite variety of gradations of crimson. At the base it commences with a saturated crimson which beautifully alters in intensity till a palish pink is acquired. Not only are examples in red contrasts discovered in natural forms, but also shadings and tintings of blue and brown. In the flimsy, delicate petals of the harebell several gradations of blue occur, running from a deep to a palish tint. For browns the foliage of autumn only need be referred to. The leaves teem with diversity of shade, yet all the colours are of a brownish cast, varying from bright tan to rich russet. Some species of sandstone (which have been subjected to oxidizing elements) exhibit useful gradations of drab, such as cool and warm colours, specially suitable for application to textile patterns.

The chief characteristics of gradated contrasts—which apparently compose a large variety of colourings in decorative design—are softness and mellowness of toning, combined with lustre and force of effect. Compared with hue contrasts they may lack strength and precision of emphasis, but they possess a smooth, saturated fulness which qualifies them for extensive use in the production of fancy textures.

45. *Toned and Tinted Contrasts.*—Mono-chromatic compositions may be considered under two varieties, namely, Toned and Tinted Contrasts. The former comprise all associations of shades in which the colours have been toned or darkened by admixture with black; while the latter are composed solely of colours which have been tinted with white. These contrasts comprise the most valuable assortments of colours seen in fabrics produced for wearing purposes. Their quiet and mellow toning makes them of the widest utility in textile designing. Probably the largest proportion of fancy textures manufactured for gentlemen's clothing results from this sort of colour association.

Illustrations in this species of colourings deserve to be carefully considered. The first example which will be alluded to is furnished on Plate IX. in No. 1. It is a toned contrast, being a mixture of the three browns supplied in Shades 1, 2, and 3 on Plate III. The style is suitable for either woollen or worsted materials, and is of a check description. The mode of sketching has developed every detail of arrangement due to the simple twilled weave used in its construction, as well as the peculiar form of check resulting from the plan of blending shades. But it is the colour element of this fabric, with its gradated contrasts, that is at this stage most important. The three shades of brown have been combined thus in both warp and weft: 8 threads of dark brown, 8 threads of mid brown, 8 threads of light brown, and 8 threads of mid brown. The mid shade thus alternates with the dark and light colours, maintaining one depth of contrast throughout the whole pattern. Blues (Shades 7, 8, and 9, Plate III.), greens (Shades 1, 2, and 3, Plate VI.), or olives (Shades 7, 8, and 9, Plate VI.) might have been selected with equally as good results as the browns of this illustration. Three greys would also have shown the principle of this type of contrast, for compositions of dark, mid, and light greys form an endless diversity of textile patterns. But to return to this brown example. The contrast is of the mellowest kind. There is no marked distinction between the shades, the three composing a softly-toned coloured effect. This characteristic of the style is of course attributable to the several shades being derivatives of the same hue—the red element predominating in each. Whatever kind of shaded or tinted contrasts are considered, they are characterized by the same smoothness of colouring seen in this pattern.

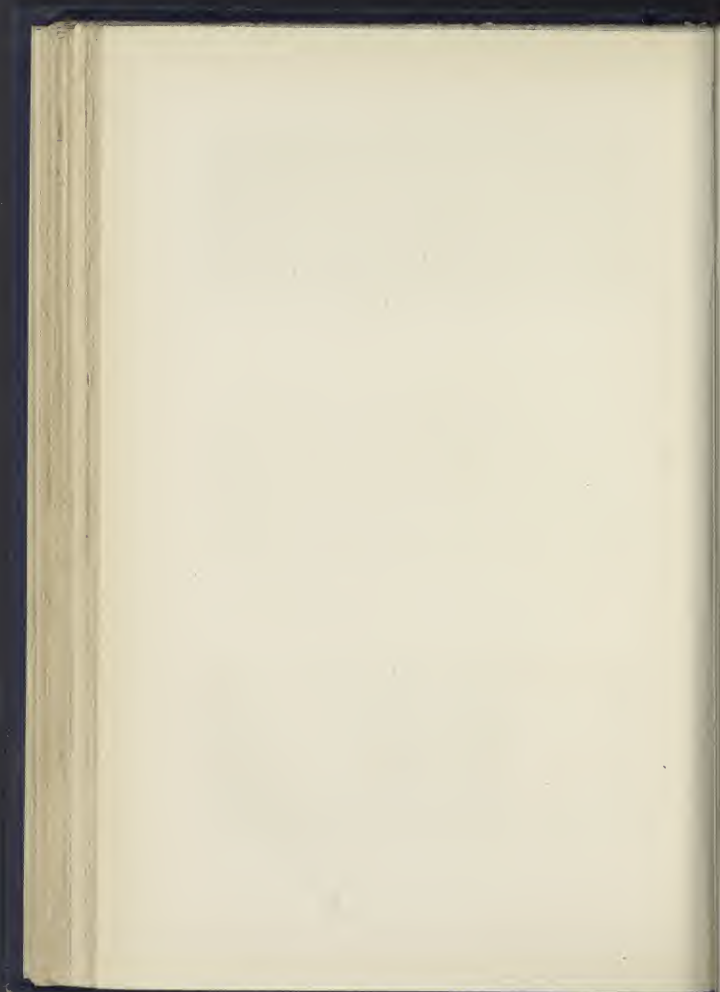
In order to show the precise nature of this class of contrast in tints instead of shades, another illustration is supplied in No. 2 on Plate IX., composed in this instance



1



PLATE IX.



of the three lilac tints similar to those given in Nos. 16, 17, and 19, on Plate VI. Again the plan of the weave of the fabric is cassimere twill, but the system of colouring has been diversified; thus, it consists of 16 threads of the deep tint, 8 threads of the medium tint, 16 threads of the light tint, and 8 threads of the medium tint. While this arrangement forms a somewhat more varied style than the preceding method of combination, the tints of which it is composed are distributed in equal quantities, producing a uniform colouring. Its qualities of mellowness and smoothness are even more pronounced than those of No. 1 on this Plate. Being a light pattern, it possesses a unique delicacy of toning. This applies to all compositions of tints, which, when properly gradated, constitute the most mellow type of colouring producible.

These illustrations in Toned and Tinted Contrasts are typical of the general effects obtainable by combining colours of the same hue but of different degrees of lightness and shade; they show that while effective compositions may be acquired with shades or tints, yet they are usually deficient in that force of contrast characterizing patterns containing a variety of hues.

46. *Comparison of Contrasts by Shade and Contrasts by Colour.*—Relatively considered, contrasts in several colours are more ostentatious and brilliant than contrasts in shades or tints; hence the former obtain extensive application to all classes of decorative fabrics, while the latter constitute the bulk of the colouring in textures made for wearing purposes. Of course both systems of colouring largely overlap each other, making it impossible to limit the classes of fabrics in which each finds expression; still, in the general run of styles, tempered colours are the most appropriate for the ground or foundation of wearable textures; while, on the other hand, bright and positive colours impart the most telling precision to ornamental forms. Hence it

may be affirmed to be a common law in textile colouring that shades and tints compose a large proportion of styles intended for garments, whereas the special province of hue contrasts is in the development of figured designs. Tartan checks are amongst the principal exceptions to this rule.

47. *Shaded and Tinted Compositions.*—These may either result from the use of one or more colours. First, suppose an instance in which blue shades are combined with blue tints, or in which the same hue prevails throughout the whole of the colouring. Thus, take the three shades given in Nos. 7, 8, and 9, and combine them to form a striped pattern with the three tints furnished in Nos. 10, 11, and 12 on Plate III. Providing they are arranged in the order here mapped out, they would constitute a perfectly toned shade of blue. The gradations would run from a deep shade to a light tint, or from an extreme dark to an extreme light tempered blue. An idea of how shaded patterns are arrived at in woven textures, in one hue of colour, may be gleaned from this example, for it is evident from the elements of its arrangement that a shaded effect may be produced in all kinds of hues, such as brown, olive, and green, if they are capable of yielding a sufficient diversity of toning.

But, in addition to this method of associating tints and shades, these colour derivatives are also combined in distinct hues, forming an infinite assortment of elegant colourings. A ground pattern, for example, consists solely of an arrangement of shades; but, in order to give brightness to the style, a few fancy threads of tints derived from other hues—possibly of opposite, or maybe of complementary, qualities to those from which the shades have originated—may be called into requisition. This principle of colouring may be clearly demonstrated by referring to the brown check pattern given in No. 1, Plate IX. To impart a degree of freshness to this design, blue tinted threads might be employed, say

about two between each shade. Exactly the same tint should not be introduced between the checks of the several shades. For the darkest shade the deepest tint should be used, for the medium shade the medium tint, and for the light shade the light tint; in other terms, whatever the nature of the shade, a corresponding tint is requisite. Balance of colouring and of contrast is only attainable by strict adherence to this rule. If the same tint were used for all the shades, it would appear stronger and more pronounced in some sections of the pattern than others. The blue tint which produces exactly the desired contrast when associated with the light brown of this pattern would have a very different effect if placed on the dark brown: so that in applying tints to a good blend of shades, or shades to a good blend of tints, to secure diversity and freshness of pattern combined with uniformity of contrast, care must be exercised in the selection and appropriation of these fancy or brightening elements, otherwise they are likely to prove more or less effective in some instances than calculated, and to destroy the harmony of the whole colouring.

The several methods of acquiring contrasts by amalgamating tints and shades may be summarized as below:

I. Compositions of several Shades of the same Hue; II. Compositions of several Tints of the same Hue; III. Compositions of Shades of different Hues; IV. Compositions of Tints of different Hues; V. Compositions of Shades and Tints of the same Hue; and VI. Compositions of Shades and Tints of different Hues.

48. *Primary Contrasts Modified with Black and White.*—

Some elaborate check patterns for dress materials are executed in primary colours. An illustration in this type of contrast is supplied in No. 3 on Plate IX. Though the effect here is loud, still it is harmonious and beautiful; showing that the most potent colours may be associated in textiles with satisfactory results.

The arrangement of the colours in both warp and weft is as appended :—

6	threads of yellow,
4	„ black,
2	„ scarlet,
4	„ black,
4	„ white,
4	„ blue,
16	„ scarlet,
16	„ blue,
6	„ yellow,
4	„ black,
2	„ blue,
4	„ black,
4	„ white,
4	„ scarlet,
16	„ blue,
16	„ scarlet.

However this pattern is examined, it is lustrous and rich in composition. Possibly the black and white introduced into the texture mellow and soften the general colouring, for they undoubtedly subdue the strength of the contrast arising from three such positive hues being in immediate affinity with each other. It is already understood that these shades are of great utility as mellowing agents when affiliated with bright colours. They effectually obviate the origination of a sharp and almost irritating contrast which sometimes ensues when several lustrous hues are in close proximity with each other. Blue and red in certain forms constitute a harmful contrast, each impinging on its neighbour, and the two producing anything but delicate and elegant harmony. On separating them with small quantities of white and black, as in the illustration, hardness of toning and tendency to incongruity of colouring are entirely prevented. Vigorous as the contrast is, in this

instance it is not harsh or defective. There are several elements which are conducive to its harmony. First, there are the black and white threads just alluded to; second, the quantities in which the several colours are associated; and third, the peculiar effect due to the plan of interlacing the warp and weft threads in the construction of the texture. Weaving largely multiplies the effects due to a combination of colours, as is instanced by this pattern, which, though only comprising three distinct colours, and white and black, contains no less than fifteen varieties of work. These result from the different colours crossing and blending with each other on various systems in the formation of the check. At intervals the scarlet weft covers the scarlet, blue, yellow, white and black warp yarns, producing a specific effect in every transition. As each kind of filling forms a similar diversity of associations, it will be evident how the large number of combinations mentioned originate in the weaving of the fabric. Analysis shows the various effects to comprise solid checks of red, blue, yellow, black, and white; and mingled checks of the following shade couplets: blue and red; yellow and red; blue and yellow; blue and black; blue and white; red and black; red and white; yellow and black; yellow and white; and black and white. What a variety of important lessons in colouring such a woven sample teaches! Let a few of these be considered. In the first place, examine the groups of solid colours or the rectangular patches of red, blue, and yellow respectively. Purity and brightness of hue are the distinguishing features of these primaries. They are as closely related in these attributes to their contemporaries in the spectrum as possible. Now note the principle on which they are amalgamated. Should they have been blended on such a system as to be in contact with each other, the harmonious qualities of this colouring would have been wanting; as it is, both the red and blue checks

adjoin sections of mingled red and blue, consequently there is some tie of connection between each of these solid checks and their immediate environment, an element in the colouring that contributes largely to the perfect congruity of the pattern when viewed in its entirety.

Next observe the quantities or proportions in which these colours are distributed in the pattern. Red and blue occupy similar sections of the style, but yellow is used very sparingly. The reason for this is obvious. The two former hues are of corresponding intensity and lustre, but yellow is considerably more luminous than either blue or red; hence, if utilized to the same extent, it would appear more prominent than they in the pattern. Any increase or even variation in the quantities of this colour would certainly produce an incongruous composition. Regard must, therefore, be paid to the nature and potency of colours in determining their scheme of association in textile design.

Black and white, having been employed specifically for modifying or toning purposes, only occur in the pattern in limited quantities; but they occupy those positions in the arrangement of the colours in which they most effectively develop, or in some cases subdue, the several hues with which they are associated.

49. *Successive and Simultaneous Colour Effects.*—In the above pattern (No. 3, Plate IX.) both successive and simultaneous contrasts are found. A simultaneous contrast is a blend or group of colours in which the several hues are in the closest proximity, being unitedly perceived and not acting separately on the colour nerves of the retina. The intermingled checks of red and blue, yellow and blue, etc., are all illustrative of this type of shade amalgamation. In successive contrasts there may be precisely the same colours, but instead of being in affinity with each other, they are detached; and, consequently, do not act in perfect

unison on the optic nerves, but each independently of its neighbour.

Comparison of the results of these contrasts shows that colours suffer the most in lustre and purity of hue when in "simultaneous" association, being rendered thereby more competent of impinging on each other's individuality. Several examples of this kind occur in the pattern given in No. 3 of Plate IX. For instance, in those sections in which the blue and red are intermingled in equal proportions, both colours undergo an apparent change in hue. In reality it is simply the fundamental law of all colour contrasts asserting its influence on the colouring as a whole, whereby each hue is modified by the attributes of its associate, causing the red to appear somewhat crimsonish, and the blue somewhat purplish. Following up these investigations into this interesting series of contrasts, the various phenomenal changes in the colours, owing to being mixed with other hues, afford some scope for analysis. Blue is not only mixed with red but also with yellow, with black and with white. Red is also blended with these hues, providing several contrasts deserving of special notice. When blue and yellow cross each other, the former is deepened and the latter brightened in hue. The admixture of the same colour with black gives the blue threads a dingy, non-lustrous cast, while in combination with white it acquires fulness of tone. Turning to red, with black it appears slightly brickish, with white it evidently tends to crimson but does not diminish in saturation, while with yellow it assumes a more or less orangish-purple hue. Yellow in company with black is bright, luminous, and potent, but when associated with white it suffers in intensity and becomes perceptibly paler in tint. As white and black contrast perfectly with each other, neither of them suffers by juxtaposition, nor are they, in such minute quantities as they occur in this pattern, altered to any

apparent degree by the colours with which they are associated.

Amongst some of the most salient principles of textile colouring emphasized by this design that should be specially noticed, are these: Colours are modified the most largely in hue when in actual contact; the stronger two or more colours, the less are they changed by simultaneous contrast; bright colours on a dark ground increase in luminosity, but are impoverished if applied to light grounds; and lastly, that intense colours gain in saturation on light grounds, but suffer in this quality on medium and dark surfaces.

50. *Methods of Neutralizing the Effects of Strong Colour Contrasts.*—It has been pointed out in the preceding paragraph that when red and blue, or any other positive colours are in immediate proximity, each suffers somewhat in purity of hue. To obviate, or partially neutralize, this sequence of colour association, some ingenious methods and technical devices are adopted. As already explained, colours suffer the most in character by juxtaposition, so that the object to be attained is to separate them without bringing the divisional lines into marked prominence. It is not always feasible, in figured and fancy fabrics, to have the colours detached; they frequently intermingle, and it is at the points of actual contact where the skill of the colourist in obviating an inelegant contrast, due to the proximity of two or more brilliant hues, is called into requisition. No. 1, Plate X., which is a sample of this species of composition, will illustrate what ingenuity is exercised in such cases. This pattern may be defined as a red and blue colouring; yet it contains small quantities of a third hue which are of inestimable value to the harmony and contrast of the design. If the red had been allowed to actually touch the blue ground, the figuring would have lacked precision, and the colouring



1



2

PLATE X.

rose edging; and also soft, mellow harmony produced by this tint and the tan ground-work. Should each of the colourings alluded to be similarly experimented with, they would constitute equally pleasing and elegant combinations. As important principles underlie this kind of colour arrangement, it is advisable that numerous experiments of this class should be made by the reader; for, in order to educate the eye for colour contrasts and harmonies, practice in the combination of hues is absolutely essential. Essays should be made, as far as possible, by such means as those indicated, to supplement the knowledge acquired of the theory of colouring by useful and suggestive experiments.

51. *Colours in Relation to Light and Dark Grounds.*—Colours may not be applied with the same degree of facility to both light and dark grounds: generally, the latter afford the largest scope for diversity of treatment with fancy or bright colours. Take a few illustrations. Supposing a fabric has a drab foundation, and it is required to embellish it with fancy shades; then these must invariably be deeper in hue and more lustrous in tone than the drab surface on which they are intended to be distributed. There are several colours which will do for this purpose, such as pale or light blue, orange, and chocolate; and others which are totally inappropriate, including scarlet, purple, and kindred hues.

A light pea-green fabric might be elegantly figured with crimson and salmon, and perhaps with minute quantities of warm brown; while light slate surfaces can be admirably decorated with claret browns, lavenders, and scarlets. Of course the intensity and lustre of the fancy colour must in these and similar examples depend on the depth or saturation of the ground colouring.

Referring next to the application of fancy hues to medium and dark shaded materials, there is here more latitude for

variety of colouring than in the case of light grounds. Thus a dark brown surface may be embellished with drab, green, blue, lavender, and other colours; dark blue with light olives, browns, salmons, and pale blue; dark olive with lavenders, purples, scarlets, etc.; and dark green with russets, crimsons, browns, and medium tints of blue. These contrasts are grouped for direction in the selection of fancy colours for spotted and figured fabrics, but they may also be worked to in arranging tints in the production of fancy woollen, worsted, cotton, and silk textures.

52. *Harmony*.—This is a subtle and intricate quality of colours; and one which it is impossible to treat of as governed by a series of fixed laws.

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

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

53. *Principles of Harmony.*—Though Colour Harmony is thus intricate, and more or less incapable of being reduced to rigid principles, yet its general qualities may be clearly defined. For instance, certain colours when amalgamated fail to produce congruous patterns: amongst these are yellow and green, purple and red, and their derivatives; whereas other colours, such as red and green, orange and blue, yellow and purple, and their derivatives, invariably constitute harmonious compositions.

Harmony, moreover, is only attainable when the several colours are combined in such proportionate quantities, and on such principles of shade-association, that each hue employed will conduce to the mellowness of the whole pattern. Should any colour obtain unique conspicuity, it is sufficient to detract from the harmony of the entire colouring. Balance of hues is an important essential; and it is generally a feature dependent on the proportions in which the several colours are combined. Examine, for example, the green and scarlet check given on Plate X., No. 2. If these colours had been blended in equal quantities, the check resultant could not possibly have possessed the rich harmony of composition by which it is characterized. Red is so much more potent than green, that when these two hues are associated in the same pattern, the former requires to be used less extensively than the latter. The common rule is that those colours which are the intensest and strongest in hue in any combination should be most sparingly employed. When the various shades are of equal depth, the quantities may be more uniform, being only varied to such an extent as to impart precision to the leading features of the design.

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

CHAPTER IV.

MIXTURES.

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

54. *Varieties of Mixture Patterns.*—There are three methods of producing mixture patterns, namely, by carding several colours of materials together, and by spinning them promiscuously into the same thread; by using fancy twist yarns; and by mixing two or more classes of threads in the weaving process. Each system is extensively practised; but the most intermingled combinations ensue from blending the various coloured elements in the raw material form. This system of producing mixtures yields a yarn in which the separate particles of colour, however numerous and diverse they may be, are uniformly distributed throughout its length. Carding affords every facility for obtaining a softly-toned blend, or one in which the filaments of distinct colours are perfectly mixed and intermingled. The shades are, as it were, united in this instance in the powdered or most minute particled form possible in textile compositions; whereas the methods of

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

55. *Elements of Mixture Colouring.*—All mixtures require

mellow treatment as to colour constituents. Patterns of this order should not be characterized by a patchy, but by a tinted appearance; every hue employed should combine with its associates to compose an indefinite series of minute and closely mingled colour effects. To produce such styles no single hue should be allowed to obtain greater distinction or more marked prominence than its adjacent colours. One shade more pronounced than its contemporaries is sufficient to destroy the beauty of the whole combination; hence the necessity of proportionating the colours according to their intensities and qualities of vividness and saturation. Bright colours like red, crimson, blue, and yellow, never require to be used in large quantities. Black and white, browns, tans, mid blues, mid greens, olives, and other toned and tinted colours, form the main factors of mixture compositions; while the more potent hues find a province in enriching and importing lustre into these patterns.

Though the bulk colours should generally be of a tempered type, still it is important to use bright and decided hues. Dauby and murky shades should be avoided, as they are only capable of yielding dingy and inelegant effects. The fragmentary nature of mixture colourings largely affects the lustre of the pattern resultant. Two colours which, when combined in large quantities, may possess congruous attributes, on being broken up into particles and hopelessly intermingled lose both lustre and elegance. Let it be understood that never, in blending colours in the natural state, are the separate factors distinguishable after carding, for each, in the carded sliver, helps to constitute quite a new and additional shade of a more or less indescribable character. If, for example, claret, mid drab, and bright orange wools in quantities of four pounds, one pound, and one pound again were scribbled together, neither the orange, drab, nor claret would in the

resulting "blend" possess precisely its original cast. Traces of each would be noticeable, but a species of indefinite drabish-brown mixture, streaked with filaments of orange, would be the composition obtained.

56. *Importance of Pure Materials.*—Bright and lustrous mixtures can only be secured by using pure wools. Such colourings are not feasible in the low materials used in making some classes of woven goods. Scotch mixtures will always excel in brilliant tinting so long as fibres of a mungo, shoddy, and extract class are rejected by manufacturers north of the Tweed, and sound wools are selected. Having a good foundation to work upon—a fibre that will not only take a vivid colour but retain it—Scotch textures, notably Bannockburn and heather mixtures, are unsurpassed in lustre and mellowness of toning. Mixtures made in Dewsbury, Batley, and other seats of the low woollen industry, are not comparable with them in any respect as regards colouring. Of course, a passable imitation of the Scotch article is produced in these places, but the fabric lacks not only bloom and fulness of colouring, but quality and softness of handle. How is it feasible to get these elements of excellent mixtures developed to the same degree in these inferior articles, made of materials which in some instances have been utilized time after time in made-up garments, and as frequently ground up or reduced to filaments, scribbled, spun into yarn, and woven into a marketable fabric, as are obtainable in the genuine Scotch texture? If mixtures bright in colouring are to be acquired, resource must be had to wools of a sound quality. Stress is laid upon these points because they lie at the basis of good colouring in mixture styles; and also on account of the necessarily futile essays made by some manufacturers to secure corresponding richness of composition in a mungo, or partially mungo production, as characterizes an all-wool article, which it is important to

understand is totally impossible, for the simple fact that the better the raw material, the more lustrous the coloured effects secured.

57. *Several Classes of Mixture Compared.*—The diversity of mixtures, acquired by blending several shades of raw materials, is very large, comprising an infinite range of light, medium, and dark effects, in both woollen and worsted goods. There is, however, one quality characteristic of every species of this type of mixtures, namely, a rich, mottled aspect of colouring, whose elements are so perfectly intermingled as to baffle analysis. Whether considered in the fibrous state or in the woven fabric this mingled but continuous poly-tinted appearance is noticeable. Where the separate hues occur, and are lost to view, or how numerous they are, it is only possible to determine after careful examination. All the hues are scattered equally throughout the composition, hence the blend in every part possesses similar qualities of bloom and diversity of tinting. These mixtures may be distinguished from those obtained by other processes by the thoroughness with which the various coloured factors are associated, forming one compact surface of richly variegated colour.

If a mixture fabric made on this system were compared by analysis with one got by using twist yarns, or by adopting threads of divers colours in both warp and weft, some interesting results would be obtained. To dissect a mixture fabric produced by "blending," the yarns of which the texture is composed would require to be untwisted or reduced to a multitude of filaments, whose colours might be most feasibly determined by a microscopic examination of them. The proportions in which the colours are combined is far more difficult to arrive at than the nature of their hues, for these can only be estimated, and not calculated by any precise process. Having, however, secured the exact colour elements, some data has been discovered

upon which to base experiments, which, if properly conducted, will lead to the determination of the quantities in which the colours have been combined in the production of the composition. Ordinary twist-yarn mixtures do not offer so many difficulties to the analyzer. First, as to their colour constitution: this is easy to discover if the different kinds of threads are classified, which can be done by unravelling the texture. Next, ascertain the colour composition of each by untwining the twists or separating the threads used in their construction. By adopting this system of analysis, both the exact hue of the colours and the quantities in which they have been combined may be obtained. The reason why the routine of dissection is in this case comparatively simple, is because the coloured factors of the fabric may be feasibly separated, whereas in the preceding class of mixtures the isolation of the various hues of the filaments employed was found impracticable. To discover the composition of a mixture in which self-coloured yarns have been used, it is only necessary to ascertain the methods of warping and wetting, or the plan of combining the yarns in the production of the fabric. Evidently, in these two last styles of mixtures, exact analysis of the colourings, both as to quantities and hues, is quite feasible, but in the first kind the proportions, as well as the precise colours, are difficult to acquire.

58. *Blend Mixtures*.—The most economical species of mixtures belonging to this class is that obtained by combining any one colour with white. Mixtures of this kind may be defined as tinted wools, for the process of production exactly coincides with that of forming tints with pigments. They differ, however, from the latter in appearance. A tint obtained by mixing red with white, for example, constitutes quite an even surface of pink; but mix white and red wools in similar quantities, and something more than a rose compound is produced, namely, a

mottled, intermingled colouring, whether seen in the material, yarn, or piece. Equal quantities of blue and white, green and white, and orange and white wools, all form colourings streaked with their composing hues. It will be evident that this class of colour amalgamation opens up a wide field for investigation. First, there is the immense range of colours with which white may be associated, comprising both positive and tempered hues of a primary, secondary, and tertiary character. Second, there is the considerable diversity of proportions in which the elements forming the mixtures may be combined; for either the white or coloured factor may preponderate, or the two shades may be equally mixed. In addition to these mixtures, which are of the most elementary class, there are those resulting from blending black with other colours, and from compounding materials of two or more colours. The two former kinds are utilized in the manufacture of yarns for serge dress textures, for which fabrics they are particularly well adapted. The tints and shades furnished on Plates III. and VI. illustrate the results obtained by this scheme of blending. In combining wools, however, or other materials, though the same proportionate quantities of tinting and toning elements were used as in forming these examples, still compounds of a somewhat different character would ensue, arising from the colour factors being of a fibrous character.

59. *Blends of Wools and Pigments Compared.*—It is important that the dissimilarity between wool and pigment mixtures should be thoroughly understood; for it will be quite evident from the nature of these substances that, though in each the same quantities of similar colours were blended, yet the resulting compositions would be characterized by many features of difference. To these reference will next be made. When two or more shades of wools are amalgamated, each colour—however well the

materials are grouped and intermingled in scribbling, carding, and spinning—retains its individuality of hue, which, of course, is opposed to the law of pigment combinations, in which all traces of the original colours as separate hues disappear by admixture. Still, when fibrous materials are associated, a sort of new shade, streaked more or less with its composing elements, is obtained. For example, a species of elegant bluish-drab mixture would result from blending wools as follows:—

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

But, while the resultant composition in this illustration might be designated a peculiar kind of drab, yet, if it should be closely examined, the brown, pale blue, and green factors would be discovered, which give bloom and saturation of tone to the whole shade. Providing the same elements were mixed in pigments they would yield quite a different result. In only one particular would it correspond to its wool contemporary—it would be a drab shade; more murky and dingy, however, and scarcely recognizable as being composed of exactly the same colours in like proportions. When paints are mixed, all colours, as individual hues, are totally obliterated, hence a shade is formed in this instance in which the green and blue can hardly be distinguished, the brown and drab with which they are associated largely neutralizing their effect.

Of course their presence is perceivable, but not to the same degree as in wool mixtures, for the simple reason that, whereas in this latter instance the fibres of blue and green are mixed and grouped with those of brown and drab, and the four colours in association form a brownish drab mixture, tinted with each of its colour elements, in

the case of pigments the particles of various colourings entirely disappear, and combine to constitute a perfectly new shade of somewhat indescribable qualities. It follows that, in one sense, fibrous blends of colours are more effective than those of pigments, for they not only possess the nature of new shades, but the several elements of which they are composed are kept intact, enhancing the beauty and intensity of the whole combination. Each colour of filament used remains, and is traceable in the mixture as a separate hue, and thus a pleasing and attractive compound is obtained; one, moreover, only producible by blending different colours of fibrous materials. These effects are alone seen in woven textures, and in that class of fabrics in which the colours have been blended prior to weaving or in the carding operations. Should twist yarns be employed instead of various hues of fibres, a more patchy and a broader pattern results; one, indeed, in which the colour factors are more prominently separated, and hence devoid of those qualities of neatness and softness invariably associated with mixtures produced in the processes of scribbling, carding, and spinning. Passing to mixtures got in the loom by self-coloured yarns, a still further divergence from a one-shade mixture, resulting from blending several colours, is obtained; for here the several tints employed remain quite detached and distinct. Undoubtedly, in woven fabrics, the most elegant style of mixture is that secured by combining the colours in the material form, or in mixing them in the production of the thread; which method produces a promiscuous shade, tinted, freshened, and brightened with every element of colour entering into its composition; and which constitutes, moreover, quite an evenly balanced colouring.

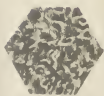
60. *Modes of Testing Compositions of Colours.*—Two methods of testing the effect of combining different shades may be practised. First, the most handy system consists in

mixing the various coloured elements in the pigment form. Although it is barely possible to represent in this manner the precise result any amalgamation of shades would have in textile materials when scribbled, carded, and spun into yarn, still a fairly accurate idea of the tone and general aspect of a mixture of tints may thus be arrived at. Tests of this kind also serve another purpose—they foster in those who practise them a taste for colouring, and develop the faculty of judging the depth and brilliance of the tone and tint of mixtures in general. A liberal use of the pallet when seeking to produce new blends is, therefore, recommended, because it helps to the arrangement and association of bright and attractive colourings. This method of testing new sets of colours for mixtures is so important that it may be fully described. The pigments should be used in solution, which, for convenience, may be kept in small bottles, so that, in mixing, the minutest quantities can be readily and accurately measured off. When thus working with liquid colours, in order to properly test any group of shades, a surface should first be prepared of the principal colour in the mixture. Should this be black, brown, or any other dark colour, it will be necessary to mix the bright colours with white. After the body of the mixture—that is, in this instance, the black or dark brown—has been obtained, the whole should be completed by stippling on to it the other colours in succession, care being exercised not to apply a new colour before that previously used has become perfectly dry. Let an illustration be considered. A mixture of colours which it is required to put through this test is compounded thus:—

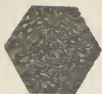
4 parts of black
3 „ „ scarlet
2 „ „ mid-green
1 part of white.

lustre is proportionate to the brightness of the hues amalgamated. If these are washy and murky, the resulting combination will be unsatisfactory. While it is impossible to enumerate all the colours suitable for this species of blending, yet it may be remarked that one of the hues should, at any rate, possess bloom and force of tone; not necessarily harshness of hue, but fulness of tint and definite emphasis of shade; in order that it may be capable of affording colour character to the mixture in which it is used. Such colours as claret, maroon, deep purple, russet, chocolate, tan, warm olive, full-toned drab, blue, and green drab, are appropriate for this purpose.

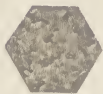
62. *Compounds of Two Colours in which White is used.*—Blends of this class are both numerous and important. They are of all tones, depths, and intensities. Three illustrations are furnished on Plate XI., comprising light and medium compositions. The former (No. 1) results from mixing 3 lbs. of white with 1 lb. of brown; the second (No. 2) is composed of 3 lbs. of drab, and 2 lbs. of white; and the third consists (No. 3), 3 lbs. of reddish purple, and 1 lb. of white. In the first and last of these mixtures the proportions are the same, but in the former white is the prevailing, and brown the subordinate tint, while in the latter lavender is the main element, and white simply the secondary factor of the blend. This leads to the consideration that in forming such mixtures it is imperative to determine, in the first place, whether white or the colour element, whatever that may be, is to preponderate in the mixture about to be produced. Having decided upon this point, some calculation should be made as to the extent in which one element is to be overpowered by the other. The illustrations will assist us in the solution of this problem. Starting with the brown and white combination it is quite apparent that, in this instance, it has been sought to acquire an effect of a light character, one, in a word, just tinged or



1



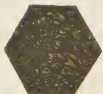
2



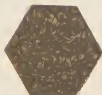
3



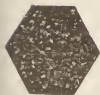
4



5



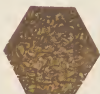
6



7



8



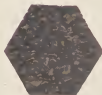
9



10

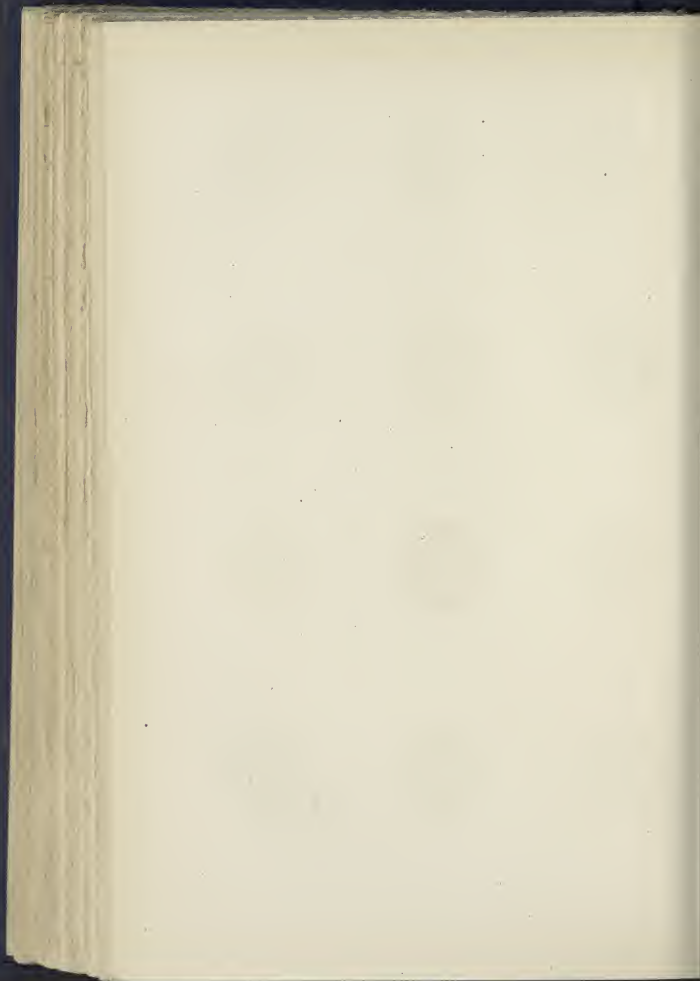


11



12

PLATE XI.



toned with a brownish element. As a consequence, white must be the preponderating shade, but the point arises to what degree. If the proportions were four parts of brown to one part of white, the mixture would be too pale; if three parts of white and two parts of brown were combined, the mixture would assume a dark cast, for the brown element would be too potent; hence the proportions from which the illustration has been obtained are the most appropriate for producing a light-shaded compound. Results of this kind can only be arrived at by experiment. Theory merely expounds the principles of the art, practice alone can illustrate and verify them. With pigments the reader may acquire much useful and reliable knowledge of these combinations; or by dyeing for himself in a small vessel a number of different shades, which is no difficult task, and using the hand cards alluded to in a previous paragraph, he may become a competent and skilful combiner of fancy shades for mixture yarns. He should, however, first understand the elements of the science, and, by a study of the subject in its theoretical phases, learn the style of colourings and the proportions of tints capable of giving the most elegant results.

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

portions rendered, forming a mixture of considerable utility.

The remaining sample in these mixtures (No. 2, Plate XI.) is the most suitable for tweeds yet considered. As a compound shade it possesses many excellent features for both summer and autumn styles. First, it is of medium depth; second, it possesses a mealy softness; and third, it does not readily appear sullied, being one of those mingled combinations that will stand much wear without appearing any worse in a colour sense. Here, as already stated, white is the minor element of the composition. While in the two preceding examples it is the predominate shade, here it simply acts as a tinting factor which gives softness and mellowness to the green-drab forming the bulk of the mixture. The utility of white for this purpose is thus clearly seen. The green drab of itself possesses a dull and heavy cast that partially disqualifies it for extensive use as a solid colour in fabrics made of one shade only, but when it has been mellowed with white on this principle, it produces a mixture that is highly suitable for such goods. It might be assumed that if the drab shade were not so deep, a similar effect would have been acquired as that here furnished, but for obvious reasons this would not be the case. Of course a similar depth or tone of colour might, by this means, be secured, but it would lack that mealiness characterizing this blend, which is entirely due to the white appearing here and there in the mixture in minute flakes, adding largely to the elegance and beauty of the whole composition.

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

I.

3 parts of peach blue.
1 part of white.

II.

3 parts of tan
1 part of white.

III.

3 parts of olive brown.
1 part of white.

IV.

3 parts of slatish drab.
1 part of white.

V.

2 parts of deep chocolate
brown.
2 parts of white.

VI.

4 parts of chocolate.
1 part of white.

VII.

6 parts of white.
4 parts of deep slatish blue.

VIII.

3 parts of white.
2 parts of drab.

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

64. *Mixtures composed of Black and another Colour.*—
These, if anything, have a more extensive application than

the mixtures just alluded to, and are probably more diversified in composition and colouring. They are largely employed in the production of yarns for dark and medium-shaded goods. As the illustrations furnished on Plate XI. indicate, many exquisite combinations may be obtained on this method. The first example (No. 4, Plate XI.) that may be considered is a russet brown mixture. Probably, the russet is a degree too warm, but for some purposes the blend is all that could be desired. Bloom, mellowness of cast, and rich fulness of tint are its chief characteristics. As a tweed mixture produced by using two colour factors it is invaluable. It contrasts strongly with the following mixture, No. 5 of the same Plate, which results from blending one part of black with one part of light olive. This is a popular blend, being at the same time neat and attractive in colouring. The olive used is more drab than orange, and in association with the black assumes a greenish cast. By combining yarns made of this mixture with yarns made of the preceding mixture some excellent patterns might be readily produced, simple, but neat and elegant in composition; the streaks of russet in the one, beautifully harmonizing and contrasting with the filaments of olive in the other. The qualities of bloom and warmth lacked by this latter example are possessed by the russet blend, while the mellow and refreshing characteristics of the olive mixture, when associated with the russet, yield a compound colouring of elegant and tasteful properties.

But one further illustration, No. 6, Plate XI., in this species of blend calls for description, namely, a black and fawn combination in which fawn is the principal hue. This is one of the most admirable mixtures that it is possible to produce, hence it requires to be closely examined. It is illustrative of the diversity of effect that may be acquired by combining but two colour elements. As the fawn hue composes the bulk of the blend, it possesses, when

viewed at some distance, a greyish tone, but on more minute inspection the small flakes of fawn colouring assume a warm and a rich bloom as well as a soft, mellow aspect. If a similar mixture slightly darker in tint were required, five parts of black and six parts of olive-tan would give it, but if the proportions forming the example, namely, four parts of black and six parts of tan, are retained the richest result is acquired.

Other examples in this style of mixture not illustrated may be briefly described. They comprise dull, warm, bright, and intermingled compositions. The colourings of which they are constituted and the proportionate parts will first be furnished, and then the general features of each described.

I.

5 parts of black.
2 „ tan.

II.

1 part of black.
1 „ tan.

III.

6 parts of black.
3 „ bluish green.

IV.

4 parts of black.
5 „ dark purple.

V.

3 parts of black.
2 „ sage green.

VI.

4 parts of black.
3 „ drabish fawn.

VII.

4 parts of black.
1 part of lilac (medium shade).

VIII.

6 parts of black.
1 part of rose pink.

Combinations I. and II. are quite dark. The former is a warmish, and the latter a somewhat cool colouring. Yarns from these two mixtures harmonize well when associated in

the same pattern. The tan used in No. I. is similar to No. 3, Plate III., and the bluish green to No. 2, Plate V., but rather more blue in tone. Mixture II. is a medium colouring, suitable for suitings and the general run of fancy tweeds. Warmth, freshness, and lustre are its main and characterizing elements. No. IV. is a unique colouring. It forms an admirable dark thread. A fabric in which the warp is composed of yarns made of this mixture and woven with yarn from Blend I. is an excellent combination of tints. Mixtures V. and VI. are both of a medium tone. No. V. is rather dull in tone as compared with No. VI., but both are useful colourings. Blends VII. and VIII. are of a different character. In these examples the colour element is small, but comparatively light and lustrous in tint. The object has been to obtain a black composition just streaked with filaments of a bright shade, forming elegant mixtures for small yarns for winter dress goods. The quantity of lilac in No. VII. is just sufficient to change the tone of the black, and to produce a compound approaching a species of grey, but bright and fresh in colouring. No. VIII., though very dark, is cheerful and lustrous, being suitable for a fancy yarn, or for thin textures for robes and other ladies' costumes. It is unnecessary to multiply examples of mixtures in this class, as those furnished are typical of the endless variety of combinations which in practice are required by this scheme of colouring.

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

Some of the most important and common proportions are as follows:—

I.

6 parts of black.
1 part of white.

II.

5 parts of black.
1 part of white.

III.

4 parts of black.
1 part of white.

IV.

3 parts of black.
1 part of white.

V.

2 parts of black.
1 part of white.

VI.

1 part of black.
1 „ white.

VII.

2 parts of white.
1 part of black.

VIII.

3 parts of white.
1 part of black.

IX.

4 parts of white.
1 part of black.

X.

5 parts of white.
1 part of black.

XI.

6 parts of white.
1 part of black.

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

To produce a perfectly gradated shade it is necessary to use some five or seven greys, but in ordinary styles, for both woollen and worsted textures, it is not customary to employ a larger number than the three mixtures just

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

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

I.

1 part of black.
1 „ white.
1 „ red.

II.

2 parts of black.
1 part of white.
1 „ red.

III.

2 parts of white.
1 part of black.
1 „ red.

IV.

2 parts of red.
1 part of black.
1 „ white.

These proportions, giving typical results, will be adopted throughout the exposition of these mixtures, that is to say, when the tinting element is changed to blue or orange, the same quantities will be combined as in those furnished in the above examples.

In No. 1 the shades are amalgamated in equal proportions, hence there is no tint preponderating in the resultant mixture, which is a species of brownish grey, neat and elegant in composition, and one that is liberally used in textile designing. Black predominates in Mixture II., resulting

in the production of a more appropriate shade than that formed by No. I. for autumn and winter cloths. Referring to No. III.—here white is the chief element, hence a medium compound shade is acquired; if anything somewhat pinky in appearance, owing to the entrance of white and scarlet into the blend, but still the whole is toned and increased in depth of composition by the admixture of black. It is, possibly, on account of its richness, more suitable for yarns for dress fabrics and ladies' stuffs than for heavy goods for gentlemen's wear. The same remark applies with corresponding truth to Mixture No. IV., in which red is the preponderating hue. But this is a bright and cheerful colouring, and one that makes an excellent fancy yarn. These reddish grey mixtures all form valuable shades for winter styles, as they are decidedly cheerful and warm in aspect, and produce a style of pattern both bright and comfortable in character.

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

V.
 1 part of black.
 1 „ white.
 1 „ yellow.

VI.
 2 parts of black.
 1 part of white.
 1 „ yellow.

VII.
 2 parts of white.
 1 part of black.
 1 „ yellow.

VIII.
 2 parts of yellow.
 1 part of black.
 1 „ white.

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

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

Black and white in association with blue form an exquisite and valuable series of mixtures, more or less applicable to all classes of fancy goods. They are characterized by unique freshness, elegance, and coolness, which qualities recommend them to the designer of textile patterns. When the quantities of the several shades are equal (1 part black, 1 white, 1 blue), the mixture formed is of a peacock blue tone, streaked with grey. This mixture may be applied both as a fancy and as a ground shade, according to the texture being produced. Increasing the black (2 parts of black, 1 white, and 1 blue) results in the formation of a dark bluish grey, eligible for application to a large variety of fabrics. By giving preponderance to the white (2 parts of white, 1 black, and 1 blue), a slatish blue grey is obtained, which, in combination with certain brown mixtures, is capable of forming elegantly coloured patterns. When the blue element is the principal hue (2 parts of blue, 1 black, and 1 white), the mid grey, constituting one half of the compound, assumes a mellow, quiet blue tone, making a mixture

specially appropriate for goods in which cheerful but soft colouring is an important feature of the design.

It is evident from these examples that a wide field of colouring is opened up in the admixture of black and white with the primary colours. In the illustrations considered, only four sets of proportions have been dealt with, but by multiplying these it will be obvious that an endless diversity of results, even with these five shades—black, white, red, yellow, and blue—can feasibly be acquired. But when it is taken into account that other hues besides those named are used in combination with black and white, it will at once be seen that the possibilities of this preliminary method of combining colours for textile work are largely increased. The subject cannot be followed further than the secondary colours at this stage; but these, in conjunction with the primary combinations just described, will give a fairly comprehensive view of the styles of compound shades obtained in practice by this system.

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

Green, when associated with black and white on this system, does not constitute mixtures admirably adapted for yarns for fabrics of a heavy description, but yields compounds useful in the decoration of dress and other thin textures. These blends partake of a species of mellow,

mingled, greenish grey, at once æsthetic and attractive in composition. Such blends are more pleasing to the eye in woven fabrics than solid green, possessing a softer, quieter, and a more satisfactory tone. Beginning with white, black, and green, equally compounded, a mixture is obtained that may be appropriately described as a slatish green, the grey element imparting to the blend a rich mellow cast. By increasing the black factor (2 black, 1 white, and 1 green) the slatish tone is augmented, because it is due to the association of this shade with the green element of the blend. As black is, in this instance, the principal shade, the mixture, while mellow and greenish, is decidedly deep and full in tone. The employment of white as the leading shade (2 parts of white, 1 black, and 1 green) yields an interesting combination between a pea and a slate green. If the yarn, made from this mixture, were associated in the same pattern with that resulting from blend No. III. of the red series, an exquisite assortment of tints would be obtained. It is by blending the yarn product of one combination with that of others that attractive colourings are arrived at. When the proportions are 2 parts of green, 1 part of black, and 1 part of white, the compound has too greenish a cast to be of extensive use in textile designing, hence this mixture is chiefly used in the form of a fancy or lively thread.

Allusion has now only to be made to the purple grey combinations, and as the utility of this hue, as a blooming agent for grey mixtures, was referred to in Paragraph 34, it is only necessary to briefly describe the results of blending according to the scheme of proportions adopted with the other secondary as well as with the primary colours. First, when the proportions are 1 part of black, 1 part of white, and 1 part of purple, a distinctly purple grey is produced, owing to the extraordinary potency and diffusiveness of this secondary. Making black the predominant

yarns may be succinctly indicated. First, consider the claret-drab blend given in No. 10, Plate XI., and composed of 4 parts of claret, 1 part of drab, and 1 part of gold. This is a unique but useful assortment. The colours combined not only harmonize in the mixed but in the isolated state. If any one of the colours were removed, the combination would be incomplete, showing the perfect union of the tints associated. Should four colours be blended, increased freshness and lustre of combination may be acquired, as is instanced by No. 11, which consists of 4 parts of black, 2 parts of drab, 1 part of scarlet, and 1 part of white. As in the previous example, a dark shade is here employed for the bulk of the mixture, the other tints combining to impart cheerfulness and brightness to the entire group of colouring. The touch of scarlet is very appropriate, giving warmth and tone; the drab is utile as a filling-in factor, while the black and the white unite with their *confrères* to constitute that general mellowness which characterizes the whole blend. Another example, No. 12, of a dark description should be noticed. It is a compound of three colours, blended thus:—

2 parts of purple.
1 part of orange.
 $\frac{1}{2}$ a part of smoke.

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

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

69. *Multi-Shaded Mixtures.*—The general principles of the art of blending have now been so fully expounded, that it will not be needful to treat extensively of the remaining kinds of mixtures. By the aid of further illustrations the methods of combining any reasonable number of colours in the constitution of "stock" for fancy

yarns may be succinctly indicated. First, consider the claret-drab blend given in No. 10, Plate XI., and composed of 4 parts of claret, 1 part of drab, and 1 part of gold. This is a unique but useful assortment. The colours combined not only harmonize in the mixed but in the isolated state. If any one of the colours were removed, the combination would be incomplete, showing the perfect union of the tints associated. Should four colours be blended, increased freshness and lustre of combination may be acquired, as is instanced by No. 11, which consists of 4 parts of black, 2 parts of drab, 1 part of scarlet, and 1 part of white. As in the previous example, a dark shade is here employed for the bulk of the mixture, the other tints combining to impart cheerfulness and brightness to the entire group of colouring. The touch of scarlet is very appropriate, giving warmth and tone; the drab is utile as a filling-in factor, while the black and the white unite with their *confrères* to constitute that general mellowness which characterizes the whole blend. Another example, No. 12, of a dark description should be noticed. It is a compound of three colours, blended thus:—

2 parts of purple.
 1 part of orange.
 $\frac{1}{2}$ a part of smoke.

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

DARK BLENDS.

I.

4 parts of brown.
2 „ light brown.
1 part of lavender.

II.

4 parts of brown.
1 part of sage.
1 „ scarlet.

III.

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

MEDIUM BLENDS.

I.

4 parts of brown.
2 „ light olive.
2 „ white.

II.

4 parts of claret.
3 „ white.
1 part of gold.

III.

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

LIGHT BLENDS.

I.

4 parts mid brown.
1 part of drab.
1 „ white.

II.

2 parts of brown.
2 „ white.
1 part of drab.

III.

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

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

Scotch goods, cotton textures, and a large range of other fancy fabrics are also embellished on this system. The following colourings in ordinary twists, and in curl, cloud, and knop yarns, are suitable for this type of mixture effects:—

- | | |
|------------------|-----------------|
| I. | II. |
| Black and brown. | Black and tan. |
| III. | IV. |
| Black and white. | Black and drab. |

V.

Black and dark blue.

VI.

Brown and white.

VII.

Slate and white.

VIII.

Black and grey.

IX.

Grey and white.

71. *Weave Mixtures*.—These are least manufactured of any of the three classes of mixtures. They result from intermingling self-coloured yarns in the loom. Plain and other simple crossings are alone suitable for producing these effects. It is usual to have the warp of one colour, such as grey, and the weft of two colours, such as brown and blue; or the warp of two colours, and the weft of one. There is a set arrangement about these mixtures entirely foreign to the preceding types. This is due to the yarns being of solid colours, and hence only capable of yielding a comparatively uniform pattern. In neither of the two foregoing classes of mixtures could anything approaching a repetition of effect be traced in the woven sample, whose surface is invariably one mass of mottled tinting; but when weave-mixtures are considered, something like rigidity of style and a prescribed pattern are arrived at. These of course are objectionable features, and hence the very limited variety of these cloths compared with those got by other methods. For an analysis of the principles on which those patterns are acquired, the reader is referred to page 246 of "Woollen and Worsted Cloth Manufacture."

CHAPTER V.

ELEMENTS OF TEXTILE COLOURING.—STRIPES.

72. Colours applied to Textiles on Various Systems—73. Types of Woven Colouring—74. Single Weave Colourings—75. Colour in relation to Backed and Double Cloths—76. Colour applied to Single-make Figured Cloths—77. Fancy Shades applied to Backed and Double Weave Combination Designs—78. Colour in Designs in which the Figures are produced by the Weft Yarns—79. Figured Effects obtained by Warp Colouring—80. Colour in Textiles Figured by both Warp and Weft Yarns—81. Pattern Design—82. Styles due to Colouring only—83. Stripes—84. Checks—85. Mixtures—86. Figures—87. Classes of Striped Patterns—88. Hairlines—89. Stripes composed of Longitudinal and Transverse Lines—90. Regular Stripes composed of Two Colours—91. Regular Stripes Composed of Three or more Colours—92. Irregular Stripes composed of Black and White Yarns—93. Irregular and Indefinite Stripes in Two Colours—94. Irregular Stripes—Shades in Two Colours—95. Shaded Stripes in Two Colours for Bed Ticks—96. Irregular Stripes containing several Colours—97. Shaded Stripes in several Colours.

72. *Colours applied to Textiles on Various Systems.*—There are numerous methods of introducing colours and fancy shades into woven patterns. According to the kind of fabric being produced, the nature of the materials composing it, and its structural arrangement, the scheme of colouring practised varies. Suitings, trouserings, mantlings, dresses, vestings, shawls, rugs, carpets, and other important typical textures, are all coloured on distinct principles. Worsteds are not treated in a colour sense precisely on the same system as woollens, nor silks as cottons. Simple

weaves allow of more varied colouring than diagonals and other intricate crossings; figured designs of a floral or geometrical character than those resulting from combining several small weaves; single make than double and treble make patterns; ordinary decorative fabrics than plushes and lenos, and so on. Yet there are some principles of textile colouring common to all species of woven design. Certain modes of grouping yarns in elementary plans of interlacing warp and weft threads yield, under all conditions, the same style of effects. As a well-known combination of lines makes the key pattern, so in textile designing there are methods of classifying and uniting shades which cannot but produce one form of pattern. While in subsequent chapters it will be needful to specialize and indicate the complex modes of colouring practised by the weaver, here the general principles of the art will be simply expounded.

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

TABLE ILLUSTRATING THE TYPES OF WOVEN COLOURINGS.

I. COLOUR IN SIMPLE AND FANCY WEAVES.

(A) *Single-make Cloths.*—These comprise woollen, worsted, cotton, linen, and silk textures for suitings, trouserings, dresses, flannels, shawls, wraps, etc., in plain, twilled, mat, sateen, corkscrew, leno, diaper, and other weaves.

(B) *Backed and Double Weave Cloths.*—These comprise effects produced principally for gentlemen's wear, in both woollen and worsted yarns; also rugs, travelling modes, winter mantlings, etc.

II. COLOUR IN FANCY AND FIGURED PATTERNS.

(A) *Single Fabrics*.—These comprise stripes, checks, and drafted patterns for dresses, mantlings, ulsterings, shirtings, etc.

(B) *Backed and Double Weave Combination Patterns*.—These comprise woollen and worsted patterns, chiefly for gentlemen's garments; also shawls, mantlings, rugs, "Kidder" or Scotch carpets and damasks.

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

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

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

74. *Single Weave Colourings*.—The single-make cloths named in Group A of the first class of coloured effects are textures not only single in structure, *i.e.*, not backed, but composed of one weave of a simple character. Here the most elementary types of textile colouring occur. Many of the patterns produced in these crossings owe their entire ornamentation to the methods adopted in grouping the shades, and to the plan of interlacing the warp and weft yarns. They form a species of woven design which is purely technical in construction. The artistic knowledge requisite to their origination is exercised in the selection and combination of colours. As regards the elements which give the pattern its form or outline, these are solely of a technical nature, and relate to dexterity and ingenuity in the invention of novel plans of cloth construction, and of applying to such makes those schemes of colouring which

will most effectively develop their structural composition. This class of textile pattern may be described as Colour Association or Design, for it is one in which the all-important principle consists in devising new systems of shade arrangement and distribution. When considering pattern as obtained in simple weaves, this feature of design is the most prominent for examination. Scotch tweeds, as well as various classes of fancy woollens for suitings, trouserings, and flannels, some styles of cotton fabrics, and a considerable quantity of worsted, silk, and linen goods, are beautified with this description of design. The more or less complex nature of these textiles is determined by the intricacy of the weave employed, and the plan of grouping the shades adopted. Irregular makes or crossings, such as diagonals, fancy twills, diamond and broken weaves, are more difficult to treat with colour than simple twills and hopsacks. The comprehensiveness of this type of textile colouring will be evident when it is mentioned that in the plain weave, and the cassimere twill, there is practically no limit to the variety of patterns obtainable in stripes, checks, diagonals, small figures, mixtures, spotted, and other styles.

75. *Colour in relation to Backed and Double Cloths.*—The fabrics named in Section B of Part I. of the Table are much more intricate in structure than those alluded to in the previous paragraph, and hence require greater technical skill in colour treatment. Fabric structure—comprising stoutness, firmness, and heaviness of cloth—is a factor which necessitates the use of a compound, or backed or double weave, difficult to colour, and so technical in construction as to limit the facilities for colour application. As these cloths are in some instances double in the weft, in others double in the warp, and in others double in both warp and weft, they cannot be economically and advantageously coloured unless their build or structure is

thoroughly understood. The yarns employed in the composition of the face pattern have to be kept distinct from those forming the back of the fabric, and *vice versa*. Frequently the colouring of the face forms a different style from that on the back, in which case a combination of at least two principles of colouring takes place.

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

76. *Colour applied to Single-make Figured Cloths.*—These form the A Group of textures given in Part II. of the Table. In addition to the effect in this instance due to association of colours, there is design or pattern produced by a combination of weaves differing in structure or build, and moreover in appearance in the woven fabric. The weaves may be arranged to form stripes and checks of all dimensions and figures, both of geometrical and floral descriptions. The classes of goods to which these designs are applied are very numerous, including trouserings and coatings in wool and worsted yarns, fancy dress goods, mohair, silk, and other classes of mantlings, ulsterings, silk handkerchiefs, cotton textures, and decorative fabrics. The principles involved in this type of textile designing comprise the application of colour in the development of simple weave effects, and its introduction into de-

signs composed of several weave elements to give precision and smartness of figuring. Before colour can be well applied here, its effect on the elementary crossings must be clearly apprehended. The designs containing various makes, such arrangements of fancy shades have to be used as will emphasize exactly the proper parts of the whole style, and not result in the suppression of some weaves and in too bold a development of others. The larger the number of weaves entering into any single design the greater the intricacy of colour application. When colour in relation to the *A* Group of fabrics in the first section of the Table is understood theoretically and practically, its functions and scope in this branch of designing may be readily mastered.

77. *Fancy Shades applied to Backed and Double Weave Combination Designs.*—Winter goods of a figured order for apparel are included in Group *B* of the Figured Patterns. This class of textiles also comprises a limited series of shawls, mantlings, and rugs. Many types of trouserings of a striped aspect, in which two double makes occur, come within the scope of this useful group of textiles. Generally, if the method of colouring is simple, the combination of weaves is largely diversified; but should the latter only comprise a few elements of weaving, more complex schemes of colouring are requisitioned. This order of patterns, moreover, includes certain species of textile effect not producible by having resource to any other principle, or association of principles, of weaving, but those appertaining to double cloth combinations. Regarding the style of figuring feasible here, it may be either elementary or elaborate in arrangement. Every description of ornamentation can be developed, from the simplest rectangular pattern to the most fantastic and complex blend of floral and other forms. It is this feature of this principle of design and colouring which makes it useful in the production of various kinds of reversible fabrics—textures figured and

wearable on both sides, such as shawls, Austrian blankets or rugs, and Scotch carpets. Yet while the application of colour to these designs may yield these elaborate loom productions, the same scheme of colouring applied to the identical type of weave designs may give such patterns as obtain in fancy trouserings, suitings, mantlings, and ulsterings of infinite variety of style. The structure and weave composition of these fabrics, and modes of gaining effects in them by colour, will be explained in detail in the proper place.

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

79. *Figured Effects obtained by Warp Colouring.*—This is the reverse of the preceding principle of intertexture. All the fabrics enumerated in Class D are constructed on this system. They have one weft and several warps, the number of the latter varying according to the multiplicity of colours forming the pattern. Evidently warp colouring is applicable to an extensive assortment of useful fabrics.

Commencing with the simplest type first, this mode of colouring plays an important part in spotted designs, or patterns in which the distinguishing feature is a series of spots or minute specks of bright colours. These effects appear in suitings, mantlings, dresses, and cotton goods, including fabrics for aprons and small-ware purposes. Very elaborate dress styles are also figured by several sets of warp colourings. Here the weft is a sort of binding agent, uniting into one compact and firm fabric the various elements of warp colouring. Velvets and figured plushes, comprising astrachans and all pile goods made in imitation of animal skins, in addition to Brussels, Axminster, and velvet pile carpets, all owe their design composition to the employment of two or more layers of warp threads.

80. *Colour in Textiles Figured by both Warp and Weft Yarns.*

—This is the most comprehensive of all classes of textiles to which colour is related. The most elaborate patterns made in the loom, and the most costly, are the product of combining both warp and weft colouring. It is quite evident, on consulting the Table of the different types of textile colouring, that, in theory, the *E* Group of fabrics results from combining the systems of weaving included in Groups *C* and *D*, but, in practice, as subsequent analysis will demonstrate, many other details of designing and colouring are involved in the execution of this class of fabrics than those here comprised. As this species of colouring finds expression in all the types of figured woven effects specialized in the above mentioned styles of fabrics, it is useless to attempt further classification. These textures are intricate in build and unique in principles of intertexture. Usually, they are neither purely double nor yet purely single in construction, but embrace many schemes of designing and colouring, such as may only be mastered by those who previously study the former fabrics to which colour is applied, and which are named in the Table.

81. *Pattern Design.*—This style of pattern results solely from the methods of grouping fancy warp or weft yarns, or both these elements of textile fabrics. It may be appropriately designated "Colour" to distinguish it from "Weave" design; for, if the colours are removed from such patterns, all effect is destroyed. Colour here yields both the form of the design and the beauty of the style. No type of textile designing is more extensively utilized than this, for the styles resultant are characterized by neatness and almost universal utility. Pattern design relates not only to the artistic grouping or blending of shades, but to their arrangement. The latter is a factor which has to be suited



Fig. 5.

to the build of the weave. The same plans of colours are capable of yielding quite distinct effects in two different weaves. Figs. 5 and 6 plainly demonstrate this important principle of textile colouring. The arrangement of threads and the colours of the yarns in both illustrations is the same, but in the former the weave is plain, and in the latter cassimere twill; and this dissimilarity in the construction of the weaves results in the formation of the two different patterns sketched. The plain make so determines the crossing of the warp and weft yarns, that the white picks always float under the black threads and over the white threads, while the black picks always float under the white and over the black threads, hence the solidity of the

respective lines of colour is uninterrupted, and a pattern produced of a simple stripe order. Coming to the twill weave, it distributes the colours differently. Firstly, it allows of four changes in the positions of the yarns, whereas the plain make only allows of two. Secondly, each pick floats over and under two threads at a time, so that the picks at every interlacing cover, or are covered, by both a black and a white thread. Let it now be shown what is the result of this. Supposing the first thread and pick to be black and the second thread and pick white, then, if the effect of the interweaving of the first pick is traced, it will be obvious how it forms part of the minute diagonal pattern



Fig. 6.

sketched in fig. 6. This pick floats over a black and a white, and then under a black and a white thread, so that a small transverse line of black is formed equal in length, not to a float over *two*, but *three* threads, for although the extent of the weft float is two, yet the black thread adjoining it enlarges it in effect to three. Next take the second pick. It floats over the second and third threads, and, being white, makes a transverse line of this shade of similar dimensions to the preceding pick, because the fourth thread in the warp is white, and in the texture is added to the two-weft float. If picks three and four are examined, it will be noticed that they give like results, only the positions of the small lines of colours are moved one thread in

each case to the right, causing the diagonal effect in the fabric to move to the right. Analyzing the first and second threads it will be seen that they make short vertical lines, equal in length to flushing over three picks in succession. Take the first thread, which is black: it is depressed on the first pick, being covered by the black pick, then up twice; the second thread is also down on the first pick, then down on the second pick, being covered by the white weft, and afterwards elevated over picks three and four, forming a float of white of the same size as if the thread had flushed over three succeeding picks.

These illustrations show how the structure of the weave modifies the effect of the colours. From them it is clear that one group of colours or plan of shades may give very excellent results in one weave, but yield an unsatisfactory style in another. This relation of weave to colour, as regards systems of arranging fancy shades, is one of the most technical elements of textile colouring. Weaving principles cannot be ignored; they must always be considered, as they are capable both of destroying and of beautifying a set of colours.

Pattern design also relates to the invention of novel methods of grouping fancy threads, or to the assortment and distribution of the several colours in both warp and weft. Independent of the somewhat subtle question of harmony of tints which has to be considered here, such schemes of blending warp and weft threads of appropriate colours have to be devised as will be capable of yielding various styles in the same colourings and the same weave. By a mere modification of the plan of combining the yarns great variety of pattern may be obtained. Even when limited to this mode of producing pattern in the loom, novelty and force of style is feasible. The simplest alteration in the classification of the threads frequently gives quite a new cast to the design. There are three features

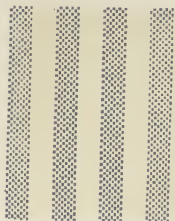
of Pattern Design that are intimately associated with the elegance or disproportion of the pattern originated: I. the selection of appropriate shades; II. their classification and arrangement as to quantity; and III. the invention of such a plan of combining these colours in the fabric as will be in accordance with the construction of the weave or design composing the cloth.

82. *Styles due to Colouring only.*—The patterns produced wholly by varying the plan of associating colours in textiles may be grouped under four heads, viz., Stripes, Checks, Mixtures, and Minute Figures. These designs obtain in almost endless variety in all kinds of materials.

83. *Stripes.*—Treating of each description of style analytically, stripe patterns may be primarily examined. They consist of bands or lines of different shades, varying in width, running lengthways of the fabric, that is, in the direction of the warp. The distinctive characteristic of a stripe is its line-like composition. All patterns of this order are nothing more than a blend of lines of divers shades and of various dimensions, extending from end to end of the piece. For trouserings, shirtings, and some styles of dress and mantling cloths, no form of pattern is better adapted, but it is unsuitable for coatings or even suitings. The variety of these styles is legion: commencing with the single-thread hairline, there is endless diversity of pattern as to size and colouring, until a stripe is obtained several inches in width. The prominence of the several bands of colour, their solidity and distinctness, or their intermittent character and subdued or toned aspect, are all qualities depending on the structure of the fabric and its weave composition, which will be subsequently noticed. Seeing that the pattern in striped styles is principally a warp product, the weft here is only a secondary element of the design, being employed, firstly, to bind the warp ends together and thus form a wearable fabric; and, secondly,

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

84. *Checks*.—These may be considered as forming the second great class of patterns in which colour is the all-important element. Of course reference is only made at this time to that type of check in which the weave is a simple factor. No allusion is made to, or consideration taken of, weave compounds which of themselves will form



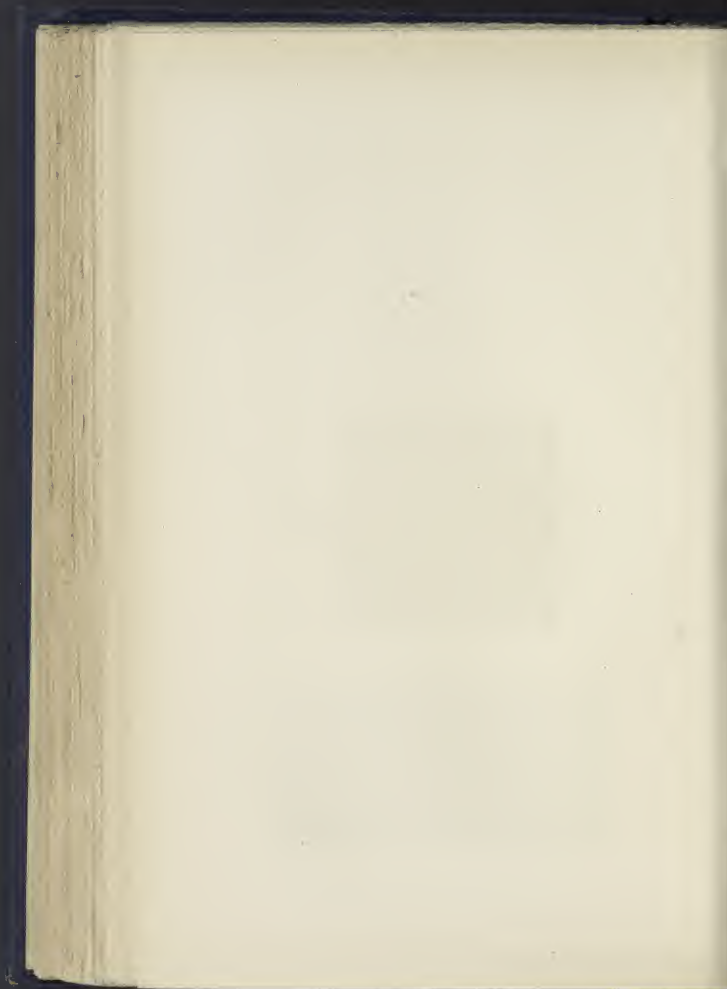
1



2



3



a species of check. The checks now being examined are those resulting from adopting the same or a similar order of weft as warp colouring. In other words, if the arrangement of warp yarns were 10 threads of black and 2 threads of white the weft would be the same, forming a solid square of black, surrounded by a skeleton square of white. The term "check" is suggestive of the appearance of these styles and of the scheme of their construction. The warp colourings, however complicated in arrangement and diverse in composition, to yield a perfect check must be crossed or "checked," as the operation is technically called, in precisely the same manner and by exactly the same shades in the weft. No better example can be furnished of the principle of constructing these patterns than the tartan check alluded to in Chapter II., and supplied on Plate V. Here it is evident that each set of colours in the warp when woven with corresponding shades of weft forms a square of colour perfectly solid. The blue threads of warp and weft make blue checks; the green, squares of this colour; and the black and yellow also checks of these shades. The size of the check is determined by the mode of grouping the yarns, the coarseness of the texture, and the thickness of the yarns of which it is composed. Many of the principles of woven colouring applicable to stripes also apply to checks, which strictly speaking are patterns striped both in transverse and lineal directions.

85. *Mixtures*.—The mixtures implied here may be defined as small all-over effects in which the various colours used are so fully co-mingled that the particular part played by any one colour is not observable. They require the most mellow treatment of all coloured styles. Nothing of a loud character succeeds, nor appears attractive in these goods. Smooth, smart, and choice combinations are desired. The pattern should present not so much a patchy as a rich and tinted appearance—every colour utilized in its formation asso-

ciating with its neighbours to compose one indefinite blend of minute effects. To produce styles of this order no single colour should be distinct and louder than the rest, nor be allowed to intrude on the eye more than another—complete harmony of colouring and uniformity of tone are absolutely essential. But one shade more pronounced in tint or more powerful in hue—being of a deeper intensity than its associates—is sufficient to destroy the beauty of the whole combination. This being the case, the system of mixing the several shades must be such that all colours will be equally emphasized; for evidently lack of equality in the prominence of the various colour elements amalgamated destroys the essential character of these useful and valuable styles.

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

86. *Figures*.—Necessarily these are very minute in dimensions and limited in form. Perhaps they might be also appropriately designated spotted patterns, but as the figures are of definable shapes, and are arranged on various bases, the former term appears the most suitable. Both cotton and all-wool fabrics—including worsted and carded yarn goods—are covered with this species of colour ornament. Invariably the weaves employed are of the most elementary grade. In these neat, and minutely-figured styles are developed in considerable variety. Thus in the plain weave alone, several patterns of distinct appearances are

obtainable; while in the celtic, or mat crossing, and in the cassimere, and six-end twills somewhat more broken up figuring is acquired, which for some makes of cloths is preferable to designs consisting of pronounced and decided forms.

87. *Classes of Striped Patterns.*—All kinds of striped patterns may be comprised in two classes of styles, namely, Regulars and Irregulars. In the former the bands of colours, however numerous they may be, are of equal widths, but in the latter they vary to an indefinite extent. The several species of stripes resulting from blending colours will be treated of as follows:—

I. REGULAR STRIPES.

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

II. IRREGULAR STRIPES.

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

88. *Hairlines.*—These are the smallest striped patterns produced. The real hairline is composed of two colours, and is made most extensively in woollen yarns, but is also produced in worsted and cotton threads. It is only obtainable in the double-plain make, yet a very common stripe of a hairline character is acquired in the single plain weave. This species of hairline is illustrated in fig. 5. This style is largely produced in various kinds of yarns, in both fine and coarse textures. The particulars appended are what are generally adopted in manufacturing the fabrics under which they appear.

I. FLANNELS.

Warp and Weft.

1 thread of 32 skeins slate or any other colour.
 1 " " " " white " "
 12's reed, 3 threads in a split, 36 picks on the inch.

II. WOOLLEN TROUSERINGS.

Warp and Weft.

1 thread of 10 skeins black.
 1 " " " " grey.
 8's reed, 3 threads in a split, 24 picks on the inch.

III. WORSTED DRESSES.

Warp and Weft.

1 thread of 2-fold 60's blue.
 1 " " " " white.
 26's reed, 2 threads in a split, 52 picks on the inch.

IV. COTTON TEXTURES.

Warp and Weft.

1 thread of 2-fold 60's cotton twist pink.
 1 " " " " " " white.
 40's reed, 2 threads in a split, 80 picks on the inch.

Small stripes of a hairline class are also obtained in the hopsack, swansdown, and sateen weaves.

89. *Stripes composed of Longitudinal and Transverse Lines.*
 —This pattern—sketched in fig. 7—is a derivative of the common single-cloth hairline. It is due to changing the positions of the colours in relation to the intersections of the weave. Analysis of the fabric shows that in Sections *A* the light threads float *over* the light picks and the dark threads *over* the dark picks; whereas in Parts *B* the opposite rule

obtains, viz., the light threads float *under* the light picks and the dark threads *under* the dark picks. As a consequence, the lines of colours in *A* are vertical, while those

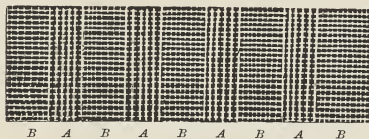


Fig. 7.

in *B* are horizontal. This arrangement of pattern is entirely due to the system of warp colouring practised, which is as follows:—

1 thread of black.	}	<i>A</i> .
1 „ „ white.		For twelve threads.
1 „ „ white.	}	<i>B</i> .
1 „ „ black.		For twelve threads.

The weft is 1 pick of white and 1 pick of black throughout the pattern. Now as the plain weave has been employed, and is arranged to allow the white and black threads in *B* to be crossed or covered by corresponding picks, it causes the same threads in *A* to float over the respective picks, producing this useful form of stripe, which is applicable to similar goods as those for which particulars are supplied in the preceding paragraph.

90. *Regular Stripes composed of Two Colours*.—Here are found the most elementary of all colour effects. A minimum amount of technical skill is requisite to their construction. The whole art of producing patterns of this description is confined to the selection and adjustment of

appropriate shades. An illustration in this species of stripes is given in No. 1, Plate XII. It is an Oxford shirting, the order of colouring being thus:—

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

Such shades and tints as the following would form cheerful patterns: No. 1, Plate II., and white; No. 7, Plate II., and white; and No. 4, Plate III., and white. In each case the lighter shade should be used for weft.

This class of pattern is largely applied to woollen and worsted trouserings in which simplicity and neatness are required. Take No. 2 on Plate XII. as an example. This pattern has been produced in the five-end doeskin and has been submitted to a dress-face finish. The arrangement of colours is:—

<i>Warp.</i>
10 threads of 20 skeins olive.
10 " " " " drab.
16's reed, 3 threads in a split.

<i>Weft.</i>
20 skeins olive, 48 picks on the inch.

Without multiplying illustrations, it will be evident how considerable diversity of styles is attainable on this system by varying the width of the stripes and the colours employed.

91. *Regular Stripes composed of Three or More Colours.*—As a larger number of shade elements enters into this description of stripe than that just described, it follows that the patterns are somewhat more intricate in composition. Yet, as the weaves used here are invariably of the

simplest type, and the widths of the stripes of different shades in the separate patterns is the same, little technical complication occurs in their production. One illustration will sufficiently indicate the nature of this kind of woven colouring. It is given in No. 3 on Plate XII. Four shades are present in this fabric—blue, tan, slate, and crimson. The dark blue runs against all the shades, so that while the widths of the several bands is the same,



Fig. 8.

there are three times as many blue bands as tan, slate, or crimson. In this way an appropriate ground is produced on which the various shades may be advantageously developed. If slate were made the ground colour a totally different pattern would result; indeed, by changing the positions of the shades in this manner, a considerable range of distinct samples are producible. The illustrations in Regular Stripes show that this principle of colouring does not admit of very extensive diversity of composition. Usually the results acquired are plain and bare in tone,

and wanting in richness of arrangement. Still, in some makes of fabrics it is an invaluable type of design.

92. *Irregular Stripes composed of Black and White Yarns.*— These patterns are far more diversified in construction than regular styles. Even when limited to the use of these shades almost endless variety of design arrangement may be practised. A few examples will be considered. Fig. 8 is a trousering style made in the ten-heald buckskin, fig. 8 a. The warp colourings are arranged thus, the weft being all black :—

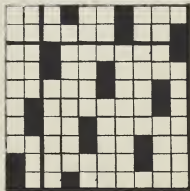


Fig. 8 a.

38 threads of 2-fold 60's black.

2 „ „ fine white silk.

Of course, any other two shades might be employed, *e.g.*, Nos. 1 and 3, Plate III., and No. 13 and No. 15, Plate VI.

As illustrative of the widely different effects that may be secured in the same shades, take fig. 9, and compare it with the previous style. It is a pattern slightly over an inch in width, and composed of bands of three sizes. There are, first, bands *A*, containing twelve threads each; then bands *b*, containing six threads each; and, lastly, the small lines of white of two threads each. Moreover there are



1



2



A

B

B

B

PLATE XIII.

1
12

twelve white stripes : eleven *b* stripes, and one stripe of *A*, in each repeat of the pattern. Both this style, and that given in fig. 8, may be said to be of a decided character, being quite pronounced in design, but it is possible to obtain more subdued effects in two colours, as may next be demonstrated.

93. *Irregular and Indefinite Stripes in Two Colours*—No. 1, Plate XIII., is, in one particular, constructed on a similar principle to the last illustration, for it contains a series of small stripes, nine in number, which in combination form one broad band; and then follows a small band of brown, each repetition of which determines the size of the pattern. It is a style adapted to lawn tennis trouserings, flannels, and cotton fabrics. Though there is a marked contrast in the shades, yet the design is somewhat mellow and indefinite in aspect. The arrangement of warp colours is appended.

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

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

94. *Irregular Stripes—Shades in Two Colours.*—The principle of shading by colour yields a very useful range of woven patterns. These obtain in fancy dress fabrics, ulsterings, cottons, and, in small styles, in trouserings; just as shades are acquired in black and white in sketching, they may be produced in fabrics in any two colours by softly gradating one into the other. Generally an ordinary twilled weave is employed, and two colours of warp yarns, one of which must be dark and the other of a light shade. Thus, a shaded stripe of blue may be produced in the Venetian twill by grouping blue and white threads together, according to the plan given below:—

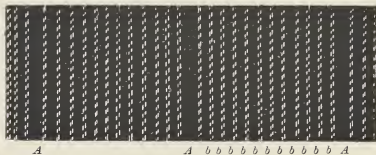


Fig. 9.

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

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

95. *Shaded Stripes in Two Colours for Bed Tickings.*—Two excellent bed ticks shaded on this system are supplied in Nos. 2 and 3, Plate XIII. Both samples have been woven at the Yorkshire College. The former consists of broad bands of drab, and small bands of scarlet and white, and blue and white shades. By consulting the order of threads appended the reader will see how the style has been constructed :—

- 4 threads of colour (red or blue).
- 1 thread of white.
- 3 threads of colour.
- 1 thread of white.
- 3 threads of colour.
- 1 thread of white.
- 2 threads of colour.
- 1 thread of white.
- 2 threads of colour.
- 1 thread of white.
- 1 " " colour.
- 1 " " white.
- 4 threads of colour.
- 1 thread of white.
- 1 " " colour.
- 1 " " white.
- 2 threads of colour.
- 1 thread of white.
- 2 threads of colour.
- 1 thread of white.
- 3 threads of colour.

1 thread of white.
 3 threads of colour.
 1 thread of white.
 $1\frac{1}{4}$ inches of drab.

The same plan of colours adopted in black and mid grey, and black and mid brown, the ground shade being dark blue, is capable of making a choice dress fabric.

Next, consider No. 3, Plate XIII. This, a style containing a shaded stripe of more than an inch in width. While the principle of its construction is the same as in the preceding example, it is more intricate in arrangement, and comprises a much larger group of threads. It is as follows:—

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

8 threads of blue.	} For
8 " " white.	

Shade of red, Section *A* of No. 3, Plate XIII.:—

5 threads of white.	
1 thread of red.	
4 threads of white.	
1 thread of red.	
4 threads of white.	
1 thread of red.	
3 threads of white.	} For
1 thread of red.	
2 threads of white.	} For
1 thread of red.	
1 " " white.	
1 " " red.	
1 " " white.	
1 " " red.	
1 " " white.	

2 threads of red. } For 12
 1 thread of white. } threads \Rightarrow \rightarrow C
 3 threads of red. } For
 1 thread of white. } 16 threads.

4 threads of red.
 1 thread of white.
 4 threads of red.
 1 thread of white.
 4 threads of red.
 1 thread of white.

5 threads of red. \Rightarrow \rightarrow D

1 thread of white.
 4 threads of red.
 1 thread of white.
 4 threads of red.
 1 thread of white.

3 threads of red. } For
 1 thread of white. } 16 threads.
 2 threads of red. } For
 1 thread of white. } 12 threads.

1 " " red.
 1 " " white.
 1 " " red.
 1 " " white.

1 " " red. } For 12
 2 threads of white. } threads \Rightarrow \rightarrow E
 1 thread of red. } For
 3 threads of white. } 16 threads.

1 thread of red.
 4 threads of white.
 1 thread of red.
 4 threads of white.
 1 thread of red.
 5 threads of white.

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

8 threads of blue.	} For
8 " " white.	
1 1/4 inches of drab.	

56 threads.

In this arrangement of colours about as elaborate a shade as it is possible to form in two hues is furnished. It commences with a maximum degree of white, which gradually diminishes until a maximum quantity of red is acquired, when a similar decrease of red and an increase of white element occurs, until the maximum white quantity is again arrived at. An analysis of the plan of colouring may explain how the softly toned result has been produced. This commences with a 5 of white, then follows a 4 of white, and subsequently 3, 2, and 1 of white. Meantime the red element has remained unaltered. At *C* a change takes place. Now the red begins to augment in quantity while the white factor is invariable, consisting of one thread only. The red starts at this point *C* with 2, then 3, 4, and 5 in succession. Here the maximum intensity of this hue is reached. (See *D* in the order of colours.) From *D* to *E* the red factor of the shade decreases, and from *E* to the end of the pattern the white increases. While the gradation of tinting in this pattern is complete, both sides of the shade are exactly symmetrical.

This valuable and elegant style may be applied to various descriptions of goods. It should be adopted in fine cotton textures and in worsted dress fabrics; other colours than those appearing in the illustration being of course employed.

96. *Irregular Stripes containing Several Colours.*—In this class of stripe are included many of the neatest trousering patterns woven. Such stripes are generally mellow in colouring, and ingeniously diversified in arrangement.

Almost any number of shades may be combined, but the patterns should always be characterized by softness of tone. To this feature force and strength of style must not however be sacrificed. Though the several bands of colour combined, when separately examined, may not be loud and inelegant, yet they must be sufficiently forcible as to give form and richness to the whole *ensemble* of fancy yarns employed.

This branch of textile colouring is so important that two illustrations will be considered, one a light and the other a dark fabric. The first, No. 1, Plate XIV., is made of worsted yarns and has a brown ground. On this surface softly marked lines of olive brown and mid green occur. Between these, which are the elements that afford the main features to the style, are fine intermittent lines of bright blue, obtained by using a series of black and blue twist threads. But for these the spaces between the mid green and the olive brown would be solid dark brown, and the pattern would, as a consequence, be considerably impoverished. To tone down the various colours a black weft thread has been used. The pattern of the warp is as follows:—

- 3 threads of olive brown.
- 3 " " dark brown.
- 1 thread of black and blue twist.
- 2 threads of dark brown.
- 1 thread of black and blue twist.
- 2 threads of dark brown.
- 1 thread of black and blue twist.
- 2 threads of dark brown.
- 3 " " mid green.
- 3 " " dark brown.
- 1 thread of black and blue twist.
- 2 threads of dark brown.
- 1 thread of black and blue twist.

- 2 threads of dark brown.
- 1 thread of black and blue twist.
- 2 threads of dark brown.

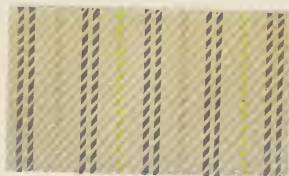
It will be observed that the mid green and olive brown stripes are similar distances apart,—indeed there is the same number of threads between each,—and that they are of approximate degrees of intensities, the olive brown being somewhat more marked than the green. This arrangement is usual in patterns of this stamp. When two or more colours run against each other, that is to say, occur in equal quantities, and are of corresponding distances apart, they should be of similar weight of hue, otherwise a harmonious combination will not result. The blue threads have been employed mainly for tinting and mellowing purposes. Those sections of the fabric in which they have been introduced expose the method of breaking up bare spaces in striped compositions without interfering with the principal colours in the design, or those which determine the form and aspect of the style.

Now consider the light texture given in No. 2 on Plate XIV. It is a combination of shades that may be applied to trouserings, ladies' jacketings, and dress textures. Here again are two colours of allied intensities running parallel with each other, being intervened by the same spaces of grey and duplex lines of claret brown. These are scarlet and gold. Both are equally pronounced, and both congruously associate with the other shades entering into the texture. While the weft is stained white, the arrangement of war s colours is thus:—

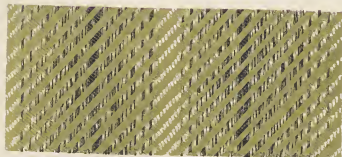
- 8 threads of lavender.
- 2 " " scarlet and white twist.
- 8 " " lavender.
- 2 " " claret brown and white twist.
- 2 " " lavender.
- 2 " " claret brown and white twist.



1

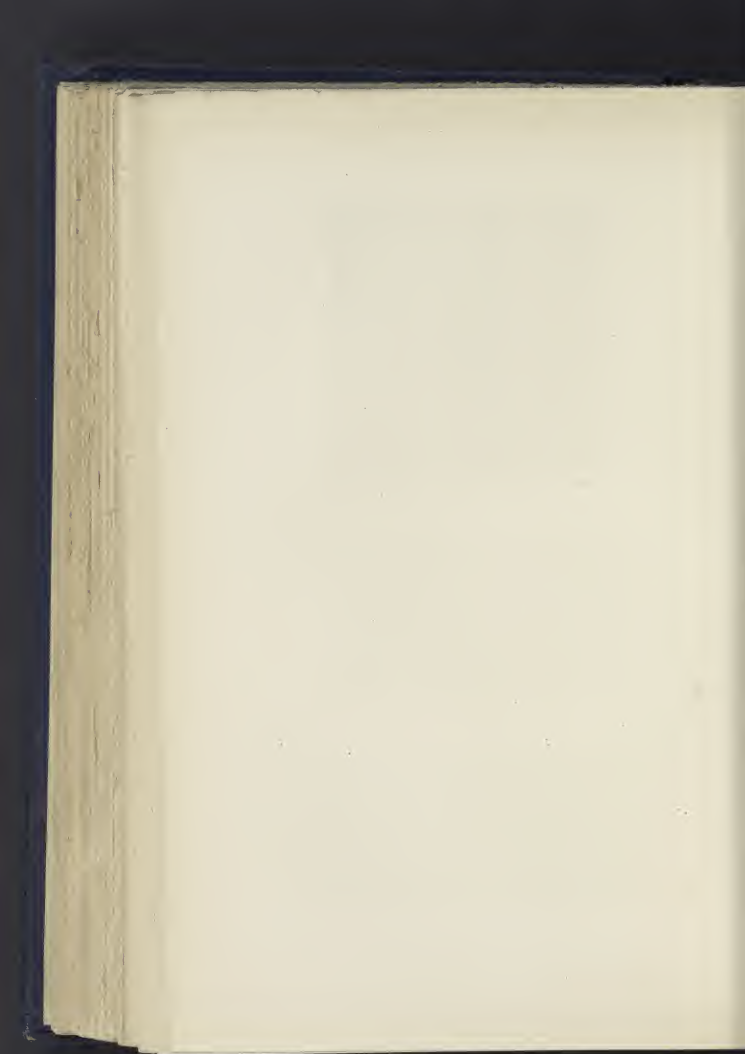


2



3

PLATE XIV.



- 8 threads of lavender.
 2 " " gold.
 8 " " lavender.
 2 " " claret brown and white twist.
 2 " " lavender.
 2 " " claret brown and white twist.

As the claret brown, when twisted with white, is not so bright and intense as the scarlet and gold, it has been advantageously used in larger quantities than these colours. It forms pairs of small lines, which materially enhance the choiceness of the pattern. In this style only two sizes of stripes are adopted, yet if it had been developed in two colours—say lavender and claret brown—no less than four effects would have been formed: first, there would have been the eight-thread stripes of lavender, separated by a line of claret and white twist; second, the eight-thread stripes of lavender, divided by duplex bands of claret and white twist; third, the two-thread stripes of claret; and fourth, the single two-thread stripe of lavender. But in the colours in which the sample has been woven a much more interesting pattern is formed. Here there are stripes of lavender intervened by lines of scarlet, gold, and claret; and small bands of claret separated by a fine line of lavender. Other colours might be employed. For example, if purplish blue takes the place of scarlet or of the gold, quite a new cast is given to the pattern. But these are only slight modifications. By retaining the order of the threads, and utilizing new shades throughout, numerous useful variations may be obtained.

97. *Shaded Stripes in several Colours.*—Another system of shading, besides that already illustrated, consists in employing several shades of yarns of the same hue. For instance, to form a brown shade by this method, at least three or five tints—the larger the number the better, and the more complete the gradation—of this colour would be

required, such as very dark, dark, medium, light, and very light brown. Each shade should be continued for about eight threads, taking them in succession, and running from dark to light, and *vice versa*. But to obtain diversity of colouring in shaded styles economically, other methods are adopted besides this. An illustration will prove useful. It is given in No. 3, Plate XIV., and is a woollen mantling pattern, but the scheme of shades is applicable to other textures. The weft yarn is light olive, but the warp is as appended:—

- 10 threads of white.
- 1 thread of black and white twist.
- 2 threads of white.
- 1 thread of black and white twist.
- 2 threads of white.
- 4 „ „ black and white twist.
- 1 thread of white.
- 6 threads of black and white twist.
- 2 „ „ black.
- 4 „ „ black and white twist.
- 2 „ „ black.
- 6 „ „ black and white twist.
- 1 thread of white.
- 4 threads of black and white twist.
- 2 „ „ white.
- 1 thread of black and white twist.
- 2 threads of white.
- 1 thread of black and white twist.

The twist yarns used in this instance give a blended or mixed cast to the pattern. Then, whereas only two shades are used in the warp, several effects are obtained in the fabric, owing to both self and twist yarns having been utilized. Thus, there are the effects formed by the solid white and black threads respectively, and also those yielded by the twists. Strictly speaking this is a broken

shade, not being so perfectly gradated as those given in Nos. 2 and 3, Plate XIII. Yet it is so full of diversity of tinting that it is probably more frequently resorted to in the manufacture of fancy woollen and worsted fabrics than those described in former paragraphs. Its peculiar broken and mingled appearance is the feature which is admired. It lacks that straight and well-defined quality characterizing other systems of shading, and hence is better adapted than they for textiles in which more or less indistinct and mellow colourings are absolute requisites.

CHAPTER VI.

CHECK PATTERNS.

98. Utility of Check Styles—99. Principles of Checking—100. Several Styles of Checks. CHECKS COMPOSED OF TWO COLOURS—101. Forms of Checking in Two Shades—102. Common Check—103. Modification of Common Check—104. Check consisting of Two Sizes of Squares—105. Pattern composed of Solid Squares and of an Over-check—106. Counter-change Check—107. Compound Checking—108. Gradated Check—109. Broken Check in Two Colours—110. Basket Check. CHECKS COMPOSED OF THREE OR MORE COLOURS—111. Principle of Checking with Three Colours—112. Ordinary Three-shade Check—113. Set Check—114. Compound Checking in Three Shades—115. Counter-change Check in Three Shades—116. Inter-changing Check—117. Counter-change with Over-check. SHADED AND IRREGULAR CHECKS—118. Shaded Check in Black and White in Cassimere Twill—119. Shaded Check in Two Colours due to using Designs composed of Various Weaves—120. Double-shaded Check in Three Colours—121. Irregular and Mixture Checks—122. Fancy Broken Check.

98. *Utility of Check Styles.*—Checks form one of the commonest types of patterns developed in woven goods. They obtain in all species of colouring, such as subdued and tempered shades, and bright and lustrous tints. They are characterized by unlimited diversification of arrangement, outline, and dimensions. As a rule, the check styles appearing in cotton, silk, and worsted threads are clearer in pattern than those produced in woollen fabrics, which are frequently more or less indistinct and intermingled in composition. Possibly no form of design or method of grouping shades is more extensively worked

than that of checking. It affords infinite scope for novelty of pattern construction, and new schemes of blending shades in the yarn state. No class of fabric is produced for any length of time without being ornamented with checks of one sort or another. Even the most elaborate figured goods occasionally possess a checked surface of mellow colouring, on which the floral or geometrical design is distributed. Not infrequently this check groundwork enhances the beauty and elegance of both the fabric and pattern in which it occurs, furnishing diversity of surface to the former, and developing with suitable precision the integral parts of the latter. But in addition to this principle of textile design being utilized in figured fabrics according to the system indicated, it is adopted in the construction of an endless series of styles admirably arranged for clothing purposes. Shawls, mantlings, shirtings, flannels, suitings, coatings, dress fabrics, and other classes of textiles, are all embellished with this description of pattern. Amongst dresses and shawls, tartan and plaid checks, which are produced in an illimitable variety of shades and systems of blending, are found; whilst in tweeds, ulsterings, and Irish homespun, numerous loud and broad checkings, generally soft in colouring, have been produced. When suitings and coatings are considered, the checks are usually small in size and neat in colour arrangement.

Scotch designers play on this species of pattern with marked ingenuity. In their hands it is ever capable of yielding novelties; hence they introduce it into every season's goods. Moreover, the designer of cotton textures, and of the fancy worsteds made in Huddersfield looms, as well as the stuff designers of Bradford and of the fine silks produced in Macclesfield, all employ this base, which they develop with such technical skill as to obtain from it a valuable series of admirable woven effects.

Checks thus obtained vary in size and aspect, from the

minutest square to patterns consisting of solid squares of colour many inches broad, and from compact rectangular spaces of colour to intermingled liney patterns more or less intermittent in character, but still forming a decided square or check design.

99. *Principles of Checking.*—While there are innumerable systems of checking, yet there are some principles of construction common to every class of check pattern. For example, whatever plan of colourings obtains in the warp, in order to make a perfect check the same set of colourings must be employed in the weft. This condition is invariable in checking; indeed it is the crossing of the warp shades with corresponding weft shades which constitutes the square or check divisions of which styles of this order are composed. All checks are formed of rectangular spaces of colours. Such designs may be defined as compositions of squares of various sizes of distinct shades fitting into each other to form one complete pattern. When producing these styles, the first work to be accomplished is the arrangement of the warp threads, which will determine the plan of the check. Supposing this to be, for instance, the pattern given in fig. 9, on page 140, then, in order to convert it into a check, the same order of wefting as warping would require to be adopted, which would yield a large check of black—formed by the eight ends of this shade in the warp and weft—filled in with a series of minute skeleton checks of white surrounding solid squares of black. Again, consider the tartan pattern given on Plate V. Here is furnished a perfect illustration of the principles of checking. It is a pattern comprising in each repeat several sets of checks or square divisions. First, there is the skeleton or outline check of yellow; second, the squares of green; third, the squares of blue; and fourth, there are the main checks of black. These various squares are so combined as to make a perfect pattern, or

one in which each rectangular space neatly fits into the squares of colour with which it interlaces. In producing such a fabric, the system of colouring the warp is primarily determined upon, the wefting being simply a counterpart of it; that is to say, in this example whatever number of black threads there are in the warp, and in whatever order they occur, they are repeated exactly in the weft, and also in the cases of the green, blue, and yellow yarns.

It will be obvious that on this principle any form of check may be acquired; for by colouring, say, the shaded stripes given on Plate XIII. in the weft as in the warp, a shaded check naturally results. There is, however, one technicality to be considered, which adds to the intricacy of this kind of pattern construction, namely, the weave of the fabric. So long as the weaves employed float the warp and weft equally and regularly on the respective sides of the fabric, the same balance of colouring is acquired in both the direction of the warp and weft; but should the weave bring more warp than weft, or more weft than warp, on to the face, then whichever factor predominates it will be impossible to obtain a check style in which both the warp and the weft colouring will be equally pronounced. If, for instance, fig. 8, page 137, were changed into a check, in order to obtain the same precision of white colouring across as lengthways of the piece, some alteration in the structure of the weave would be necessary. This will be evident on consulting fig. 8A, the plan of the weave of this striped fabric. It will be observed that this make floates $\frac{4}{5}$ ths of the warp to $\frac{1}{5}$ th of the weft on the face; hence, if it should be used as here given, and the same order of colouring practised in the weft as in the warp, the white lines in the weft would be far less distinct on the face than on the back of the cloth, for they only cover one thread out of five. To get a similar prominence of white in the weft as is seen in the warp of the fabric,

the weave would have to be extended to twenty threads and picks, and the 19th and 20th picks modified in such a manner as to bring $\frac{4}{5}$ ths of the weft to $\frac{1}{5}$ th of the warp on the face of the texture. When, as in common twills and other simple weaves, there are equal quantities of warp and weft yarns appearing on both sides of the cloth, no difficulties of this kind arise in converting a stripe into a check pattern.

There are various kinds of broken checks in which a good and choice combination of warp shades is made to appear like a check by weaving it with some order of weft colouring that, while forming a series of transverse shades, will not partially obliterate nor conceal, but develop the fancy yarns in the warp which constitute the main element of such patterns. These, as well as other recognized types of checking, which are particularly effective in the woven fabric, and illustrative of the general principles of this class of textile colouring, will now be fully described.

100. *Several Styles of Checks.*—It will be advantageous to consider check patterns under three heads, as follows:—

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

A considerable range of patterns is obtained in two shades; while checks composed of three or more colours usually comprise almost unlimited diversity of tinting. If the principles of checking with two shades are fully mastered, the more advanced species of check designs in which a large variety of colours obtains will be readily understood. Indeed, it may be said that checks of three or more colours are invariably elaborations of two-shade patterns. When an extensive diversity of colourings is requisitioned, it does not follow that large quantities of each shade are used, but as a rule two simple shades compose the general cast of the pattern, while the addi-

tional hues are so many brightening factors. The main art of checking consists in the skilful employment of two and three shades, so that several useful schemes of grouping the threads in such patterns may be considered separately.

Intermingled and irregular checks are composed of square spaces of colour lacking clearness and rigidity of character. They are much admired in tweeds and certain classes of worsted goods.

CHECKS COMPOSED OF TWO COLOURS.

101. *Forms of Checking in Two Shades.*—These, which are very numerous, are illustrated in figs. 10 to 16 inclusive. The illustrations furnished are typical of the different systems of combining two shades in making check patterns with colours. It will be noticed that there is in these examples considerable diversity of arrangement. The forms of checking are, strictly speaking, unlimited. Beginning with the smallest check, consisting of two ends of a dark and two ends of a light shade alternately, the forms increase in intricacy and dimensions until patterns of several inches in size, and comprising several types of checking, are acquired.

102. *Common Check.*—The commonest form of check is given in fig. 10. It results from arranging the warp and weft threads as follows:—

8 or any number of threads of black.

8 " " " " white.

Of course the number of threads of each colour, as well as the shades, may be varied to any extent. This style of check is worked in shepherd plaids and in many varieties of patterns, in neatly contrasting shades, in all kinds of materials. The weaves generally employed are plain, cassimere twill, and mat, each making giving suitable clearness to the colours.

103. *Modification of Common Check.*—Fig. 11 shows how, by a simple variation in the order of colouring the common check, it may be totally changed in character. This modification

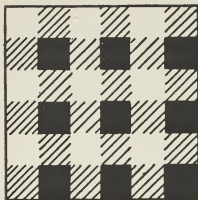


Fig. 10.

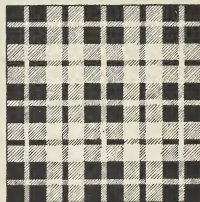


Fig. 11.



Fig. 12.



Fig. 13.

destroys the stiffness of the pattern. The plan of colouring in this example is as appended:—

8	threads of	black.
2	”	” white.
8	”	” black.
8	”	” white.
2	”	” black.
8	”	” white.

An outline check of black is thus arranged to divide the square of white into four sections, and an outline check of white to similarly divide the square of black. It is a neat and useful form of pattern, and is worked in almost all classes of coloured fancies. Though only consisting of two shades, it comprises five effects, namely, solid squares of black, white, and squares of black and white equally mixed; and also of outline checks of black and white respectively. Other colours besides those in which it is sketched are used in great variety, and it is a style applied with satisfactory results to shawls, dresses, cottons, woolens, and worsteds, being altered in size in the several fabrics according to the degree of loudness required.

104. *Check consisting of Two Sizes of Squares.*—Another valuable form of check, and one that is very extensively utilized, is furnished in fig. 12. Practically it is a combination of two sets of squares of different sizes. It is given here in its most elementary arrangement, the plan of colouring being twelve threads of black and six threads of white, but it is rarely employed without being subjected to various modifications. Some of these schemes of alteration may be alluded to. In the first example the large checks of black, and also of white, are bisected. This is done without increasing the colour factors, as follows:—

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

In this way the stiffness of the pattern is removed and a check obtained on the same base, but containing fuller variation of construction. Secondly, the square of black might be warped and woven thread and thread, while the square of white should remain solid, making a pattern

suitable for flannel shirtings. One further modification to which this style is subjective consists in bisecting the square of black or of white, but preferably the former, because it contains the largest number of threads.

105. *Pattern composed of Solid Squares and of an Over-check.*—An over-check is a small line of colour forming a skeleton square, filled in with solid squares of several shades. This base—illustrated in fig. 13—is employed in dress fabrics, shawls, and ulsterings, and, in small effects, in suitings and mantlings. The yarns are arranged—4 threads of black, 2 threads of white, 4 threads of black, 10 threads of white, 10 threads of black, and 10 threads of white. The characteristic feature here is that only every alternate square of black is bisected, causing the small line of white which divides it to form an over-check equal in size to four of the black or white squares. This outline or skeleton check contains one solid square of black, four squares of white, and four squares of black and white twilled. It is a plan of shade association peculiarly well adapted for plaids produced in two shades, and in such colours as blue and white, black and red, tan and mid blue (Nos. 2 and 7, Plate III.), and lavender (No. 10, Plate III.), and lilac (No. 16, Plate VI.). In reality fig. 13 is but a modification of the common check supplied in fig. 10; for if the over-check were removed it would be reduced to precisely the same pattern. To gain novelty and change in this style, one of the squares of white is frequently bisected with fine lines of black, leaving one black and one white check perfectly solid, but dividing one of the white checks into four equal sections, and the remaining white checks into two parallelograms. The order of the colourings in such an instance would be thus:—

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

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

This modified arrangement of fig. 13 is one that is extensively adopted in making this description of check in larger numbers of threads than here given, say twenty threads instead of the tens, and the other numbers similarly doubled. Patterns of these dimensions are mostly produced in extremely bright or delicate colours for dress fabrics in fine worsted and cotton yarns.

106. *Counter-change Check*.—A counter-change check is a pattern in which the several sets of squares are exactly reversed; thus, in fig. 14, the checks included in the bracket 1 are just the opposite in shade, but of the same size, as those grouped in bracket 2. On examining the illustration, it will be noticed that the principal square of black has one square of white at each corner, while the principal square of white has one small square of black at each corner, forming the counter-change which gives this species of checking its designation. The arrangement as here given obtains development in various materials. It is modified in size according to the fabric to which it is applied. The colourings may be grouped as below:—

8	threads of black.
8	“ “ white.
16	“ “ black.
8	“ “ white.
8	“ “ black.
16	“ “ white.

Shades and tints and mixtures are combined in colouring. The style lends itself to numerous schemes of modification, but two or three can only be named. Firstly, bisect the large squares of black with small lines of white, and the

large squares of white with fine lines of black; secondly, divide the small squares of the respective shades with black and white lines; and thirdly, combine these two systems of alteration.

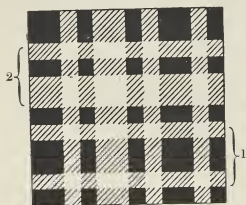


Fig. 14.

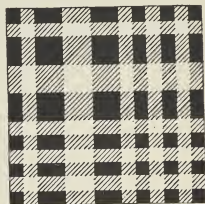


Fig. 15.

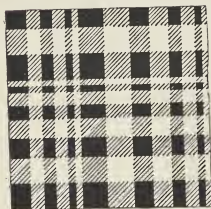


Fig. 16.

107. *Compound Checking.*—Of all the schemes of checking, this is one of the most valuable, and yields in all classes of yarns admirable styles when suitable shades are blended. The example given—fig. 15—only contains two sizes of checks, but such designs may be composed of a much larger series of different-sized squares. Here the plan of

grouping is also elementary, including a set of eighteen small squares of black and white separated by similar-sized checks of white and black twilled, and also an assortment of large checks of black and white. The colourings are arranged as appended:—

4 threads of black.	} For 24 threads.
4 ,, ,, white.	
8 ,, ,, black.	
8 ,, ,, white.	
8 ,, ,, black.	
4 ,, ,, white.	

In light shades and colours forming a mellow contrast it makes an exceedingly useful style, being a base capable of considerable development, and one that may be altered in several ways. Thus the single large square of white is divisible by two ends of black, which produces an over-check that considerably improves the whole pattern. Next, each of the squares of black should be divided with small lines of white, and lastly both alterations should be combined.

108. *Gradated Check*.—This style—fig. 16—is not so largely employed as those previously described, but it gives, nevertheless, quite an attractive pattern. The object of the arrangement is to gradate from a series of small to a series of large checks. In the fabric the respective checks appear to run into each other. No less than eight sizes of squares occur in this example, varying from a check of two to eighteen threads, the order of colouring being thus:—

2 threads of white.
4 ,, ,, black.
6 ,, ,, white.
8 ,, ,, black.
10 ,, ,, white.
12 ,, ,, black.
14 ,, ,, white.
16 ,, ,, black.

When using fine materials and high counts of yarns the series of gradations is largely extended, continuing to checks containing as many as forty-eight and even sixty-four threads. Occasionally the check is gradated from a

maximum to a minimum size on both sides of the extreme large square, and not simply shaded off on one side as in the illustration.

109. *Broken Check in Two Colours.*—A species of irregular check in two colours is given in No. 2 on Plate XV. The order of the threads is not intricate, being 8 threads of maroon, 8 threads of green, 2 threads of maroon, and 2 threads of green, yet it forms a remarkably mellow check style. This arises, first, from the corresponding strength of the two shades used; second, from the system of blending practised; and third, from the manner in which the weave distributes the threads. The size of the yarns employed in making the cloth is 2-fold 16's worsted both warp and weft, while the set is 16's reed, 3 threads in each split. This pattern illustrates what neat effects, full of diversity of thread distribution, may be acquired in two shades by an appropriate method of combining colours which contrast and harmonize. The style under consideration is composed of contrasting but melodizing colours. Green and maroon make a perfect contrast; and when they are of corresponding intensities, as in this illustration, they also give perfect harmony. This is evident by the sense of completeness which characterizes the style when it is closely examined. It does not require any additional hue to brighten or freshen it, for it is apparently rich and mellow in colour composition.

Respecting the plan of grouping the shades, this causes the full checks of maroon and green to be in contact with each other, while the two threads of the respective hues give a shaded tone to the pattern—the colours seeming to vanish into each other. When making checks in which softness rather than loudness of effect is desirable, this toning of one colour into another is a very requisite element.

110. *Basket Check in Two Colours.*—Basket checks are

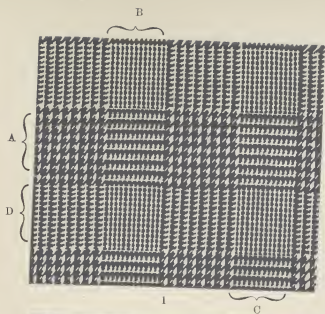
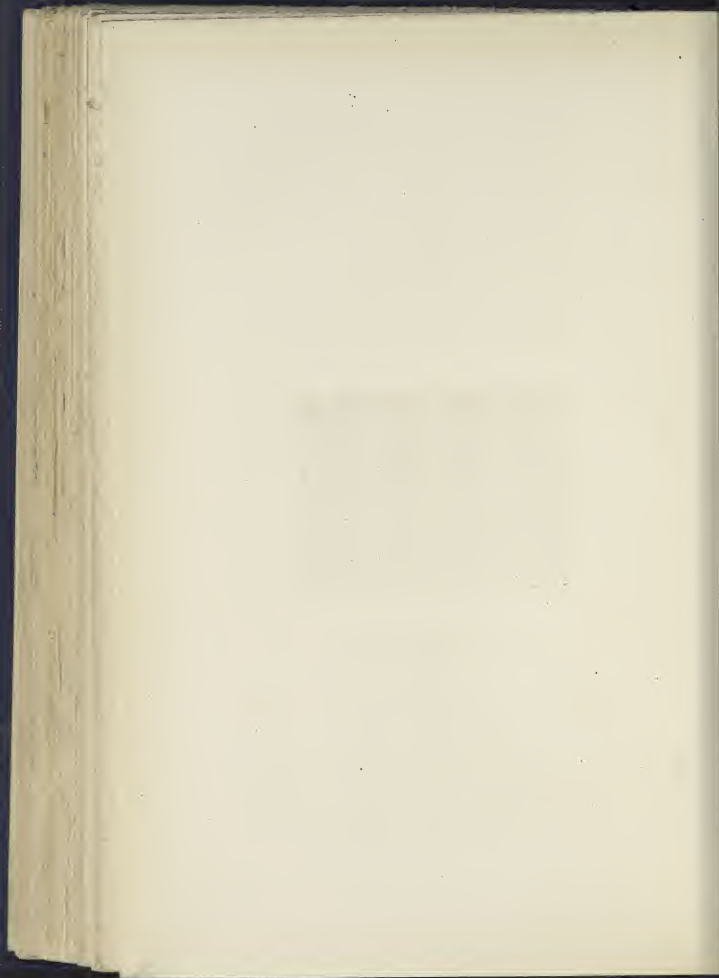


PLATE XV.



generally obtained in two shades, and comprise two sizes of checking. They are produced in both four and six shaft twills, and also in fine yarns in the eight-end make. They always contain four varieties of work, due to the manner in which the several sets of threads interlace with each other. A reference to No. 1, Plate XV., will make it evident what is the nature of these effects. This is a basket check which has been woven in the cassimere twill, and in the order of threads which follows:—

	For	{	4 threads of slate.
64 threads.		{	4 „ „ white.
	For	{	2 „ „ slate.
48 threads.		{	2 „ „ white.

The four-and-four grouping gives the shepherd plaid effect bracketed A, and the two-and-two grouping the fine and minute checking bracketed B. The remaining effects in the pattern are due to the four-and-four wefting crossing the two-and-two warping—part C,—and the two-and-two wefting crossing the four-and-four warping as seen in Section D. Both in woollen and worsted yarns this style of check is largely developed. In the illustration the sizes of the respective checks is not the same, the large plaid effect extending over 64 and the small plaids only over 48 threads; but in some patterns they are exactly of the same dimensions. When the six-end twill is used, the shades are not grouped in fours and twos, but in sixes and threes, as in the example appended:—

	For	{	6 threads of white.
48 threads.		{	6 „ „ drab and white twist.
	For	{	3 „ „ white.
48 threads.		{	3 „ „ drab and white twist.

The basket check given on Plate XV. may be made in 2-fold forty's worsted yarns and in 16's reed, 4 threads in a split, with 64 picks on the inch, but this six-shaft twill arrangement is workable in such counts of yarns as 2-fold

20 skeins white, and 20 skeins drab and 20 skeins white twist, in a 9's reed, 4 threads in a dent, and 36 picks on the inch. So that the size of one repeat of the pattern would be $2\frac{2}{3}$ inches. One feature in colouring these checks is very important—no strong contrast of shades is allowable. Seeing that the system of grouping the shades is enough to produce ample diversity of style, loudness of colouring is unnecessary. From both the illustrations given, which are typical of the shades generally employed, it will be seen that there is no marked distinction of hue in the colours combined. In the former, No. 1, Plate XV., an instance of the extreme strength of contrast beneficial is furnished; while in the latter example one of the softest assortment of shades used is given. Here the shades practically tone into each other, owing to the drab yarn being twisted with white. Such shades as white, and slate and white twist; white, and brown and white twist; and white, and blue and white twist; all yield patterns of the requisite depth of contrast. These examples are in light shades, but this type of checking also obtains an important place in dark patterns for ulstering and mantling fabrics.

CHECKS OF THREE OR MORE COLOURS.

111. *Principle of Checking with Three Colours.* — The principles of design and colouring involved in making check styles in three shades are somewhat more intricate than those expounded in treating of checking with two colours. More ingenious patterns, fuller of detail and more diversified in composition, are producible with three than two shades. The third colour is important and valuable in toning and mellowing the check arrangement. Thus, supposing a light and dark shade formed the principal sections of a check composition, then by introducing into it a third and intermediate colour increased softness of

effect could be acquired and harshness of contrast obviated. Check arrangements of this class are employed in almost every type of woven goods, and are particularly useful in designing for some species of suitings, mantlings, and

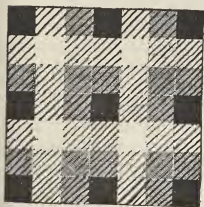


Fig. 17.

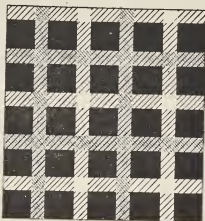


Fig. 18.

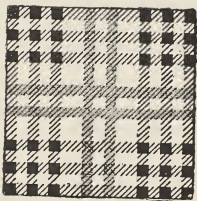


Fig. 19.

cotton fabrics. They are not so rigid and formal in cast as two-shaded patterns, the square spaces of colours being better toned and richer in detail. Some of the most generally adopted systems of grouping the shades in these styles are represented in figs. 17 to 23 inclusive. By comparing them with the checks obtained in two colours given in figs. 10 to 16, it will at once be evident that they contain a more complete range of effects and are more diversified in outline and composition than the preceding examples. The function of the third shade and its utility in improving the aspect of the patterns will also be observed. Fig. 18, for

instance, though a simple arrangement, possesses a mel-lower character than any of the checks developed in two shades. The grey factor not only increases the multiplicity of effects appearing in the patterns, but enhances the value of the respective checkings by giving a softly-toned cast to them. Amongst the forms of check combinations illustrated in these figures are the common three-shade pattern, the set check, the compound base, the counter-change base, the interchanging base, and counter-change with over-check base.

112. *Ordinary Three-shade Check.*—The commonest and most elementary form of three-coloured checking is illustrated in fig. 17. When the squares of each colour are large it yields a remarkably stiff and unattractive design; but if they are minute, say about four threads each, and composed of neat colourings, it makes a pattern highly appreciated for suitings and other “fancies.” Should the colours be dark, mid, and light, or black, grey, and white, as in the illustration, a shaded check is formed of limited gradation. In these greys, blues, browns, or slates, this arrangement makes a very useful form of pattern, and one that may be modified in various ways. It might, for example, be shaded off on both sides by allowing the intermediate shade to alternate with the dark and light colours. Another alteration may be effected by bisecting one of the squares of colour, say the black with two ends of a lighter shade, in which instance one skeleton check would be obtained in each repeat of the pattern, which would give quite a new aspect to the style. If this idea of dividing the checks is further worked, a considerable range of appropriate modifications of this base may be acquired. Let one example be considered. Alter this form by arranging the shades as below:—

4 threads of black.
2 ,, ,, mid-grey.

4	threads	of	black.
4	"	"	mid-grey.
2	"	"	black.
4	"	"	mid-grey.
4	"	"	white.
2	"	"	mid-grey.
4	"	"	white.

According to this scheme the aspect of the check, though the base remains unaltered, would be completely changed. Each square of colour is here divided into four sections. The black checks are embellished with an outline check of grey, the grey with an outline check of black, and the white with an outline check of grey. It will be clear from this method of elaborating fig. 17, that it is an elementary principle of grouping three shades to form a check which is competent of being utilized in the development of complex and ingenious patterns.

113. *Set Check*—A check pattern in which certain squares—namely, black in the illustration—form the main feature of the design, and are set at corresponding distances apart, with the respective shades alternately intervening, is supplied in fig. 18. It is designated a "set" check, on account of the manner in which the large spaces of the leading shade in the pattern are arranged, these repeating on such a principle as to give a stiff and "set" appearance to the whole composition.

It is made in various dimensions, according to the style of fabric being manufactured. The size of the black check in dress and shawl textures ranges from eight to forty-eight threads, but in suitings and jacketings it is frequently not more than six or four threads, and the spaces of grey and white proportionately reduced.

Taking the plan of the shades to be 16 threads of black, 8 threads of white, 16 threads of black, and 8 threads of

grey, then one method of elaborating this base occasionally practised with good results is this:—

6 threads of black.
 4 " " grey.
 6 " " black.
 2 " " grey.
 4 " " white.
 2 " " grey.
 6 " " black.
 4 " " grey.
 6 " " black.
 2 " " white.
 4 " " grey.
 2 " " white.

The centre of each of the squares of black would by this means be occupied with a square of four threads of grey, while the square of white would be outlined with skeleton checks of grey, and that of grey with skeleton checks of white. When this system of alteration is adopted a pattern fairly diversified in construction is the result.

114. *Compound Checking in Three Shades.*—Fig. 19 forms a neat principle of checking in three shades in which several series of small squares of colour are combined. Owing to the absence of large spaces of the different shades, it possesses peculiar richness of composition. The manner in which the small checks are grouped obviates the stiff cast which characterizes many forms of checking. It will be observed that the respective shades do not occur in uniform quantities. White is the main element, for it alternates with both black and grey; then comes black, of which there are three sets of checks, but only two sets of grey. To produce the pattern, the yarns are grouped as indicated below:—

8 threads of black.
 8 " " white.

8 threads of black.
 8 " " white.
 8 " " black.
 16 " " white.
 8 " " grey.
 8 " " white.
 8 " " grey.
 16 " " white.

The white factor not only produces numerous minute checks, but also four large squares in each repeat of the design—a feature which contributes to the attractiveness of the whole check.

This base may be varied in many ways. One appropriate alteration consists in dividing the large squares of white with fine lines of black; another modification practised changes the single square of white, intervening the checks of grey, into black; while a third system of alteration bisects each of the checks of black with outline squares of white; then a fourth principle combines these several methods of utilizing this form, making a pattern constituted thus :—

3 threads of black.	} Repeat.
2 " " white.	
3 " " black.	
8 " " white.	
3 " " black.	
2 " " white.	
3 " " black.	
6 " " white.	
4 " " black.	
6 " " white.	
8 " " grey.	
8 " " black.	
8 " " grey.	
6 " " white.	

6 threads of white.

6 „ „ black.

Thus many systems may be practised in splitting up the twelve threads of white. To begin with, this group of ends may be changed to 2 threads of grey, 8 threads of white, and 2 threads of grey; or the four threads in the centre of the twelve may consist of 2 grey and 2 black; while a third variation would change the white square into 4 threads of white, 4 threads of black or grey, and 4 threads of white. If other diversifications of this base are required, the small squares of white should each be bisected with two threads of black, the checks of grey with two threads of white, and the checks of black with two threads of grey.

117. *Counter-change with Over-check.* — Fig. 22 is a very loud check form. It is mostly used in tartan patterns for cotton, fine worsted, and woollen yarn dress fabrics. More variety of effect may be introduced into it by further subdividing the main squares of black and white. Each of the spaces of white is in this instance split up by lines of grey as well as black, and the spaces of black with lines of white in addition to the light grey in the illustration. This form of check is often made in very large patterns, some four or five inches in size, and in strongly contrasting colours, for which it is, by arrangement, peculiarly well adapted.

It ought to be observed that all the examples described may be subjected to numerous modifications in sectional parts and colouring, besides those quoted and analyzed at length. The skilful and trained designer can work on these forms *ad libitum*. With a view of making it evident to the reader how the schemes of checking alluded to are elaborated in practice, it has been shown to what an extent patterns of a check description are susceptible of variation in the loom; but no attempt has been made to furnish an ex-

haustive series of check compositions—the principles of constructing these have been, however, most extensively elucidated, while the principal forms of checking have been fully treated of.

SHADED AND IRREGULAR CHECKS.

118. *Shaded Check in Black and White in the Common Twill.*—Checks of a shaded class are very largely made in materials for dress goods. They are generally of immense dimensions, in order to allow of the acquirement of delicate and well-toned gradation of colouring. In the manufacture of such “shades” either two or more colours may be employed, but if cheapness of texture is an object it is advantageous to only use two hues. With these, and a proper method of grouping the yarns, a pattern may be produced of a beautiful shaded character. The weave used, if the order of shade arrangement is diversified, must be of a simple class. An example will demonstrate the principle of developing this useful description of woven designs. It is furnished in fig. 23, and is a shade in black and white, the cassimere twill being the weave adopted in constructing the fabric. There are several features of this pattern which may be considered. Obviously it is a compound check, combining both the ordinary and shaded schemes of checking. A set of common checks of a shepherd plaid type surround the shaded check proper. These lend novelty and diversity to the whole style. Coming to the shaded effect, it consists of three factors, which may be separately examined. Beginning with the square spaces, in which white is the main element, a light shade is here acquired by gradually decreasing the quantity of black and increasing the quantity of white yarns until a perfect edging of white is acquired. Next there are the parallelogramic forms of a deeper shade, due to the threads used in the composition.

of the principal check crossing those which occur in the shaded white checkings; and lastly, there is the broken square of black, which decreases by degrees in intensity from the centre to its respective edges. Though the shading as a whole is not uniformly continued, for there is

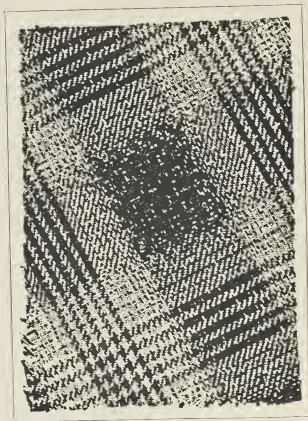


Fig. 23.

a somewhat sudden change from dark to light shading, yet at this juncture the effect obtained is characteristically soft and delicate. Mellowness of gradation is an important element of the pattern. In all the shaded sections it is neatly toned, the shaded aspect being skilfully emphasized.

The irregular manner in which the white and black yarns appear, like specks on the surface of the fabric, arises

from the employment of a print thread in which these shades alternate in lengths of about $\frac{3}{8}$ ths of an inch. Solid black and white threads alone would not yield the intermingled effect so prominent in this style. They would produce a much stiffer and more uniform result. If this system of checking should be applied to woollen and worsted or cotton goods, twist yarns may be employed in place of the printed threads. These, in all species of designing, give more richly intermingled patterns than self-coloured yarns, and for this reason are particularly useful in the production of shaded textures.

The plan of colouring this example is rather complicated, running as follows:—

4 threads of black, } For 36	6 threads of black. $\rightarrow\rightarrow$ D.
4 " " white } threads.	1 thread of print yarn. } Repeat.
6 threads of white. } Repeat.	3 threads of black. } Repeat.
1 thread of print yarn. } A.	1 thread of print yarn. } Repeat.
5 threads of white. } Repeat.	2 threads of black. } Repeat.
1 thread of print yarn. } Repeat.	1 thread of print yarn. } For 6
4 threads of white. } Repeat.	1 " " black. } threads.
1 thread of print yarn. } Repeat.	8 threads of print yarn. } E.
3 threads of white. } Repeat.	1 thread of white. } Repeat.
1 thread of print yarn. } Repeat.	1 " " print yarn. } Repeat.
2 threads of white. } Repeat.	2 threads of white. } Repeat.
1 thread of print yarn. } Repeat.	1 thread of print yarn. } Repeat.
1 thread of white. } Repeat.	3 threads of white } Repeat.
1 " " print yarn. } Repeat.	1 thread of print yarn. } Repeat.
8 threads of print yarn. $\rightarrow\rightarrow$ B.	4 threads of white. } Repeat.
1 thread of black, } For 6	1 thread of print yarn. } Repeat.
1 " " print yarn. } threads.	5 threads of white. } Repeat.
2 threads of black. } C.	1 thread of print yarn. } Repeat.
1 thread of print yarn. } Repeat.	6 threads of white. } Repeat.
3 threads of black. } Repeat.	1 thread of print yarn. } E.
1 thread of print yarn. } Repeat.	

The light shade, which composes the squares consisting mainly of white, is formed by the threads included within A and B. This will be seen on examining the plan of colouring. At A there are six parts of white to one part

of black and white print yarn; but at *B* there is a small quantity of print yarn only—the toning from extreme white to a complete mixture of black and white having been gradually effected by the intervening groups of shades. From *C* to *D* the dark shade is produced. Not containing as many changes as the light shade, it is more decided in composition. Practically this shade commences at *B*, which connects it with the adjoining gradated square of white and black. At *C*, however, the first move to black begins, for here black and print yarns are equally mixed. The number of black threads now increases until Section *D* is reached, when it begins to diminish, ultimately shading off to a group of print threads as indicated at *E*. From this stage the white shade is renewed, and continues to the end of the pattern.

Apart from its intrinsic value as a principle of shading, this style is extremely suggestive of what may be accomplished by a careful grouping of two shades in woven fabrics of a simple or common twill class. Evidently shaded styles may be developed in the loom on this method as delicately gradated as if painted on canvas.

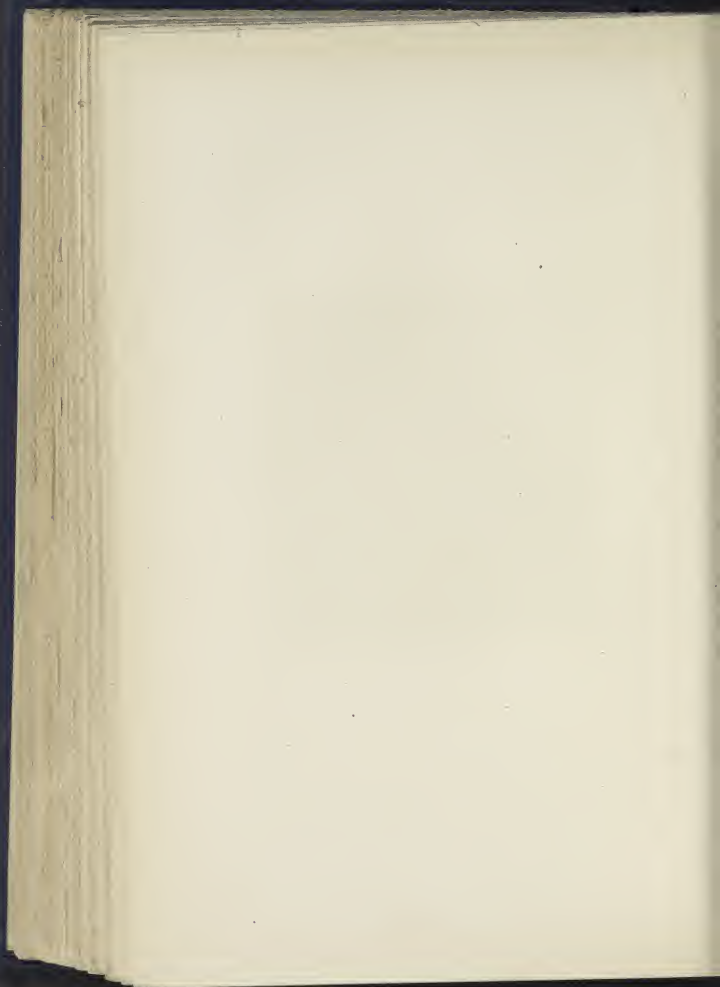
119. *Shaded Checks in Two Colours due to using Designs Composed of Various Weaves.*—These patterns are in some respects simpler to produce than the preceding class of check. There is no diversity of shade arrangement in such styles, the warp and weft being solid colours throughout. In the example supplied on Plate XVI. a white warp and fawn weft have been employed. Now in an ordinary twill such colouring would not give any form of check whatever, so that this is quite a distinct principle of checking. It is one that is applied to worsted, silk, and cotton, but not to woollen textures to any large extent. The combination of weaves necessary is not so well adapted for development in wool as in the other classes of threads named. Colouring being remarkably simple, the design is correspondingly in-



B

A

PLATE XVI.



tricate. If this is well constructed it will yield a shaded pattern, though the warp and weft yarns be of precisely the same colour, size, and quality. When this sort of shade is formed, it must, however, be produced in yarns of high reflective powers, such as worsted and silk. Cotton or wool threads would not give any definite effect in designs arranged on the principle of a gradual movement from a maximum warp to a minimum weft flush, and inversely as in figs. 24 and 25. It may appear on a primary consideration somewhat anomalous to speak of shading without varying the shade or tint of the yarns composing the cloth. Does not the very essential of a shade consist in diversity of tinting? A brown, or any other colour of shade, is producible if several colours of brown of variable depths are appropriated, but not otherwise. How then may a shade be obtained when the yarns are all black or white? What in this instance is impracticable from a colour standpoint, is feasible by a suitable arrangement of weaves. The shade that may thus be produced is not, of course, so clear and pronounced as that due to a diversity of colouring, for it simply results from the difference in effect of the flushes of warp and weft yarns composing the pattern. As there is some visible distinction in the brightness of the floates of warp and weft respectively, if the weaves constituting the design are arranged on such a principle as to tone one into the other, they produce an effect of a shaded type. According to the example furnished, one set of weaves which combines admirably on this method is that derived from a sateen base. But these weaves are not by any means the only makes used, many varieties of twills being employed for similar purposes, but they yield the most uniform shades of any class of weaves that can be utilized for shading. On referring to figs. 24 and 25, which each forms one-fourth of the checks *A* and *B* of the fabric represented on Plate XVI., it will be seen that the weaves differ from

each other in the extent to which they flush the warp and weft yarns on the face of the texture. To construct a shaded pattern of this kind, commence with the extreme warp-flush weave, adjoining which place the weave most closely approaching it in structure; the diminution in warp

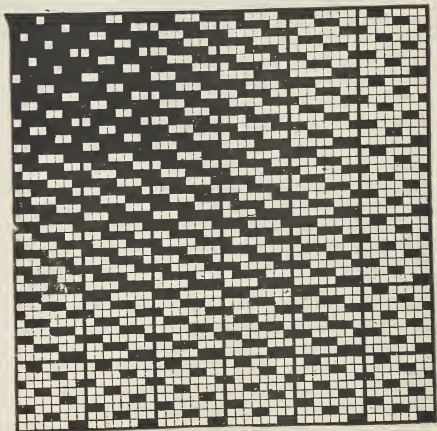


Fig. 24.

and the increase in weft flush continuing from one weave to another until the extreme or maximum weft flush is attained. In such a scale of shades the extreme warp- and weft-flush makes represent opposite ends of the shade, the weaves intervening completing the gradation or toning of the pattern. The form or outline of the check is first

decided upon, and then the weaves appropriated according to the dark or light effect required in the various parts of the design. In the sample of this description of checking illustrated, Section *A* is the reverse of Section *B*, hence in fig. 24, which produces the effect seen in *A*, the weaves are

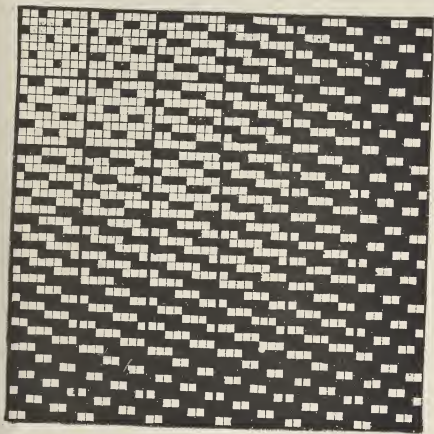


Fig. 25.

so blended as to shade from a dark centre to a light edge; while fig. 25, which produces *B* part of the pattern, shades from a dark edge to a light centre.

It is remarkable that the form of this style of checking is determined by the system of arranging the weaves used, and not, as in the previous examples, by changing the

scheme of colouring; hence this species of shaded check is extremely simple to produce, so far as the blending of colours is concerned.

120. *Double-shaded Check in Three Colours.*—One further system of producing shaded checks is illustrated. It is given in No. 3, Plate XV. Here three colours—olive green, olive drab, and white—have been combined. The white is a degree too strong for the other two colours, but imparts pronounced emphasis to the arrangement of the shades. By consulting the order of yarns appended, the method of constructing this check will be evident:—

8	threads of olive green.
2	“ “ olive drab.
2	“ “ olive green.
4	“ “ olive drab.
2	“ “ white.
2	“ “ olive drab.
4	“ “ white.
2	“ “ olive drab.
2	“ “ white.
4	“ “ olive drab.
2	“ “ olive green.
2	“ “ olive drab.

Drab is the principal shade in the pattern, alternating with both olive green and white. The lining of the check is particularly distinct, and when the arrangement is extended it is a capital base.

Strictly speaking it is a twofold shade, for drab and white form a broken light shade, while drab and olive form a broken medium shade. The contrast between the extreme light and the medium shade, and the extreme deep and the medium shade, should be of similar strength, otherwise balance of shading will not result.

121. *Irregular and Mixture Checks.*—The styles of this species of checking are quite numerous. On account of

their neat and subdued character, they are extensively produced in all classes of woollen and worsted fabrics. Two typical examples will be considered—Nos. 1 and 3, Plate XVII. First examine No. 1 of this Plate. It is an intermingled check in five colours, and possesses a black ground, the order of warp colouring being:—

- 3 threads of black.
- 1 thread of black and scarlet twist.
- 2 threads of black.
- 1 thread of black and green twist.
- 2 threads of black.
- 1 thread of black and scarlet twist.
- 3 threads of black.
- 2 threads of olive green.
- 3 threads of black.
- 1 thread of black and scarlet twist.
- 2 threads of black.
- 1 thread of black and green twist.
- 2 threads of black.
- 1 thread of black and scarlet twist.
- 2 threads of black.
- 3 threads of olive brown.

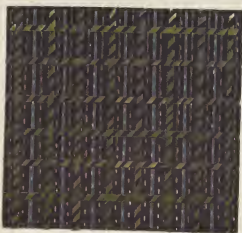
The method of webbing is much simpler than that of warping, consisting of 12 picks of black, 2 picks of olive brown, 12 picks of black, and 2 picks of olive green. The pattern is a combination of outline checks, enhanced with spotting threads of scarlet and black, and green and black twists. There is a skeleton check of olive green interlacing with a similar check of olive brown. The intensity of the two leading fancy colours ought in such patterns to be the same, as they should both be equally prominent in the texture.

Next, as to the twist yarn or mixture check—No. 3, Plate XVII. Here the bulk of the pattern is composed of green and drab twist. On the intermingled mixture

ground formed by these threads is a small check of maroon. This hue forms a mellow contrast with the general colour composition of the fabric. Twist yarns are alone capable of yielding the rich and mellow indistinctness of effect seen in this example. The maroon is a self thread, to give character to the pattern. For suiting and coating fabrics this scheme of checking, in both woollen and worsted fabrics, is well adapted, as it combines softness of colouring with neatness of pattern. Such compositions as a black and brown twist ground, with blue check; a drab and white twist ground, with slate check; and a slate and white twist ground, with light brown or olive check—all form mellow blends, and make excellent styles for summer mantlings and dress fabrics when produced in fine yarns.

122. *Fancy Broken Check.*—This is a species of check in which the plan of wefting differs from that of grouping the warp colours, the object being to produce a check-like effect more or less irregular in composition. Reference to No. 2, Plate XVII., will make it plain what is the general form of this sort of checking. A pattern composed of small checks is here obtained, although the most casual analysis of the colourings shows the warp and weft to consist of different shades. Thus, while the order of warping is 5 threads of light drab, 1 thread of green, 4 threads of slate, 5 threads of light drab, and 5 threads of slate; the weft is 4 picks of black, 1 pick of scarlet, 5 picks of bluish grey, 5 picks of black, and 5 picks of bluish grey. The contrast between the warp and weft shades is useful in smartly defining the weave, which, if the warp and weft colourings had been alike, would, in some parts of the pattern, have been almost obliterated.

The great point to be observed in this type of colouring is to employ shades of similar intensities in both warp and weft; thus, in this example, the slate is as prominent in the woven fabric as the black, the light drab as the bluish



1



2

PLATE XXX

grey, and the green as the scarlet. It is only by securing this balance of hues that really harmonious colourings are producible in broken check patterns. Should any particular colour be stronger in character than its associates, it will destroy the other valuable elements of the pattern.

This principle of cross checking is also applied to various classes of striped fabrics, in which it is desirable to partially subdue the continuity of the warp colourings, and impart to the pattern a softer but richer appearance. Almost all types of woven fabrics—including cotton dress textures, worsted mantlings and trouserings, and woollen suitings—are ornamented with this mode of introducing colour into loom products.

CHAPTER VII.

SIMPLE COLOURINGS.

123. Simple and Compound Colourings — 124. Regular Simple Colourings — 125. One-and-One and Two-and-Two Systems — 126. Figured Styles in Common Weaves and One-and-One Colouring — 127. Utility of the One-and-One Principle in Figured Textiles — 128. Three-and-Three Colouring — 129. Four-and-Four Arrangement — 130. Four-and-Four Method applied to Fancy Weaves — 131. Six-and-Six and Eight-and-Eight Schemes — 132. Six-and-Six Colouring in Various Crossings — 133. Three-Odd-Thread Arrangement — 134. Various Three-Shade Patterns — 135. Simple Colourings composed of Four Shades — 136. Irregular Simple Colourings — 137. Irregular Patterns of Two Shades — 138. "Irregulars" composed of Three Shades — 139. "Irregulars" composed of Four Shades.

123. *Simple and Compound Colourings.*—As in Weave Design there are two important types of pattern—such as effects resulting from the use of one crossing, and effects due to combining several crossings—so the styles obtained by blending fancy shades are also of two kinds, and may be designated Simples and Compounds. Both classes are divisible into Regulars and Irregulars. In the most elementary or regular class of Simples, the colour elements are of equal quantities and systematically alternate; but in Compounds the shades may occur in various quantities and be irregularly distributed. If, for example, a pattern were arranged—

2 threads of black,
2 " " brown,
2 " " blue,
2 " " slate,

it would be a Simple colouring, because it is composed of similar numbers of each sort of yarns, and the respective shades regularly succeed each other. The same shades could be made to form an Irregular Simple pattern in two ways: first, by diversifying the plan of the colours in such a manner as to allow any one or more shades to intervene the other shades, as follows:—

2 threads of black,
 2 " " brown,
 2 " " black,
 2 " " blue,
 2 " " brown,
 2 " " slate;

and second, by retaining the original order of succession of shades, but by varying the quantities in which they occur, as illustrated below:—

8 threads of black,
 6 " " brown,
 4 " " blue,
 2 " " slate.

Here are two types of irregular simples, viz., those in which the shades are grouped in similar quantities but are irregularly combined, and those in which the shades obtain in different proportions though following in regular order.

To convert the same group of shades into a compound colouring, it is only necessary to combine two or more systems of blending the yarns, as follows:—

For { 4 threads of black.
 16 threads. { 4 " " brown.
 For { 2 threads of blue.
 16 threads. { 2 " " slate.

From this example it will be observed, that in making a regular compound at least two systems of elementary colouring are combined; in this instance, the four-and-four and the two-and-two methods have been selected.

Compounds necessarily give more diversified styles of pattern than simples; but unless the effects of the latter have been investigated and studied, the arrangement and composition of compounds cannot be fully understood. Simple colourings are the elements of all compounds. In order to obtain well-balanced effects in designs combined of various weaves, the construction and woven result of each weave have to be considered, and only such makes united as will yield symmetrical patterns and regularly built fabrics; and similar laws determine the association of shades as determine the combination of weaves.

124. *Regular Simple Colourings*.—The principal forms of elementary simple colourings are comprised in the three classes given in the table appended:—

REGULAR SIMPLE COLOURINGS.

CLASS A.—COMPOSED OF TWO SHADES.

<i>I. Scheme.</i>		<i>II. Scheme.</i>	
1 thread of black.		2 threads of black.	
1 " " white.		2 " " white.	
<i>III. Scheme.</i>		<i>IV. Scheme.</i>	
3 threads of black.		4 threads of black.	
3 " " white.		4 " " white.	

CLASS B.—COMPOSED OF THREE SHADES.

<i>I. Scheme.</i>		<i>II. Scheme.</i>	
1 thread of black.		2 threads of black.	
1 " " grey.		2 " " grey.	
1 " " white.		2 " " white.	
<i>III. Scheme.</i>		<i>IV. Scheme.</i>	
3 threads of black.		4 threads of black.	
3 " " grey.		4 " " grey.	
3 " " white.		4 " " white.	

CLASS C.—COMPOSED OF FOUR SHADES.

I. Scheme.

- 1 thread of black.
 1 " " mid grey.
 1 " " light grey.
 1 " " white.

III. Scheme.

- 3 threads of black.
 3 " " mid grey.
 3 " " light grey.
 3 " " white.

II. Scheme.

- 2 threads of black.
 2 " " mid grey.
 2 " " light grey.
 2 " " white.

IV. Scheme.

- 4 threads of black.
 4 " " mid grey.
 4 " " light grey.
 4 " " white.

It is not needful to increase the number of these examples, for it will be observed that in each scheme of the several classes given, the order of colouring is identical, but that the quantities of the respective shades are systematically enlarged. In fine fabrics, the number of threads of each colour might be increased to twelve or sixteen; but in these examples the bases of all styles of elementary and compound colourings are furnished. On this account they will be considered separately, and the effects of the various systems in the woven fabric will be fully analyzed and described.

125. *One-and-One and Two-and-Two Colourings.*—These are the most elementary arrangements of shades. They yield different effects, according to the weave in which they are developed. The one-and-one system is applied to both plain and twilled weaves, in which it constitutes two styles of patterns very extensively produced in simple fancies. First, in the plain make, it forms the hairline stripe sketched in fig. 5; and in the cassimere twill, the step-diagonal effect sketched in fig. 6. Both are extremely useful textural styles. In cottons, silks, and fancy woollens and worsteds, this order of threads can be made to produce patterns of some intricacy of composition by simply em-

playing in one instance the two plain makes given in figs. 26 and 26*a*, and in the other instance the two twills given in figs. 27 and 27*a*. Should the plain makes be combined, say, in such a manner as to make a stripe, and this design woven in the one-and-one system of colouring,

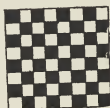
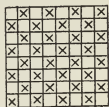


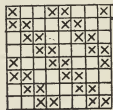
Fig. 26.

Fig. 26*a*.

the woven result would consist of a band of lines of the respective colours associated, running longitudinally in the fabric, and of a band of transverse lines of the same shades. This is a principle which, as is shown in the sequel, is capable of being utilized in the construction of elaborately figured designs.



Fig. 27.

Fig. 27*a*.

When the weaves supplied in figs. 27 and 27*a* are combined, and the resultant design woven in this order of shades, in such sections of the fabric as fig. 27*a* occurs, the effect produced consists of small diagonals twilling to the right, but in the sections composed of fig. 27, of similar diagonals twilling to the left; hence, by combining these

in the form of stripes, checks, or figures, woven patterns are obtainable richly diversified in aspect and arrangement.

Next as to the two-and-two system (Class A, Scheme II., of Simple Colourings) of combining shades. This is another admirable plan of grouping colours for certain elementary crossings, particularly the cassimere twill and the mat or Celtic. Its effects in these two makes may be taken as typical of the general style of pattern it is capable of yielding.

Referring primarily to the results it gives in the twill, these are represented in figs. 28, 28*a*, and 28*b*. The different effects are due to the employment of distinct wefts.

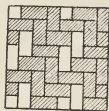
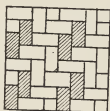
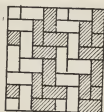


Fig. 28.

Fig. 28*a*.Fig. 28*b*.

Thus, in fig. 28 the weft is grey, in fig. 28*a* it is white, while in fig. 28*b* it is the same as the warp, or two picks of black and two picks of white. When the grey weft is used, a stripe of black adjoining an intermittent stripe of white is obtained; when white forms the weft, a small line of white adjoins a broken line of grey and white; but when a corresponding method of wefting is adopted as warping, the smallest broken check effect producible in textiles is acquired. Should appropriate shades be combined, a large diversity of useful patterns for suitings, trouserings, and other textures may be constructed on this system.

Changing the weave to hopsack or mat entirely alters the patterns resultant. Taking, for example, the weft to be black in this two-and-two-colouring, and the weave

four-end Celtic, a style is constructed similar to that given in fig. 29, or a pattern with a black ground on which squares of solid white are regularly distributed at uniform distances apart. Substituting white for the black weft, a texture with a white foundation and a black square spot, just the reverse of fig. 29, is produced; whereas if the weft is the same as the warp, a style composed of solid lines of black and white, or a pattern of a hairline description, results.

These examples clearly set forth the principles of weaving in relation to methods of colouring. Here the same order of threads—though extremely simple—in two different

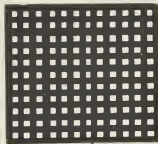


Fig. 29.

crossings of an elementary structure forms quite distinct and characteristic ranges of effects. In the cassimere twill more intermingled, and hence less severe patterns, are formed than in the mat or hopsack. They consist of small indefinite stripes and of a minute and irregular check. But in the mat the same warp colouring gives a well-defined check composition, even when the wefts are all one colour, and instead of a broken check ensuing in the fabric when the weft is similar to the warp, as in the twill, a stripe of a decided and clearly-pronounced arrangement is got.

126. *Figured Styles in Common Weaves in One-and-One Colouring.*—The principles of woven effect, just elucidated, whereby a combination of plain or twilled makes may, in the simplest of all arrangements of colours, be made to produce in the texture two widely dissimilar patterns, are competent of being extensively utilized in the development of textures of a figured class. This is all the more remarkable, because the general descriptions of these fabrics

all necessitate the adoption of various schemes of weaving and colouring in their manufacture; whereas in this type of design there is no elaboration neither of weave nor colour. These are particulars of construction peculiar to patterns acquired on this system.

The beauty and excellence of designs of this class consist in the uniform appearance and sound wearing qualities they impart to the woven product. Many kinds of figured textiles are more or less loose on the surface and in structure, owing to the diversity of finishing requisite to develop the objects or figures composing the designs used in their production. No arrangement of this sort, involving intricacy of cloth structure, is needed in gaining patterns by this scheme of weaving. The fabrics, though in some instances elaborately figured, are plain or twill throughout, according to the makes employed—hence the textures are even, firm, and neat in both appearance and construction. Experience demonstrates that not only by this method of producing woven design may an endless diversity of styles be developed, but patterns exquisite and novel in composition. Effects of this order are more subdued in tone and possess a mellower aspect than figured styles due to combining various principles of weaving and colouring.

Reference to figs. 30 and 31 will indicate, first, how the designs are constructed; and, second, how the textural results are acquired. Fig. 30 is a small spotted design composed of two plain makes. In constructing these designs the form of the figuring is primarily sketched out on point paper, and the weaves subsequently added. When the two makes are in contact there must never be more than a float of three. Having worked out the design on point paper, the next matter to be arranged for is the development of the ground sections in vertical and the figured parts in transverse lines of colour, as in fig. 31, which is a sketch of the textural effect produced by this design. In all designs

and transverse lines of fig. 31 have been substituted by neat diagonal effects, and a pattern of more diversified outline and arrangement obtained. It has been pointed out that the thread-and-thread scheme of shades yields in the cassimere twill the two effects seen in fig. 32. When the weave runs to the right the black and white diagonal effect

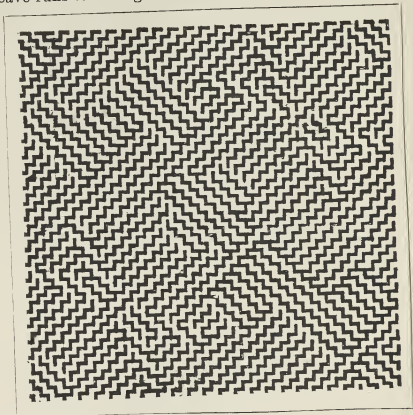


Fig. 32.

runs to the left, and *vice versa*; so that in preparing the designs for the loom it has, in the first place, to be decided whether the ground or the figured sections shall be developed in the minute diagonals of shades travelling to the right. Generally it will be found that this effect is most suitable for the ground. Some care is requisite in combining the weaves, or numerous irregularities will be

formed at the extremities of the figures, or at such junctures as the makes come in contact with each other. When these occur they seriously destroy the uniformity of the fabric.

127. *Utility of the One-and-One Principle in Figured Textiles.*

—The scheme of textile colouring and designing analyzed in the previous paragraph is applicable to a large diversity of goods, including cotton, silk, worsted, and woollen fabrics. Styles for dress stuffs and mantlings may be produced in this manner. Cotton yarns in these designs produce very effective patterns. The compact structure and solid circumference of these threads develop both series of effects with a clearness and prominence that are absent from cloths composed of woollen and worsted materials. Whether the designs are employed in one set of yarns or the other, the following schemes of colouring may be advantageously employed:—

I.

- 1 thread of dark brown
(Shade 1, Plate III.).
1 thread of mid brown
(Shade 3, Plate III.).

III.

- 1 thread of mid grey.
1 " " white.

II.

- 1 thread of dark grey.
1 " " light "

IV.

- 1 thread of lilac (Tint 17,
Plate VI.).
1 thread of white.

Colours slightly contrasting in hue, or merely in shade, may be used in worsted yarns; but in woollens, where the effect is not so clear nor pronounced, owing to the structure of the yarn, more contrast of colouring is requisite to emphasize the figuring. Woollen goods embellished on this principle may be either clear finished or covered with fibre. It depends entirely on the type of fabric produced. If a dress texture, the best results may be obtained by

developing the effect of the colours as much as possible in the finishing processes; but if a mantling, a soft, fibrous surface enhances the mellowness and attractiveness of the patterns formed.

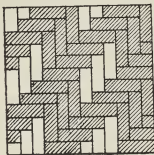


Fig. 33.

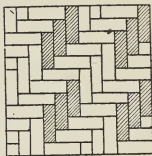


Fig. 33A.

Of course the methods of figuring yielded by this thread-and-thread colouring are combined with other schemes of colours in making elaborate patterns. For example, a band of figuring, such as is given in fig. 32, may be arranged

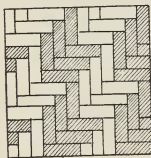


Fig. 33B.

to adjoin a bold stripe of entirely distinct colouring, and thus a pattern produced containing much diversity of composition.

Pattern is evidently acquired in these designs on the most economic lines possible in the loom. No complication, neither of weave nor of colour, arises in their origination. By the employment of two shades and one weave—used in such a

manner as to yield two varieties of style—any form of figuring is on this system producible.

128. *Three-and-Three Colouring.*—This method of amalgamating shades of warp and weft (Class A, Scheme III.) is most largely employed in the six-end twill, three threads up and three threads down on each pick. This make gives

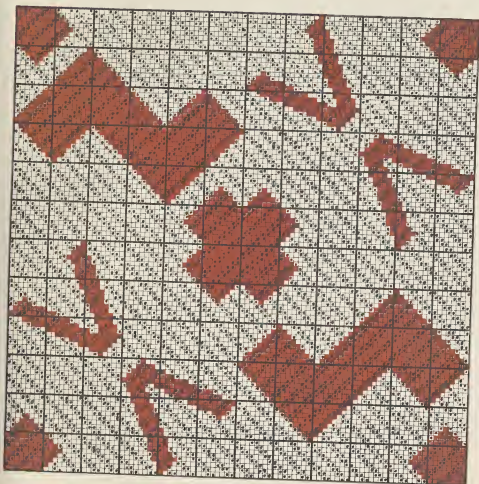


PLATE XVIII

unique emphasis to this plan of colours—no crossing being so admirably adapted for yielding diversification of pattern in this three-and-three colouring as this common and useful twill. Its various effects in the fabric, according to the method of wefting practised, are represented in figs. 33, 33*a*, and 33*b*. The first of these illustrations has a grey weft; fig. 33*a* is woven with white, and fig. 33*b* with three picks of grey and three picks of white.

The check as well as the stripe patterns here given are always to be found in fancy woollen and worsted goods, novelty of style being acquired from season to season by the employment of yarns unique in mechanical formation, or new in shade or colour. Success in this type of effect is always proportionate to the freshness and elegance of the shades selected.

129. *Four-and-Four Arrangement*.—Twill, hopsack, and other common weaves are all used in producing styles in this order of colours, which is supplied in Scheme IV. of Class A of the Regular Simple Colourings. Black and white shepherd plaids are largely made with this base, a useful form and size of check resulting from its employment. Some of the effects got in the cassimere twill by warping four threads of grey and four threads of white, and wefting with white, grey, and with the same order of shades as in the warp, are sketched in figs. 34, 34*a*, and 34*b*. The check style here is particularly neat. It is produced in an infinite variety of colours for almost all kinds of fabrics. When the four-end mat weave is used, a species of star check is formed as seen in fig. 35. A considerable range of patterns ensues from adopting this plan of colours and combining the cassimere and mat weaves in the construction of stripe, check, and diagonal designs. Thus, supposing the last type of weave-combination were employed, then in such parts of the diagonal as the twill occurred the shepherd plaid effect would result, but the hopsack sections

would yield the star check style, so that diagonal bands of these respective patterns, regularly alternating, would extend across the fabric.

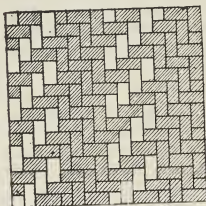


Fig. 34.

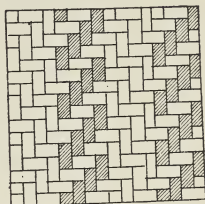


Fig. 34A.

130. *Four-and-Four Method applied to Fancy Weaves.*—
There are various unique patterns obtained in this order

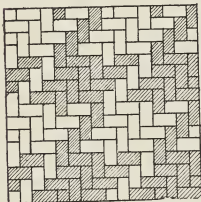


Fig. 34B.

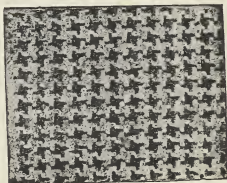


Fig. 35.

of threads by using other weaves than the twill or mat. As an illustration in these effects, fig. 36, which has been produced in the weave given in fig. 36a, may be examined.

It is a small spotted design; the minute crosses of white, surrounded by rectangles of black, are entirely determined in shape and dimensions by the arrangement of warp and weft flushes composing the crossing. The weft yarn of this pattern is all black.

Comparing this style with that sketched in fig. 34, which is composed of precisely the same order of threads, it will be observed that any modification of weave is capable of completely changing the pattern resultant from a given arrangement of shades. In the weave furnished in fig.

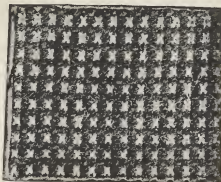


Fig. 36.

36a, the white threads only show on the face of the texture where the blank spaces occur; whereas, in the cassimere twill employed in the manufacture of the sample shown in fig. 34b, the white warp threads float on the face of the fabric on the same system as the black picks.

The pattern given in fig. 36 is ingenious and instructive, and indicates how, by resorting to novel schemes of weaving, the simplest methods of colouring may be made to produce original patterns.

Employment of other weaves than the twill and mat give equally satisfactory results. Such makes are, of course, multiplied in proportion to the ingenuity of the designer. The example considered is but a type of the numerous styles obtainable in this four-and-four colouring by having recourse to designs of a combination class.

131. *Six-and-Six and Eight-and-Eight Schemes.*—These are not given in the plan of regular simple shade-arrange-



Fig. 36a.

ments, because they are but extensions of Schemes III. and IV.; but they are so important in practice, that they must be considered as distinct principles of grouping colours. They are mainly employed when well-pronounced patterns are required in fine yarns, in which instances they yield far more effective styles than the schemes of shades from which they are derived. Then, in fancy woollens of a tweed character whose surfaces are a mass of loud and bold checks, these orders of colourings are invaluable. In both worsted and cotton dress and tweed mantlings they are also used extensively.



Fig. 37.



Fig. 37A.

Both systems are illustrated. The six-and-six plan, and the styles it gives in the six-end twill, are furnished in figs. 37, 37*a*, and 37*b*. The same method of weft colouring has been practised as in previous sketches, showing the changes resulting from varying the weft from light to dark, and from having it exactly like the warp. Fig. 38 has been produced in the eight-shaft twill, and is composed of 8 threads of black and 8 threads of white in both warp and weft. Should such shades as the following be used in the six-end twill, more toned patterns ensue than those supplied in the illustrations :—

I.

6 threads of slate.
 6 " " slate and white
 twist.

II.

6 threads of drab.
 6 " " drab and white
 twist.

III.

6 threads of blue.
 6 " " brown.

IV.

6 threads of No. 2 mixture,
 Plate XI.
 6 threads of No. 8 mixture,
 Plate X.



Fig. 37B.



Fig. 38.

The I. and II. Schemes are for light textures. They illustrate an important method of combining shades, inasmuch as the same shade occurs in both the first and second group of six threads in each example. Thus, in Scheme I. the second group of ends consists of slate and white twists, —the slate being exactly of the same hue as that used in the first six threads. This arrangement is calculated to give very neatly-toned patterns, and is admirably suited for Simple Colourings in which the respective shade factors are considerable. The third group of shades is for a dark pattern. Here the contrast should not be strong; the mellower the better. It only requires to be sufficiently

pronounced to develop the outlines of the checkings and the effects due to the plan of interlacing the threads. A mixture yarn example is also given in the fourth scheme of shades supplied above. Threads of this class are extremely useful in the manufacture of both worsteds and tweeds, in the construction of whose patterns any of the Simple Colourings may be utilized, but particularly those in which the shades are grouped on the six-and-six and the eight-and-eight methods. Their employment implies the production of neater, richer, and more attractive styles than self-coloured yarns are capable of yielding.

The black and white shades which have been blended in



Fig. 39.

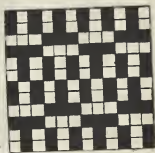


Fig. 39A.

these illustrations—37, 37a, 37b, and 38—bring out with appropriate emphasis the character of the pattern due to the arrangement of the weave. One is competent to estimate at a glance the value of an excellent weave in making patterns composed of elementary forms of colouring. How materially these have been enhanced in attractiveness by the twills here employed, is plainly obvious from the examples. Still, it should be remembered that, while a unique crossing or weave generally increases the diversity of effect due to shade-arrangement, and produces a textural result manifestly different from the result of blending similar shades in patches on canvas, yet the weave

is a factor which may develop or subdue, exhibit or obliterate, the effects producible by any prescribed system of colours.

132. *Six-and-Six Colourings in Various Crossings.*—Two examples may be examined in which weave has been advantageously employed in these schemes of colouring. The first sample, fig. 39, is a species of check, the patches of the respective shades being differently shaped from what they are in fig. 37*b*, which is a composition of the same shades. This arises from the structure of the weave

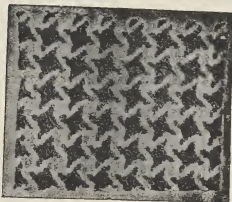


Fig. 40.

employed. It is given in fig. 39*a*, and may be described as a combination of warp and weft ribs. The former rib causes the spaces of black and white to practically run into each other in the direction of the warp, and the latter makes them continuous in the line of the weft yarns. The fabric sketched is made of 2-fold 40's threads, with about 72 ends and picks on the inch, but it is also applicable to cotton and silk textures in all species of shades.

Fig. 40*a*.

The succeeding illustration, fig. 40, is commonly termed the star check. It somewhat resembles fig. 35, but the stars are more prominent and better developed. The weave used in this case is nothing but the six-end twill angled, as given in fig. 40*a*. In making the fabric, the first six picks must be black, or they will not meet the inter-

lacings in the weave on the system requisite to give the star effect. Black and white are the shades furnished in the illustration, but any other two colours may be employed. This form of design, in combination with that given in fig. 37*b*, makes an elegant type of pattern for ulsterings or dress fabrics.

133. *Three-Odd-Thread Arrangement*.—For the plain weave and the six-end twill, this is one of the most serviceable schemes of colouring that can be employed in pattern production. Its effect in the plain make may first be considered. It forms, when woven with the same order of weft as warp threads, the neat style sketched in fig. 41. When the shades are black, grey, and white, as in Scheme I.,—Class B, of the Irregular Simple Colourings,—small vertical and transverse lines of these shades are formed, meeting each other at right angles. Thus, in fig. 41, the vertical lines of black oppose the transverse lines of black, and the same arrangement obtains in regard to the grey and white lines. This pattern frequently obtains in these shades, and also in black, blue, and brown; and in slate, drab, and twist (composed of drab and white).

A check of elegant proportions is producible in this scheme of shades by colouring as follows:—

For	}	1 thread of russet (No. 7, Plate II.).
18 threads.		1 " " citron (No. 8, Plate II.).
		1 " " olive (No. 9, Plate II.).
For	}	1 thread of russet.
18 threads.		1 " " citron.
		1 " " blue.

In the first eighteen threads in this arrangement, the figures formed are of russet, citron, and olive; but in the last eighteen, blue takes the place of the olive, so that when the style is woven with the same series of weft as warp colourings, it makes quite a mellow check design.

Another method of adding to the utility of this form of pattern consists in introducing into its composition an over-check of fancy shades, which may be obtained thus:—

For 19 threads.	{	1 thread of black.
		1 " " brown.
		1 " " black and white twist.
		1 thread of black and blue twist.
		1 " " black and scarlet twist.

There results from this method of grouping shades a pattern consisting of a rectangular space of nineteen ends and picks of small effects, similar to those seen in fig. 41, but consisting of black, brown, and black and white twist, instead of black, grey, and white. These are environed by a neat outline or skeleton check composed of black and blue and of black and scarlet twist yarns. Such a modification as this is capable of being utilized in the construction of an extensive variety of fancy patterns.

Turning now to the effects resulting from using this scheme of threads in the six-end twill, these are of a more diversified character than those producible in the plain make. Correctly speaking, they may be of three distinct styles. The style of pattern now acquired depends on the method in which the respective shades meet each other in the weave. The several effects re-

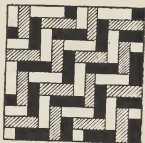


Fig. 41.

sultant when this make is employed are shown in fig. 42. This has been obtained by employing the weave given in fig. 42a, which is a small check design composed of six-end twill, running in two directions. Let the respective sections of the woven pattern acquired in fig. 42 be analyzed separately. It must at the outset be understood that the order of shades is the same throughout, namely, that furnished in

Scheme I. of Class B of the Irregular Simple Colourings. Hence the diversification of style here noticed is a resultant of weave and not of colour combinations. The different effects

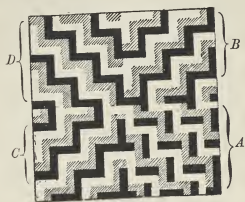


Fig. 42.

acquired in Sections *A*, *B*, and *D*, are sufficient to lead to the conclusion that makes of various constructions have been employed. What a distinct style obtains, for instance, in Part *A* from Part *B*. In the former, lines of black are set at right angles to other lines of this shade, while

the grey and white yarns form diagonals; but in *B* all the three shades run diagonally. Section *C* is practically the same as *B*, while *D* is also similar, only twilling to the left.

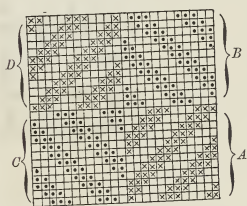


Fig. 42A

The parts lettered *A*, *B*, *C*, and *D* in the design furnished in fig. 42*a*, correspond to those just described. One other effect may be got in the six-end twill besides those considered in this order of threads, namely, that in which two diagonals, grey and white, twill to left, or the opposite to what they do in *A*, and small transverse lines of black be set across similar vertical lines. If the positions of the shades were altered, the grey or the white yarns might be made to form the disconnected spots.

A further principle of colouring exhibited by this illus-

tration is that the same plan of shades and method of weaving are capable of yielding different woven results according to the system on which they are combined. Thus, as has just been indicated, without modifying the scheme of colours, the same fabric has been made in the six-shaft twill to give the effects sketched in fig. 42. Parts *A, D*, are practically formed by one weave running to the right, yet how different they are in character. To what is the difference due? A careful examination of the design shows that the black threads and picks do not meet each other on analogous principles, for while in Part *A* of fig. 42*a* the first pick is two threads down, three up, three down, three up, and one down; in Part *D* it is three up and three down, so that in reality the first pick in *A* corresponds to the fifth pick in *D*. Still, though the order of the threads is the same in both sections, the methods on which the colours are crossed in the respective parts of the texture are dissimilar, hence corresponding results cannot possibly ensue. This difference of effect, arising from commencing colouring on certain threads and picks of the weave, increases the variety of styles obtainable in the same order of threads and principle of intertexture.

134. *Various Three-shade Patterns.*

—Amongst other simple schemes of colouring composed of three shades are those given in Methods II., III., and IV. of Class B in the table of Elementary Arrangements of Colours. Each system may be advantageously developed in the six-end twill—the last system, which may be termed the three-4's scheme, being, however, also workable in four-shaft weaves. Only two of these principles are illustrated, namely, the three-2's and the three-3's. It will be evident from the sketches, figs. 43 and 44, that these patterns belong

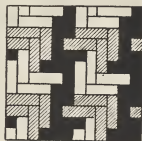


Fig. 43.

to a useful class of effects; and, also, that they are extensively employed in the manufacture of suiting and dress styles. Fig. 43 is a particularly neat form of intermingled check. In such shades as the following it gives admirable effects:—

I.

- 3 threads of citron (No. 9, Plate II).
- 3 " " olive (No. 1, Plate II).
- 3 " " russet (No. 7, Plate II).

II.

- 3 threads of dark blue (No. 7, Plate III).
- 3 " " dark olive (No. 13, Plate III).
- 3 " " dark brown (No. 1, Plate III).

III.

- 3 threads of light olive (No. 9, Plate VI).
- 3 " " lilac (No. 17, Plate VI).
- 3 " " drab (No. 10, Plate VI).

The I. and III. of these colourings are specially suitable for dress fabrics, but the II. assortment is best adapted for tweed suitings. This form of pattern should also be developed in mixture and twist yarns in woollen, worsted, cotton and linen materials.

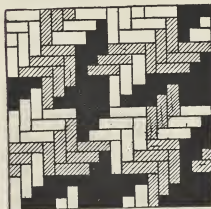


Fig. 44.

As a result of employing this scheme of shades, three sets of checks, each formed within the other, are obtained in the fabric. By examining fig. 43, the outlines of these checkings will be readily observed. First there is the check of black, second the check of grey, and third the check of white. The character of the style due to the weave is also apparent in this illustration. There is also

perfect balance of shades. This feature, which mainly results from the twill employed in the construction of the pattern, contributes to the general excellence of the style. Still, it will be noticed that the manner in which the black threads interlace produces a different form of check from that resulting from the grey or white yarns. It is not feasible to have all the three checks exactly similar in outline; and hence it is a point for the colourist to determine, in making this style, which shade shall be utilized in producing the effect here due to the black yarns.

Fig. 44 gives a more irregular style than fig. 43, on account of the weave being repeated three times, and the order of the shades twice, before one complete pattern is acquired. This arises from there being nine threads in the plan of shades—3 of black, 3 of grey, and 3 of white—and six threads in the weave. The pattern sketched in fig. 44 is extensively used as a base of colouring. In one particular it resembles the preceding style, for the shades combined form three broken checks, but in all other characteristics it is quite different. The checkings of the several shades lack continuity, and the whole pattern resembles an irregular grouping of colours. Yet close examination makes it evident that the element of black is exactly proportionate to that of grey or white, and each shade constitutes a well-defined series of minute effects, which, by repetition, bring out the check character of the style. It is a base that is largely improved by diversity of colouring. In combination with fig. 43 it yields stripe and check designs of a broad character, which are applied to dress fabrics, flannels, trouserings, suitings, and mantlings.

135. *Simple Colourings composed of Four Shades.*—Each of the four arrangements given in Class C of Simple Colourings are illustrated. Scheme I. is given in fig. 45. This is the most elementary scheme of the four. It only forms a hairline stripe of four colours if

produced in the swansdown weave supplied in fig. 46, when the order of the wefting is 1 pick black, 1 pick dark grey, 1 pick white, and 1 pick mid grey. This style is largely worked in fancy woollens, and also in worsteds. It is an excellent colour-base for trouserings and goods

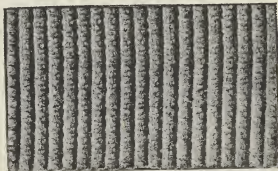


Fig. 45.

where a neat but diversified effect is required. The same arrangement of shades in the plain weave makes a mixture pattern, or a minute design, in which the shades are so completely intermingled as to give the fabric the aspect of a texture made of mixture yarns. In the common twill the colourings form an extremely minute broken check effect, which, when the colours are well selected, is a pattern of considerable excellence, and adapted for suitings and coatings, where small styles are invaluable.



Fig. 46.

Fig. 47 results from the second scheme of colouring given in Class C of the Simple Combinations of Shades. The weave here is cassimere twill, but the celtic or mat, and other weaves of a regular construction on four and eight shafts, may be advantageously used. For neatness and diversification of style it is one of the most valuable arrangements that can be adopted. Here are four more or

less disconnected checkings of colours forming an intermingled pattern choice in outline and soft in tone. It is one of those styles which, on account of its richness of construction and appearance, and yet simplicity of arrangement, is applicable to all textures where mellow-tinted effects are required. Generally it yields the most satisfactory and effective combinations when the colours shade or tone into each other. Strong contrasts in hue are to be avoided in making patterns according to this scheme, while those colours should only be combined which will mingle into each other.

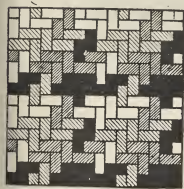


Fig. 47.



Fig. 48.

A more marked and better pronounced style of course ensues when the quantities of the several shades are increased, and a weave selected of an opener structure. These points are brought out in fig. 48, in which the same arrangement of shades obtains as in fig. 47, only the quantity of each colour is augmented one-third, and the six-shaft twill substituted for the four-shaft twill. Broader effects are therefore the result. Were this sketch repeated, to show the outline of the pattern more clearly, it would be observable that the black, dark grey, mid grey, and white shades all form checkings, which, in the fabric, are quite

distinct from each other. As the order of shades here—Scheme III. of Class C, Simple Colourings—contains twelve threads, the six-shaft twill is one of the best that can be employed for regularly and equally distributing the shades.

Eight-shaft makes being repeated three times before they

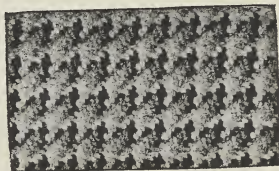


Fig. 49.

meet the plan of colours, give more irregular and mingled effects. Where indistinct checks are important, they are preferable to six- and twelve-end makes.

The last example in Simple Colourings obtained by combining four shades is given in fig. 49. It has been produced in the Mayo weave, represented in fig. 49a.



Fig. 49a.

In common twills of more uniform interlacings, it necessarily gives a pattern of more decided markings. Here the weave has broken up the groups of fours into which the colours are divided. As a consequence, the resultant style is characterized by softness and intermingled colouring. The weave effect noticeable is an important feature.

It enhances the beauty of the textural effect. Either sets of hues of different colours of the same depth, or sets of shades in one colour, may be employed in this scheme.

It is a base which may be associated with fig. 47 in the construction of patterns of a check or stripe class.

All the examples described in Regular Simple Colourings are of a typical character, and in practice are diversified *ad libitum* in colouring and in weave. As the order of shades remains *in statu quo*, though the colours are diversified, the general cast of the effects as to outline, minute figuring, and textural composition is invariable.

136. *Irregular Simple Colourings*.—These are patterns in which the quantities of the different shades used, or the plans of colouring as to succession of colours, are not uniform. They are not so numerous as the "Regulars" already considered, but they are very important in pattern designing. The principal of these combinations are furnished in the table below :—

IRREGULAR SIMPLE COLOURINGS.

CLASS A.—COMPOSED OF TWO SHADES.

I. Scheme.

2 threads of black.
1 thread of white.

II. Scheme.

4 threads of black.
1 thread of white.

III. Scheme.

4 threads of black.
2 " " white.

IV. Scheme.

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

CLASS B.—COMPOSED OF THREE SHADES.

I. Scheme.

2 threads of black.
2 " " grey.
1 thread of white.

II. Scheme.

3 threads of black.
2 " " grey.
1 thread of white.

<i>III. Scheme.</i>		<i>IV. Scheme.</i>	
6 threads of black.		6 threads of white.	
4 " " mid grey.		2 " " grey.	
2 " " white.		2 " " black.	
		2 " " grey.	

CLASS C.—COMPOSED OF FOUR SHADES.

<i>I. Scheme.</i>		<i>II. Scheme.</i>	
3 threads of black.		4 threads of black.	
2 " " dark grey.		3 " " dark grey.	
2 " " mid grey.		3 " " mid grey.	
1 thread of white.		2 " " white.	

<i>III. Scheme.</i>		<i>IV. Scheme.</i>	
4 threads of black.		4 threads of black.	
2 " " mid grey.		2 " " mid grey.	
4 " " light grey.		2 " " light grey.	
2 " " white.		4 " " white.	
		2 " " light grey.	
		2 " " mid grey.	

137. *Irregular Simple Patterns of Two Shades.*—In this class of colouring are found some useful bases for fancy textures composed of simple twills and other elementary crossings. They may be considered in the order named in the table. The first scheme given is most generally used in the three-end prunelle twill, in which weave it gives lines lengthways or across the texture, according to whether the make is warp or weft flushed. These two twills are consequently frequently combined in figured designs for mantlings, and then this order of colouring adopted, producing a style of pattern resembling that got by blending two plain makes, only in these weaves the cloths may be ranker set, and one line of colour is always twice as broad as the other.



Fig. 50.

The II. Scheme finds application to five-shaft weaves. Thus, in the twill given in fig. 50*a*, it makes the neat and precise check style seen in fig. 50. When this arrangement is used in worsted coatings, the effect seen in white may be composed of silk yarns. Certainly the introduction of silk in this manner adds richness to the effect. The same scheme is applied to cottons and fancy woollens. Some effective patterns ensue from colouring—

For	{	4 threads of black.
25 threads.	}	1 thread of white.
For	{	4 threads of white.
25 threads.	}	1 thread of black.

Of course the shades are varied according to the taste of the colourist. But the form of the pattern resultant from this arrangement comprises a series of effects similar to

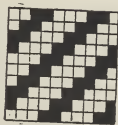
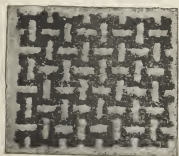
Fig. 50*a*.Fig. 50*b*,

Fig. 51.

that sketched in fig. 50, and then a series of effects with a white ground and black spotting.

The extent to which one thread and a slight change in the weave may alter the nature of a woven pattern is forcibly illustrated by the next sketch, fig. 50*b*, obtained in the four-end celtic and the III. Scheme of shades in

Class A. This grouping yields a very characteristic pattern—practically, a small figured style. The weave and the colours associate with each other on such a principle that the shade used in the smallest quantity forms short vertical and transverse lines on the surface of the texture. This, like the preceding example, is an order of colouring that is frequently varied by transposing the

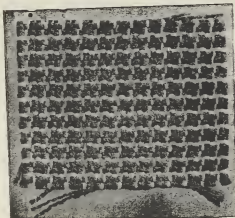


Fig. 52.

shades thus:—

For	{	4 threads of black.
24 threads.	2	,, ,, white.
For	{	4 threads of white.
24 threads.	2	,, ,, black.

Providing the weft is the same as the warp, a square is first formed in which the lines or spots are white, and arranged on a black ground, and then a check of black lines on a white ground. When the shades do not form strong contrasts, this base is capable of being utilized in the production of a large variety of fancy fabrics.

A more irregular and intricate effect results from employing Scheme IV., fig. 51, than either Schemes II. or III. The weave is that supplied in fig. 50a, and materially affects the mingled aspect of the pattern. Shades may be employed here that produce well-emphasized contrasts. If these are not selected, the broken-up character of the base will detract from, instead of add to, the elegance of the pattern woven.



Fig. 52A.

There are several other forms of these colourings, such as the following:—

(a)	(b)	(c)
5 threads of black.	6 threads of black.	8 threads of black.
2 „ „ white.	2 „ „ white.	3 „ „ white.
		2 „ „ black.
		3 „ „ white.

The first of these is applicable to seven and fourteen-

shaft weaves, in which it may be made to produce some excellent effects. The second of these additional irregular two-shade simples is mostly employed in eight-end makes of special construction. Two patterns in which it has been used are sketched in figs. 52 and 53. It is the structure of the respective weaves that is the cause of one pattern—fig. 52—being a minute check



Fig. 53.

of a remarkably clear outline, and of the other pattern—fig. 53—being a bird's-eye spot. Take fig. 52 first. Here the weave is a sort of fancy mat, being supplied in fig. 52*a*. The white threads in both warp and weft fall on the 7th and 8th threads and picks in the weave.

To these threads and picks the check character of the pattern is entirely due. They cause the black yarns to be grouped together in the form of a minute irregular rectangle, and the white yarns to give the skeleton check effect. Considering fig. 53, the same threads and picks again determine the specific effect of the pattern. They so control the



Fig. 53*a*.

grouping of the yarns that the white threads produce the small spot or star. In both these examples the weaves have been specially constructed to so govern the mode of uniting the threads as to develop the effects described. So that

these are illustrations which demonstrate the principle of originating plans of weaving which will change the pattern produced by a given set of colours in such manner as to compose novel styles.

The effect of the third arrangement given above is to form the pattern seen in fig. 54. It is a base that frequently finds an important place in tweeds, flannels, dresses, and worsted suitings. It may be described as a neatly-marked check. The weave employed in its construction is supplied in fig. 54*a*, and is what is technically known as the eight-shaft diagonal. This scheme is devel-

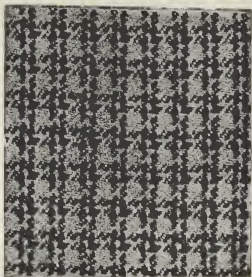


Fig. 54.



Fig. 54A.



Fig. 55.

oped in light, medium, and dark shades, and in self, compound, and mixture yarns. Considering that only two shades are requisitioned in its construction, it is a pattern replete with diversity of outline and multiplicity of effects.

138. *Irregular Simple, composed of Three Shades.*—But brief descriptions need only be given of these. A neat but very minute check is obtainable by the first of these schemes. It is best adapted for weaves occupying five

threads. The weave employed in the construction of this pattern—fig. 55—is furnished in fig. 50*a*. Ingenious colouring and combination of threads produce admirable coating and ground effects for figured textures on this principle.

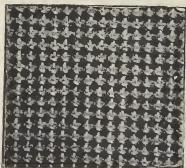


Fig. 56.

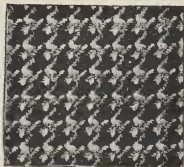


Fig. 57.

The II. Scheme is workable in the six-end twill, in which it yields a common suiting style (fig. 56). Those shades which are employed in the largest proportions in this pattern should invariably be the mellowest, while the shade which occurs in quantities of one thread at a time should be the most brilliant. It will be observed that this arrangement has been adhered to in the illustration. If the positions of the shades are reversed, that is to say, black substituted by white, and *vice versa*, a light texture well adapted for jacketings is obtained. In slates, drabs, smokes, and toned browns and olives, this colouring is very useful.

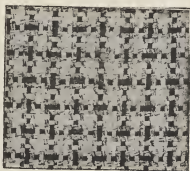


Fig. 58.

Schemes III. and IV. may be analyzed together. The former, fig. 57, has been developed in the six-end twill, and

the latter, fig. 58, in the mat or celtic. They are two typical patterns. The latter pattern appears to combine both check and figured effects, the small detached lines of black producing the figured appearance, and the grey shade, in combination with the black and white factors, yielding the toned check characteristic. In well-assorted

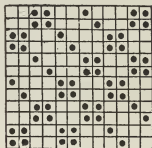


Fig. 59.

shades it is applicable to all classes of simple fancies. It does not possess that marked check cast which is so apparent in fig. 57. This style is really constructed on a similar principle to fig. 56, for the respective shades gradually decrease in quantity from the beginning to the end of the pattern. All such arrangements admit of two methods of colouring.

In the first place the darkest shade may be made the principal factor, and in the second place the lightest shade. The intermediate colour—in this instance grey—is invariably the centre element of this species of style.

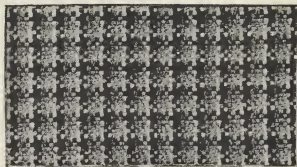


Fig. 60.

139. "Irregulars" composed of Four Shades.—The first of these schemes gives an effect somewhat similar to that which results from fig. 56, only here the cassimere twill

may be advantageously employed, and probably a neater pattern acquired. In certain weaves, such as fig. 59, the second scheme produces an excellent species of suiting. It is illustrated in fig. 60. If more pronounced effects are needed, common twills should be employed, particularly

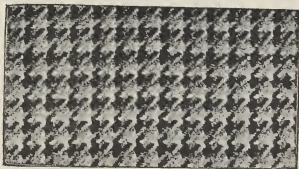


Fig. 61.

the six-end weave. If this twill is employed, it forms the pattern supplied in fig. 61. The III. Scheme yields in the Mayo a very effective pattern, as is seen in fig. 62. Here the black yarns produce an indistinct figure, while the other

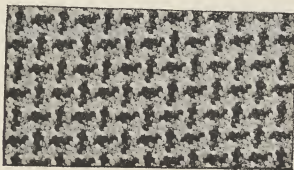


Fig. 62.

colours constitute intermingled checkings. This is an admirable base, and one capable of being employed in the manufacture of various classes of fancy textures for both ladies' and gentlemen's wear. Scheme IV., fig. 63, is a neat

and effective method of grouping shades for a fancy checks in Cheviot, Saxony, or fine worsted yarns. The pattern

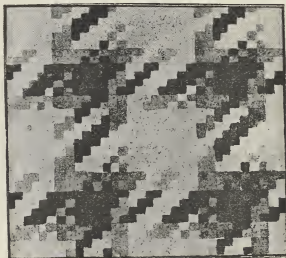


Fig. 63.

sketched has been produced in the sixteen-head diagonal furnished in fig. 55*a*, but it might also be worked in common

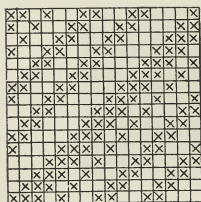


Fig. 63A.

twill and mat weaves. Such a diagonal adds, however, to the attractiveness of the intermixture of shades. Much of the complex association of colours that obtains in this example is due to the system on which the threads of warp and weft interlace. The pattern may be appropriately designated a species of shaded check. From the tinted white to the black element in the sketch there is a gradated shade of greys, and in the several sets of colourings appended the same mellow toning is

observed. Especially is the twist-yarn scheme supplied interesting, forming a pattern replete with diversity of composition.

I.

4 threads of light drab.
 2 " " olive brown.
 2 " " brown.
 4 " " black.
 2 " " brown.
 2 " " olive brown.

II.

4 threads of light grey.
 2 " " slate.
 2 " " dark blue.
 4 " " black.
 2 " " dark blue.
 2 " " slate.

III.

4 threads of dark blue and white twist.
 2 " " " " " light grey twist.
 2 " " " " " mid " "
 4 " " " " " dark " "
 2 " " " " " mid " "
 2 " " " " " light " "

The same colour-base may be applied to cotton textures and light fabrics for ladies' wear, when the colourings should be considerably brighter than those enumerated. For variety of effect it is one of the most important colourings included in the ordinary series of irregular elementary styles.

CHAPTER VIII.

COMPOUND COLOURINGS.

140. Compounds—141. Compounds composed of Three Types of Elementary Colouring—142. Results of combining Simple Colourings—143. Compounds and Weave Combinations compared—144. Utility of a Practical Acquaintance with the Woven Effects of Simple Colourings

145. Compound Patterns subjective to the Nature of the Fabrics Manufactured—146. Types of Compounds—147. Compounds composed of Two Simple Types—148. Patterns composed of Two Types and Three Shades—149. Styles of Four Shades containing Two Simple Types—150. Styles composed of Three Simple Types—151. Irregular Compounds.

140. *Compounds*.—As these are composed of several elementary schemes of colouring, they are generally patterns of some intricacy of composition. With only two shades it is possible to obtain an infinite variety of effects in this style of woven design. When three or more shades are at command, and various simple methods of grouping shades are practised, though the weave may be of a common twill or mat description, compound patterns may be quite elaborate in arrangement. The elaborateness of the style resultant is determined by several factors, such as the character of the types, multiplicity of the simple colourings associated, and the diversity of the shades employed. The simpler the schemes of colours selected, the fewer the elements of the compound, the more ordinary in cast and aspect the pattern acquired. Still, the commonest groupings of shades, even when combined on the simplest system, are capable of forming woven styles of considerable rich-

ness of composition. One example, given in fig. 64, will exhibit the variegated character of this species of textile colourings. It is the most elementary type of compound, resulting from combining Methods I. and II., supplied in the table of Simple Orders of Shades, and only containing two elements of colour, namely, black and white. But it is, nevertheless, a pattern which comprises several styles of minute effects. It is divided into four



Fig. 64.

rectangular spaces, *A*, *B*, *C*, and *D*. Each square is formed of a different kind of textural design. Thus, in Section *A*, which is composed of two threads of black and two threads of white in both warp and weft, it will be noticed there are small irregular checkings forming vertical lines; in *B*, where the one-and-one order of warp colouring is crossed

by the two-and-two order of wefting, minute figures, or spots of white, separately surrounded with black, occur; in Section *C* the same figures obtain as in *B*, only they are inverted, owing to the warp and weft colourings meeting each other in the reverse way to what they do in *B*; for in this segment of the texture the two-and-two warping is interlaced by the one-and-one order of wefting; as to Section *D*, it is constituted of the small diagonal effects described in Paragraph 81. So that in this pattern there are four important textural results so associated as to form a neat check design, which is producible in wool, worsted, silk, and cotton yarns. It may be diminished or increased in size, and modified in various ways, so as to cause it to possess a novel cast. For example, Checks *A* and *C* may be double the size of *B* and *D*; or several striped patterns may be acquired by using Sections *C* and *D* together and Sections *A* and *B*—the spaces of each effect being determined according to the class of fabric in which the style is produced. For trouserings they must be comparatively small, but for dress textiles and mantlings they may be some inches in width. In such shades and tints as are appended, both the original pattern and the modifications named may be advantageously developed:—

I.

For 24 { 1 thread of Shade 2, Pl. III.
 threads. { 1 " " " 8, " "
 For 24 { 2 threads of Shade 2, Pl. III.
 threads. { 2 " " " 8, " "

II.

For 24 { 1 thread of Shade 7, Pl. VI.
 threads. { 1 " " " 13, " "
 For 24 { 2 threads of Shade 7, Pl. VI.
 threads. { 2 " " " 13, " "

III.

For 24 { 1 thread of Tint 4, Pl. III.
 threads. { 1 " " " 4, " VI.
 For 24 { 2 threads of Tint 4, Pl. III.
 threads. { 2 " " " " VI.

IV.

For 24 { 1 thread of Tint 10, Pl. VI.
 threads. { 1 " " " 16, " "
 For 24 { 2 threads of Tint 10, Pl. VI.
 threads. { 2 " " " 16, " "

These colourings, with the exception of No. 1, are more suitable for dress and fancy fabrics for ladies' materials

than for trousering and coating textures. They are too lustrous for the latter types of loom products, but are of the exact depth and luminosity of colour appropriate for fancy dress and mantling fabrics. More sombre blends—such as Nos. 2 and 13, and Nos. 7 and 14, Plate III.; and Nos. 1 and 7, and Nos. 8 and 14, Plate VI.—yield patterns of the proper cast and tone for gentlemen's wear.

141. *Compounds composed of Three Types of Elementary Colouring.*—In these compounds only two schemes of colouring obtain; but in fig. 65 three elementary systems of grouping shades have been combined, yielding a style rich in diversity of small types of design. The schemes of shades employed in its construction are the I., II., and IV. Methods furnished in Class A of the Simple Colourings. They constitute, in the fabric given in this illustration, no less than nine distinct effects. These must be closely examined, in order that the principles of pattern design involved in the formation of the compound style may be clearly demonstrated. Commence with the three effects succeeding each other in Bracket A. First, there is a square of similar minute figuring to that noticed in C of the previous pattern; second, a rectangle of vertical stripes composed of neat markings; and third, a repetition of the effect seen in D of fig. 64. Next, consider the types included in Bracket B. The first space here is a composition of the small running checks referred to in Section A of the former pattern; this adjoins a square filled in with vertical stripes; and then follows a space of similar dimensions, and of the same species of effects, as characterizes B of the preceding style. Both the A and B series of effects comprise two types of pattern like those composing fig. 64, but in the C and E groups five entirely distinct types of textural work are developed. Two of these—the two vertical stripes—have been alluded to. The horizontal stripes, comprised in Bracket C, have not been described.

They are similar to the stripes seen in Bracket *E*, only they are formed across instead of lengthways of the fabric. Between the rectangular spaces of these effects there is a square of black and white shepherd checks. It may be useful to indicate how the several effects forming this compound may be utilized on other systems than that illustrated. Primarily the space of black and white checkings may be considerably enlarged, when an appropriate dress pattern results. But it is not simply in the form of checks these sets of colourings are combinable, for they may be associated on such principles as to yield an extensive range of stripe designs. Take, for example, the series of effects included in Bracket *A*. These of themselves make a neat stripe, especially if choice colourings are selected. Parts *D*, *E*, and *F* may be varied in dimensions according to the class of texture being manufactured. About half-an-inch of *D*, an inch of *E*, and half-an-inch of *F* makes a useful base. In the shades and tints furnished for the preceding example—fig. 64—this form of stripe is capable of yielding attractive styles.

The group of types in *B* should be similarly employed as that constituting *A*. After *B* sections have been separated from the rest of the pattern they may be used thus for a dress fabric:—A band of two inches of the effect given over *E*, and bands of one inch in width of the two adjacent types. If the style is applied to trouserings, smaller quantities of each type should be employed, and some fancy twist yarns added to the shades forming the bulk of the pattern, to give freshness and diversity of colouring.

Even the series of broken or irregular types included in Bracket *C* might be worked into admirable stripes for mantlings. In woollen yarns and mellow colourings these broad effects in bands of about an inch in width yield effective patterns. Toned browns, slates, drabs, light greys, light olives, and lavenders are appropriate colours for this

kind of textiles. Mixture yarns, of which several illustrations are given below, are also applicable here.

I.

1 thread of No. 1, Plate XI.	1 thread of No. 6, Plate XI.
1 " " No. 2, Plate XI.	1 " " No. 8, Plate XI.
2 threads of No. 1, Plate XI.	2 threads of No. 6, Plate XI.
2 " " No. 2, Plate XI.	2 " " No. 8, Plate XI.
4 " " No. 1, Plate XI.	4 " " No. 6, Plate XI.
4 " " No. 2, Plate XI.	4 " " No. 8, Plate XI.

II.

III.

1 thread of No. 5, Plate XI.
1 " " No. 7, Plate XI.
2 threads of No. 5, Plate XI.
2 " " No. 7, Plate XI.
4 " " No. 5, Plate XI.
4 " " No. 7, Plate XI.

142. *Results of Combining Simple Colourings.*—It will be obvious from these illustrations—figs. 64 and 65—that, by combining several schemes of simple colouring, patterns are obtained rich in diversity of types of textural design, though the number of shades combined may be very limited. This is not usually the case in simple colourings. If the shades in such arrangements are not numerous, the resultant effect is invariably plain; whereas, it is obvious that in compounds, even should one weave only be employed and two shades combined, styles full of detail and minute textural patterns are producible. They represent the most economical method of developing design in woven goods, for they are neither complicated in weave structure nor colour composition.

143. *Compounds and Weave Combinations compared.*—Patterns of a compound class, being composed of two or more simple schemes of colouring, may be compared to

designs resulting from combining several small weaves or crossings. Compound colourings bear the same relation to the general classes of coloured patterns as combination designs bear to the effects obtainable by diversifying the systems of crossing warp and weft yarns. Thus, the former are the resultants of blending elementary schemes of col-

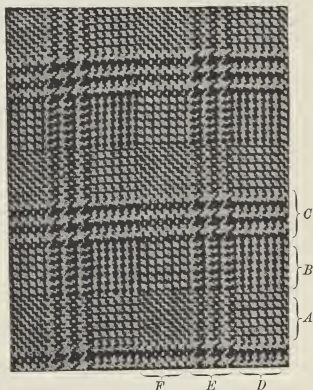


Fig. 65.

ouring, and the latter the resultants of uniting the elements of weaving, or those crossings which constitute the alphabet of all systems of woven design due to intermingling warp and weft yarns. Moreover, the complexity of weave combinations is proportionate to the variety of weaves associated, and the intricacy of the elementary schemes of intertexture employed, and it will be noticed that, as

compounds are more minutely examined, their complex arrangement and fullness of detail are determined by the number of "Simples" entering into their composition, and on the character of the methods of colouring amalgamated.

When constructing weave combinations, only those weaves are associated which fit and unite with each other correctly, and which yield in conjunction a texture regular in structure; and when forming compounds, those schemes of elementary colouring are only combinable which produce a properly balanced style. Just as those weaves which are obtained from a similar base are generally adapted for introduction into the same combination style, so those colourings which have a common symmetry of arrangement give correct results. No amount of ingenuity and technical dexterity can make certain crossings work uniformly together; and, similarly, whatever skill and colouring capacity are exercised in the union of some systems of shade-association, incongruous patterns ensue—a principle of textile colouring which implies that the schemes of colours selected for combination must have, if not precisely the same, a corresponding base of construction.

144. *Utility of a Practical Acquaintance with the Woven Effects of Simple Colourings.*—Before attempting to combine simple methods of arranging shades, in the execution of compound patterns, the textural results of the various elementary systems of grouping colours already described should have been ascertained if possible by loom experiments. For the purpose of facilitating the combination of well-assorted simple colourings, it will be found advantageous to make a collection of the woven patterns resulting from the adoption of the schemes of shade arrangements given in Paragraph 124. These yield standard styles which are as needful in the construction of compounds as the letters of the alphabet are in the formation of words. The utility of such a series of woven samples may be readily

indicated. Supposing, for example, a pattern were required in the cassimere twill in which the two-and-two and the one-and-one schemes of colouring were to appear. Then, by consulting the woven results of these two principles of grouping yarns, some calculation could be made of the actual aspect of the proposed pattern. This, of course, is an advantage in designing, where the work is always more or less of a speculative character. Still, generally speaking, the most effective styles are those which the designer, by the aid of his technical knowledge, has been able to partially imagine the woven effect of when the patterns were in the theoretical form. Even an incomplete conception of compound colourings cannot be formulated unless the elements of which they are composed are thoroughly apprehended; hence the simple schemes of shades should all be tested in the loom—the weaver's laboratory—and the patterns they severally produce systematically recorded for handy reference in the arrangement or planning of compound styles.

145. *Compound Patterns Subjective to the Nature of the Fabric Manufactured.*—Another factor which affects the selection of "Simples" in the construction of compounds, is the class or description of fabric being produced. In some species of cotton, linen, and dress textures, bold and broad effects are required, necessitating the use of the large types of elementary colourings; but in the ordinary fabrics for gentlemen's wear, the neatest and smallest types should be associated. While this may be regarded as a general condition, yet the degree of colour contrast, the force and strength of the shades, and the fineness of the structure of the fabric, all, in some measure, modify the type of shade-arrangements most appropriate for any specific class of fabrics. It is here chiefly a question of the size of the pattern required, which is governed by the dimensions of the various effects combined in its construc-

tion. So that, granting the class of fabric has been determined upon, and that its structure is known, then those types of simple groupings of shades may be readily appropriated which will give a compound style of requisite textural composition, form, and size.

146. *Types of Compounds*.—Compounds, like simples, may be divided into Regulars and Irregulars, which may be subdivided thus: compounds composed of two elementary schemes of colouring, and compounds composed of three or more elementary schemes of colouring. Each of these

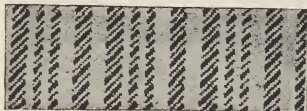


Fig. 66.

subdivisions includes styles of two, three, or four shades. Examples in these several classes of compounds are supplied in the table given below:—

COMPOUND COLOURINGS.

REGULAR COMPOUNDS—

CLASS A.—COMPOUNDS COMPOSED OF TWO SIMPLE TYPES.

I.—Styles in Two Shades.

I. Scheme.

1 thread of black.

1 „ „ white.

2 threads of black.

2 „ „ white.

III. Scheme.

3 threads of black.

3 „ „ white.

II. Scheme.

2 threads of black.

2 „ „ white.

4 threads of black.

4 „ „ white.

IV. Scheme.

4 threads of black.

4 „ „ white.

} A. } A.
 } B. } B.

} A. } A.

6 threads of black.	} B.	8 threads of black.	} B.
6 " " white.		8 " " white.	

II.—Styles in Three Shades.

<i>I. Scheme.</i>		<i>II. Scheme.</i>	
1 thread of black.	} A.	2 threads of black.	} A.
1 " " grey.		2 " " grey.	
1 " " white.		2 " " white.	
2 threads of black.	} B.	4 threads of black.	} B.
2 " " grey.		4 " " grey.	
2 " " white.		4 " " white.	

<i>III. Scheme.</i>		<i>IV. Scheme.</i>	
3 threads of black.	} A.	4 threads of black.	} A.
3 " " grey.		4 " " grey.	
3 " " white.		4 " " white.	
6 threads of black.	} B.	8 threads of black.	} B.
6 " " grey.		8 " " grey.	
6 " " white.		8 " " white.	

III.—Styles in Four Shades.

<i>I. Scheme.</i>		<i>II. Scheme.</i>	
1 thread of black.	} A.	2 threads of black.	} A.
1 " " dark grey.		2 " " dark grey.	
1 " " grey.		2 " " grey.	
1 " " white.		2 " " white.	
2 threads of black.	} B.	4 threads of black.	} B.
2 " " dark grey.		4 " " dark grey.	
2 " " grey.		4 " " grey.	
2 " " white.		4 " " white.	
<i>III. Scheme.</i>		<i>IV. Scheme.</i>	
3 threads of black.	} A.	4 threads of black.	} A.
3 " " dark grey.		4 " " dark grey.	
3 " " grey.		4 " " grey.	
3 " " white.		4 " " white.	
6 threads of black.	} B.	8 threads of black.	} B.
6 " " dark grey.		8 " " dark grey.	
6 " " grey.		8 " " grey.	
6 " " white.		8 " " white.	

CLASS B.—COMPOUNDS COMPOSED OF THREE SIMPLE TYPES.

I. Scheme.

Composed of Two Shades.

1 thread of black.	} A.
1 " " white.	
2 threads of black.	} B.
2 " " white.	
4 threads of black.	} C.
4 " " white.	

II. Scheme.

Composed of Three Shades.

1 thread of black.	} A.
1 " " grey.	
1 " " white.	
2 threads of black.	} B.
2 " " grey.	
2 " " white.	
4 threads of black.	} C.
4 " " grey.	
4 " " white.	

III. Scheme.

Composed of Three Shades.

1 thread of black.	} A.
1 " " grey.	
1 " " white.	
3 threads of black.	} B.
3 " " grey.	
3 " " white.	
6 threads of black.	} C.
6 " " grey.	
6 " " white.	

IV. Scheme.

Composed of Three Shades.

2 threads of black.	} A.
2 " " grey.	
2 " " white.	
4 threads of black.	} B.
4 " " grey.	
4 " " white.	
8 threads of black.	} C.
8 " " grey.	
8 " " white.	

IRREGULAR COMPOUNDS—

I. Scheme.

Composed of Two Colours.

2 threads of black.	} A.
1 thread of white.	
4 threads of black.	} B.
2 " " white.	

II. Scheme.

Composed of Two Colours.

1 thread of black.	} A.
1 " " white.	
3 threads of black.	} B.
1 thread of white.	

III. Scheme.

Composed of Two Shades.

1 thread of black.	} A.
1 " " grey.	
1 " " black.	

IV. Scheme.

Composed of Three Colours.

6 threads of black.	} A.
4 " " grey.	
2 " " white.	

1 thread of grey.	}	3 threads of black.	}	} B.
1 „ „ black.		3 „ „ white.		
1 „ „ grey.				

NOTE.—Groups *A*, *B*, and *C* may be repeated to any number of threads of which they form a multiple.

147. *Compounds composed of Two Simple Types*.—Four examples in this class of compounds are given in Class A of the table. Three of them have been previously examined—namely, Schemes I., II., and III. The I. Scheme is fully analyzed in Paragraph 140, while the II. Scheme produces a common check pattern, and the III. Scheme makes what is called the basket check. Scheme II. is



Fig. 67.

extensively used in worsted designing for both suiting and dress fabrics, and also in cotton yarns. Both this and the III. Scheme are worked in the mat or hopsack, as well as in the four- and six-end twills in which they are respectively developed. These forms of pattern also obtain in stripes and checks. No great contrast of colours is called for in their execution, as they are effective in a textural sense. The difference between the effects of the two-and-two and the four-and-four, and the three-and-three and the six-and-six orders of colouring, is so pronounced as to make emphatic shade composition unnecessary. Colours of the same hue but of various depths are appropriate here. Another useful type of colour association for these schemes of grouping shades is illustrated below :—

I.

- A. $\left\{ \begin{array}{l} 2 \text{ threads of brown.} \\ 2 \text{ ,, ,, brown and} \\ \text{light brown twist.} \end{array} \right.$
- B. $\left\{ \begin{array}{l} 4 \text{ threads of brown.} \\ 4 \text{ ,, ,, brown and} \\ \text{light brown twist.} \end{array} \right.$

II.

- A. $\left\{ \begin{array}{l} 2 \text{ threads of light grey.} \\ 2 \text{ ,, ,, light grey} \\ \text{and white twist.} \end{array} \right.$
- B. $\left\{ \begin{array}{l} 4 \text{ threads of light grey.} \\ 4 \text{ ,, ,, light grey} \\ \text{and white.} \end{array} \right.$

Parts *A* and *B* may be repeated two, four, or six times, according to the size of pattern required. A very mellow sort of style results from this system of colouring. The surface of the texture is one uniform tint, slightly diversified with the twist yarns, which develop the details of the pattern, due to the method of grouping the threads. This species of colouring is soft in tone and artistic in composition, being equally applicable to wool, worsted, and cotton fabrics. In cottons, more pronounced colouring may also be adopted, such couplets of shades as follow being useful: brown and slate, pink and white, and deep blue and pale lavender.

The woven effects of Scheme IV. are given in figs. 66, 67, and 68. The weave employed in the production of these patterns is an eight-shaft twill running two threads down, one thread up, two threads down, and three threads up on each pick. Whatever twill were used, providing it flushed the warp and weft equally, the general aspect of the patterns would be as here illustrated. In order to afford as clear an insight into the principles of compound colourings as possible, the effect of changing the weft on the pattern resultant, when the system of warping is not varied, is also shown in these examples. All the three patterns have the same arrangement of warp yarns, but in fig. 66 the weft is white; in fig. 67, black; and in fig. 68 it is exactly like the warp. It will be obvious that in rich and choice shades this style would be materially improved. If, for example, the weft contrasted in hue with both the shades of warp yarns, quite a new type of effect would be

acquired. Supposing, for illustration, it were drab. Such an alteration would completely change the appearance of the fabric. Neither the black nor the white stripes would be solid, but the former would be half black and half drab, and the latter half white and half drab—yielding a useful and neat species of dress or mantling texture. However the weft might be varied, the form of the pattern would remain the same—that is to say, it would always consist in

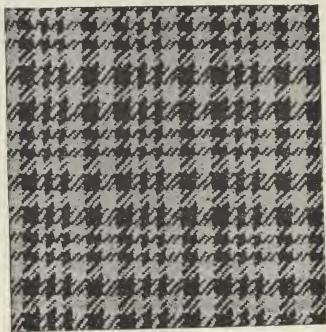


Fig. 68.

the stripes (figs. 66 and 67) of four broad lines and two narrow lines, and in the check (fig. 68) of sixteen large and sixteen small squares.

Considering that only two shades are used in this compound, the patterns it forms are remarkably full of textural detail. The series of effects it gives is put to useful purposes in textile designing. Even the stripes possess diversity of composition, and are characterized by neatness

and clearness of arrangement. Seeing that the shades used are black and white, the absence of bold and stiff outlines is an interesting feature, and one that recommends the base for extensive application in the development of fancy fabrics. In the check there is much variety of work. In addition to the solid squares of black and white of two sizes, there are rectangles composed of twills of black and white blended, of several dimensions and shapes. The system on which the respective checks mingle and interlace enhances the elegance of the style, and imparts to it a mellow and neatly-toned cast.

148. *Patterns composed of Two Types and Three Shades.*—Scheme I. of Class A of the Regular Compounds, in the

styles composed of three colours and of two simple types, gives somewhat mellow and subdued effects. The patterns sketched in figs. 69 and 70 illustrate the



Fig. 69.

style of design arrangement resultant when this method of colour-grouping is adopted. The stripe pattern has a particularly mingled appearance. Parts *A* of both the check and the stripe are composed of minute work, which neatly contrasts with the broader and more distinctly pronounced effects comprised in Section *B*. The patterns have a softer aspect and tone than if only two shades had been employed, the third shade adding the diversity of colouring and freshness of the style. Fig. 69 is woven with a white weft, and fig. 70 with exactly the same order of weft as warp shades. The two simple schemes, forming this compound, work harmoniously together. The three-odd thread grouping, constituting the *A* sections of the fabrics, yields a species of textural effect which affords prominence to the small spaces of black, grey, and white composing parts *B*. There is in

these samples congruity of effects. This is one of the main elements of a well-arranged compound. It is an invariable condition of all descriptions of designing that the forms amalgamated, if the result is pleasing to the eye, help to suitably develop each other, and yield in unison a well-balanced and effective scheme of ornamentation. Even in the smallest textural effects, resulting from combining various systems of shade-arrangement, this principle of design has to be taken into account. For example, the check style given in fig. 73 would not form a satisfactory pattern if combined with the check furnished in fig. 70.

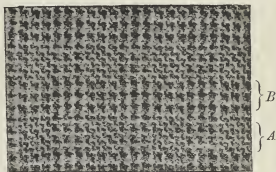


Fig. 70.

This is all the more remarkable, because both styles are composed of similar arrangements of shades, and have precisely the same colour constituents. The character of the respective checkings is, however, very different. In fig. 73 the patches of colours are so grouped as to yield a broad and clearly-pronounced series of effects, whereas fig. 70 is a compound of various minute types of woven design; hence the incongruity which would ensue from their amalgamation. The elements of figs. 69 and 70 are, on the other hand, exceptionally suitable for combination. Examine the stripe first, which possesses much neatness and yet force of arrangement. It is a style that may be

utilized in various ways. Should, for instance, bands *A* and *B* be varied in width, a range of useful patterns for dress and mantling textiles may be produced. Thus, stripes averaging from two to four inches in width, in mellow shades of twist or self-coloured yarns arranged on this system, are, by reason of their elegance of tone and aspect, developed largely in worsted, woollen, and cotton materials.

In the check, fig. 70, the fullest development of this compound scheme of colouring is shown. Practically it is made up of the two types lettered *A* and *B*. It is a style which is equally effective and pleasing in the piece as in the small sample. Diversity of composition and mellow intermingling of shades are its distinguishing elements. This pattern has a general application. In tweed yarns and comparatively coarse setting it is a scheme which yields a useful range of woollen mantling effects; in fine setting and small yarns, but clear and fresh colours, it produces interesting dress styles; while it may also be employed in the construction of suiting patterns. Several groups of shades are given below illustrative of the type of colouring appropriate for the respective textures named.

I. MANTLINGS.

Example A.

For 12 threads.	{	1 thread of drab.
		1 " " light brown.
		1 " " brown.
For 24 threads.	{	2 threads of drab.
		2 " " light brown.
		2 " " brown.

Example B.

For 12 threads.	{	1 thread of light olive.
		1 " " slate.
		1 " " mid blue.

For 12 threads. $\left\{ \begin{array}{l} 2 \text{ threads of light olive.} \\ 2 \text{ " " slate.} \\ 2 \text{ " " mid blue.} \end{array} \right.$

II. DRESSES.

Example C.

For 24 threads. $\left\{ \begin{array}{l} 1 \text{ thread of white.} \\ 1 \text{ " " lilac (Tint 16, Plate VI.).} \\ 1 \text{ " " olive (Shade 9, Plate VI.).} \end{array} \right.$

For 48 threads. $\left\{ \begin{array}{l} 2 \text{ threads of white.} \\ 2 \text{ " " lilac (Tint 16, Plate VI.).} \\ 2 \text{ " " olive (Shade 9, Plate VI.).} \end{array} \right.$

Example D.

For 24 threads. $\left\{ \begin{array}{l} 1 \text{ thread of yellow olive (Tint 10, Plate VI.).} \\ 1 \text{ " " light blue (Tint 11, Plate III.).} \\ 1 \text{ " " olive (Shade 8, Plate II.).} \end{array} \right.$

For 48 threads. $\left\{ \begin{array}{l} 2 \text{ threads of yellow olive (Tint 10, Plate VI.).} \\ 2 \text{ " " light blue (Tint 11, Plate III.).} \\ 2 \text{ " " olive (Shade 8, Plate II.).} \end{array} \right.$

Example E.

For 6 threads. $\left\{ \begin{array}{l} 1 \text{ thread of light brown (No. 3, Plate III.).} \\ 1 \text{ " " mid " (No. 2, Plate III.).} \\ 1 \text{ " " dark " (No. 1, Plate III.).} \end{array} \right.$

For 12 threads. $\left\{ \begin{array}{l} 2 \text{ threads of light brown (No. 3, Plate III.).} \\ 2 \text{ " " mid " (No. 2, Plate III.).} \\ 2 \text{ " " dark " (No. 1, Plate III.).} \end{array} \right.$

Example F.

For 6 threads. $\left\{ \begin{array}{l} 1 \text{ thread of brown and white twist (No. 3,} \\ \text{Plate III.).} \\ 1 \text{ thread of blue and white twist (No. 9,} \\ \text{Plate III.).} \\ 1 \text{ thread of olive and white twist (No. 15,} \\ \text{Plate III.).} \end{array} \right.$

For 12 threads. $\left\{ \begin{array}{l} 2 \text{ threads of brown and white twist.} \\ 2 \text{ " " blue and white " "} \\ 2 \text{ " " olive green and white twist.} \end{array} \right.$

On looking over these colourings, it will be observed that in the Dresses (Examples *C* and *D*) the brightest colours are combined, and the largest patterns are arranged for. Thus, one repeat of the style here contains seventy-two threads, but in the Mantlings thirty-six threads, and in the Suitings only eighteen threads. About twelve skeins yarns should be used for the mantlings, and some forty-four threads to the inch. The dress styles are workable in wool, worsted, and cotton. Suitable counts of yarns for Examples *C* and *D* are forty skeins wool with fifty-six threads to the inch; two-fold sixty's worsted with sixty threads to the inch; and forty's cotton twist with eighty threads to the inch. For the suitings twenty-two skeins yarns in woollens

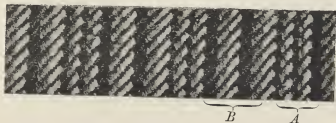


Fig. 71.

and two-fold thirty-six's worsted are the most suitable—forty-eight and sixty-four threads to the inch being adopted for the respective yarns. In furnishing these particulars it has been assumed that the weave is a common twill.

The II. and IV. Schemes of the styles in three shades of Class A (see Table of Compounds) are not illustrated. The former style is most frequently worked in six-shaft weaves, and the latter in four and eight-shaft makes. On account of the colours being grouped in larger quantities than in Scheme I. just described, they give patterns of a broader and more effective character. They are used for similar classes of textiles as those to which Scheme I. is applicable, being selected when styles composed of well-emphasized types of textural work are required. Should

thick yarns be used, they give an excellent form of pattern for travelling rugs, shawls, and wraps.

Coming to the III. Scheme of these styles consisting of three shades and of two simple types, it is illustrated in the three patterns supplied in figs. 71, 72, and 73. A more attractive and interesting system of grouping shades it is scarcely feasible to construct. The patterns are twice the size of Scheme III., that is to say, they contain fifty-four instead of twenty-seven threads, as given in the Table of Compounds, for Sections *A* and *B* in producing the fabrics have both been repeated. Types *A* and *B* here combined evidently work well together, and form a species of pattern which on various grounds may be carefully dissected.



Fig. 72.

Firstly, contrast the effect obtained in fig 71 with the effect obtained in fig. 72. The arrangement of shades in the warp is the same as supplied in the table in both styles; but in the former the weft is black and in the latter white. Had a blue shade of weft yarn been employed, or any colour which would have formed an equal weight of contrast with the black, grey, and white elements of the patterns, a species of design comprising increased diversification of effects would have resulted; or, had fancy colours instead of neutral shades been combined, a more elaborate type of colouring would have been produced. But to revert to the contrast of style due to changing the weft shade. How marked it is, and how forcibly it illustrates the importance of employing the proper shade of filling for developing

the various elements of coloured styles of some intricacy of shade-assortment. Each example is applicable to the dress and mantling branches of weaving, while in certain shades capable of yielding subdued and toned effects, they have a province in the production of trousering patterns. For dresses, Sections *A* and *B* require to be increased in width in order to give more character and breadth of effect to the colourings.

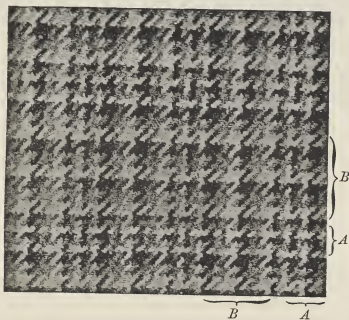


Fig. 73.

Fig. 73, which is composed of the same warp yarns as the two preceding combinations, and woven with a similar order of weft as warp colouring, is literally full of textural types, and possesses a unique richness of composition. It comprises a most effective plan of arranging shades. The letters on the respective patterns enable the reader to trace the same group of shades through the several effects they are capable of forming according to the system of wefting practised. Thus, in fig. 71, the black lines in parts *A* and *B* are quite

solid, and the white and grey effects broken, being crossed with black; in fig. 72 the white lines are clear, and the grey and black mingle with white; but in fig. 73 Sections *A* and *B* each contain rectangular spaces of various sizes and shapes of black, grey, and white yarns. These blend and interlace with each other on a unique and pleasing method. Part *A* of this style, being composed of the three-threes' system of grouping colours, consists of a smaller series of effects than Part *B*, which results from the three-sixes' plan of combining shades. As loudness and rigidity of style do not enter into the composition of this pattern, it has a wide application. The dimensions of each section are varied according to the description of fabric in which it is developed.



Fig. 74.

149. *Styles of Four Shades containing Two Simple Types.*
 —Four examples are given in these styles in the table on page 234. They do not form patterns so rich in mingled effects as the preceding set of compounds. This arises from their occupying an even number of threads, and constituting, as a consequence, a more regular and set description of pattern. Schemes I., II., and IV. are not illustrated, but they produce a similar species of style to that resulting from Scheme III. given in figs. 74, 75, and 76. Indeed, these types considerably resemble each other in outline and textural detail. The only difference consists in the sizes of the effects produced. This is not the case in Schemes I. and II. of the Styles in Three Shades, in which Parts *A*

are composed of an odd and Parts *B* of an even number of ends. When the composition of the two types amalgamated is thus dissimilar, the resultant compound is much fuller of effects than if the two simple colourings both comprised an even number of threads. By, however, resorting to the use of fancy weaves, the textural appearance of the patterns referred to may be considerably diversified.

Figs. 74, 75, and 76 have been acquired in the cassimere twill by repeating *A* and *B* of Scheme III. of the Styles of Four Shades in Class A. In fig. 74 the weft yarn is black; in fig. 75, white; and in fig. 76 it is exactly the same as the warp. By using grey and light grey wefts respectively, other stripes may be obtained. A contrasting shade of weft



Fig. 75.

also yields a valuable class of effects. Both figs. 74 and 75 are bases extensively employed in various kinds of wool, worsted, and cotton textures. Fig. 76 is particularly neat and fresh, and is suitable for both ladies' and gentlemen's garments. The black weft somewhat destroys the effect of the warp shades, hence brown, blue, or olive would be more suitable. As to the check, it is regular and stiff in arrangement. It is a common base, and is employed in larger or smaller forms in the construction of dress and other fabrics. Where set effects are required this arrangement is a most valuable one. Its advantages are great in the construction of check and stripe styles rigid in outline and general detail.

150. *Styles composed of Three Simple Types* (see Table

of Compounds).—As pointed out in reference to fig. 65, which results from the adoption of Scheme I. of Class B (see page 230), when three elements of simple colourings are combined a pattern is acquired rich in diversity of textural work. This is very forcibly made apparent by the example. Composed solely of black and white yarns, it is an admirable specimen of the diversity of style obtain-

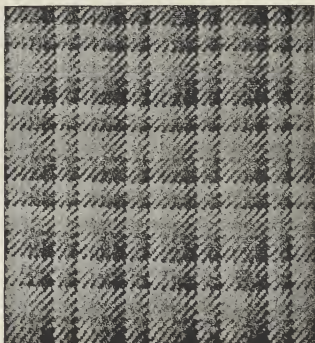


Fig. 76.

able with two shades in compound patterns. It follows that if the multiplicity of the shades employed is increased that designs richer in character and mellow in tone will be producible. If figs. 77, 78, and 79, which have been woven from the arrangement of shades supplied in Scheme II. of Class B, are examined, it will be noticed that though the number of effects corresponds with that of fig. 65, yet the addition of the grey tint has produced quite a dif-

ferent form of style. Figs. 77 and 78 have been woven with black and white weft respectively. They are composed of three types of work, comprising minute effects in *A*, somewhat larger effects in *B*, and still broader details in *C*. The patterns have a partially shaded aspect. As bases of colouring they are excellent. The three effects each contains may be combined in various ways, giving stripes of suitable proportions for dresses, mantlings, and trouserings, according to the class of materials employed. A few examples in colouring this base are appended. Any one of the three shades of which they are severally composed may be used for weft.



A *B* *C*
Fig. 77.



A *B* *C*
Fig. 78.

I. Example.

For 6 threads. $\left\{ \begin{array}{l} 1 \text{ thread of brown (No. 1, Plate III.).} \\ 1 \text{ " " blue (No. 7, Plate III.).} \\ 1 \text{ " " olive (No. 13, Plate III.).} \end{array} \right.$

For	}	2 threads of brown.
12 threads.		2 " " blue.
		2 " " olive.
For	}	3 threads of brown.
18 threads.		3 " " blue.
		3 " " olive.

II. Example.

For	}	1 thread of olive (No. 9, Plate VI.) and white twist.
6 threads.		1 " " blue (No. 9, Plate III.) and white twist.
		1 " " slate and white twist.
For	}	2 threads of olive and white twist.
12 threads.		2 " " blue and white "
		2 " " slate and white "
For	}	3 threads of olive and white twist.
18 threads.		3 " " blue and white "
		3 " " slate and white "

III. Example.

For	}	1 thread of light blue (No. 10, Plate III.).
12 threads.		1 " " rose (No. 4, Plate III.).
		1 " " white.
For	}	2 threads of light blue.
12 threads.		2 " " rose.
		2 " " white.
For	}	3 threads of light blue.
36 threads.		3 " " rose.
		3 " " white.

IV. Example.

For	}	1 thread of russet (No. 7, Plate II.).
12 threads.		1 " " olive (No. 8, Plate II.).
		1 " " slatish purple (No. 14, Plate VI.).
For	}	2 threads of russet.
12 threads.		2 " " olive.
		2 " " slatish purple.

For $\left\{ \begin{array}{l} 3 \text{ threads of russet.} \\ 3 \text{ " " olive.} \\ 3 \text{ " " slatish purple.} \end{array} \right.$
 18 threads.

The I. and II. Examples are for suitings—one for dark and the other for light fabrics. These may be produced in either woollen or worsted yarns. Example III. is for dress fabrics. Bright and cheerful colours are combined here. The two smaller types of work of which it is composed

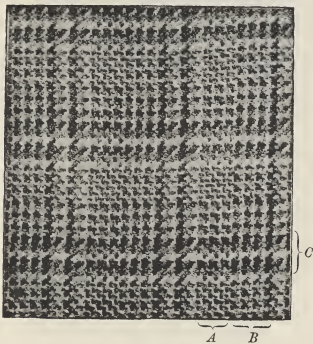


Fig. 79.

form the same size of section in the texture; but the arrangement of the three 3's yields a section half as large again as that formed by the other elements of the style. A bold and clearly-defined pattern is as a consequence produced by this plan of grouping.

Example IV. is intended for mantlings, and is composed of shades of a medium depth and intensity. It gives a mellow and harmonious combination.

The check, fig. 79, is specially interesting. It contains nine species of work, well grouped and arranged. The two types *A* and *B* are just sufficiently emphasized to contribute to the neatness of the style, while the series of effects comprised in Bracket *C* give a distinct strength of outline. This check is workable in the colourings supplied for the stripes.



Fig. 80.

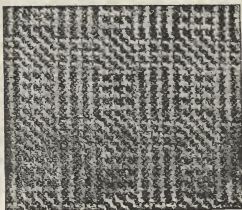


Fig. 81.

It is unnecessary to illustrate Schemes III. and IV. of Class B of the table, which yield similar species of patterns to those just described, though there is considerable dissimilarity traceable in the types of work making the respective patterns. Thus, the detail of Scheme III. is richer in contrast than Scheme II., and Scheme IV. yields a broader description of effects still. The cast and arrange-

ment of the styles is the feature in which the schemes resemble each other.

151. *Irregular Compounds* (see Table of Compounds).—Styles of this class are generally quite mingled in colouring. They are composed of such methods of grouping threads as comprise various quantities of the different colours used. Thus, in Scheme I. of the Irregular Compounds, there are twice as many threads of black as white in both sections *A* and *B*; in Scheme II. the black again predominates; while in Scheme IV. the several shades all occur in distinct quantities. Herein consists the dissimilarity between Irregular and Regular Compounds—whereas the former result from combining Irregular Simple types, the latter are composed of Regular types. Scheme III. is a special class of compound. In Part *A* there is an excess of black, but in Part *B* an excess of grey. This species of pattern is therefore obtained by taking a simple base, in which one shade is in excess, and repeating it for a suitable number of threads, and then reversing the positions of the shades. The following examples of this system of compounding elementary schemes of colouring may be considered in addition to that supplied in Scheme III. of the table:—

Example I.

A.	18 threads.	For	}	4 threads of black.
				2 " " brown.
B.	18 threads.	For	}	2 threads of black.
				4 " " brown.

Example II.

A.	16 threads.	For	}	4 threads of brown.
				2 " " slate.
				2 " " blue.
B.	16 threads.	For	}	4 threads of slate.
				2 " " blue.
				2 " " brown.

$$C. \quad \text{For } 16 \text{ threads. } \left\{ \begin{array}{l} 4 \text{ threads of blue.} \\ 2 \text{ " " brown.} \\ 2 \text{ " " slate.} \end{array} \right.$$

In the *A* section of Example I. black is the principal and brown the secondary shade, but in the *B* section the positions of the colours are reversed. Such a method of colouring frequently yields very attractive and unique styles. This scheme in the four-shaft mat produces a two-fold effect. Section *A*, when this colouring is worked in this make, forms a black ground on which small lines of brown are set at right angles to each other, but Section *B* gives a brown ground with a similar series of black lines. The style is produced in both wool and cotton materials in the plain, twill, and mat weaves.

Example II. illustrates the method of changing the positions of the shades when three colours are employed in this class of compounds. No perfect style can be obtained on this system unless each colour occupies every possible position in the repeat of the pattern. Reference to this example will make this point evident. Here three colours—brown, slate, and blue—are combined. In Part *A* the brown leads, in Part *B* the slate leads, and in Part *C* the blue. Each colour leads, each occupies the central position, and each takes the last of the set in its proper turn. Even distribution of colouring is thus secured, and the production of a pattern in which uniformity of effects is paramount is effected. The principle of the compounds illustrated by these examples affords considerable scope for ingenious arrangement of colours.

Two of the Irregular Compounds given in the table are illustrated by sketches of woven samples, namely, Schemes I. and IV. Figs. 80 and 81 have been produced by Scheme I.,—Section *A* being repeated to 18, and Section *B* to 24 threads. As this style is only composed of two shades, the textural result is somewhat wanting in

variety of effect. Still, it is a useful base. Both the stripe and check arrangements are frequently developed in wool



Fig. 82.

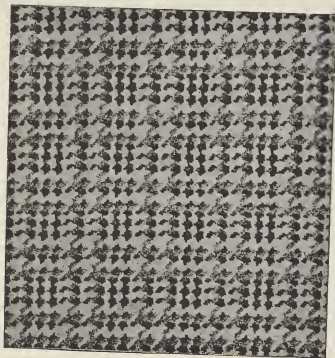


Fig. 83.

and worsted yarns. The check pattern is a compound of three effects, consisting of the spaces of vertical lines of black and white, of the parts of intermingled work lettered

B, and of the segments of minute twilled work. In such couplets of shades as brown and drab, blue and slate, and olive and slate and white twist, neater patterns may be obtained by this base than are producible in black and white.

Scheme II. of the table gives even more mingled styles than those resulting from Scheme I. It also possesses one peculiarity. It is a composition of a Regular and of an Irregular type; for grouping *A* is the simplest scheme of textile colouring, but grouping *B*, containing three elements of black to one element of white, is an Irregular base. This arrangement is extended and worked out in a considerable diversity of weaves. Scheme IV. is also constructed on this system. Part *B*, in this instance, is composed of the Regular elementary type, and Part *A* of the Irregular type. The class of patterns it yields is illustrated in figs. 82 and 83. The former of these styles has been woven with black weft, and the latter with the same shades of weft as warp. Part *A* has been repeated to twenty-four, and Part *B* to twelve threads. More decided patterns generally result from combining Irregular and Regular types, than from combining two or more systems of each of these representative schemes of textile colouring. In the check pattern under consideration the Irregular type constitutes broad rectangular spaces of white, grey, and black, which surround a series of small black and white checks. An endless diversity of shades and tints may be practised here, and the base modified and utilized in the construction of fancy fabrics of various descriptions.

CHAPTER IX.

FANCY SHADES APPLIED TO SPECIAL DESIGNS.

152. Colour applied to Special Makes—153. Colouring of Corkscrews—154. Modified Corkscrews—155. Fancy Woollen Weaves—156. Granite Effects—157. Diagonals—158. Diagonals composed of Plain and Double Plain Makes—159. Stripe and Check Colourings on Diagonals—160. Methods of Colouring Fancy Weaves for Cottons—161. Gauze Textures—162. Systems of Colouring Gauzes—163. Imitation or Mock Gauzes—164. Colour in relation to Rib Styles.

152. *Colour applied to Special Makes of Cloth.*—Having examined the various schemes of grouping shades in relation to the elementary order of weaves, and also the methods of combining colours in both warp and weft, analysis may next be made of the principles of textile colouring for the development of specific woven effects. Here it may be an adaptation or an invention of a scheme of shades—the construction of the weave being the principal modifying factor. It is not now a matter of the origination of a system of colouring, irrespective of any particular type of weave, but a question of employing that assortment and plan of colours which will prove most effective in a certain design. The build of the fabric, the method of intertexture, and the weave, are here fixed factors; and it becomes a problem of what grouping of fancy threads will yield the most satisfactory style and best emphasize the already attractive elements of the cloth. Designs or crossings requiring such methods of colouring are invariably both novel and unique in cast. All weaves employed in developing colour effects

in simple fabrics belong to one of the orders of crossings given below :—

- I. Weaves in which there is a preponderance of warp.
- II. Weaves in which there is a preponderance of weft.
- III. Weaves in which the warp and weft effects are equally pronounced.

The I. class of weaves, which may be termed warp effects, includes corkscrews, sateens, buckskins, certain species of diagonals, and twilled mats ; the II. class—weft weaves—is not so comprehensive, being composed mainly of ribs or cords, twills and small diagonals. A very extensive series of fancy makes of various types is found in the III. class.

But in addition to these important orders of intertexture, practised in the construction of single-make fabrics requiring special plans of colouring, there are some kinds of backed and double weaves that are so unique in build as to need exceptional treatment in a colour sense. This, however, is not so largely the case in backed as in double-make cloths. Backed textiles, and also some types of double textures, such as trouserings, coatings, and simple effects in mantlings, are practically coloured on the same principles as single cloths. The under surface of these builds of woven styles is occasionally distinctive in shade-arrangement, but the face generally corresponds in scheme of colouring to single-make textures. In the combinations of double weaves the exceptions to this method occur. Double-plain fabrics, for example, are coloured on quite distinct principles from any other description of loom products. The double-plain weave is adapted to the development of a specific range of patterns due to the utility of a formula of colouring only applicable to its structure. Some other types of double weaves, which will afterwards be specified, have also their peculiar orders of shades.

153. *Colouring of Corkscrews.*—As corkscrews form one of the principal species of warp weaves, the application of

colours to their construction may be primarily considered. The methods of colouring adopted here relate collaterally to other weaves in which the warp effect is the most clearly developed on the face of the fabric. Corkscrews lend themselves admirably to several orders of warp colouring. Fancy shades are forcibly distinguished when introduced into the warp of textures in which they are used. They acquire a peculiar conspicuity, which makes strong contrasts and high colourings in the warp unnecessary. But while the build of these makes thus affords ample provision for elaborate and various methods of tinting in the warp, it effectually neutralizes the effects of weft colouring. This might be changed from black to dark blue in the common corkscrew without the character of the face of the fabric undergoing any perceptible modification in hue. If, for example, the warp and weft were in such a weave twelve threads of brown and twelve threads of blue, a stripe, and not a check, pattern would result. Of course in a common twill this colouring would yield a perfect check. There are two reasons why in the corkscrew such a scheme of shades forms a stripe—first, because textures composed of this class of weaves possess a warp face; and second, because they, if properly made, contain a larger proportion of warp than weft threads to the inch; hence the weft yarns are almost entirely concealed by the warp. On these grounds it will be obvious that variety of pattern in these weaves, when due to colouring, is a product of warp tinting. To the typical methods, therefore, of grouping fancy shades in the warp for corkscrew and kindred weaves attention has mainly to be directed. In such instances the weft is simply the factor which binds the threads together, and produces or builds, in conjunction with the warp yarns, the fabric; and hence it only to a small degree affects the style of the



Fig. 84.

pattern resultant, and consequently it is a minor consideration in producing the design.

A pattern illustrative of two of the commonest methods of colouring applied to all kinds of corkscrews is furnished in fig. 84. This style is a combination of three effects, viz., of the bands of solid colour, of the stripes *A*, and of the stripes *B*. The textural types seen in the lettered sections are due to two distinct but simple schemes of grouping shades, namely, the one-and-one and the two-and-one systems. They frequently occur in this weave, giving neat effects. The plan of warp colouring is as appended:—

		18 threads of black worsted.
<i>A.</i>	For	1 thread of white silk.
	9 threads.	1 „ „ black worsted.
		17 threads of black „
<i>B.</i>	For	1 thread of white „
	10 threads.	2 threads of blue „

Should part *A* be modified thus:—1 thread of white and 1 thread of black for six threads; 1 thread of white and 1 thread of crimson for six threads; and 1 thread of white and 1 thread of black for six threads—a very different style would ensue. Section *A* would, in this arrangement, consist of two small stripes of twills of black and white separated by a minute band of fine twills of crimson and white. This plan of grouping shades is very extensively practised. Another alteration of this base, which is also frequently adopted, is as follows:—

		9 threads of black.
		9 „ „ brown.
		9 „ „ black.
<i>A.</i>	For	1 thread of brown.
	27 threads.	1 „ „ black.
		9 threads of black.

- B. For { 1 thread of tan silk.
6 threads. { 1 ,, ,, black.
- C. For { 1 thread of slate silk.
6 threads. { 1 ,, ,, black.
- D. For { 1 thread of tan silk.
6 threads. { 1 ,, ,, black.

On analyzing this group of shades it will be evident that it comprises several elements. First, there are the three nine-thread stripes, viz., black, brown, and black. These are succeeded by stripe *A*, composed of twills of black and brown. Between this part and Sections *B*, *C*, and *D* there is another series of nine threads of black. Coming to the

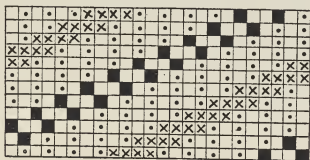


Fig. 85.

last three groups, they are interesting, inasmuch as the black yarns alternate with both the tan and slate silk in succession—an arrangement which tends to mellow the effect of the bright hues here employed. Of course the numbers of threads in the several sections of this pattern of warp are arbitrary, and, in practice, may be varied according to the dimensions of the style required.

154. *Modified Corkscrews*.—In order to obtain a weft effect in corkscrews, the weaves are altered in the principles of construction. Take an example. The weave supplied in fig. 85 is in reality a corkscrew, for should the cross characters be erased and the square characters added, the

weave, though occupying twenty-four threads,—which is not a number on which this type of weave is usually constructed,—would possess the main features of this description of twill. But the weave must now be considered as being composed of the round dots and crosses only—the square marks corresponding to the blanks. The thread-and-thread scheme of warping in this modified corkscrew has a very different effect from what it has in the common corkscrew. Taking the shades to be brown and slate, and the weft blue, a pattern containing four species of work results. First, there are the two fine twills of the respective shades of warp yarn ; and, second, a furrow of intermingled colouring, due to the solid floats of warp in the design. These effects are purely warp products. In addition to these, a fine diagonal of blue, resulting from the flushes of weft, is also formed, so that an alteration of this kind in the corkscrew system of twilling considerably increases the diversity of work producible by a simple arrangement of shades.

Another very useful style might be developed in this crossing (fig. 85) by warping nine threads of a dark and three threads of a light shade of yarn, and by weaving with a medium colour of weft. Supposing the shades to be black and white for warp, and drab for weft, then a pattern consisting of a series of furrows of



Fig. 86.

black interrupted by small effects of white, arranged on a drab surface, would result.

In fig. 86 is given the effect of twilling this make, fig. 85, to the right and left alternately, when the thread-and-thread system of warping is adopted, and when the weft is all one colour. If the ordinary build of corkscrew had been employed, the diagonal of black and white would only

have been produced. The grey twills are distinctly a weft development, and result from the marks of a cross character in the weave. This and the preceding examples are but types of the styles producible, by modifying this most useful weave, in worsted fabrics of a fine trousering and coating class.

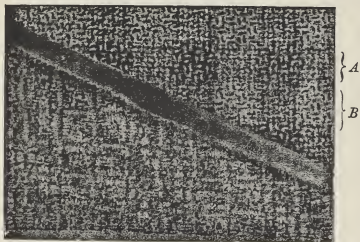


Fig. 87.

155. *Fancy Woollen Weaves*.—There is not a large diversity of weaves employed in the construction of woollen fabrics; still there are some crossings used in these goods which require specific colouring. Occasionally some ingenious and novel patterns are produced by using makes which are tinted on principles harmonizing with their scheme of interlacing. Such an example is furnished in the upper section of fig. 87. Quite a unique combination of textural effects has here been obtained by resorting to the employment of an uncommon weave. (See

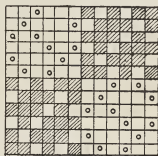


Fig. 88.

fig. 88.) The scheme of colouring for this style belongs to the elementary class, being as follows in both warp and weft :—

	For	{	1 thread of black.
A.	24	{	1 „ „ grey.
	threads.	{	1 „ „ black.
	For	{	1 thread of grey.
B.	24	{	1 „ „ black.
	threads.	{	1 „ „ grey.

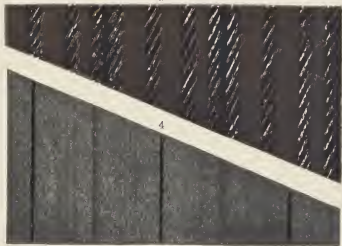
Hence it is the weave which has given the novelty of cast to the pattern. In a simple twill it would yield an ordinary style, but in this weave (fig. 88) it forms a series of minute and rare textural effects. The weave is evidently of a check type, and is workable on twelve shafts. In the sections marked in diagonal lines the weft floats on the surface of the texture, while in the sections marked in small circles the warp effect is clearly emphasized. Both warp and weft are equally prominent. But as the method of floating these threads groups the weft effects and the warp effects alternately, the result is a pattern possessing an assortment of minute markings of an interesting character. These are the product of three shades; this is a remarkable element of the style. If a plain twill or mat make had been used, this diversity of textural composition by such a limited assortment of shades and simple plan of shade-arrangement would not have been possible; so that it is obvious that new systems of weaving on a small and regular basis may be employed in woollen textures to advantage if novel patterns are required. The check characteristic of the style is due to the system of grouping the shades. Thus the plan of colouring is in two parts; in *A* black is the principal, and grey the secondary shade; and in *B* *vice versa*. By this means in some parts of the fabric a dark or black ground-work is figured with grey, and in others a grey surface is figured with black markings.



1



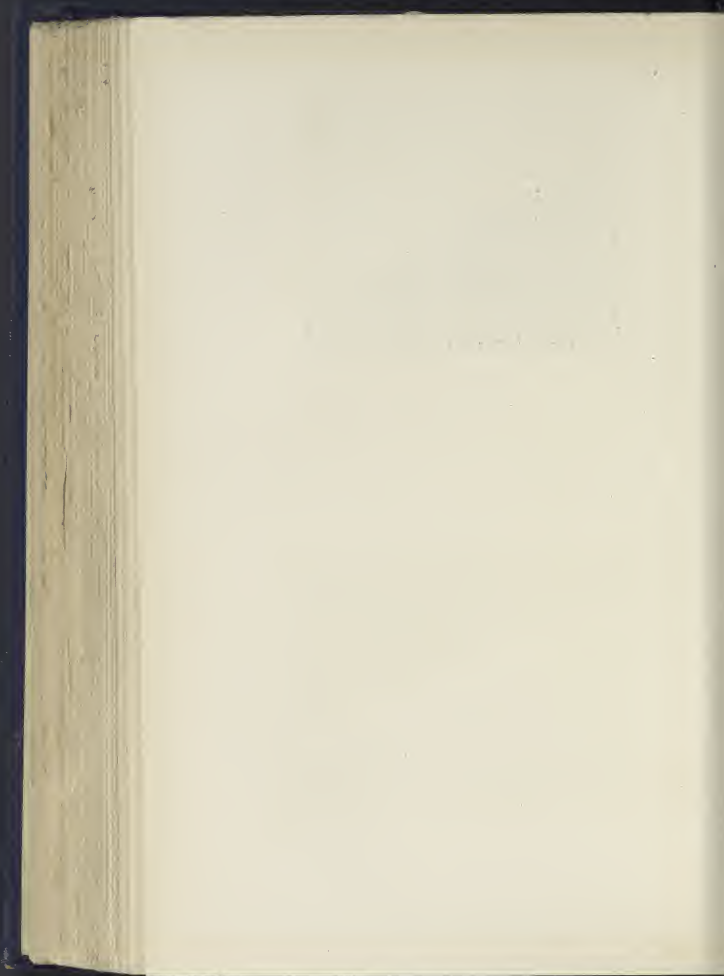
2



3

4

PLATE XIX.



The scheme of colouring here illustrated is applicable to worsted and cotton as well as to the woollen textures in which it has been developed. For the latter class of fabrics it is specially well adapted, because in these textures blended and intermingled effects are most appropriate.

A very different species of style is supplied in Nos. 1 and 2, in Plate XIX., to that just described. Its peculiar novelty of composition is, however, due to the use of an uncommon weave; this is of a fancy twill order, being arranged on the base of the following plan of interlacing, which is the first pick of the design: 3 threads up, 1 thread down, 3 threads up, 2 threads down, 2 threads up, 2 threads down, 1 thread up, 3 threads down, 1 thread up, 2 threads down, 2 threads up, and 2 threads down.

Had, for instance, the six-end twill been employed in its stead, the patterns resultant would have lacked that richness of style and novelty of colour-association by which they are characterized, and have possessed a plain and ordinary aspect. It may therefore be understood that even in woollen goods of a suiting and trousering class the weave may be arranged to contribute materially to the freshness of the styles obtainable from given methods of colouring. The scheme of shade-grouping in these samples is as appended:—

Part 1 (Plate XIX.).

4 threads of light drab.
2 " " olive brown.
2 " " brown.
4 " " black.
2 " " brown.
2 " " olive brown.

Part 2 (Plate XIX.).

4 threads of drab.
2 " " olive green.
2 " " dark brown.
4 " " blue.
2 " " dark brown.
2 " " olive green.

The order of the weft colouring for Pattern 1 is the same as the warp; but in Pattern 2 grey and slate take the place of drab and olive green. By varying the weftings numerous

modifications of these effects may be acquired. One rule should be observed in this work—the warp colourings should slightly preponderate. They should in no case be subordinated to the scheme of wefting, for it is rather a subsidiary than a primary element of this class of patterns.

The diagonal make utilized here being a composition of twills, each of which floats the warp and weft to a different degree on the face of the fabric, it yields a style composed of various effects and rich in textural work.

156. *Granite Effects*.—These are occasionally largely produced in woollen yarns, whose nature is admirably adapted to the construction of blended and intermingled styles. Patterns of this class may be due to the employment of special kinds of fancy yarns, or to the use of a peculiar type of weave in combination with a given order of threads. With these effects, as producible by novel yarns, there is no need to deal, as they have been treated of with the ordinary class of mixtures. Reference may therefore be made to the function of unique weaves in the production of granite and other blended styles. The pattern supplied in the lower section of fig. 87 is an admirable example of this species of weaving. Its interesting mottled aspect is mainly due to the construction of the design used and the order of colouring practised. The weave is given in fig. 89. It is an assortment of several crossings, such as warp and weft rib of various sizes, and of warp and weft prunelle twills. The order of colouring for both warping and wefting is thus :—

For 24 threads. { 1 thread of black.
 1 „ „ slatish lavender.
 2 threads of black.

For 6 threads. { 1 thread of black.
 1 „ „ slatish lavender.
 2 threads of black.

For 10 threads. { 1 thread of black.
 threads. { 1 ,, ,, slatish lavender.
 2 threads of black.

For 6 threads. { 1 thread of black.
 threads. { 1 ,, ,, slatish lavender.
 2 threads of black.

For 26 threads. { 1 thread of black.
 threads. { 1 ,, ,, slatish lavender.

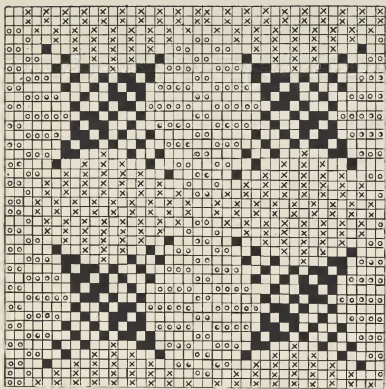


Fig. 89.

This scheme of threads, conjointly with the weave to which it is applied, cannot fail to give an intermingled pattern. Even if the weave were of a common class, the result of this set of shades would be a broken, irregular cast of style; but the design is exactly arranged on that base

which is most calculated to give a mixed distribution of shades. The warp and weft ribs which occur in the plan, are particularly useful weaves for mingling fancy shades, and so are the twilled makes employed. Add to these characteristics the arrangement of the design, which groups the several weaves into small figures of different forms. The style is workable in both worsted and woollen yarns, and in twists as well as self-colours. This assortment of weaves is uniquely appropriate for patterns in which mingled colouring, combined with a definite species of marking or textural form of effect, is required.

157. *Diagonals*.—As a rule, diagonals are but plainly coloured. Being usually complex in weave-construction, they do not require elaborate colouring; moreover, they are frequently of such a character as to yield intricate and interesting textural patterns in the simplest arrangements and contrasts of shades; there are, however, some notable exceptions. Certain important types can only be satisfactorily developed when specific colouring is practised. Some illustrations in these may be considered. First, suppose two corkscrews—flushing the warp and weft respectively—were combined in a diagonal pattern of medium size. This arrangement of crossings, if the yarns were grouped on the one-and-one method in both warp and weft, would form a style resembling that sketched in fig. 90. The warp corkscrew yields the effect seen in Band *A*, and the weft weave that seen in Band *B*. On analysing the effects observed in this illustration, it will be evident that by combining various makes on the diagonal base an important class of patterns may be produced. By arranging the bands of the diagonal in this example to run at a different angle from the twills of either the warp or weft corkscrew of which it is composed, an additional effect is obtained than would have been the case if they had moved in a line with the twills in either the *A* or *B* band. In the texture

the alternate twills—providing the shades were black and white—would be in different colours. Regarding the application of this principle of pattern development, it relates to all diagonals composed of two or more simple weaves. One of the commonest methods of applying colour to such designs is to adopt a simple scheme of shade-grouping, which

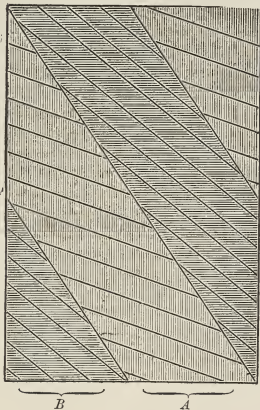


Fig. 90.

develops neat but contrasting effects in the several makes employed.

158. *Diagonal composed of Plain and Double Plain Makes.*—In fig. 91 is furnished a striking example of how simple schemes of colouring may be made to produce quite a diversity of effects running in a diagonal sense in the

fabric. This style has been developed by arranging the colours one thread of white and one thread of black, in the warping and wefting alike, and constructing the design on the base of the sixteen picks given in fig. 92. It is unnecessary to explain here how the several effects have resulted, as the principles involved in producing the types *A* and *B*, which are constituted of plain weave simply, are already understood; while the many varieties of patterns obtainable in the double-plain makes, forming Sections *C* and *D*, will require to be fully considered in a subsequent chapter. Still, it may be observed that in solid shades such a grouping of weaves would give but an indefinite pattern, one lacking character and marked precision of outline. The weaves employed in this example are the only ones which can be made to develop effects of this order. There are certain restrictions to their methods of combination. Figuring requiring large spaces of the double-plain makes is not feasible; these crossings are necessarily looser and opener in structure than the single weaves, and may therefore only be used in comparatively small quantities; moreover, the weaves may not be grouped in the stripe form, or the texture will not be satisfactory as to firmness and soundness, nor will it weave regularly. The very fact that the makes in the example run diagonally, equalizes the interlacing of the warp and weft, and ensures the construction of a uniformly-built fabric.

159. *Stripe and Check Colourings on Diagonals.*—Other methods of colouring weaves of a diagonal construction comprise the development of stripe and check effects, in neatly-toned shades, on their surface. Coatings, dresses, and, in bright colours, vestings, are all decorated with patterns of this order. It is necessary, in order to have the same weight of colouring in both warp and weft of such styles, to modify the design on those threads and picks on which the fancies occur. Unless this is done, the effect produced

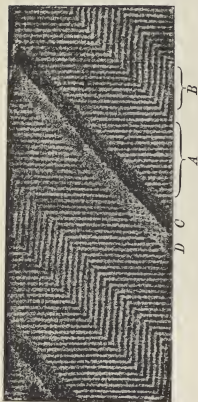


Fig. 91.

B
A
C
D

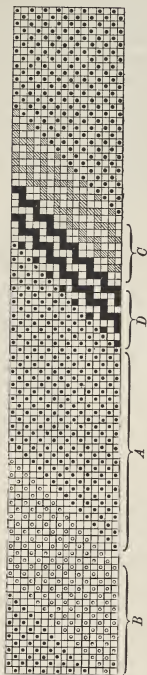


Fig. 92.

C
D
A
B

is irregular and imperfect. By, however, altering the design where these bright striping or checking shades are added, complete balance of colouring is acquired both across and lengthways of the fabric.

160. *Methods of Colouring Fancy Weaves for Cottons.*—Generally these require brighter and more cheerful combinations of shades than woollen or worsted fabrics, but the weaves, when of a similar construction to those used in the production of these textures, are coloured on similar principles. It is mostly in the selection of the shades where

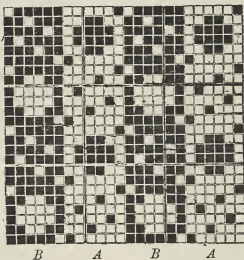


Fig. 93.

specific treatment is required. There are, however, some specially-constructed weaves employed in the manufacture of fancy cottons, and these have to be coloured according to their principles of arrangement and the type of pattern they are required to form.

Amongst these weaves small fancy effects, such as those illustrated in figs. 93 and 94, and leno and gauze combinations, are to be found. Reference may, in the first place, be made to figs. 93 and 94. The former is a striped pattern composed of two sateen weaves. The alternate bands have

warp- and weft-flushed grounds. On the weft-flushed surface a warp spot is formed, and on the warp-flushed surface a weft spot. A marked and well-emphasized contrast of effects is thus secured. The arrangement is an excellent one, and capable of numerous modifications. Section *B* might, for example, be repeated several times, or the whole design might be enlarged with good results. A third variation might be secured by converting the pattern into a check. A light warp and a medium shade of weft should be used. Supposing, for instance, the warp were

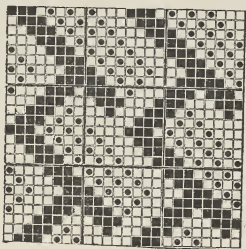


Fig. 94.

light blue and the weft medium blue, then stripe *A* would consist of light blue ornamented with small spots of mid blue, whereas stripe *B* would consist of mid blue mainly, with light blue spotting. This method of colouring is useful where the designs are arranged on a base of this character. Another plan of introducing fancy shades in such weaves involves the use of two shades in the warp—one for stripe *A* and another for stripe *B*. Taking these to be pink and white, and the weft a light slatish blue, a pattern of increased intricacy of colour composition would ensue.

Bands *A* would in this arrangement possess a white ground with a slatish-coloured spot, while bands *B* would have a pink spot and a slate ground.

One further method of varying styles of this kind deserves mentioning. Add to the design as here furnished a band of fancy twill, which should be elegantly coloured with bright yarns in the warp, but the sateen sections plainly tinted, in order to allow of clear and distinct development of the spotting.

The next weave, fig. 94, is of a more figured character than that just described; hence it requires more diversified schemes of colouring. In the woven texture it forms a species of serpentine pattern filled in with small figures of plain make. The warp and weft flushes compose similar figuring. Analysis of its composition shows that it comprises three varieties of crossings. First, there is the plain weave parts; second, the solid warp-flush figuring; and lastly, the wave effect formed by the solid floats of weft. It will therefore be perceived that it is a design containing considerable diversity of work. If the thread-and-thread system of colouring is adopted, an interesting woven effect results. Thus, assuming the colourings to be pale blue and light olive, the plain sections would consist of longitudinal stripes of these colours; the blank spaces in the weave would give warp floats of the same shades; and the solid floats of weft transverse but very diminutive lines of olive and blue. Should one colour of warp yarn be used—such as light drab, and a second colour for weft, tannish brown, for instance—quite a different species of style would be obtained. In this example a serpentine figure of light drab would be adjacent to a similar figure of tannish brown; the repetition of the two serpentines being intervened by simple oblong figures composed of plain weave, and hence of mixed colouring.

These styles, figs. 93 and 94, when coloured on the lines

indicated, are suitable for silk and mixed materials, as well as cotton textures, for which they have been specifically arranged.

161. *Gauze Textures*.—Gauze or leno effects are very different in structure and appearance from ordinary textile combinations. When amalgamated with the common methods of weaving, an extensive variety of useful and novel designs can be obtained. Compared with ordinary

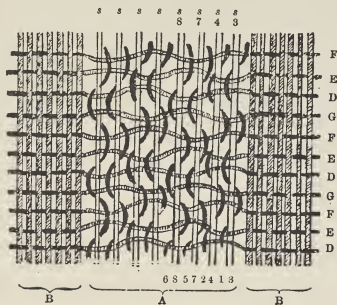


Fig. 95.

woven results they are what may be defined as porous or transparent in composition, or, more strictly speaking, they consist of infinitesimal compact and open spaces which regularly alternate. The dimensions of the perforations, and the intervals at which they occur, are determined by the weave used and the method of heading adopted. On examining a sample of these textures the threads appear to be drawn together in some sections in entangled meshes, and in others to be separated and apart. They scarcely

seem to possess any definite system of crossing, and have the appearance of a mass of threads which have been mixed and crossed beyond description, and yet evidence is not wanting in the structures, as a whole, of a well-defined scheme of interlacings having been practised in their production. Part *A* of fig. 95 will afford some idea of the mode in which the yarns twirl round, over, and under each other in succession in these fabrics. One feature of these goods is evident to all who anatomize their structural or architectural arrangement; the yarns of which they are composed are not, as in ordinary textures, laid in parallel lines, for they curve and twine in various ways. Note, for example, the crossings of threads 1 and 2 with 3 and 4 in section *A* of this illustration. The two former rise alternately on the right and left of the two latter. Further analysis will show that some of the threads—namely, those lettered *s*—are never drawn out of their positions. They alone preserve uniform fixedness of position, being always under the picks of weft and twined round by the whip yarns 1 and 2, 5 and 6, etc. These ends bear the same relation to the whip or twisting threads as the oak does to the mistletoe or the ivy. Being rigidly fixed they form a kind of a stem for the adjacent yarns to twine themselves round, and to which the latter may, in conjunction with the picks of weft, be fastly secured; hence, if one of these yarns is removed, the whole structure of the fabric is decomposed. The invariable rule in gauze weaving is for the whip threads to rise successively on both sides of the stationary ends; indeed, it is this series of movements which gives to the component yarns that sinuosity of aspect which characterizes all products of a leno description. In the first sample of fancy gauze supplied in fig. 95, two whip threads rise on the left and on the right of the ends *s* simultaneously, forming an intermingled, wavy, texture replete with minute vacancies. The picks are introduced at

such intervals as to be bound together in pairs, first by ends 1 and 2, thus: *D* and *E*, *F* and *G*, etc.; and, second, by ends 5 and 7, as follows: *E* and *F*, *G* and *D*, etc. The bending of the picks is due to this mode of coupling them together. When producing this elegant style, first arrange for a band or stripe, of about 1 inch in width, of the gauze effect *A*, and then for a band of $1\frac{1}{2}$ to 2 inches in width of plain, like those sections lettered *B* in the illustration. The weaving plan of this pattern is given in fig. 96, and

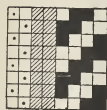


Fig. 96.



Fig. 98.

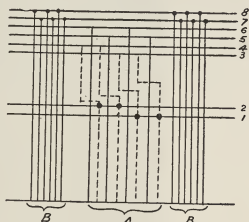


Fig. 97.

the healding draft in fig. 97. A word or two of explanation is necessary on the latter. Shafts 1 and 2 are the doupe heddles. In healding, the whip threads are first entered into shafts 3 or 4, then into shafts 1 or 2, as the case may be. It is necessary that these should be drawn underneath the stationary ends. When the doupe heddles rise, the whip ends are lifted on the right of the fixed threads, but when shafts 3 and 4 rise they are lifted on the left. The weave given in fig. 98 is a very appropriate modification of this style. This weave, in the same draft, gives the

stripes of plain unaltered, but those of leno are more pronounced in sinuosity, for four picks are in this case fastened together at each change of the whip threads. Numerous variations might also be wrought in the same method of healding, and by the same plan, by simply altering the dimensions of the respective stripes.

The style furnished in fig. 99 is of a different class from that sketched in fig. 95. Here the gauze yarns form a

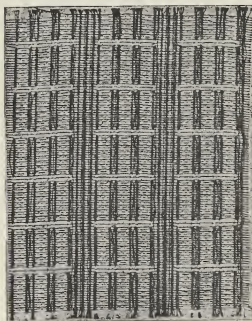


Fig. 99.

species of lozenge figure. For some sixteen picks they interweave regularly, and then they pass round four threads, being thereby drawn together by the picks, and at the same time made to prevent the shoots from being forced into contact with each other. It is thus that the porous features of the pattern are originated. Between each series of gauze effects in this illustration there is a band of twelve threads of fine cotton, not including extreme threads which,

conjointly with the whip yarns, form the considerable interstices at intervals. In heading for this style the doubling threads pass under four ends in succession, so that five threads are sleyed together in the gauze sections. In the plain parts, however, only four threads are entered into each reed, while a vacant split is allowed between the different sets of these yarns. This sample, like the preceding one, and that given in No. 2 on Plate XIX., illustrates the endless diversity of textural arrangement feasible in gauze products.

162. *Systems of Colouring Gauzes.* — The methods of colouring these patterns may be grouped under three heads, as follows:—

I. Gauze patterns in which colour is applied to those sections composed of the ordinary principles of intertexture only.

II. Gauze patterns in which colour is applied to the gauze parts only.

III. Gauze patterns coloured in both the ordinary and gauze sections.

Examples in each class may be considered. Primarily, then, it is feasible to apply colour to these styles on such a system as the gauze sections will be developed in one shade, while the adjoining effects may be coloured on any system applicable to single-make designs composed of simple weaves. Thus, taking fig. 95 as a design which it is required to colour by this method, then the weave of parts *B* being plain, any of the Simple or Compound Schemes of Colouring might be appropriated; or these parts might be coloured on a special system to form, for example, a shaded band of tints. If the colours used were pink and white, the maximum quantities of pink could approach the band of gauze effects, when the largest portion of white would fall in the centre of the plain stripe; or the shading might proceed from white at the edges to a pink central band.

Whether the first or the second arrangement is adopted, the stripe of gauze should be in white, and the weft also of this shade. Obviously the ordinary schemes of colouring are applicable to such sections as *B* of any gauze pattern. With some slight modification, or rather adaptation, they also relate to the leno or gauze portions of these styles. When it is requisite to introduce the fancy shades into the gauze proper, the structure of the fabric has to be taken into consideration. Fig. 99 is a sample of gauze in which the fancy yarn—white in this instance—is the thread which constitutes the gauze effect. By making it such, the character of the pattern has been clearly developed. It is only by an arrangement of this kind that the twisting of the gauze yarns can be prominently brought out. If the ground threads, round which the gauze twine, had been white, and the whip yarns black, the effect would not have been nearly so good. Hence it is advantageous in applying colours to these textures to make the twisting or whip threads into fancies.

Another important feature about the application of colour to gauze effects is that different materials and thicker yarns are frequently employed for the whip than for the ground ends of the fabric. This is the case in fig. 99, where the gauze threads are silk and several fold in thickness. The object of this contrast of materials and in sizes of yarns is to cause the gauze effects to appear prominent and distinct from the other characteristics of the pattern.

The third example in the colouring of these styles is furnished in No. 2 on Plate XIX. There are several textural principles here for analysis. The gauze sections are developed in three kinds of yarns. The variegated silk threads form the main element of the tinting. Such yarns are only used in the finest of these fabrics. They impart richness of tone and lustre to the whole effect. Next there are the thick threads of cotton forming the diamond-work in the gauze

parts. Intervening these stout yarns, and constituting the smaller interstices, the fine threads occur. These various yarns are effectively employed, and each is subsidiary to the other—the silks give the twisting, the stout threads the open gauze, and the fine threads the groundwork. As to the other sections of the style, these are composed of twill and plain. Fancy shades might be forcibly added to the twilled part, and so the pattern converted into a colouring of the third class.

In addition to these striped combinations, a limited range of checkings in gauze are obtained, while figured

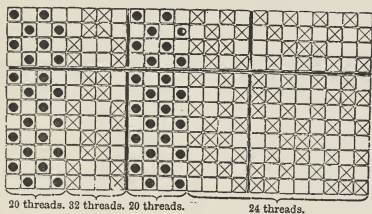


Fig. 100.

effects are produced in this scheme of weaving in a considerable diversity of tints.

163. *Imitation or Mock Gauzes.*—The somewhat intricate mounting required to produce gauze fabrics has led to numerous ingenious attempts to obtain a gauze effect in the texture without increasing the complication of the weaving process. One of the most important methods of accomplishing this is shown in fig. 100. The small weave in this design, marked in crosses, yields such a perfect imitation of gauze proper that its spurious structure is very difficult to detect. It is

only by careful analysis that one is able to trace its common principles of intertexture. The weave in crosses of this design so groups the threads and picks that they result in forming a fabric replete with diminutive perforations like the real gauze. It is used in combination with the plain weave and fancy makes in the origination of various descriptions of patterns. As a rule, the colourings are of a simple order, only a limited variety of shades being used. The stripe given in fig. 100 is colourable in the warp as follows:—

24	threads of light blue.
20	„ „ tan.
32	„ „ light blue.
20	„ „ tan.

The weft might be either light blue, tan, or a tint that would contrast with both the colours in the warp. Assuming it to be blue, the pattern resultant would consist of a stripe of mock gauze in solid blue, a stripe of plain in brown and blue neatly mingled, a stripe of hopsack in which the respective shades would form small diaper-work, and of a second stripe of plain weave of intermingled colouring. The novelty of these patterns is largely proportionate to the ingenuity exercised in varying the methods of combining the weaves and in the selection of new types of crossings; while the special function of the colourings is to develop the weave elements.

164. *Colours in relation to Rib Styles.*—The rib make of cloth is largely utilized in the construction of worsted trouser patterns. It is one of the neatest schemes of weaving that can be used for this purpose. Allowing, as it does, of considerable scope for both intricate colouring and designing, it enters into an extensive diversity of fancy fabrics. The rib principle admits of a peculiar type of colouring. Though two wefts may be employed in producing this class of design, only one of them appears on the face of the

fabric when forming the rib or cord effect. As a result of this, the cord may be variously coloured, and yet quite independently of the other sections of the style. Fig. 101, which is the plan of the rib style given in Pattern 4 on Plate XIX., illustrates the base on which such designs are arranged. Part A forms the cord. It is produced solely by the even picks. These, in weaving, come as close together as if the odd picks were not part of the construction. At the same time they float under the several sets of threads forming the other parts of the style. It is this speciality of arrangement which makes it feasible to develop the cord in any order of colours without modifying the pattern generally. Pattern 4, Plate XIX., shows the rib of a distinct shade. The method of colouring is as appended:—

Warp.

- 10 threads of brown.
- 10 " " brown and white twist.
- 6 threads of brown.
- 10 " " brown and white twist.
- 10 threads of brown.

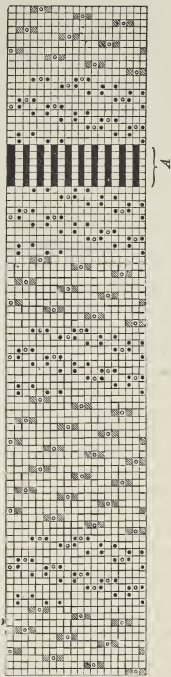


Fig. 101.

10 threads of brown and white twist.
 20 „ „ brown.
 10 „ „ brown and white twist.
 10 „ „ brown.

Weft.

1 pick of brown.
 1 „ „ black.

It is the black weft which forms the cord. Greater diversity of effect in this section of the fabric might have been acquired by wefting thus:—

For { 1 pick of brown.
 92 picks. { 1 „ „ black.
 For { 1 pick of brown.
 4 picks. { 1 „ „ silk.

In this scheme of wefting the rib is spotted with silk. Occasionally two colours of silk are employed, so that there is evidently some facility for fancy weft tinting in makes of this character. It is not necessary to enter into the details of the warp colouring, which depend largely on the weaves combined.

Pattern 5 of Plate XIX. is a rib of a different arrangement to that of the preceding sample. Its construction can be best explained by referring to the weave (fig. 102) used in its manufacture. Several sizes of ribs are here combined; and Bands *A* and *B* consist of four and two cords respectively. Now, it should be noted that where more than one rib constitutes any stripe, both the odd and even picks are utilized in forming the corded effect, and, as a consequence, it is no longer possible to have the whole of the rib stripes of a distinct shade from the rest of the design. If Band *A* only contained three ribs, the pick-and-pick method of colouring might be practised with advantage, because in such an arrangement the fine twill would start on the first pick of the design in both Sections *C* and *D*, admitting of the small ribs in *A* and of the large ribs

in *B* being of a different colour from the opposing cords and also from the twilled parts. But this order of wefting, if applied to the design given in fig. 102, would partially destroy the solidity and neatness of one of the twilled bands. Should the odd picks be selected for the fancy it would be stripe *C*, but should the even picks be selected it would be stripe *D* that would be modified by the additional shade of weft.

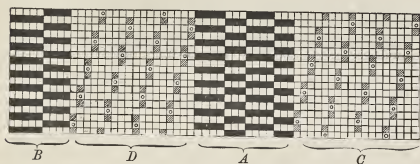


Fig. 102.

In the pattern given in No. 5 on Plate XIX. the shades are grouped in the warp as below:—

- 18 threads of slate mixture.
- 4 " " dark brown.
- 50 " " slate mixture.
- 4 " " russet.
- 28 " " slate mixture.

The colour of the weft is slate mixture.

It may be observed that as a rule weaves of a warp class are combined with corded effects, clearer patterns, comprising more forcible contrasts of textural work, resulting from the use of these than from employing crossings which flush a considerable proportion of weft yarn on the face of the fabric. Mellow and choice colouring is therefore increasingly important in the warp of these styles, because the yarns composing it float with comparatively few weft interruptions on the upper surface of the texture.

CHAPTER X.

COLOURING OF COMBINATION DESIGNS.

165. Principles of Colouring Weave-Combinations—166. Examples in Colouring Compound Designs—167. Main Points in applying Shades to Combinations of Crossings—168. Species of Drafted Patterns—169. Designs composed of Two Prunelle Twills—170. Drafted Designs composed of Two Four-Shaft Weaves—171. Style composed of Prunelle and Cassimere Twills—172. Combinations composed of Two-, Six-, Seven-, Eight-, and Nine-Shaft Weaves—173. Drafted Designs composed of Three or More Weaves—174. Fancy Stripe Combinations—175. Irregular Woollen Combinations—176. Cotton Stripes—177. Colouring of Trouserings containing Three Weaves of Varied Construction—178. Compound Stripe Patterns containing Four Weaves.

165. *Principles of Colouring Weave-Combinations.*—In applying fancy shades to designs containing several weaves, not only has the character of the pattern as a whole to be considered, but also the character of its component parts. That grouping of shades which forms a perfect style in the common twill may yield incongruous effects in other fancy weaves with which it may be associated, necessitating in some designs—particularly in those of a stripe and check order—the adoption of various systems of colouring, according to the structure of the crossings forming the different sections of the pattern. Generally, the elementary schemes of colouring are the most appropriate for weave-combinations, as they constitute the most uniform effects. To exemplify the methods practised in colouring this description of textile designs, some illustrations may be considered in detail. Supposing, in the first place, a

design were composed of prunelle twills and the plain weave, and it were required to colour it on such lines as to obtain neat textural effects in each weave. Now, it will be clearly understood from the analyses made of Simple Colourings that several schemes might be employed, so far as the plain make is concerned, such as the one-and-one, the two-and-one, and the three-odd-thread systems; but if these analyses have been carefully studied, it will at once be evident that neither the first nor the last of these colourings would be suitable for application to this design, because, while producing satisfactory types in the plain sections, they form incongruous combinations in the twills; and it is imperative in this case to use a method of grouping shades that will give equally clear and regular effects in the prunelle as in the plain crossings. On this ground, therefore, both these systems must be rejected. There is not the same objection to the appropriation of the two-and-one arrangement, for it yields a good pattern in each of the makes. In the plain weave it forms a species of neat spotting, in the warp prunelle lines lengthways of the fabric, and in the weft prunelle lines of the two shades across the fabric.

166. *Examples in Colouring Compound Designs.*—Let the following examples also be considered: I. a design composed of four-end twill and mat; II. a design with a cassimere twill ground, small upright twill for figure, and swansdown twill for extra spotting; III. a design consisting of six-shaft twill in the ground, with warp and weft ribs for figures; and IV. a design containing mayo, common twill, and mat.

In the first design mentioned two weaves are combined in which several schemes of colouring might be utilized, such as the two-and-two, the four-and-four, and the four-two's arrangements. But assuming that it were required to adopt a formula of colouring which would cause the twilled parts of the design to consist of minute checkings,

and the hopsack parts of fine vertical stripes, then it would become a necessity to employ the two-and-two plan of shades. And this order is in some respects one of the best that could be employed in all-over patterns consisting of twill and mat weaves, for it not only thus produces a distinct effect in both makes, which in figured styles would result in the full and precise development of the integral parts of the design, but also a combination in which the products of the respective crossings are equally prominent.

The second design named contains four weaves, but the one most largely employed and which constitutes the ground of the fabric is common twill. Now, in colouring such patterns the ground weave must be primarily considered, all other makes, so far as the application of fancy shades to the entire design is concerned, being of secondary importance. In a combination comprising four weaves it is not, however, usual to adopt an order of shades calculated to produce a special effect in any of the crossings, but rather to employ a scheme of colouring largely composed of one shade. In other terms, it is advantageous in designs of this class to allow the bulk of the fabric to be composed of yarns of one tint—any fancy threads which may be introduced being used sparingly, and frequently singly, and not in pairs, triplets, and larger groupings, as is the case in other modes of colouring. By adopting this arrangement the weave characteristics are clearly emphasized, and yet the surface of the texture is neatly embellished with fancy shades.

The six-shaft twill is the main factor of the third style. It is therefore a question of selecting in the first instance a plan of colours that is adapted to its structure. As it forms the bulk of the texture, it requires to be primarily considered. Reference should be made to the series of simple and compound colourings applicable to this weave, and then that employed which, while making a neat pat-

tern in the twill, will not form an unattractive effect in the rib crossings. Some of the standard groupings of shades for this weave are quite unsuitable when it is in association with these rib makes. The three-two's and two-three's are arrangements of this character. They form neat patterns in the twill, but absolutely imperfect styles in the ribbed crossings. The one-and-one and the three-odd-thread schemes are the most appropriate in a combination of such weaves. They are both capable of producing regular effects in this trio of makes. Thus, take the thread-and-thread order. In the six-end twill it forms neat spotted work; in the warp rib, transverse bands of colours; and in the weft rib, vertical bands of colours, varying in dimensions according to the size of the rib-weaves used.

Turning briefly to the mayo, twill, and mat combination, it will be evident from the relation of these weaves to simple colourings, considered in a former chapter, that there are several schemes of shades feasible here. The point to be acquired when such is the case, is the employment of a method of tinting that will yield effects in each weave sufficiently marked in character as to contrast neatly with each other, and yet constitute a pattern harmonious in its entirety. This can only be practically worked out by comparing the patterns resulting from each crossing in standard groupings of shades, which will lead to the appropriation of that order of yarns known to develop forms of pattern in the respective makes calculated to harmonize satisfactorily in combination.

167. *Main Points in applying Shades to Combinations of Crossings.*—From these examples in the methods of colouring designs consisting of several elementary crossings, it is apparent that there are certain principles which must be observed in introducing fancy yarns into this species of woven patterns. First, whatever the character of the design, the primary factor for consideration is the structure of the

weaves—that make which occurs in the largest quantities being the most important, and calling for specific treatment. Second, when the weaves combined are similar in arrangement, a simple scheme of colouring should be adopted. Third, no order of shades should be employed which, while giving pleasing patterns in one weave, produces inelegant results in others. Obviously these rules are only applicable to designs composed of elementary weaves, and in which the variety of crossings is very limited. For example, in designs comprising such a series of dissimilar weaves as obtains in fig. 120, it will be clear that, to acquire a well-balanced pattern as to colouring, the several sections of the style must be specifically treated in a colour relation. To warp an assortment of weaves of this type on one system throughout would be utterly inutile, and could only result in the construction of a most unsatisfactory range of effects. The order of colouring here must vary with the alteration in weave. This of course is only feasible in stripe and check designs, but is absolutely necessary in styles comprising a considerable diversity of intricate weaves arranged on either of these methods.

168. *Species of Drafted Patterns.*—These may be considered as follows :—

I. Designs composed of weaves related to each other in structure and occupying a similar number of threads, and in which the several makes are used in corresponding proportions.

II. Designs of a stripe and check arrangement diversified in weave assortment.

III. Designs composed of several crossings, but with a simple twill, mat, or plain weave for the ground of the texture.

In the I. group a range of irregular patterns occur, consisting mainly of three-, four-, and six-end makes. In colouring these patterns it is necessary to consider how the

simple schemes of colouring develop in the several weaves combined, in order that the scheme which will give the most uniform result in all the crossings may be appropriated. If three or four weaves obtain in the same design it is occasionally advantageous to employ an irregular grouping of shades, or one which is not intended to give a particular type of pattern in any one of the weaves associated.

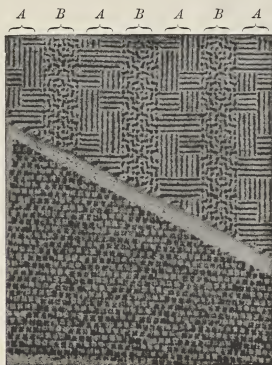


Fig. 103.

Fig. 106.

Increased colouring ingenuity and practical skill are required in the treatment of the second group; because in the designs included here it is frequently necessary to adopt various orders of colouring—one for each type of weave in the design.

The third group of combinations is largely developed in cotton fabrics, dress goods, and mantlings. The method of colouring these patterns is twofold, relating, first, to the

fig. 106. The arrangement of the shades is one-and-one,

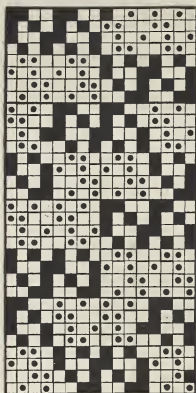


Fig. 107.

so that one weave here being the reverse of the other, while the parts developed in solid squares are forming one textural type, the parts developed in small circles are yielding a second type. It is the plain picks of the respective sections which constitute the minute skeleton squares of grey and black; the twill picks filling up the spaces formed by the grey with black, and those formed by the black with grey. This pattern is developable in various shades of fancy yarns; and the two weaves may also be blended on such methods as to form stripe and check styles of several descriptions.

The fabric given in No. 1 on Plate XX. has some principles of construction common

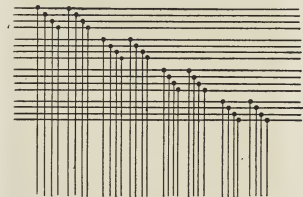
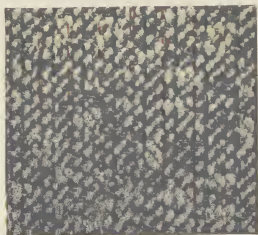


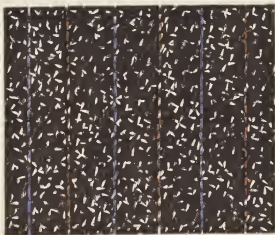
Fig. 108.



1



2



3

PLATE XX

with the effect just described, inasmuch as the design employed in its manufacture is a composition of cassimere weave twilled to the right and left successively. Thus it results from the plan and draft given in figs. 109 and 110, hence it is, in reality, a cassimere twill pattern, for this is the only weave used. But as it runs forward for six picks, and then starts again—this process being repeated throughout sections *A* and *B*, in which the weave twills in both directions—there is formed by the draft a check pattern, occupying forty-eight threads and picks, and in which the weave twills to the right in each alternate space of twenty-four threads. The order of colouring is somewhat intricate, being as appended:—

Warp.

		2 threads of a dark shade.
A.	For 8 threads. {	2 " " light "
		2 " " dark "
		1 thread of a light shade.
		1 " " fancy "
A.	For 8 threads. {	2 threads of a dark shade.
		2 " " light "
		2 " " dark "
		4 " " light "
		2 " " dark "
		4 " " light "
		1 thread of a dark "
		2 threads of a light "
		1 thread of a fancy "
		2 and 3 threads of a light shade.
		1 thread of a fancy shade.
		1 " " light "
		1 " " dark "
4 threads of a light "		
2 " " dark "		
4 " " light "		

- 2 threads of a dark shade.
- A. For 8 threads. { 2 " " light "
 2 " " dark "
 1 thread of a light "
 1 " " fancy "
- A. For 12 threads. { 2 threads of a dark "
 2 " " light "

Weft.

- For 21 picks. { 2 picks of a dark shade.
 1 pick of a light shade same as warp.
 2 picks of a dark shade.
 1 pick of a fancy "



Fig. 109

There is a sort of broken or irregular shading produced by this arrangement, the construction of the design having an important effect on the grouping of shades. The particles of two-and-two colouring, which occur in brackets *A*, develop, in association with the peculiar interruptions in the weave, the apparent sinuosity of aspect characterizing some of the coloured effects. The comparatively large patches of one group of yarns in the warp do not form a clear stripe in the fabric, because the system of wefting is irregular, being such, however, as to tally with the plan of changing the twilling of the weave on every seventh pick. The effect of the two-and-two order of shades in the warp in this drafted design illustrates the extent to which the construction of the plan of interlacing may modify the result of a simple order of shades, while the whole style teaches that a larger diversity of effects is obtainable by employing weave-combinations than simple makes.

171. *Style composed of Prunelle and Cassimere Twills.*—This is rather an irregular combination,

but in the two-and-one system of colouring, if the weaves are skilfully adjusted, it is capable of producing a species of pattern rich in textural details. Referring, for example, to section *B* of fig. 103, the effect of the cassimere twill worked into checks of sixteen threads and picks in this grouping of shades is given. It is a neat type of pattern, contrasting effectively with the effects of the prunelle twills, to which allusion has already been made. The quantity of cassimere twill must not be large in combinations of this class, or a cloth lacking uniformity of structure will be produced. Further, the weaves require to be carefully amalgamated, or a fabric possessing an irregular surface will ensue. It is an admirable scheme of weaves for dress fabrics, as it



Fig. 110.

gives the most pleasing results in fine yarns. Figured patterns in which the objects are developed in prunelle twill and the ground in the checked cassimere, have a neat appearance when appropriate shades are used. The arrangement is also adaptive, in small styles, to trousering and similar fabrics.

172. *Combinations composed of Two-, Six-, Seven-, Eight-, and Nine-Shaft Weaves.*—There are several varieties of patterns obtained in designs containing six-end makes. As a rule the twill is the principal weave. One example in which the hopsack and a fancy crossing are combined may, however, be described, as it is an interesting and typical specimen of the general range of patterns obtained

in this class of weaves. This style is sketched in fig. 111, while the design producing it is a composition of the two makes given in fig. 112. The method of colouring is three threads of white and nine threads of black in both warp and weft. In the mat sections the minute figures are formed, but the intermingled checking is a consequence of the weave marked in full squares in fig. 112. These two crossings are combinable in figured arrangements suitable for dress and mantling textures. In soft colours, brightened at intervals by a few fancy threads, this compound of weaves and scheme of colouring are highly capable of yielding a comprehensive series of fancy fabrics. By

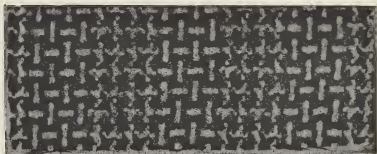


Fig. 111.

changing the mat to twill, quite a distinct species of pattern is obtained. Both weaves now yield check effects, but the type of effect resulting from the twill is uniform and regular in appearance. Some neat figured and check designs are also obtained in six-shaft makes by employing the twill for the ground of the texture, and neat small weaves which may be readily combined with it, and colouring on the three-one's, two-three's, and three-two's systems.

The variety of styles workable in seven-shaft crossings is somewhat limited. Such weaves as the corkscrew and twill, and the upright twill and small diagonals, are

blended here. In combinations containing a large portion of corkscrew the one-and-one method of colouring is appropriate, particularly if the make is of a common twill construction. The five-and-two, four-and-three, and six-and-one groupings of shades are useful in designs in which an ordinary seven-shaft twill forms the bulk of the texture.

Eight-thread weave combinations comprise the largest variety of styles. Designs composed of several classes of twills, of simple, twilled, and fancy mats, of minute diagonals, and small figured types, are all colourable on the simple and compound systems of blending shades containing four and eight threads.

Nine-shaft compounds, consisting of weaves about equally balanced as to warp and weft floats, are principally developed in the following groupings :—

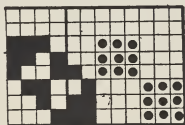


Fig. 112.

I.

5 threads of a dark shade. 7 threads of a dark shade.
4 " " mid " 2 " " mid "

II.

III.

3 threads of a dark shade. 4 threads of a dark shade.
3 " " mid " 3 " " mid "
3 " " light " 2 " " light "

IV.

173. *Drafted Designs composed of Three or more Weaves.*
—Four-, five-, six-, and eight-shaft weaves are all used in the construction of these designs, belonging to the second group, but the generality of such styles is compositions of four-end makes. For fine textures, and for fabrics in which a broad cast of pattern is required, weaves occupying larger

numbers of threads are employed. It will, however, be sufficient if illustrations are considered in designs composed of the four-thread weaves. These are given in Nos. 2 and 3 on Plate XX. They are taken from stout woollen textures made of ten skeins yarns. The colourings are as follows:—

PATTERN I.		PATTERN II.
<i>Warp.</i>		<i>Warp.</i>
2 threads of white.	For 9	{ 1 thread of black and brown.
1 thread of black and scarlet.	threads, {	1 ,, brown and white.
2 threads of white.		1 ,, scarlet and green.
1 thread of black and green.	For 9	{ 1 ,, brown and white.
2 threads of white.	threads, {	1 ,, black and brown.
1 thread of black and white.		1 ,, blue and green.
<i>Weft.</i>		<i>Weft.</i>
All slate.		1 pick of black.
		1 ,, black and white twist.

Referring to the draft (fig. 113) and the reduced design

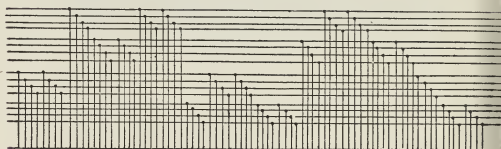


Fig. 113.

for Pattern 2 (fig. 114), these are arranged to form the same series of interlacings on each thread, which insures the construction of a regularly-built fabric.

It will be noticed that both plans of colouring are irregular, the first scheme containing nine, and the second scheme twenty threads. Now as the weaves forming the designs are on four shafts, the fancy yarns fall on dif-

ferent threads of the respective makes in different parts of the figuring. In this way a blended effect is acquired. The bulk of the first warp being white, and the weft of a medium shade, the weave details are clearly distinguished. The three makes, comprising the design (fig. 114), are all traceable. The small spaces of white are due to the twill marked in crosses; the spaces of slate to the twill marked in full squares; and the spaces of slate and white, equally mixed, to the cassimere twill which forms the ground of the design. When the warp consists of broad bands of neatly contrasting shades this type of weave-combination gives excellent results in dress and mantling fabrics for which they have been made.

Pattern 3, though produced in the same draft and composed of similar weaves as Pattern 2, is very different from it in appearance and composition. It forms a type of granite mixture. The colours being arranged practically on the one-and-one system throughout the fabric, the effects of the various crossings amalgamated are partially subdued. As a consequence, the figuring, which is broader in character than that adopted in the previous design (fig. 114), is also somewhat neutralized. Cheviot yarns and medium counts of worsteds are admirably adapted for this type of intermingled tinting, which is so appropriate to the development of fancy styles in designs of a drafted class.

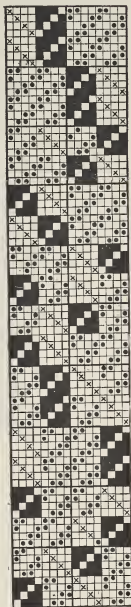


Fig. 114.

174. *Fancy Stripe Combinations*.—Designs of this class for worsted trouserings, cotton textures, and tweed mantlings, are frequently very intricate in both weave and colour composition. Indeed it follows as a natural sequence that if a striped design is richly diversified in weave arrangement, it will be correspondingly complex in colouring. Probably a greater degree of art knowledge and weaving ingenuity is requisite in the origination of this type of woven design than of any other description of

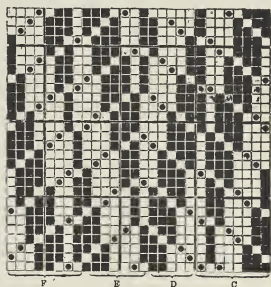


Fig. 115.

textile effect. Not only in a weave, but in a textural and colour relation, is there extreme intricacy of technical contrivance in these fabrics. First, a uniform texture is indispensable; second, this quality must be obtained in conjunction with elegant and novel weave effects; and, third, the arrangement of colouring adopted must be harmonious in shading and in accordance with the structure of the weaves combined.

175. *Irregular Woollen Combinations*.—A unique assortment of crossings, forming a style of design specially suit-

able for woollen yarns, is supplied in fig. 115. Whether produced in fine or medium yarns for dress or mantling goods it forms an effective pattern. It is workable on fourteen healds, the plan of drafting being as follows: Threads 1 to 14 straight drawn, then shafts 6, 5, 4, 3, 2, 1, 7, 8, 14, 13, 12, 11, 10, and 9. Should this method of drafting be adopted, Parts *C* and *D* would constitute the pegging plan. Though the design contains fourteen distinct threads, it is, nevertheless, merely a modification of the first seven ends. These form a species of diagonal weave suitable for worsted coatings.

The whole arrangement of this pattern is particularly interesting. It may be divided into four sections. Parts *C* and *D* have the diagonal moving to the right, but parts *E* and *F* to the left hand. The manner in which each diagonal commences and terminates is the most novel characteristic of the pattern, and is illustrative of a method of combining this type of weave that may be followed out with pleasing results. For dress materials the following weaving particulars are appropriate:—

Warp.

- 1 thread of fine black and white twist.
- 5 threads of 30 skeins mid grey.
- 1 thread of fine black and white twist.
- 10's reed 4's.

Weft.

- All 28 skeins dark grey.
- 40 picks on the inch.

For ulsterings or mantlings, about 16 skeins warp and 14 skeins weft yarns, and a 10's reed slayed 4's, with 40 picks on the inch, may be used. But little variety of colouring is needed, as the pattern is very elaborate in a weave relation. A light shade of warp and a medium shade of weft are sufficient to give due precision and proper develop-

ment to the various features of this design. In mixture yarns it forms quite a novel and tasteful pattern.

176. *Cotton Stripes*.—These have frequently a plain ground, and belong to the third group of drafted designs. The figuring is developed in good warp and weft flushes neatly grouped in diamonds, twills, and fancy mats. A typical example of these designs is furnished on fig. 116—a compound weavable on twelve shafts. It consists of bands of plain weave, warp, rib, and figure. The figured section comprises objects of the same form and dimensions developed in both warp and weft floats. Thus, while the

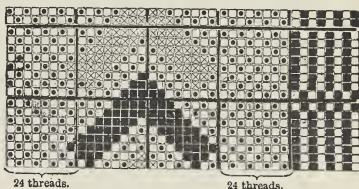


Fig. 116.

figure marked in solid squares would in the fabric be composed of weft flushes, the figure marked in crosses would consist of floats of warp; hence, providing the warp is light in shade, and the weft of an intermediate colour, these figures would be of distinct hues. Much of the merit of this class of design is dependent on suitable colouring. The following scheme is illustrative of the methods generally adopted:—

Warp.

- 8 threads of bright blue.
- 2 " " white.
- 2 " " lavender.
- 4 " " white.

	2	threads of lavender.
	4	“ “ white.
	2	“ “ lavender.
	4	“ “ white
	2	“ “ lavender.
	20	“ “ white.
	2	“ “ lavender.
For 18	{	4 “ “ white.
threads.		2 “ “ lavender.
		2 “ “ white.

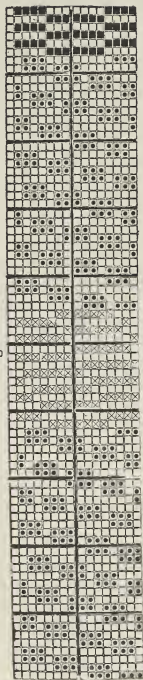
Weft.

All lavender.

According to this arrangement of colours the rib section would consist of furrows of bright blue and lavender, while the bands of plain would be divided into stripes of solid lavender of two threads each, and of mixture stripes of white and lavender of two and four threads in width. As to the figured sections, the object formed of warp flushes would be solid white on a ground of lavender and white; whereas the object composed of weft floats would be solid lavender on the same mixture ground. This order of colours, but in different shades, such as pink and white, slate and white, and salmon and white, also develops well. In these latter shades, bright and pale pinks, and salmon and a deep and pale slate, are requisite to obtain the proper gradation of tinting.

177. *Colouring of Trouserings containing Three Weaves of Varied Structures.*—This work requires considerable technical skill. An elegant weave-composition may be totally destroyed by inapt colouring. Its varied sections have to be separately treated, yet there must be connection between the colourings *in toto*. Three typical illustrations in the methods of introducing fancy shades into this sort of compound designs may be considered. They are given

Fig. 117.



in figs. 117, 118, and 119. A glance at these examples shows how full of weave effect styles of this class are. Thus, in the first design, fig. 117, which is composed of three weaves, there are four distinct stripes, consisting of fancy mat weave, corkscrew, and rib respectively. One of the most effective modes of colouring such a compound is as follows:—

	2 threads of mid blue silk.
2	“ “ white “
2	“ “ mid blue “
10	“ “ light mixture.
10	“ “ mid “
10	“ “ light “
For 15 ends.	{ 1 thread of mid mixture.
	{ 1 “ “ light “
	10 threads of light “
	10 “ “ mid “
	10 “ “ light “

According to this system of colours, the rib section consists of mid blue and white silk, the bands of fancy mat of stripes of light and mid mixture yarns, and the section of corkscrew, being warped thread and thread, consists of diagonals of the two shades of yarns employed.

Fig. 118 is a composition of vertical and oblique twills. There is a strong contrast in the weave effect here. The make marked in round characters forms an oblique twill of about the same de-

gree as the upright twill yielded by the crossing developed in solid marks. Both weaves produce excellent coating patterns. In combination, though so widely dissimilar in woven results, they weave well together and construct a uniform texture. The following is an appropriate scheme of colouring :—

	8 threads of 2/50's brown.
Repeat	{ 1 thread of 2/100's black and green.
	{ 1 " " 2/50's brown.
	{ 1 " " 2/100's black and crimson.
	{ 1 " " 2/50's brown.
	8 threads of 2/50's brown.
	8 " " 2/50's blue.
	3 " " 2/50's slate.
	2 " " 2/100's brown and white.
	3 " " 2/50's slate.
	8 " " 2/50's blue.

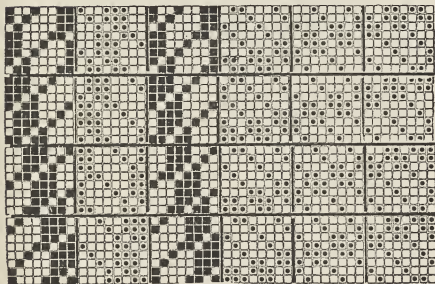


Fig. 118.

The centre of the large band of twenty-four threads is

thus neatly tinted with fancy twist threads. Then, while the diagonals developed in full squares are composed of blue threads, the same diagonal, when twilling to the right, consists mainly of slate, with a fine line of brown and white twist down the centre. There is, therefore, not only in this arrangement an apt grouping of shades in a colour sense, but the plan of amalgamation produces a form of stripe at once neat, clear, and in keeping with the construction of the design.

The subsequent three-weave stripe—fig. 119—is composed of quite an uncommon set of crossings, namely, of sixteen-shaft twilled hopsack, of an eight-shaft diagonal,

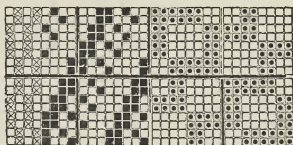


Fig. 119.

and of a fine warp rib. The threads making the rib section ought to be on a separate beam.

A good system of introducing colour here consists in shading the diagonal with colour, as indicated in the plan of working given below:—

- 4 threads of white silk.
- 4 " " brown.
- 4 " " mid brown.
- 4 " " light brown.
- 16 " " slatish drab.

The depth of the brown and the slatish drab must be about the same; if anything, the latter should be the darker.

It is not unusual in these designs to employ bright shades of silk for weaves of a rib class, which are so constructed as to exhibit the characteristic qualities of yarns of this material. Moreover, it is almost a general rule to apply the brightest colours to those sections of the design composed of warp rib crossings.

178. *Compound Stripe Patterns containing Four Weaves.*—As a rule the larger the number of weaves a design contains, and the more diversified they are in structure, the greater the intricacy of the plan of colouring. Figs. 120 and 121, which are designs widely dissimilar in composition, both comprise four varieties of crossings. Consider fig. 120 first. It is a fine worsted trousering style, and is composed of four excellent weaves, namely, a warp wave or serpentine, corkscrew warp flushed, corkscrew weft flushed, and of fine twill. But it is not merely the variety of crossings which deserves notice, but also the arrangement or plan of combination is also commendable. On both sides of the warp serpentine are bands of weft twill, markedly contrasting with not only the former weave, but

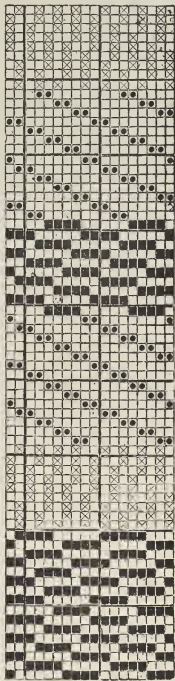


Fig. 120.

the bold stripes of fine twill represented in round dots. These latter bands are intervened by a line of nine-head corkscrew or round twill. The scheme of warp colouring should be such as to admit of the corkscrew sections being

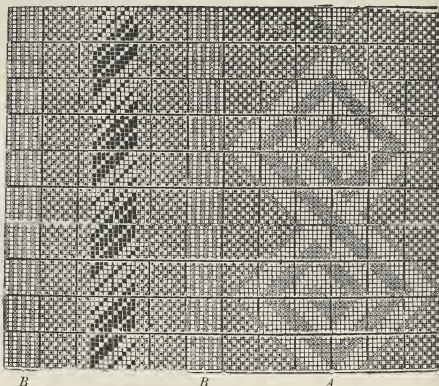


Fig. 121.

developed in fine worsted and silk twist. This can be effected by colouring as below:—

Warp.

16 ends.	{	1 thread of 2/60's drab mixture.
		1 " " " brown "
		23 threads of 2/60's blue mixture.
		9 " " fine worsted and white silk twist.
		23 " " 2/60's blue mixture.

Weft.

All 2/60's brown or 2/60's blue mixture.

By this arrangement the bands of upright twill are developed in blue mixture, the warp wave in drab and brown, and the corkscrew in silk twist threads. Should the weft be brown, the bands of weft twill marked in crosses would be of this shade.

Design 121 is full of diversity of arrangement and of weave effects. First, there is the figuring developed in crosses, which is the most prominent feature of the design, and which is distributed on a plain groundwork. It is obtained in bold warp and weft flushes, and is composed of a kind of key pattern. It forms an elegant stripe, even if not associated with the other elements of the design. These, however, have much to do with its prominence in the texture, and in enhancing the general attractiveness of the whole composition. Adjoining the respective sides of this band of principal figuring are stripes of warp rib, which, it will be noticed, according to the colourings given, are developed in two bright shades, and contribute to the clearness and uniqueness of the pattern. Then follow bands of plain, and an important band of shaded diagonal, which contrasts well with the other effects entering into the composition of the style. By considering the effect of the following order of colours on the design, other features of its arrangement will be brought out:—

Warp.

	48 threads of light blue cotton.
For 8	{ 1 double thread of bright scarlet cotton.
double threads.	
	11 threads of light blue cotton.
	10 " " slate.
	11 " " light blue.
For 8	{ 1 double thread of bright scarlet cotton.
double threads.	

Weft.

All fawn cotton.

According to this order of colours, the figuring represented in blank characters in band *A*, would be light blue, and the figuring in crosses fawn shade. As to bands *B*, these would be little affected by the weft, and would consist of bars of scarlet and white alternately. The shaded diagonal section, given in solid squares, would be composed of slate and fawn colouring, while the plain weave ground would be a mixture of light blue and fawn, so that there are here several neat contrasts of colours, as well as prominent design effects resulting from the unique arrangement and association of weaves to constitute the figuring and the bands of rib, diagonal, and plain make respectively. It is a cast of pattern susceptible of much variation; thus the rib sections may be changed to twill, the diagonal parts to small diamonds, while the mode of colouring may be diversified as to shade, assortment, and methods of blending to an unlimited extent.

CHAPTER XI.

SPOTTED EFFECTS.

179. Varieties of Spotted Fabrics—180. Spots due to Specific Systems of Weaving—181. Swansdown Twill Spotted—182. Spots composed of Two Broken Swansdown Weaves—183. Weave-Spotting produced by both Extra Floats of Warp and Weft—184. Irregular Spotted Stripes and Checks—185. Spots developed by Extra Warp Threads—186. Fabrics Spotted with Weft—187. Mat Weaves Spotted—188. Cork-screw Weave with Extra Spotting Pick—189. Spotted Diagonals—190. Warp and Weft Spots compared—191. Spotting in both Warp and Weft—192. Advantages of the Warp and Weft Methods of Spotting—193. Yarns used for Spotting—194. Spotted Effects in Ordinary Weaves.

179. *Varieties of Spotted Fabrics.*—Woolen, worsted, cotton, and linen fabrics are all more or less ornamented on the spotted principles of designing and colouring. In all cases it is sought to distribute or arrange, on a neatly tinted groundwork, a series of minute spots, which may be composed of either the same or of distinct shades from those used in the construction of the general surface of the fabric. When this species of pattern is developed in woollens and worsteds, the spotting consists of mere specks of colouring, resulting from the employment of a special scheme of interlacing the warp and weft yarns. Cotton and linen styles require bolder and clearer spots than woollens, and, as a rule, are fuller of effects. There are various points to be considered in the construction of these patterns, relating to the method of development, the plan of grouping, and the dimensions of the spots.

Respecting the method of development, this is subjective to the facilities at command. Thus, if the spotting can only be worked out in those yarns that constitute the ground of the texture, then it is more a matter of inventing a suitable scheme of weave-design than of any specific process of colouring. But should a special series of warp threads be usable for the spotting, then it becomes necessary to utilize both a particular type of weave and order of colours. Generally considered, spotted patterns are of four varieties, as follows :—

I. Spots developed by the ordinary warp and weft of the cloth.

II. Spots obtained by using an extra series of warp yarns.

III. Spots obtained by using an extra series of weft yarns.

IV. Spots obtained by using both an extra series of warp and weft yarns.

The first is the simplest class of spots. It is due to special schemes of floating the warp, weft, or both these sets of yarns, at regular intervals in constructing the fabric; that is to say, if the construction of the texture were of the mat order, here and there the mat effect would be substituted by groups of warp and weft flushes, lending to the surface of the fabric a spotted aspect. This type of spotted weaving is largely practised in designing for various descriptions of fancy woollens, worsteds, and cottons. In the second, third, and fourth classes of these patterns extra groups of shades, entirely independent of those forming the ground of the cloth, are employed. They allow of the production of more intricate effects than those developable by the first system, but are more difficult to manipulate in both weave and colour combinations. Ornamental styles coloured in the warp for dresses, robes, and mantlings, also in the weft, and in both warp and weft, are but developments of these

forms of weaving and shade-arrangements. Subsequent analyses of these textiles will demonstrate the affinity of the principles of their construction with those of the spotted designs now under consideration.

180. *Spots due to Specific Systems of Weaving.*—As these are purely a product of the plan of building the fabric, they may be aptly designated Weave-Spots. Thus the design given in fig. 122 would yield a spotted effect, however simple the system of colouring might be. The texture

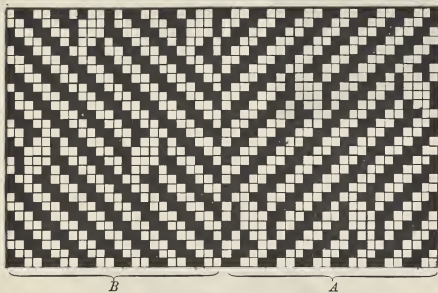


Fig. 122.

resulting from its employment, and furnished in fig. 123, is an example of this. The shades in this texture are slate and white—the latter being the warp—yet the pattern obtained, though possessing a twilled surface, is decorated with small white spots. Of course in silk and worsted dress fabrics the spots are of various forms, and are arranged on well-planned geometrical bases; but in woollens small effects, as in the illustration, are the most appropriate. Still the principles of this type of designing, whatever the

form of the spot and the scheme of distribution, are the same, relating primarily to a diversification of the plan of weaving. Further examine fig. 122. Here the twill is



Fig. 123.

interrupted at certain periods to allow of the formation of a spot composed of floats of warp yarn of some three threads in width and five picks in length. In Section *A* such spots lean to the right, and in Section *B* to the left, or in both parts of the style they run with the twill. It should be observed that, when modifying a common weave to develop spotted results, care must be exercised not to injure the general build of the fabric, for this is a factor that must always remain intact. As to the size of the spot, it varies according to the fineness of the fabric and the nature of the pattern to which it is applied.

181. *Swansdown Twill Spotted*.—The spots in this in-



Fig. 124.

stance are all formed by the weft yarn. They may consist of small diamonds, minute figures, and other forms, and be arranged in diagonals, twills, or on such a system as to constitute an irregular effect. For example, in fig. 124 they

run in oblique lines, and in fig. 125 they compose a vertical diagonal. As a rule the colouring of these styles is of a simple order, merely comprising the employment of neatly-contrasting shades. If any additional shade-effects besides those yielded by the spots of weft yarn are required, fancy yarns are introduced into the warp to a limited extent. Take an illustration in colouring fig. 124, in which the yarns are combined to form a striped pattern for cotton dresses :—

<i>Warp.</i>	<i>Weft.</i>
26 threads of mid blue.	All bright mid brown.
2 " " slate.	
2 " " mid blue.	
2 " " white.	
2 " " mid blue.	
2 " " slate.	

This arrangement gives a pattern consisting of a bold band of mid blue, succeeded by fine lines of slate and white ornamented with spots of bright brown on a warp twill ground. Now consider fig. 125 in relation to worsted dress goods. Taking the warp to be a light fawn shade and the weft drab, again a texture results with a twilled surface, but in this instance the ground parts are fawn spotted with drab by the little figures entering into the weave, which are planned to constitute *en masse* a diagonal form of pattern. It will be apparent from these illustrations that in designs of this class but a small degree of elaborateness of tinting is beneficial, and that the fancy shades are invariably worked into the

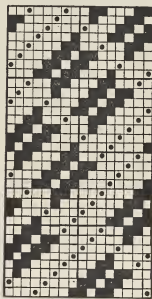


Fig. 125.

warp, while the weft, in order to afford uniform emphasis to the spotting, is of one shade throughout the texture.

182. *Spots composed of Two Broken Swansdown Weaves.*

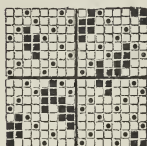


Fig. 126.

illustrations are given in figs. 126, 127, 128, and 129. Whatever the weft yarn employed in the manufacture of

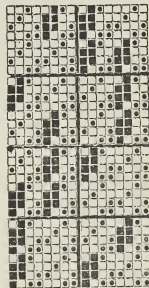


Fig. 127.

these textiles, it constitutes, as in the preceding examples, the spotting, while the warp yarns tint the ground of the fabric. Though in these designs the spots generally appear to be most irregularly associated, and the system of arrangement incapable of concise description, still, on closer examination, it will be obvious that in the planning of each weave well-defined principles of textural composition are observed. Thus, in fig. 126 each thread is down six times in each repeat of the design; in fig. 127 each thread is down sixteen times; and in figs. 128 and 129 each thread is down eight times. Here, therefore, is one element of uniformity of structure denoting the existence of designing principles in these respective weaves. This uniformity of interlacing extends to the picks also,

—The main elements of these styles are the fantastic character of the spotting, the regularity of the weft floats—these never covering more than three threads in succession—and the clearness of the patterns when shades forming a strong contrast are used for warp and weft purposes. They yield an extensive series of combinations, and several

illustrations are given in figs. 126, 127, 128, and 129. Whatever the weft yarn employed in the manufacture of these textiles, it constitutes, as in the preceding examples, the spotting, while the warp yarns tint the ground of the fabric. Though in these designs the spots generally appear to be most irregularly associated, and the system of arrangement incapable of concise description, still, on closer examination, it will be obvious that in the planning of each weave well-defined principles of textural composition are observed. Thus, in fig. 126 each thread is down six times in each repeat of the design; in fig. 127 each thread is down sixteen times; and in figs. 128 and 129 each thread is down eight times. Here, therefore,

hence the designs are essentially regular in construction, and, with the exception of fig. 126, yield patterns in which the flushes of warp and weft are equally balanced. It is needless to observe that this is an all-important characteristic in the build of spotted combinations.

Respecting the schemes of colouring practised here, they are so various that a few of them may be indicated. First, suppose fig. 126 were woven in a brown and white twist warp, and crossed with drab, slate, or blue weft. The pattern resulting from this arrangement would consist of a brown and white twist ground spotted with minute figures of different shapes of drab, slate, or blue, according to the weft yarn used. Fig. 127 produces a more regular cast of pattern than the preceding style. Here an appropriate method of colouring in

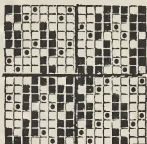


Fig. 128.

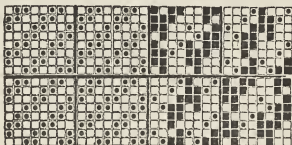


Fig. 129.

the warp is two-and-two, while the weft again should be one solid shade. For example, take the following arrangement:—

Warp.

2 threads of 14 skeins slate.

2 „ „ 30 skeins mid blue and white twist.

Weft.

All 14 skeins brown.

10's reed, 4 threads in a split.

40 picks on the inch.

This order of shades produces a pattern of some diversity of tinting. It is only furnished as an illustration in shade-arrangement, and ought, in practice, to be considerably elaborated. A fabric would result from its adoption possessing a brown, slate, and mid blue and white twist ground, spotted with small patches of twist threads and of brown.

A still more irregular plan is given in fig. 128. By adopting this scheme of weave-arrangement a complete intermingled effect is acquired. The warp and weft shades used in this design should slightly contrast, but produce a soft, mellow colouring. The pattern may be advantageously striped in the warp, thus:—

Warp.

16 threads of 12 skeins mid grey.

16 „ „ 12 skeins light grey.

9's reed, 4 threads in a split.

36 picks on the inch.

Weft.

All 14 skeins drab.

The shade of drab that should be used ought to form exactly the same depth of contrast with the light as with the mid grey.

Refer lastly to the example given in this type of weave in fig. 129, which is of a striped order, for the spotted effect is here combined with a band of sixteen threads of cassimere twill. Any simple method of colouring the twilled section may be practised. An elementary plan of shade-assortment is, however, the most appropriate, because if the scheme of colouring is too elaborate it will not unite well with the shades forming the latter part of the design.

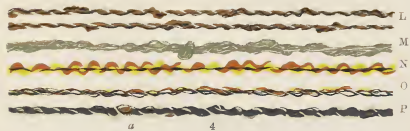
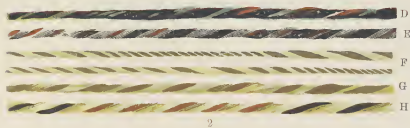


PLATE XXI.



Such a scheme as the one appended is typical of what is usually adopted in this class of effects :—

Warp.

- 1 thread of black and drab twist.
- 1 „ „ black and green twist.
- 2 threads of black and dark twist.
- 2 „ „ slate.
- 1 thread of black and green twist.
- 2 threads of black and drab twist.
- 1 thread of black and green twist.
- 2 threads of slate.
- 2 „ „ black and drab twist.
- 1 thread of black and green twist.
- 1 „ „ black and drab twist.
- 16 threads of slate.

Weft.

All blue.

The former, or twilled part of the style, would thus be striped with lines of colour, while the last part of the design would be developed in slate and blue, the slate shade composing the ground, and the blue the figured or spotted appearance.

183. *Weave-Spotting produced by both Extra Floats of Warp and Weft.*—A more elaborate and interesting species of patterns results from this plan of spotting than that of producing the spots by the warp or weft separately. All the shades entering into the texture now assist in the development of the spotted effects—an element of the designs which largely increases the diversity of colouring and pattern formation feasible. Two very distinct specimens of this scheme of spotting deserve analysis. They are supplied in figs. 130 and 131. Considering fig. 130 first, it has a plain ground, the spots being arranged on an eight-shaft sateen base. Such a design may be tinted on two methods

—the warp and weft may be of distinct or of the same colours. Supposing, therefore, that in the first place the warp is composed of one colour only, such as brown mixture and crossed with blue mixture, then the mingled effects due to the plain ground would be enhanced by the specks of these colours resulting from the spots in the weave marked in full squares. By adopting, in the second instance, the thread-and-thread system of colouring in both warp and weft a still more diversified style would ensue. In such a

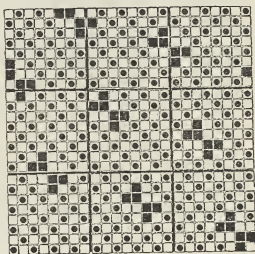


Fig. 130.

case the ground of the fabric consists of vertical lines on which slightly indistinct spots occur at regular intervals. For fabrics in which clear effects are requisite this latter system of tinting is the most appropriate, but in goods where mingled colouring is admired the former mode of colouring is preferable. Next as to fig. 131, which, like fig. 129, is a compound of cassimere twill and of a spotted weave. Part *A* is, strictly speaking, a spotted twill, the spotting comprising both warp and weft flushes, thus securing a proper balance of colouring when fancy yarns

are used. This design is capable of numerous modifications, both in weave-arrangement and colouring. Allusion may primarily be made to the alterations it may be subjected to in a weave sense. If it were, for example, worked out on twenty-four threads and twenty-four picks, with the same size of spots, it would form in some respects a neater style, one in which more cassimere twill would be distinguishable. Provided a stripe were required, the eight threads of twill, bracketed *B*, might be added. A check, in which the same weave forms the principal factor, is obtainable by surrounding Section *A*, which should be doubled in

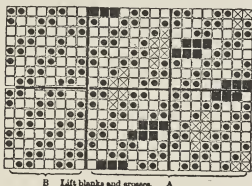


Fig. 131.

size, with a band of eight threads and picks of common twill. This modification in worsted yarns, when backed with weft, forms a capital suiting. Now as to colouring.

Take the following as a useful arrangement, developing well in the twilled sections :—

Warp.

2 threads of medium grey.
2 „ „ dark grey.

Weft.

1 pick of medium grey.
2 picks of dark grey.
1 pick of medium grey.

The small figures developed in the design in crosses would by this scheme of colouring consist in the woven

sample of medium grey warp, while those figures developed in solid squares would be composed of medium grey weft; but, as the groundwork of the pattern would be a composition of small dark and medium grey checks alternating, the spots would not be markedly pronounced, only indeed just sufficiently distinct to impart freshness and novelty to the resultant style. Another useful method of colouring is as follows:—

<i>Warp.</i>	<i>Weft.</i>
6 threads of brown mixture.	Blue mixture.
1 thread of black and blue twist.	
1 „ „, black and crimson twist.	
2 threads of brown mixture.	
1 thread of black and crimson twist.	
1 „ „, black and blue twist.	
12 threads of brown mixture.	

In this instance, the spots marked in the design in crosses would, in the texture, be brown mixture, and those in full squares blue. Both this and the first method of colouring, are practised with valuable results. This arrangement of spotted pattern is also coloured on such principles as to form mixture, check, and other styles.

184. *Irregular Spotted Stripes and Checks.*—These styles constitute a further important type of weave-spotting. Designs constructed on this base are compounds of three weaves. Generally the ground weave is common twill, but it may be also mat or any other crossing which combines well with the twills employed in forming the spotted lines. If the makes associated are of the four-shaft class they are invariably those given in fig. 132. This pattern is a spotted check. The fine warp and weft lines running transversely and longitudinally in the fabrics are of similar dimensions. Thus the effects formed by threads *A* exactly correspond to those formed by picks *A*¹.

In both instances there is one small weft and warp line, and one large weft and warp line. It is a rule for each spotting thread and pick in these designs to contain the same set of interlacings. The plan of grouping the spots, combined with their sizes, are the main factors requiring skilful adjustment in constructing these designs.

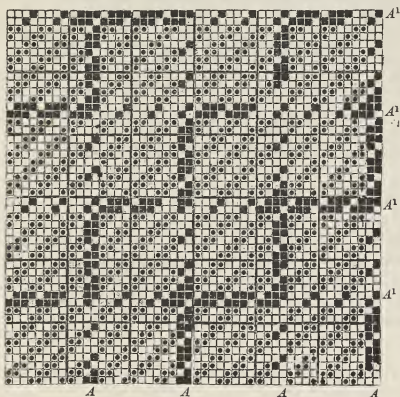


Fig. 132.

By supposing that fig. 132 is woven in a white warp and brown weft the general character of such styles may be clearly explained. The cassimere twill sections would, in this method of colouring, be a composition of brown and white twills, while the surface of the texture would be dotted with small lines of the respective shades, so grouped as to form indefinite rectangular figuring. Should the

picks A^1 be changed to common twill, the spotting would only be lengthways of the fabric, showing the principle on which the spots are made to produce striped patterns.

There are several methods of colouring practised in tinting this build of design. Firstly, the spotting threads and picks are alone fancy yarns, the intervening threads and picks being composed of solid colours, thus :—

Warp.

- 14 threads of slate.
- 1 thread of black and green twist.
- 1 " " black and orange twist.

Weft.

- 14 picks of olive.
- 1 pick of black and blue twist.
- 1 " " black and orange twist.

Secondly, the ground or common twill parts may consist of small checkings, and the spotting threads of bright shades. This scheme is worked out in fancy suitings and dress fabrics. A third arrangement comprises the use of cotton, silk, and worsted yarns. It is principally practised in designing for dress materials. The following is an example of this species of colouring :—

Warp.

- 10 threads of 2-fold 80's drab cotton.
- 2 " " 60's blue silk.
- 10 " " 80's drab cotton.
- 2 " " 60's orange silk.
- 10 " " 80's drab cotton.
- 2 " " 60's crimson silk.

Weft.

- 10 picks of 30's light brown worsted.
- 2 " " 2-fold 60's blue silk.
- 10 " " 30's light brown worsted.

- 2 picks of 2-fold 60's orange silk.
10 " " 30's light brown worsted.
2 " " 2-fold 60's crimson silk.

The ground shade of weft should be slightly darker than the ground shade of warp, and the several silk colours should be of corresponding intensities and equally distinct.

185. *Spots developed by Extra Warp Threads.*—Patterns of this character are applicable to wool, worsted, and cotton textures. Differing in construction from the preceding examples, the system on which they are produced provides for the interlacings of a special series of fancy warp yarns in developing the spotted effects. These threads virtually yield a pattern supplementary to that resulting from the colourings forming the ground of the fabric, and from the twilled or other weaves used in the structure of the cloth. Any plan of weave or system of colouring may be adopted in producing the general foundation of the pattern; for the spotting is obtained by a distinct set of threads, and is controlled by a section of the weaving plan entirely independent of the design giving the cloth proper. As all spots got on this principle are due to the use of a perfectly regular yarn, and not to fancy twists of a knop, cloud, or spangle class, the fabric resultant is quite uniform in texture and smooth on the surface. This is a very important advantage the weave method of spotting possesses over the yarn system. Threads of a knickerbocker type, though giving the requisite spot, always yield a fabric more or less rough in appearance and handle, while the patterns, as regards the spotting, are destitute of form and arrangement. On the other hand, in the weave system, the spots may be located or distributed over the face of the fabric according to the effect required. If desirable, the spotting may be arranged to form check, diamond, small figure, and other designs. Further, there is another dif-

ference between these two systems of introducing dots of bright colouring into woven pattern. When fancy twist yarns are the spotting factors, the whole design, both ground and weave effects, result from the interlacing of these threads; whereas, in the weave arrangement, the

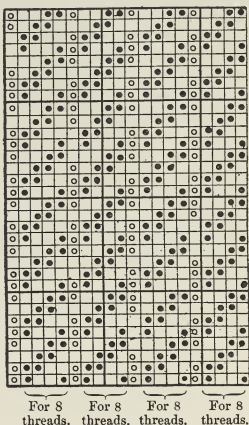


Fig. 133.

dotting yarns do not constitute the groundwork of the texture, but merely add lustre and freshness to the general outline of the pattern. The spots in this latter instance impart finish and completeness to the effects produced by the ground plan and colourings of the fabric.

Fig. 133 is an illustration in this method of spotting.

It will be observed that there are eight threads of twill to one thread of spotting. According to the patterns of warp which are given below the spotting yarns are much brighter in colour than those forming the ground of the fabric. This is an invariable rule. The spots appear on the face of the pattern in those positions in the design where they flush over three picks in succession, but flush on the back of the texture in all other instances. The spotting ends are so controlled that the small specks of bright colouring they yield are arranged on the four-shaft sateen base, and hence are not only regularly distributed, but are also at equal distances from each other in the woven cloth. As the groundwork of the pattern is simple in colouring, and forms a species of shaded check, a neat and choice style results from introducing these dotting yarns into its composition.

Two examples in colouring this design are appended:—

I.—Warp.

4 threads of black.
 4 „ „ mid grey.
 1 thread of blue.
 4 threads of light grey.
 4 „ „ black.
 1 thread of scarlet.
 4 threads of mid grey.
 4 „ „ light grey.
 1 thread of tan.

I.—Weft.

4 picks of black.
 4 „ „ mid grey.
 4 „ „ light grey.

II.—Warp.

4 threads of black.
 4 „ „ brown.
 1 thread of lavender.
 4 threads of mid brown.
 4 „ „ black.
 1 thread of orange.
 4 threads of brown.
 4 „ „ mid brown.
 1 thread of green.

II.—Weft.

4 picks of black.
 4 „ „ brown.
 4 „ „ mid brown.

186. *Fabrics Spotted with Weft.*—There are various methods of producing weft spots, but they may be

grouped under two heads, thus: First, effects in which certain picks of the weave are removed and substituted by special shoots that will bring the spotting yarns on to the face of the texture; second, effects in which a special series of spotting picks is employed. The latter system is the most extensively practised, because it gives the best results and the most uniform effect.

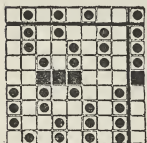


Fig. 134.

Fig. 134 is an illustration of the former method. It is a weave with a corkscrew-twill ground, the fifth pick of which has been supplanted by the shoot marked in solid squares, which brings the fancy silk pick prominently into view. To increase the weight of the cloth the crossing might be backed with warp as in fig. 137. The following yarns illustrate the scheme of

colouring generally adopted in patterns of this description:—

<i>Warp.</i>	<i>Weft.</i>
Olive mixture worsted.	4 picks of olive mixture.
	1 pick of blue silk.
	4 picks of olive mixture.

The result is a fabric of a corkscrew structure composed of olive mixture yarns neatly spotted with bright blue silk.

187. *Mat Weaves Spotted.*—One of the most useful methods of spotting with weft is furnished in fig. 135. The spotting picks, *A*, appear on the face of the fabric where the full squares are seen in the illustration. They have been arranged on what is termed the eight-shaft sateen base, which ensures an even and regular distribution of the spots. Whenever a neat dotted effect is required, this mode of spotting should be adopted; for though the pat-

terns obtained by this arrangement are not bold and loud in character, yet they possess a uniform neatness, which is an admirable quality in styles of this description. The structure of the design is of the most elementary kind. It only differs very slightly from the hopsack weave backed with weft. The square characters, ■, are the only feature which cause it to possess a different structural appearance to the same weave when backed with the four-end twill, three threads up and one thread down. These marks are, however, sufficient to produce the required spotted effect in the woven cloth, when fancy yarns are introduced into picks *A* of the pattern. Some excellent styles in both carded and combed yarns are woven on this principle.

The following comprise two typical methods of colouring this class of weave. In the first system the ground of the fabric is one solid colour, but in the second system it is striped with twist yarns.

I.—Warp for Worsted.

Blue or slate mixture worsted.

I.—Weft for Worsted.

2 picks of blue or slate mixture worsted.
1 pick of silk.

II.—Warp for Woollens.

16 threads of brown.

1 thread of black and scarlet.

1 thread of brown.

4 threads of black and lavender.

1 thread of brown.

1 ,, ,, black and scarlet.

II.—Weft for Woollens.

2 picks of black.

1 pick of black, blue, and white silk twist.

188. *Corkscrew Weave with Extra Spotting Pick.*—The

scheme of spotting given in fig. 136 is extensively utilized. It possesses one considerable advantage over that furnished in fig. 134—the ground weave or crossing is kept intact. Any make or combination of weaves may be employed for forming the texture, and the spots may be distributed on any simple principle. If a fancy effect is required, they

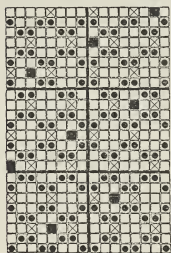


Fig. 135.

Warp.
Black worsted.

Weft.
4 picks of black worsted.
1 pick of silk.
5 picks of black worsted.

189. *Spotted Diagonals.*—Fancy diagonals, as well as other types of fancy weaves, are frequently spotted with silk yarns, particularly in the construction of vesting patterns. An example in this class of designing is furnished in fig. 138, which consists of a twenty-four shaft diagonal composed of corkscrew and ordinary twilled effects.

Here special picks have been inserted for developing the spot. Thus the shoots *A*, marked in crosses, ☒, are intended to produce the spotting. They form a broken twill

pattern, two of the spots leaning to the left and two to the right. The weave is an excellent coating style, and suggests a mode of diversifying the appearance and effect of designs constructed on a diagonal base.

Minus the spotting, this crossing is of an elegant character, for it comprises three distinct effects: first, a solid, compact warp twill; second, a similar twill of weft-flush; and third, a furrow of corkscrew twill. The warp colouring might be solid, but the weft should consist of one pick silk and of six picks of worsted.

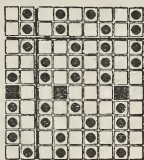


Fig. 136.

190. *Warp and Weft Spots compared.*—Probably the method of developing spots by an extra series of warp threads is better adapted to woollens and cottons than to worsteds. In the last style of fabrics silk is the common material used for spotting purposes. Being fine and lustrous it imparts richness of character to the woven fabric. For

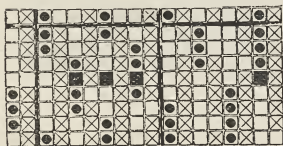


Fig. 137.

several reasons it is preferable, in spotting worsteds, to make the weft the dotting yarn. Thus the weft principle of spotting, while allowing considerable latitude for figured work and variety of pattern, does not largely increase the cost of weaving, nor add materially to the complication of design construction. This much cannot be said of the warp

system. If, for instance, worsteds are spotted with silk in this way, an extra chain beam is required, and an additional set of healds—which multiply the difficulties of the weaving process. Even when these increased facilities are requisitioned the amount of figuring feasible is very limited; whereas by the weft method the spot can be of any form or dimensions. On the other hand, the warp scheme is specially adapted to woollen effects of a tweed order in

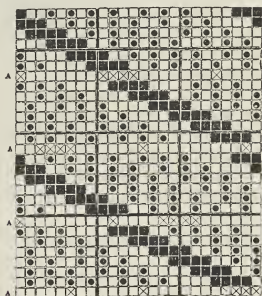


Fig. 138.

which colouring is the main element, and where the additional yarns are more tinting factors, forming mere dots of colour on the surface of the texture, than anything else. Each principle has therefore its specific province in textile designing.

191. *Spotting in both Warp and Weft.*—This principle of design combines the two preceding methods of spotting—making it feasible to dot the surface of the fabric with bright hues both lengthways and across. It naturally

follows that patterns fuller of effect and richer in spotting are producible by this system than any other. There is, however, one disadvantage in the employment of this duplex method of spotting—it adds to the intricacy of the weaving operation, for special sets of shafts and lags are necessary in the production of fabrics thus constructed.

The spotted twill furnished in fig. 139 illustrates the plan of arrangement. The twill or ground weave is, in

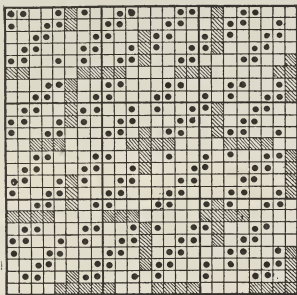


Fig. 139.

designs of this class, continually running, so that it forms, independently of the spotting, a perfect texture. Further, the spotting is so arranged that it does not interrupt the twilled effect. It is an additional and separate element of the design. When constructing such styles, the order and size of the spots are the two main points for consideration. Treating of these, the methods of grouping the spots is invariably similar in both warp and weft; thus, if there are four threads of ground weave to one thread of spotting:

in the warp, there will be the same ratio of ground and spotting picks in the weft. Adherence to this rule results in the manufacture of a uniform pattern. Having decided upon the scheme of grouping, say five threads of ground to one thread of spotting, as in fig. 139, proceed by mapping out the spotting threads and picks on point paper in colour, next add the ground weave, and lastly, determine the dimensions and order of the spots. As to the ground, it may consist of any well-planned assortment of twills, mats, or fancy weaves. With regard to the size of the spots, this varies according to the class of texture being manufactured. For tweed fabrics small effects are the neatest and the most admired, but in some types of mantlings, in which the spotting yarn is mohair or lustrous worsted, large, clear, and bold spots yield the most attractive patterns. Worsteds and linens with silk yarns for spotting are, as a rule, decorated with minute, præcise, and smart effects. Distribution of the spots is accomplished on numerous systems, such forms of arrangement as the diamond, simple figures, and sateens being largely developed. In the example furnished in fig. 139, the spots are grouped on a broken-check base. Three methods of colouring this design require explanation.

I.—COLOURING FOR COTTONS.

Warp and Weft.

For 5 threads. { 1 thread of tan.
 1 " " fawn.
 1 thread of pale blue (spotting).
 For 5 threads. { 1 thread of fawn.
 1 " " tan.
 1 thread of rose pink.

II.—COLOURING FOR WORSTED SUITINGS.

Warp and Weft.

5 threads of drab mixture.

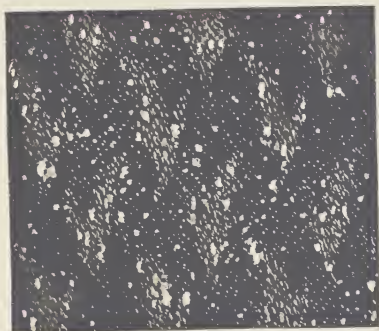
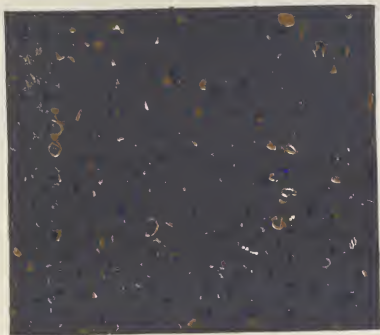


FIGURE 1

Faint, illegible text, possibly bleed-through from the reverse side of the page.

- 1 thread of black worsted and blue silk twist.
 5 threads of drab mixture.
 1 thread of black worsted and russet silk twist.

III.—COLOURING FOR WOOLENS.

Warp and Weft.

- 4 threads of black.
 1 thread of blue.
 1 „ „ dark brown and drab.
 3 threads of blue.
 2 „ „ black.
 1 thread of black and tan.
 2 threads of black.
 3 „ „ blue.
 1 thread of black, brown, and drab.
 1 „ „ blue.
 4 threads of black.
 1 thread of black and tan.
 4 threads of blue.
 1 thread of black.
 1 „ „ dark brown and drab.
 3 threads of black.
 2 „ „ blue.
 1 thread of black and tan.
 2 threads of blue.
 3 „ „ black.
 1 thread of dark brown and drab.
 1 „ „ black.
 4 threads of blue.
 1 thread of black and tan.

In the first colouring given above, the ground of the fabric is a composition of tan and fawn grouped on the thread-and-thread system, the spotting yarns being pale blue and rose pink. The second scheme is for textures consisting of one solid shade in the ground ; the surface of

the fabric in this instance is drab, dotted with the check spotting produced by the weave—fig. 139—with fancy worsted and silk twists. The third arrangement is a simple four-and-four check composed of black and blue, the spots falling in different parts of the checks. Should it be necessary to have the spotting always in the centre of the four threads, the construction of the design would have to be modified. Instead of the arrangement being five threads of ground to one thread of spotting, it would require to be four threads of ground to one thread of spotting.

192. *Advantages of the Warp and Weft Method of Spotting.*—In all fabrics in which force of spotting is invaluable, the warp and weft principle of design construction is the most effective. Mantlings of a matelasse order, worsted dress textures, fancy cottons for vestings and quiltings, are all admirably spotted by this arrangement. Allowing as it does for the employment of a double series of spotting yarns, it yields patterns characterized by much diversity of tinting and by unique intermingled effects. By causing the two sets of spotting threads to interlace with each other, and by arranging for them to be of different colours, patterns full of textural details are produced. Still, for ordinary coating and suiting fabrics either the warp or weft method is generally practised, because in these textiles the spotting yarns are only intended to dot the surface of the cloth with minute specks of bright colouring, and not to form elaborate patterns as in mantling and dress styles.

193. *Yarns used for Spotting.*—The yarns used for spotting purposes are of various types. Indeed, all classes of fancy threads, from the ordinary bright-coloured yarn to the most complex twists, are employed in spotted fabrics. The greater the skill exercised in the construction of these yarns, and taste in the combination of their colours, the more attractive and artistic in composition the patterns resultant. Some interesting species in these threads, com-

prising three-ply, cloud, knop, curl, and gimp yarns, are furnished on Plate XXI. Yarns *A*, *B*, and *C* are ordinary threefold twists, being composed thus: *A*, black and scarlet worsteds, and salmon silk; *B*, black and green worsteds, and salmon silk; *C*, black, russet, and orange. For spotted worsteds there are few yarns so useful as this class of worsted and silk twists, for they give exquisite effects both as regards neatness of pattern and delicacy of tinting. Samples *D*, *E*, *F*, *G*, and *H* are cloud threads. They are chiefly used in fancy tweeds. As a rule they are rich in colouring and full of ingenious combinations. Without entering into the mechanical construction of these yarns, reference may be made to their structure and utility in spotted fabrics. Take threads *D*, *E*, *G*, and *H*, which are analogous in arrangement, for they are all composed of four tints and have one thread, which, on account of its being continuous, may be termed the central or principal yarn, all other threads twisting or twining round it. The composition of these respective specimens is as follows:—

D. Black for the central thread or shade, and crimson, green, and blue for the intermittent colours.

E. Grey for the central thread or shade, and scarlet, black, and tan for the intermittent colours.

G. Dark olive for the central thread or shade, and blue, yellow, and light olive for the intermittent colours.

F. Light drab for the central thread or shade, and black, scarlet, and tan for the intermittent colours.

Obviously the result of using such yarns is to spot the surface of the texture which they help to form with the various tints entering into their composition.

In one particular thread, *F* is a type to itself. Being of several thicknesses, they differ in construction from threads *D*, *E*, *G*, and *H*. Still this type of thread gives effects in the fabric somewhat resembling those resulting from the yarns with which it is grouped, and is, like them, designated

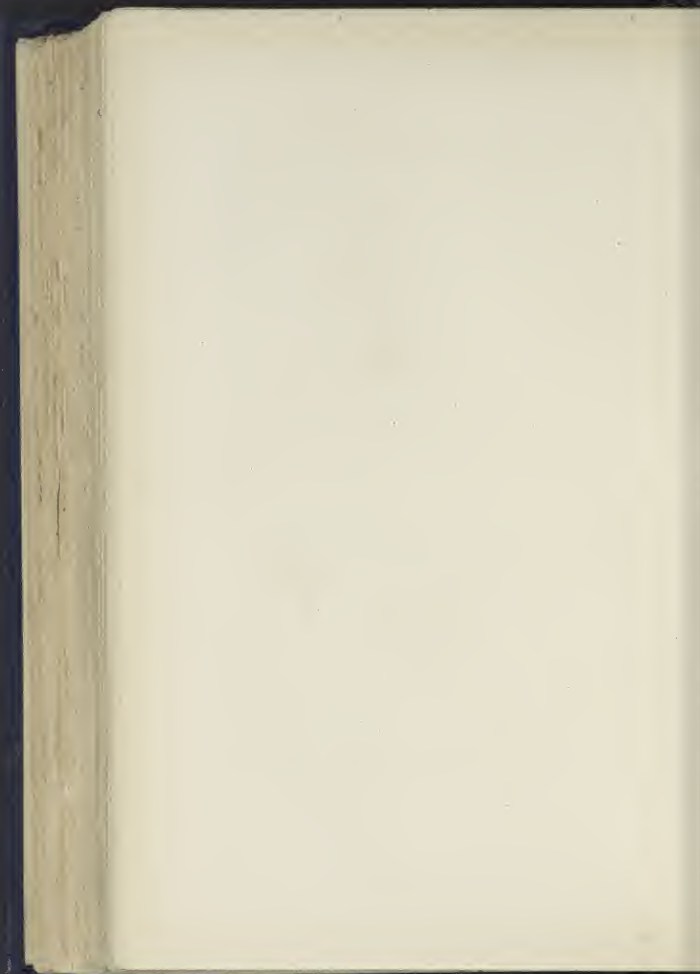
a "cloud" or "flock." It is, however, less complex in colouring, and forms an elongated spot in the texture.

The curled yarns are illustrated in types *I*, *J*, and *K*. Three examples are given—slate, crimson, and drab. The curls or loops are of different sizes. Such threads are applied to both woollen and worsted fabrics, but mainly to tweeds and fancy textiles for ladies' costumes. They give to the pattern a richly-tinted aspect. Some classes of trimmings are made entirely of these threads, but their relation to the the spotted fabrics is here alone considered.

Gimp and knop twists are also employed largely in designs of a spot class. Five illustrations of these are given in samples *L*, *M*, *N*, *O*, and *P* on Plate XXI. These threads are so fantastic in construction, and so exquisite in colouring, that they are only applied to high-class fancies. Yarn *L* is a composition of three threads—black, blue, and tan. The black and blue form a two-ply twist to which the tan is secured in the twisting operation. Small knops, causing the yarn to be somewhat irregular in thickness, are formed at intervals by the tan thread. Compound *M* is even more fantastic in colouring and construction. Loose in twine, and of various thickness, it gives a unique type of spot, but on account of the lack of adhesiveness in its composition it is a difficult thread to manipulate in weaving, and hence is but sparingly employed. Yarn *N* is a real gimp. Two black threads, well tensioned in twisting, have in this case been combined with yellow and crimson threads of slack twist, and running loosely. Thread *O* is similarly constructed to *N*, only the gimp is not so prominent, owing to the several colours being more evenly tensioned during twisting. Compound *P* is a speciality. It is a combination of gimp and knop. Thus knops or buttons of tan colour—see *a*—are formed at intervals in its circumference. Yarns *N*, *O*, and *P* are capital twists for spotted goods of various descriptions.



PLATE XXIII.



194. *Spotted Effects in Ordinary Weaves.*—The several classes of spotted patterns analyzed have all resulted from the employment of special builds of weaves. There are, however, some important species of these effects obtained in designs constructed on the ordinary principles of intertexture, which are extensively developed in both plain and ornamental fabrics. Allusion will now be made to a few of the standard types of these patterns. It may be observed that in producing the spotting in all these styles the fancy twists described in the preceding paragraph are extensively utilized. Pattern No. 1 on Plate XXII. is a specimen of fancy tweed spotted by this method. The cloth is woven from a twelve-end twill, the weft being black, and the order of warping as appended:—

2 threads of dark blue.

1 thread of black and tan curl.

2 threads of dark brown.

1 thread of black, brown, and white small curl.

2 threads of dark grey.

1 thread of black and blue curl.

It is scarcely necessary to observe that the curled yarns are the main elements of this colouring, spotting the fabric with small loops of tan, blue, and white. Knop, cloud, and gimp threads are similarly introduced into fancy fabrics. The effect of the knop twist is seen in the next coloured illustration—Pattern No. 2, Plate XXII. The minute figuring is due to combining two broken crow weaves. It is a style of design originated at the Yorkshire College for union mantlings, and is capable of being varied to an unlimited extent in both colouring and ornament. The warp is entirely composed of brown and white knop cotton twist. The dots of white noticed in the texture are a product of the warp yarns, and not of any peculiarity in the structure of the weave or design. Such an irregularly

spotted combination as this sample is only producible by yarns of the knop and cloud species. A third pattern, interesting on account of its spotted surface, is given on Plate XXIII. Like the preceding fabrics, it has been designed and woven in Yorkshire College looms, being a novel description of quilting. The fancy chain, knop, and other cotton twists entering into its composition have also been prepared on the college twisting frame. These yarns yield the spots of lavender, tan, and scarlet which are irregularly distributed throughout the pattern. The construction of this style of texture, and the scheme of colouring the same, will be treated of more fully in Chapter XII. This and the two preceding spotted textures are typical of the unique and elegant effects obtainable in plain and ornamental designs by employing various classes of compound threads, neat in construction and rich and mellow in colouring.

CHAPTER XII.

COLOURING OF DOUBLE WEAVES AND REVERSIBLES.¹

195. Principles of Double Cloth Colouring—196. Styles of Colour Effects obtained in Double Weaves—197. Double Plains—198. Classification of Double Plain Stripes—199. Double Plain Stripes in Two Shades—200. Two-Shade Stripes Warped Irregularly—201. Styles in Three Colours—202. Double Plains combined with other Weaves—203. Intermingled Double Plain Compositions—204. Reversibles—205. Methods of Colouring Double Plain Reversibles—206. Colouring of Figured Designs containing Double Plain and other Weaves—207. Reversibles arranged Two and One—208. Double Twills.

195. *Principles of Double Cloth Colouring.*—As briefly indicated in Chapter V., the general principles of colouring fabrics of a backed and double-make structure, resemble those applied to single textures. Particularly is this the case when the fabrics are the ordinary types of trousering, coating, and suiting styles. This follows from the fact that the face of these cloths largely consists of patterns of similar composition to those produced in single textiles. Still there are some builds of backed goods, which, owing to being coloured on both surfaces, involve the employment of two distinct schemes of tinting—one for each side of the fabric. The object to be attained in such fabrics is the development on the under side of the texture of a pattern that will, in general tone and character, correspond with that appearing on the face; but, though this species of colouring on the back is frequently necessary, inasmuch as it enhances the selling qualities of the fabric, yet the

¹ For information on the principles of designing double-make fabrics, the reader is referred to "Woollen and Worsted Cloth Manufacture."

grouping of the face shades is the primary consideration, for it must be in accordance with the weave-compound used in the construction of the cloth, whereas the scheme of colouring applied to the back is of secondary importance, and should be made to coincide in its main outlines with the style of colouring composing the face of the texture. Let an example be analyzed. Fig. 117 is a weave-combination which it is required to back with warp and colour on such lines as to obtain a stripe style of pattern on the under surface. The face order of colouring is given on page 306, and has already been treated of. Without describing the structure of this build of backed fabric, it may be stated that the arrangement is generally one thread of face weave and one thread of backing throughout the design. Assuming this to be the case, it is customary to plan the backing warp according to the composition of the face design, so that the following scheme would, in this instance, be appropriate:—

	6	threads of	slatish blue.
30	„	„	light mixture.
14	„	„	mid „
30	„	„	light „

This would result in the production of an effect in colouring on the back of fig. 117 quite in keeping with the scheme applied to the face, though the elements of colouring are not on the average so numerous. The simpler the arrangement of shades on the back the better, so long as it conforms with the order of colours producing the pattern on the face side.

Another method of duplicate colouring in double and backed cloths consists in having any ordinary scheme on the back which comprises a number of threads that is a multiple of that number occupied by the face pattern. Thus, in the scheme of colours for the design just considered,

fig. 117, there are eighty threads, hence arrangements comprising twenty, forty, and eighty threads might be utilized. These are divisible into two or four stripes, according to the style of effect required on the back of the texture. In this species of colouring it is evident that the combination of face shades is not closely worked to—a stripe neat in composition and tinting being the main factor for development.

When the yarns for the face and back of the fabric are of the same size and material, it is a rule in making out the pattern of warp to amalgamate the two schemes of colouring, but each scheme is necessarily designed separately. In fabrics backed on the warp principle, it is only feasible to have patterns of a striped character on the under surface, while if the fabric is backed with weft only, colouring on the back is not practicable, as it only results in striping the texture transversely; it is, therefore, only by employing the double-cloth method that all forms of colour effects may be developed on both sides of the fabric.

196. *Styles of Colour Effects obtained in Double Weaves.*—While, as is evident from the brief summary of the principles of double-cloth colouring furnished in the preceding paragraph, the application of fancy shades to the ordinary groups of double weaves is more or less analogous to their application to single weaves and compound designs, yet there are some important builds of double cloths which yield specific styles of patterns such as are not producible in other descriptions of weaving and schemes of colouring. Amongst the most useful of these types are the double-plain, the double-cassimere, the double-mat, and combinations of these weaves. Patterns obtained in these makes cover a large diversity of styles for trouserings, coatings, suitings, mantlings, shawls, rugs, curtains, and carpets. Here, however, the plan of colouring is not usually elaborate, being adapted to the structure of the design. The main characteristic of these fabrics which distinguishes them from effects obtained in

single-make designs is the firmness and strength of the cloth, combined with clearness and precision of ornament or pattern. The utility of this class of design is forcibly evident in the important varieties of textures whose patterns are products of the double-weave system of cloth construction. It will be shown how the different styles of pattern applicable to the fabrics enumerated above are produced in specific types of colouring and of double-make designing. Obviously, as the build of the cloth is uniform in the trousering, mantling, and other fabrics mentioned, there will be certain principles of colouring applicable to each class of effects. But, generally speaking, the use of a new double-weave necessitates the practice of a distinct system of colouring.

197. *Double Plains*.—For variety of effect and richness of pattern there is no class of double make comparable with the double plain. The analyses made in a former chapter of the schemes of colouring used in the single weave will make it evident to the reader what the common principles of gaining effect by combining fancy shades in double plain crossings are; and, moreover, what is the species of pattern here producible; for, as the system of interlacing is still plain—one fabric being formed above or over the other—whatever pattern is workable in the single crossing may, by duplicating the plan of colouring, be also obtained in the double crossing. Bearing this principle in mind, the methods of pattern development in double-weave designs of all classes will be readily understood.

In the hands of the skilful designer the double plain weave yields styles characterized by neatness of arrangement, and textures uniquely sound and firm in build, and possessing exceptional wearing properties. The simplest type of effects developed in this structure of weave is stripe patterns. It includes fabrics of two, three, and four shades. As a rule the shades combined are of a flat cha-

acter—lustrous and extravagant tints only being sparingly used. Mellow and subdued colours are more in keeping with the build of the fabric than bright shades. Still, in fine worsted textures, somewhat more cheerful shade associations obtain, and are more appropriate than in the woollen fabrics, which, being usually submitted to excessive felting, mainly consist of patterns resulting from combining toned colours. These stripe arrangements may practically be of any dimensions and range, from mere line-like effects to broad bands several inches in width. Next to stripe patterns in importance, so far as woollens and worsteds are concerned, are intermingled patterns, which are developed without limit in this make. Such styles possess a peculiar diversity of minute effects which makes them readily distinguishable from the mingled patterns obtained in other weaves and methods of colouring. Some of these effects will be analyzed. Checks, diagonals, small figured styles, and elaborately-ornamented textiles, are also developed in these designs, and will be treated of in proper succession. All these fabrics are virtually plain throughout. Though the weave, on a casual examination, is apparently an unimportant factor, yet it is closely related to the pattern produced, and has moreover to be modified with every change effected in the outline and form of the design resultant. Strictly speaking, all double plain patterns are composed of at least two weaves—one of which brings the odd series of yarns on to the face, and the other the even series. It follows that if a cloth is warped and woven one-and-one—say black and white—that one make gives a black and the other a white effect on the face of the fabric. Remembering this important principle, it will be evident in the sequel how, by changing these weaves in working out figured or ornamental patterns, any construction of design may be acquired.

198. *Classification of Double Plain Stripes.*—Striped de-

signs, obtainable by colouring double plain designs according to various systems, are as follows:—

I. Patterns in two shades.

II. Patterns in three shades.

III. Patterns in four shades.

IV. Patterns in two, three, or four shades, comprising double plain and other weaves.

The most elementary form of pattern obtained in the double plain is known as the hairline. It resembles in appearance the effect produced by warping and wefting the single plain make thread-and-thread, only the fabric is sounder and stouter in build, as well as finer and more compact in construction. Considering that this most simple style is a product of a certain method of colouring the double plain crossing, it is remarkable that the same weave can be so arranged and tinted that it will yield an endless variety of elaborate patterns.

Three-shade stripes are on the average far richer in colouring and intricacy of composition than the first order of patterns, and may be said to include the most useful forms and builds of double plain stripes. The third class, while composed of a larger number of shades, lacks scope for diversity of arrangement. As to the patterns comprised in the fourth class, they are rarely composed of more than two shades, but owing to containing additional weave elements they are frequently well embellished with textural design.

199. *Double Plain Stripes in Two Shades.*—These are of two types: I. Patterns warped and woven one-and-one; and II. Patterns coloured variously, but in strict accordance with the structure of the design used. Allusion will primarily be made to the I. type of these styles. In this form of pattern it is a question of arranging the double plain weaves on such principles as to form any species of stripe pattern. Take an illustration. Patterns 1 and 2 on



1



2



3



4

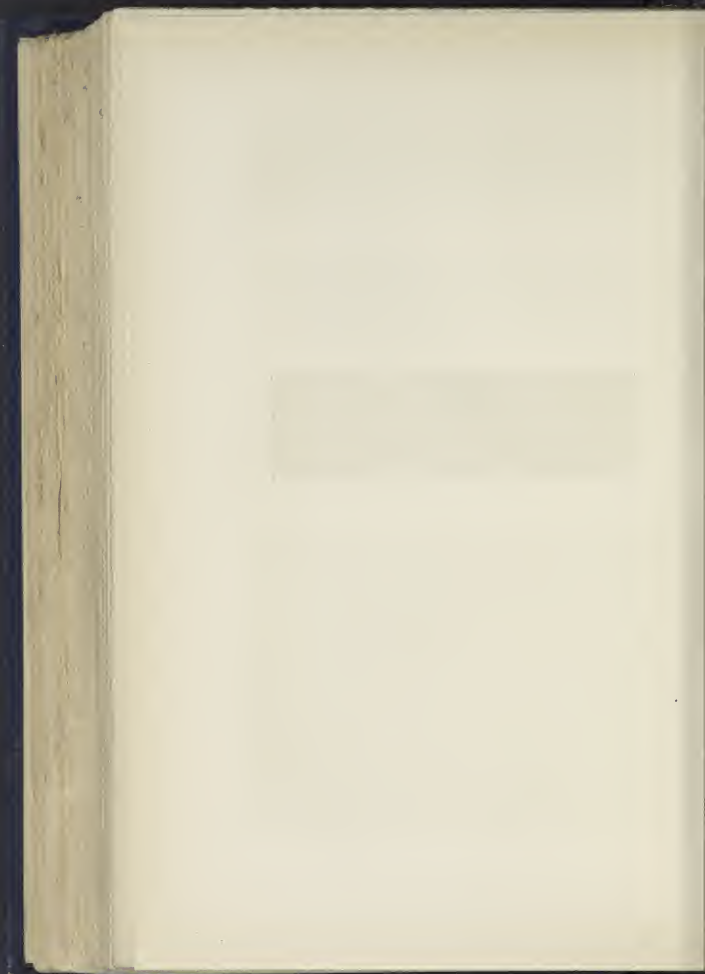


Plate XXIV. are double plain stripes obtained by this method. The colourings are as follows:—

- | | |
|--------------------|---------------------------------|
| 1. | 2. |
| 1 thread of olive. | 1 thread of brown. |
| 1 „ „ slate. | 1 „ „ brown and
white twist. |

The feature for analysis is, how the various combinations of stripes, and in Pattern 2 of twilling, are developed in these textures, which are composed solely of double plain weaves. Treating of Pattern 1 first—it is an assortment of small stripes of four different sizes worked out in two shades. If necessary, the design—*i.e.* the plan of weave—could be so modified as to give a pattern in which the stripes would not only run from a broad to a narrow band, but tone off on both sides. A brief analysis of the design for this texture, given in fig. 140, will make it evident what the principles of weaving are which determine the construction of this species of pattern. Here two double plain makes are combined, one of which floats the odd and the other the even threads and picks on the face. Now these weaves are so grouped in this design that they yield a form of pattern corresponding in every detail with No. 1 on Plate XXIV. In the use of these two crossings, and in the method of amalgamation, are two elements of design to which all such styles of woven effects are due. It should be observed that the weave marked in grey is the reverse of that marked in round dots, for it brings the even set of threads on to the face, while its neighbour takes them on to the back. When it is considered that the arrangement of



Fig. 140.

colouring is one slate and one olive, and that each of these

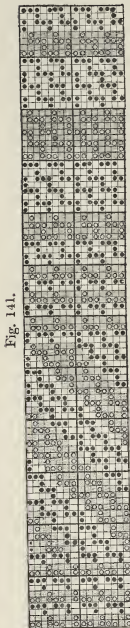


Fig. 141.

weaves forms two fabrics one over the other, it becomes obvious that in Sections *A* of the design (fig. 140) a slate stripe of plain fabric will cover an olive stripe of similar dimensions; but in Sections *B* a plain olive band conceals a corresponding stripe of slate. Referring to fig. 141, which is the weave arrangement for producing Pattern 2 of Plate XXIV., it will be observed that it is a style containing, in addition to the stripe effects, a band of clear twills. Evidently these have been developed on the same system as the preceding example, for the identical weaves and order of colouring as obtained in fig. 140 are found here unaltered. Diversity of pattern has, therefore, been acquired by adopting a different method of combining the weaves, which leads to the consideration of the construction of these designs. This is effected by first sketching out on point the exact form of the pattern required, and then adding weave *A* of fig. 140 to the uncoloured parts, and weave *B* to the coloured sections. It will be subsequently shown that reversible double plain styles are but developments of this species of designing.

200. *Two-Shade Stripes Warped Irregularly.*—First, there are styles of this class which are compositions of two shades, and in which variety of pattern is only producible by ingenious methods of grouping fancy yarns. By the aid of two examples (Patterns 1 and 2,

Plate XXV.) it may, however, be shown that even when thus limited to the use of two colours a considerable range of patterns may be acquired. Taking the order of shades for Pattern 1—the design for which is furnished in fig. 142—to be as appended it may be readily explained how the effect noticeable has been constructed, as well as those principles of colouring and weaving elucidated which are at the basis of this class of design:—

	<i>Warp.</i>	<i>Weft.</i>
For	{ 8 threads of slate. 2 „ „ black.	1 pick of slate.
58 threads.		1 „ „ black.
For	{ 6 threads of slate. 2 „ „ black.	
54 threads.		

One principle that requires to be taken cognizance of in making double plain stripes is, that while only every other thread comes on to the face, every pick, to some extent, is useful in forming the pattern on the right side of the fabric. As the principal feature about such styles is the solidity of the several lines of colour, providing these do not exceed four in number, it becomes a problem of so constructing the design that each shade of weft used shall only float or flush over that colour of warp yarn it is supposed to match. To produce a stripe in two colours is comparatively an easy task; but, in the example given in Pattern 1 on Plate XXV., the difficulty of arranging the plan of weave has been increased by varying to a considerable extent the order and size of the lines of colour. Thus, there are bands of colour of eight, six, and two threads each, or, on the face, of four, three, and one thread respectively. If the design is examined, it will be observed that the odd picks only cover the face-threads in parts *D*, which are the black threads in the fabric, while the even picks are arranged to cover the face-threads in part *A* only, floating under the entire series of black yarns. Should the weave be further dissected, it

will also be noticed that picks 1, 3, 5, and 7 interlace plain with the face-threads of *D*, but that picks 2, 4, 6, and 8 interlace plain with the face-threads of sections *A*. In this manner the solidity of each stripe of colour, which is the essential feature of such styles, is kept intact, and a pattern formed possessing unique distinctness of parts. This example and style—No. 2 of Plate XXV.—illustrate the numerous effects producible in these weaves by this method of colouring. Both parts *A* and *B* of Pattern 1 form stripe arrangements, which are frequently developed in trousering fabrics. By varying the number of bands of these respective combinations, many useful species of pattern are producible. Pattern No. 2 shows how a broad band of one shade may be worked into the texture, and then a line-like stripe of a second shade formed on it.

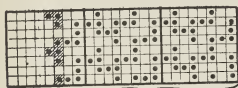
Fig. 142.



There is one peculiarity about the weave-design (fig. 143) forming the drab band of this fabric, which contains eighteen threads. Knowing the ordinary double plain used in figs. 140, 141, and 142 is untied, it follows that if some sixteen or more threads were used of it, as in this instance, the woven pattern would be loose and unsatisfactory in structure. So long as no more than eight threads form a stripe, tying is not necessary; but as soon as this number is exceeded a make must be employed that, while tied or stitched, will not interfere with the neatness, compactness, and uniformity of this type of woven colouring. The make generally used for this purpose is given in part *A* of fig. 143. Though somewhat irregular in construction, it produces a fabric perfectly even on both

surfaces, and as smart and clear in other respects as the pure double plain. The order of colouring for this example is: *Warp*, 18 threads of drab, 2 threads of brown; and *weft*, 3 picks of drab and 1 pick of brown. The invariable rule in developing these effects has thus been adhered to; for the drab picks never float over the face ends of brown, and, on the other hand, the brown picks always float under the drab face-ends—this being the principle of intertexture to which the solidity of the respective lines of colour is due.

201. *Styles in Three or More Colours.*—Some extremely interesting and effective stripes are got in double plain



A
Fig. 143.

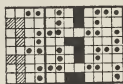


Fig. 144.

weaves by employing three and four colours. Two examples in Patterns 3 and 4 on Plate XXV. are furnished in styles composed of three shades. The weave for producing the former (fig. 144) is extremely simple, being so constructed as to form lines of lavender, claret, lavender and white. By comparing the order of colouring—which is given below—with the weave, the principles of design in which the pattern is obtained may possibly be obvious:—

<i>Warp.</i>	<i>Weft.</i>
4 threads of lavender.	1 pick of claret.
2 " " claret.	1 " " lavender.
4 " " lavender.	1 " " stained white.
2 " " stained white.	1 " " lavender.

It will be noticed that the first pick is claret; the reason for this is, that in the design the face-thread of claret is

down, and if it were covered by any other pick but its match in shade, the solidity of the claret line would be interrupted. For a similar reason the second and fourth picks are lavender, and the third pick is stained white. Pattern 3 of this Plate contains the same number of colour elements, but is quite different in arrangement. The design for this style, which is given in fig. 145, is so planned as to yield an effect, on the face of the fabric, as follows : a stripe of four threads of claret and white twist, a fine line of lavender, a stripe of four threads of claret and white twist, a fine line of lavender, a fine line of claret, a fine line of twist, a fine line

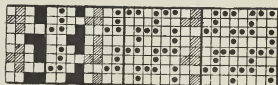


Fig. 145.

of claret, and a fine line of lavender ; in other words, it forms a compound of eight separate bands of colour. The plans of warping and wetting are appended :—

Warp.

- 8 threads of claret and white twist.
- 2 „ „ lavender.
- 8 „ „ claret and white twist.
- 2 „ „ lavender.
- 2 „ „ claret.
- 2 „ „ claret and white twist.
- 2 „ „ claret.
- 2 „ „ lavender.

Wet.

- 1 pick of claret.
- 1 „ „ claret and white twist.
- 1 „ „ lavender.
- 1 „ „ claret and white twist.

The effects in four shades are somewhat limited in variety, the respective stripes generally being of a single-thread character on the face. These styles are, however, extremely neat, and on this account are always manufactured to some extent. They are constructed on the same lines as the three-coloured patterns just described.

202. *Double Plains Combined with Other Weaves.*—Patterns of this class are chiefly made in worsted yarns for trouserings. The weaves which combine the most satisfactorily with this double make are of a warp flush character, including the more open types of corkscrews. The twills or makes used should be capable of forming neat patterns when coloured on the one-and-one system, which

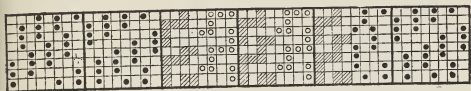


Fig. 146.

is the invariable method of picking or webbing such designs. Referring to fig. 146, which is a weave compound of this description, distinct bands of double plain are united with a band of corkscrew, resulting in the construction of the style given in Pattern 3 on Plate XXIV. The colours are maroon and dark green, and are grouped on the end-and-end system in both warp and weft; hence the solid lines of these shades in the double plain parts, and the oblique twills of maroon and green in the corkscrew sections of the fabric. Practically there are two points to consider in the selection of weaves for amalgamation with double plain crossings, namely, the webbing capacity of the crossing, *i.e.*, its power to weave regularly with the plain; and second, its structure in regard to the scheme of shade-assortment practised in these designs. Respecting the first

point, if another double make is used, such as cassimere or mat for face, and plain for back, there will not be much liability to form a fabric lacking regularity of construction, and hence evenness of surface; but, should the additional weaves be singles, they must be exactly of that structure as to work uniformly with the double plain. One point that may be noted in designing for these combinations, is to frequently divide the pattern, and so avoid the formation of broad bands of the several weaves. Then, as to the structure of the crossings in respect to colouring. Warp twills and warp weaves are most suitable because they do not exhibit the weft colouring to any marked degree, and hence they allow of quite a distinct method of tinting being introduced in the warp of these sections of the design in which they occur.

Styles of this description rank amongst the neatest in form, tinting, and effect of patterns producible in fine worsted yarns. They rarely obtain in any of the medium or coarse qualities of fabrics, being principally confined to superior cloths. Being characterized by special smartness

and elegance of composition, and richness of textural effects, they are developed to an unlimited extent.

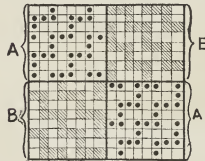


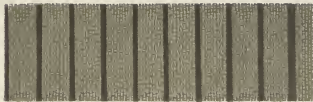
Fig. 147.

203. *Intermingled Double Plain Compositions.* — The most extraordinary effects producible in double plain crossings are possibly those resulting from employing schemes of colouring con-

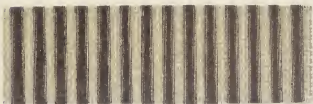
taining an odd number of threads, such as 2, 1, 1 and 1, and the 4, 1, 1 and 1 groupings. The weave used in such schemes of combining shades is given in fig. 147. In larger styles, sections A and B are increased to sixteen



1



2



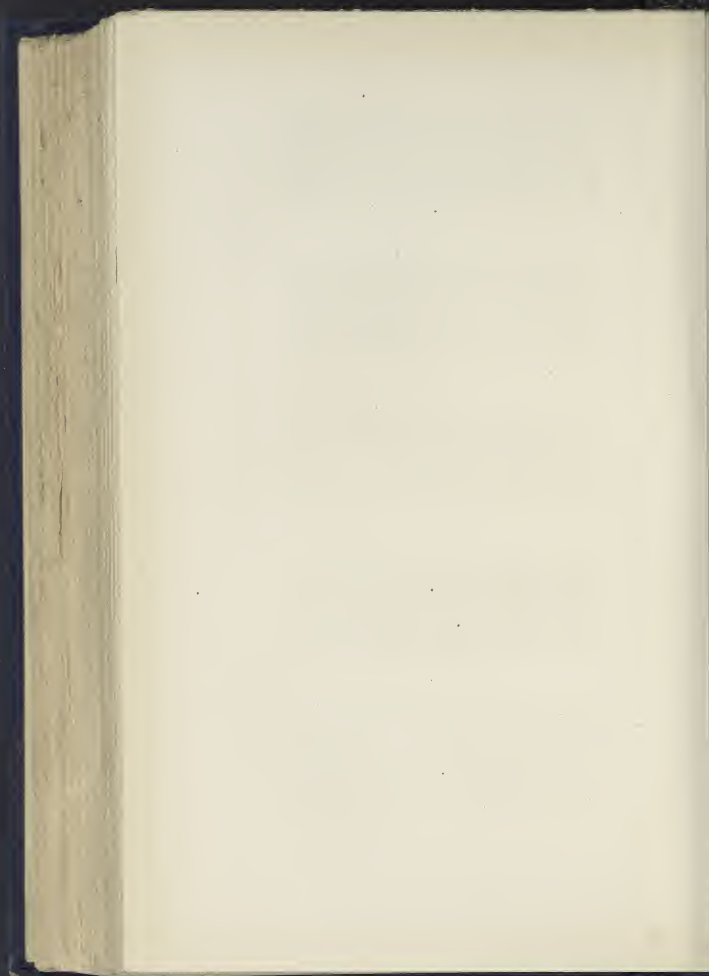
3



4



5



threads and picks each. By the aid of an example the principles underlying this form of pattern construction may be expounded. The style given in Pattern 5 on Plate XXV. results from the following arrangement of colours and the weave furnished in fig. 147:—

	<i>Warp and Weft.</i>			
For	{	4 threads of brown		
42 threads		1 thread of black and white twist.		
		1 " " brown.		
		1 " " white.		
For	{	4 threads of brown.		
14 threads		1 thread of black and white twist.		
		1 " " brown.		
		1 " " orange silk.		

This pattern was designed by the late Professor John Beaumont about thirty years ago. Its uniqueness consists in its dimensions and peculiar diamond spotted appearance. Though weavable in eight shafts, one repeat of the pattern contains no less than 112 threads, causing it to possess the leading characteristics of a Jacquard design. It need not be pointed out here what an advantage a designer secures when he thus succeeds in producing by limited means or weaving facilities an elaborate style, saving labour, expense, and intricate manipulation in the manufacture of the fabric. To what is the size of this pattern due? Not, as is usually the case, to the plan of the weave design, for it only occupies sixteen threads, and is merely capable of yielding a plain texture. It is the order of grouping the colours, combined with the weave, which is at the basis of this unique woven effect. Thus, as there are fifty-six threads in each repeat of the colourings before the plan of weaving will tally with the order of blending the shades, the pattern of warp must run through two, and the weave through sixteen repetitions. Herein lies

the cause of the construction of this exceptional pattern—in the appropriation of a system of colouring containing a number of threads not a multiple of the number of ends and picks in the weave. This species of colouring is practised in fine worsteds and woollens for mantlings, in medium counts of yarns for suitings, and also in linen and cotton textures for vestings.

There is practically no limit to the variety of effects

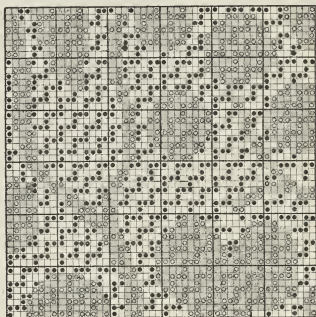


Fig. 148.

obtained on this system of colouring double plain combinations. On the diamond composition, forming Pattern 5 of Plate XXV., an indistinct check in silk twists is distinguishable; and in this plan of weave and by these irregular orders of colouring many varieties of spotting, intermingled checkings, and other effects in minute and in clear, bold patterns, are produced in all thicknesses of both woollen and worsted yarns. The 2 black, 1 twist, 1 grey,

and 1 of a second twist grouping is particularly useful in this manner, yielding a form of pattern that by ingenious modifications in colouring can be diversified *ad libitum*. The quiet tone of these designs, and yet their freshness of tinting and uncommon composition, are qualities that will always cause them to occupy an important position amongst textile styles. On account of the structure of the cloths in which they appear being plain and somewhat unattractive, such styles are not however so successful in worsted as in woollen fabrics. When developed in worsteds the yarns should be stout, to impart a broad effect to the build of the fabric.

204. *Reversibles*.—Fabrics of this class are ornamented, finished, and wearable on both sides. Double and treble makes are extensively employed in the construction of these effects. Amongst the double weaves used for this purpose the double plain is one of the most important. It gives a species of figuring as clearly developed on one side of the texture as the other. The system of colouring is mainly one-and-one, with some slight modification, such as a stripe or check effect in addition to the ornamental details worked out in colour. This principle of weaving is practised in the decoration of woollen and worsted shawls and rugs, tapestries, curtains, and carpets of the "Kidder" order. In the examples given in No. 4, Plate XXIV., Nos. 1 and 2, Plate XXVI., and on Plate XXVII., in these styles, several builds of fabrics are represented, including the double plain and the double twill. They may be regarded as standard examples of the form of pattern obtainable by these methods. They show that even mellow and soft contrasts of shades yield in such textiles effective and precise ornamentation in conjunction with elasticity and soundness of cloth structure. An important element of all such figuring, distinguishing it from that obtained by other schemes of weaving, is the singular clearness with

which the details and component parts of the design are developed. This remarkable characteristic of this kind of woven ornament is a pure product of the double weave arrangement. Taking, for instance, the shades of a texture thus constructed to be black and white, it follows that any double make combination in which the figuring is produced by changing the positions of the weaves, that is, by

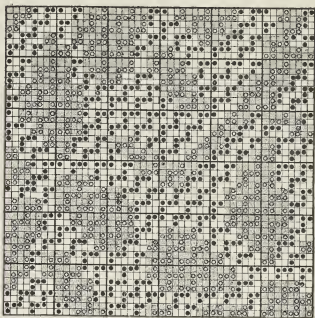


Fig. 149.

transferring that weave on to the back which has appeared on the face, and *vice versa*, there must result a pattern smart and clear in outline and general composition. No other principle of weaving is capable of giving effects so well pronounced in these respects. Other figured styles are always more or less wanting in precision and regularity of outline, but here the ornamental details may be as effectually developed in the fabric as on paper or canvas by pencil or brush. Reversibles are made in double weaves

arranged on the one-and-one, the two-and-one, and the three-and-one principles. The first method is, however, the most frequently practised. When the second and third schemes are adopted the yarns used are of two sizes—that forming the figure being considerably stouter than that employed for the ground of the texture.

205. *Methods of Colouring Double Plain Reversibles.*—Generally these are not very intricate, the main work in ornamenting such fabrics consisting in the adoption of a well-arranged design, with the various sections of the figuring perfectly represented on point paper. A few illustrations may be described. On Plate XXIV., Pattern 4, and on Plates XXVI. and XXVII., various textures for mantlings and shawls are furnished. Sections of each design are given in figs. 148, 149, 150, and 151. It should be observed that in executing these styles the first work relates to sketching the pattern on point paper, the weaves being subsequently added. The ground sections are occupied by the opposite weave to that applied to the figured parts. There should never be figure outlines requiring less than two threads and picks to develop, or the effect in the woven fabric will not be satisfactory. It should be considered in preparing these designs that practically every other thread and pick are duplicate yarns—both the odd and even threads never being utilized simultaneously in the construction of the pattern on the face of the cloth. Providing the figure has been correctly worked out on point paper, the next work consists in applying an appropriate scheme of colouring. Here various technical details and other points have to be considered, such as the structure of the design, whether bold or subdued colouring is the most suitable, and the scheme of grouping shades necessary to develop the ornamental forms of the style. First, it is absolutely impossible to arrange the shades in a fundamental sense on any system but the one-and-one, that

is to say, whether stripes or checks, the colours forming the groundwork of the fabric, the warp is planned end-and-end throughout, in order to meet the structure of the double-plain weaves. Second, it will be useful to consider types in which the designs are clearly pronounced in every detail, and others in which the figuring is more or less subdued. Begin with an instance of the latter order, namely, the

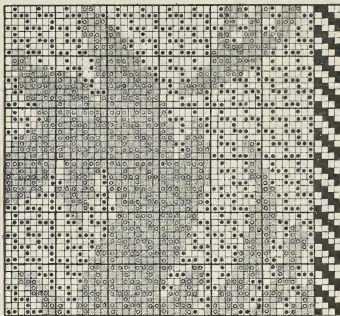


Fig. 150.

worsted shawl pattern supplied in No. 4 on Plate XXIV. By employing mixture yarns arranged one thread of deep and one thread of light drab, the figuring on the upper side of the fabric is developed in the light and the ground in the dark shade, the effects on the under side being exactly the reverse of those seen in the illustration, namely, light ground with dark figure. For shawls few principles of design are more useful than this, for it gives a texture in every particular as neatly ornamented and constructed on

one surface as the other. The border of these goods generally consists of a different pattern from the centre or groundwork of the shawl, and is also differently coloured. Take the following as an example:—

1 thread of mid brown.	}	For 384 threads—the edge of the shawl.
1 " " drab.		
1 thread of blue.	}	40
1 " " white.		
1 thread of scarlet.	}	40
1 " " white.		
1 thread of blue.	}	40
1 " " white.		
1 thread of orange.	}	40
1 " " white.		
1 thread of blue.	}	128
1 " " white.		
1 thread of orange.	}	40
1 " " white.		
1 thread of blue.	}	40
1 " " white.		
1 thread of scarlet.	}	40
1 " " white.		
1 thread of blue.	}	40
1 " " white.		
1 thread of mid brown.	}	For 3648 threads—centre of the shawl.
1 " " drab.		

Repeat the border.

Repeat the edge.

The above arrangement is for a fine worsted shawl made of about twofold fifty's yarns and set in twenty's reed four ends in a split. The centre and edges of the shawl are simple in colouring, but the border consists of checks of blue, scarlet, and orange on a white groundwork. As the white yarns alternate with each of these colours, the figuring on one side of the shawl in the border is solid

white on the checks named, but on the reverse side the figuring is developed in the various tints, while the ground is perfect white. Other and simpler forms of borders besides this are frequently adopted; for instance, an appropriate method of colouring for the border of a shawl composed of Pattern 4 of Plate XXIV. in the centre, and of a diagonal weave for the edges, is thus:—

1 end of white.	}	60
1 „ „ light grey.		
1 „ „ white.	}	60
1 „ „ dark grey.		

When this class of designing and colouring is executed in woollen yarns for rugs, the fabrics are covered with pile on both surfaces, causing the colourings to possess a very mellow aspect. Pattern 1 on Plate XXVI. is an example of this kind. The design (fig. 149) is made on precisely the same system as that for the preceding style. The arrangements of shades are as follows:—

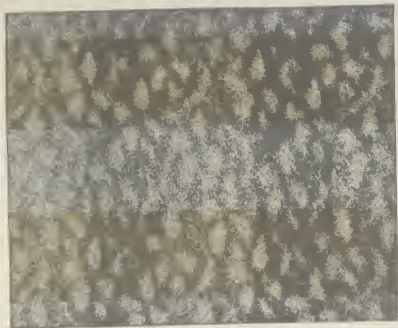
Warp.

1 thread of dark grey.	}	For
1 „ „ white.		
1 thread of light grey.	}	48 threads.
1 „ „ white.		

Weft.

1 pick of dark grey.	}	For
1 „ „ white.		
1 pick of brown.	}	48 picks.
1 „ „ white.		

206. *Colouring of Figured Designs containing Double Plain and other Weaves.*—One illustration in this species of fabric will show the principles of colouring and weaving which have now to be considered. The object is to obtain three or more effects in figured fabrics mainly composed of double-



1

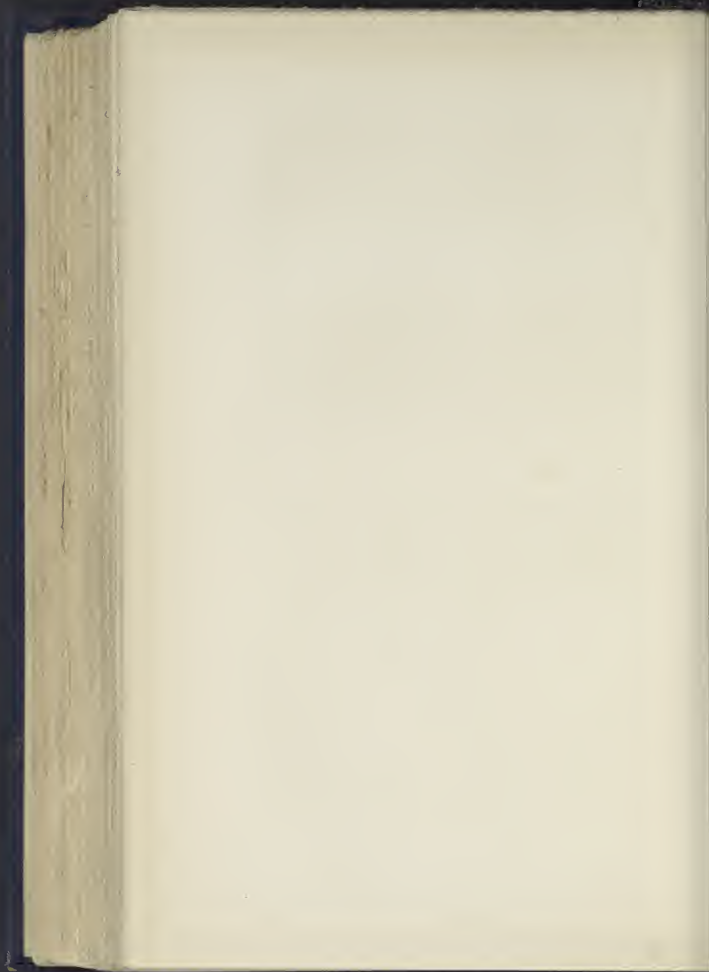


A

2

A

PLATE XXVI.



plain crossings, and at the same time to develop with special emphasis the ornamental forms combined. In Pattern 2, on Plate XXVI., part *A* is a band of common twill, which in the end-and-end colouring yields an effect between the solid white figuring and brown groundwork. A very particular point to be guarded against in the construction of such designs is the employment of such quantities of this

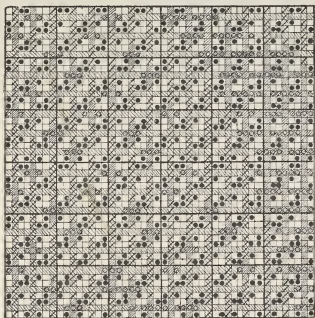


Fig. 151.

or other single weaves as will result in the production of a fabric irregular in build. Fig. 150 shows the manner of combining the different crossings to obtain the effects specified with regard to Pattern 2 of Plate XXVI. Extremely intricate orders of colouring are feasible here, providing the thread-and-thread scheme is not sacrificed. Seeing that the styles are made for mantlings and some classes of curtains, the more ingenious the system of grouping the shades the more valuable the results obtained.

on similar principles to reversible double plains—such duplicate schemes of shades as are workable in single make cloths of the same weave structure being employed. Double cassimeres are coloured on such various methods as to be used in the manufacture of trouserings, coatings, and suitings, as well as in figured textures for goods of a mantling class and suitable for decorative purposes. From fig. 152,

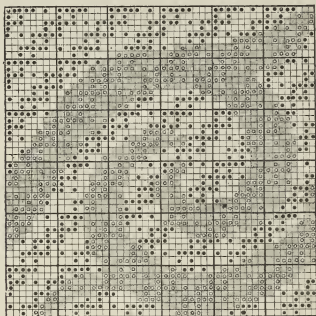
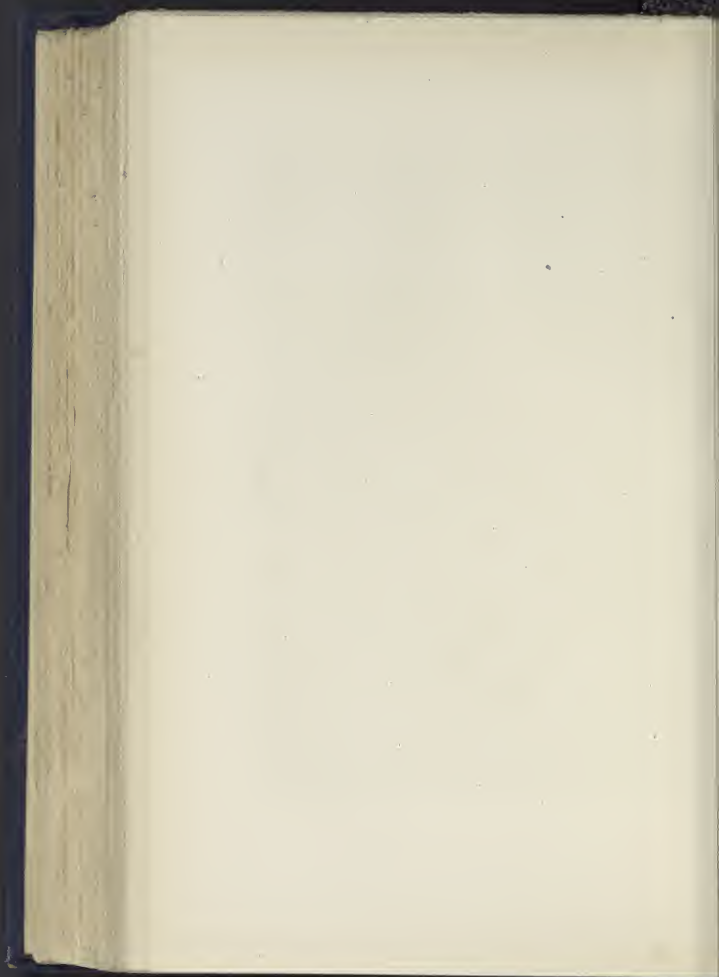


Fig. 152.

which is a plan of the weaves for the curve effect seen in the pattern on Plate XXVII, it will be apparent how the designs are constructed. It is precisely the same weave which is run on to the ground as is run on to the figure, only in the former the odd threads appear on the face, and in the latter they appear on the back, while the even threads come on to the face. Knowing that the order of warping is one thread of dark brown and one thread of light brown, and the order of wefting one pick of drab and



PLATE XXVII



one pick of olive green, it will be evident from the structure of the weave-design why the ground is a composition in the texture of olive brown and drab and the figure of dark brown and olive. Precisely the opposite effect obtains on the reverse side of the fabric from that represented in the illustration—the tints which form the ground on one side composing the figure on the other.

It may be remarked, in reference to the colourings of all classes of reversibles composed of double weaves, that it is only by studying the principles of designing and colouring of single make textures, patterns well arranged in a technical and æsthetic sense are obtainable. The art of treating these intricate compound fabrics with colours is based on a thorough knowledge of the various methods of introducing fancy yarns of different classes into single-weave styles.

CHAPTER XIII.

FIGURED TEXTILES COLOURED IN THE WARP.

209. Methods of Colouring Figured Fabrics—210. Special Elements of Ornamental Woven Design—211. Art and Technique—212. Styles of Figured Fabrics Coloured in the Warp—213. Cotton Quiltings for Vests—214. Ornamental Characteristics of Quilting Designs—215. Attributes of Plush Fabrics—216. Origin of Velvet Weaving—217. Velvets, Compound in Structure—218. Two Classes of Plush Fabrics—219. Warp Plushes—220. Methods of securing the Pile—221. Analysis of the Process of Velvet or Warp Plush Weaving—222. Colouring of Warp Plushes and Figured Velvets—223. Brussels and Tapestry Carpets compared—224. How the Pattern is developed in Brussels—225. Structure of Brussels Carpets.

209. *Methods of Colouring Figured Fabrics.*—There are three distinct systems of colouring figured textiles—namely, colouring in the warp, colouring in the weft, and colouring in both warp and weft. According to the first method the fancy shades are introduced into the warp only—the weft being of one colour throughout the texture. This scheme of tinting is practised in ornamenting various types of mantlings and dress fabrics, also pile textures of a figured velvet and plush class, and Brussels, tapestry, and velvet pile carpets. Each additional colour imported into these styles of woven products involves the use of a specific set of warp yarns, which, as will subsequently be indicated, materially increases the complications of manufacture. Turning to the second system of colouring named, which also obtains in certain descriptions of dress textiles, and in vestings, rugs, and matelasses, it neces-

sitates the employment of several groups of weft threads of different colours. On comparing these two distinct schemes it may be observed that while the former relates to the utilization of various warp shades—which multiplies the difficulties of weaving in two ways, first, by requiring a Jacquard of large figuring capacity; and, second, by increasing the intricacy of the plan of the warp yarns—the latter relates to the employment of various groups of weft picks, which, in their turn, add to the complexity of production by increasing the number of cards necessary in the construction of the design, and by making the use of various shuttles a desideratum. These are, however, technicalities that are elucidated in the analysis made in the sequel of the principles of colouring and designing figured textiles.

Lastly, the third method is a combination of the arrangements just considered, and is applicable to similar fabrics as they, excluding the plush and pile productions. It is, for obvious reasons, the most complex system of colouring, and is only feasible in looms specifically constructed and mounted for the weaving of figured compositions, comprising both warp and weft tinting in a considerable diversity of shades.

210. *Special Elements of Ornamental Woven Design.*—Woven design requires distinct treatment from other species of decoration; it is not simply surface ornamentation, for it also relates to the production of a suitable fabric for developing the details of the pattern. Every description of textile designing has, in a word, a twofold relation, for it is both utilitarian and ornamental. Primarily, it relates to the construction of a texture uniform in surface and of the requisite softness, lustre, and strength; and, secondly, it relates to the decoration of the face of the fabric. Ornament in woven goods is inseparable from the weave which produces it. Consequently, it

cannot be applied with the same facility to a textile surface as to paper-hangings, porcelain, etc. In these instances the designer's work simply relates to the embellishment of an article obtained by a preceding process of manufacture; whereas, in textiles, warp and weft are the elements out of which both the pattern and the cloth are evolved. Design or ornament and texture have by these agents to be developed simultaneously. Instead of manipulating straight and curved lines in the formation of the pattern—the character of the ornament resultant depending on the system of amalgamation adopted—threads of warp and weft have here to be interlaced on such methods as to constitute the design required. In order to develop the integral parts of woven design, by imparting appropriate prominence to certain sections and subordinating others, a knowledge of the structure of textile fabrics in general is indispensable. Elaborate textile designing is only perfect so far as the various figures and details of the ornament *in toto* are neatly finished and smartly executed. The correct delineation of the objects, and evenly-balanced grouping and distribution of figure, but touch the artistic phases of the subject. There must be a smart, decided finish given to the designs, which, while adding to their effective appearance and developing their graceful forms, will also impart regularity and evenness of surface to the fabric. Textile pattern is too frequently marred by defective and faulty development. Either the materials used are unsuitable for displaying the characteristics of the style, or the designer has only partially understood his work. With the form and general conception of the design there is no fault to be found, but with the bungling manner in which it has been executed.

211. *Art and Technique.*—It will be obvious from the purport of the preceding paragraph that technical dexterity in textile designing is the power of developing, with appro-

priate emphasis, all types of ornamental effects, whether in relation to form or colour, in association with the construction of a fabric uniform in texture, soundly built, and neat and attractive in composition. Technology relates primarily to weaving, but in an ampler sense to the invention and combination of schemes of crossings calculated to add novelty and uniqueness to woven design. As the heavens are beautified by the myriads of shapes in which the fleecy clouds are formed, and these again are enriched by an infinitude of tints and colouring, so the otherwise monotonous surface of a woven fabric is augmented in beauty by those manifold systems of structure only familiar to the true student of the weaver's art. With these all classes of figured fabrics literally team. Only the apt union of technique and art is competent to produce a well-balanced and cleverly-constructed woven effect. But for this kind of design the surface of woven textures would be as uniform in structure as so many sheets of paper; the only difference would be in fineness, just as the texture of paper is also determined by smoothness, glaze, and strength. Ornament, then, would possess a similar aspect in woven fabrics as when applied to any other plain surface, and might as well be obtained by the artist's brush, the printer's block, and the embroiderer's needle, as by the loom. Technical or weave patterns provide, however, infinite diversity of texture. It may be ribbed, furrowed, twilled, diagonalled, covered with pile like the coat of the seal, and varied on a thousand systems. These technicalities of structure give novelty, fashion, aspect, and cast, which a woven fabric can only receive in the loom. Weave design is the very essence of the ornamentation of some types of silk patterns. Of course it is materially enhanced by artistic combinations of form and colour, for technique and art are, in these fabrics, uniquely amalgamated. In all woven decoration art is the natural and requisite

associate of technique. It is impossible to separate them and attain satisfactory results. Technique determines the strength and fineness of the fabric; art determines its ornamental force and symmetry. Technique regulates the distribution of materials; art appoints the forms, groups the figures, and blends the colours. Technique constructs, builds, composes; art beautifies, embellishes, enriches.

Evidently mere decorative merit or beauty does not include all points in textile design. Besides elegance and symmetry of form and æsthetic colouring, which are principally artistic considerations, there must be technical force and exactitude.

The difference between the artist's rough drawing and the finished picture is no more obvious than the contrast between ornament appropriately and inappropriately obtained. In one instance, embellishment exists in association with richness of texture and beauty of interlacing of threads; in the other, embellishment is manifoldly impoverished by environment totally unsuitable to its development and out of harmony with its composition. Yet there are art designers who teach that a knowledge of weaving is neither essential nor helpful to the designer of decorative fabrics. If this be true, the sculptor need not learn how to use the chisel, nor the art jeweller the cutting and finishing tools. Art *workmen* and not art *theorists* are the desideratum of the times. The distinction is important. One can apply his art, the other cannot. The trained and practical designer understands the utility of art knowledge and blends it with technique in all species of woven ornamentation. Possessing, moreover, technical skill, he also understands the possibilities and ramifications of the weaving process. As the very essence of the sculptor's skill lies in execution, the very essence of precise and congruous expression of woven pattern lies in a sound grasp of the principles of the weaver's craft. While the techni-

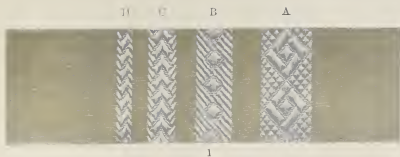
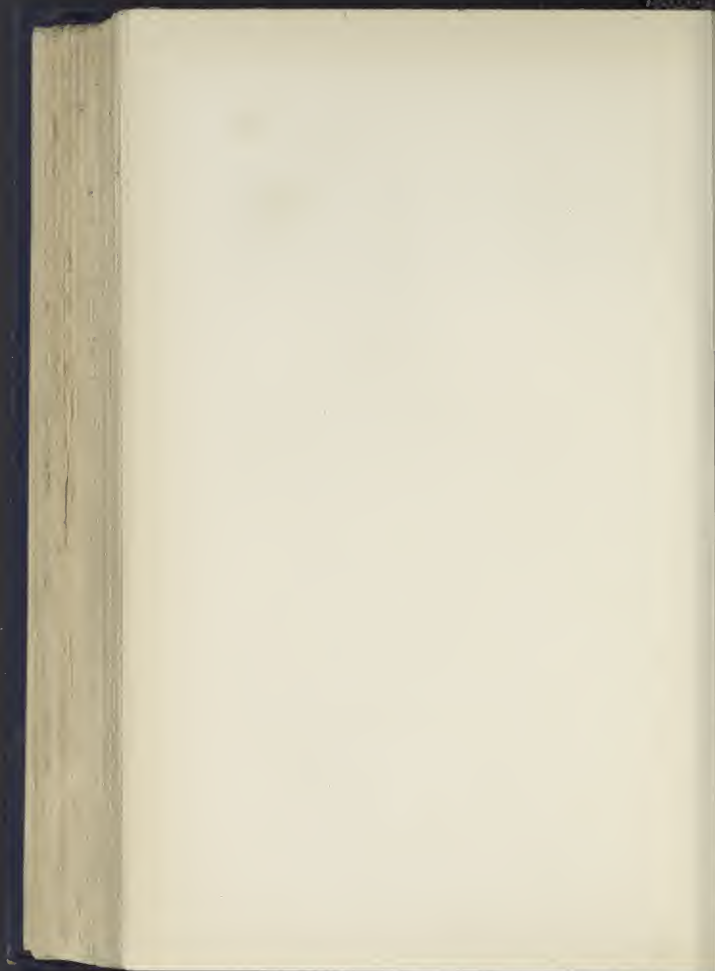


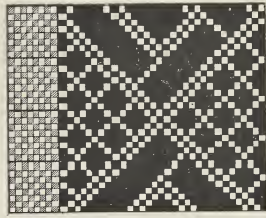
PLATE XXVIII.



cally incompetent designer plays on a few systems of textile compositions, his skilled *confrère* imports into his loom performances, to give them variety and freshness of style, all species of crossings, and practises all schemes of colouring, and adopts all modes of intertexture. All know the difference between a monochrome and a coloured picture. The skilled designer's work, in technical richness, may be compared with the latter; while that designer's patterns, however competent he may be as an artist, whose knowledge of weaving principles is restricted, being characterized by a dearth of technical excellencies, may be compared to the monochrome. It is as though the former had at his command an endless field of resources, while the latter's capabilities transcribe for him a circle in which he revolves with automatic precision.

212. *Styles of Figured Fabrics Coloured in the Warp.*—The simplest type of figured textures coloured solely on the warp principle is essentially single in construction. There is no duplicate series of yarns for tinting purposes, but merely a special colour of threads used in certain sections of the ground warp of the fabric. Pattern 1 on Plate XXVIII. illustrates this scheme of colouring. From this example and the section supplied of the design used in its production—fig. 153—it is apparent that the texture is constructed on the single-weave principle, the only irregularity consisting in a specific number of threads—white in the pattern—being flushed or floated on the surface of the fabric to form the figure in stripes *A*, *B*, *C*, and *D*. The weft effect is therefore concealed in these sections of the texture. In warp matelasses the same principles of weaving and colouring obtain—the weft yarns acting as binding agents, and not in any case appearing on the face in the figuring, unless a special set of weft yarns is employed, as in some styles of matelasse vestings, for spotting with bright colours. This description of warp effect is,

however, a compound fabric, possessing two warps and two wefts. They are frequently arranged two threads of figuring to one thread of ground in the warp, but one-and-one in the weft. The ground warp is invariably cotton, but the figuring warp is worsted, silk, or mohair. One weft is stout cotton or wool, and is used for wadding or for giving fulness and clearness to the design, and the other is fine cotton, worsted, or silk, according to the quality of fabric produced. Not infrequently an additional woollen weft is employed for backing.



Part 4 of Pattern 1, Plate XXVIII.

Fig. 153.

Quite a distinct scheme of warp colouring is practised in some classes of dress and plush textures from that just alluded to. These are virtually in those sections in which several colours run in the same line of the design, two-, three-, and fourfold in structure, according to the number of tints used. In Pattern 2 on Plate XXVIII. a fabric coloured on this principle is given. It is a vesting style of the quilting character, but is illustrative of the common methods of colouring by extra series of warp yarns. On analysis, it is found to be composed of three tints—a white ground, and chocolate and tan figuring. These are all

introduced in the warp. Now in such textures there is invariably a ground warp or chain which runs through the fabric, and forms, conjointly with the weft, a firm texture to which the figuring yarns are secured. This ground warp is usually drawn on to a set of shafts, and, in dress and mantling fabrics, is worked plain, twill, mat, and other simple crossings. It is of one colour from list to list of the piece. Next come the figuring yarns, the principle of combining which is shown in figs. 154 and 155. In the former

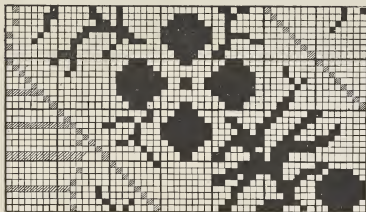
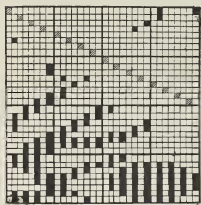


Fig. 154.

the effects as they are seen in the texture are given, the blank spaces representing the ground of the fabric, the greys the tan spotting, and the solid blacks the chocolate figuring. Fig. 155 shows how the figuring threads succeed each other in the harness and the sley or reed. Between each two threads of figuring there is one ground end. When three or four colours are employed in figuring, there is one ground end between each group of threads; in other terms, the rankness or firmness of the ground of the fabric is exactly the same throughout the texture. The different series of fancy yarns, working on distinct systems with the weft, have to be run on to separate beams—an arrangement which adds materially to the cost of the manufacture of

these goods. Moreover, the principle of construction minimizes the weaving capacity of the machine. If a design, for example, required a 192 Jacquard to produce it when developed in one colour, had to be so modified as to be executed in three tints, each of which was always forming some part of the figure, it could not be woven in a machine possessing a less capacity than 576 wires. In addition to this machine, the ground of the texture would be obtained by shafts or heddles. The same design, if coloured in the weft, would be weavable in a 192 Jacquard, but would require 576



First 16 threads of Fig. 154.

Fig. 155.

cards for developing the figure and 192 cards for producing the ground of the fabric. Hence, while the warp method of colouring is the most economical in respect of cards, weaving, and card stamping, the weft method does not necessitate the employment of a Jacquard of such large figuring capabilities.

Amongst the ornamental styles of woven goods coloured in the warp that may be specially analyzed, are cotton quiltings for vestings, velvets, and various classes of pile fabrics.

213. *Cotton Quiltings for Vests.*—Quiltings being one of the most interesting and important of warp-coloured figured textures, may be primarily examined.

In texture and ornament they constitute a specific type of woven goods. They comprise a principle of textile effect that is prolific in capabilities, and which has not by any means been developed to its utmost limits. One very important essential in which they differ from other textures of a vesting character consists in the figure or orna-

mentation being produced by several colours, or rather series, of warp threads. Generally belonging to that class of fabrics which are figured by the warp and not by the weft yarns, the designs are arranged to elevate or depress any particular set of threads, according to the section of the pattern being formed. The threads which traverse the entire fabric, constituting the ground of the texture, compose what is termed the ground warp, while all other series of yarns are called "extras." A similar arrangement of warps is employed in some classes of plush, tapestry, and carpet weaving, but in no fabric is an identical effect obtained to that which characterizes this species of vesting.

The warps which produce the figured pattern in quiltings never flush or float loosely on the surface, but are regularly secured to the foundation texture, constituting what may be defined as a "fast" figure, that is, a pattern which, though marked and well pronounced, is as uniform on the surface and as firm in arrangement as a plain woven calico. Anyone but an expert would find considerable difficulty in saying on what principle of weaving this texture is produced. The fact is, it is a twofold fabric, possessing, as already indicated, a ground and several figuring warps.

Invariably quiltings have a light or white groundwork, which is neatly ornamented with small lozenge, diaper, or other figured effects. This characteristic of the cloths may be most effectively shown by an illustration. The plan of this design (No. 2, Plate XXVIII.) is strictly geometrical, yet there is an absence of that rigid appearance which is frequently associated with patterns constructed on this basis. Weave, or the system of interlacing adopted, is the factor which imparts a variety of tone and effect to the style. It should be observed that the cloth is woven in three colours—light olive, drab, and white. The floral and sprig combinations are formed of the first colour, the raised or diamond portions of white, and the indentions of olive-

drab. The excess of white or drab in any particular part of the fabric is due to the structure of the design employed. The groundwork of the fabric is particularly neat and effective. It consists of a fine texture of white, slightly elevated above the indented border surrounding the figures. The small diamond effects are produced by the systematic elevation of the figuring warp, which imparts an indented appearance to the cloth. On this elegant groundwork two rectangular objects are placed in such a way that the inverted triangular figures they contain will be set reverse ways. Treating of the rectangular objects first, it will be noticed that they are separated from each other by the diamond groundwork, and also by the narrow border of dotted effect, in which, in the fabric, the drab colour is the most prominent. The space between this edging and the central figures on which the floral and sprig work are delineated is occupied by vertical ribs or reps. Here the white and drab are equally balanced. The V-shaped figures crossing each other possess a solid white ground, which very forcibly displays the neat floral forms they contain. The sprig ornamentation is characteristic of this style of vestings. It has not been produced, nor can it be applied with such facility, to any other description of woven fabrics. In these goods the fineness of the texture, and smallness of the threads employed, make it possible to develop the most minute figuring quite distinctly. A neat and interesting contrast is obtained by having the sprig effect in one V figure faintly marked, while in the other the floral work is both bolder in form and more compact in arrangement.

214 *Ornamental Characteristics of Quilting Designs.*—The ornament applied to this make of fabric is so unique that it deserves to be briefly noted. Certainly it is typical of the texture in which it is developed, being, so to speak, part of its construction. No other build of fabric admits

of the production of such fine, line-like, and detailed figured effects as are obtainable by this principle of weaving. The most minute decoration is here delineated with a precision that it would be difficult to surpass with the pencil. All the figures employed possess a graceful and delicate appearance, due mainly to the absence of extensive floats or flushes from their composition. Elaborate designs, crowded with combinations of form, are thus produced on a neat, tasteful system. Some patterns which would appear coarse and vulgar in other makes of fabric, possess in these textures elegance combined with an effective arrangement. The example supplied in Pattern 2 on Plate XXVIII. is an illustration of the minute character of the ornamental forms developed in these fabrics. Whatever the class of figuring practised, it is full of small twig effects and clear and precise details.

215. *Attributes of Plush Fabrics*—Another description of woven production coloured in the warp is plushes, including the imitation skin, the figured velvet, and several species of carpets. The distinguishing feature of all plush fabrics is the soft shag or pile with which they are so completely overspread that the very essential appearance of a woven texture—namely, the crossing of warp and weft threads—is entirely concealed from view. The pile is of two kinds: in some fabrics it consists of one uniform mass of short filaments, while in others it is in the form of minute curls or loops compactly clustered together; but in both cases it projects from the surface of an ordinary texture. The fineness of the fibre and density of the plush both combine to conceal the foundation on which it is produced. It is not too much to say that the characteristic appearance of velvet, as well as its remarkable softness to the touch, which distinguishes it from all other loom products, are due to the pile alone. As to the elegance and beauty of this article, they are dependent

upon the compactness and uniform evenness of its plush, any inequality in the length of the filaments of which it is composed producing an irregular and defective appearance in the texture. The differences between this and the two preceding principles of weaving are very decided. In the former makes of cloth the warp ends are invariably arranged longitudinally, and the weft ends transversely in the piece; whereas in plush weaving, one series of threads is pulled or drawn into a species of curl on the ground of the fabric, or, after having been secured to the foundation of the texture, they are actually cut into short filaments, causing them to stand erect on the surface of the cloth: hence a plush or velvet fabric may be defined as an ordinary texture overspread with a smart, compact, dense pile.

216. *Origin of Velvet Weaving.*—Velvets, as compared with other classes of fabrics, are not what may be termed ancient productions. They are reported to have been originally produced in Asia. The Chinese claim to have been the makers of a fabric of this description at a comparatively early date, but the specimens examined only indicate inferior workmanship, being coarse in texture and not comparable with those of European looms. Velvet manufacture, for a considerable period after its introduction into Europe, was confined to Italy, where, in the weaving establishments of Venice, Milan, Florence, and Genoa, it was extensively carried on with marked success. Two Genoese manufacturers, Etienne Turquetti and Barthélemy Narri, under the patronage of Francis I., in 1536, are reported to have commenced velvet weaving in Lyons, at which place it has even down to the present day remained an important industry. The productions of the French looms speedily surpassed those of Italy, both in fineness of texture and in soft, lustrous appearance. Rather more than a century after velvet manufacture had been established in France, it was introduced into England by the refugees of that nation when

compelled by the Revocation of the Edict of Nantes, in 1685, to abjure their country, who, coming over to England, settled in Spitalfields, that ancient seat of the English silk industry, and there domesticated this important textile art.

217. *Velvets, Compound in Structure.*—All velvets are what may be termed compound in construction—that is to say, one series of threads is appropriated to the production of the *ground* of the texture, while a second series is employed in the formation of the *pile*; in other words, there are distinct warps or wefts necessary to produce the plush and foundation of the fabric respectively. As to the ground, it may be formed of the plain make or of a fine twill, but generally the former. The threads used in the production of the pile may be of various colours, and treated in such a manner as to yield a shag or plush of several lengths. When the pile is obtained in the warp it may be either cut or uncut; that is, the plush may be formed of small, curl-like loops, or of merely the ends of threads projecting from the body of the cloth. In figured plushes the various parts of the pattern are developed by resorting to these two modes of producing effects, some sections of the pile being cut, and others remaining uncut, while to further enhance the character of the design an ottoman rib effect may also ornament specific portions of the fabric.

218. *Two Classes of Plush Fabrics.*—Technically, plushes are divisible into two great classes: (1) Weft plushes, or fabrics in which the pile is formed of flushes of an extra weft thread distinct from that producing the ground of the cloth. (2) Warp plushes, or fabrics in which the pile results from the use of an extra warp distinct from and independent of the warp utilized in forming the foundation of the texture or the cloth proper.

The richest and largest assortment of effects is producible on the latter principle, which is probably the original method of plush weaving. Weft plushes comprise, however,

a considerable variety of textures, including velveteens, corded velveteens, corduroys, astrakhans, feather trimmings, and recently, some choice fancy goods for trimmings for ladies' robes have been made on this system.

219. *Warp Plushes*.—In the first place, let it be understood that for whatever purpose the fabric is intended, whether for floor decoration, for forming an exquisite, costly robe, or for decorating and covering the head—to all of which and many other purposes such plushes are applied—at least two warps are essential in its production. Though independent of each other in action, being wound on to separate beams and subjected to different tensions, yet they are so combined by the filling yarn, that they both, when amalgamated, become important factors in the same cloth. The weave used in the construction of a warp plush is essentially of a twofold character, consisting of a ground crossing, and of a flush arrangement for producing the pile effect. Plain, hopsack, rib, and twill weaves are applied to the ground, according to the fineness and characteristics of the required texture. As to the pile, it may be either cut or uncut, of one, or several colours, and also of such variable lengths as are requisite to the development of the forms contained in the pattern. Whatever the character of the plush, it is due to the employment of wires which are inserted between the threads of the pile warp. Thus the wires are always introduced when the entire series of threads in the ground chain is depressed, and such threads elevated in the pile warp as are in accordance with the formation of the design. In some velvets the whole of the pile warp is lifted for the insertion of each wire. Fig. 156¹ is intended to illustrate the system on which the wires are employed, as well as the

¹ This and the three succeeding illustrations have been taken from the late Prof. John Beaumont's lecture on "Velvets: or Cut and Uncut Figured Plush Fabrics," which was published in the "Textile Recorder."

manner in which they produce the pile. Only nine warp threads, six picks of weft, and three wires are represented. The threads lettered *A* form the pile, and those lettered *G* the ground warp. In this diagram the wires are shown entering the warp when threads *G* are depressed and threads *A* elevated.

220. *Methods of securing the Pile.*—Fastening the pile is an important feature of the weaving process. Unless a

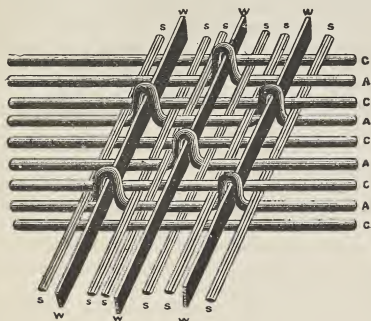


Fig. 156.

sufficient number of ground shoots is inserted between the wires, and unless they form such interlacings with the pile warp as to secure the threads it contains to the ground of the texture, whether the plush is looped or cut, it will draw out, and the result will be a defective fabric. A point, therefore, that should have careful attention is that of securing the pile in such a manner that it will remain erect after the withdrawal of the wires. The usual method of effecting this consists in arranging for the ground shoots

to float over the pile threads, both immediately before and after the insertion of the wires, as illustrated in fig. 156. This plan is extensively adopted, because it has not only a tendency to drive the wires into position, but to keep them there. It is not, however, the only system; in fact, there are two other useful methods of forming a "bed," so to speak, for the wires. One feature of the foregoing arrangement is, nevertheless, common to all systems, namely, the pile warp is invariably depressed after the insertion of each wire; consequently any difference existing between this and other modes of fastening the plush will be found in the plan of interlacing the picks *preceding* the wire. For example, in making tapestry carpets the pile warp is not down, but up, in the shed before that formed for the wire; while in a third system the pile threads float over two ground picks and the wire in succession. Both these systems are better adapted for the insertion of a large number of wires to the inch of the fabric than the first method alluded to, and are advantageously adopted when a full pile is desired.

Having thus indicated how the wires are secured in plush structures, a brief sketch may be furnished of the actual operation of velvet weaving.

221. *Analysis of the Process of Velvet or Warp Plush Weaving.*—The weaver, having interlaced the requisite series of ground shoots between the threads of the combined warps, proceeds to form a division among the threads, by depressing the whole of the ground chain, and in some cases the half of the pile warp, for the admission of the wire. This shed remains formed until the wire has been passed from side to side of the warp on its flat side and with the grooved edge towards the sley of the going part. On the wire having thus been fixed, the reed is brought with considerable force against the texture already woven, carrying the wire along with it, which it causes to stand on its lower

edge. In this upright position it is maintained by keeping the going part in contact with it till a new division of the threads (obtained by depressing all the threads covering it and elevating a portion of those floating under it) is secured, when the sley or reed is removed from the cloth and a ground pick introduced to be driven into actual contact with the ground shoot which preceded the wire. On this principle the wires are bound to the ground of the cloth, for the threads covering them are not only securely woven into the texture by the shoots preceding, but also by those following their insertion. Such, in a word, is the permanent manner in which the wires are fixed, by the loops of pile threads with which they are overspread, to the ground of the texture, that it is only with considerable difficulty they can be removed, if the pile is not cut, from the positions assigned to them in weaving. After the proper complement of ground picks has been added, the process of inserting the wires is repeated, several wires always being retained in the fabric. The necessity for this is obvious; thus, if the weaver, before he has introduced a sufficient number of wires, passes his knife within the groove of the first wire, and so cuts the loops covering it, the pile ends would, when tension was put on the warp in the formation of the next shed, draw out, and thus the plush would be destroyed. Premature removing of the wires should consequently be avoided, as it always endangers the character of the plush—hence a cautious weaver, in order to retain the pile intact, is mindful to have some four to six wires in the cloth before he proceeds to cut, or even before he commences drawing out, should the velvet be of a loop class.

222. *Colouring of Warp Plushes and Figured Velvets.*—Plushes made in imitation of animal skins are generally composed of several tints, and also of different lengths of pile. Fig. 157 is a weave for a plush of this order. Threads

B are brown pile, and threads *T* are tan pile. The ground of the texture is formed by threads and picks *G*. The two sets of pile yarns are wound on to separate beams. As the marks in this case indicate threads lifted, it will be noticed that on the first wire only one pile thread is up, namely, B^1 , both the tan and the ground ends being depressed. The second wire elevates T^1 , the third wire B^2 , and the fourth wire T^2 ; so that in each repeat of the design all the pile yarns are up once. This is one of the most elementary methods of colouring plush fabrics, and is extensively practised in the production of fancy effects in which no figure or ornamental design is required. When colour is introduced into styles of a figured class for robes and mantlings it is accomplished on other systems. Patterns 1 and 2 of

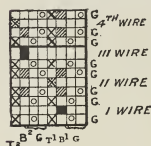


Fig. 157.

Plate XXIX. are illustrations of two types of plush or velvet colouring. The former has been tinted on the thread-and-thread method—resulting in the development of an intermingled composition in which both the ground and the figuring are neatly emphasized. It may be pointed out that the scroll is developed in loop pile, but the ground in cut pile. Each pick of designs for this make of plush is stamped twice; thus there is one card for the ground effect when half of the silk warp in this section of the texture is depressed, and the whole of the warp in the scroll part; and one card for the figure when the whole of the warp in the ground section is down, and half of that in the ornamental parts of the fabric. The following pick of the design elevates the opposite series of threads. Of course there are, in addition to these cards, special picks for the foundation of the fabric, which form a tabby cloth, two ends working together with the cotton warp. This chain, as in the quiltings, is mounted on a

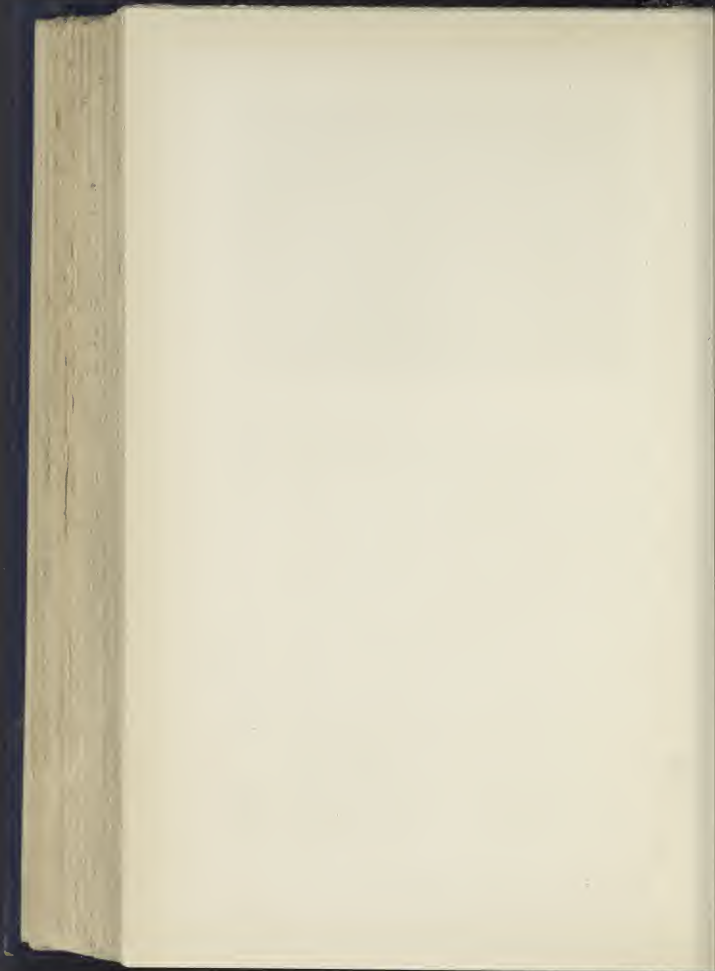


1



2

PLATE XXIX.



special series of shafts, while the figuring warp passes through the harness.

Pattern 2 on Plate XXIX. is another species of colouring. This is an admirable specimen of woven tinting and effect. Three warps have been employed in its construction, white silk for ground, greenish drab for the principal figure, and a warp coloured variously for the minor parts of the pattern. To produce elaborate textiles of this description a complicated form of loom mounting is necessary. First, the ground warp, which is run off a special beam, is passed through a set of shafts hung before the harness and worked by the Jacquard. Second, one section of the harness receives the greenish drab warp, and another section the various hues composing the remaining warp. These two figuring warps are also mounted on separate chain beams. The designs have to be so prepared as all the effects which are intended to be of one colour will fall exactly in the same line or occupy the same threads in design. If this rule is not strictly observed an irregularly-coloured fabric will result. This is one of the most intricate types of plush weaving, but, when skilfully treated in an ornamental and technical sense, yields some of the finest and most costly textures for robes, mantlings, trimmings, hangings, and tapestries producible in the loom.

223. *Brussels and Tapestry Carpets compared.*—Brussels and tapestry carpets are so similar in appearance that they might readily be regarded, on a casual consideration, as fabrics of the same structure. But, when the principles on which the pattern is obtained in the respective articles are examined, it is at once evident that there is practically no actual resemblance; for while in the Brussels the design is purely a woven effect, in the tapestry it is merely a print. The technical differences between these manufactures being understood, there are numerous causes apparent for the superior wearing qualities of the Brussels. First, in point

of colouring it possesses a distinct advantage over the tapestry, for all the shades used in its composition are supposed to be "fast," the yarns being hank dyed and not coloured in the warp. Second, the pile is fuller and made of better materials, while the thickness and substance of the fabric are not due to cotton strengthening threads, like the "body" of the tapestry, but to the worsted yarns used in the formation of the pile. Third, the pattern is more smartly defined, its various parts being clearly and distinctly developed; whereas the figure in tapestry carpets is always more or less indistinct, arising from the system on which the pattern is produced.

224. *How the Pattern is developed in Brussels.*—The weaving of this article affords some characteristic features for investigation. The pile warp, for instance, instead of running off ordinary yarn beams, is wound on bobbins, or miniature beams, fixed in frames, or a huge creel, stationed behind the loom. Each colour requires what is technically called a separate frame. A five-frame Brussels is a carpet with this number of colours succeeding each other in the same line of the fabric. The manner in which the various colours are controlled—in other words, in which they are concealed from, or brought into, view—is an important factor in the manufacture of this article. On examining a Brussels carpet, it will be observed that the individual threads forming the pile seem either to be composed of several colours, or to be substituted by yarns of other shades, according to the section of the pattern being formed. For instance, in the same line of the design, looking at the fabric lengthways, apparently in the same thread, as many as from three to five colours, such as black, green, drab, scarlet, and blue, form the pile in succession. If these effects are not due to a variegated yarn, they result from the employment of five distinct threads, each of which is so controlled that it only appears in the pile when assisting to

develop the design. The question occurs, How are the threads concealed when not appearing on the face of the fabric? An important principle of weaving is implied in the production of results of this character. Whatever the colour of the warp yarn in a single cloth, the pattern is, throughout the piece, continuously tinged with that shade, excepting in such positions as it is crossed with the weft thread. In a double cloth two colours of warp yarns may be applied to one line of the fabric; that is to say, supposing the shades selected were black and white, the pattern produced might be composed of these colours alternately, while in a triple-make fabric three shades could



Fig. 158.

be brought on to the surface of the texture in succession. Effects of this order are due to changing the positions of the threads of the respective warps by reversing the weaves. The several shades of a Brussels carpet are manipulated on this double weave principle of intertexture. To obtain a three-frame pattern composed, say, of black, scarlet, and olive, at least three separate weaves are necessary—one for each shade. Thus the weave used in forming the shed in the warp for the black pile is so arranged as to depress the scarlet and olive, while that for giving the scarlet pile conceals the black and olive threads, and lastly, that for producing the olive pile hides the black and scarlet ends; so that, by an appropriate application of these respective weaves to the design, the colours are brought up in the figure where required.

225. *Structure of Brussels Carpets.*—The structure of this make of carpet may next be briefly examined. In fig. 158 a sketch is furnished of the interlacing of the threads in a section of this fabric. The intertexture represented is that of a three-frame carpet. Section *A* may be supposed to correspond to the black, *B* to the scarlet, and *C* to the olive pile in a carpet of this description. The positions the threads occupy when not covering the wires will be evident on examining this illustration. Thus it is now clear that when a thread of pile yarn is not active in the formation of the figure, it is covered or concealed by the wire and ground shoots of weft. Take thread *b*, for instance, which, having covered the first two wires shown, floats underneath the succeeding wires; a similar arrangement obtains in the interlacings of thread *c*, which floats under wires 1 and 2, and over wires 3 and 4, while thread *a* is covered by the first four, but flushes over the last two wires; hence each class of pile threads interweaves with the ground weft on the same system, producing a carpet of uniform strength, and one in which every species of pile is equally permanent.

CHAPTER XIV.

WEFT-COLOURED FIGURED FABRICS—CURL TEXTURES.

226. Warp and Weft Colouring compared—227. Classes of Designs Coloured in the Weft—228. Designs in which the Pattern is a product of the Ground Weft—229. Extra-Weft Styles—230. Vestings—231. Vestings with one Extra Weft—232. Two-Cover Vestings—233. Four-Cover Styles—234. Two-Cover Mantlings—235. Three-Cover Mantlings—236. Double-Weft Reversibles—237. Warp and Weft Coloured Figuring—238. Curl Fabrics—239. Curls, Textiles of the Astrakhan Group—240. Four Types of Curled Effects—241. Curls obtained by Wires—242. Process of Weaving Curls produced by Wires—243. Curls formed by the Weft in which the Warp is Cotton—244. The Weave of Weft Curls—245. Structure of the Fabric—246. Operation of Cutting after Weaving—247. Figured Curled Fabrics—248. Curls developed by Milling—249. Points of dissimilarity in the various Builds of Curled Textures—250. Two kinds of Curls developed by Milling—251. Spiral Threads used for Warp—252. Variety of Pattern in Spiral-Warp Curls due to Colour—253. Stripes in Curls—254. Checked Curl Effects—255. Cotton Warp Curls—256. Twist-Yarn Cotton Warp Curls—257. Backed Weave for Curled Cloths—258. Essential Characteristics of Cotton Warp Curls due to Milling—259. Examples in Designs for Cotton Warp Curls.

226. *Warp and Weft Colouring compared.*—This class of figured styles is the most comprehensive. It includes vestings of several varieties, robes, ribbons, and an endless diversity of ornamental textures. Richer combinations of tints are more feasible by this than the warp method of colouring. A comparison of these two important systems of introducing colours into figured fabrics shows that the actual weaving process is less intricate so far as shuttling is concerned—not more than one or two shades of weft being

employed—than in warp-tinted textiles; but, as explained in Chapter XIII., each additional colour in the same line of the design requiring a special chain beam, there are several complicated technicalities connected with the manufacture of figured textures on this principle. These arrangements are just reversed in the weft system, for here there may be from two to six shades of weft running in the same line of the fabric, but only one warp is utilized. These conditions make the production of such fabrics a laborious operation, inasmuch as the number of picks inserted to the inch in four- or five-colour styles is extraordinarily large. Thus, in a pattern composed of the latter number of colours throughout, four hundred picks to the inch is not uncommon.

Whatever number of shades occur in succession across the pattern it is exactly so many fold in the weft, whereas if the colours are introduced in the warp the texture is several fold lengthways. The different kinds of weft or warp form layers of threads in the woven product. When they are composing the ornamental details of the design they appear on the face of the fabric, but when not thus utilized they float loosely on the back, only being stitched at considerable intervals, and in patterns of several shades they are frequently not stitched at all. The loose yarns flushing on the under surface of the texture are occasionally cut off. One other detail in the two systems affecting economic production is, that in the weft system a somewhat inferior or rather less costly yarn may be used than when colouring by the warp scheme, which necessitates the use of sound and moderately strong threads. All know that there is a minimum degree of tension put on weft yarns and a maximum degree applied to warp yarns in weaving. In coarse fabrics and cotton textiles this condition does not materially alter the cost of manufacture, but in fine productions it is an item that has to be con-

sidered. Summarizing these points of dissimilarity, the warp method of colouring affords the most scope for the development of ornament in pile or plush goods; does not multiply the intricacies of shuttling, but tends to diminish the figuring power of the Jacquard, and requires yarns of a better quality than may be adopted for wefting; on the other hand, the weft method practically allows of infinite latitude for diversity of colouring and ornamentation of all types of fabrics excepting the plush and leno, and it is, moreover, in fine textiles, less costly, in so far as it makes it feasible to employ an inferior fancy thread with as satisfactory results as if a more expensive yarn were used; and lastly, it utilizes the utmost capacity of the Jacquard in the construction of a figured effect of large dimensions.

227. *Classes of Designs Coloured in the Weft.*—Fabrics figured and coloured by the weft yarns are of various kinds, but to facilitate analysis they may be considered under the following distinguishing types:—

- I.—Designs in which the figure is a product of the ground weft.
- II.—Designs requiring one extra weft.
- III.—Designs requiring two extra wefts.
- IV.—Designs requiring three extra wefts.
- V.—Designs requiring four or five extra wefts.
- VI.—Designs composed of two wefts and reversible.

As in warp colouring a ground chain is always an essential element of the fabric, in textiles coloured in the weft—Classes I. to V. inclusive—there must always be a ground weft, which forms a suitable texture on which the more elaborate ornamentation due to the fancy shades may be exposed. By extras are meant the shades of weft in addition to the ground picks. A design with two extra wefts is called two-cover; with three extras, three-cover,

and so on—the ground weft always being added. The word “cover” is therefore synonymous in this sense with “extra,” and has probably been adopted because it partially describes the texture to which it relates, which is virtually so many layers or covers of weft threads in thickness.

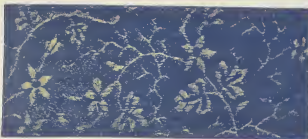
228. *Designs in which the Pattern is a product of the Ground Weft.*—In this build of fabric there is comparatively little complication of fabric-structure, of weaving, or of colouring. Thus the weft, which interlaces with the warp to form the ground of the fabric, is also used in the construction of the design. Some species of dress fabrics, particularly those of a lustre character, and mantlings for summer wear, are extensively coloured and ornamented on this principle. It may be regarded as the most elementary type of figured fabric. An example is furnished in Pattern 1 on Plate XXX., which will show the scheme of colouring generally practised in the embellishment of this style of textures. A section of the weave-design is given in fig. 159. From it the reader will observe that the small figures are composed of solid weft floats, and are arranged on a fine sateen twill groundwork. The warp is composed entirely of lavender cotton, and is mainly useful in constituting the foundation of the fabric, and in concealing the weft picks when they are not forming the figured effects. The small objects are chintzed with weft colouring, the order of picking being four of dark blue and four of white. This manoeuvre gives the pattern the aspect of a cloth composed of extra wefts. It should be noted that such a contrast in weft colouring, as obtains in this specimen, is only possible in this build of cloth when the warp is rank in threads and flushes well in the ground sections. If these conditions were not complied with, the pattern produced would be chintzed by the weft in not only the figure, but also in all other parts of the texture. A plain



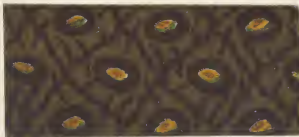
1



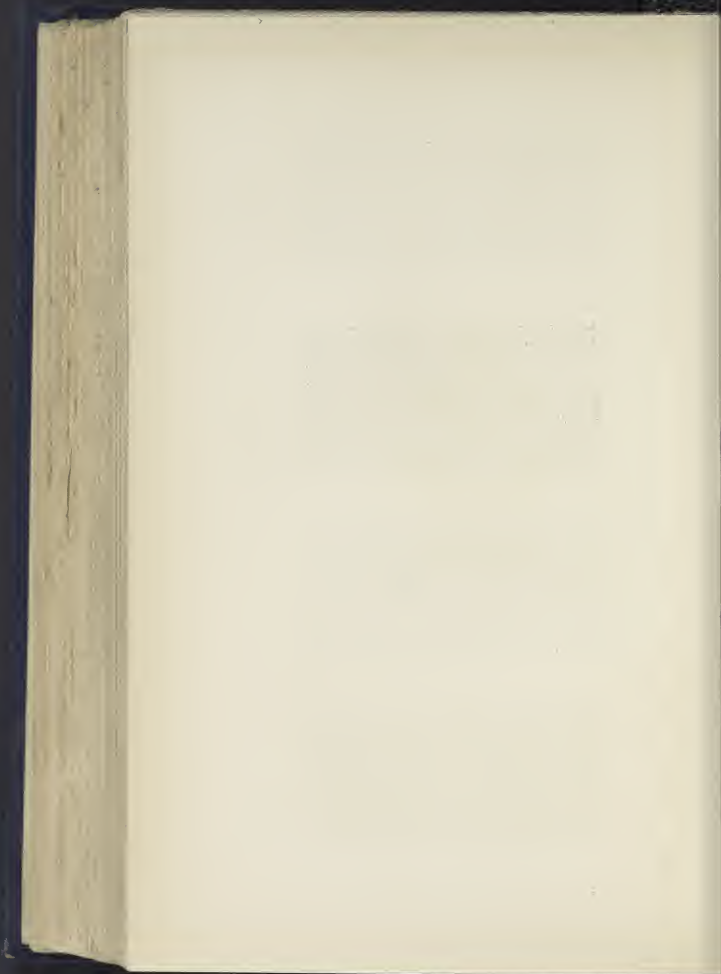
2



3



4



or twill weave, for example, would expose the blue and white shades right across the sample.

Respecting the construction of this style of fabric: it is based on the single-make principle of design, there being only one warp and one weft. The figure is purely a product of extraordinary floats of the latter yarn, which are determined by the form of the figure being developed.



Fig. 159.

In some patterns the ornamental sections are composed of twill and other fancy weaves to increase the diversity of effects obtained.

229. *Extra Weft Styles*.—Fabrics of this description are practically twofold in the weft. Mantlings, robes, and vestings are all tinted largely on this system. An illustration will probably make the scheme of colouring and design arrangement now involved evident. Pattern 3, Plate XXX., is compound in the weft and single in the

warp; for the picking consists of deep-lavender blue wool, and of salmon silk, and the warping entirely of lavender cotton. The warp threads are perfectly concealed, but this is not an invariable rule, for it may be a different shade from the wefts, and be flushed on the surface of the texture. When this is the case, a buckskin weave is generally used for the ground of the cloth, and one colour of weft is tied by one of the threads down on each pick of this crossing, and the second colour by the other depressed thread. Should, however, the wefts be worsted and silk, or wool and silk, and the warp cotton, it is customary to conceal the latter by employing a weave which flushes the ground weft on the face. For vesting and mantling fabrics this is the invariable arrangement, but in dresses and cottons the warp is used for further enhancing the colouring of the fabric. This latter type of design is a compound form of the system illustrated in fig. 159, two wefts being used instead of one, and each being utilized in the construction of the figured effects, and also in forming a fine warp twill in the ground of the fabric. Different principles of designing are practised from these in the construction of such styles as are typified by Pattern 3 of Plate XXX. Figs. 160 and 161 are the weave designs to Section A of this pattern. The former illustrates the method of preparing designs of this class on point paper for the loom, and the latter the method by which the two series of picks are amalgamated during weaving. Fig. 160 is the last eight picks of fig. 161, the blacks of which form the odd and the dots the even picks. This is exactly the routine in the actual fabric; for in stamping the cards each pick of the design as given in fig. 160 is treated twice: I., all characters—viz., the dots and the blanks—are cut but the solid squares; II., all characters—viz., the solid squares and the blanks—are cut but the dots. The ties for the silk or figuring picks are added during stamping, and

occupy similar positions in the design to those on picks *A* and *B* of fig. 161. The principle of tying here corresponds in every respect to that of stitching cloths backed with weft—so that the ties are, as far as feasible, introduced in such positions in the picks as the threads on which they occur are down both before and after their insertion. This is the case in the ties referred to. Thus

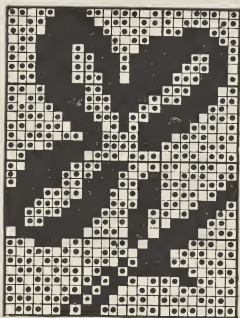


Fig. 160.

thread eight, on which the tie on pick *A* occurs, is depressed on picks twelve and fourteen—resulting in the concealment of this tie.

It will be afterwards demonstrated, that whatever number of colours is used in the construction of this species of figured fabrics, the designs are simply drawn out as in fig. 160, which shows the relation of the colours to each other in the woven structure.

The manner in which the different effects seen in

Pattern 3 of Plate XXX. have been produced may be explained by consulting fig. 161. The first pick of this sectional design—marked in solid squares—is a figure pick, being salmon in the texture, and corresponding to pick 25 of fig. 160. The second pick is ground, and also corresponds to the twenty-fifth pick of the preceding illustration. Now it will be observed that the figuring picks throughout fig. 161 float under the threads occupied by the ground picks *succeeding* them; and also that the ground picks float under the threads occupied by the figuring picks *preceding* them. In this way the effects due to the two series of picks

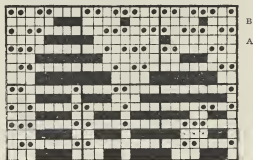



Fig. 161.

—lavender and salmon, or ground and figure—are kept separate and distinct, and a clear pattern is developed on an equally smart and regular groundwork.

The figured sections here, as in Pattern 1 of the same plate, may be chintzed, as this process does not increase the number of "extras" required. As to the ground of these styles, it is invariably a solid colour, diversity of tinting not being beneficial to the general aspect of the pattern.

230. *Vestings*.—One of the most important species of woven design to which this scheme of colouring relates is vestings. These fabrics are composed of various materials, and constructed on different principles of design, but, with

the exception of the quilting vesting referred to in the previous chapter, they are coloured and figured by the weft yarns. It necessarily follows that the most elementary type of this class of patterns only possesses one extra weft, as the example just considered. This extra colour does not, however, always run through the texture, but merely spots it at intervals. Some of these fabrics are composed of cotton and linen in the ground, with these materials or silk for spotting; others possess a worsted warp, with worsted ground weft and silk extras; while a third class has a cotton warp, with woollen ground and silk figuring. The first group is mainly produced in light shades for summer wear; the second series has either light or dark grounds; but the third series is invariably developed in dark shades, and makes suitable textures for cold weather. In the cotton and linen article the double-cloth principle of intertexture is sometimes utilized, but whatever the weave-construction of the fabric the scheme of colouring is uniform. Moreover, in the woollen and cotton ground textures but little diversity of weave is practised in producing the groundwork of these styles; whereas, in the worsted type, various crossings and unique combinations of weaves are used for this purpose. The worsted warp vesting is undoubtedly the most elegant in this particular. Its basis of construction affords scope for weave ornamentation in the foundation of the fabric as well as for elaborate figuring by variety of tinting. The two worsted vestings given in No. 2, Plate XXX., and in No. 1, Plate XXXI., are, for example, very different from each other in groundwork. The former has a broad diagonal foundation composed of several thirteen-shaft weaves; but the latter a fine corkscrew twill in the ground. Fig. 162 also illustrates another system of ornamenting the ground of these textures with weaves. If the spots developed in  were removed, this design would be a rib pattern composed

of fine twill and weft cord. With the addition of the spots it forms a neat vesting. In colouring, the rib is formed of a distinct shade from either the twilled parts or the spotting. This may be accomplished by wefting as follows:—

For	{	1 pick of black worsted.
12 picks.		1 „ „ dark blue worsted.
	{	1 pick of claret silk.
For		1 „ „ black worsted.
8 picks.	{	1 „ „ claret silk.
		1 „ „ dark blue worsted.

This grouping of shades gives a claret spot in the twill parts on a black ground, and a rib effect in dark blue.

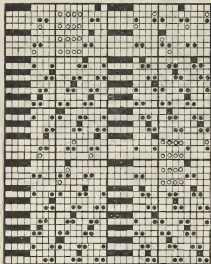


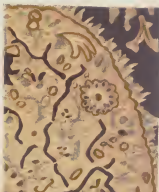
Fig. 162.

The designing of worsted vestings is an artistic work. It is important to obtain an effect which combines neatness with novelty and richness of composition. A loud assortment of crossings is rarely useful, and yet the weave effects must be sufficiently marked, to give character and freshness to the style.

231. *Vestings with one Extra Weft.*—Only one specimen in this type of vesting is furnished. It is given in Pattern 1 on Plate XXXI., and, as stated in the previous paragraph, has a corkscrew ground. The weaving plan for this pattern is supplied in fig. 163. The spots of which it is composed are arranged on the six-end sateen base. The silk picks used in forming the spotted effects are tied regularly, as indicated by the



1



2

1875

small line marks in the design; hence, in preparing for the loom, the first pick would be cut twice thus: I., cut all but the marks \boxtimes and —; II., cut all but the marks \boxtimes .

It will be observed that the spots in the fabric (Pattern 1, Plate XXXI.) are composed of green, blue, and crimson tints. This is due to the system of weft colouring practised, which is as appended:—

For	{	1 pick of black worsted.
8 picks.	}	1 „ „ crimson silk.
For	{	1 pick of black worsted.
8 picks.	}	1 „ „ blue silk.
For	{	1 pick of black worsted.
8 picks.	}	1 „ „ green silk.

Of course it is feasible to colour a design of this arrangement on other systems.

Thus the spots could all be developed in the same colour, or they might each have been composed of two tints, such as crimson and white, claret and lavender, and blue and olive. The base on which the design is constructed causes the respective spots of blue, green, and crimson in the pattern to be neatly distributed over the corkscrew twill surface forming the groundwork of the fabric.

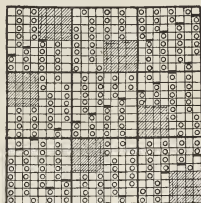


Fig. 163.

232. *Two-Cover Vestings*.—Vestings of this class possess one ground weft and two “extras” for figuring. Loud patterns only being occasionally required in these textures, a scheme of figuring is practised which reduces the cost of production. Thus the spots or figures are only produced here and there in the fabric, a considerable number of

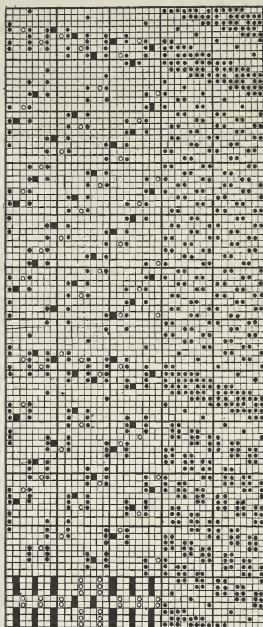


Fig. 164.

ground picks intervening them. In this way the quantity of silk used is considerably diminished. An example may be considered in which two extras are necessary in developing the spotted effects. It is the diagonal pattern given in No. 2 on Plate XXX., and referred to in a previous paragraph. The ground design here is composed of four weaves—fine corkscrew, weft sateen, twilled mat, and an upright twill—and, apart from the small figures, occupies 288 picks. The spots are developable in two hues, and are arranged on this diagonal base on a sateen method, six occurring in each repeat of the pattern. Those sections of the design—fig. 164—in which the spots occur are threefold in composition, the ground, crimson, and green wefts being amalgamated here. Considering the picks lettered *A*, for example. These comprise one spot, and include the ground, crimson, and green picks. The ties for the extra wefts are on the principle indicated. The system of wefting which has been practised in producing the pattern formed of the design worked out on the base of fig. 164 is as follows:—

For	{	1 pick of black worsted.
24 picks.		1 " " crimson silk.
		1 " " green silk.
		40 picks of black worsted.

Blue and white, orange and blue, and salmon and light-blue, also give neat patterns. Light shades may be, moreover, employed, with satisfactory results, in the ground of the fabric.

233. *Four-Cover Styles*.—Having considered two specimens of vestings in worsteds, an example in five shades may be examined in woollens. Each additional shade of weft in figured textiles increases the intricacy of the construction of this type of design. First, it implies a larger number of cards; and second, more picks to the inch,

necessitating more weaving. While, however, these complications are the natural sequence to the employment of a considerable diversity of colours, yet it is mainly by multiplying the shades of weft that the richness of the ornament obtained is enhanced. The example in the four-cover vestings given in Pattern 4 on Plate XXX. illustrates this. The bulk of the fabric is composed of two colours—light brown for ground, and claret brown for figure. The weave employed for the foundation of the texture is broken crew or weft swansdown. All the effects, as is evident from the portion of the weave design given in fig. 165, are due to solid weft floats. The diagonal marks here correspond to the light brown in the fabric, the grey marks to the claret brown, the solid round dots to the green, the solid black to the orange, and the small circles to the crimson. The order of weft colours is thus:—

For	{	1 pick of light brown.
26 picks.	}	1 " " claret brown.
For	{	1 pick of light brown.
12 picks.	}	1 " " claret brown.
	}	1 " " green silk.
For	{	1 pick of light brown.
8 picks.	}	1 " " claret brown.
	}	1 " " green silk.
	}	1 " " orange silk.
For	{	1 pick of light brown.
20 picks.	}	1 " " claret brown.
	}	1 " " green silk.
	}	1 " " orange silk.
	}	1 " " crimson silk.
For	{	1 pick of light brown.
9 picks.	}	1 " " claret brown.
	}	1 " " orange silk.
For	{	1 pick of light brown.
12 picks.	}	1 " " claret brown.

In preparing the cards, first cut all but 2; second, cut

all but \square ; third, cut all but \square ; fourth, cut all but \blacksquare ; and, fifth, cut all but \ominus . Picks *A* are stamped twice, picks *B* three times, picks *C* and *E* four times, and picks *D* five times.

234. *Two-Cover Mantlings*.—Mantlings are extensively coloured and figured on this system, which admits of the production of a considerable diversity of effects. Pattern I of Plate XXXII. is an example. The warp of this fabric is cotton, but as the ground weave is a five-end weft sateen,

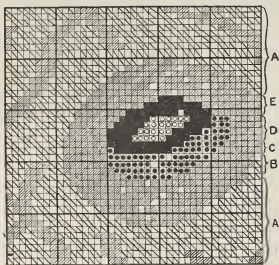


Fig. 165.

it flushes the worsted picks constituting the foundation of the texture on the surface, concealing thereby the cotton yarns. A section of the weave design used in weaving this example is furnished in fig. 166. By changing the ground weave to twill, and employing a shade of warp distinct from the weft, the pattern could be improved in colouring. As here tinted, however, it is evident that by this scheme of designing ornamental details may be clearly developed in the texture. The order of wefting is one pick of drab, one pick of black silk, and

one pick of lavender silk. The texture being two-cover, the process of card stamping is as follows: I., cut blanks,

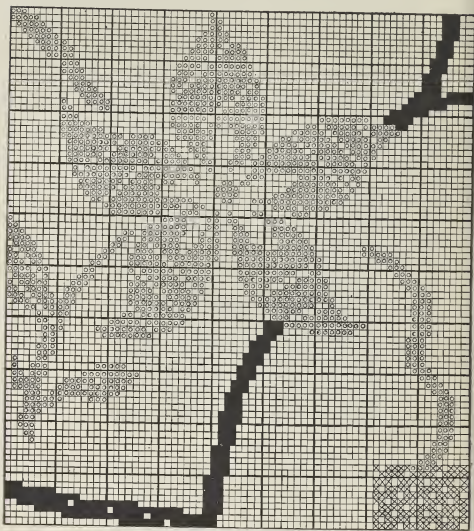


Fig. 166.

solid blacks, and small circles; II., cut crosses, blanks, and circles; and III., cut crosses, blacks, and blanks.

235. *Three-Cover Mantlings*.—An interesting specimen of four-colour figuring is given in Pattern 2 on Plate

XXXI. It is a unique combination of colours, textile effects, and ingenious principles of weaving. First, as to

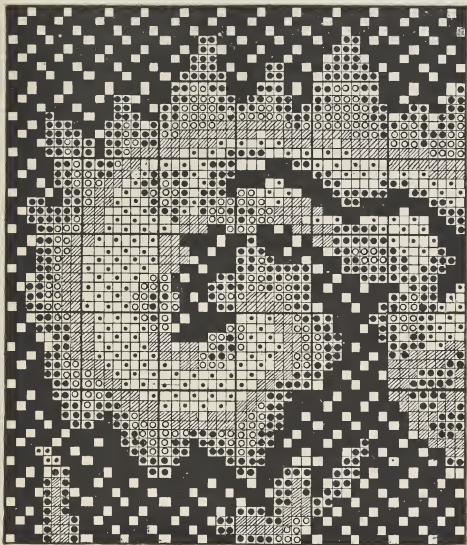


Fig 167.

the blending of tints and the figuring obtained. Though only four colours are used in the weft—claret, lavender, olive, and salmon—yet five tinted effects are produced.

The extra tint is due to working the warp—which is a bright crimson—tabby with the salmon weft, forming that intermingled colouring composing the ground of the interior of the pine figures. But this is not the only feature of this arrangement of shades deserving notice. The rich claret shade which constitutes the ground of the fabric not only gives a full velvety aspect to the entire pattern, but also develops with peculiar mellowness the other tints entering into the texture—the lavender, salmon, and olive elements all being neatly emphasized. The all-important quality of true design—that of acquiring softness and variety of tinting in conjunction with a clear expression of ornamental forms—is, therefore, secured in this pattern.

The routine of wefting and colouring is thus: *warp*, all crimson; *weft*, 1 pick of claret, 1 pick of salmon, 1 pick of lavender, and 1 pick of olive. Each shade runs through the fabric, and is continually helpful in imparting tone, character, and spirit to the whole composition of both ornamental and textural details.

As to the construction of the design. The ground weave—fig. 167—is a weft sateen. All the figured parts of the design, excepting where the warp yarns work plain with the salmon picks, are flushed solid. This is apparent from fig. 167, which is the weave-design of the upper part of the pine figures. Here the solid squares correspond to the claret in the texture, the dots to the salmon, the circles to the lavender, and the grey marks to the olive. Every pick of the weave-design is stamped four times as follows:—

- I. Cut all marks but solid black.
- II. " " " " dots.
- III. " " " " circles.
- IV. " " " " greys.

The ground weft is tied regularly, but the other wefts are flushed on the under surface of the fabric.

236. *Double-Weft Reversibles*.—Some reference must be made, in treating of fabrics coloured in the weft, to rugs and reversible textures, for some classes of shawls, and—in light materials—for mantlings. These textures are composed of weaves which are double in the weft but single in the warp. Thus they are of such a character as to allow of the employment of two series of weft threads of different colours. One layer of picks is spread over the other. This will be understood on referring to fig. 168. The weaves used in the construction of this magnified sample of this build of fabric are supplied in fig. 169. They are simply swans-down twills backed, hence, when combined and woven in a

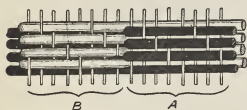


Fig. 168.

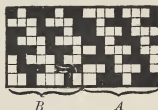


Fig. 169.

warp composed of small yarns, and with thick weft yarns arranged one pick black and one pick grey, a textile is produced of the same structure as that represented in fig. 168. Here it is apparent that the system of weaving causes the black picks to cover the grey picks in part *A*, and *vice versa* in part *B*. Of course in making this sketch it has been assumed that the fabric is lightly woven; in reality the black picks are close together in the actual texture, completely concealing the layer of picks over which they are spread. The same may be remarked of the grey picks in part *B*; consequently the warp threads, being small, are all but entirely hid, and indeed they should not be observed on either side of the finished fabric.

As the designs are twofold in the weft, they contain twice

as many picks as threads, and are worked out on 8-by-16 point paper. Having determined on the ornamental arrangement of the pattern, say that given in fig. 170—which is a design with a border to it—the sketch is transferred on to the plan paper on the same principle as in designing for double plain reversibles. Weave *A* of fig. 169 is then applied to the figured sections, and weave *B* to the ground. Should black and grey wefts be used, the figure on the upper surface would be in black and the ground in grey.

Broad ornamentation and well-pronounced groupings of forms yield the most pleasing patterns in these goods. Minute details are not effective, owing to the fabrics having to be strongly raised in the finishing processes, which tends to obliterate small effects. Forcible and bold ornament is therefore essential. On these grounds the sketch furnished in fig. 170 should be executed in a 600 Jacquard, taking 400 threads for one repeat of the central figure, and 200 threads for the diamond composition constituting the border.

As to colouring, this is only of an elementary character, very frequently not more than two colours being employed. This style might, for example, be woven in drab and lavender-blue, mid brown and claret, olive and drab, and white and crimson. The light rugs made on this principle are mostly used as blankets and counterpanes, while the darker rugs are used as travelling and carriage mauds.

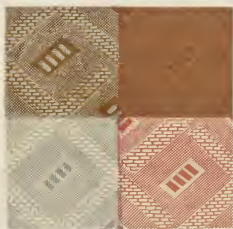
237. *Warp and Weft Colouring*.—This species of colouring is principally practised in figured textiles of a mantling and robe class. The ordinary system relates to flushing the warp and weft—which are of different shades—in the construction of the figure, as is instanced in Pattern 3 of Plate XXXII. Here the outside of the oblong figures consists of floats of weft, while the interior consists of floats of warp. Now by warping 96 ends of crimson and 96 ends of white, and weaving 96 picks of olive and 96 picks of



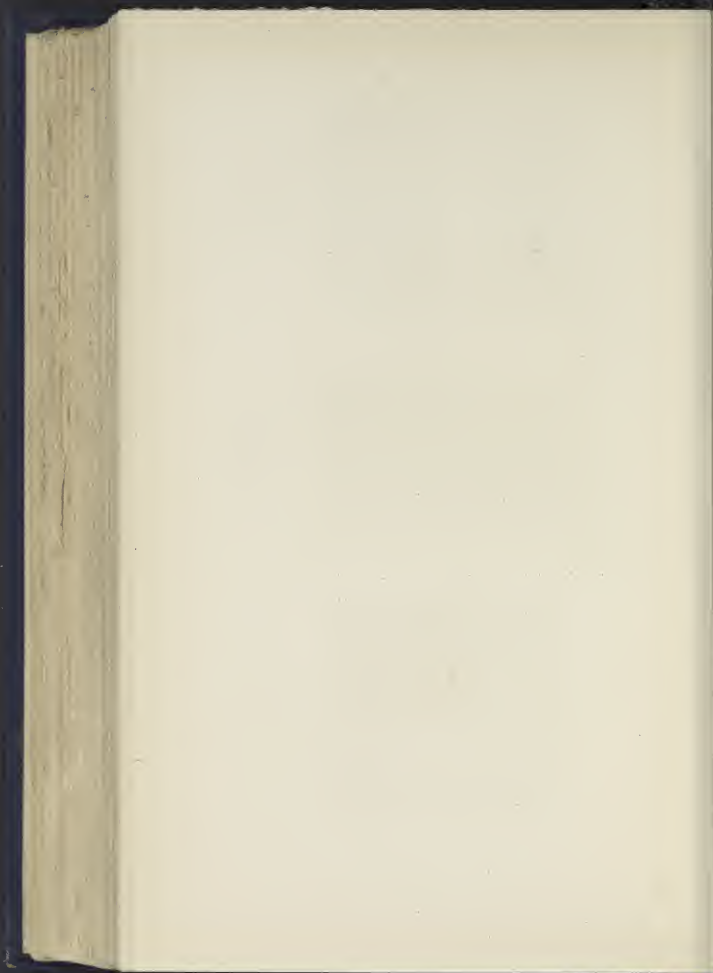
1



2



3



white, several tinted effects are obtained. First a solid square of white is formed, second square *B* is composed of crimson and white, third square *C* is composed of crimson and olive, and fourth square *D* is composed of olive and white. By this scheme of colouring and weaving a con-



Fig. 170.

siderable diversity of ingeniously-tinted patterns are producible.

Pattern 2 of Plate XXXII. is an example in compound warp and weft colouring. The warp of this fabric is brown, and helps to form both the ground and the figured effects. There are two wefts, brown and salmon, the former producing the figure and the latter the ground of the texture. The structure of the design is set forth in fig. 171, which is the weave-plan of a small section of the fabric. The circle marks represent the rib groundwork,

the dots the salmon silk, and the greys the solid floats of warp. Being composed of two wefts, the design is prepared for the loom by first cutting all but a ; and, second, by cutting all but f . The salmon silk is regularly tied to the under-side of the texture.

Other forms of compound colouring, having "extras" in both warp and weft, are also practised. They are, however, mainly amalgamations of the two systems of colouring already illustrated and treated of at length.

238. *Curly Fabrics.*—Fabrics with a curly surface—which are principally coloured in the weft — are, for several reasons, especially suitable for winter wear. Firstly, they possess a warm, substantial, comfortable appearance; secondly, they look well and cosy, and are kind to the touch; and thirdly, they are not deficient in strength, elasticity, and other wearing essentials. For mantlings and ulsterings (in an admirable assortment of colourings and patterns), it is questionable whether any other class of woollen or worsted production has been so extensively worn, and been, withal, so universally esteemed as this description of woven article. It is an exception to rule for a cloth to be suitable for both ladies' and gentlemen's wear, but this is the case with curls, for they are used for mantles, trimmings, ulsterings, and suitings.

239. *Curly Textiles of the Astrakhan Group.*—"Curly" are a species of textile that belong, strictly speaking, to fabrics of the astrakhan and lambskin type. No doubt the object here is to manufacture a textile similar in appearance, texture, and general character to the original astrakhan. But at the same time, it is sought to acquire these effects by cheaper and more expeditious methods than are practised in making the astrakhan, lambskin, and kindred fabrics. The production of cheap, serviceable "curly" has led to the construction of spiral, curled, and knopped yarns—all threads which, when appropriately employed, impart a curly surface to the cloth.

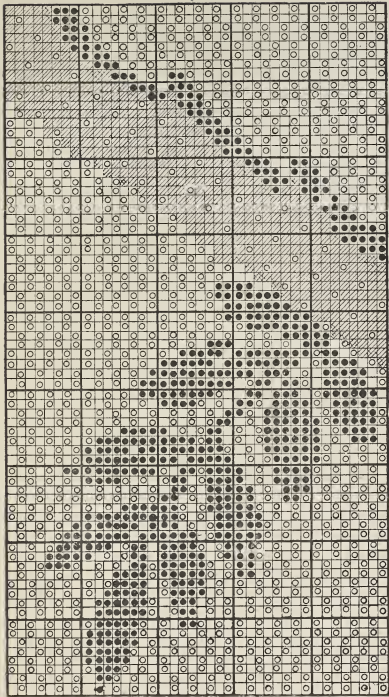


Fig. 171.

Scotch manufacturers have not been behindhand in applying curl-twists to cheviots and tweeds, producing by their use some neat and tasteful combinations. Success in one direction has encouraged designers and manufacturers to continue experimenting with these yarns, resulting in the fabrication of curled goods on an extensive scale.

240. *Four Types of Curled Effects.*—Curled effects may be classified under four heads:—

(1) Those in which the effect is obtained by employing wires in weaving.

(2) Those in which the yarn is curled previous to weaving, and the flushes of weft thread cut after the piece leaves the loom.

(3) Curls due to the employment of yarns composed of two or more classes of materials. The curl in this case is developed in milling.

(4) Fabrics in which a curled thread is used in the weft.

The first and second classes of curls represent the original methods of gaining effects of this kind, while the third and fourth classes represent the modern principles of manufacture. Examination of the individual classes will show that each possesses some advantages which the other lacks, and also that certain defects are characteristic of each process of production. If it were simply a question of which are the readiest and simplest systems of manufacture, it could be stated at once in favour of the modern methods; but this is not the only point for investigation, for it is of considerable importance to know which principle of intertexture is capable of yielding the largest variety of effects. With the object of ascertaining this, each of the four types of fabrics enumerated will be carefully and minutely examined.

In the first species of curls—in which colour is introduced into the warp—astrakhans, lambskins, and also many other classes of fabrics made in imitation of animal skins, are to be found.

241. *Curls obtained by Wires.*—Curls obtained by the use of wires are fabrics containing two warps—one of which forms the foundation, and the other the curled effect of the texture. The ground chain is usually cotton, the curled warp mohair, and the weft woollen. The mohair yarn is submitted to a process of curling or crimping before weaving, so that when the threads are cut over the wires, in the actual manipulation of the fabric, the ends thus produced twist, twirl, and roll into all kinds of fantastical shapes. The larger the curl, the thicker and more curly the material used in its formation, and the deeper the wires inserted into the cloth during weaving. Fig. 172 will illustrate the principle on which the wires are employed



Fig. 172.

and the part they play in the development of the curly appearance of such goods. In this sketch, which is a sectional drawing showing the interlacing of the threads and the position of the wires in a simple astrakhan prior to cutting, threads *A* represent the mohair warp, threads *C* the ground chain, *b* the picks or shoots of weft, and *W* the wires. It will be observed that there are several picks between each wire which interlace with threads *C* to form a texture, or foundation fabric, on to which a layer of curls, rankly grouped together, is ingeniously secured. There is, in a word, a firm woven cloth apart from the curled effect in all such structures; and it should be noticed that the more substantial this concealed portion of the complete fabric, the more durable the article produced. An insecure ground texture should always be prevented in the manu-

facture of all fabrics in which wires are employed. Generally, the picks *b* interweave with threads *C* on the plain or tabby principle, but not invariably so, as the three-end twill sometimes forms the plan of intersection for these yarns.

No less than five ground picks are inserted between each wire in the fabric sketched, forming quite a *bed* or substantial foundation for the wires. Another point secured, by having this considerable number of ground shoots intervening the wires, is the production of a large curl, because the wires are not forced into close or absolute contact with each other under this arrangement.

242. *Process of Weaving Curls produced by Wires.*—The routine of the actual operation of weaving this article may be briefly stated thus :—The proper complement of ground picks, *b*, having been interlaced with yarns *C*, one half of the mohair warp is elevated and wire 1 inserted; the same number of ground picks is again introduced into the warp *C*, and then the reverse half of the mohair warp raised and wire 2 introduced. This completes the process as far as the interlacing of the threads is concerned. One particular that has not been noticed is the mode of binding the curled warp to the texture; this is effected by depressing the mohair yarns both previous to and after the insertion of the wires, crossing them of course with the picks *b*. After some five or six wires have been secured, as shown in the illustration, cutting takes place. This is done by the weaver running his knife down the grooved part of the wire, a process which divides the loops and liberates the threads, when their curling propensities cause them to twist and curl so effectually together as to entirely cover the surface of the ground fabric on to which they have thus been fastly but ingeniously woven. The beautiful spiral condition into which the ends twist themselves on being liberated is clearly represented in fig. 173, a section of an astrakhan fabric after cutting.

A feature in which this class of curls differs from all others may now be briefly noted. If two or more shades of yarn, and several depths of wires are used, one for each colour of curled warp, then, by a suitable arrangement in the design, a beautiful and attractive combination of effects results on cutting, producing those goods which so closely resemble natural skins.

There is also a softness and richness about this species of curl that cannot be attained on any other principle of manufacture; but as the process of production is somewhat intricate, and, as a consequence, costly, it cannot be so feasibly adopted by makers of textile goods as some other



Fig. 173.

methods of gaining curled effects that will subsequently be described.

243. *Curls formed by the Weft in which the Warp is Cotton Threads.*—This class of “curls,” which may be examined in detail, also includes fabrics of the astrakhan group. But here, instead of the curl being obtained in the warp, it is obtained in the weft yarn. In cloths of this order the warp is invariably cotton, while the weft is woollen and mohair—the wool being utilized in the construction of the ground of the texture, and the mohair in the formation of the curly effect.

Though a cheap article, it has a good appearance, and possesses a soft, full handle. The system of forming the curl by the warp offers larger scope for variety of pattern and texture than when it is produced on the weft principle. In this instance the cloth is always of the simplest structure, and the curl, as a rule, of one colour throughout the

piece, but in the case of the warp style the curls may be of several lengths and colours. It is possible, however, on this principle of intertexture, to have either a short or long curl. As in warp effects, the mohair yarn has to be curled or crimped prior to weaving by submitting it to a process of boiling, which may be continued for two or three hours, according to the quality of the yarn and the permanence with which it is sought to fix the curl.

244. *The Weave of Weft Curls.*—The weave of this type of fabric is arranged on a very simple principle. It first admits of several mohair or flush picks being introduced into the warp, which are followed by a plain ground shoot. If the weave occupies, say, twenty-four threads, each flushing pick might float over seventeen ends, and then form a plain interlacing with the remaining seven ends of the series. This process securely fastens the curl picks on to the ground of the fabric. Another feature about the structure of the weave that deserves notice is, that it must be so constructed as to admit of each plain shoot being forced into absolute contact with the preceding ground pick. Unless this is admissible, the firmness and durability of the cloth will materially suffer. A fabric, stable and compact in build, can, in a word, only be obtained when this condition is complied with.

245. *Structure of Weft-Curl Fabrics.*—On consulting fig. 174, which is a drawing of the interlacing of the warp and weft yarns in this make of textile, the structure or build of the fabric may, by analysis, be arrived at. In this illustration points *a* represent the ends of the warp threads; *B*, the mohair weft yarns or flushing picks; and *c*, the plain ground picks. Obviously this cloth is twofold in the weft and single in the warp; in other words, there are two series of weft but only one series of warp threads. The layer of picks lettered *B* are placed, in the weaving process, over the picks or shoots *c*, which simply produce, along with the

ends lettered *a*, a foundation texture on to which shoots *B* may be secured. The warp threads are thus made to interlace with both kinds of weft, producing, with the cotton or woollen weft *c*, a plain fabric, and, with the mohair picks *B*, a cloth in which the face is formed of long flushes of weft yarn.

246. *Operation of Cutting after Weaving.*—When the cloth leaves the loom there is no appearance whatever of a curl effect, its under surface being nothing but a plain weave, and its face consisting purely of long floats of mohair yarn. To produce the curl these flushes require to be severed or cut, when the ends thus obtained twist and twirl themselves into the spiral forms shown in fig. 175. The cutting process



Fig. 174.

is an interesting and important one in the manufacture of this article. The work is done as follows:—About two yards of cloth having been stretched tightly on a frame, the cutter inserts the fine point of the knife and guide under one of the row of long flushes formed by picks *B*; the loops or flushes being arranged in rows, the knife can be made to travel very accurately under each row of loops to the end of the two yards of texture spread on the frame. As it is forced through this tunnel of loops, so to speak, it severs the threads, and, as the yarns were curled or crimped previous to weaving, they immediately assume curly, spiral conditions. If the cloth is woven in the white it is dyed on leaving the cutter's hands. The cutting operation adds considerably to the cost of the fabric, the weaving of the goods and the materials of which they are composed being comparatively inexpensive.

247. *Figured Curled Patterns.*—By a slight modification of this principle of weaving it is possible to produce a large variety of patterns. One example of the class of effects which may be secured in this manner will be alluded to. It is a pattern with a figured design (see fig. 176) in the ground, on which objects of a lozenge-shape, formed of curled yarns, have been woven. A weave of a fancy diagonal type has been employed to form and ornament the ground of the cloth. Designs of a more elaborate kind, such as diamond and check patterns, might be introduced into this part of the texture. The materials may be either silk or worsted, but preferably the former. Mohair is generally the material used for the curled figures. When the ground



Fig. 175.

of the fabric is tastefully figured and neatly coloured, and the curled objects distributed on its surface, a very important and artistic class of pattern results. By employing worsted yarns for the ground of the piece, and figuring the texture well with weave combinations, and then adding the mohair figures of clusters of curls, an important class of mantling is produced. Of course the objects must not be large, or they will, in the woven article, appear stiff, and also impart an undesirable formal characteristic to the goods.

248. *Curls developed by Milling.*—In the two classes of these fabrics already described, the curl effect is the result of preparing the yarn by subjecting it to a crimping process before using it as warp or weft in the composition of the cloths. Both types of curls considered are, moreover, sub-

mitted to a cutting operation, which, severing the loops or flushes of mohair yarns, results in the production of the curled characteristic of the textures. The curls in such cases are therefore formed by the ends of the various threads liberated by cutting, when their curling qualities cause them to twist and twirl into ringlet-like forms. In the cloths that will now be examined, the curl is not due to cutting one series of the yarns which helps to compose the fabric, but to the more rapid shrinking of some threads

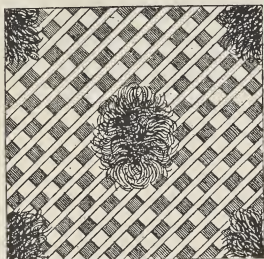


Fig. 176.

in the texture than others, a process which develops loops on the surface of the piece. The curl in this instance is produced by the doubling up of certain threads, and not by any curling and cutting operations the yarns may be subjected to either previous to, during, or after weaving.

249. *Points of Dissimilarity in the various Builds of Curled Textures.*—The difference in structure between this and the preceding classes of curls may be most feasibly demonstrated by submitting the various fabrics to analysis. If a cloth in which the curl is obtained in the warp and by the

use of wires is carefully dissected, the following data will be deduced:—On trying, in the first place, to withdraw a curl thread it would be found to be divided into short lengths, each curl being a separate length. The entire series of curls might be removed and still a plain woven texture would remain intact; if, however, either the warp or weft of this foundation structure were disturbed, the whole fabric would be reduced to a group of loose ends.

Let a fabric in which the curl is formed by the weft yarn and developed by cutting, after the piece leaves the loom, be next minutely analyzed. Here it is possible to remove the curls, as in the previous textile, and yet to retain a woven texture. The very wide dissimilarity between this cloth and the warp curl is to be found in the fact that the various short lengths of mohair which form the mass of small curls, completely covering the texture, are in this case sections of picks of weft and not threads of warp.

Coming now to the curl texture which obtains its curly appearance in the milling machine, it will be shortly apparent that it is constructed on an entirely different principle of manufacture. To remove any thread or pick from this fabric, curl or otherwise, is enough to destroy the composition of the cloth. Practically there is in this type of curl only one warp and one weft, the threads of which appear alternately on both sides of the piece. Of course either warp or weft may contain both woollen and mohair yarns, but still the cloths are constructed from single weaves.

250. *Two kinds of Curls developed by Milling.*—Curled fabrics of this group may be divided into two classes: (1) those in which the curl yarn is introduced into the warp; and (2) those in which it is employed in the weft. The latter class comprises fabrics of a mantling and trimming description; but the former class includes cloths more of an ulstering, overcoating, and suiting character. Some of

these textures are composed of the lowest kind of materials that can be made into weavable yarn. Thus the warp thread which forms the curl is in some cases made of the noil resulting from combing mohair or alpaca, or the waste from the machines in making lustre worsted yarns. These materials possess exactly the curling properties that are requisite to the production of the effect characterizing this kind of curl. As to the weft thread, it is made chiefly of "extract," that is, fibre obtained from stuffs with a cotton warp and worsted weft, the cotton, or vegetable fibre being destroyed by submitting the goods to a chemical process, while the wool or animal fibre remains more or less sound. The material thus extracted enters very largely into the composition of the weft warns.

251. *Spiral Threads used for Warps.*—The warp is composed of twist threads known as "spirals," a name applied to them on account of their crimpy form. They derive their principal characteristic from the system on which they are prepared; thus one of the two threads utilized in their production is, during twisting, only slightly tensioned, while the accompanying thread, which is considerably smaller, is run as tight as possible. This arrangement causes the compound yarn resultant to be crimpy or spiral, and to possess an undulated, wavy appearance. When the piece is subjected to the heat, soapy moisture, and friction of the milling process, the thick, slack thread shrinks up into loops, or forms small buttons, or curls, on the surface of the cloth. The process of fulling these cloths is extremely interesting. All textile goods made of wool can be very materially modified in closeness and compactness of texture, firmness of fabric, handle and appearance in the fulling-mill; but there is no class of goods which alters so completely in general condition as this type of woven product. Previous to this operation the fabric possesses a level surface; for there is not the slightest indication in the cloth when it

leaves the loom as to any curly or looped effect. This is entirely a subsequent development. As soon as the felting operation commences, this desirable characteristic appears, the thick and soft threads of the twist yarns forming the warp swelling out into loops or curls which cover both sides of the fabric. In addition to these curls enhancing the appearance of the cloth, they improve its handle, imparting a warmth and fulness of touch which it otherwise would not possess. Although this article is, in reality, defective in substance and body, yet these curly protrusions give it an apparent thickness and softness.

252. *Variety of Pattern in Spiral-Warp Curls due to Colour.*—Pattern or design in these goods is mainly due to colour combinations. As the weave is generally a four-end twill, there is every facility for developing effects of this character with precision and clearness. Styles of a mixture, stripe, and check class are all extensively employed. One example of a mixture effect tasteful in both colouring and arrangement is as follows: Warp, two ends of maroon (spiral) and two ends of green (spiral); weft, all olive brown. The pattern thus obtained is nicely intermingled in colouring, the warp threads giving indefinite and mellow patches of maroon and green, while the weft forms a solid and continued series of olive-brown twills. To this tasteful blend of shades the curled effect imparts richness and bloom.

253. *Stripes in Curls.*—A bold but neat stripe is producible by arranging the warp twelve threads of dark brown and twelve threads of russet brown, and crossing them with black weft; the warp yarns developing the curls or loops, this otherwise extravagant colouring is softened and mellowed into an attractive combination by the black weft, suitable for either mantling or ulstering.

254. *Checked Curl Effects.*—Checks are also obtainable in great variety both as to colourings and dimensions.

Two examples need only be supplied, one for a medium and the other for a large pattern.

The particulars for the first style are thus :—

<i>Warp.</i>	<i>Weft.</i>
6 threads of tan (spiral).	6 picks of mid brown.
6 " " blue "	6 " " blue.

In this arrangement a soft and undecided check style is produced, the blue, tan, and mid brown shades composing a congruous mixture.

By adopting the following plan of colouring a larger and bolder effect may be woven :—

<i>Warp.</i>	<i>Weft.</i>
24 threads of dark brown (spiral).	
24 " " slate (spiral).	
	24 picks of dark brown.
	24 " " slate.

The check resulting from this method of colouring, though large, is not harsh in tone; for the curls or loops neutralize the depth of contrast which in ordinary yarns would be produced by such a combination.

255. *Cotton-Warp Curls.* — There are two important classes of curled cloths in which cotton yarns are employed for warp that have not yet been treated of. These probably constitute the most inexpensive "curls" manufactured, yet they possess a softness of texture and a lustrous appearance that favourably compare with similar goods made of better materials. It is remarkable how entirely the cotton is concealed from view in these cloths, not the least traces of it being visible, and yet it forms the very central part of the fabric. Another interesting characteristic of these textiles is the well-developed curl, obtained at a small cost and by simple processes.

So distinct in manufacture and in structure are the two cotton-warp curls under consideration that they may be most clearly described separately. For example, in one of these curled effects a real looped or curled twist yarn is employed, while in the other textile the weft thread is simply an ordinary mohair. In the former of these patterns the curly appearance is fully developed in the loom; in the latter it is produced in fulling. The twist-yarn curl will receive priority of attention.

256. *Twist-Yarn Cotton-Warp Curl*.—Strictly speaking, this is a backed fabric, the face or right side being formed of curled twists and the back or under side of woollen yarn. Diversity of pattern or style is, in this species of curl, secured by employing several colours or shades of twists. Amongst the twists which are largely used three or four may be mentioned, namely, black and white, black and steel grey, black and olive, and black and mid blue, the white, steel grey, olive, and mid blue forming the loops or curls of the respective threads.

By combining several shades of twists a large and tasteful variety of patterns may be feasibly woven. Take an example. An over-check of fancy colouring on a black and brown or black and grey curl ground, if the colourings are mellow in tone, forms an elegant style. To produce a pattern of this type, some modification in the structure of the weave may be essential, for it will require to be so arranged as to allow of the use of corresponding twist yarns in the warp as those forming the transverse lines of the over-check in the weft.

257. *Backed Weave for Curled Cloth*.—A reference to fig. 177, which may be regarded as a standard illustration of the description of crossing employed in making this sort of curls, shows that in reality this curled texture is constructed on the backed weave principle, a system of intertexture which readily allows of the production of a thick,

stout cloth. The picks marked in crosses represent the woollen yarns, or weft for the ground of the goods, while the picks marked in dots form the weave for the curl effect, or the looped twist weft. On examining the former series of shoots it will be observed that they interlace with the warp threads on the "dent" system of weaving, that is, plain or tabby, with the warp ends working in pairs, an arrangement which provides a stable foundation on to which the curled yarn may be feasibly secured. The face weave—marked in dots—is the eight-heald doeskin or sateen, a plan of crossing which not only permits the curled yarn to be flushed largely on the right side of the fabric, but attaches it to the woollen and cotton ground texture in a uniform and secure manner. While the curl yarn should not show on the back of the cloth, the woollen yarn should not be visible on the face.



Fig. 177.

Of course it will be understood that the character of the curly effect is dependent on the kind of twist weft employed; thus, should the yarn be of several colours and the loops on its surface large, a clear, bold curl will result; but should the loops partake more of a knop than a curl, the pattern will be correspondingly indistinct.

258. *Essential Characteristics of Cotton-Warp Curls due to Milling.*—In drawing attention to curls obtained in cotton warps by milling, it should at the outset be observed that a much more promiscuous effect is producible on this system than on the principle of gaining curliness just described. Where pattern is due to weave the repeat may always be readily traced, but when it is the result of milling its definite formation is anything but marked. Here the fabric is covered with large or small curls, uniform in size, but so

beautifully blended together that the pattern, if such it can be designated, seems to have no repeat from end to end and from list to list of the piece.

The materials entering into the composition of this article, and the process the cloth is subjected to after leaving the loom, form an interesting subject for investigation. The cotton warp, which constitutes the foundation of the fabric, possesses no felting power, but the mohair yarn which forms the weft, though not possessing the same fulling quality as some classes of wools, yet when floated on the surface of a cloth of this character, felts to such an extent as to draw,

or compress, the warp ends into closer contact with each other; and it is this contracting of the texture in the direction of the weft that produces the curly or looped appearance desired.

It must not be understood that because the curliness is entirely developed in the fulling machine that the struc-



Fig. 178.

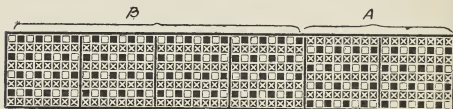


Fig. 179.

ture of the weave in no way alters the pattern obtained, for, as will afterwards be pointed out, striped and other effects can be woven by a proper modification in the arrangement of the design. A sketch of a curled stripe made on this principle is supplied in fig. 178.

259. *Examples in Designs for Cotton-Warp Curls.*—The weave (fig. 179) for this pattern is technically called a plain rib, being so constructed as to flush the curl yarn on the face of the cloth, and yet produce a fast, plain, woven texture underneath the floats. All designs for curls of this description are made on the principle illustrated in this weave, it being of equal importance to secure a stable fabric as to float the mohair yarn on the face side of the texture, for when milling takes place the floats of weft form the loops or curly protrusions.

Part *A* of the design forms the small curly effects drawn in Section 1 of fig. 178, while part *B* gives the full piping of curls represented in Section 2. A brief analysis of the weave—fig. 179—may assist to a clear understanding of the structure of curls of this class.

When the odd picks—1, 3, 5, and 7—are woven into the warp they flush over the entire series of threads in *A*, but form a plain interlacing with the threads in Section *B*. On the other hand, when the even picks—2, 4, 6, and 8—are introduced into the warp, they flush over the threads in part *B*, but work plain with the threads in *A*. What is the woven result of this arrangement? A reference to fig. 178 will demonstrate it to be of a twofold character. First, a striped pattern is formed on the upper side of the cloth, consisting of two distinct bands of curls, part *A* of the design forming the broad band or Section 1 of the sketch, and part *B* the narrow band or Section 2; second, a firm cloth is produced, though the weft is flushed to such an extent on the upper surface as to conceal the cotton warp,



Fig. 180.

for the picks which give the flushes for the curl in *A* form a plain cloth under the picks which float over the threads *B*, while the picks yielding the curly appearance due to Section *B* of the design at the same time form a plain texture underneath the shoots of weft which pass over threads *A*. So that on this principle, while every facility is afforded for a proper flushing of the weft yarns on to the upper side of the cloth, yet provision is made in the weave for the construction of an all but plain fabric to which the flushes of

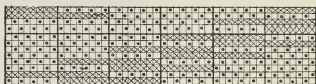


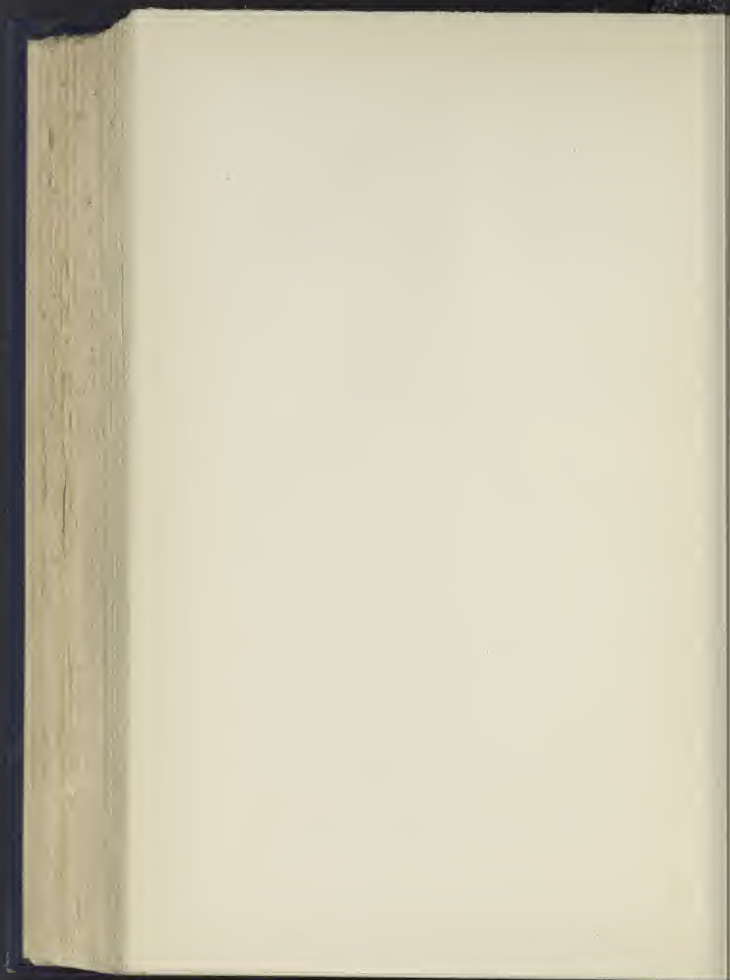
Fig. 181.

mohair that ultimately form the curl are ingeniously and securely attached.

Generally these cloths are piece-dyed, but in such a pattern as the one given in fig. 178 some excellent styles may be obtained by using two colours of weft yarn, such as black and maroon, blue and olive, and black and white. In such combinations one shade would be appropriated to the broad and the other to the narrow stripe of curls. A considerable diversity of patterns may be produced on this system for mantlings, jackets, ulsterings, and trimmings.

In fig. 180 a cloth is sketched in which the curls are distributed, without any apparent design, all over the face of the fabric. Yet on consulting the weave—fig. 181—it might be assumed that at least a twilled or diagonal distribution of the curls would be noticed in the milled texture; but such is not the case, for there is not the least indication of any pattern whatever in the finished or fulled article. This cloth not only illustrates how beautifully curliness may be

developed in the fulling mill in woven fabrics constructed on this system—with a uniformity of loop and general effect approaching that due to the use of wires—but, also, that while weave in such productions is of primary importance in the manufacture of the fabric—success depending on its arrangement—yet its effect is entirely obliterated in the process of felting to which the pieces are submitted after weaving.



INDEX.

- Admixture of coloured rays, 18 ;
of pigments, 18 ; of black with
colours, 33 ; of white with
colours, 33.
- Advantages of compound spot-
ting, 334.
- Analogy between the phenomena
of light and sound, 10.
- Application of blue to textiles,
44 ; of red to textiles, 44.
- Art and technique in relation to
woven design, 372.
- Associations of colours, table of,
59.
- Attributes of green, 49 ; of plush
fabrics, 381 ; of yellow, 45.
- Backed cloths, colouring of, 123.
- Basket check, 162.
- Bed tickings, 141.
- Black, mixture of with colours,
33.
- Blends, examples in, 115.
- Blend mixtures, 91.
- Blends of wool pigments, 92.
- Bloomed greys, 106.
- Blue, application of to textiles,
44 ; derivations of, 38 ; pro-
perties of, 36 ; shades of, 38 ;
tints of, 39 ; uses of in twist
yarns, 43.
- Bright colours of Turkey carpets,
29.
- Brussels and tapestry carpets,
389 ; development of pattern
in structure of, 391.
- Cassimere twill, figured effects in,
193.
- Check, basket, 163 ; broken, in
two colours, 162 ; common, 155 ;
composed of three or more
colours, 164 ; counter-change,
159 ; counter-change, with over-
check, 172 ; graded, 161 ; in
two sizes of squares, 157 ; in-
tersecting, 171 ; modification of
common, 156 ; ordinary three-
shaded, 166.
- patterns, 150.
- Checking, compound, 160 ; com-
pound in three shades, 168 ;
forms of in two shades, 155 ;
principles of, 153.
- Checks, 130 ; broken, 182 ; com-
posed of two colours, 155 ;
mixture, 180 ; shaded and ir-
regular, 173 ; styles of, 154.
- Cloths, dark and light, tempera-
ture of, 24.
- Colour, applied to single-make
figured textures, 122 ; effect of

- on different fibres, 6; effects obtained in double weaves, 345; in relation to dark and light grounds, 82; methods of using fabrics, 5 and 7; to what due in textiles, 9; treatment of in relation to woven textures, 4; utility of in woven productions, 3.
- Coloured greys, 107.
- Colouring of backed and double weaves, 121; of single weaves, 120; of swansdown spotted weaves, 318; of trousering designs, 305.
- Colourings, simple and compound, 184.
- Colourist, textile, 27.
- Colours, attributes of, 25; classification of, 18; compound, 19; four-and-four order of in fancy weaves, 198; influence of contrast on, 56; luminosity of, 23; method of modifying, 33; modified by juxtaposition with other hues, 58; primary, 20; principles of applying to textiles, 118; pure, 28; purity of, 22; temperature of, 23; three-and-three order of, 196; three constants of, 22; three-odd-thread order of, 204; six-and-six and eight-and-eight orders of, 199.
- Combinations of tints and shades, 39 and 72.
— of simple colourings, 229.
- Combination patterns, 286 and 289.
- Compound colourings, 224; classes of fabrics produced by, 232; types of, 233.
- Compound stripes containing four weaves, 309.
- Compounds containing three types, 227 and 236.
— table of, 233; types of, 233; composed of three types, 236; containing two types and three shades, 239; containing four shades, 246; irregular types of, 253.
- Contrast, 56; bright-coloured check, 79.
- Contrasts by shade and hue, 73; economic, 65; examples in, 64; helpful and harmful, 63; monochromatic, 70; poly-chromatic, 67; tinted and toned, 71; two kinds of, 66; simultaneous, 78; strong, how they may be tempered, 80.
- Corkscrews, colouring of, 258 and 260; modified, 261; spotted, 331.
- Cotton stripes, 304.
— weaves, methods of colouring, 272.
- Curl fabrics, 414.
- Curled cloth, backed weave for, 428.
— yarn, 340.
- Curls, 414; checks in, 426; cotton warp, 427; cutting of after weaving, 421; development of by milling, 422; effect of milling on cotton warp, 429; examples in design for, 431; formed by the weft yarn in cotton warps, 419; four types of, 416; obtained by wires, 417; process of weaving by wires, 418; stripes in, 426; twist-yarn cotton warp, 428;

- various classes of compared, 423.
- Decomposition of light, 12.
- Derivations of blue, 38.
— of yellow, 48.
- Designs coloured in the weft, 124.
— composed of prunelle twills, 292.
- Diagonals, colouring of, 268; composed of single and double plain weaves, 269; spotted, 332; stripe and check colourings in, 270.
- Distribution of colours, 30.
- Double cloths, colouring of, 121 and 123.
— plains, colouring of, 346.
— plains combined with other weaves, 355.
— plain stripes, 347, 348, 353.
— shaded check, 180.
— twills, 367.
— weaves, colouring of, 343.
— weft reversibles, 411.
- Drafted designs, 293, 299.
— patterns, species of, 290.
- Dresses, examples in colouring, 242.
- Economic contrasts, 65.
- Eight-and-eight colouring, 199.
- Elements of woven design, 1.
- Examples in contrast, 64.
— in irregular compounds, 253.
- Experiments in contrast, 81.
- Extra warp spotting, 327.
— weft styles, 397.
- Fabrics, curled, 414; figured, coloured in both warp and weft, 412; figured curled, 422; spotted, 313; spotted with weft, 329.
- Fancy broken check, 182.
— shades of special designs, 257.
— weaves, four-and-four colouring of, 198.
— woollen weaves, 263.
- Figured double plains, 364.
— effects obtained by warp colouring, 124.
— stripes in simple colourings, 190.
— textiles, 370; coloured in the warp, 375; coloured in both warp and weft, 395.
— velvets, colouring of, 367.
- Figures developed by the weft, 396.
- Five-end twill, effects in, 214.
- Four-and-four order of colours, 197.
- Four-shades simple colourings, 209.
- Functions of pure colours, 28.
- Gauze textures, 275; structure of, 276.
- Gimp yarn, 340.
- Graded check, 161.
- Granite effects, 266.
- Grey mixtures, 104; examples in, 115.
- Greys, bloomed, 107; tinted with blue, 109; tinted with green, 110; tinted with purple, 111; tinted with red, 107; tinted with yellow, 108.
- Hairlines, 133.
- Hand method of mixing coloured wools, 96.
- Harmony, 56, 83.
- Helpful and harmful contrasts, 63.

- Illustrations in toned contrasts, 72.
- Interchanging check, 171.
- Intermingled double plain effects, 356.
- Irregular colourings, 213, 218, 220.
- shaded check, 173.
- spotted stripes and checks, 324.
- stripes, 138.
- Knop yarns, 340.
- Lambert's colour experiments, 18.
- Light, analysis of, 11.
- and sound, 10.
- theory of colouring, 17.
- Mantling, two-cover, 407; three-cover, 408.
- Mantlings, colouring of, 241.
- Mat weaves, four-and-four colouring of, 215; two-and-two colouring of, 190; spotted, 330.
- Mixing of coloured wools by hand, 96.
- Mixtures, 86; classes of compared, 90; colour constituents, 88; composed of white and a colour, 99; composed of black and a colour, 101; composed of two shades, 98; composed of three shades, 100; grey, 104; twist yarn, 116; weave, 117; wool and pigment, 93.
- Multi-coloured mixtures, 103.
- One-and-one colouring of figured fabrics, 195.
- Orange, shades and tints of, 51.
- with black and white, 110.
- Ordinary three-shade check, 366.
- Origin of velvet weaving, 382.
- Ornamental woven design, 371.
- Paisley shawls, colours of, 29.
- Pattern design, 126.
- Patterns, check, 150; composed of four shades, 246; composed of two types and three shades, 239; composed of three types, 247; check, composed of solid squares and an overcheck, 158.
- curl, in spiral warps, 426.
- Pigment and spectral colours, 17.
- theory of colouring, 17.
- Plain weave, three-odd thread colouring of, 204.
- Plush fabrics, analysis of process of weaving of, 386; attributes of, 381; colouring of, 387; two classes of, 383; securing of the pile of, 385.
- Poly-chromatic contrasts, 67.
- Primary colours, 20.
- Primaries, shades and tints of, 40 and 75.
- Principles of double cloth colouring, 343.
- Prismatic colours, 12.
- Properties of blue, 36.
- Province of yellow in design, 46.
- Purple, 53.
- Quiltings, 378.
- Red, application of to textiles, 44; characteristics of, 31; derivatives of, 34; mixture of with blue and yellow, 33; shades and tints of, 35; uses of in design, 32.

- Regular compound colourings, 233.
 — simple colourings, 186.
 Reversibles, 359; arranged two-and-one, 366; double weft, 411; methods of colouring, 361.
 Rib styles, 283.
 Rose, tints of the, 70.
- Schemes of colouring, 16.
 Secondary colours, 24, 48, 60.
 Shaded check, 177.
 — stripe in two colours, 140.
 Shades, 33.
 Shawl, Paisley, 29.
 Simple colourings, 184, 209, 213, 229.
 Six-and-six colouring, 199.
 Special builds of cloth, colours applied to, 257.
 Spectral and pigment colours, 17.
 Sphere of form in woven design, 2.
 Spiral threads, 425.
 Spots in ordinary weaves, 341.
 Spotted diagonals, 332.
 — effects, 313.
 Spotting, styles of, 314; due to specific schemes of weaving, 315.
 — in both warp and weft, 333.
 Stripe combinations, 302.
 Stripes, irregular, in black and white, 138.
 — irregular, in two shades, 139; shaded, 140; composed of several colours, 144.
 — regular, 135.
 Styles of double plain stripes, 348.
 Systems of colouring figured fabrics, 370.
- Table of shades and tints, 40.
 — of colour associations, 59.
 Technique and art, 372.
 Temperature of colour, 23.
 Tertiary colours, 21.
 Testing of colour compositions, 94.
 Textile colourist, 27.
 Three-and-three colouring, 196.
 Three-odd-thread arrangement of shades, 204.
 Three-shade patterns, 207.
 Three-ply twists, 339.
 Tickings, shaded styles in, 141.
 Tints, 33.
 Toned and tinted contrasts, 71.
 Trousering patterns, colouring of, 305.
 Turkey carpet, bright colours of the, 29.
 Turner's, a scheme of tints of, 29.
 Twists, blue, 43.
 Two-and-two colourings, 187.
 Two-shade irregular colourings, 214.
 Tyndal, experiments of in the temperature of colours, 24.
 Types of compounds, 233.
 — of figured styles coloured in the weft, 395.
 — of striped patterns, 133.
- Velvet weaving, origin of the process of, 382.
 Velvets, compound in structure, 383.
 Vestings, 400; classes of, 401; composed of one extra weft, 402; composed of two extra wefts, 403; composed of four colours, 405.

- Warp and weft spotting, 334.
 Weave mixtures, 117.
 ——— spotting, 321.
 Weaves, types of, 258.
 Weft spotting, 329.
 Well-balanced colourings, 42.
 White, mixtures of with colours,
 33.
 Woollen combination designs,
 302.
 ——— checks, 264.
 ——— weaves, 263.
 Woven colourings, types of, 119.
- Woven design, sphere of form in, 2.
 ——— effects of simple colourings,
 231.
 ——— products, utility of colouring
 in, 3.
- Yarns, classes of used in spotting,
 338.
 ——— curled, 340; gimp and knop,
 340.
- Yellow, attributes of, 45; deriva-
 tives of, 48; province of in
 woven textures, 47.

By the same Author.

“WOOLLEN AND WORSTED CLOTH MANUFACTURE.”

BY THE AUTHOR OF “COLOUR IN WOVEN DESIGN,” ETC.

SECOND EDITION, REVISED.

With 200 illustrations of textile machinery, fabrics, designs, etc.

Small post 8vo, 7s. 6d.

This book treats in a complete and concise manner of the nature and physical properties of textile fibres, the processes of manufacturing, the construction of all kinds of hand looms, various kinds or builds of power looms, Jacquard looms, the principles of designing wool, worsted, cotton, and other fabrics, the analysis of woven textures, calculations, and the finishing of textiles.

Opinions of the Press.

“The author, who is a lecturer and demonstrator in the textile industries department of the Yorkshire College, Leeds, gives conspicuous evidence in its pages of his eminent qualifications for his task. To a sound and wide knowledge of his subject Mr. Beaumont adds the faculty of conveying his information in a clear and perfectly understandable form. . . . The work should be in the hands of everyone interested in the textile industry, and manufacturers would only be serving their own interests by distributing it amongst the more intelligent of their operatives. It will at once be recognized as the standard work on the subject, and it will be a long time before it is superseded.”—*British Journal of Commerce.*

“It stands out among works of its kind as dealing fully and yet concisely with the whole routine of the production of the fabric of which it treats. The exposition is always lucid, and made more clear by a great number of illustrations, plates, and diagrams. Workmen engaged in the making of woollen cloth, and students preparing for examination in the industrial arts, alike will find the work worthy of their attention.”—*Scotsman.*

“The work is illustrated with over 200 figures, large and small, which obviously considerably enhance its value as a manual for the textile student, particularly in the branches to which it is specially devoted. It is written in a clear and easy style, with the subject paragraphs numbered for easy reference.”—*Textile Manufacturer.*

TECHNOLOGICAL HANDBOOKS.

"The excellent series of technical handbooks."—*Textile Manufacturer*.
"The admirable series of technological handbooks."—*British Journal of Commerce*.
"Messrs. Bell's excellent technical series."—*Manchester Guardian*.

EDITED BY SIR H. TRUEMAN WOOD.

A Series of Technical Manuals for the use of Workmen and others practically interested in the Industrial Arts, and specially adapted for Candidates in the Examinations of the City Guilds Institute.

Illustrated and uniformly printed in small post 8vo.

DYEING AND TISSUE-PRINTING. By WILLIAM CROOKES, F.R.S., V.P.C.S. 5s.

GLASS MANUFACTURE. INTRODUCTORY ESSAY by H. J. POWELL, B.A. (Whitefriars Glass Works); CROWN AND SHEET GLASS, by HENRY CHANCE, M.A. (Chance Bros., Birmingham); PLATE GLASS, by H. G. HARRIS, Assoc. Memb. Inst. C.E. 3s. 6d.

COTTON SPINNING: Its Development, Principles, and Practice. With an Appendix on Steam Engines and Boilers. By R. MARSDEN, Editor of the "Textile Manufacturer," and Examiner for the City and Guilds of London Institute. Third Edition. 6s. 6d.

CONTENTS.—Introductory—Cotton—The Mill—Manipulation of the Material—Carding and Combing—Drawing, Stubbing, and Roving—Development of Spinning—The Modern System of Spinning—The Modern Mule—Throstle and Ring Spinning: Doubling—Miscellaneous—Appendix.

COAL-TAR COLOURS, The Chemistry of. With special reference to their application to Dyeing, &c. By DR. R. BENEDIKT, Professor of Chemistry in the University of Vienna. Translated from the German by E. KNECHT, Ph.D., Head Master of the Chemistry and Dyeing Department in the Technical College, Bradford. 2nd Edition, Revised and Enlarged. 6s. 6d.

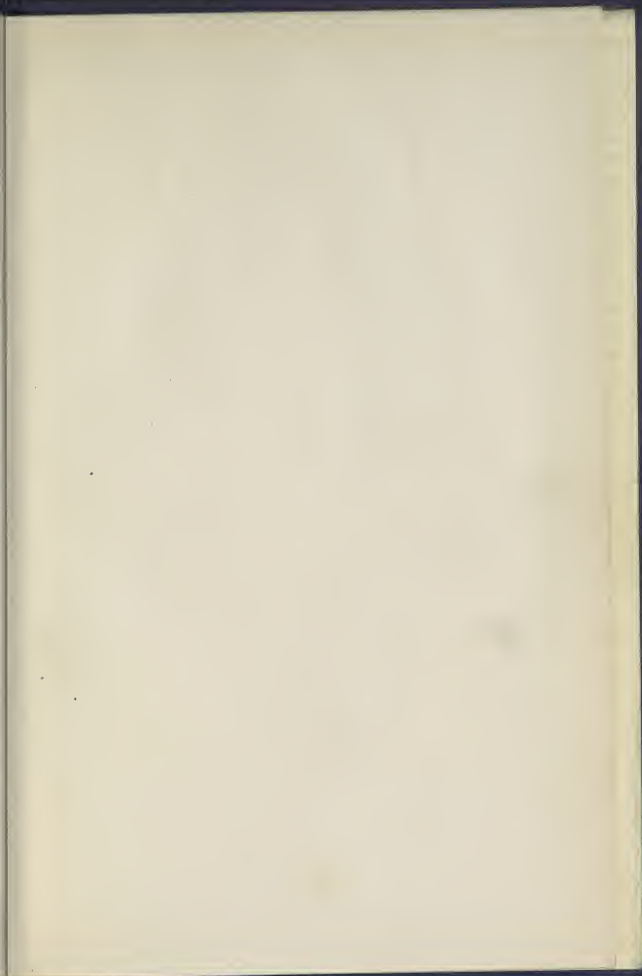
WOOLLEN AND WORSTED CLOTH MANUFACTURE. By Professor ROBERTS BEAUMONT, Textile Industries Department of the Yorkshire College, Leeds. Second Edition, Revised. 7s. 6d.

CONTENTS.—Materials—Woollen Thread Manufacture—Worsted Thread Construction—Yarns and Fancy Twist Threads—Loom-Mounting, or Preparation of the Yarns for the Loom—The Principles of Cloth Construction—Fundamental Weaves—Hand Looms—Power Looms—Weave-Combinations—Drafting—Pattern Design—Colour applied to Twilled and Fancy Weaves—Backed and Double Cloths—Analysis of Cloths and Calculations—Cloth Finishing.

PRINTING. A Practical Treatise on the Art of Typography, as applied more particularly to the Printing of Books. By C. T. JACOBI, Manager of the Chiswick Press, Member of the Council of the Institute of British Printers. With upwards of 150 Illustrations and many useful Tables. 5s.

BOOKBINDING, A Practical Treatise on the Art of. By J. ZAEHNSDORF, with 8 Plates and Diagrams. Second Edition, revised and enlarged. 5s.

LONDON: GEORGE BELL & SONS, 4, YORK STREET,
COVENT GARDEN.



677

B384c

8667



GETTY CENTER LIBRARY



3 3125 00141 2929



COLOUR
IN
WOVEN DESIGN
—
R. BEAUMONT

8b

TS

1475

B37

1890

B
D. V. CRANO