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BY

JAMES HOLMES.

James Holmes

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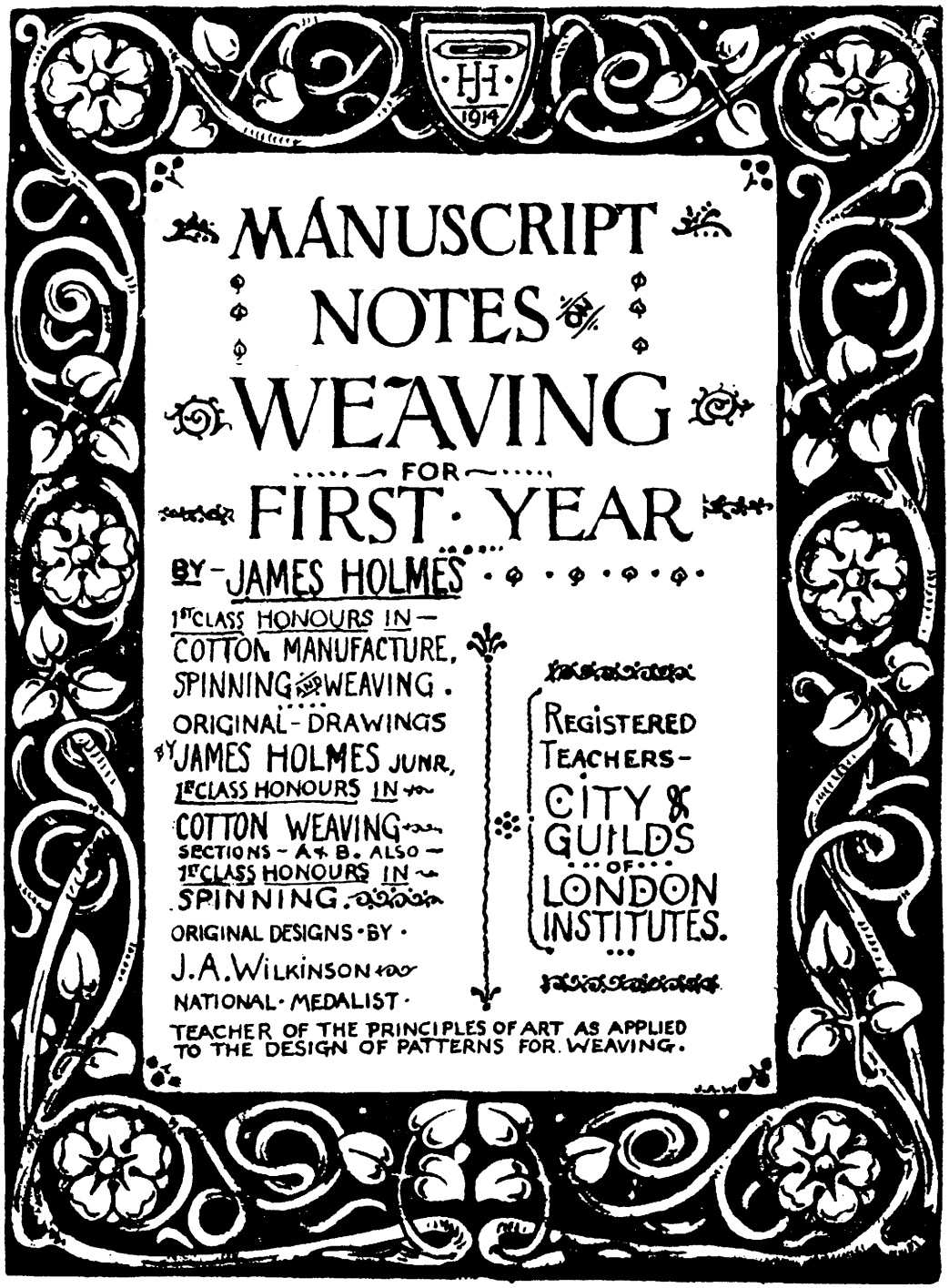
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TEACHER OF THE PRINCIPLES OF ART AS APPLIED
TO THE DESIGN OF PATTERNS FOR WEAVING.

FOREWORD

The object in writing this book is to place before the student and the practical man in as brief a manner as possible the essential points in the structure of various fabrics and the special machinery required to produce them. Principles are explained in preference to giving long descriptions, and, with the many illustrations which are given and which have been taken from actual machinery and cloth samples, it is hoped that the book will be of some little service.

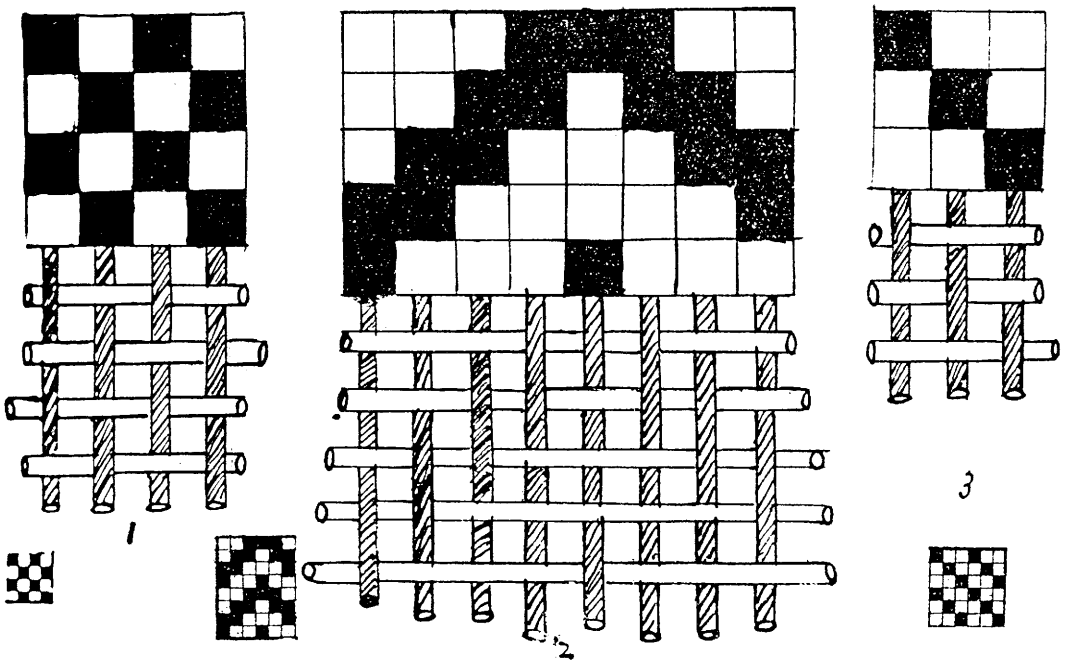
Many opportunities are now offered to students to study the subject of Cotton Weaving, and to sketch and understand the machinery and also to carry out their own ideas in designing and weaving samples of cloth in the Technical Schools of this and other Countries. Many of the drawings in this book are made from the machinery in the Burnley Municipal Technical School, England.

Many of the patterns are such as can be carried out by the student, even though the loom may not be specially built for the typple of cloth it is the intention of the student to weave.

In order to obtain the greatest benefit from a study of this book, the student must neatly and accurately make all the sketches, either from the illustrations or whenever possible from the machines, also analyse the samples of cloth for the weave and cloth structure, also finish all the incomplete designs and whenever an opportunity occurs must endeavour to weave samples of cloth involving the same principles. A new feature in this edition is the introduction of a range of patterns on plain paper indicating the lines on which the student must work for the subject of "Principles of Art as applied to the design of Patterns for Weaving."

James Holmes, Holme Lea, Burnley

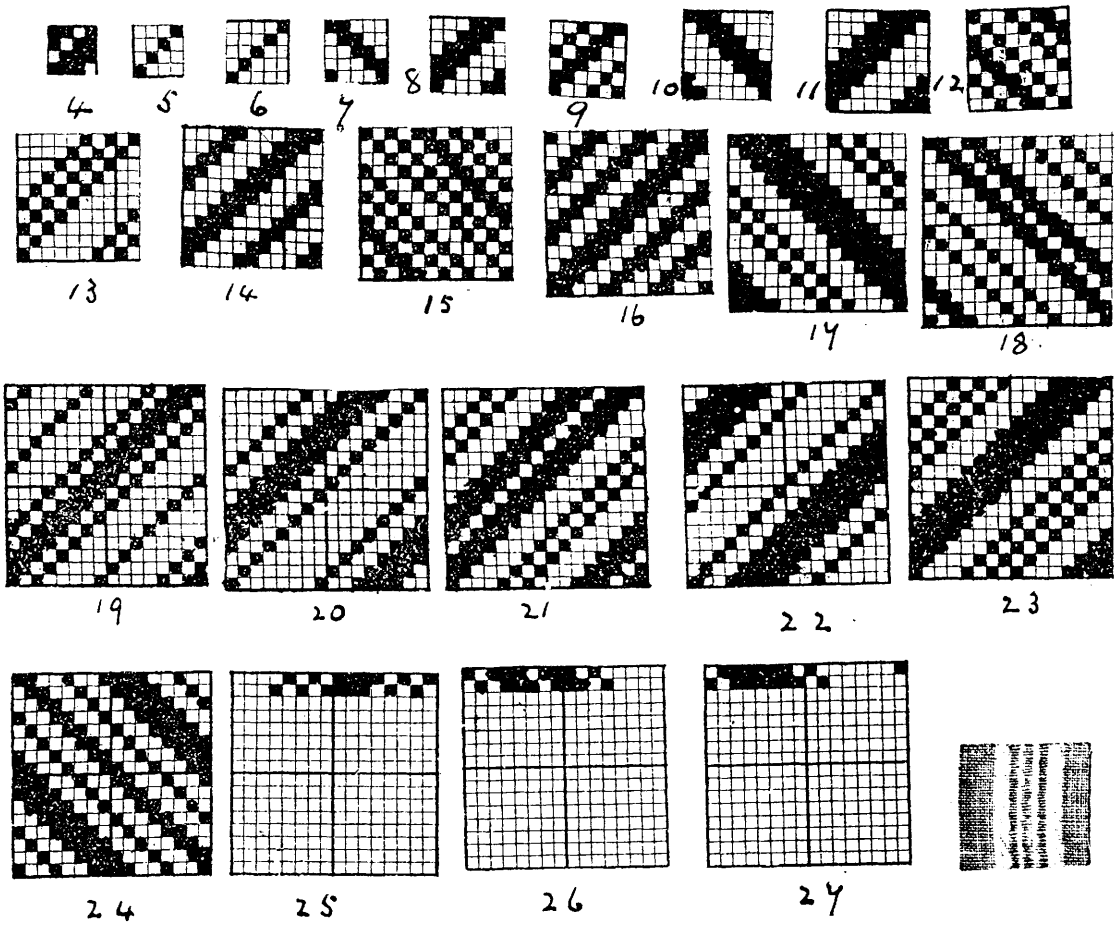
INDEX.



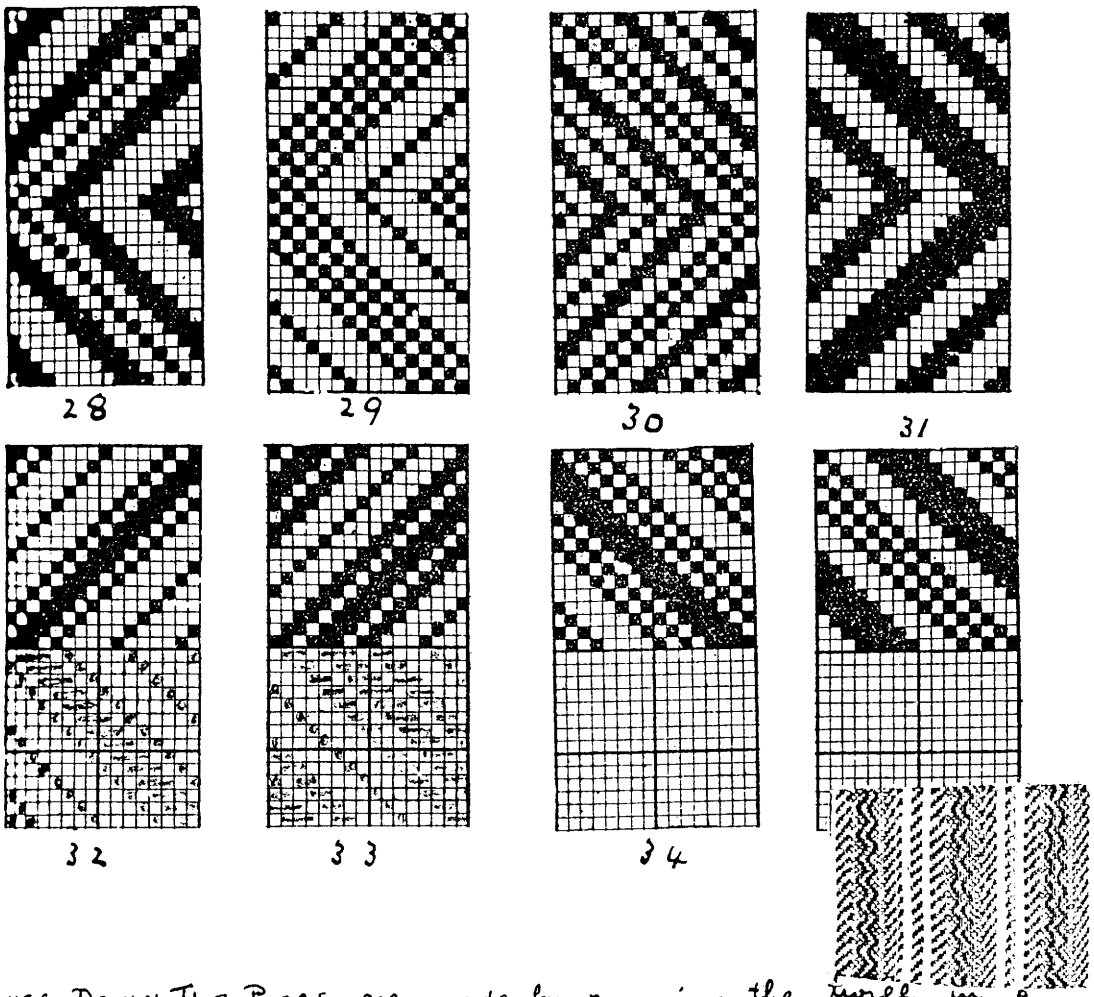
If a piece of plain cloth is examined through a counting glass it will appear the same as shown in the lower part of 1. the vertical lines represent threads of warp and the horizontal lines picks of weft. in the upper part of the figure there are a number of squares, these squares are filled in and left blank to suit the pattern of cloth given below the squares, a row of squares down the paper represents a warp end and a row of squares across the paper equals a pick of weft.

WHEN A WARP END IS LIFTED A SQUARE IS FILLED IN.

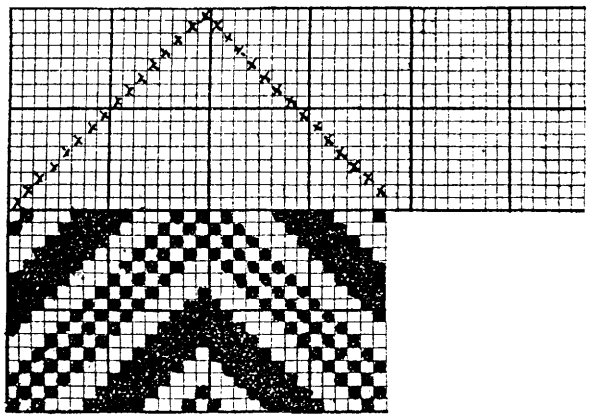
On the first pick the 2nd and 4th ends are lifted, therefore on the first row of squares the 2nd and 4th are filled in and so on for four picks Fig 2 gives a plan of cloth and the method of filling in the squares for a 3 end twill. Fig 3 is a pattern of cloth for a wave design. The three designs are shown on design or point paper



Twills are the simplest form of weave. they can be made on any number of heads from three upwards. the number of ends lifted in any one pattern is the same on each pick. the filled in squares advancing one to the right or one to the left on each pick. depending upon the way the twill is running. In regular twills the line of twill is running down the piece at an angle of 45°. Figs. 4 to 17 gives a range of twills on 4 to 15 heads. 18 to 24. 16 end twills. Complete the examples commenced in 26. 26. 27.



WAVES DOWN THE PIECE are made by running the twill in a given direction until the pattern repeats, then instead of allowing it to repeat as a twill the direction of the twill is reversed as shown in the examples 28 to 31 all of which are waves down the piece on 16 heads and 30 picks to the repeat. 32. 33. 34 and 35 are 16 end twills make them into waves down the piece as shown in the examples given..



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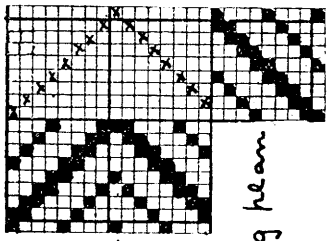
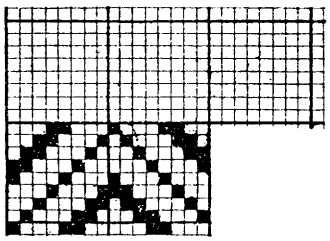


36

Peg plan



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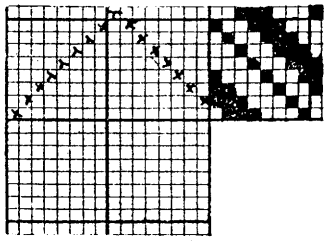

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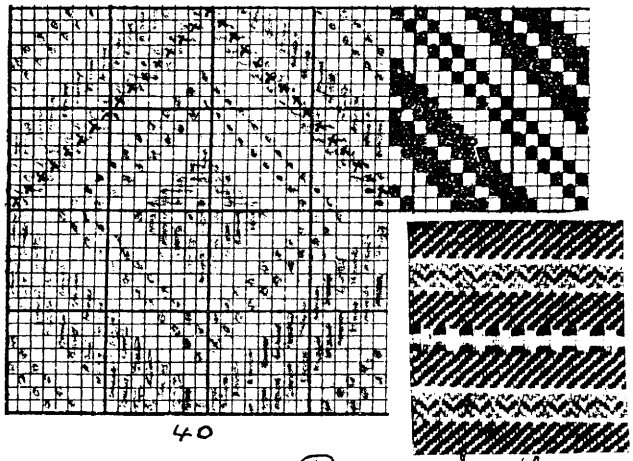
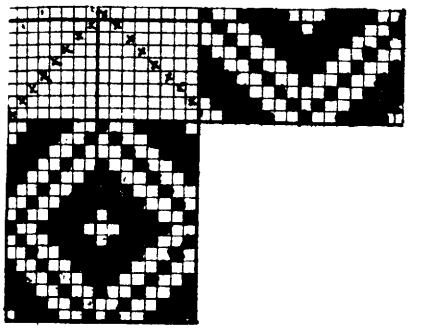


40

WAVES Across the PIECE. In these examples a knowledge of drafting the ends through the healds is required. For that purpose the squares above the pattern are used to represent the healds and a x indicates that the thread below it is drawn through the heald to which it is opposite and all ends weaving alike are drawn on the same heald. The peg plan shows order of lifting. Give drafting and peg plan for 38 Give the complete designs for 39 and 40 from the draftings and peg plans given. Give peg plan for 37



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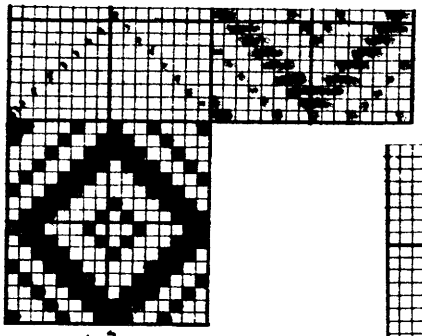

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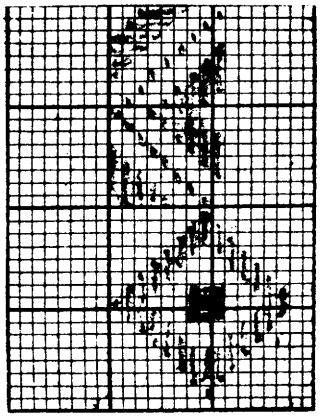

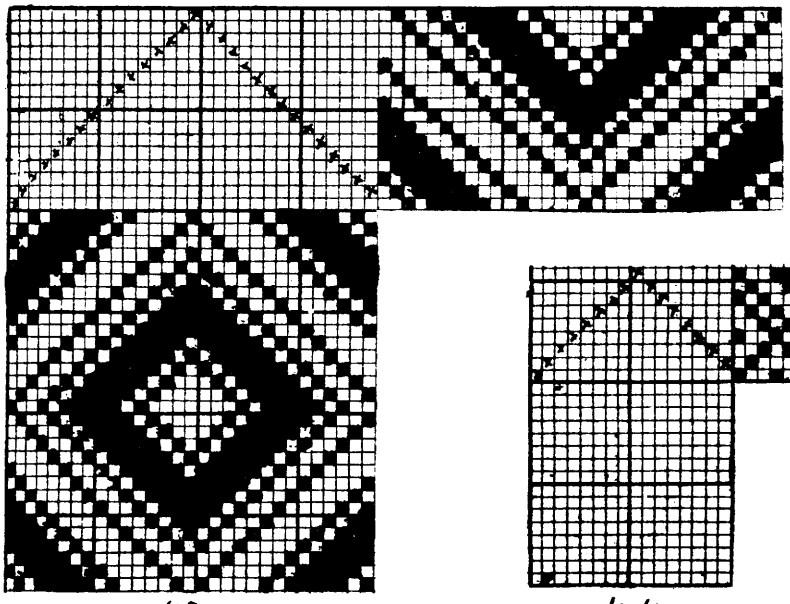

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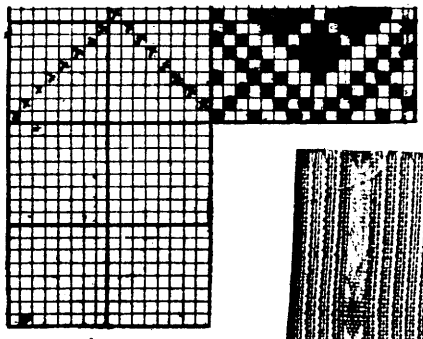

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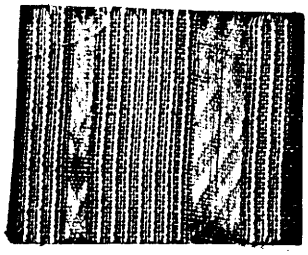
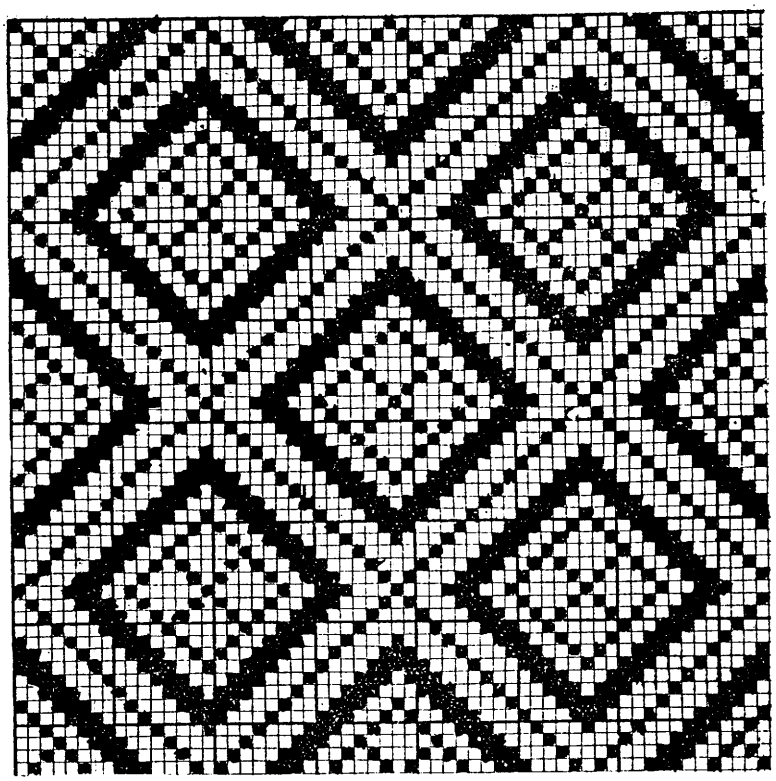


SPOT FIGURES can be made from twills by first making the twill into a wave down the piece for the peg plan and drawing the ends through the heads point or ⋰ draft. 41 gives a completed example showing design, looming and peg plan. 42 gives another completed example. Give looming and peg plan for 43 and give completed design in 44.



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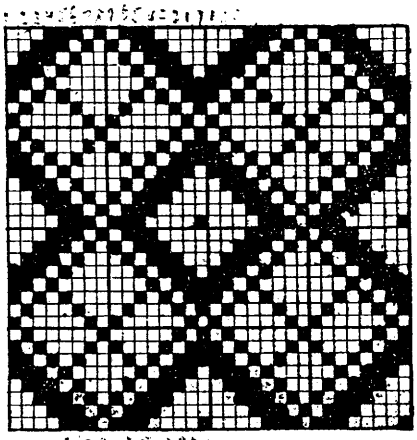

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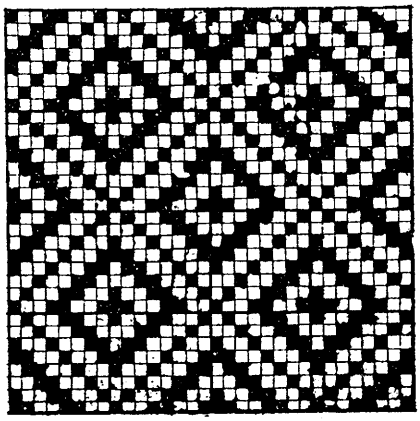
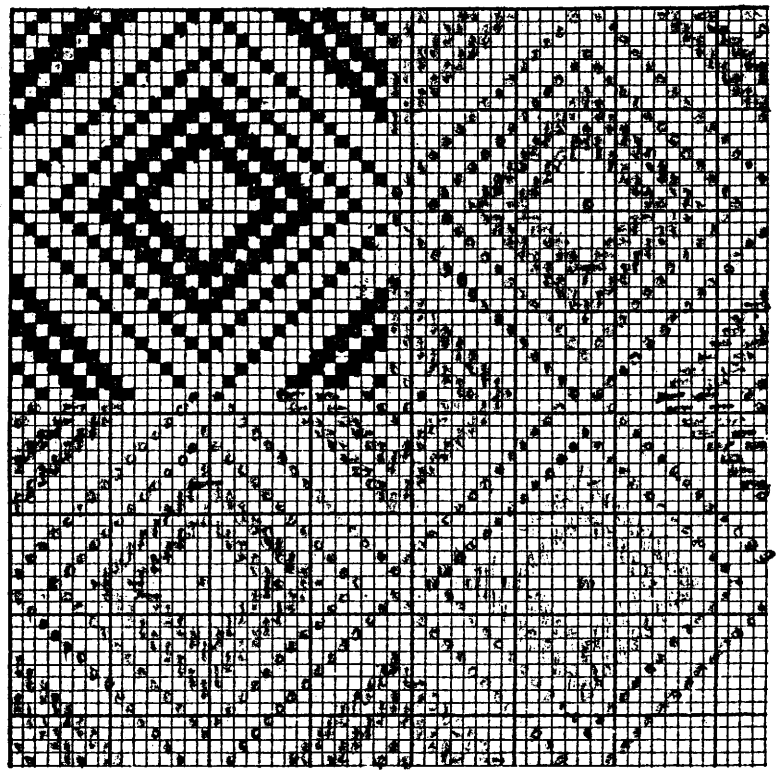


47

45. 46. and 47 give repeating spots made from twills.



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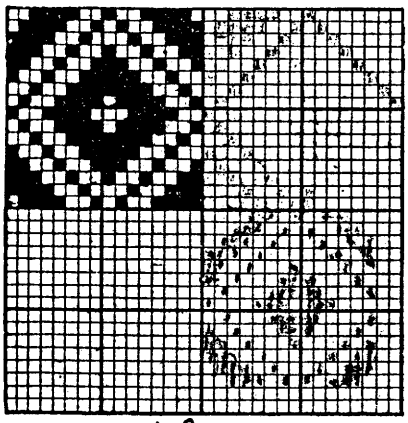

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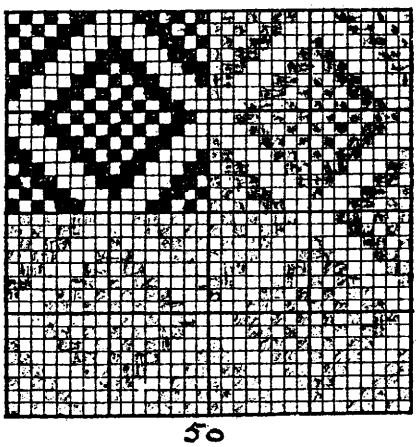
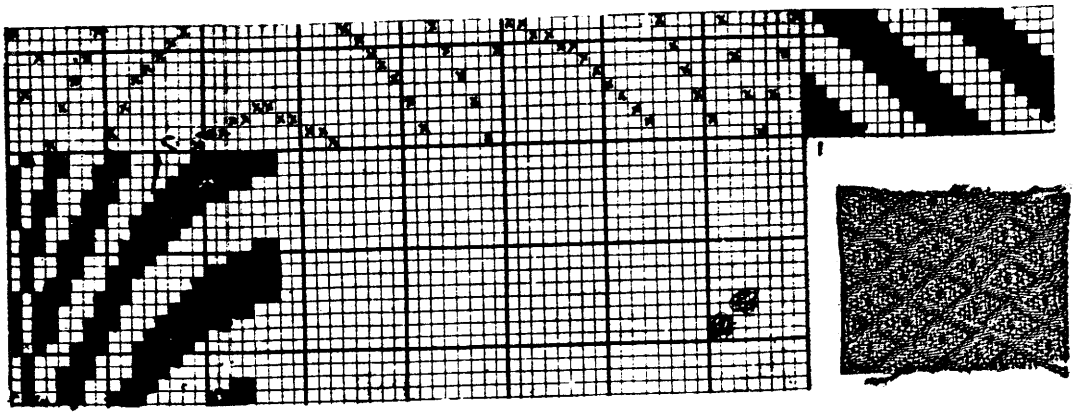


50

Repeat 48. 49 and 50 to fill the spaces given as on page 6.



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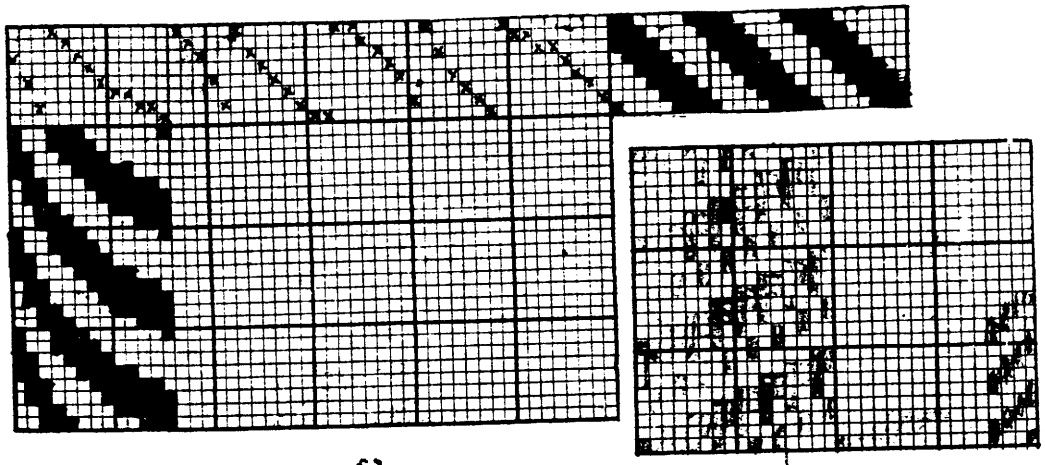

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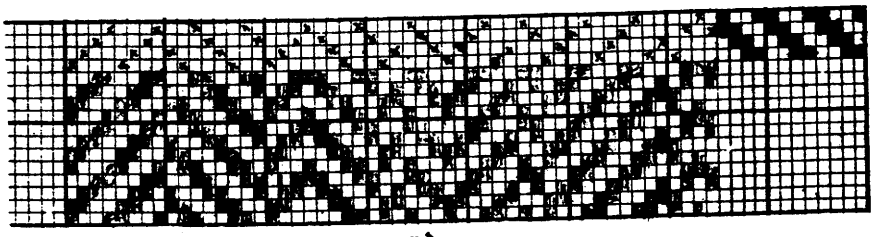
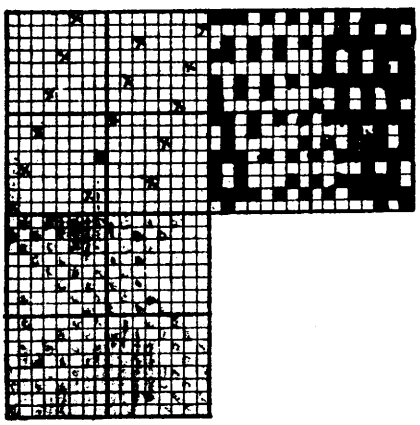


53

51. 52 and 53 give patterns with irregular drafting the peg plan is given alongside the looming or drafting in 51 and 52 and commencement has been made with the designs. Complete the same. Also complete 53 from the looming



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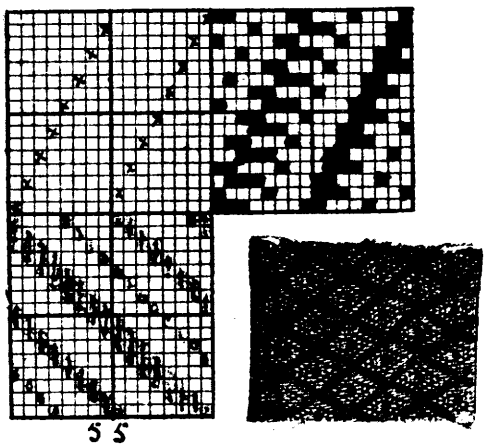

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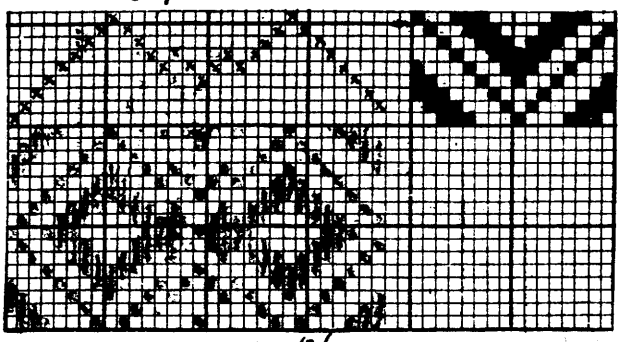

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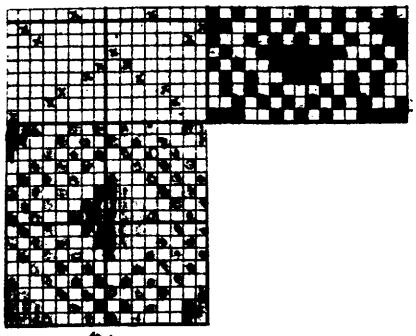

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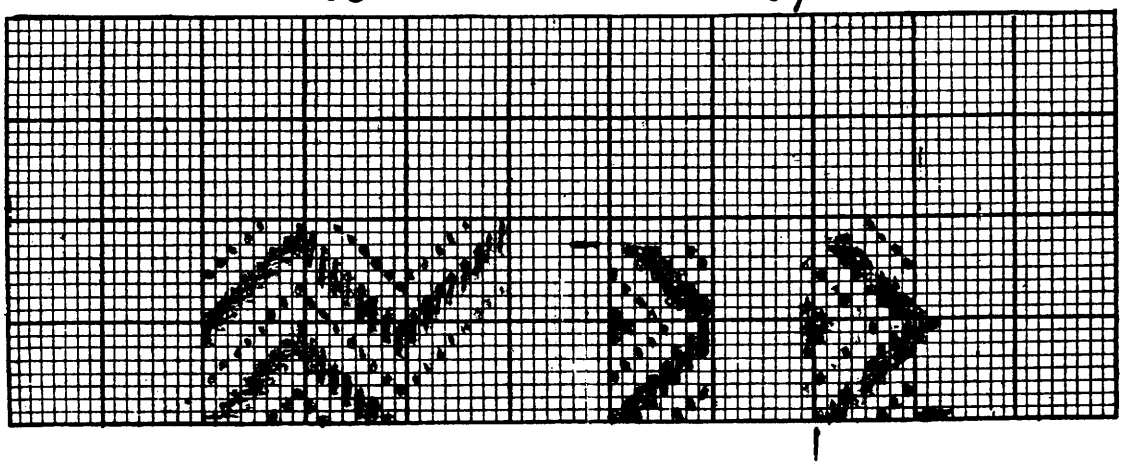
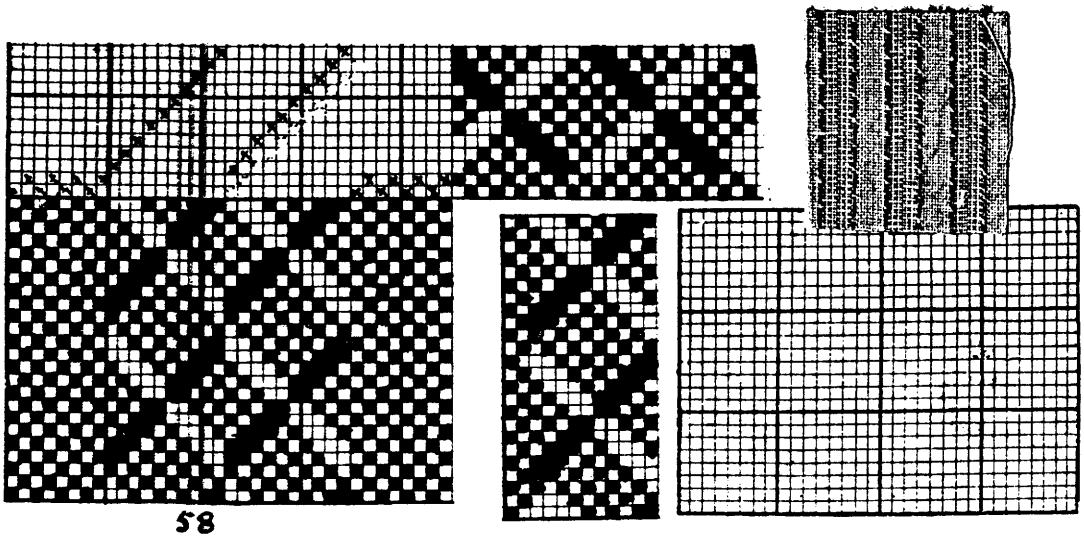


On the spaces below the loomings in 54. 55. 56 and 57. give the complete designs from the loomings and peg plans given.



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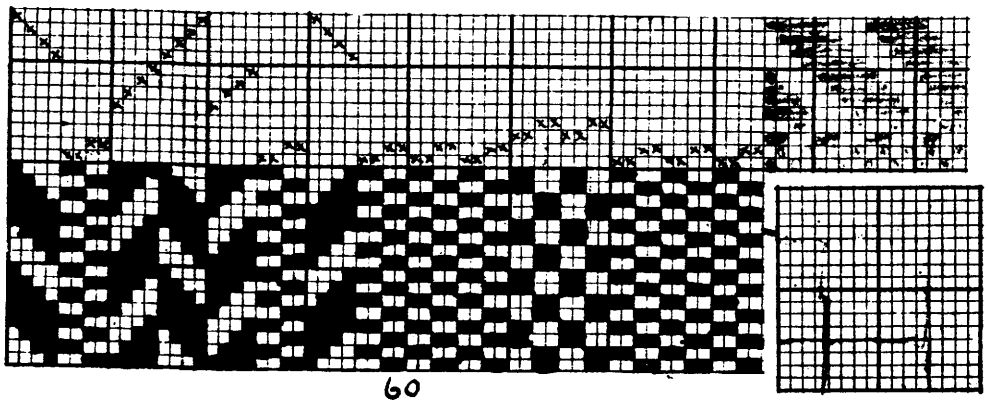

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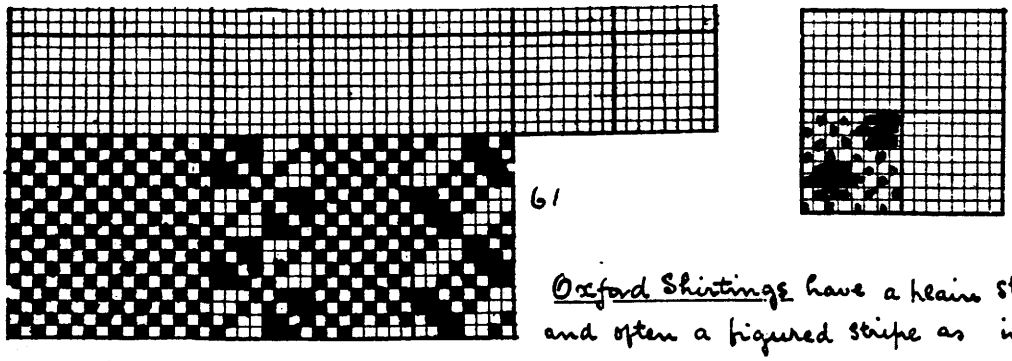
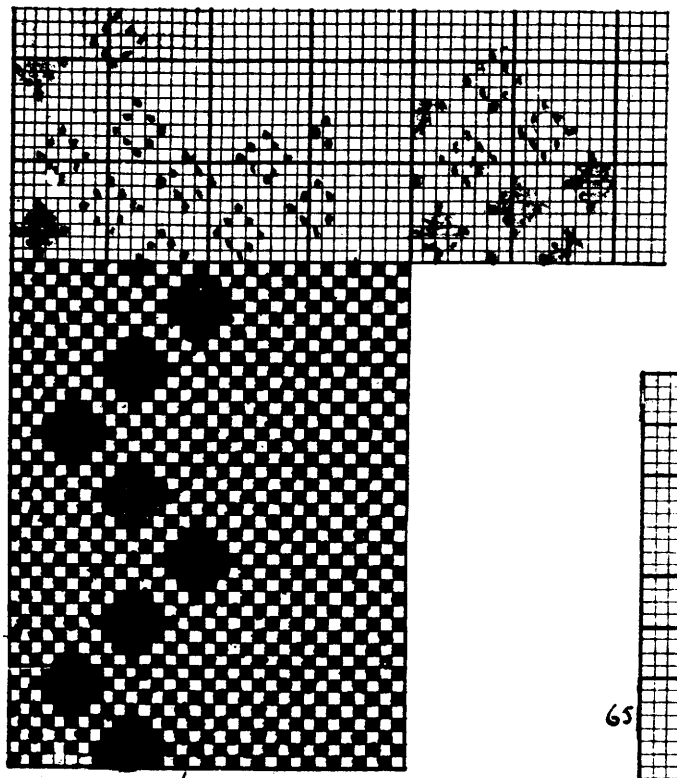


61

Oxford Shirtings have a plain stripe and often a figured stripe as in 58 which gives a design, looming and peg plan; often the plain ends are double as in 60. Give the looming and peg plans for 61



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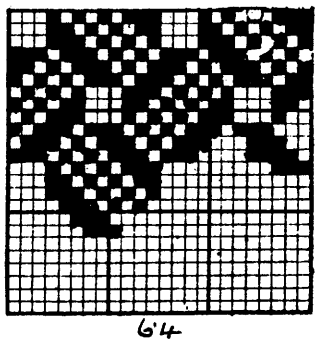

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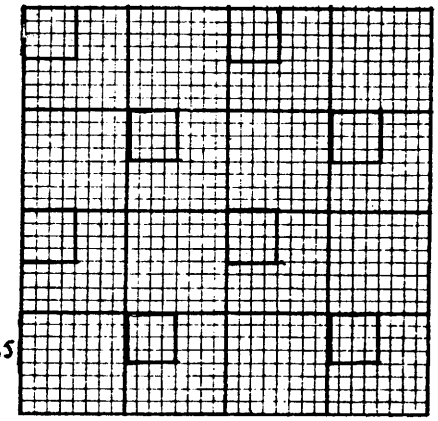
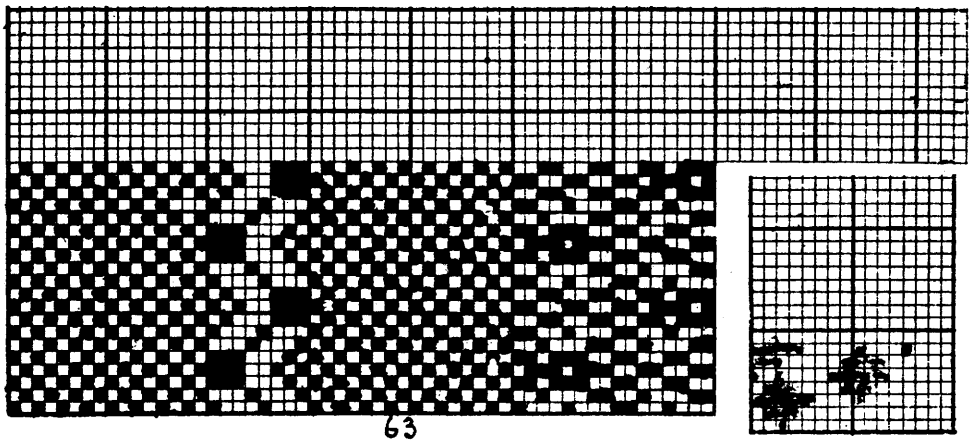


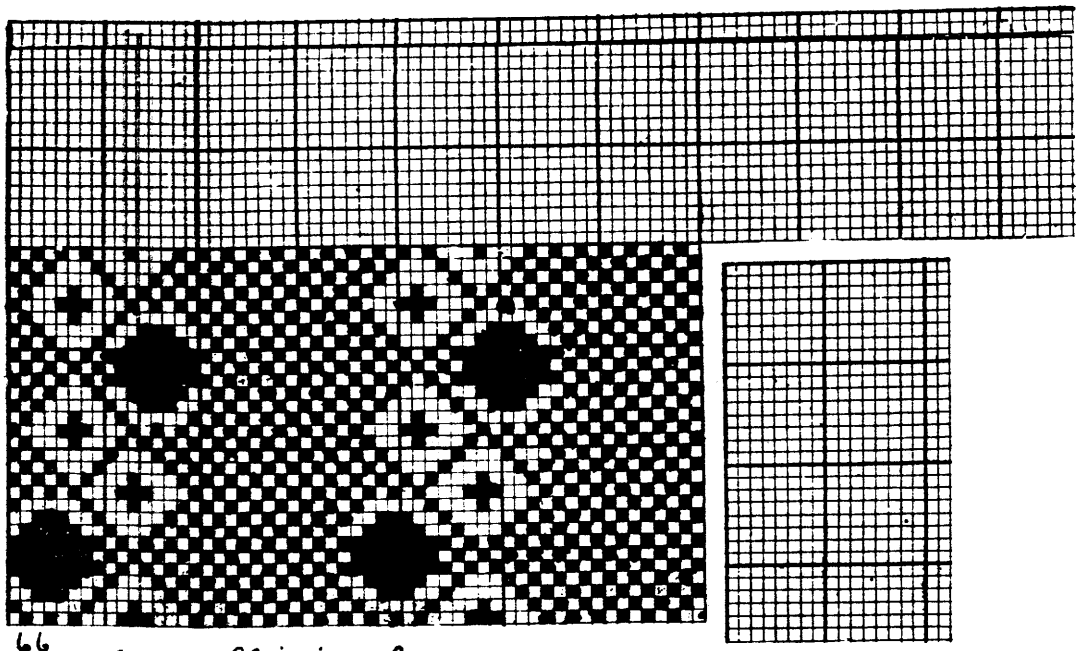
65

64 is on 12 ends and 12 picks complete the same to fill the space given. On 65 make the same design on a larger scale on 16 ends & 16 picks.



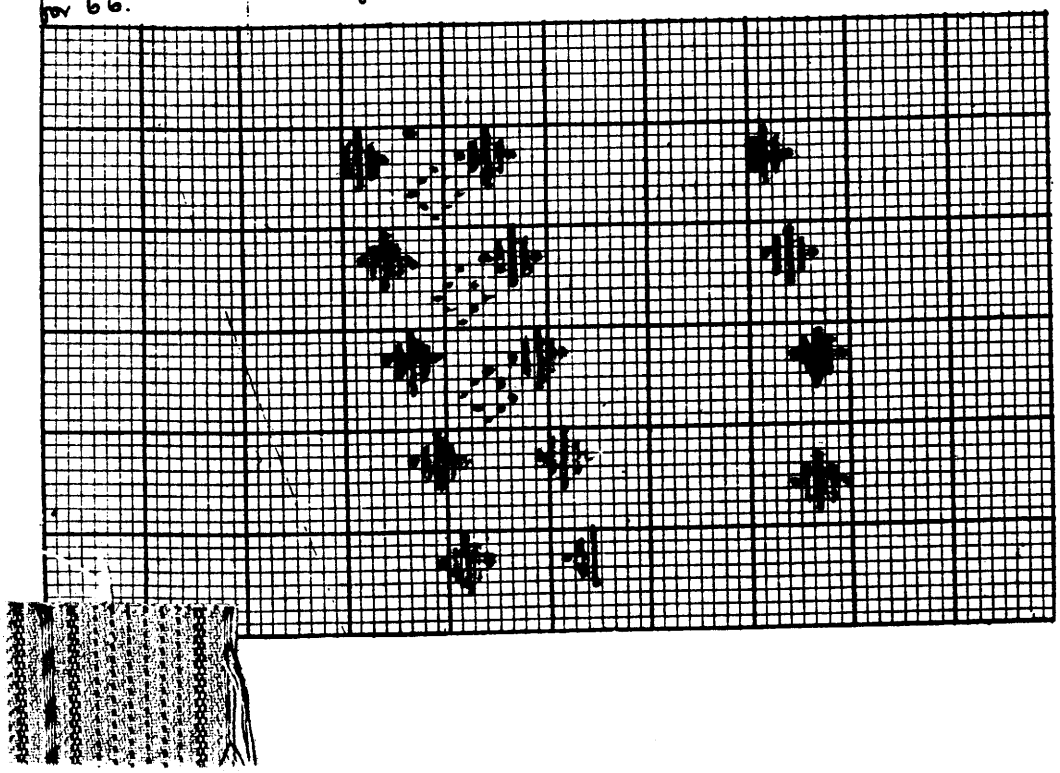
63

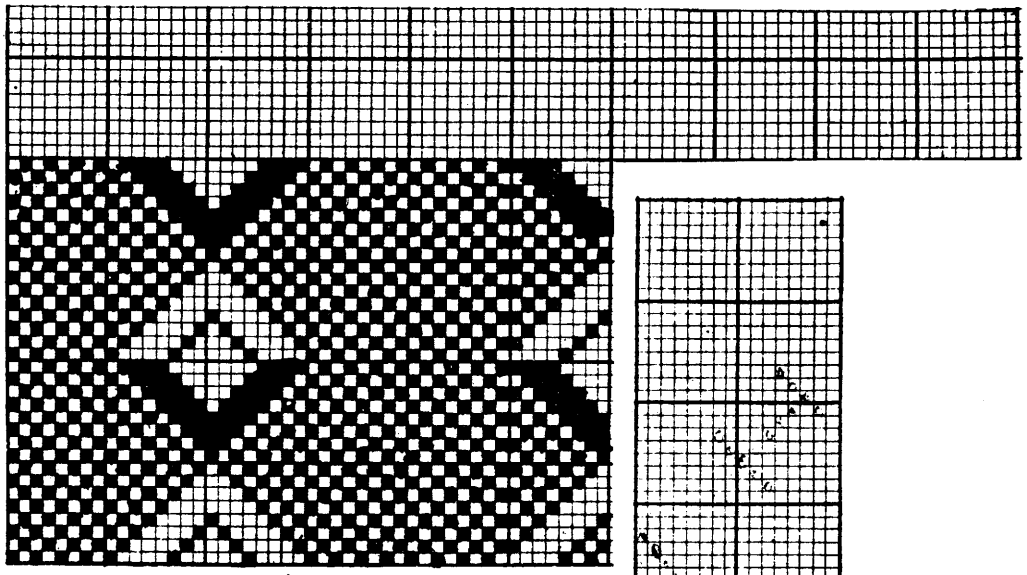
Oxford Shirtings. Give the loomings and peg plans for 62 and 63 respectively.



66

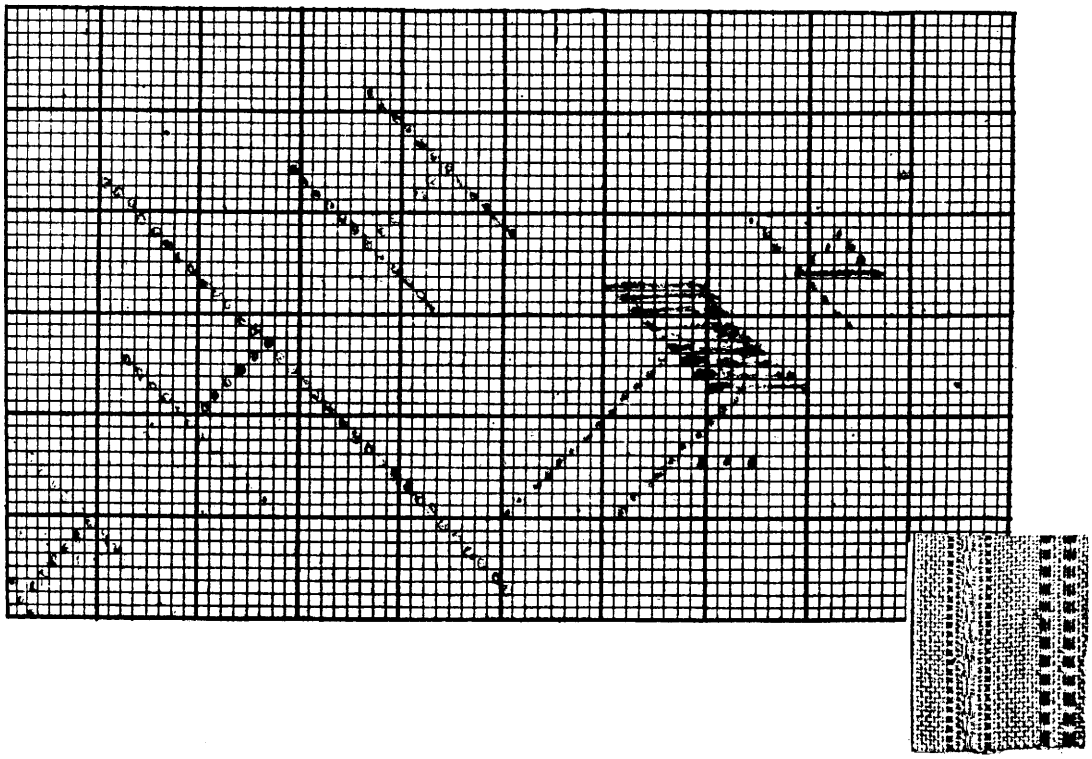
Oxford Shirting - Give looming and peg plans for 66.



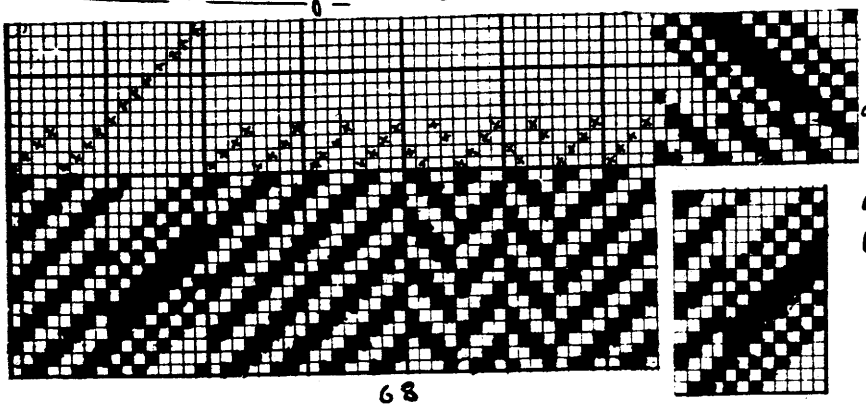


67

Oxford Shirting – 67. Give the looming and peg plan.



Harvard Shirtings have a two and two twill stripe and often a figured stripe as in 68. which gives a complete design with looming and peg plan.



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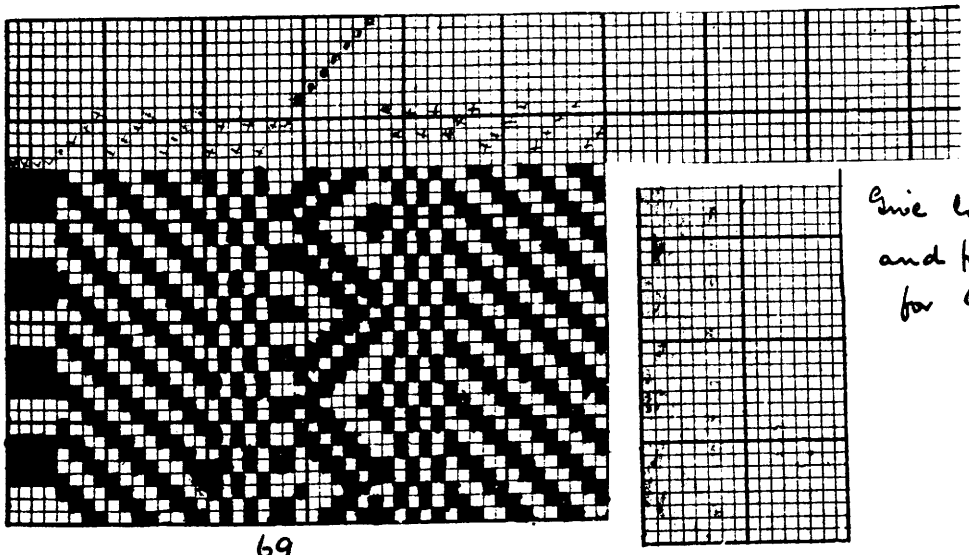
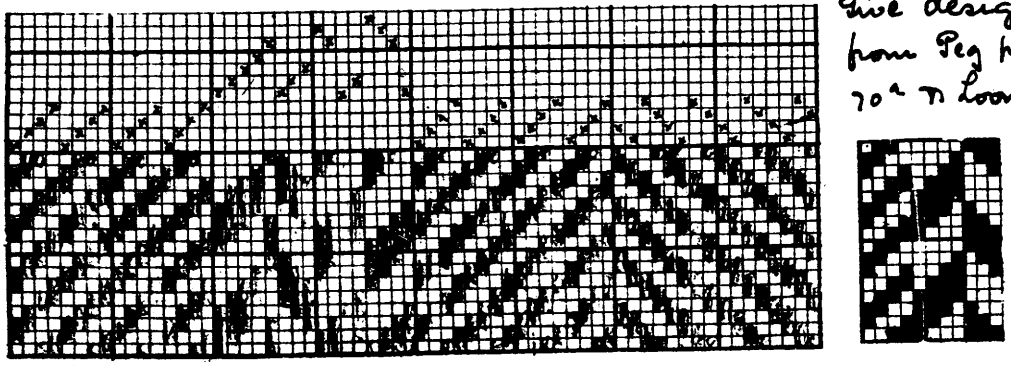


Give looming and peg plan for 69.

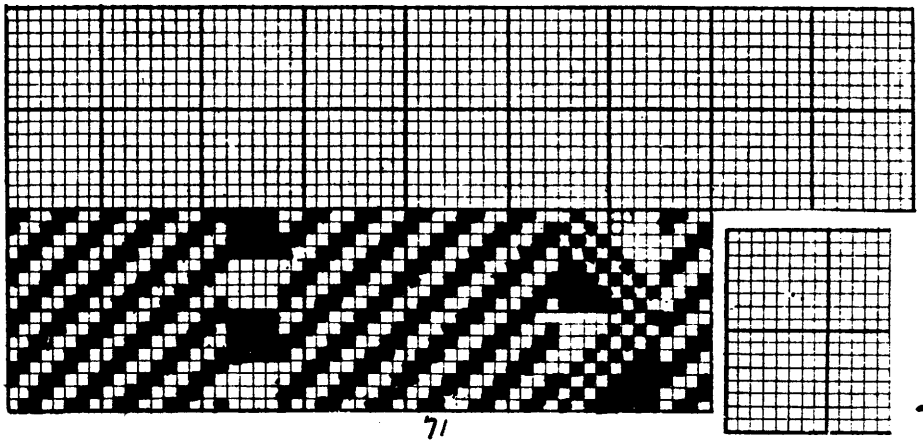
69

Give design from Peg plan 70ª & looming 70



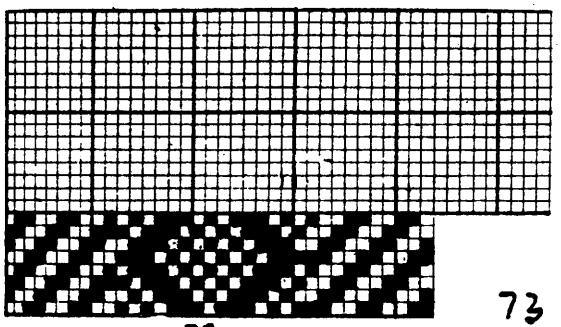
70ª

70



71

71. Give
Looming
on peg plan.



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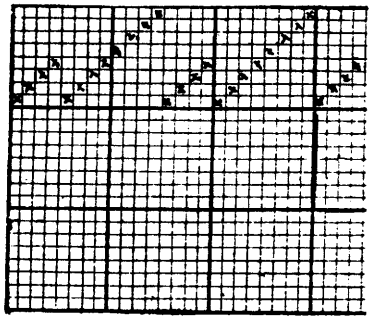
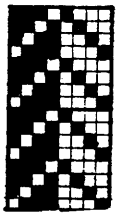
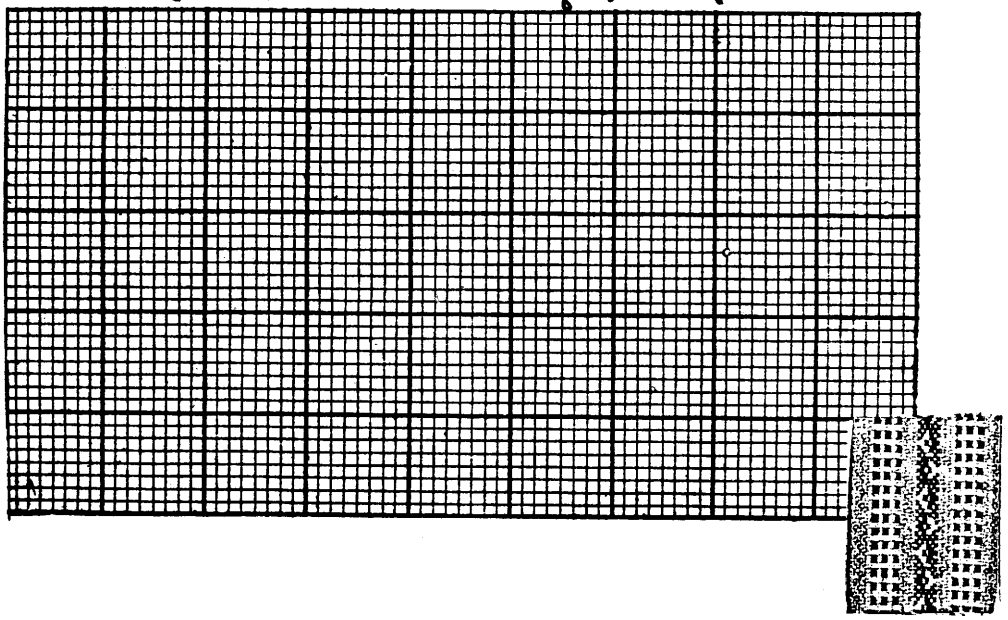
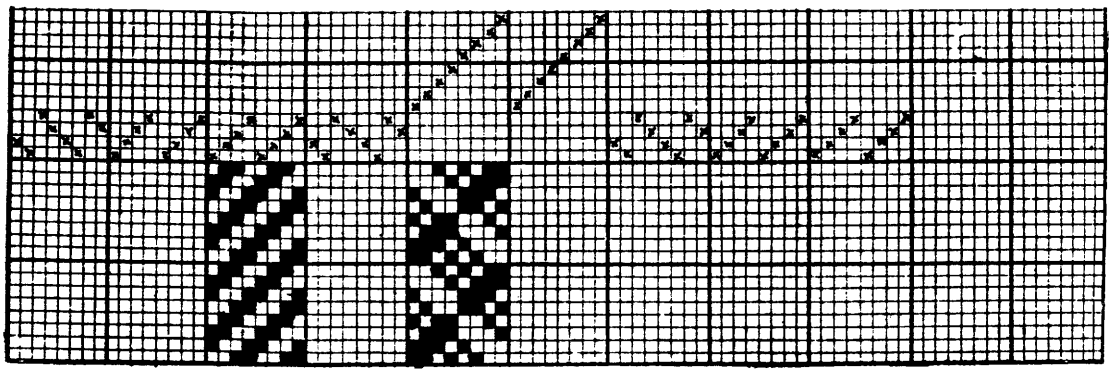




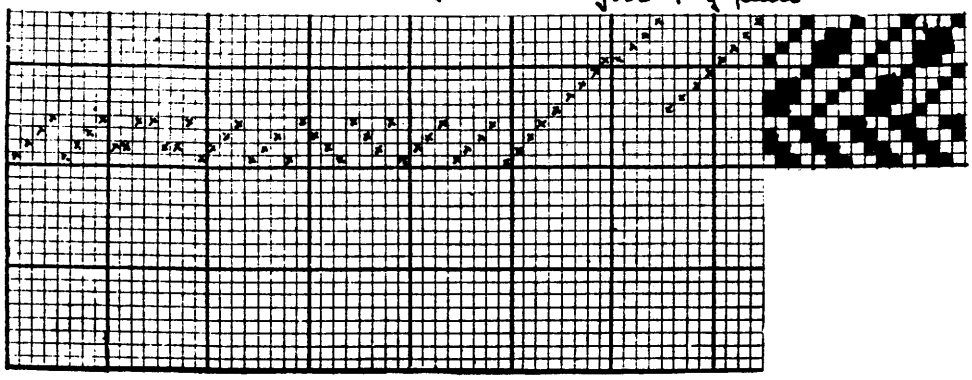
72 Give looming on peg plan. 73 Give design from peg plan 74.

74

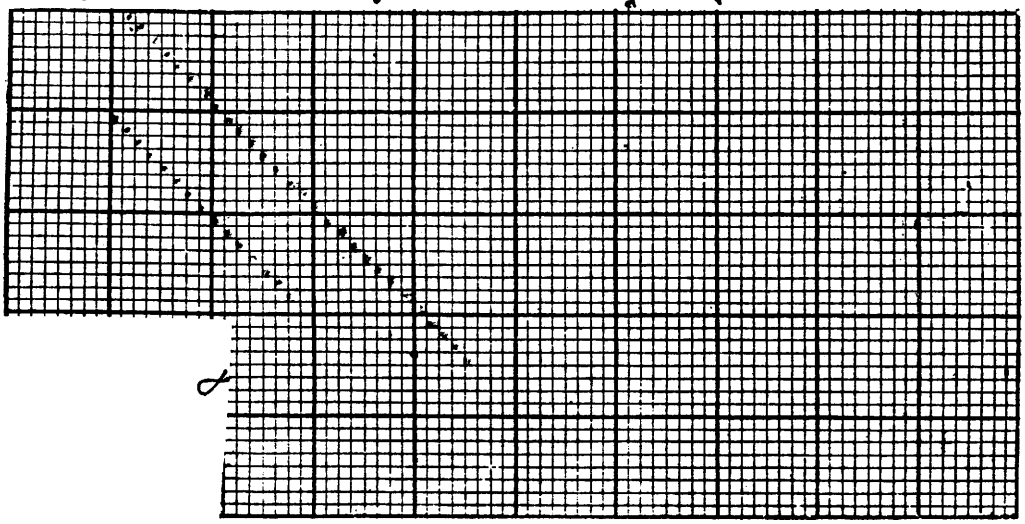




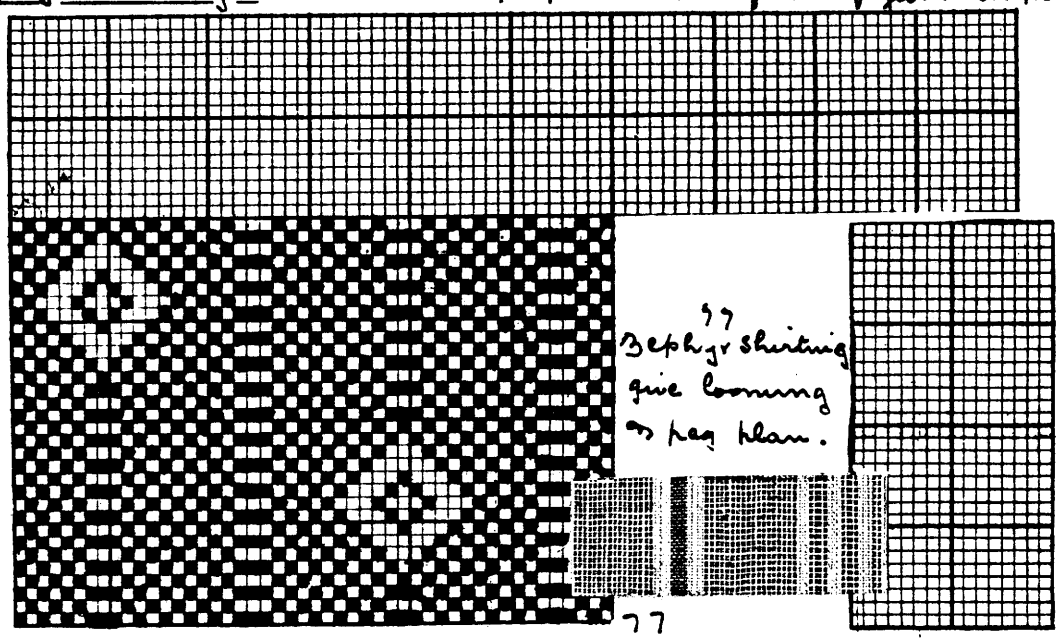
75 Finish design 75 and give peg plan



76 Finish 76 from the loom & peg plan given.

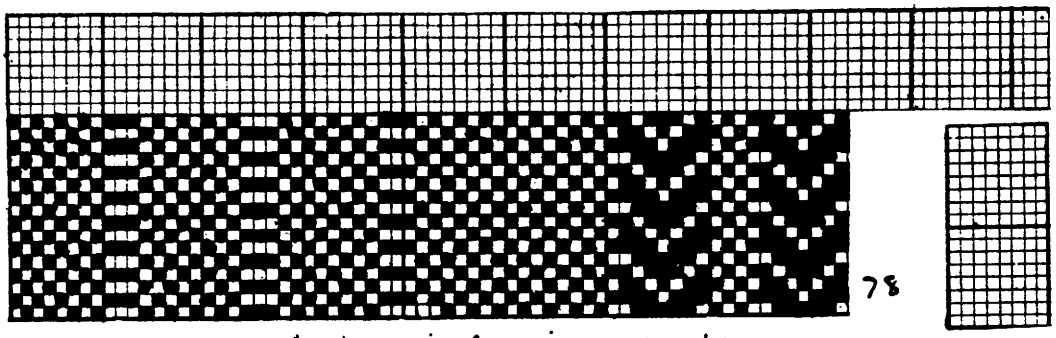


Zephyr Shirtings contain a Cord, a plain and often a figured stripe.



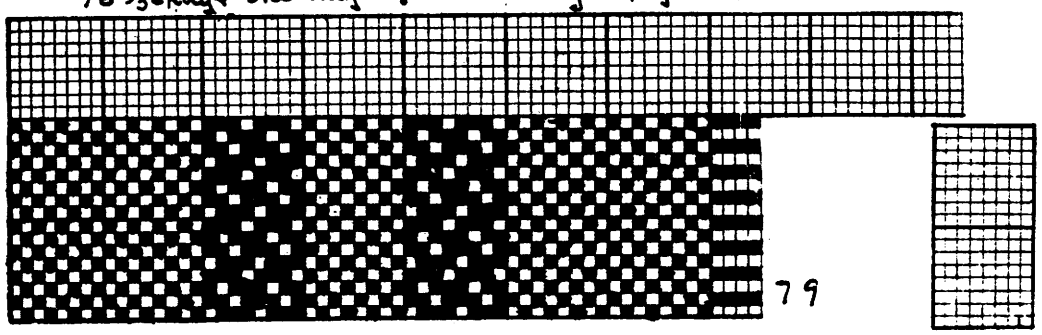
77
Zephyr shirting
give looming
on reg loom.

77



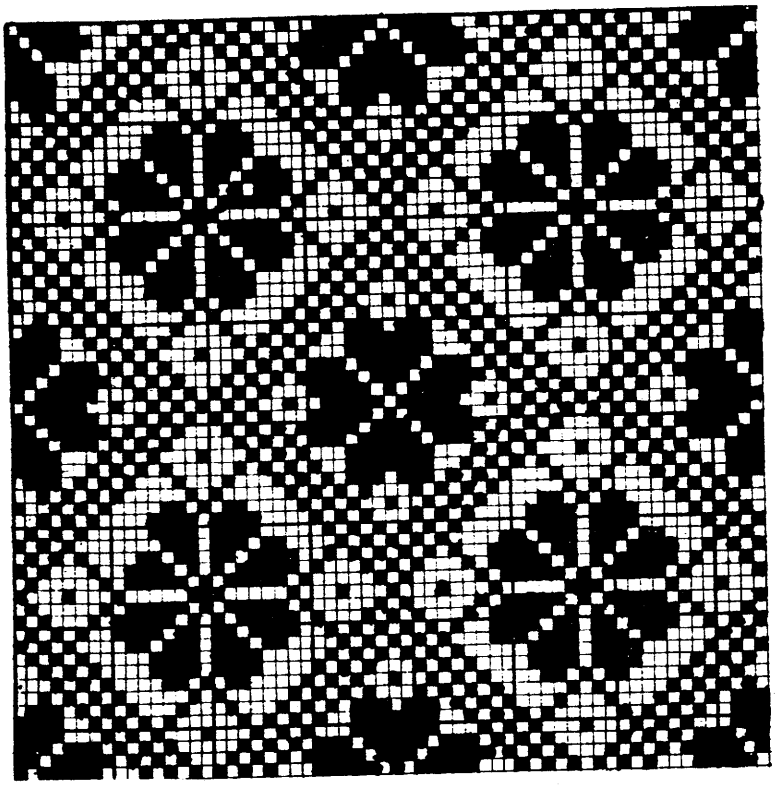
78

78 Zephyr shirting. give looming on reg loom.

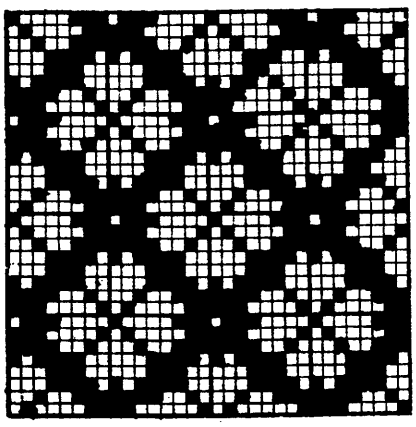


79

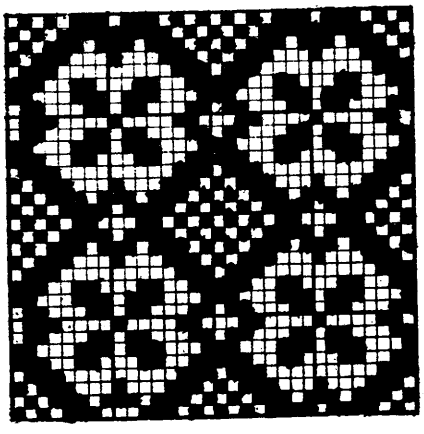
79. Zephyr Shirting. give looming on reg loom.



80

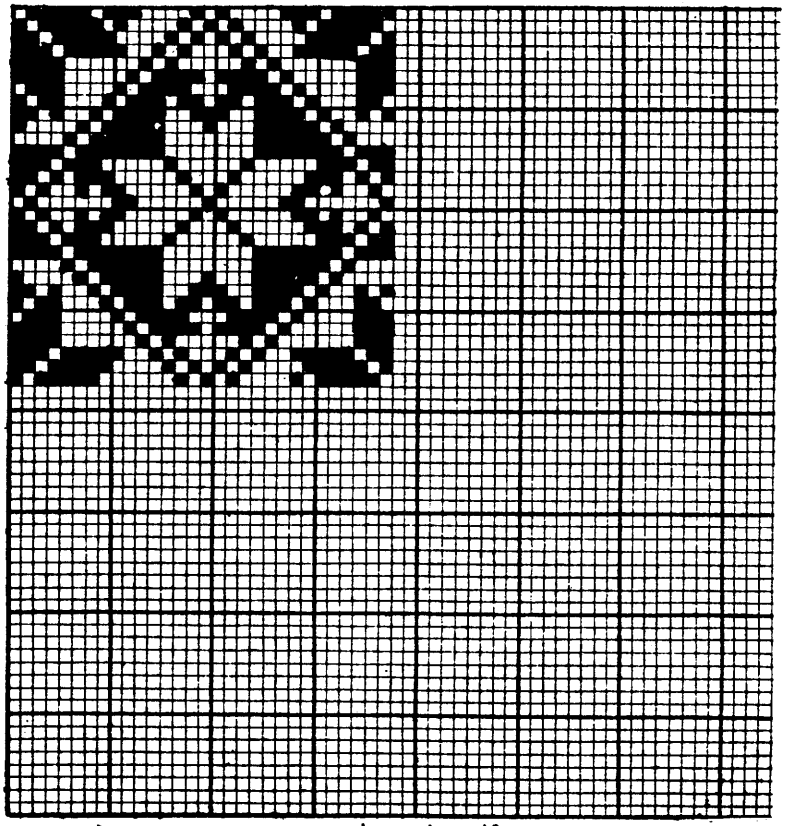


81



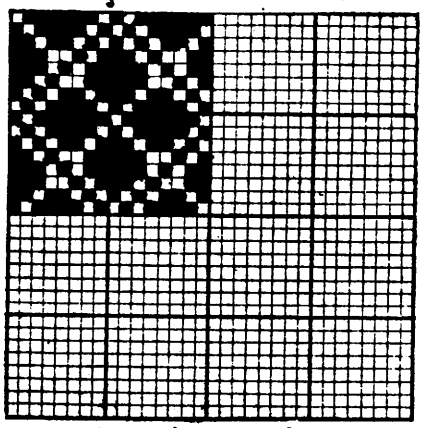
82

80. Fancy Diamond. point draft looming on 16 healds.
81 and 82. Fancy Diamond patterns on 9 healds point draft.

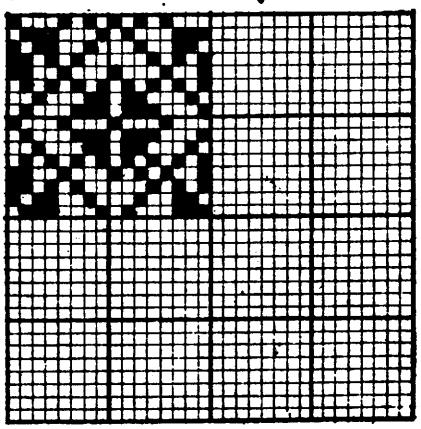


83

83 Fancy Diamond. repeat to fill the space given. 16 heards

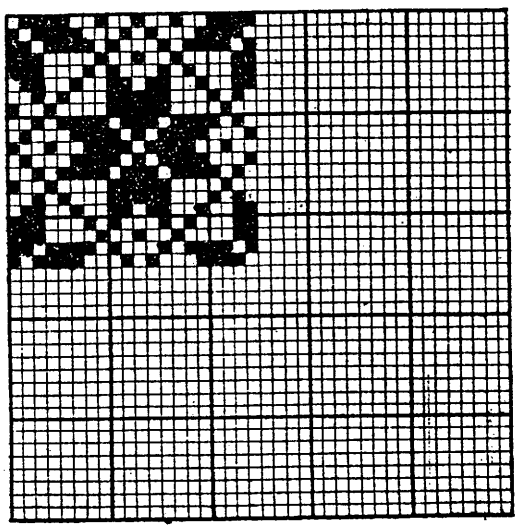


84

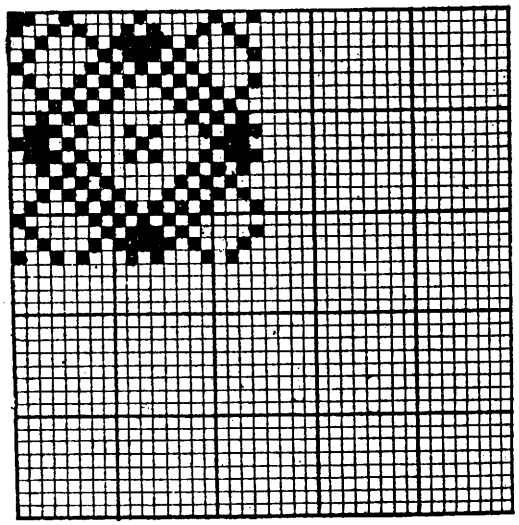


85

84 and 85 Fancy Diamonds on 9 heards point draft. Repeat each pattern to fill the space given

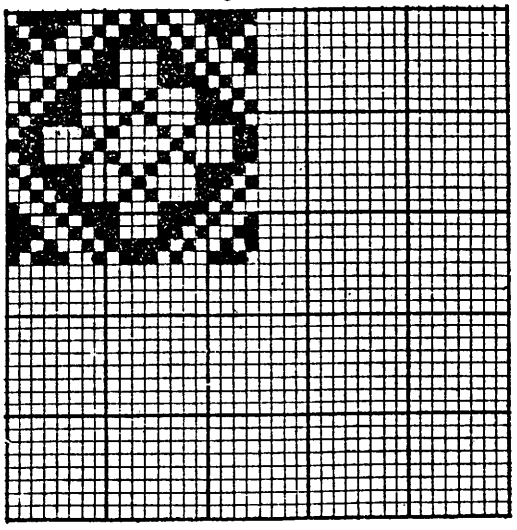


86

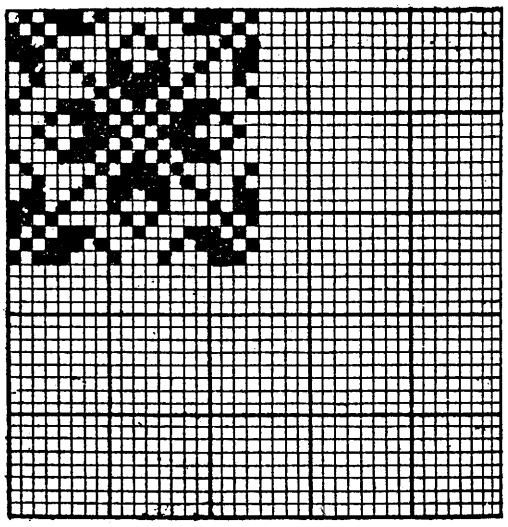


87

88

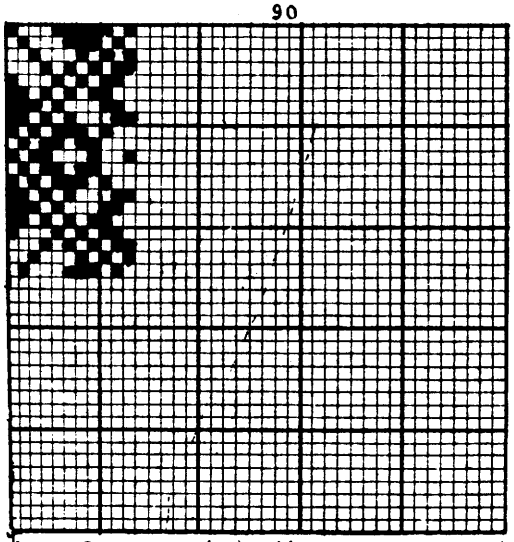


89

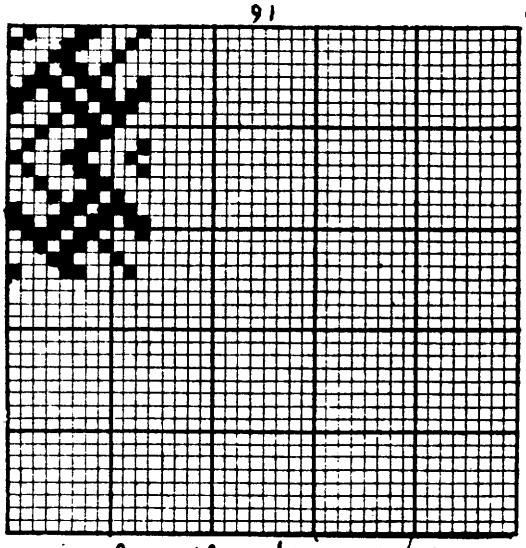


86. 87. 88 and 89. Fancy Diamonds patterns on 11 heads point draft looming. Repeat the patterns in each case to fill the spaces given.

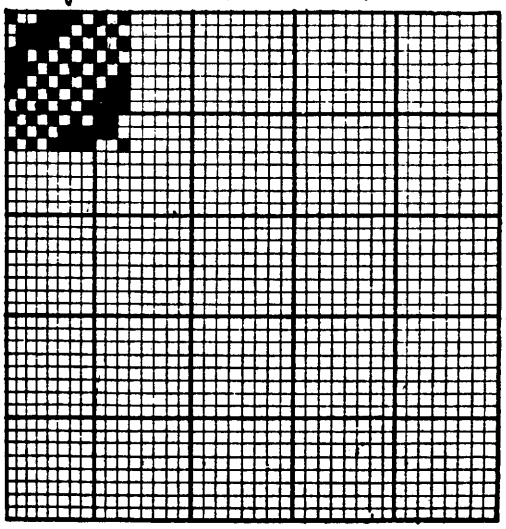
90



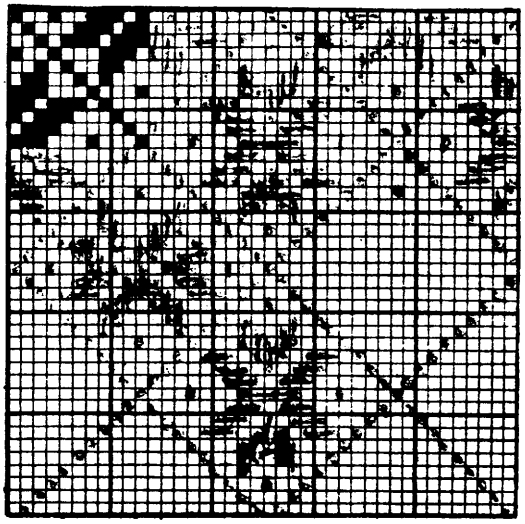
91



Fancy Diamond Patterns. 90 and 91 give half the design for centred patterns on 11 healds point draft looming, complete the design and repeat to fill the spaces in each case.

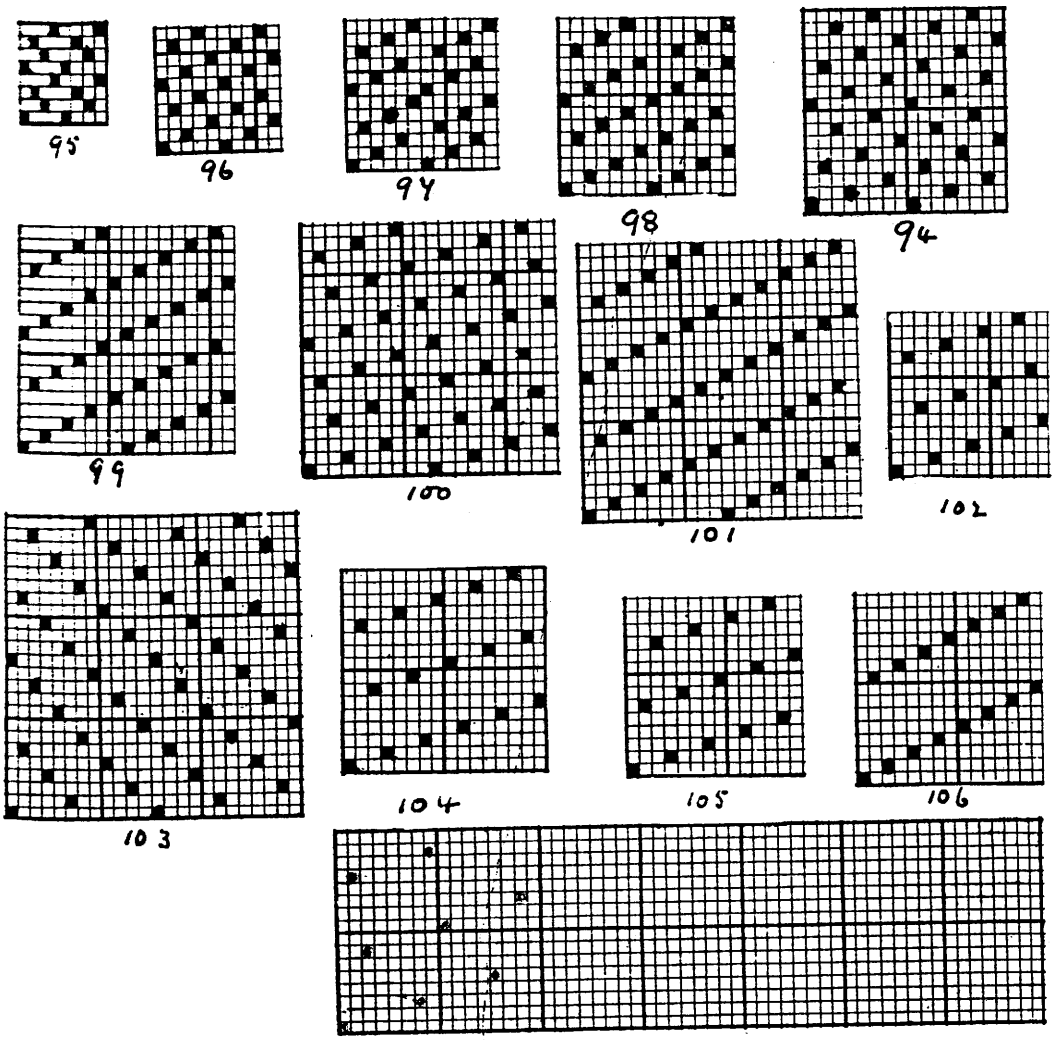


92

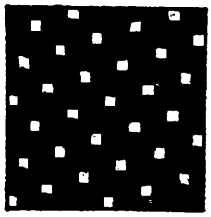


93

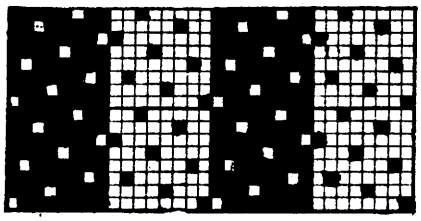
Fancy Diamond Patterns. 92 and 93 give a quarter of the design for centred patterns on 11 healds point draft looming. Complete the design and repeat to fill the space in each case.



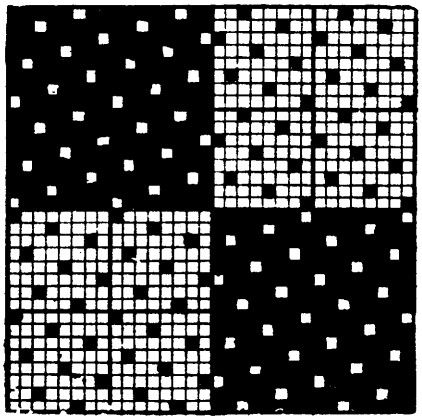
Satins. In making satins say on 8 healds (94) a number is taken for a basis. this number must not be a measure of the number of healds employed. it must also be such that it cannot be divided by any other number which is a measure In filling the squares you miss one less square that the number taken as a basis. in 94. 3 has been taken as a basis. therefore 2 squares are missed between one filled in square and the next on successive picks. 95 to 106 give satins on 4 to 16 healds



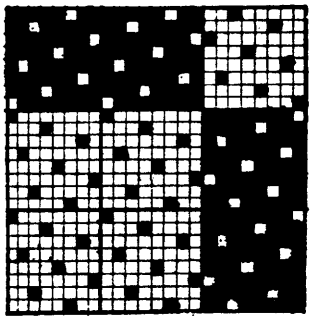
107



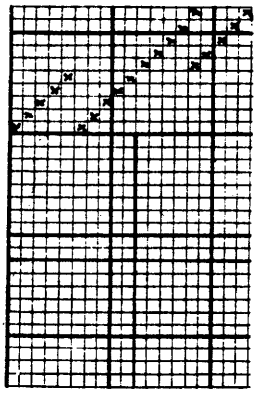
108



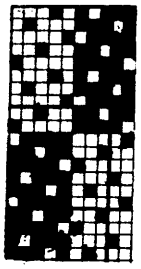
109



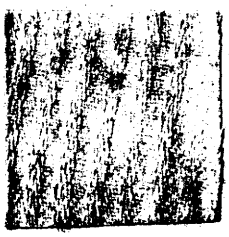
110

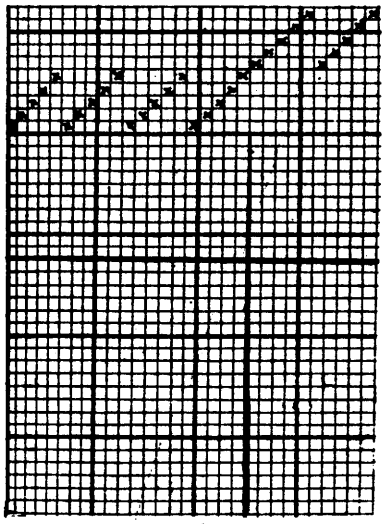


112

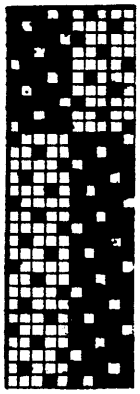


111

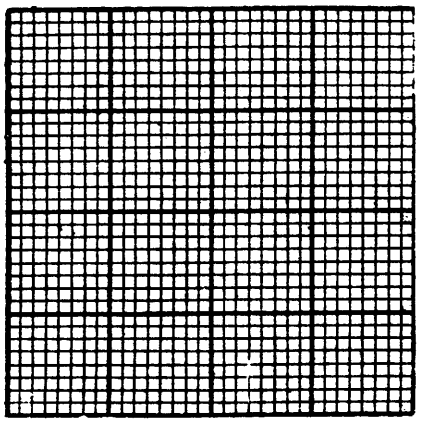




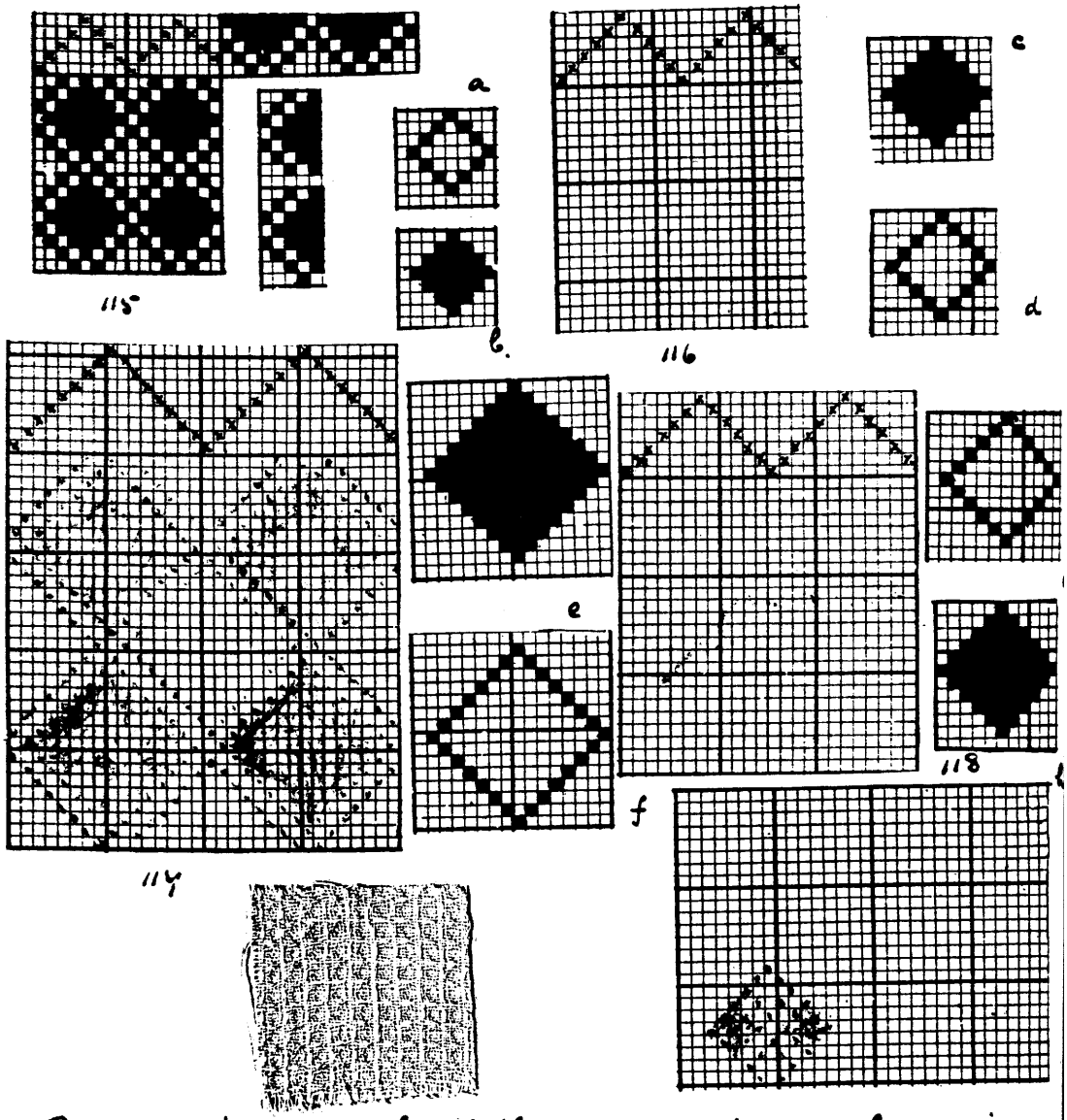
113



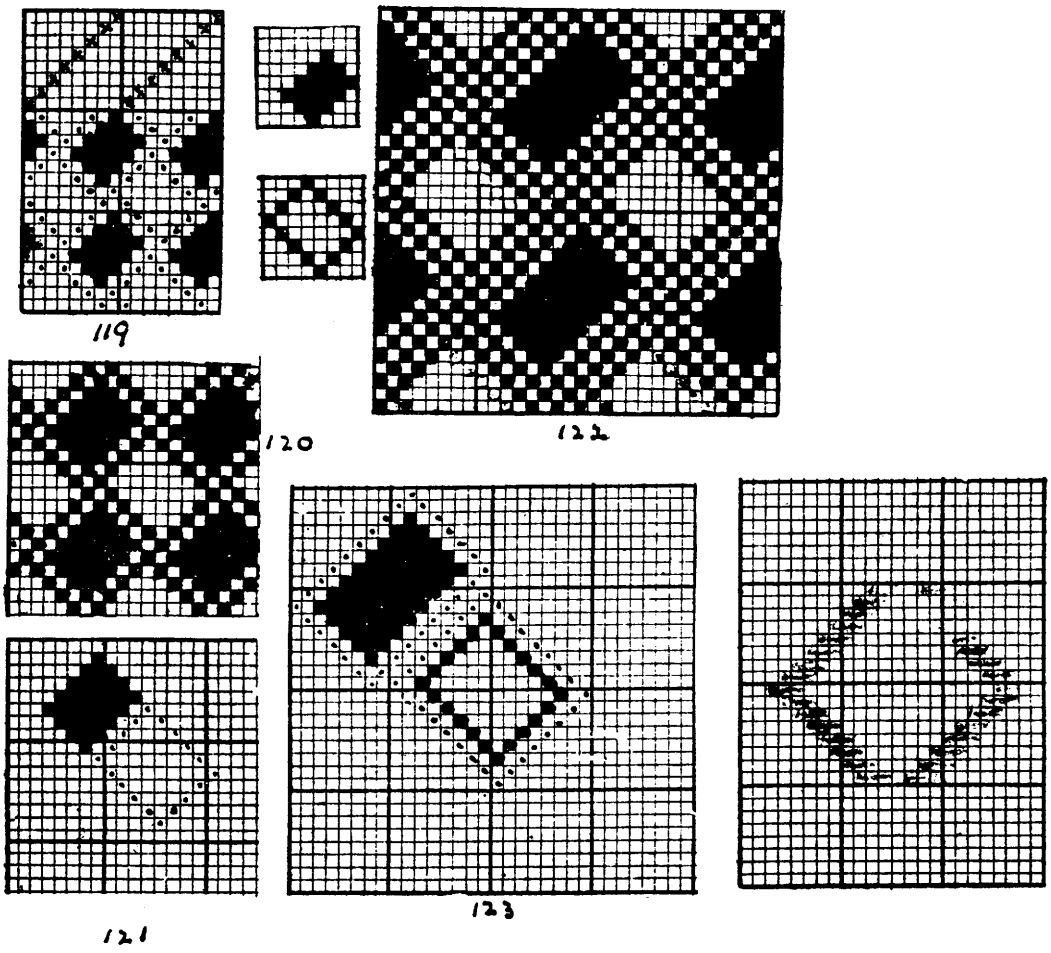
114



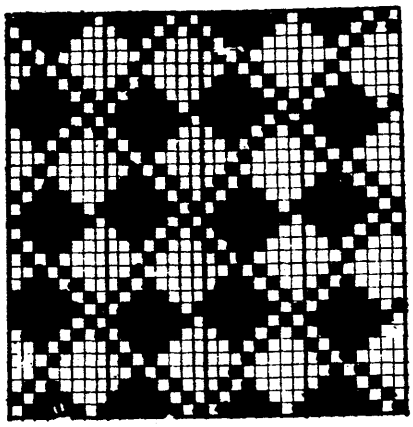
In making Satin checks it is important that the filled in squares of one check should come opposite to empty squares in the next check. This is shown in 107 to 110. Give the patterns from draft 112 and peg plan 111 also from 113 and 114



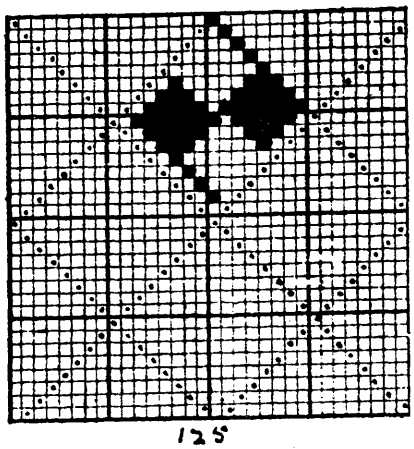
Regular Honeycomb cloths are made as shown in 115 from a point draft looming. the design is made by combining a. and b.. From the draft 116 and c. d. make a honeycomb. From e. f. and 114 make a honeycomb. From g. h and 118 make a honeycomb.



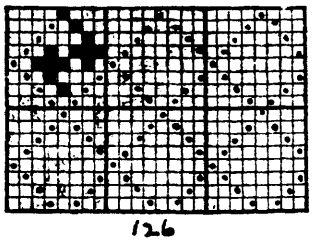
Fancy Honeycombs. The example on this page require a straight draft. Loom. 119 on 8 Shafts; 120. 10 Shafts; 122. 16 Shafts. 119 is made up from the two weaves a. b. The construction of 120 is shown in 121 which complete to fill the space. The construction of 122 is shown in 123 which complete to fill the space.



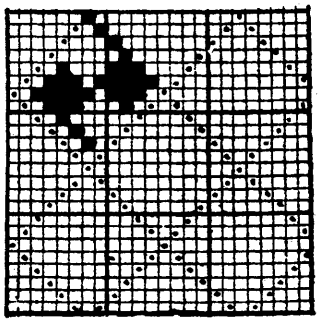
124



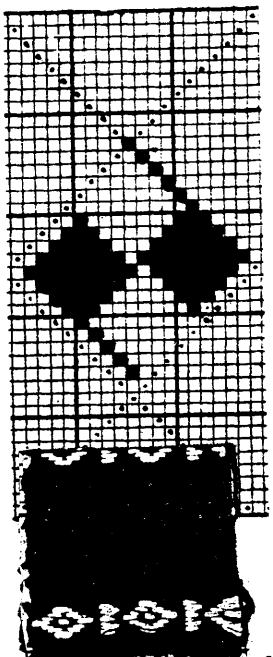
125

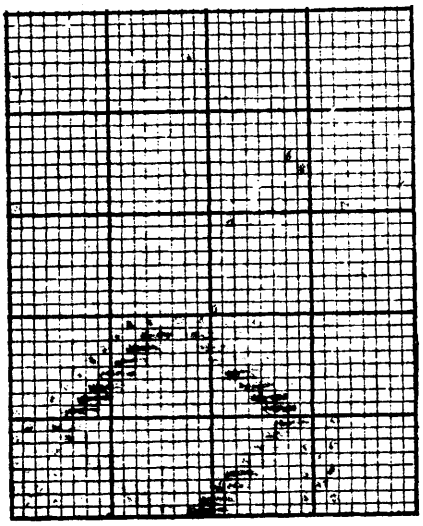


126

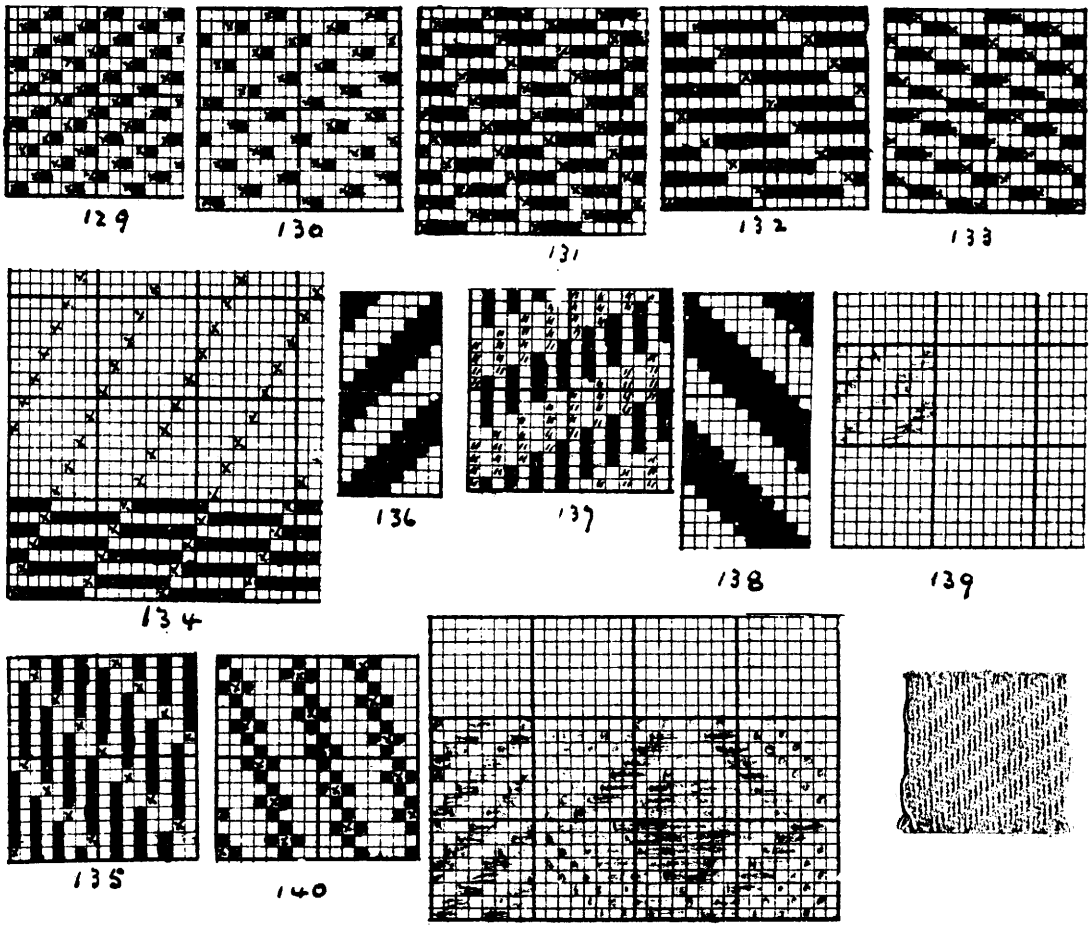


127

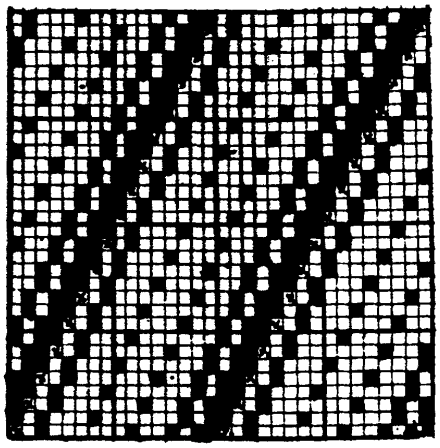




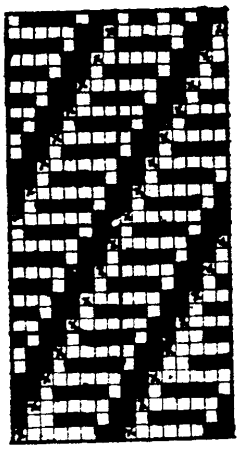
Brighton Weavers or [illegible] Honeycombs. The designs given on this page will require a straight draft loom. 124 gives a complete design (repeated) on 16 shafts straight draft. 125 shows the construction which complete. Complete 126 on 8 ends to fill the space. Complete 127 which stands on 12 ends and 12 picks. Complete 128 which requires 20 ends and 20 picks.



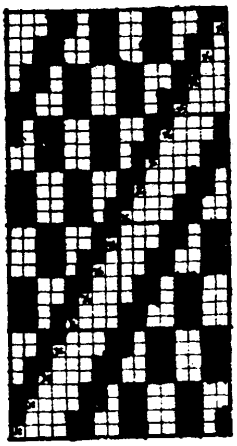
Imperial Sateens or Swansdowns. are given in 129 and 130 both have a satin basis as indicated by the x^5. these cloths are afterwards raised or perched as in swansdowns and the backs of moleskins. West Corkscrews have all a satin basis as shown by the crosses: 131. 9 shafts; 132. 16 shafts; 133. 8 shafts; 134. 13 shafts complete this example. 135 gives a warp corkscrew, satin basis as x^3 on 16 shafts. 136 gives a 8 end twill. 137 shows the ends re-arranged to produce a Warp corkscrew. Re-arrange the threads of 138 on space 139 as in 137 to produce a Warp Corkscrew. Granite Weaves are made from a satin basis (x^3) by adding filled in squares to the x^5 as in 140.



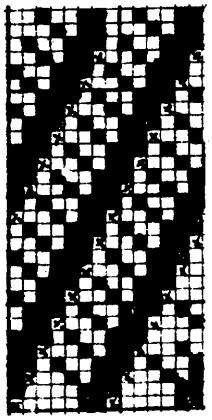
141



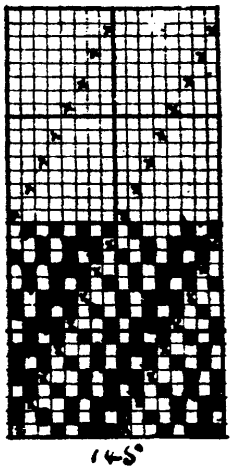
142



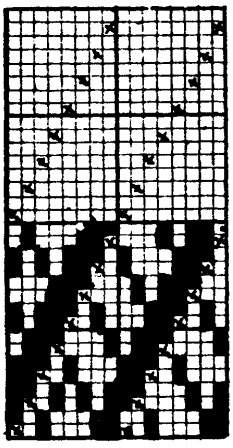
144



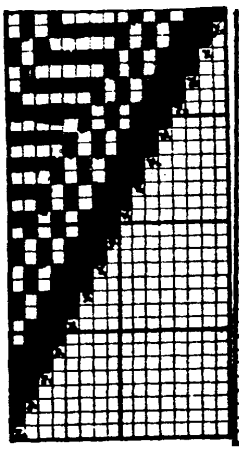
143



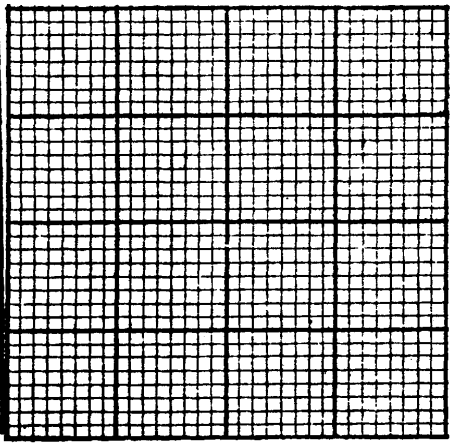
145

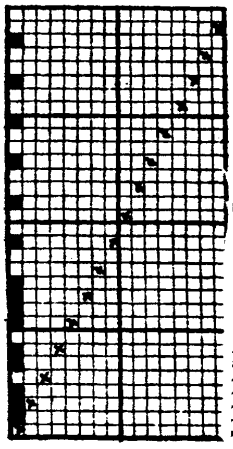


146

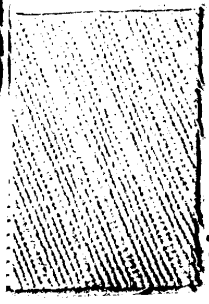


148

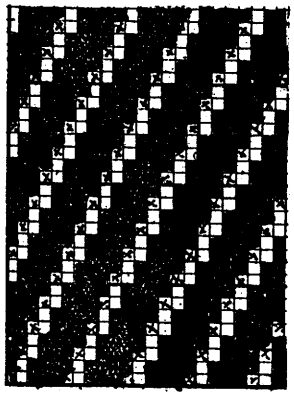


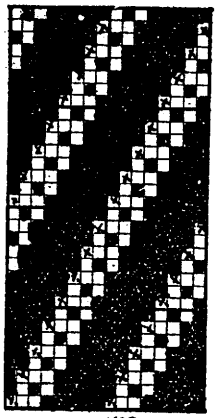


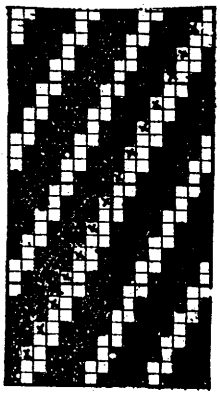
147



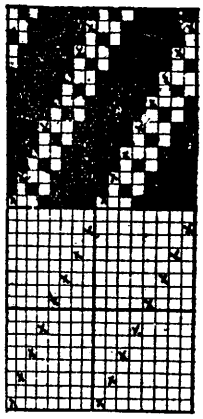
Step Twills or Diagonals are made by stepping the twill as shown by the arrows. 141 gives a completed pattern (repeating) on 16 shafts: 142 gives an example on 8 ends and 16 picks: 143. 7 ends and 14 picks: 144. 16 ends and 32 picks: 145 and 146 each on 8 ends and 16 picks. Complete examples 147 and 148.

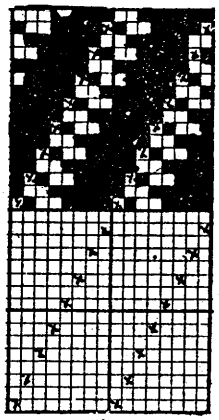

149

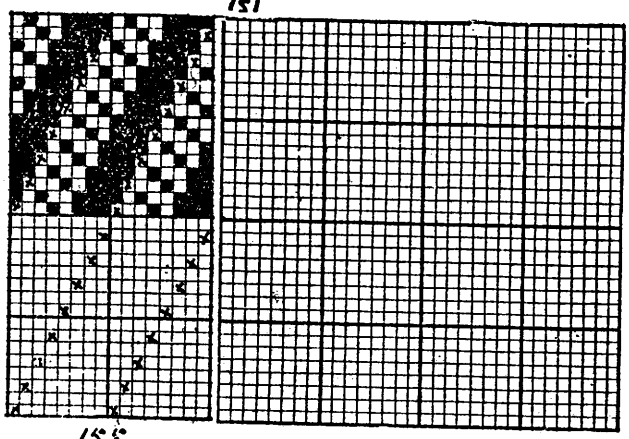

150


151


152


153


154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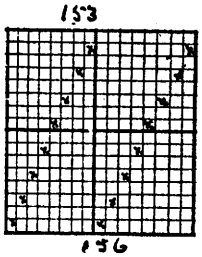
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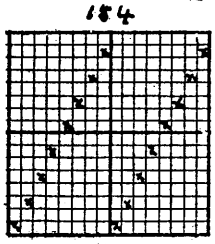
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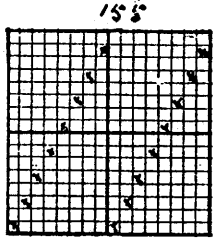
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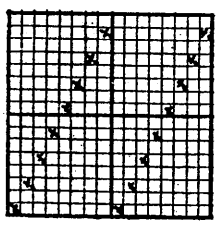
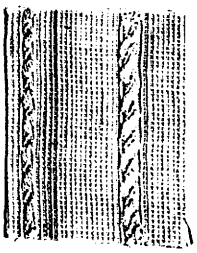
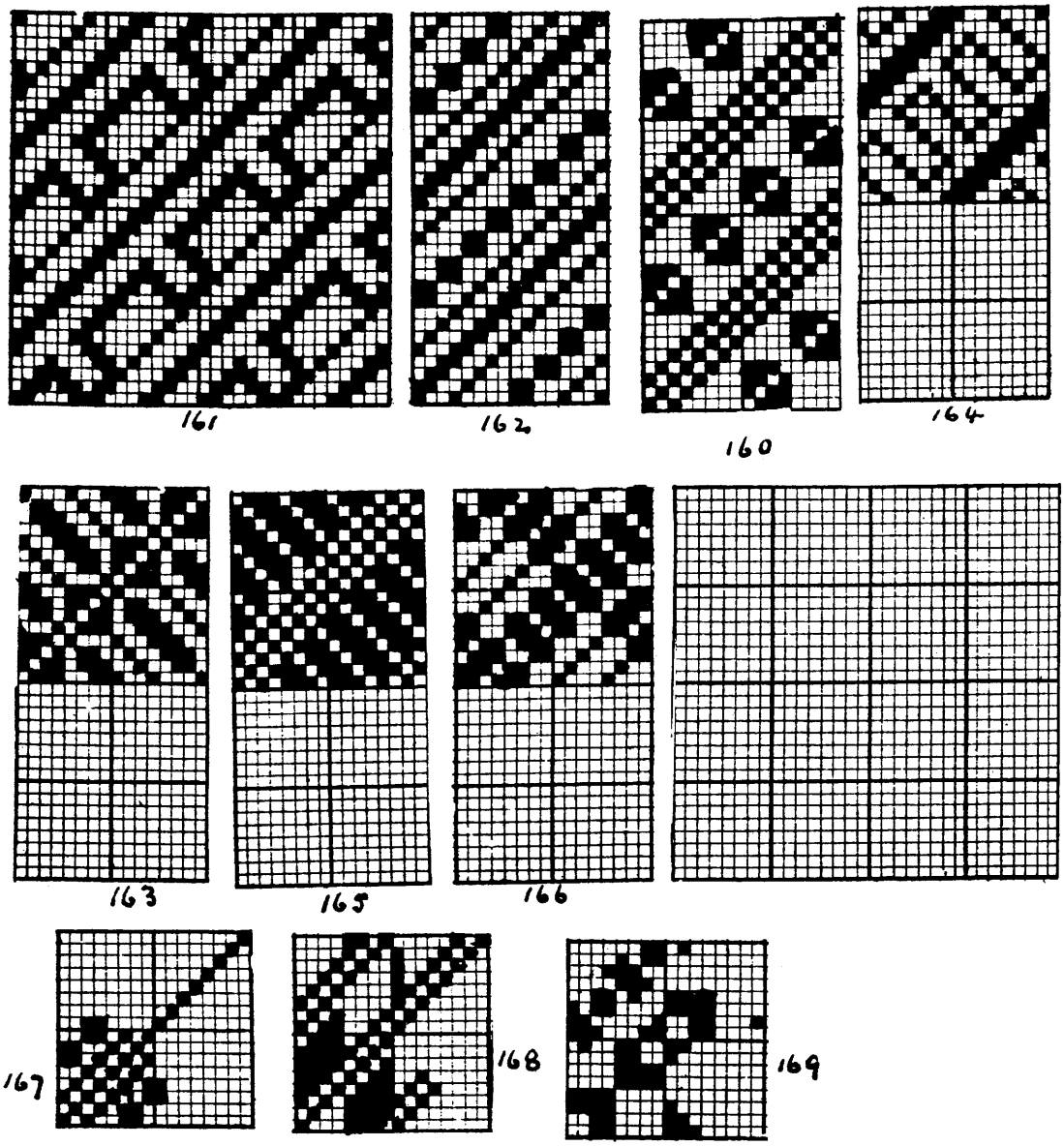
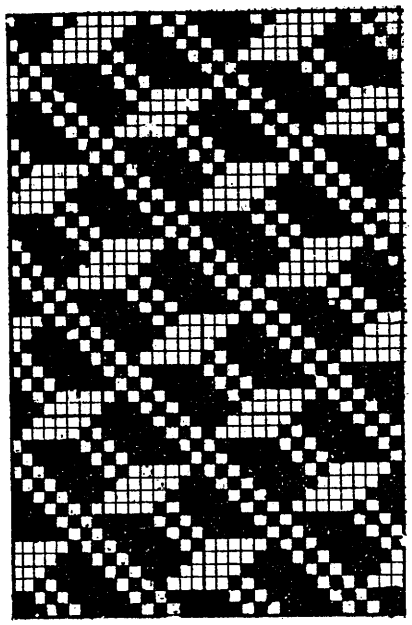

159



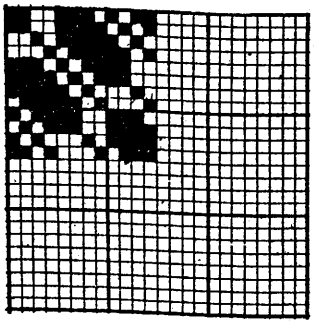
Whipcords are cloths showing a diagonal line of twill down the piece. to be effective they must contain double the number of ends to picks per inch they are made from a step twill basis as shown by the x's. 149, 150 on 8 ends : 151 16 ends : 152. 7 ends; Completes 153. 154 to 155. make whipcord designs on 156. 157 158 to 159.

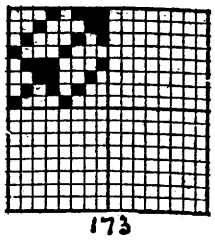


Fancy Twills The figure running along with the twill must be some measure of the ends and picks in the complete pattern, 160 to 166 give examples all on 16 shafts. Repeats 163 to 166 Complete examples commenced. 169. 168 to 169.

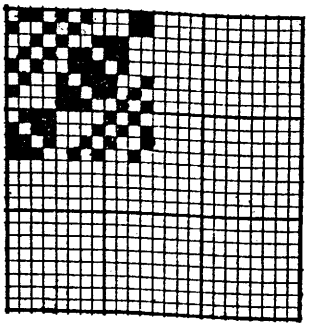


171

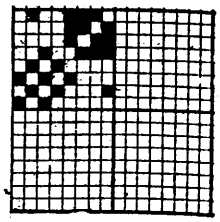




173

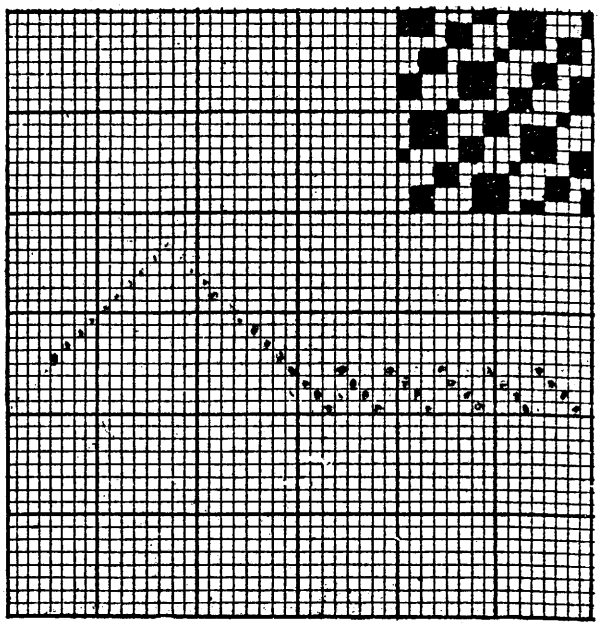


172

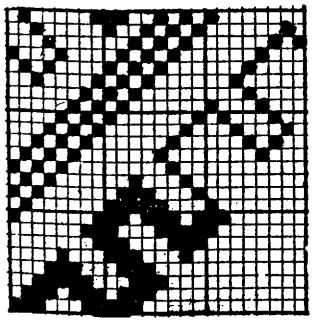


174

170 repeats on 16 ends and 40 picks.



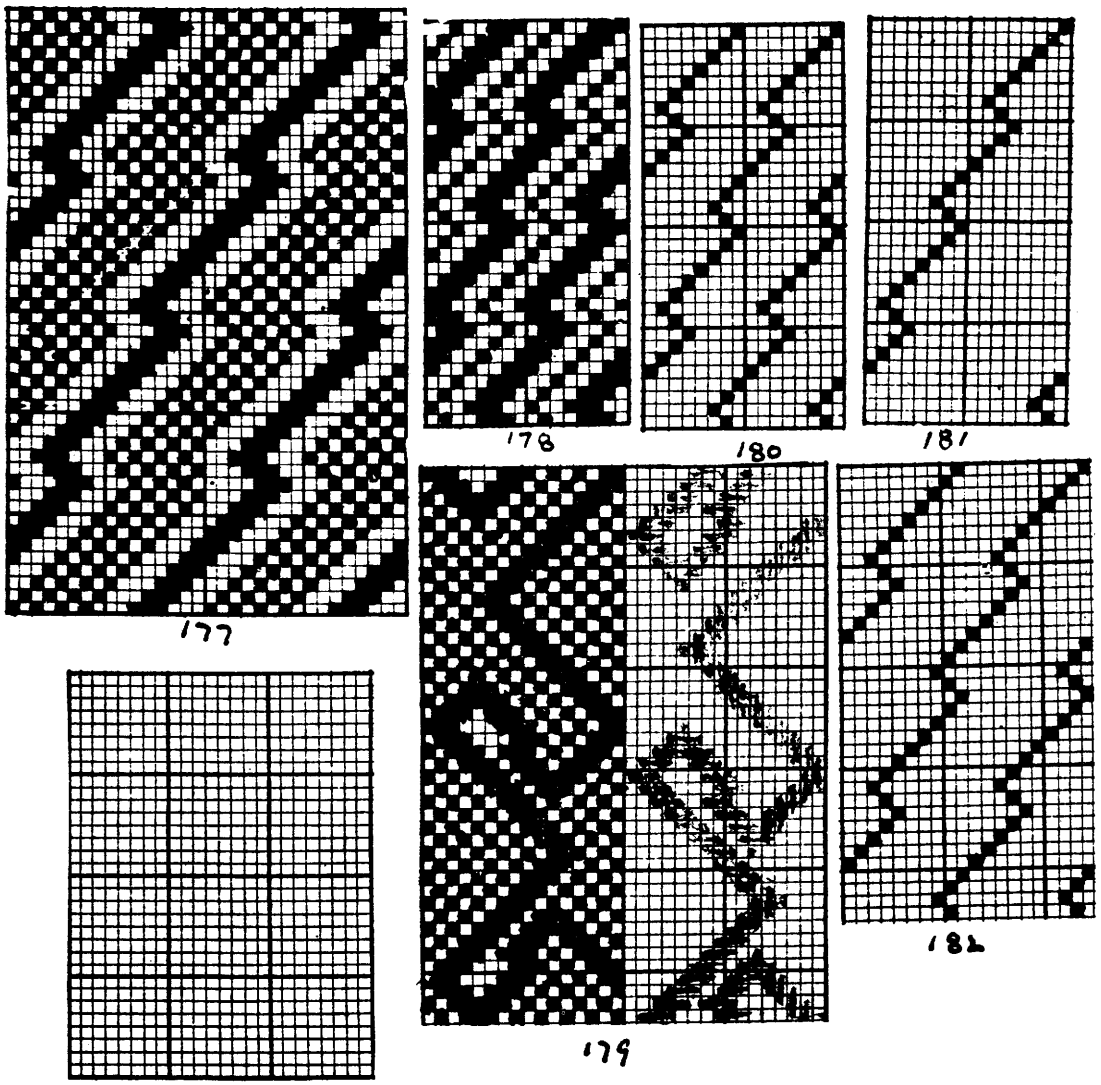
175



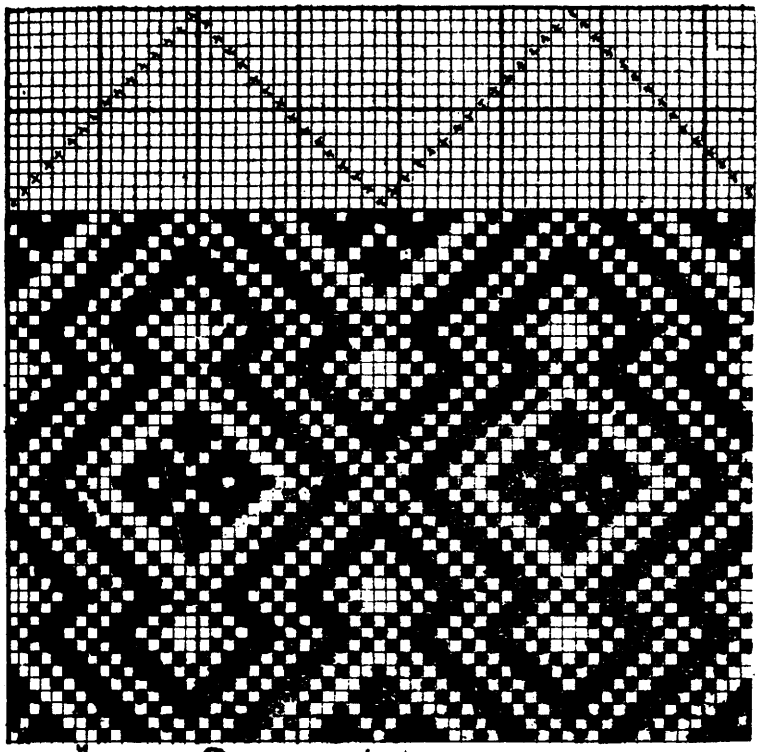
176

171. 172. 173 and 174 are all complete patterns, repeat to fill the space in each case. Complete 175. 176 repeats on 40 ends and 40 picks complete it.

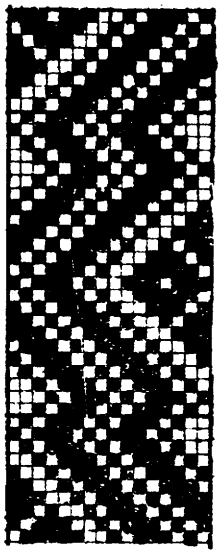
Fancy Twills.



Zig-Zag Twills are made by taking a twill basis and running the lines of twill in a given direction for a number of picks and then reversing for a number of picks. Examples are given in 177 on 16 shafts and 178 on 8 shafts: Repeat 179 on the space given. make zig-zag twills on 180. 181 & 182.

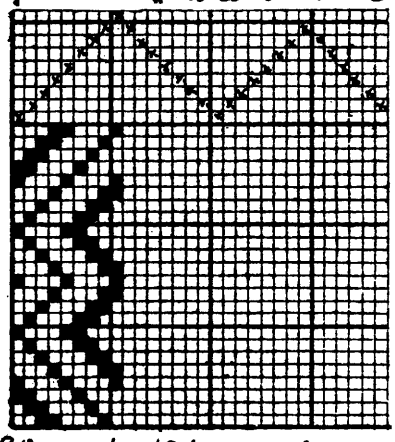


183

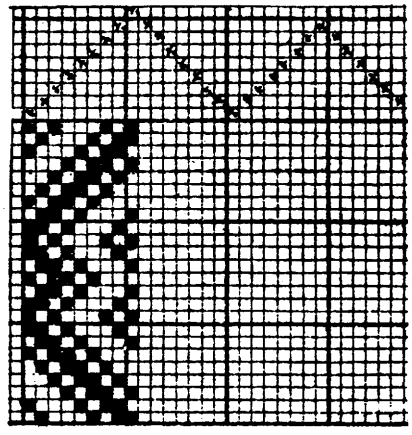


184

Fancy Diamond patterns are made from zig-zag twills and point draft looming as shown in 183. the peg plan of which is 184.

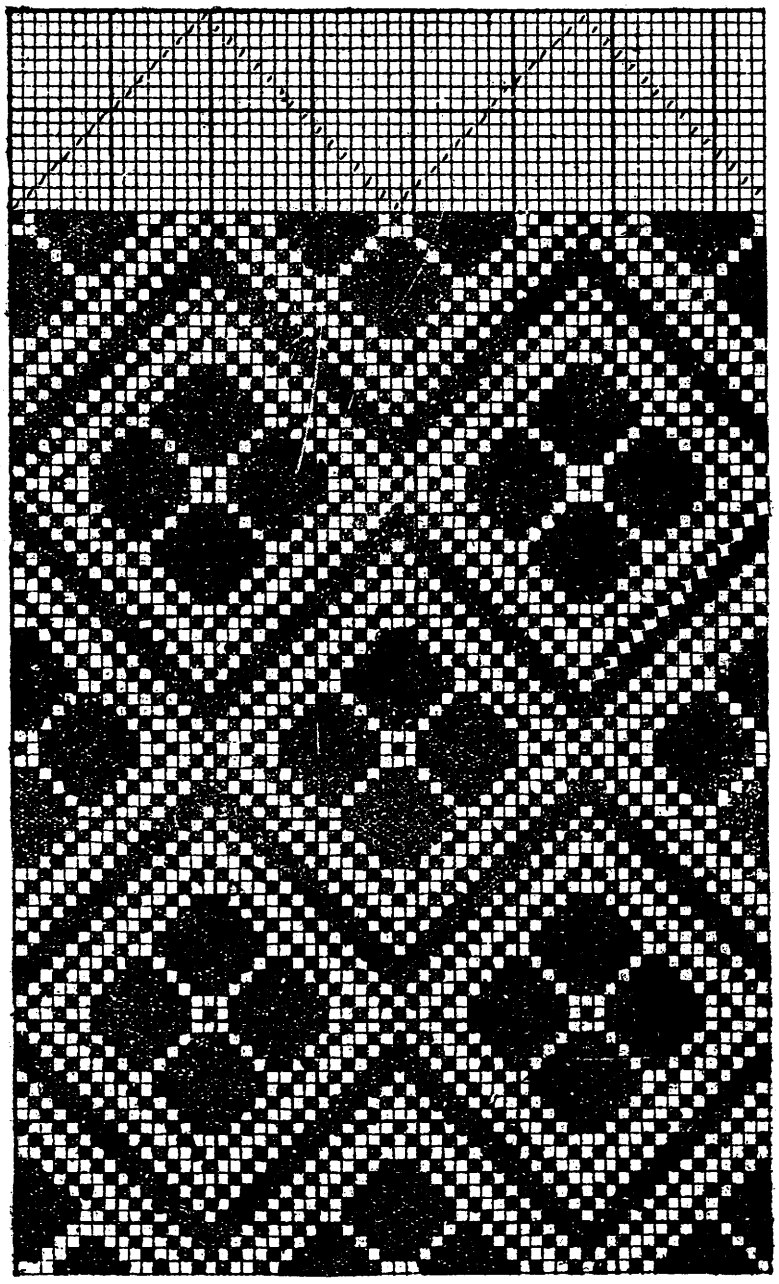


185



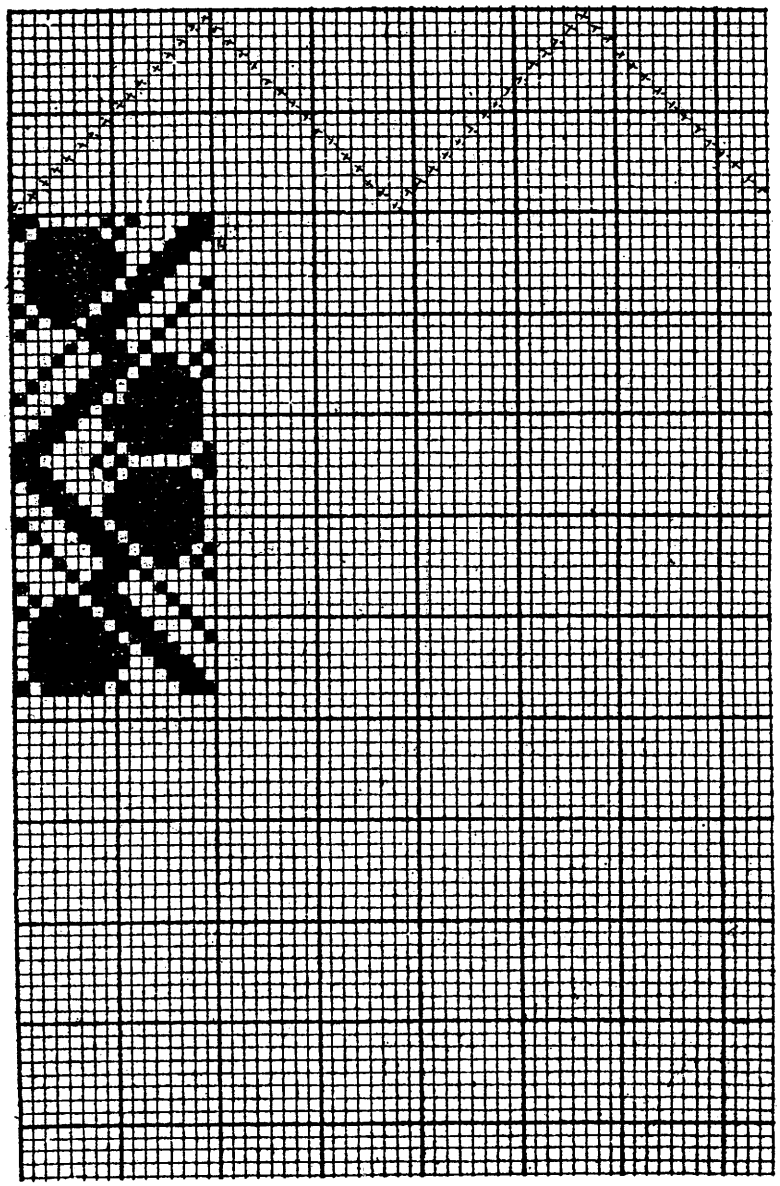
186

185 and 186 are half patterns of centred designs on 9 heald point draft. Complete each respectively to fill the space provided.



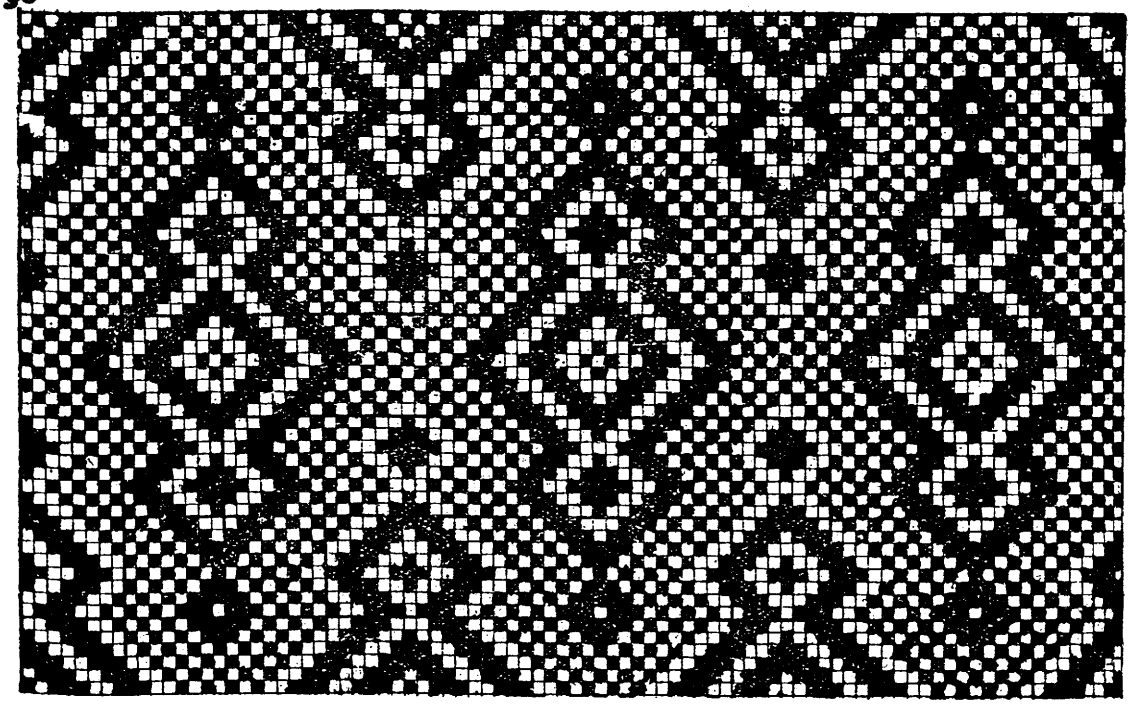
187

187 Gives an enlarged Diamond pattern on 16 heads point draft.

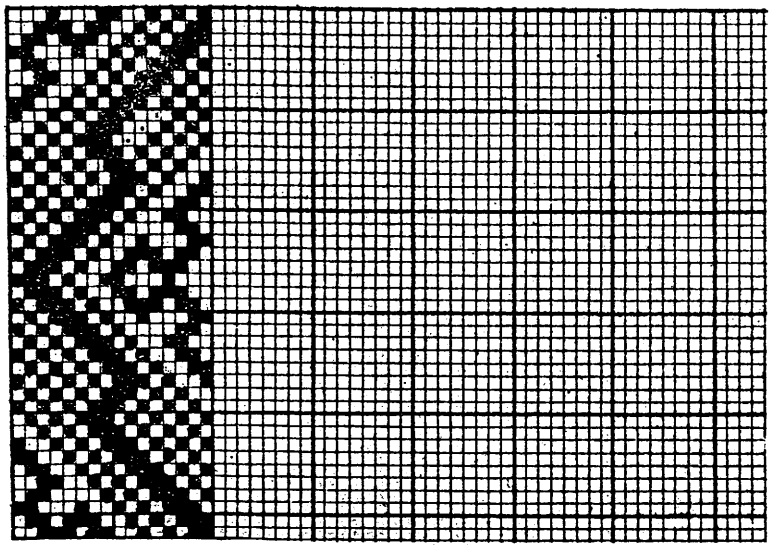


188

188 Gives one half of a centred pattern on 16 heads point draft. Complete same and repeat to fill the whole of the space as in 187.

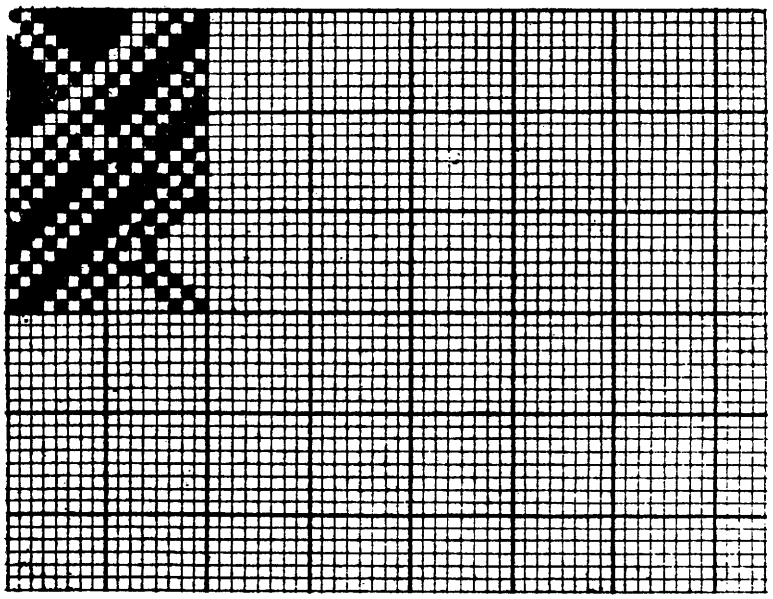


190



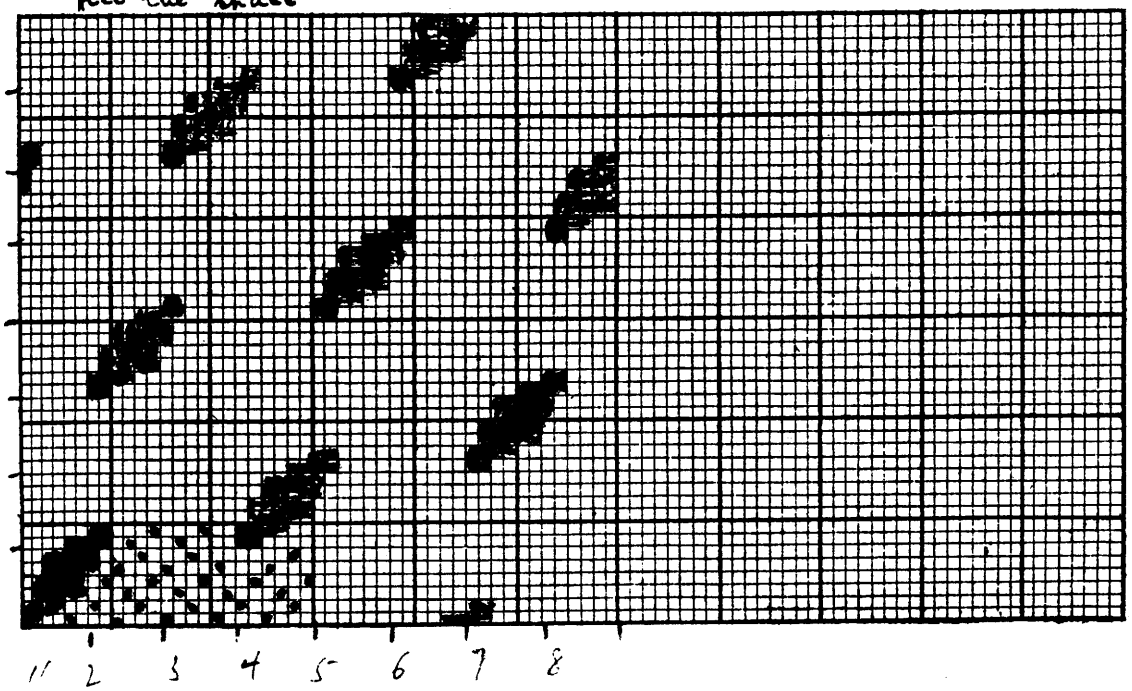
191

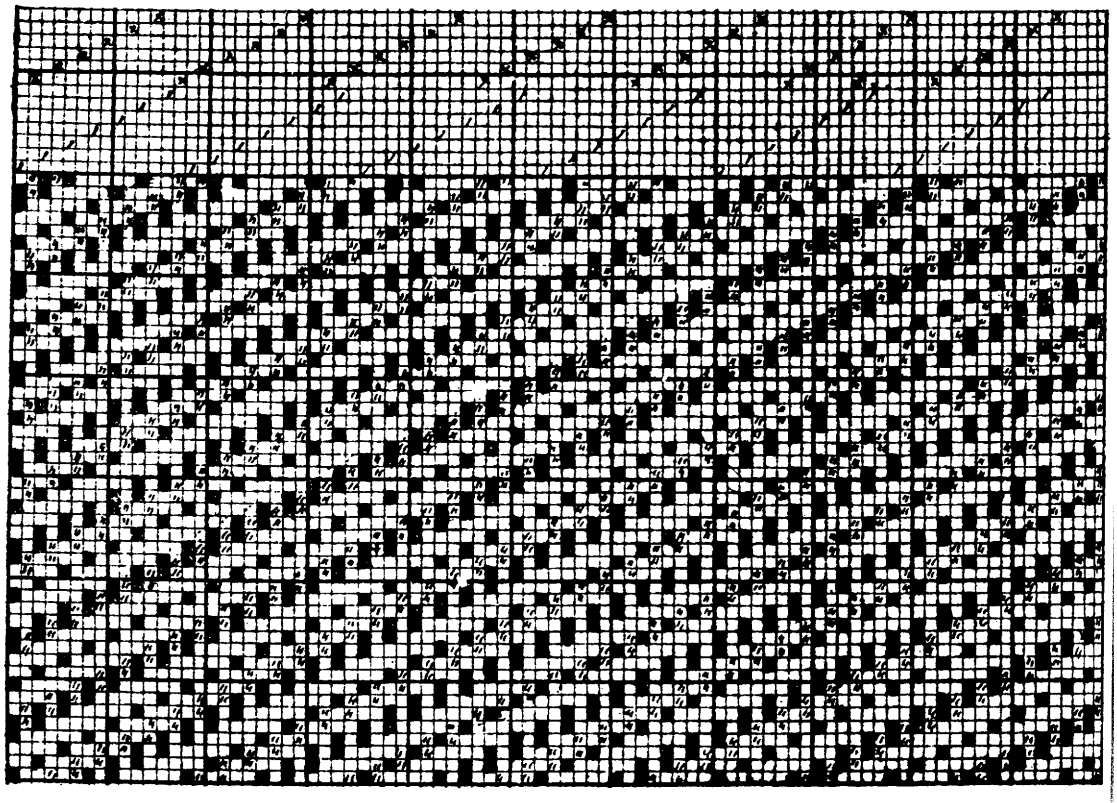
190 Gives a Fancy Diamond pattern (repeated) on 16 heads point draft. 191 Gives half a centred pattern on 16 heads point draft. Complete and repeat to fill the space.



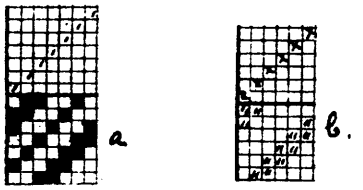
192

192 Gives one quarter of a Fancy Diamond pattern on 16 healds point draft. Reverse to make half the pattern picks way, then complete and repeat to fill the space

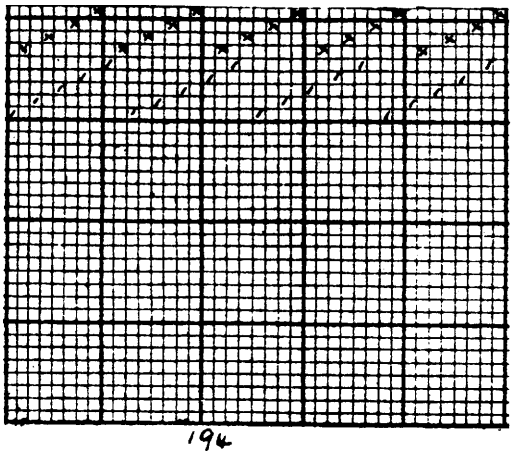




193

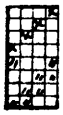


193 Gives a <u>combination twill</u> made from the two patterns a. 7 end twill b. 6 end twill by taking them end and end / gives the looming for the 7 and 8 for the 6 end twill. the pattern repeats on 84 ends and 40 picks. Two kinds of filled in squares are used ■ ▪ to enable the pattern to be more easily followed. Combine c. d on 194. also e f on 195 and g h on 196 in each case end and end. Make 8 end twills on 1/1. and combine them end and end on 197.

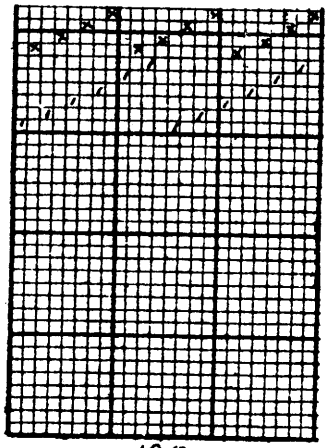


194

c



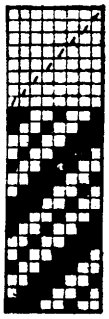
d



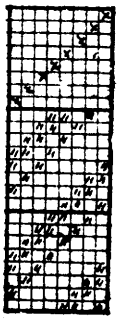
195

e

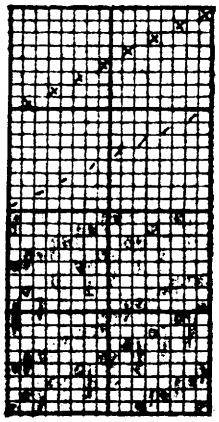
f



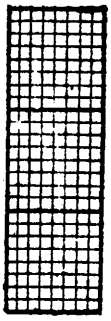
g



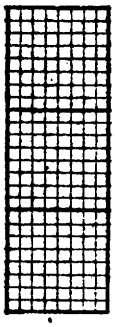
h



196



i



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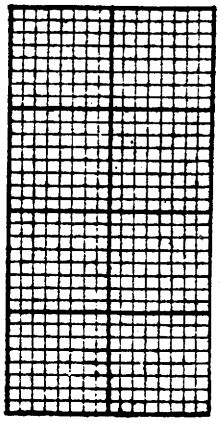
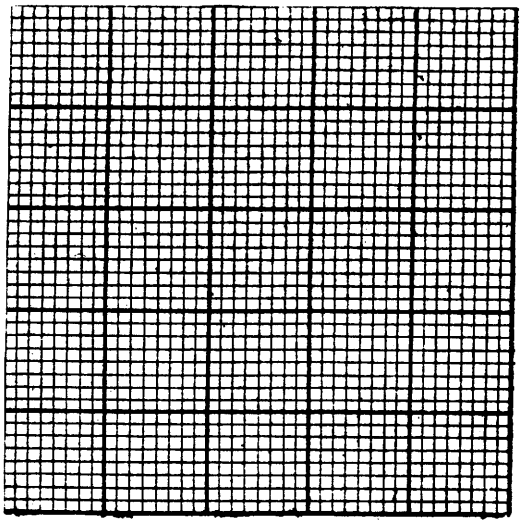
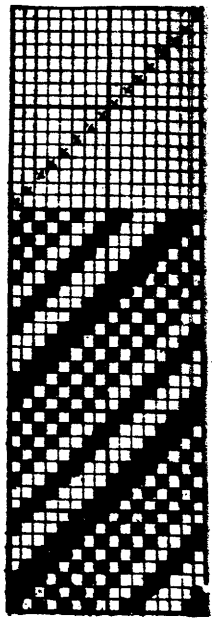


197





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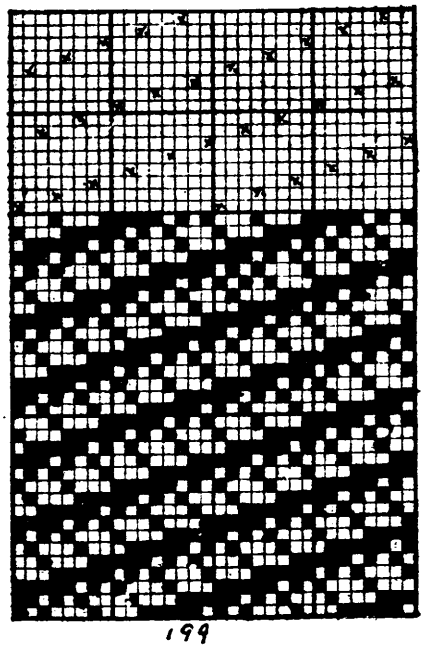
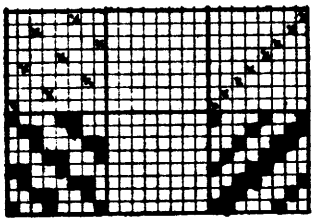
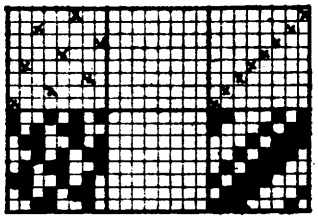


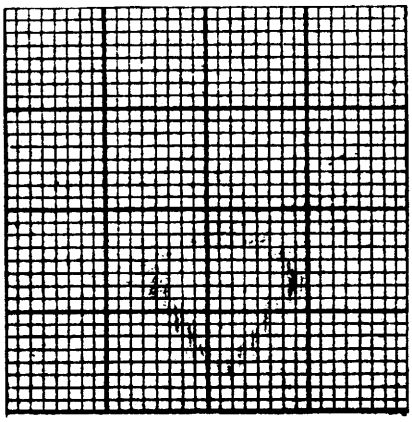
199

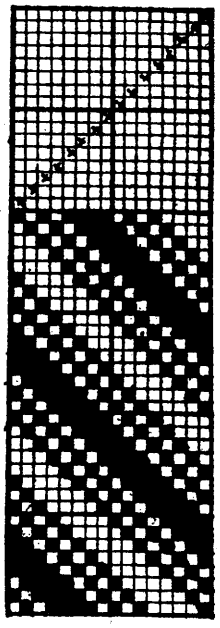


201 200



203 202





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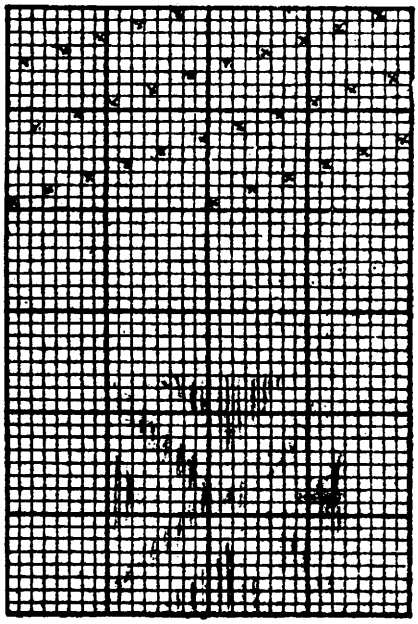
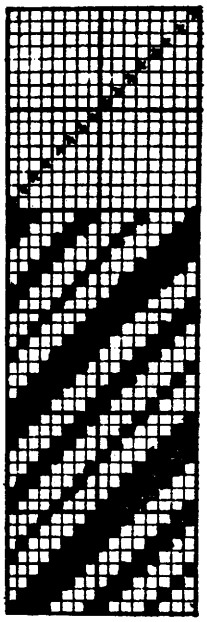
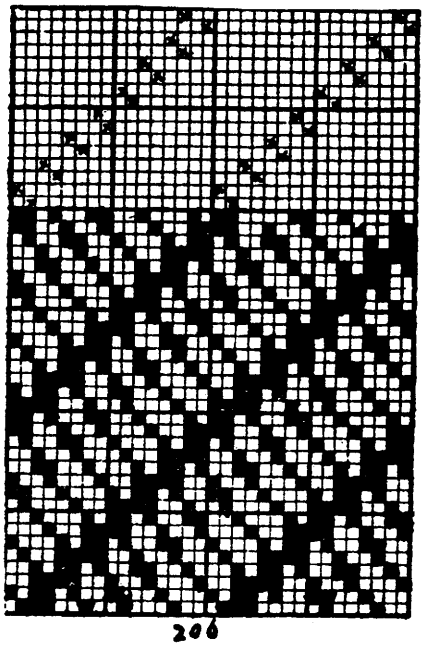


205

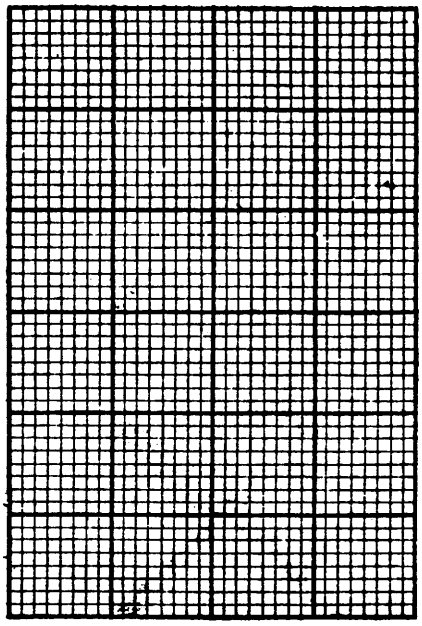
New patterns are made by re-arranging twills in satin order as shown in the examples 198-199 and 200-201 also 202-203. Rearrange the twill 204 or 205 to the looming given.

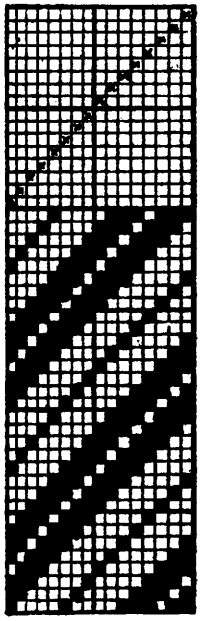


207



206





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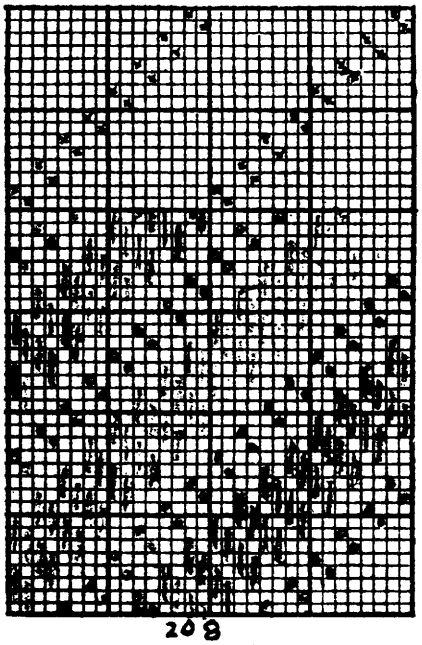
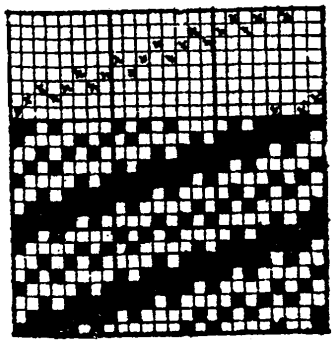


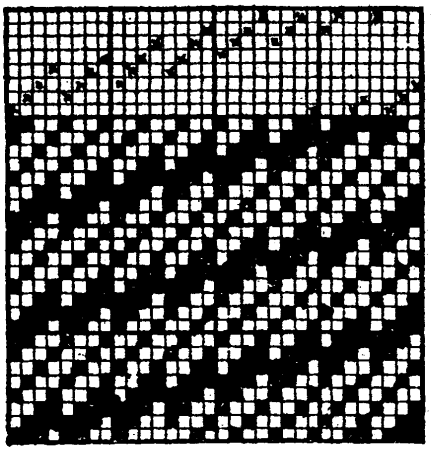
208

Stitch Drafting.

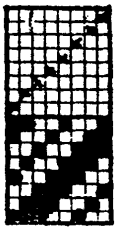
206 gives a pattern made by re-arrangement of the twill 207 to the drafting given in 206. On space 208 to the draft given arrange the twill 209.



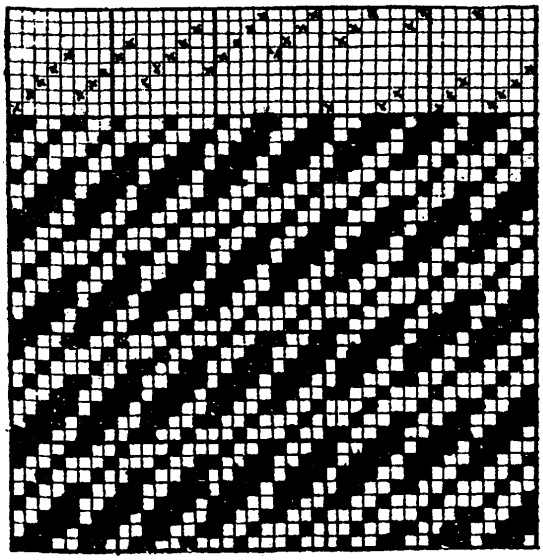
210



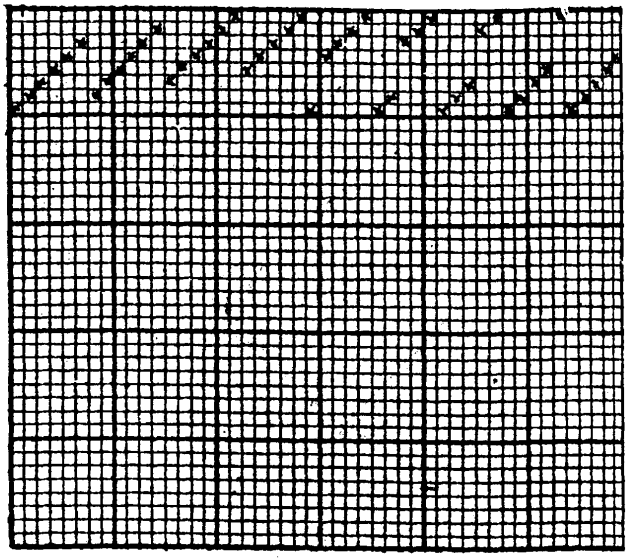
212



211

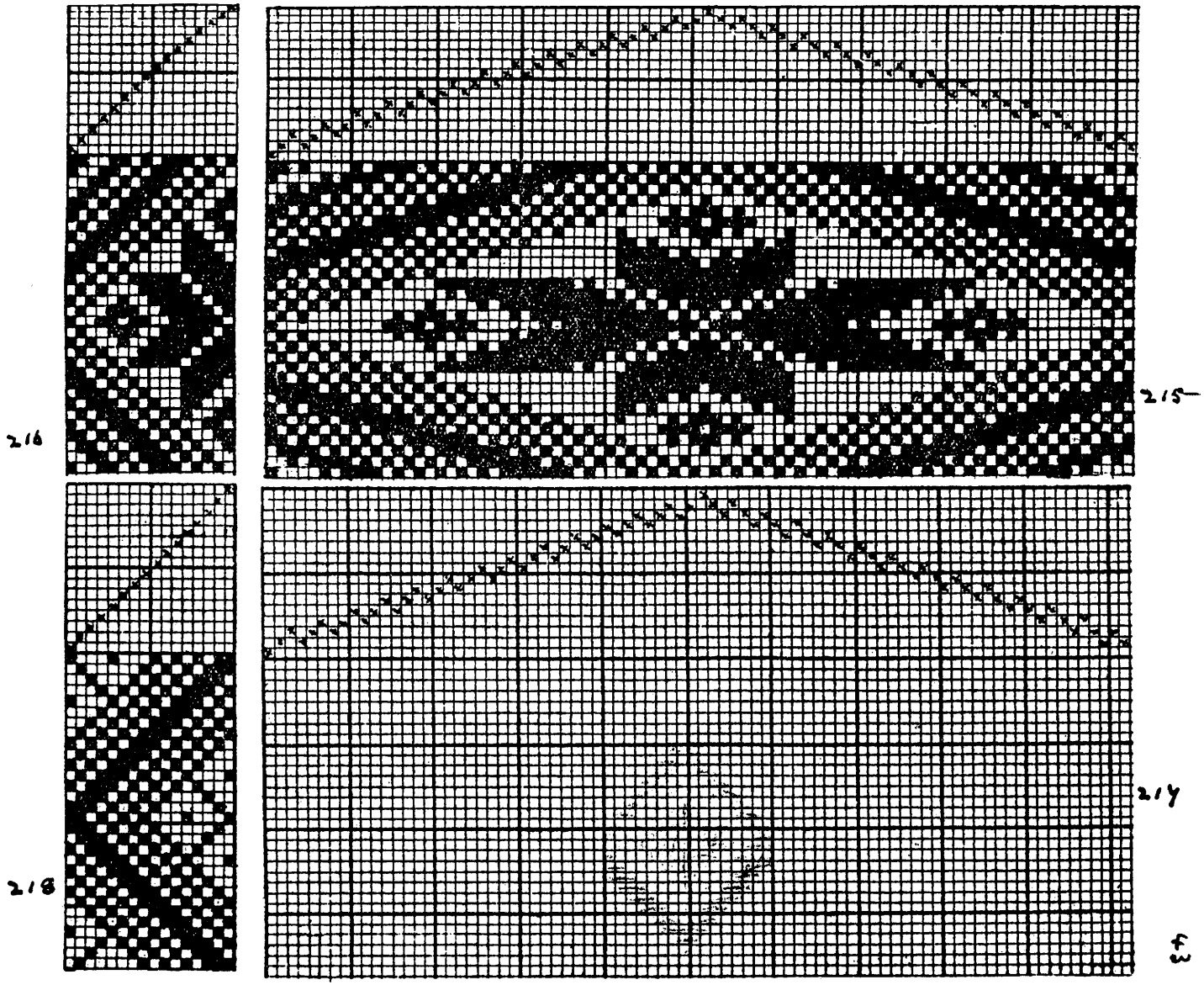


213

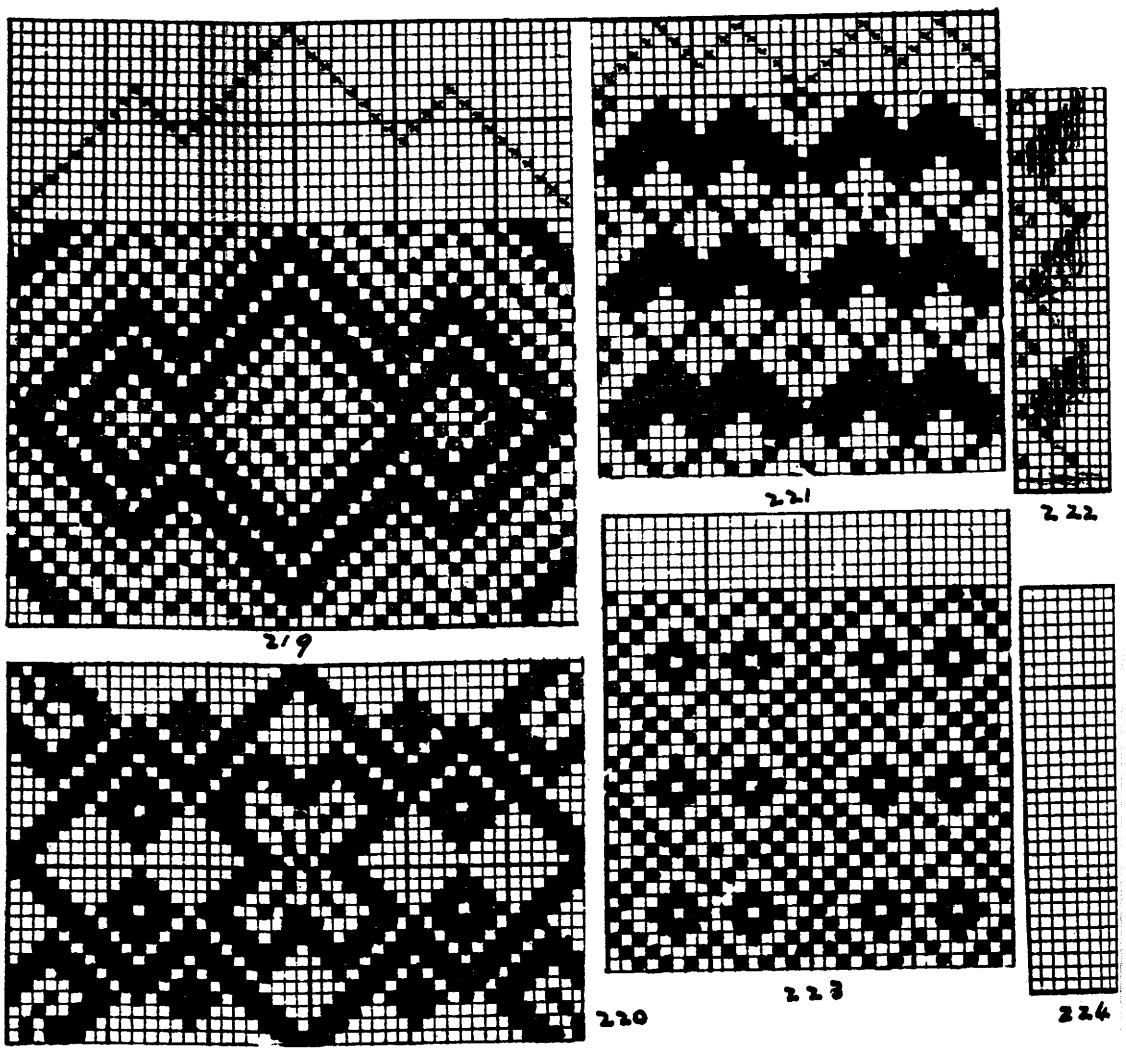


214

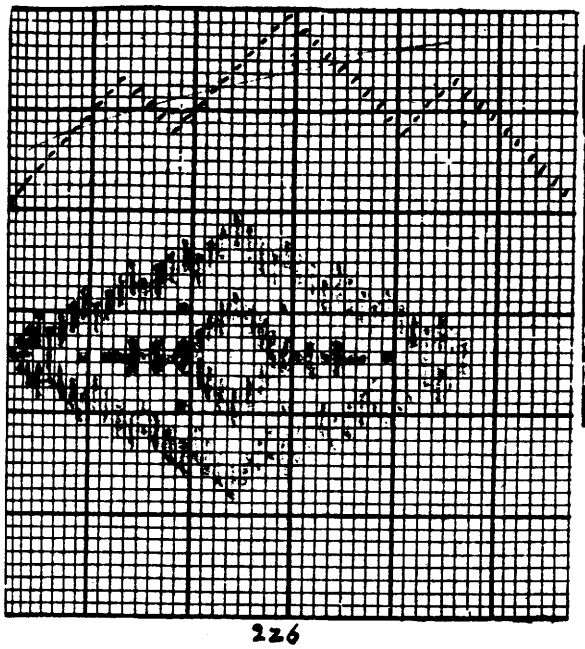
Skip Drafting. 210 gives a pattern made from the twill 211, the threads are re-arranged as given by the drafting in 210. 212 and 213 are made from 211 by re-arrangement. On space 214 re-arrange 211 to the drafting given. fill the space. In 1899 Fred Hellewell a pupil under my tuition patented the drafting given in 213. By this method the pattern producing power is enormously increased. 216 gives the peg plan. From 217 re-arrange the pattern on 217 to drafting given.



Fig

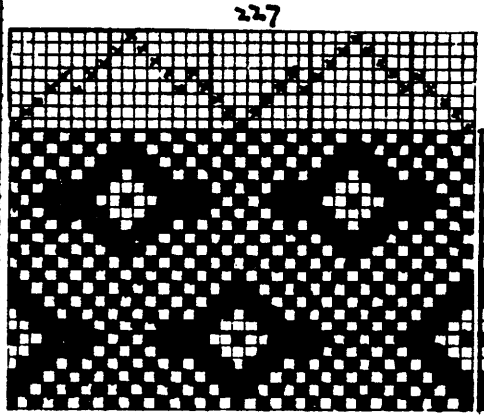


Zig-Zag Drafting: 219 gives a pattern on 16 heralds by this system of drafting the pattern is increased to 46 ends.. 220 gives another example from the same drafting. On 222 give the peg plan for 221. Give the drafting or loomning for 223 also the peg plan on 224.



226

227



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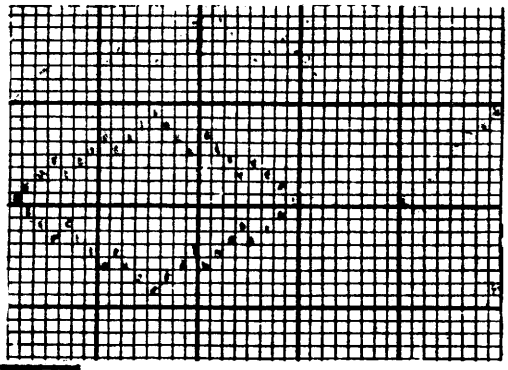
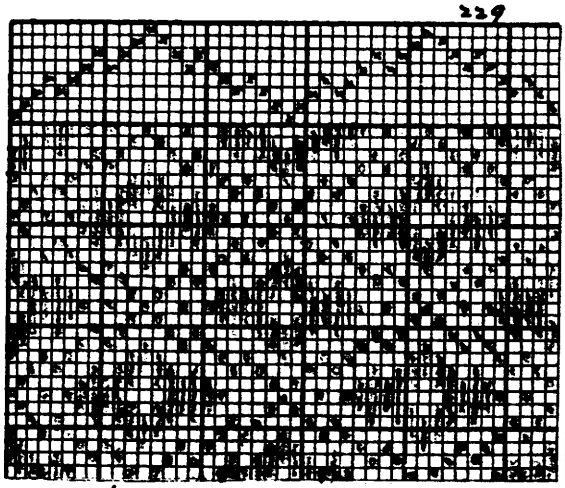
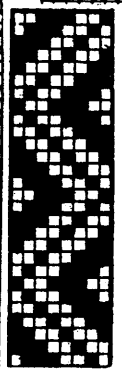


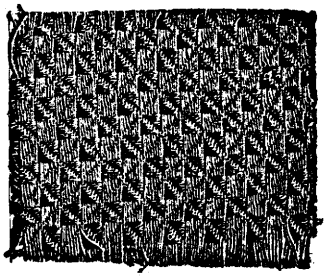
225

229



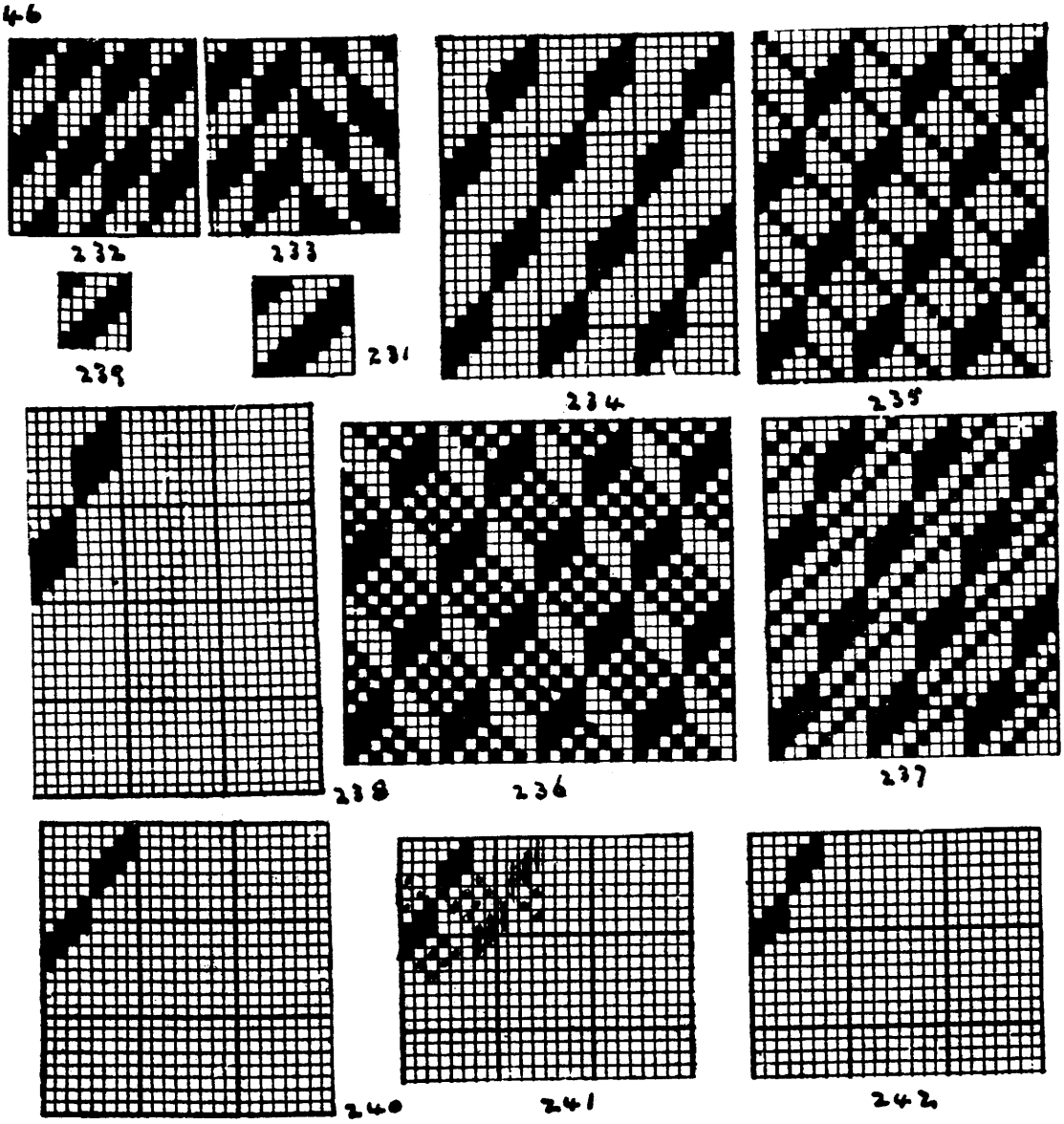


230

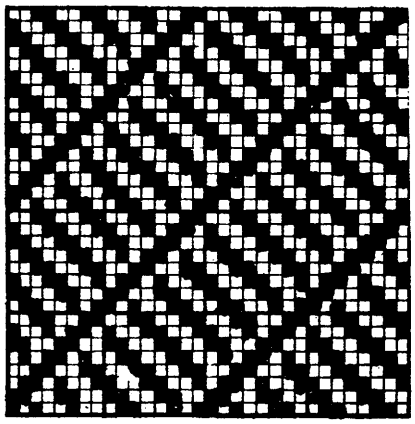


On Space 226 make a pattern of your own designing to the drafting given.

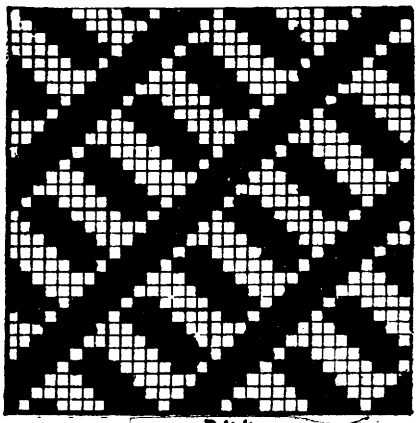
Broken Point Drafting:- 227 gives an example of a pattern produced by this type of looming. 228 gives the peg plan for the same. On 229 to the draft given and peg plan 230 complete the design. fill the space.

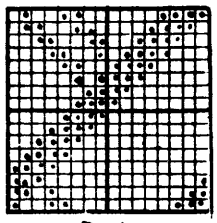


Broken Twills 231 gives an 8 end twill 4 and 4 $\frac{3}{4}$. 232 and 233 show the same broken to make new patterns. 234 is the first step in the making of more elaborate patterns from the same twill. 235. 236 and 237 are new designs made from 234. Make a design on similar lines as 238. 239 gives a $\frac{2}{3}$ twill. as 240 241 & 242 make new designs of the styles given on this page.

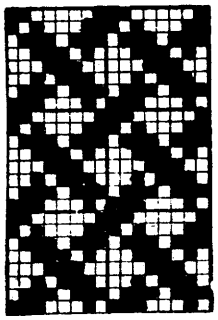


243

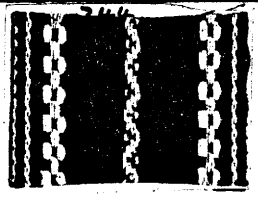


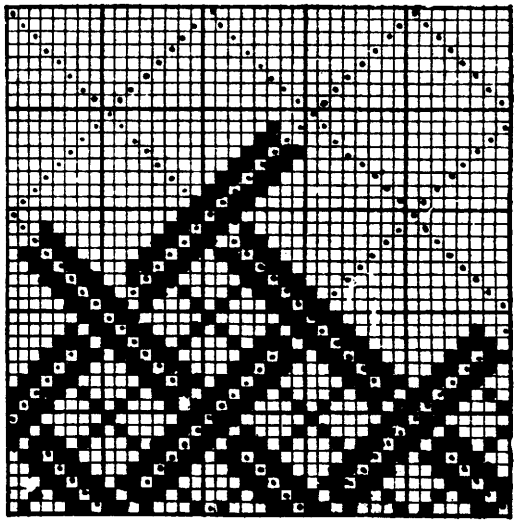


246



245





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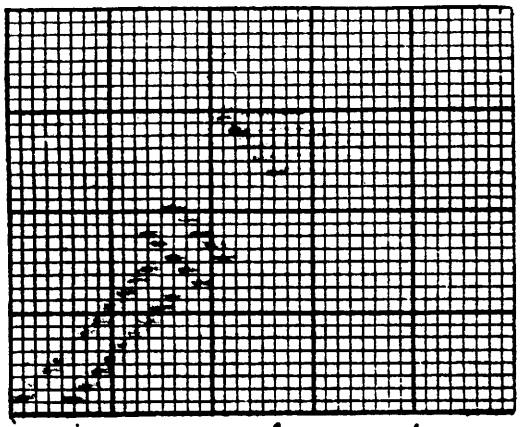
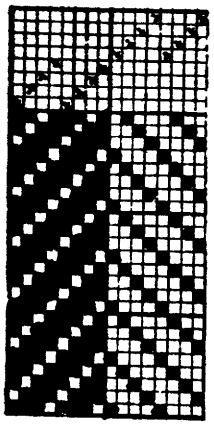


Broken Twills 243 and 244 are twills with lines of twill running at an angle of 45° and the space between filled in with bits of the same twill. both examples repeat on 16 ends and 16 picks. the bits of twill must be a multiple of the number of picks in one repeat of the pattern 245 is on 8 ends. Complete 246 on 16 ends and 16 picks. Entwining or Interlacing twills, the dots in 247 shows construction. these put in pencil may be used or rubbed out in the completed design.



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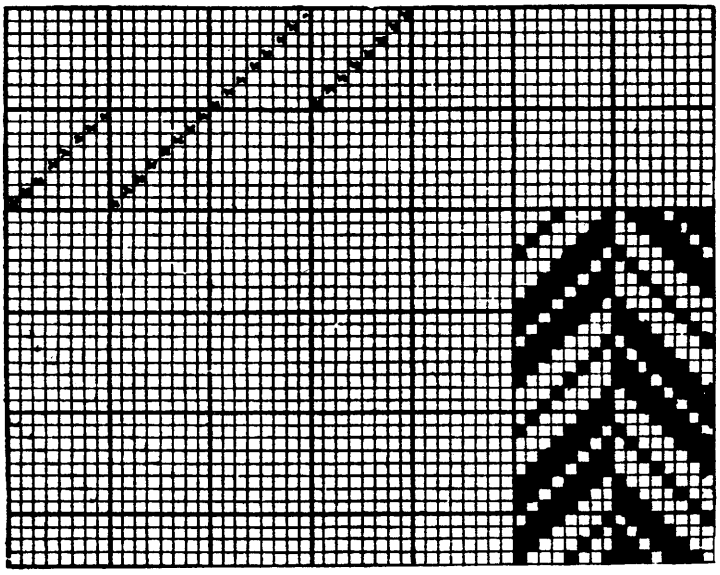
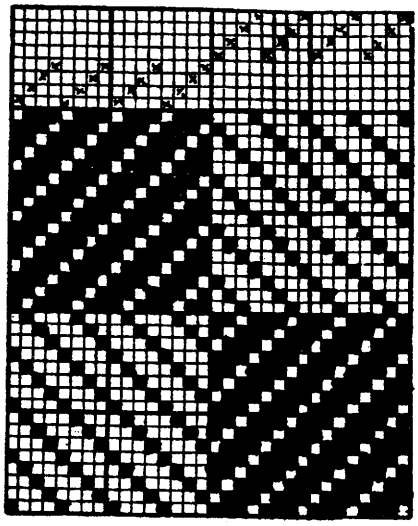
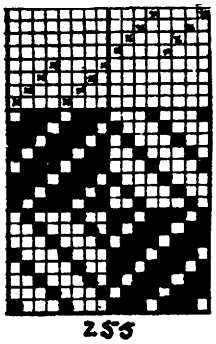


248 249





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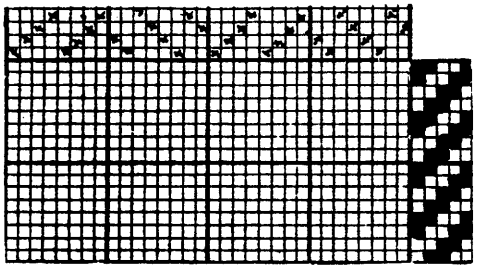
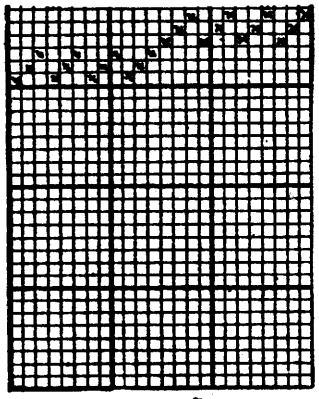
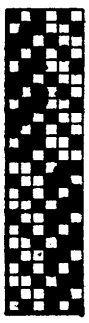


250 251



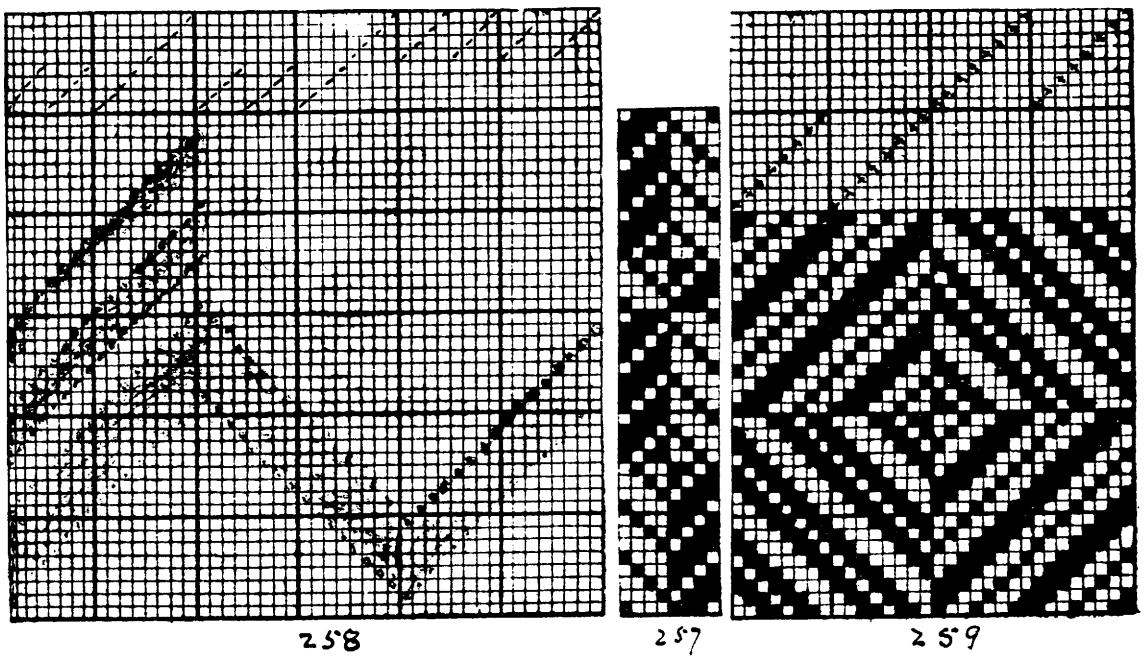


252 253

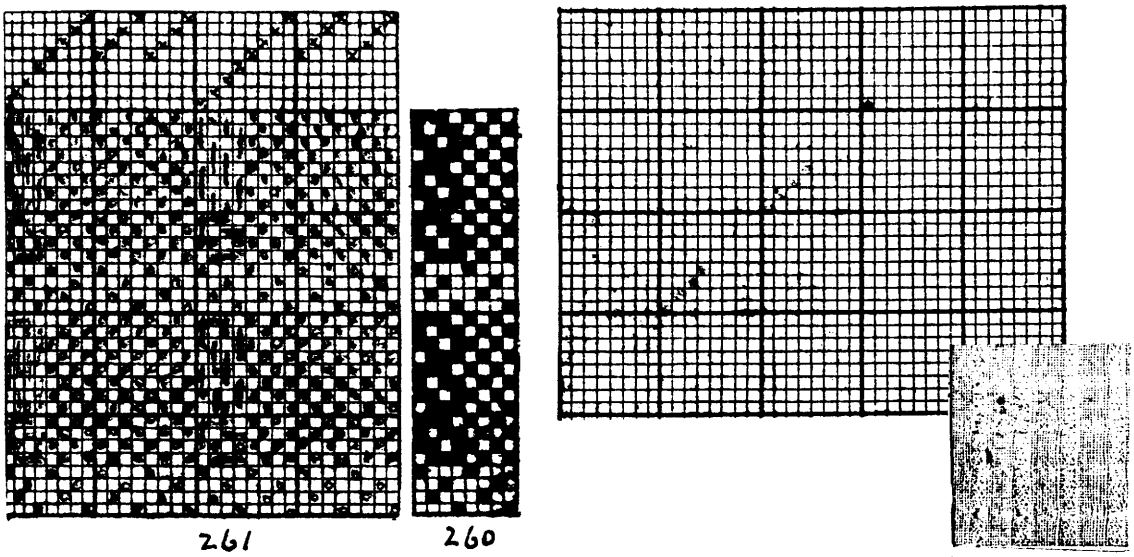
256

Warp and Weft Twill Stripes & Checks

In all these examples the filled in squares must come opposite to blanks at the points of change. Complete 248 from the peg plan 249. Complete 250 from peg plan 251. Complete 252 from peg plan 253

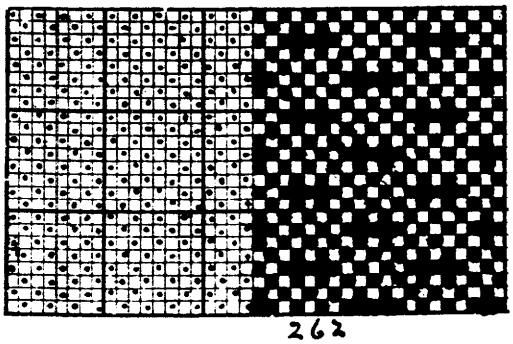


258 257 259



261 260

Warp and Weft Checks. From peg plan 257 and drafting given in 258 put down the complete design. fill the space. 259 gives a Warp and Weft check on 16 healds. From peg plan 260 put down the full design from the drafting 261



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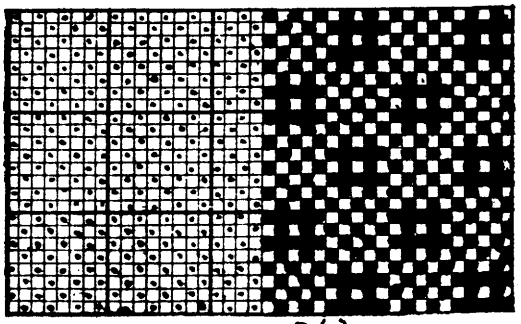
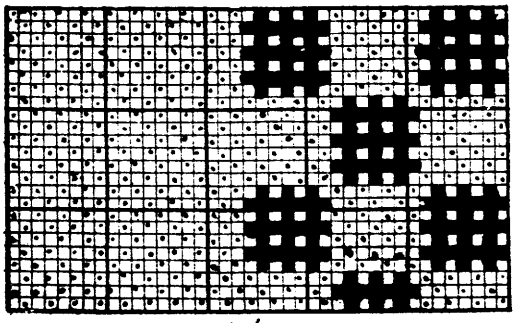
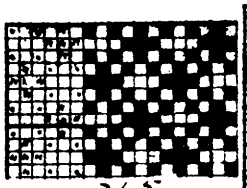


263



264



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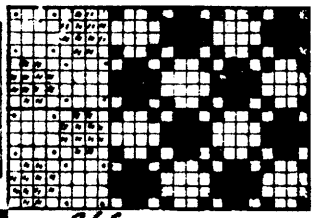
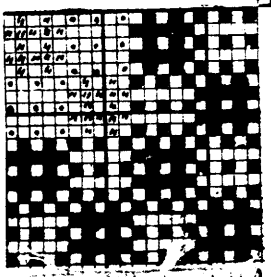
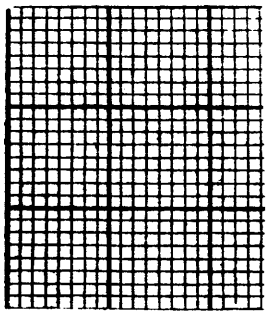
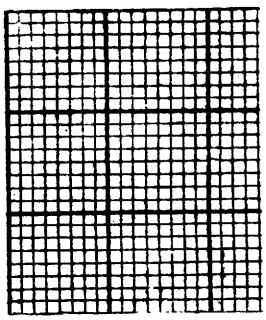
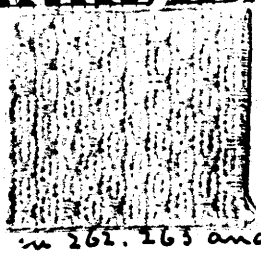


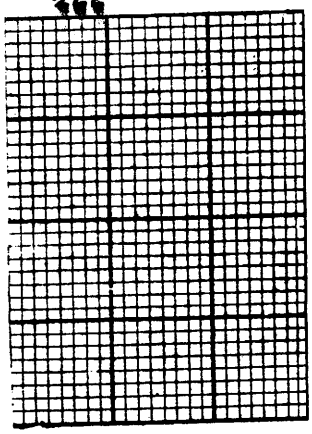
266



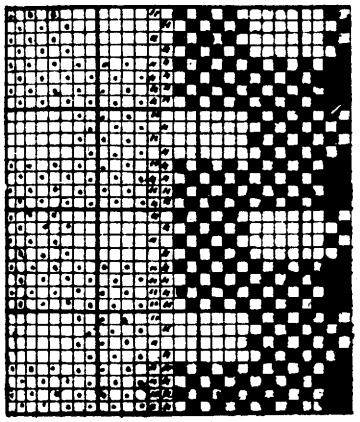




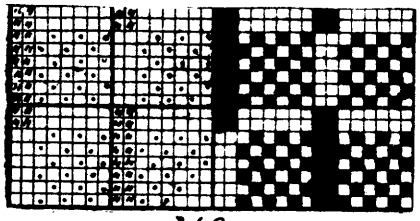




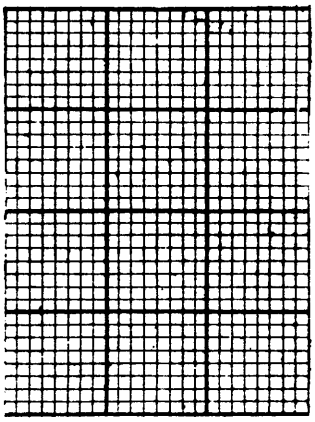
Huckaback Weaves are given in 262. 263 and 264. the dots in plain order gives the construction. completed examples are given in each case. First go over the paper with dots in plain order, then fill in small figures as shown, these make absorbent cloths suitable for glass towels. Imitation Lenos. are given in 265. 266 and 267. The dots and shaded squares gives the basis of construction in each case. To be effective 265 must be 3 ends. 266. 4 ends and 267 5 ends in a dent with an empty dent missed between each group of threads.

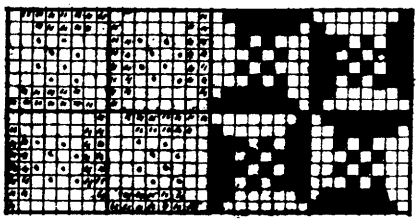


268

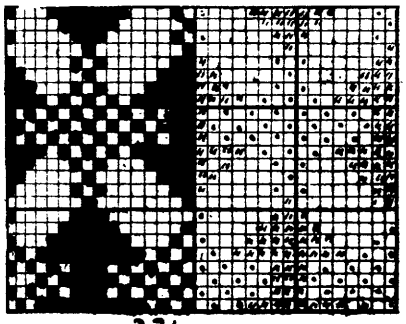


269

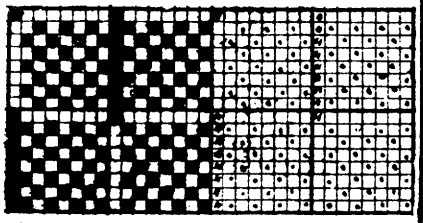


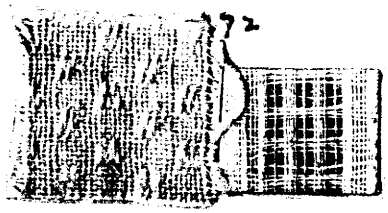


270

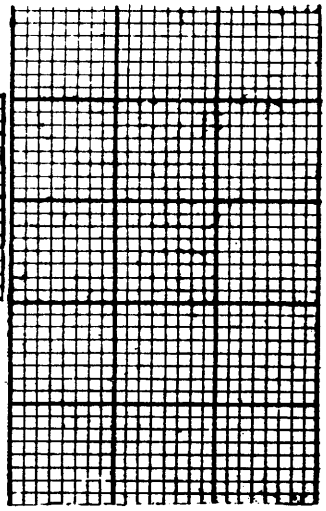


271

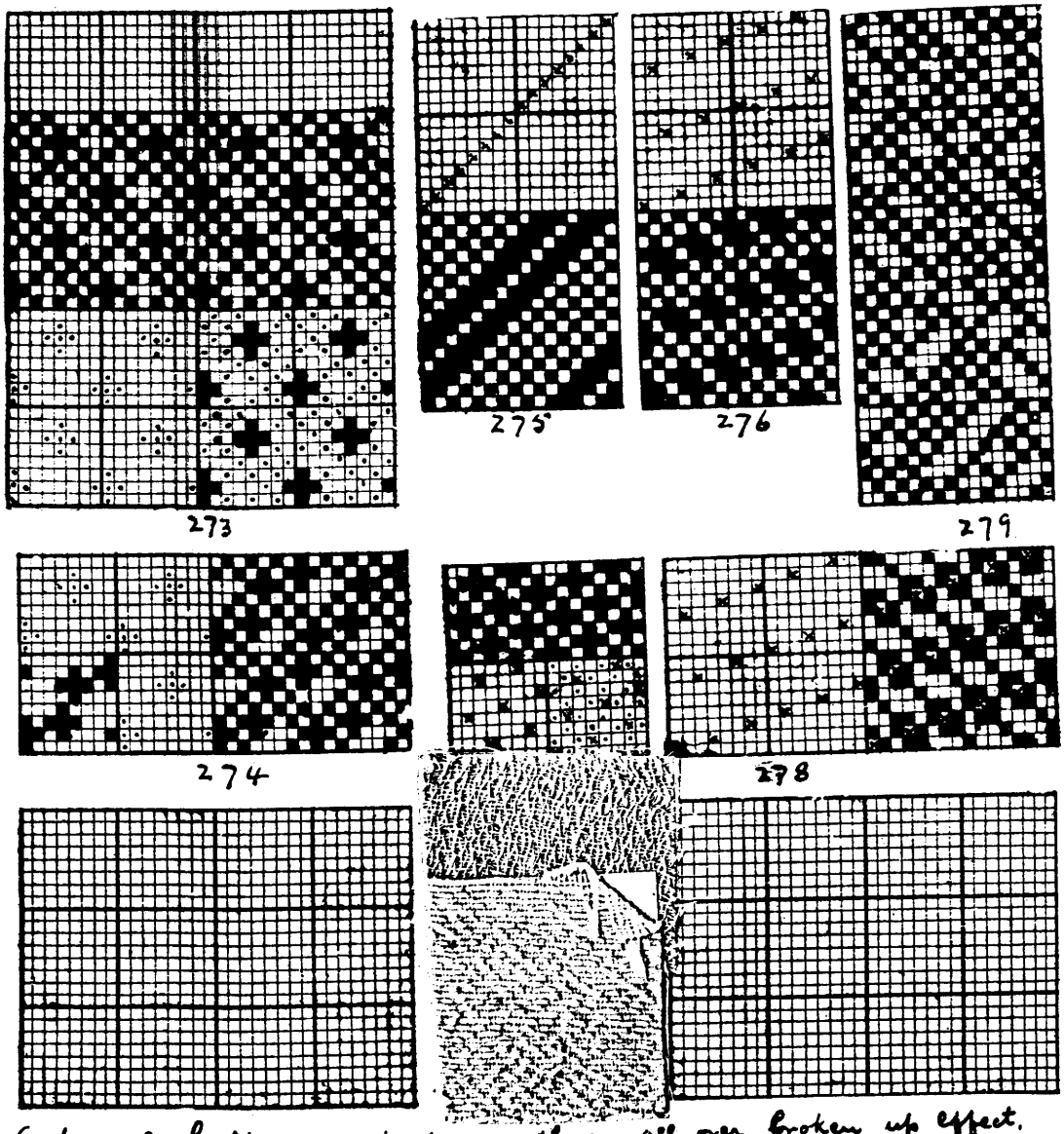




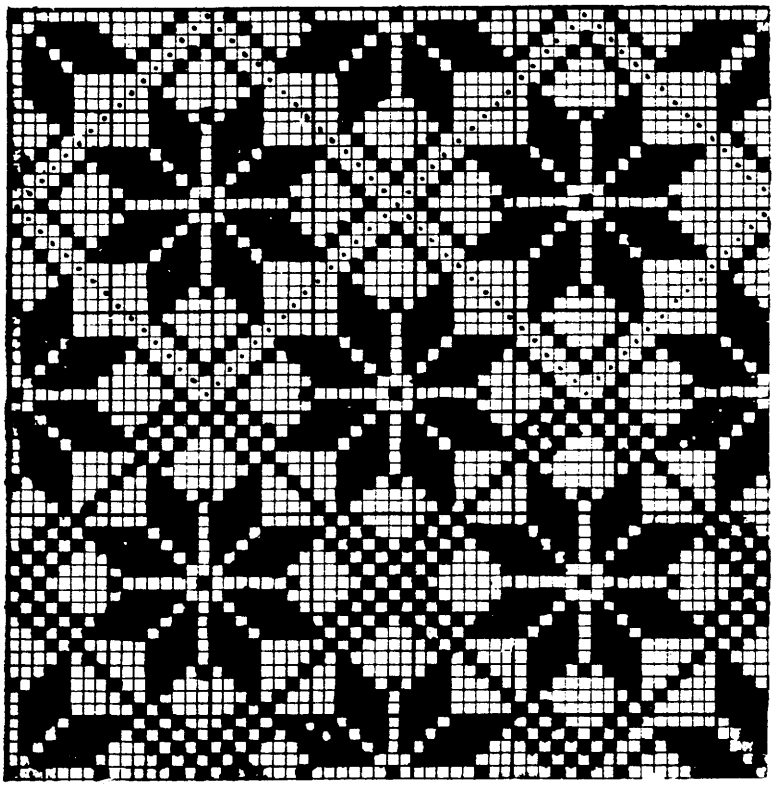
272



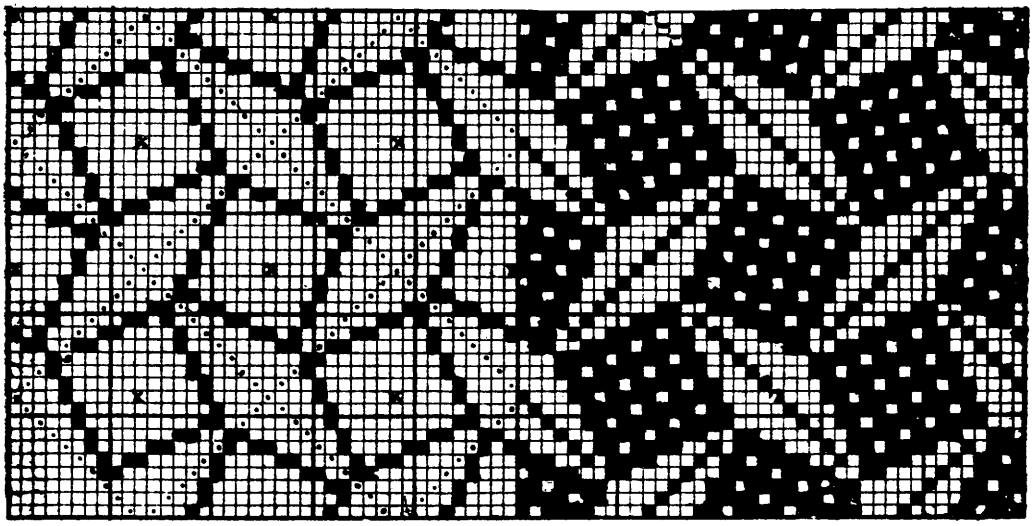
Imitation Lenos. In these cloths the warp or weft threads are pulled out of the straight line and in vaping cases both warp and weft threads are thus displaced. this effect is brought about by the weave. In 268 the floating warp threads are pulled out of the straight line. In 269. 270. 271 and 272 both warp and weft threads are pulled out of the straight line. this is due to the combined weave of the floating warp and weft and the plain weave. The effect is much more pronounced if thick ends and thick picks are introduced for the floating warp and weft. Dots and shaded squares show construction in each case.



Oatmeal Crêpes are pattern worth an all over broken up effect. in appearance, somewhat similiar to scattering oatmeal over plain cloth. They may be made as 275 to 276 arranging small figures and fill in broken plain. By arranging selected twills, (not any twill) in satin order as 275 to 276. Or by taking a satin weave basis and adding other dots as 277 to 278. Or by irregular weaves as 279 a well known crepe weave.

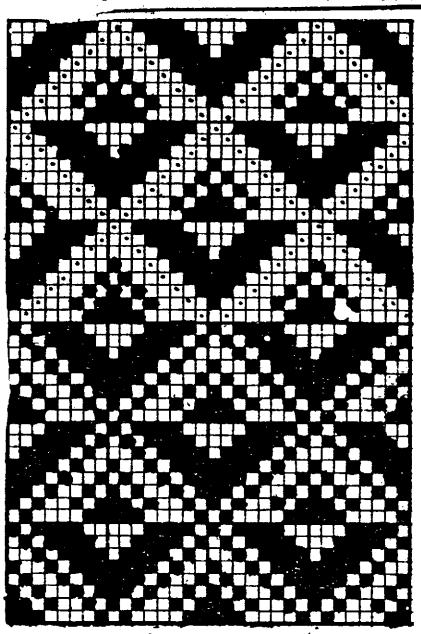


280 Spots in Alternate order. Dots give construction. 30x30



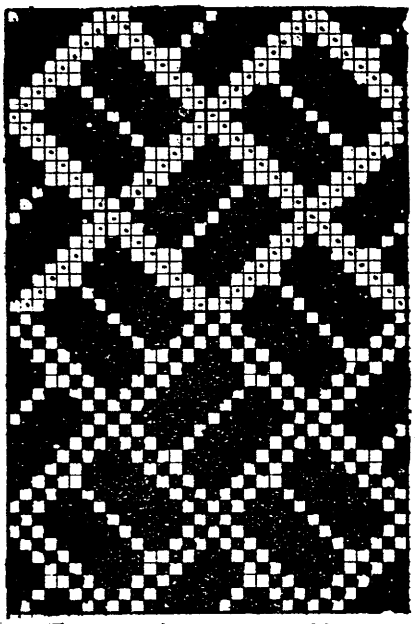
281 Spots in alternate order. Dots give construction 20x20

54. Shots in alternative order. Dots give construction



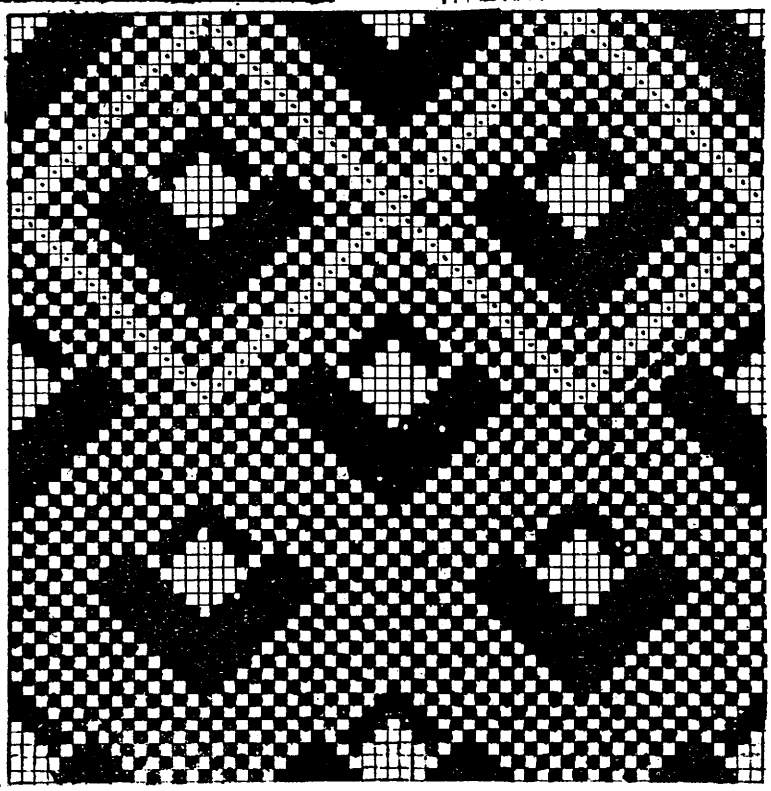
16x16

282



283

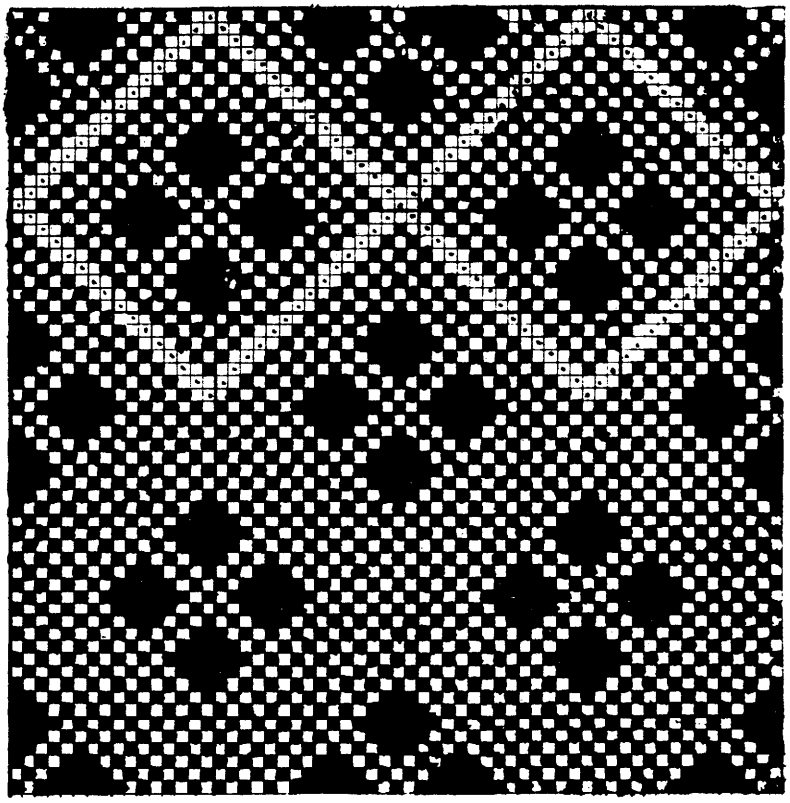
16x16



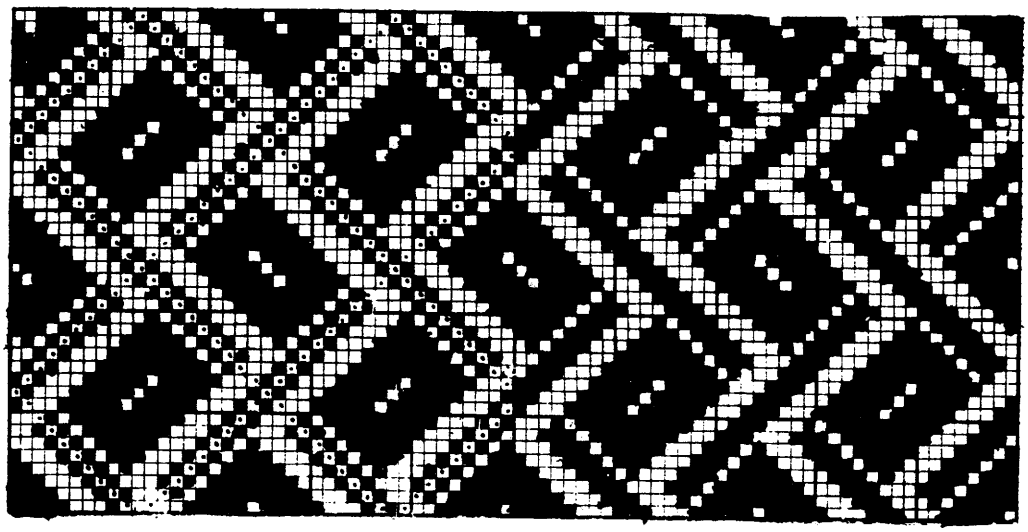
284

30x30

Spots in alternate order. Dots give construction 30 x 30



285

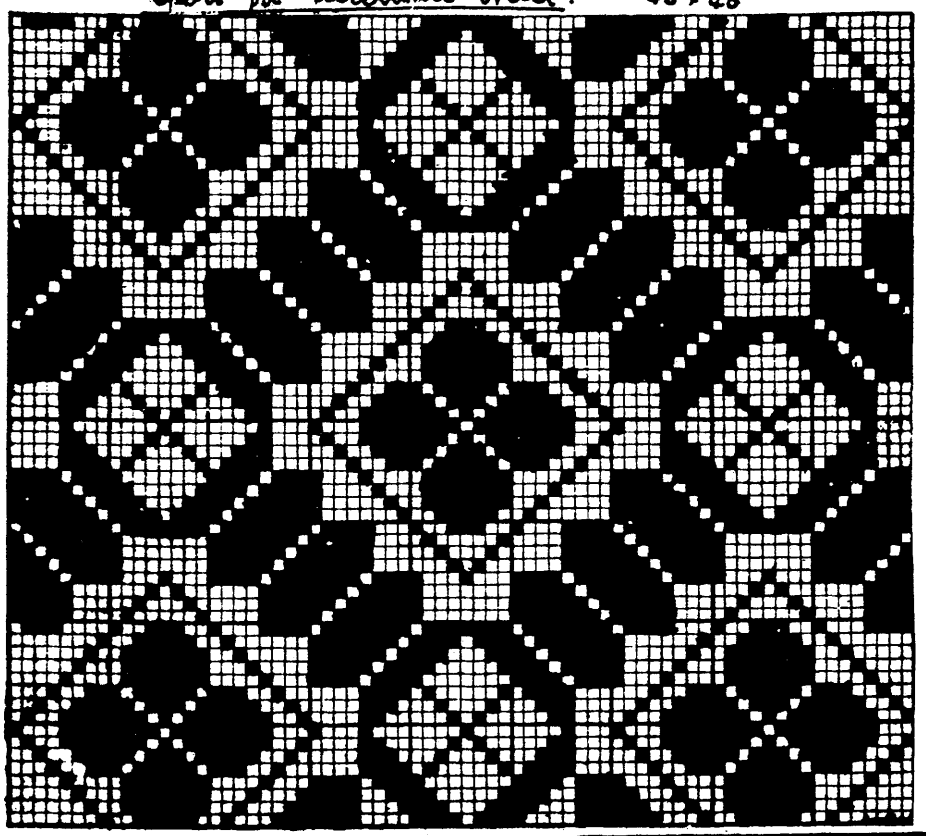


20
↑
20

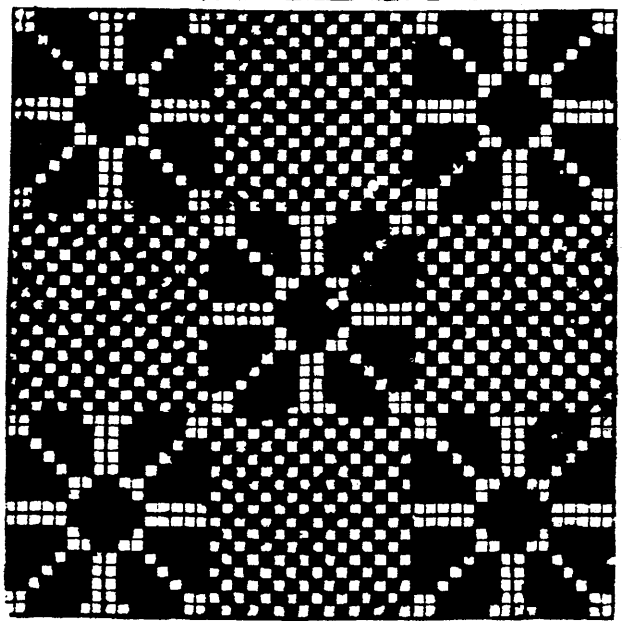
286

56

Shots in alternate order. 40 x 40

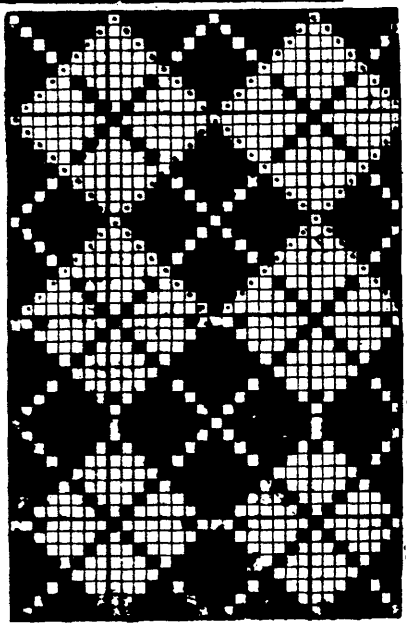


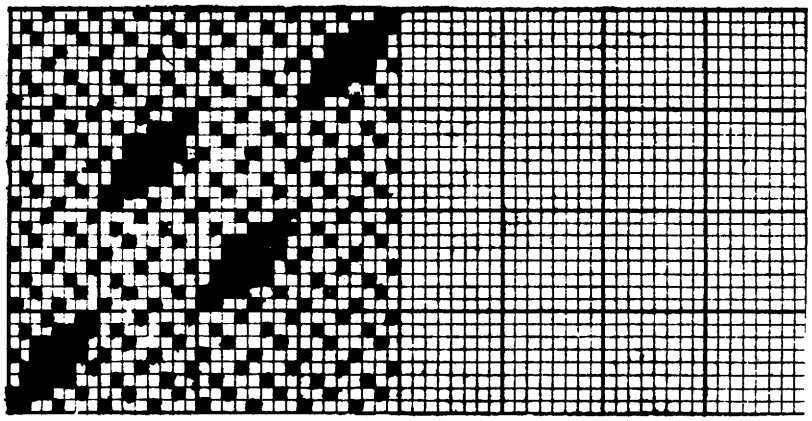
287



32
x
32

88





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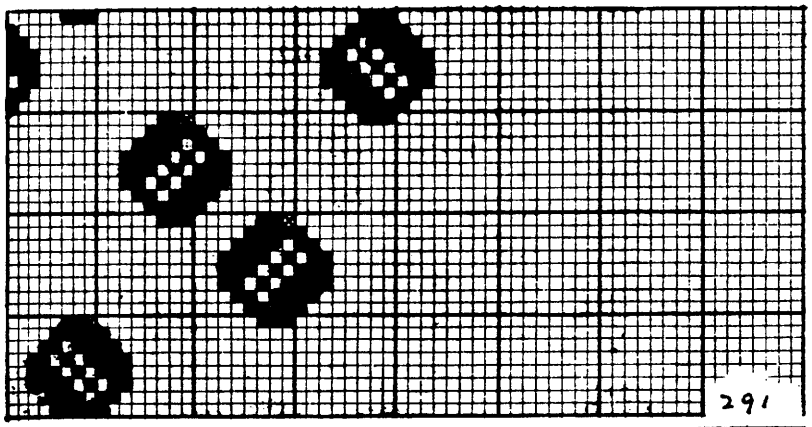

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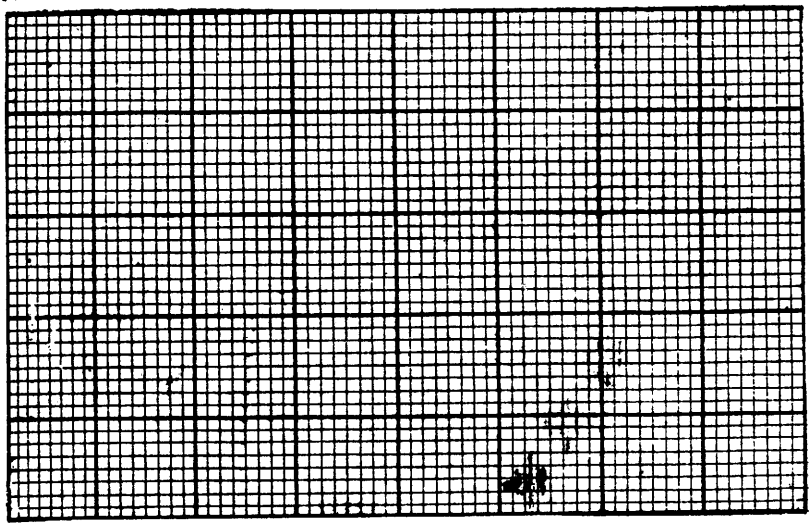
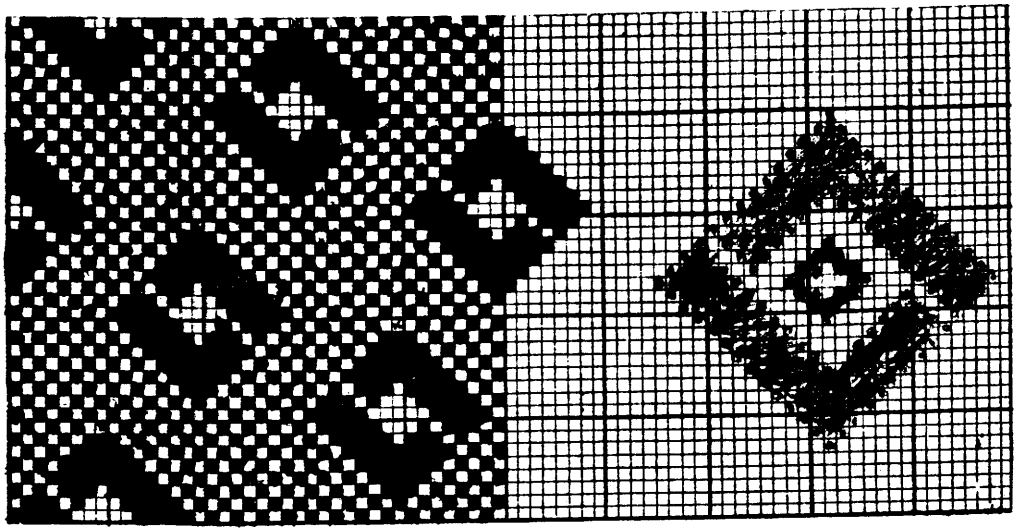
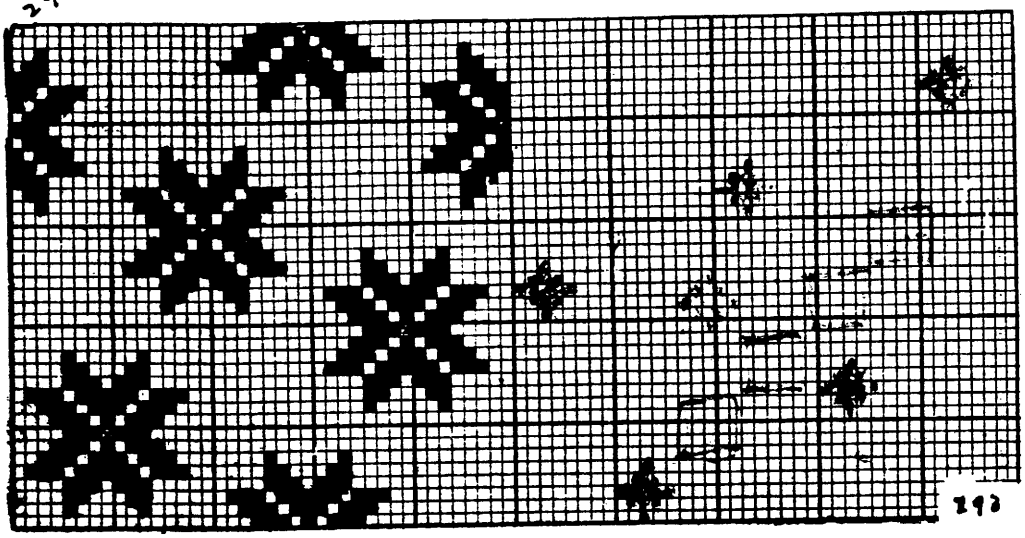


Spots in Satin Order.

Spots are often arranged in Satin order. 290 gives spots arranged in 4 end satin order with a 4 end satin ground 291 gives another example. fill in a plain ground. The xs in each indicates the satin basis. Repeat 290 and 291 each to fill the respective spaces.

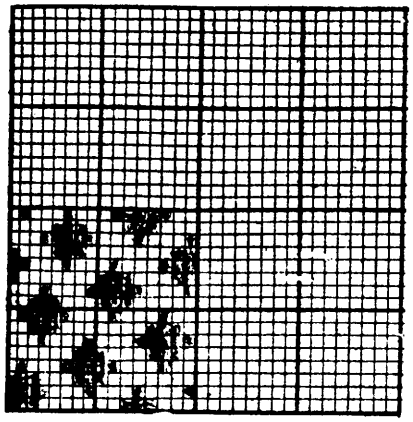


292



293

Spots in Satin order 292 and 293 give spots arranged in 5 end satin order. the x's indicate the satin basis for arranging the spots. 292 is filled in with a plain ground. Fill in 293 with a 5 end satin ground. Repeat 292 and 293 to fill the respective spaces for each pattern. Arrange 294 in 4 end satin order on 295 Arrange 296 in 5 end satin order on 297. 298 & 299 give circles to represent the maximum size of figure which can be used when arranged in 4 & 5 end satin order



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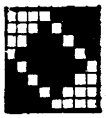
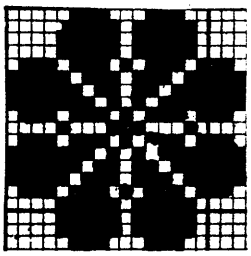
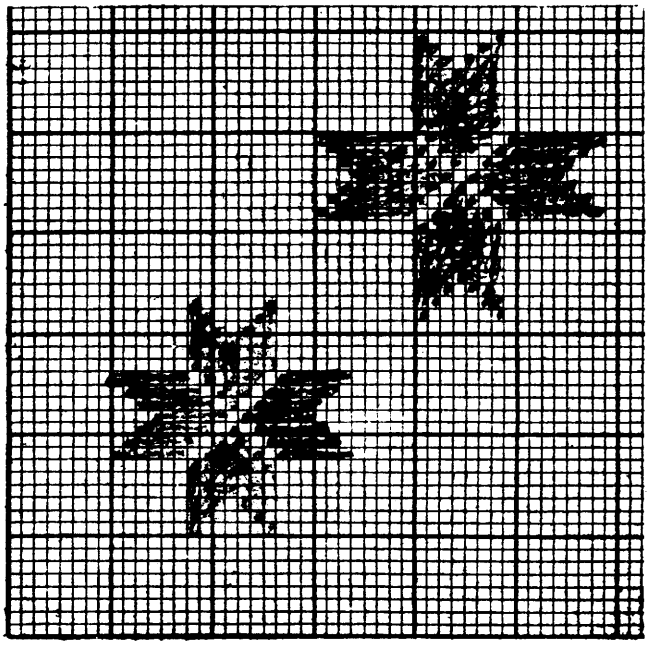
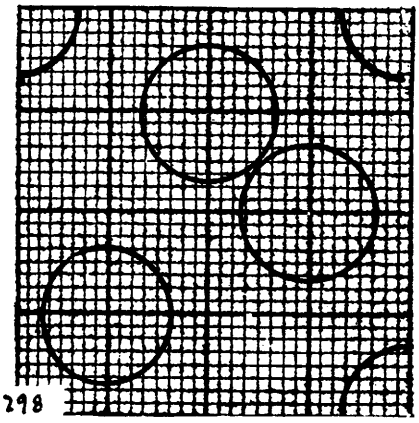


294



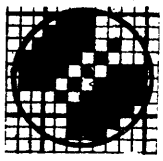
296



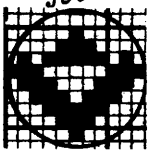


298

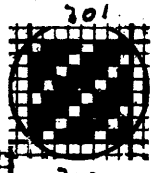
297



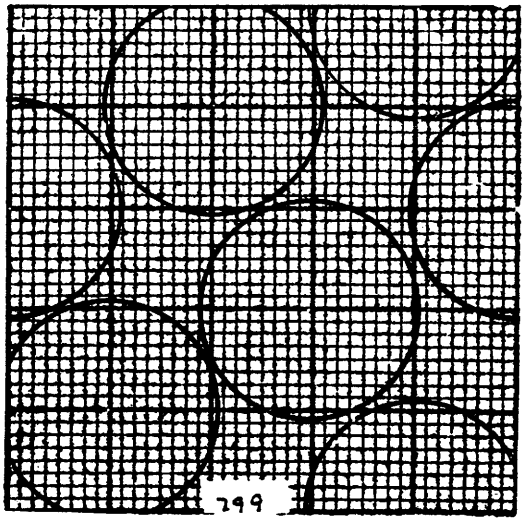
300



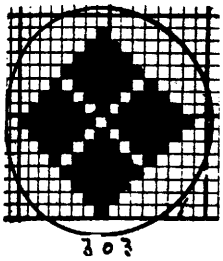
301



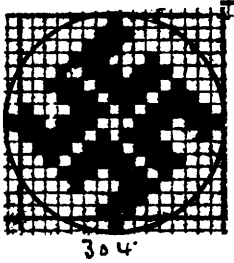
302



299

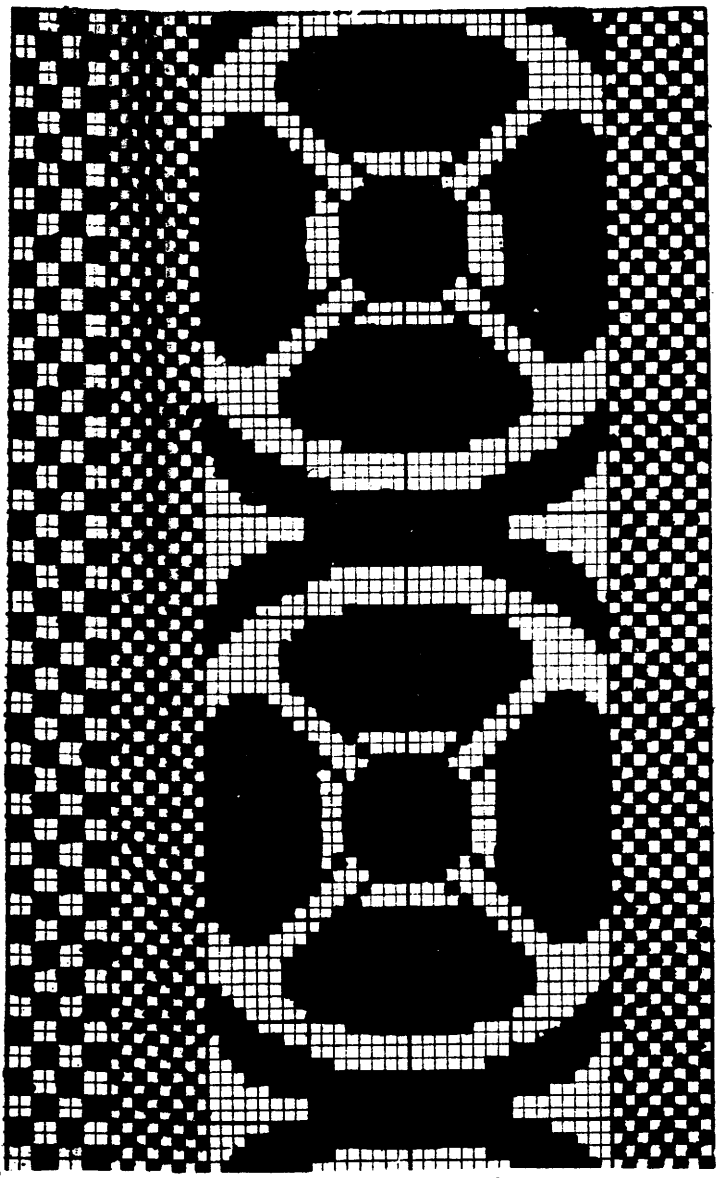


303

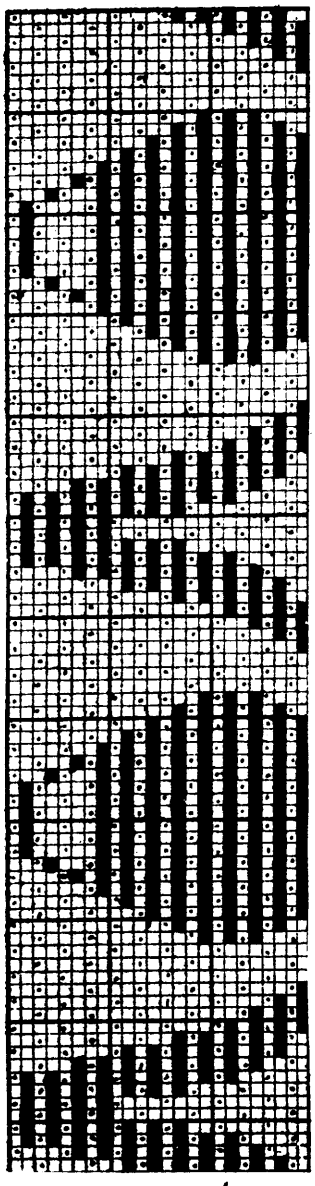


304

Arrange in 4 end satin order on 298 either of the figures 300. 301 or 302 or any two of them. Arrange either of the two figures 303 or 304 on 299 in 5 end satin order.

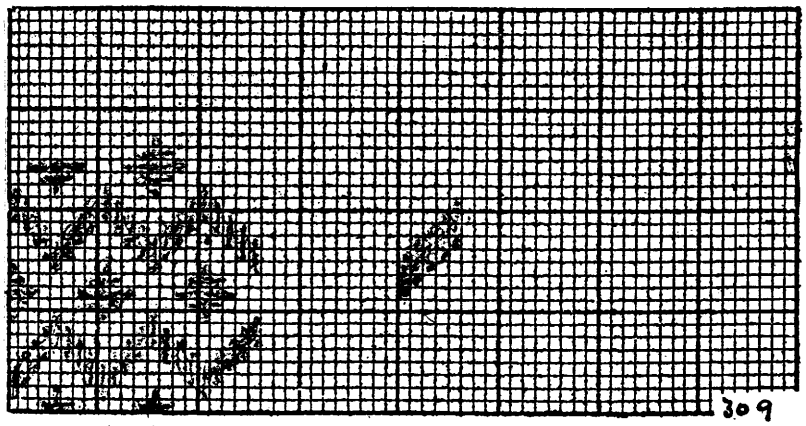


305

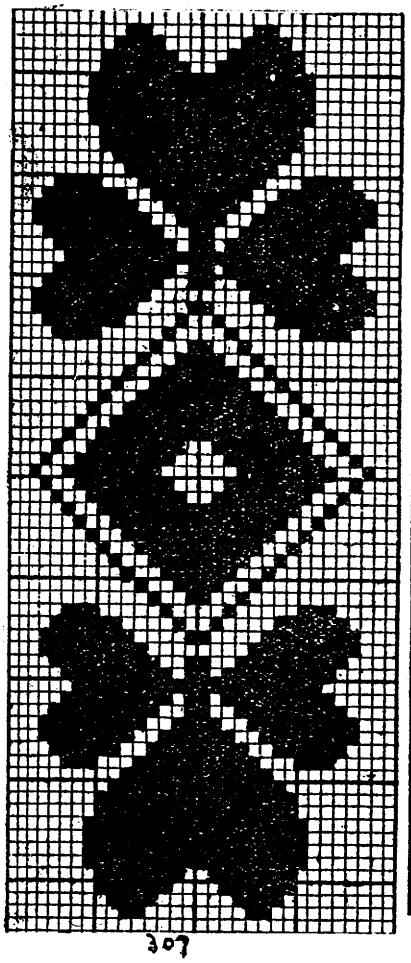


306

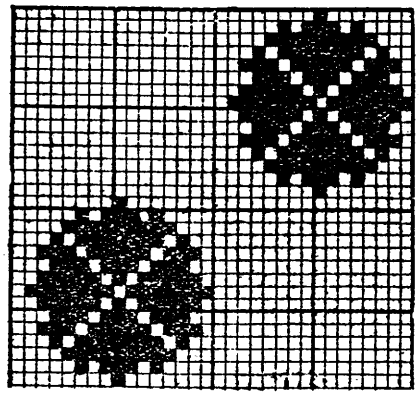
Extra Warp figured effects. Extra warp figures arranged on plain, twill, satin, crêpe or other grounds give very effective designs. 305 gives a design suitable for a Dhooty border, 306 shows a portion of the design as it would be arranged on design paper, one end extra warp one end plain ground. The denting would be 4 ends in a dent namely 2 plain or ground ends and 2 ends extra warp.



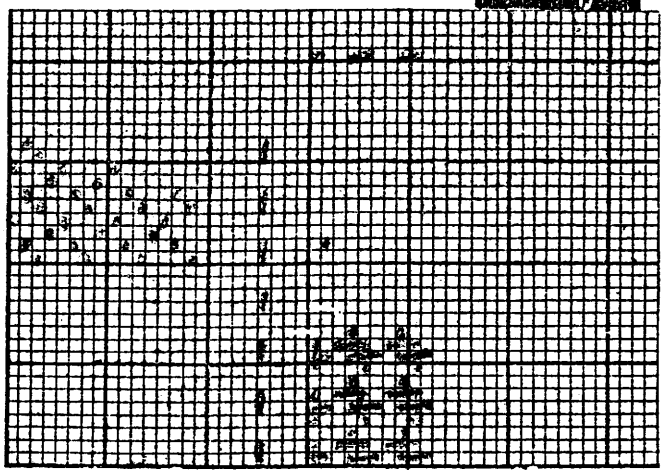
309

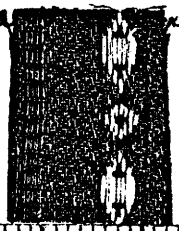


307



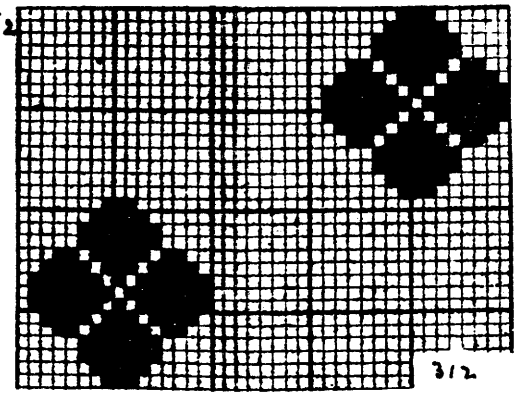
308



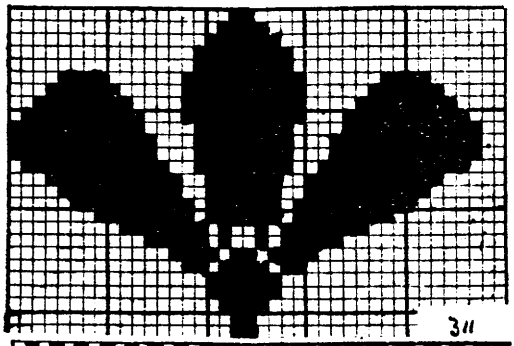


Extra Warp figuring.

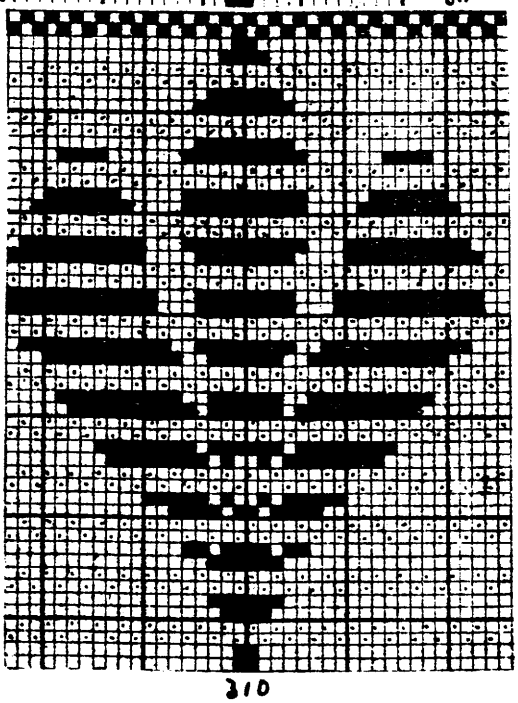
307 gives a suitable design for an extra warp striped pattern. Arrange 308 or 309 as extra warp spots in alternate order. 1 end ground dots. and 1 end extra warp fl[illegible]xes



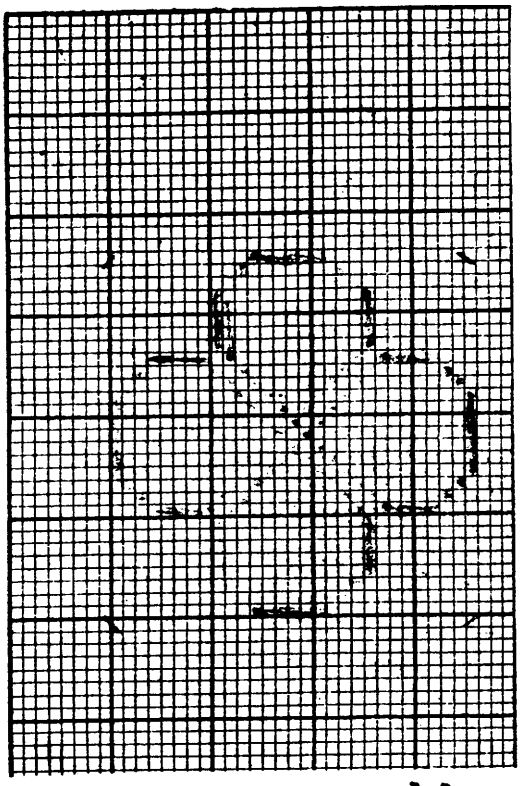
312



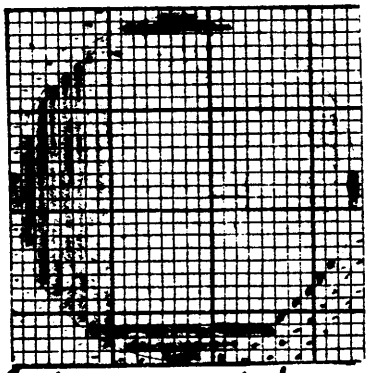
311

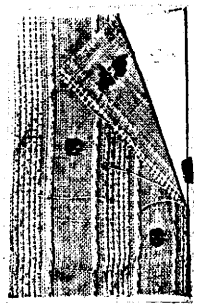


310

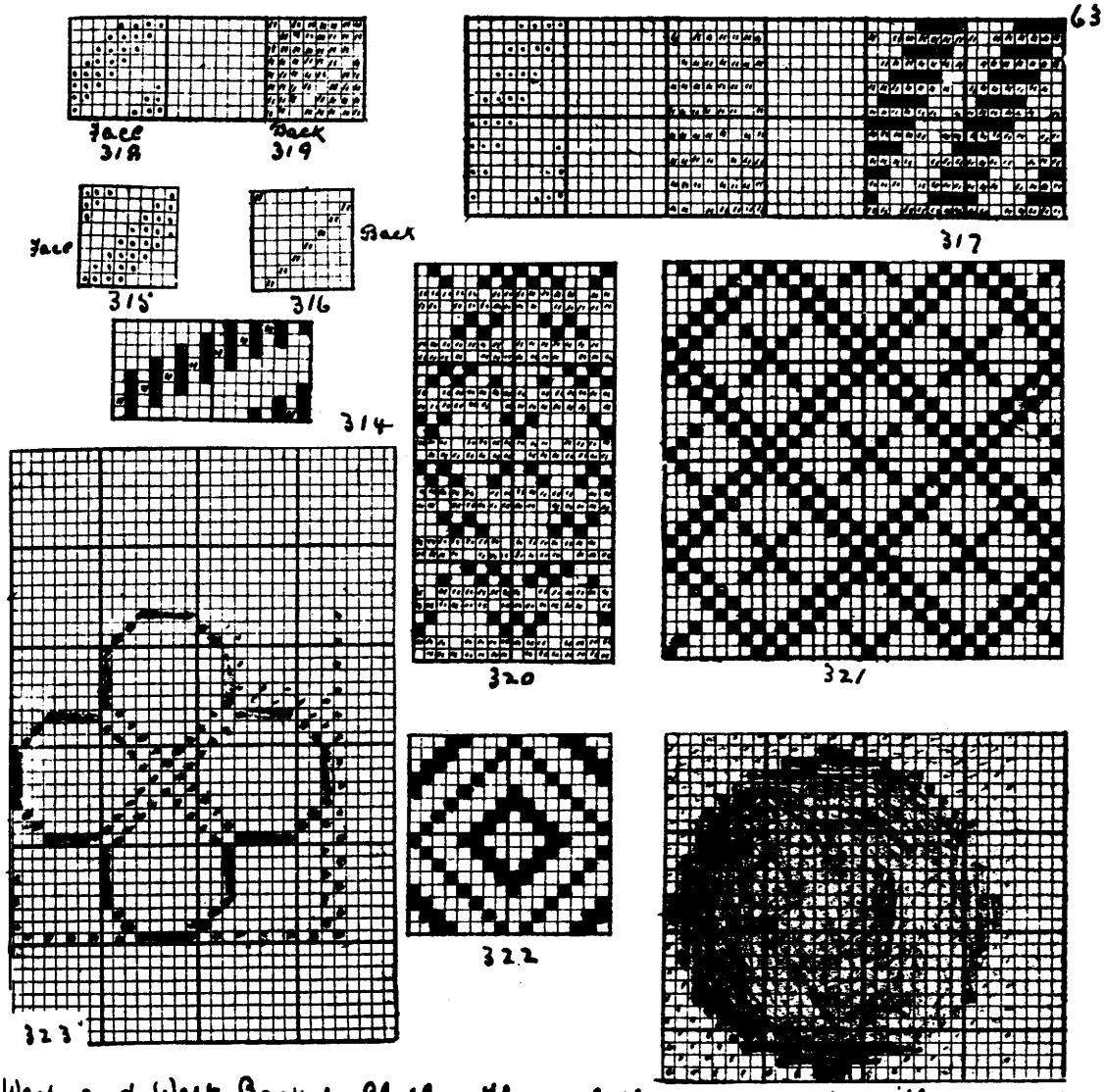


313

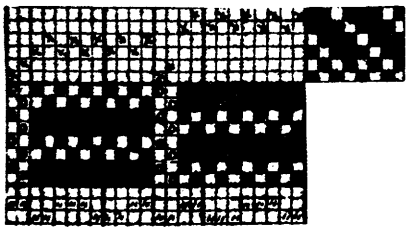




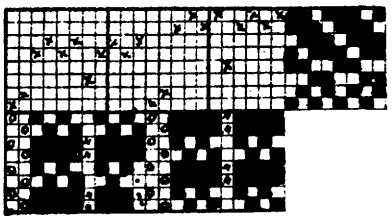
Extra Weft Spots. 310 gives 311 arranged as an extra weft shot 2 picks plain dots. 2 picks extra weft filled in squares ■. Arrange 312 on 313 as extra weft 2 picks plain ·· and 2 picks extra weft ■. Peg blanks. A circular or drop box loom required.



Warp and Weft Backed Cloths. These cloths are made with one pattern for the face and another pattern for the back. The back weave being an easy weave as twill or satin. 314 gives 315 and 316 arranged end and end as a Warp Backed cloth. 4 ends in a dent will be required. 317 gives 318 and 319 arranged as an extra Weft Backed cloth. 320 gives 321 arranged as a weft backed, with 8 end satin back. Arrange 322 or 323 as a weft backed, 2 face 2 back, 8 end satin back. These cloths will require double the number of picks to ordinary cloths.



324



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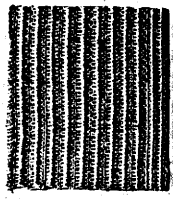

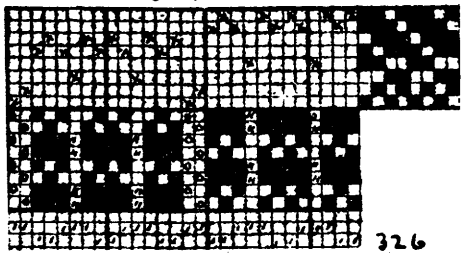

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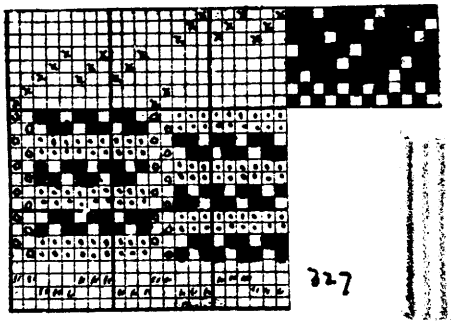
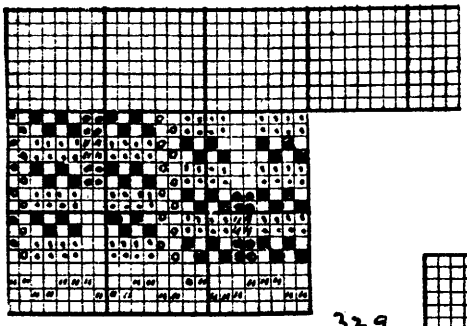
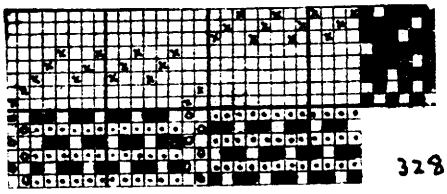


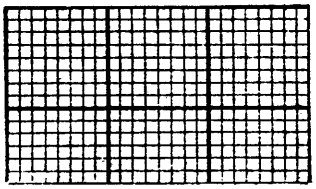
327

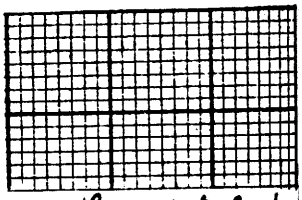


329



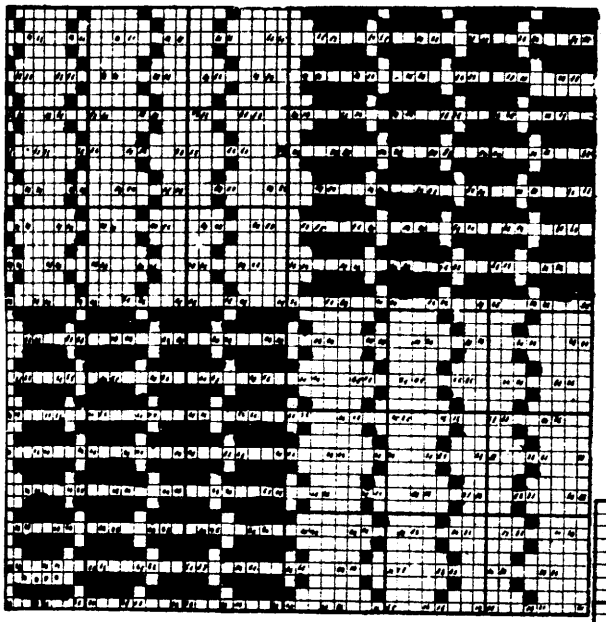
328

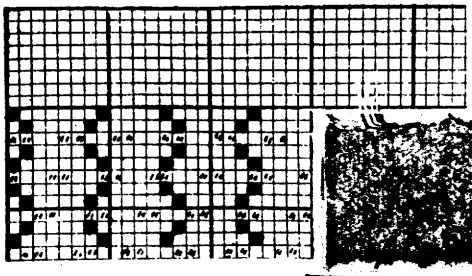


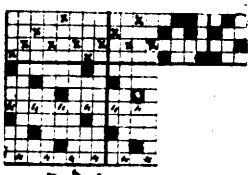


Bedford Cords. These weaves produce a ribbed or cord effect lengthwise of the piece, each cord being separated from the next cord by two ends weaving plain as shown by 0°. The cord may be either a plain or a twill weave, in all cases the weft weaves plain or twill on one cord or rib and floats under the next cord 324 gives an example. To make the cord more full and effective hadding end shaded squares ▣ in 325 and 326 are used, these lie between the face cloth and the back weft. 327 to 328 give designs with a 2 and 1 twilled cord. 329 gives a plain cord weave with extra warp shown as • and ▣ for figuring effects. The denting is important and is shown as ▣ below the respective designs.

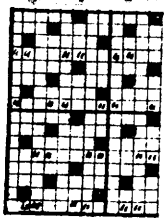
331 Fustians and Velvets 330

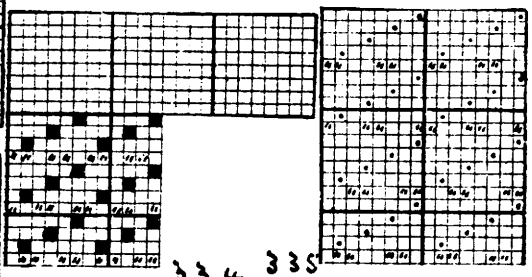




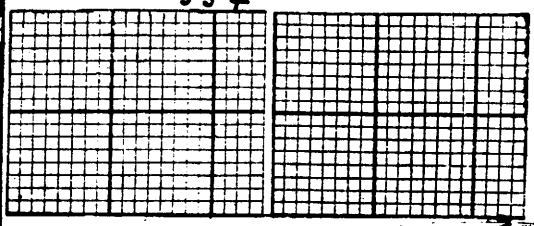


332

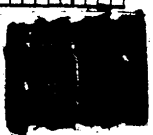




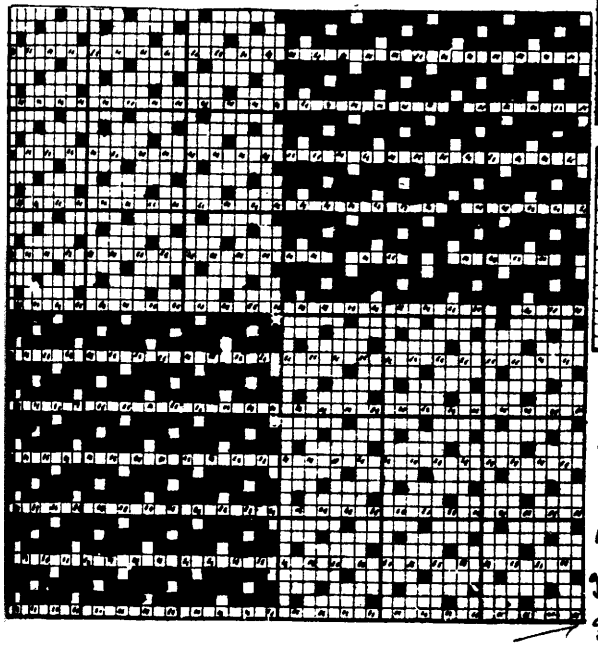
334 335



336



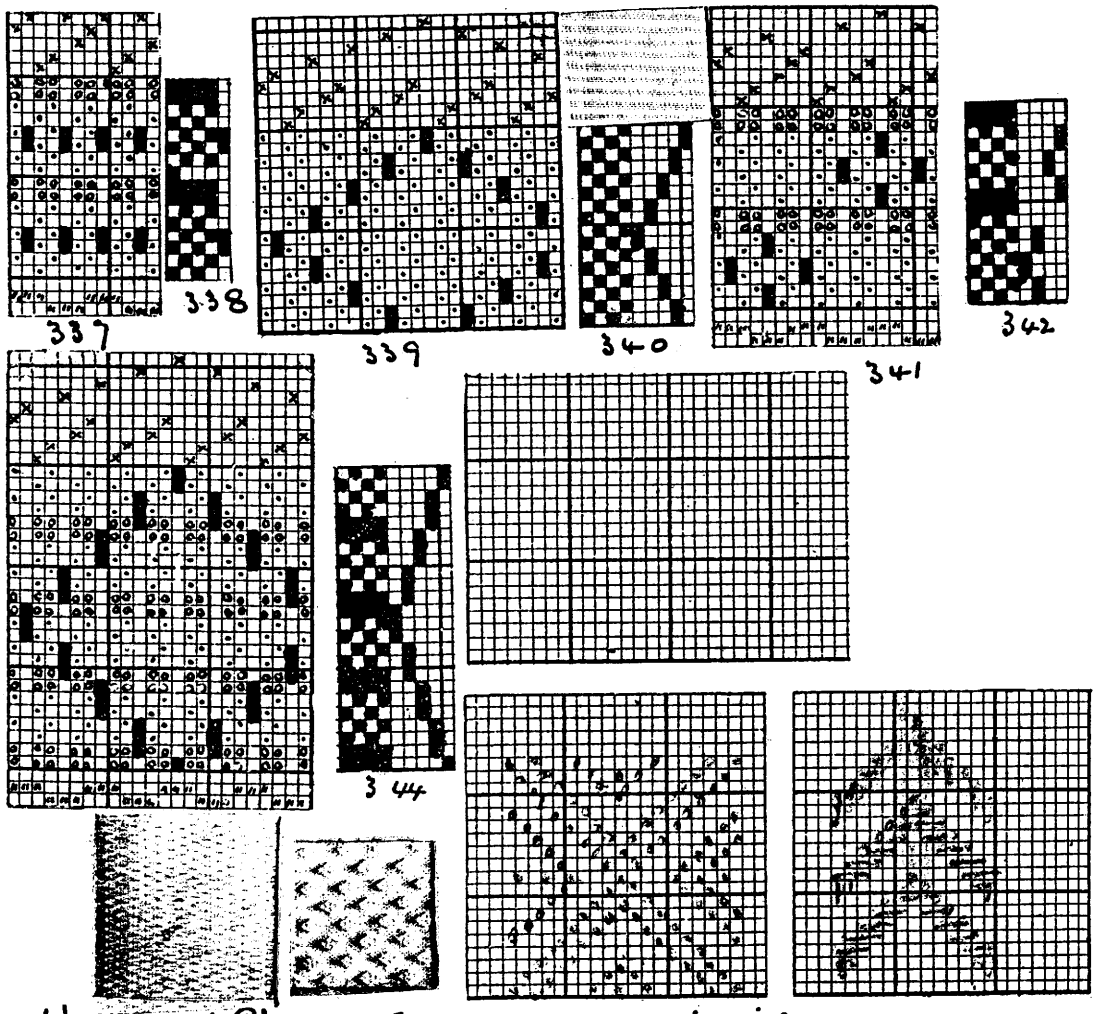
330 gives a Fustian or Corduroy. arranged 2 face & 1 back & 2 and 2 twill Ca... give looming & peg plan. 33... gives a Fustian check.



332, 333, 334 & 335 give examples of weaves. 336 gives a velvet check. The pile weft is afterwards cut by hand or machinery in both Fustians and Velvets.

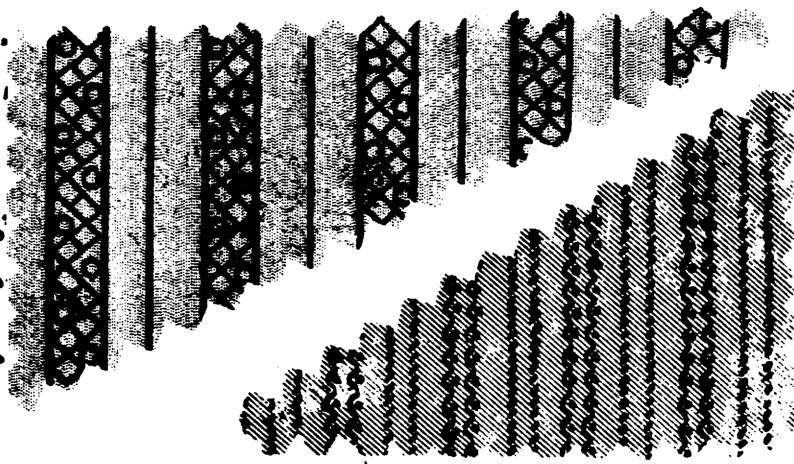
Velvets. ■ face. □ back

Welts and Piques.

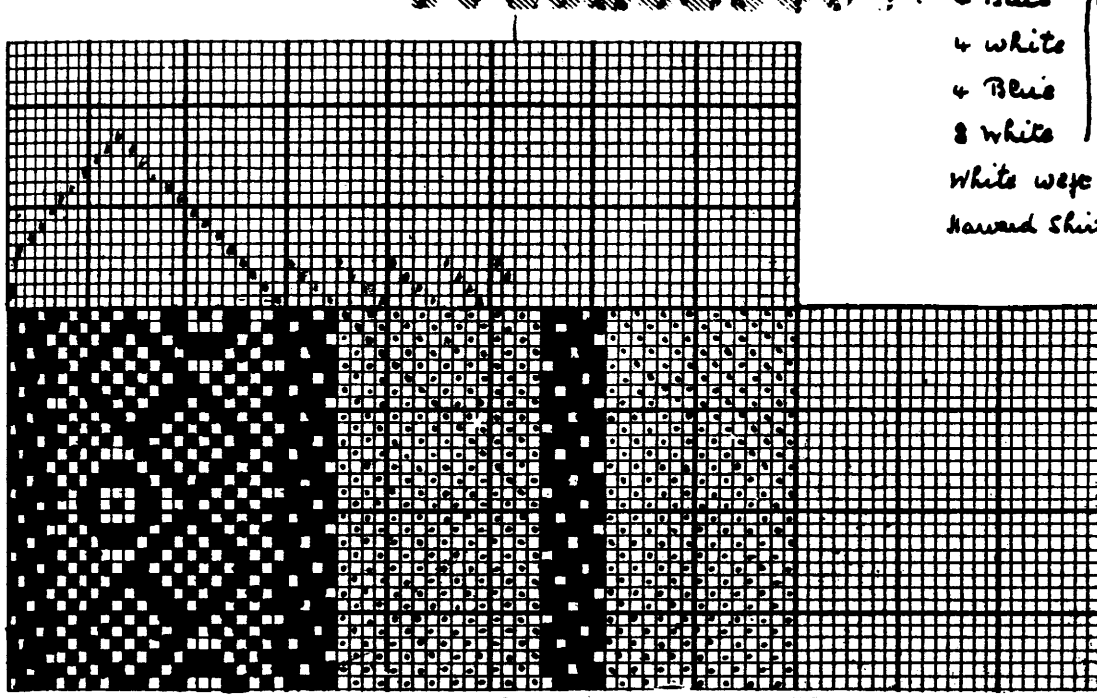


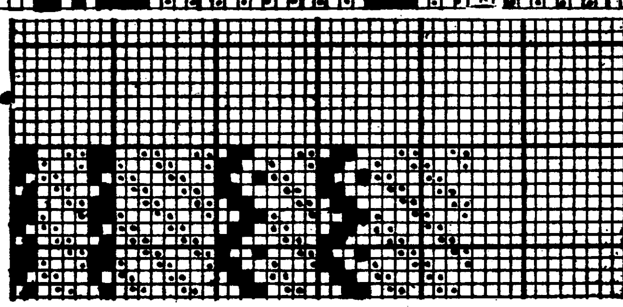
Welts and Piques These cloths are made with 2 warps: a plain face and a stitching warp for lifting the back ends into the face cloth. In Welts 337 all the back ends are lifted at one time. this makes a rib across the piece. In Piques there are two kinds. namely with wadding picks o^{s} in 341 and 343 and without as 339: there are also two kinds in respect to the appearance in 343 wadding picks lie straight in the cloth in 341 they are pulled out of the straight line. All piques are made 2 face 1 back in ends: the back end in middle. 3 ends in dent.

345. 70 Reed 1"
68 picks 1"
Warp patt.
28 Black ▪
16 white .
5 Black ▪
18 white
} 36s cts.
White weft. 34s
Dress goods.



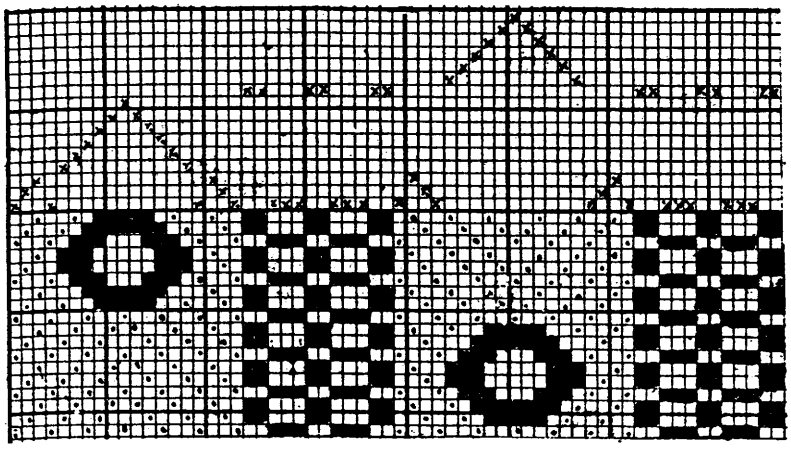
346. 66 Reed 1"
64 picks 1"
Warp patt.
2 Pink
4 white
2 Pink
8 white
4 Blue
4 white
4 Blue
8 white
} 22s cts.
White weft 18s
Harvard Shirting



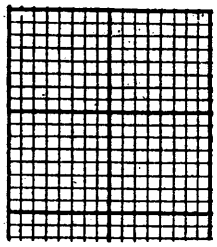


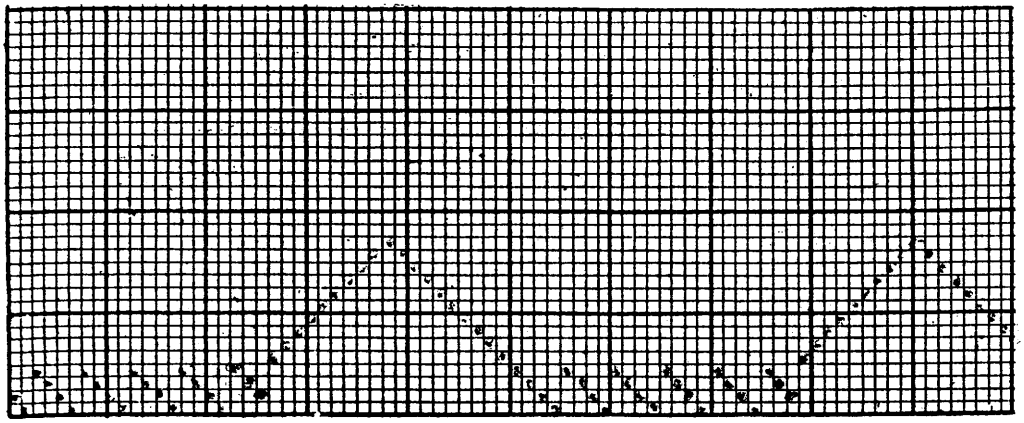
347. Design for 345 give the draft and peg plan.

348. Design for 346. give the draft and peg plan.

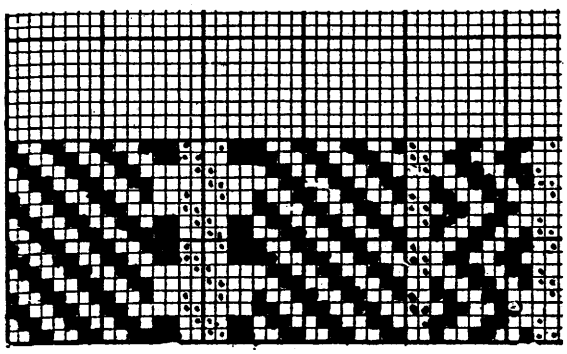


349 gives Design for 352. Give the draft and peg plan

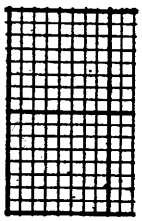




350 on this space give Design, draft and peg plan for 353

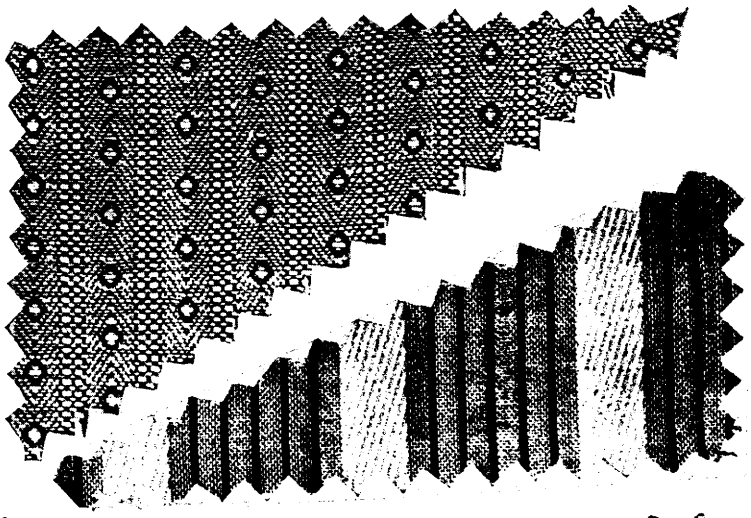


351



351 gives the Design for 354. Give the draft and peg plan

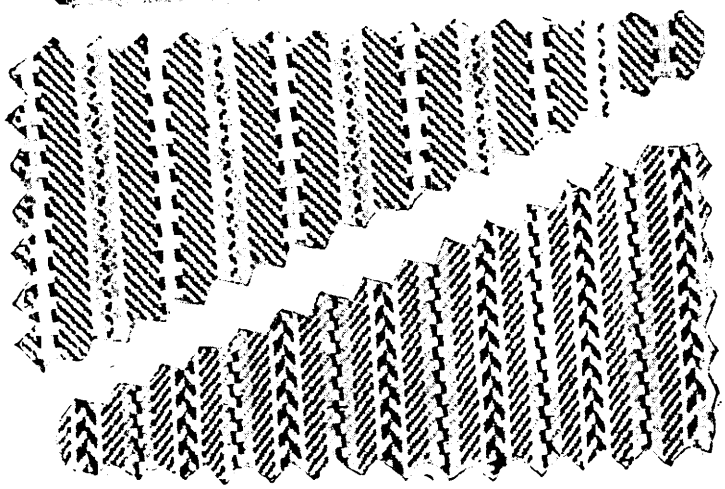
352. 68 Reed
66 picks
WARP Past.
36' Dark Blue
warp.
36' white weft.
Shirting.



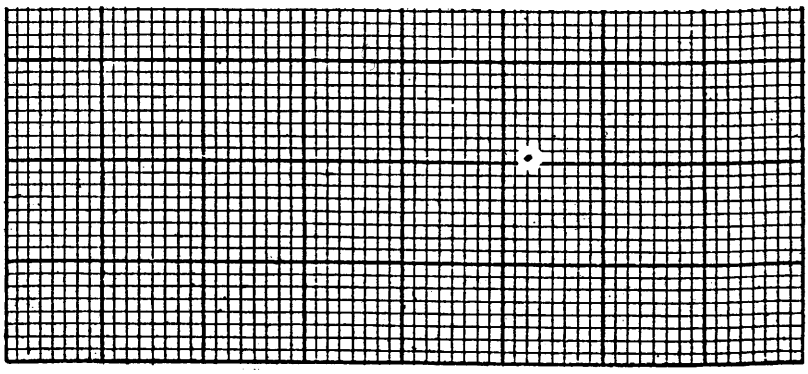
353. 64 Reed
58 picks
WARP Past.
8 white
4 Blue double ends.
} 8 Repts + 8 white
56 white
namely 7 Repts of 8 end twill
7 up 1 down
1 up 1 down
40' warp
38' weft.
Summer Blouse.

2 in 1 dent.
1 in 1 dent.

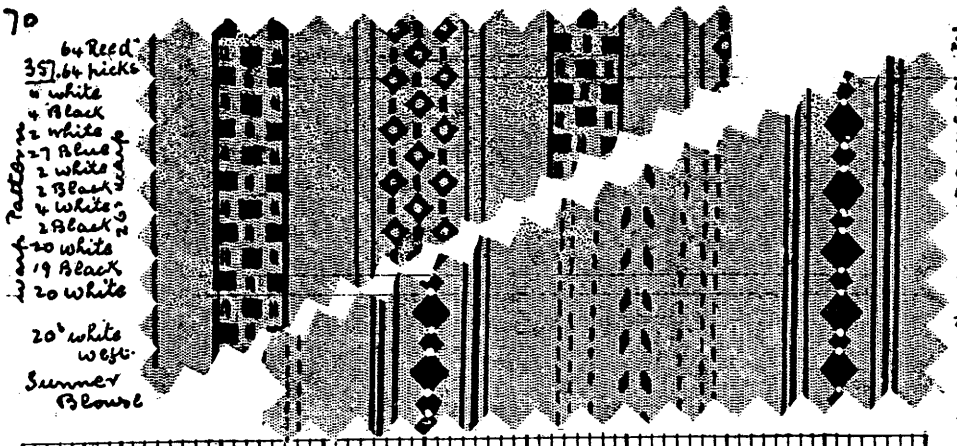
354. 64 Reed
62 picks
WARP Past.
14 Blue
4 white
14 Blue
2 White
3 Pink
2 Red
3 Pink
2 white
} 20'
18' white weft.
Harvard Shirting.



355. 66 Reed
64 picks
WARP Past.
4 Blue
4 in 4 stitch
4 Sky 2 in 2 Twill
8 Blue do.
2 whites do.
8 Blue
4 in 4 Broken Twill Dobby St.
2 White
2 in 2 Twill
8 Blue do.
2 Sky do.
White weft 18'
Harvard Shirting

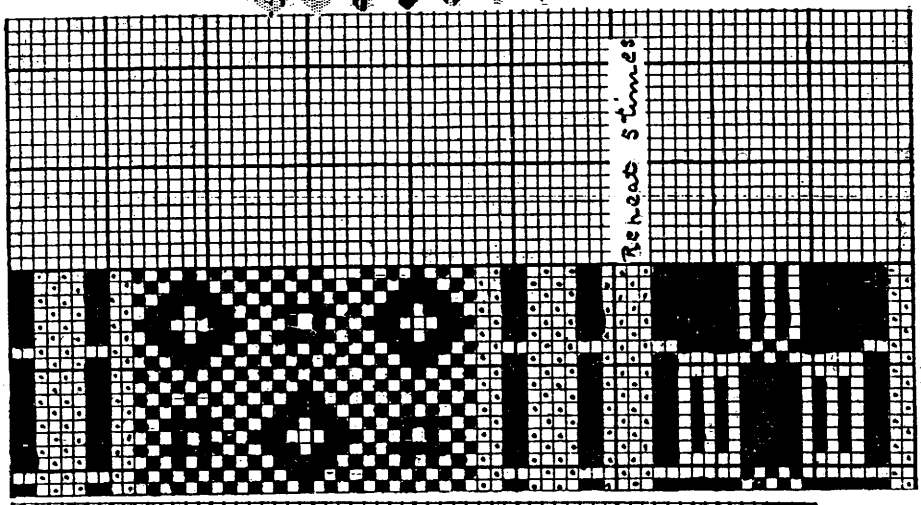


356 on this space give design, draft and peg plan for 355

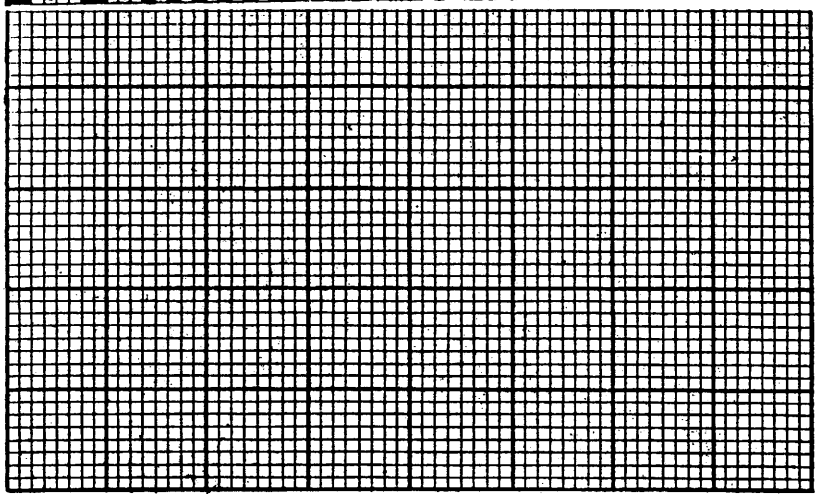


357. 64 Reed
64 Picks
8 white
4 Black
2 white
27 Blue
2 white
2 Black
4 white
2 Black
20 white
19 Black
20 white
20 white weft.
Summer Blouse

358. 60 Reed
60 Picks
2 Blue
2 white
4 Blue
2 white
2 Blue
4 white
12 Blue Dobby
4 white
2 Blue
2 white
4 Blue
2 white
2 Blue
20 white
2 Blue
2 white
2 Blue
6 white
2 Blue
8 white
4 Sky dobby
4 white
4 Sky Dobby
8 white
2 Blue
6 white
2 Blue
2 white
2 Blue
20 white
18 white weft
Summer Blou



359 gives design for 357. give the draft.

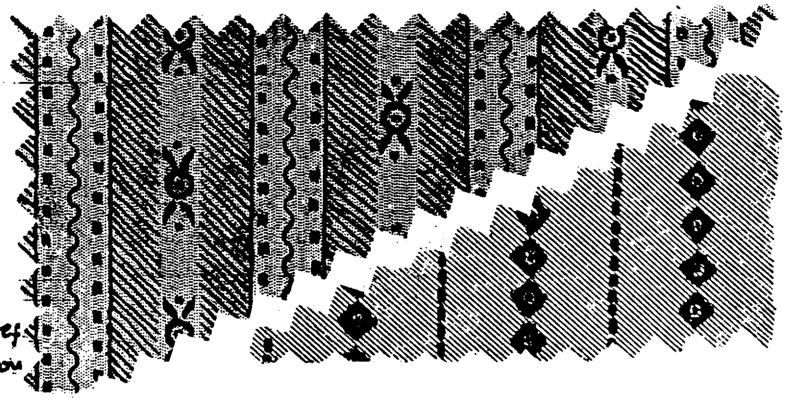


On 360 give the design only. for 358

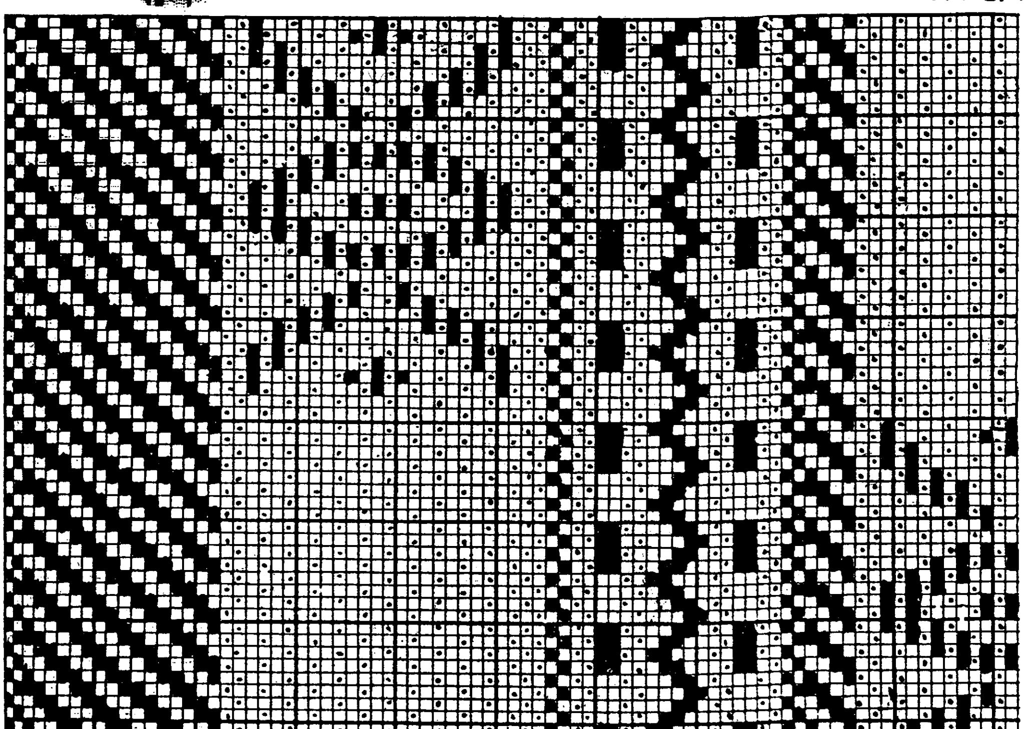
.64 Reed"
64 picks
wp patts.

lack
Blue
white
Brown
Ext. warp
Black
white
Sky
white
Sky
white
Sky
white
white weft
ummer Blou

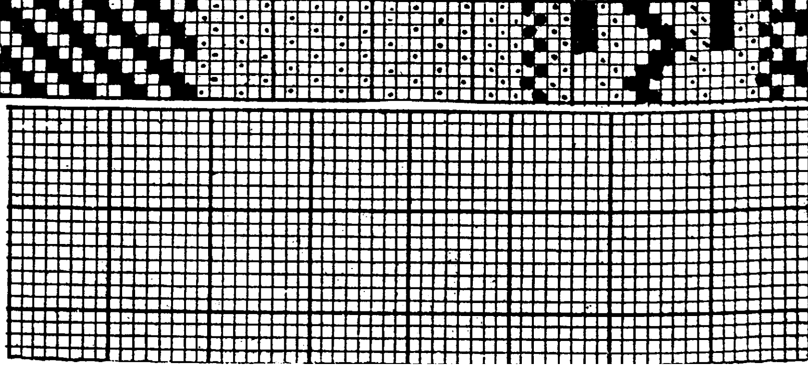
warp 36 ins



362. 60 Reed"
60 Picks"
Extra warp
figures on
2 & 2 twill
ground 24
ends separate
stripes. Ex. wp
in stripes 4
and 14
36" Green wp
" Pink Ex. "
30 Green weft
winter Blouse.



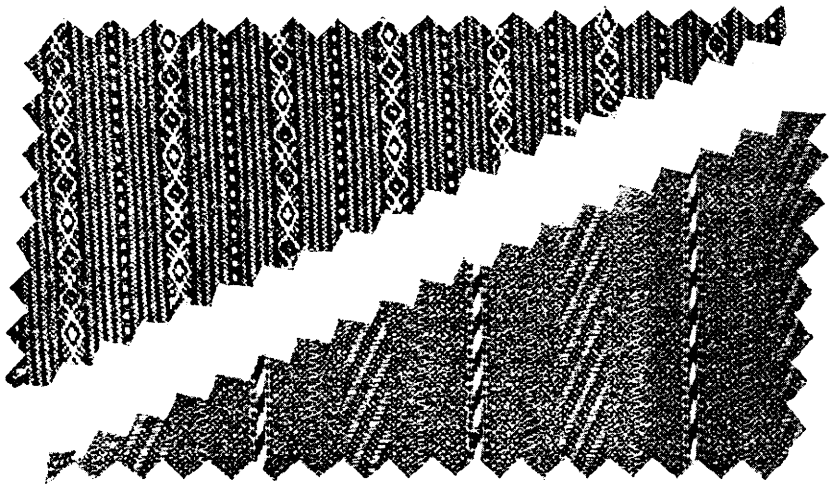
363
gives
design
for
361



On 364 give
design only
for 362

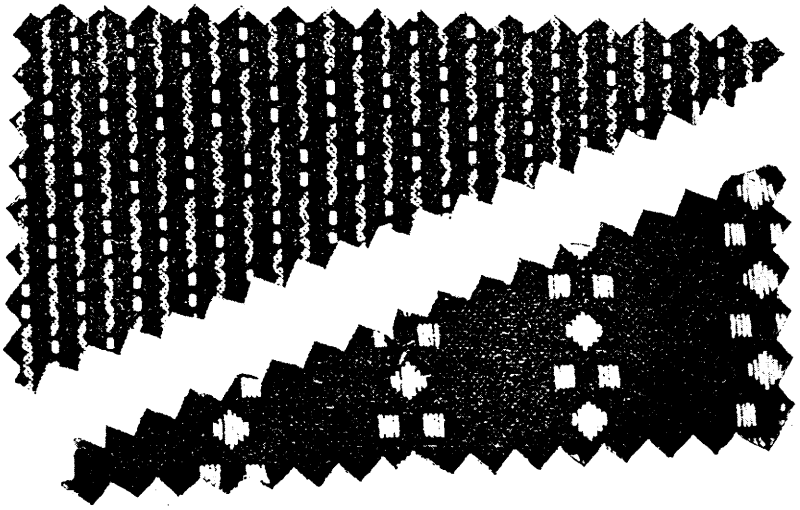
365. 80 Reed
74 picks
Warp Patt.

2 Black
2 whites
4 times plain
2 Black
2 White
Stitch
2 Black
2 White
4 times plain
2 Black
Plain
10 white
Dobby
30^{s} Black Weft
Winter
Dress goods.

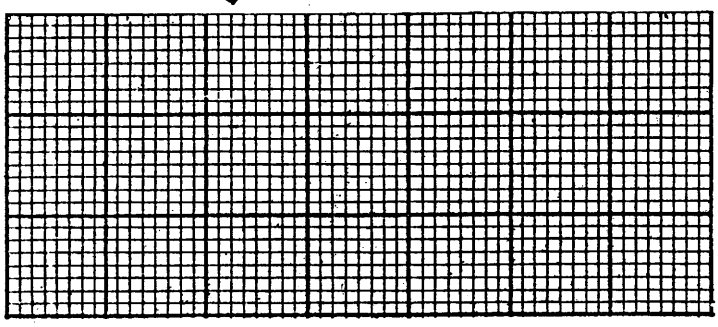


366. 66 Reed
64 picks
Warp Patt.
16 Dark Green
Dobby
8 DK Green
Plain
4 do. Stitch
12 do Plain
1 Black
1 white
6 times
Dobby
26^{s} DK Green
weft.
Winter
Dress goods.

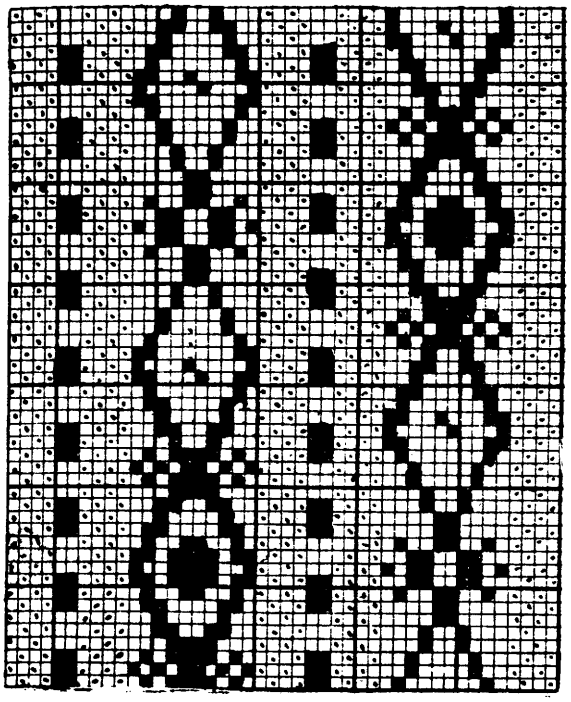
367. 72 Reed
64 picks
WARP Patt.
8 Black
4 Slate
20^{s} Black
weft.
Winter
Dress goods.



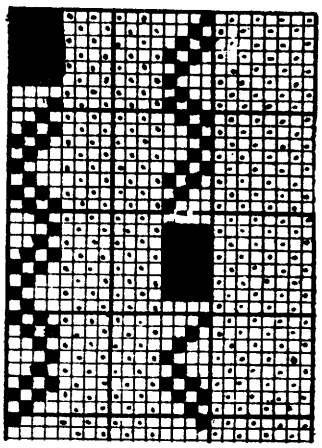
368. 64 Reed
60 picks
Extra warp
on a plain
ground
Stripes are
at 40 ends
Ext wp. 4
a dent Vig
2 gr. 2 Ext.
20^{s} Black
weft.
Winter
Dress goods



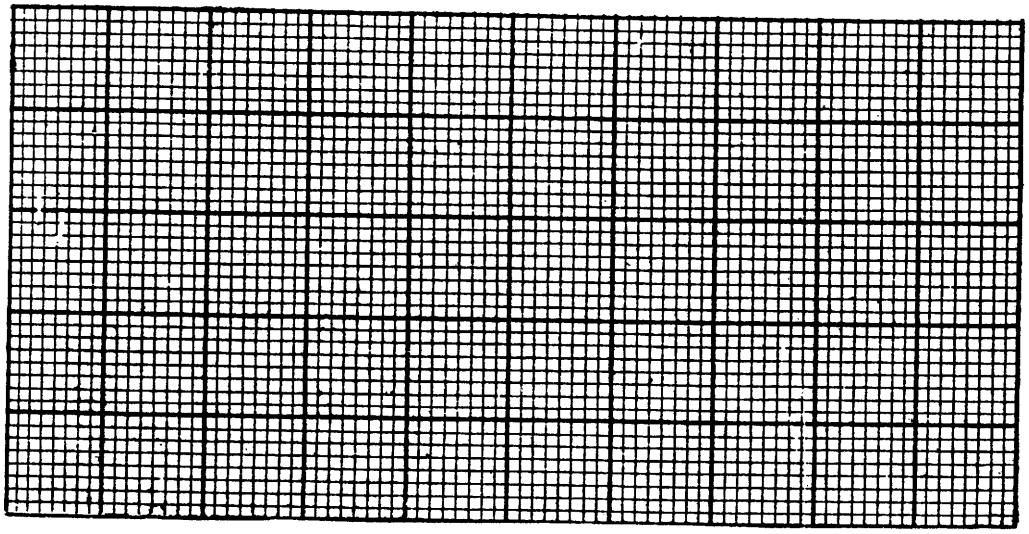
On 369 give the
Design only
for 368.



370 Design for 365

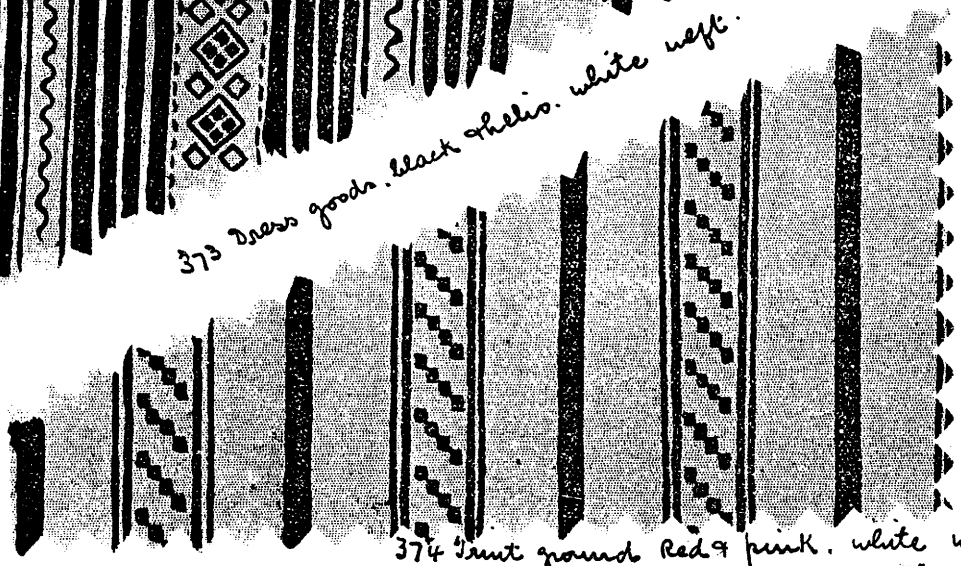


371 Design for 367

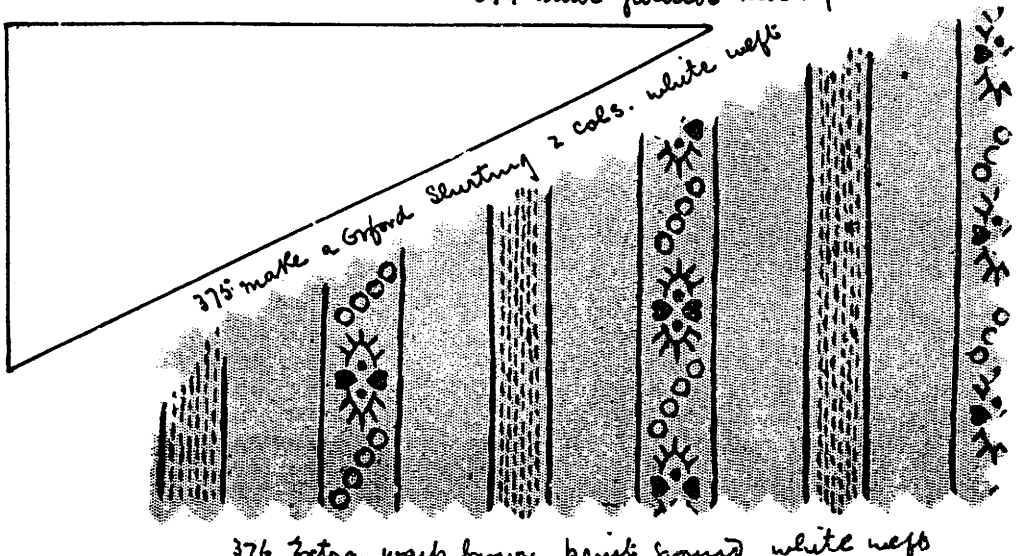


372 Give the design looming and peg plan for 368

373 Dress goods. black chêne. white weft.



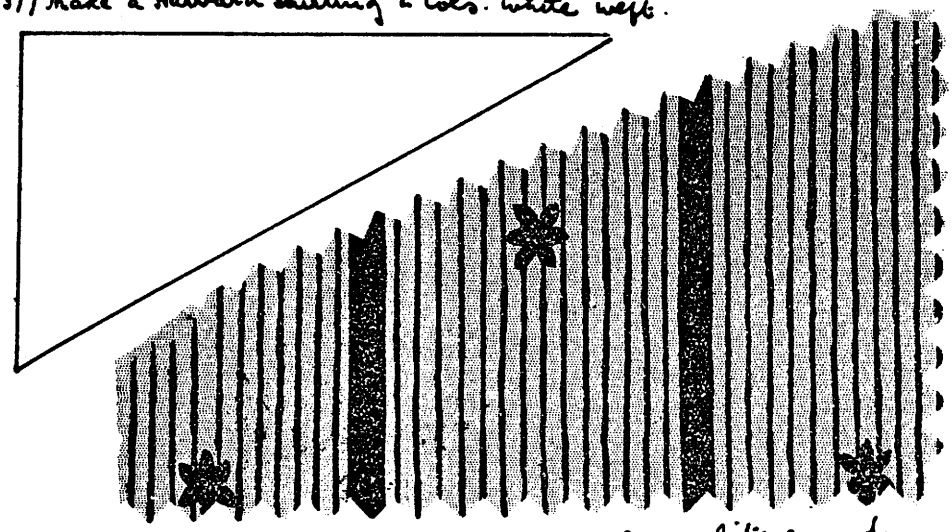
374 Tint ground Red & pink. white weft



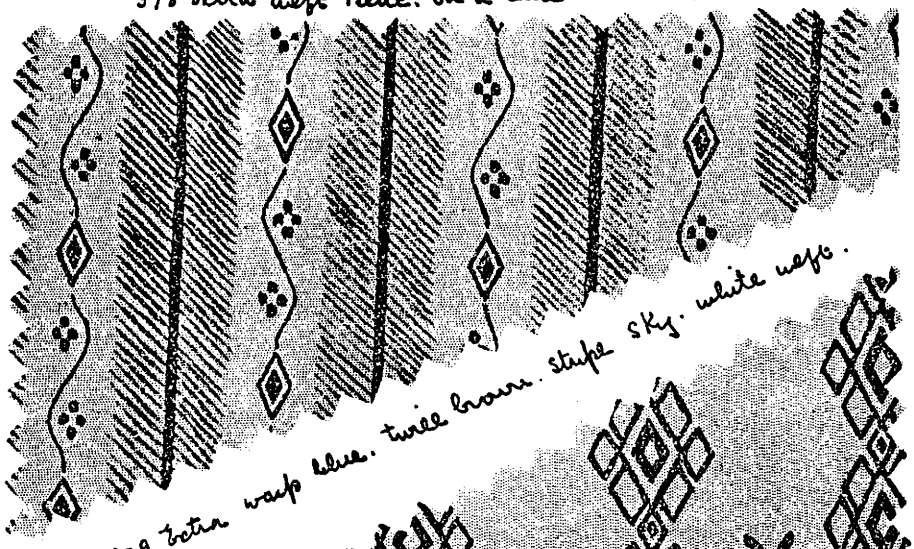
375 make a Gingham Shirting 2 cols. white weft

376 Extra warp brown. print ground white weft

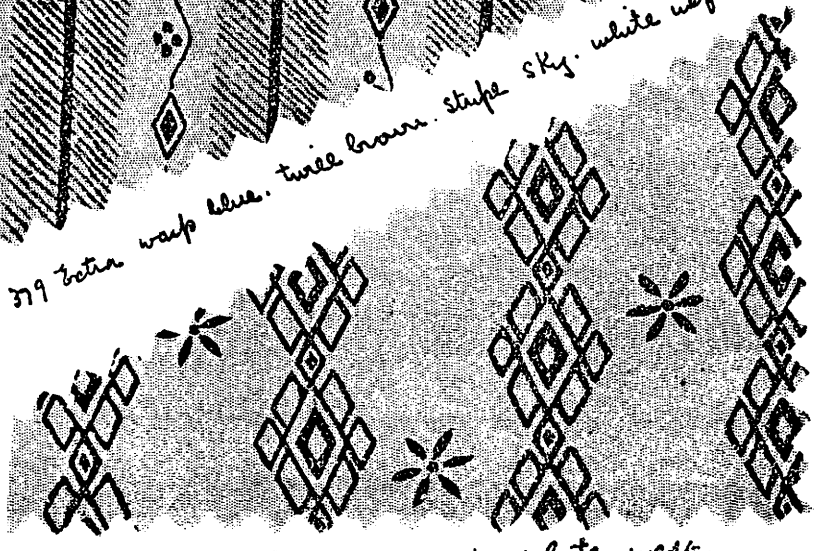
377 Make a Harvard Shirting 2 Cols. white wefts.



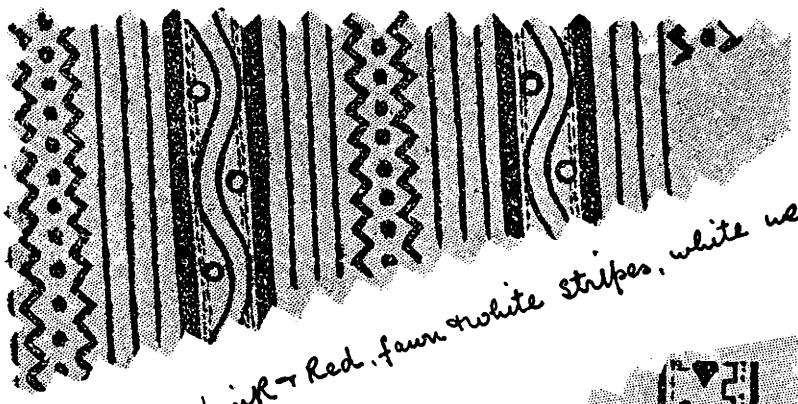
378 Extra weft Blue. on a blue white ground.



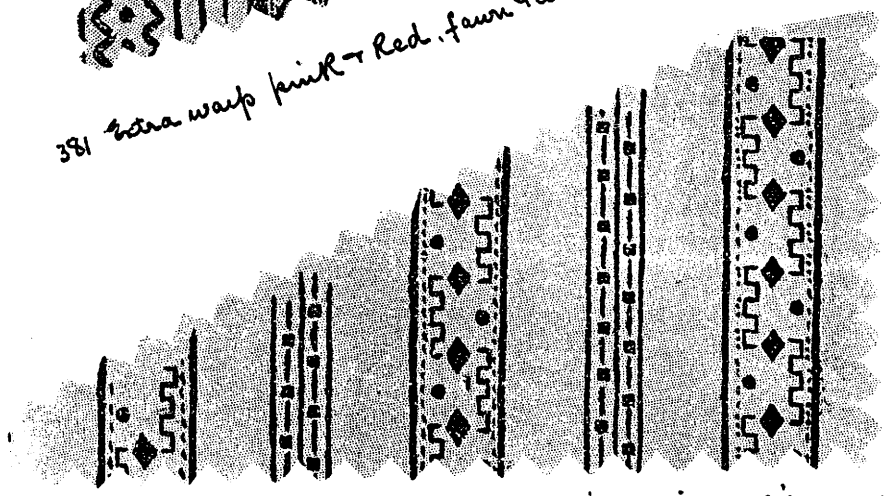
379 Extra warp blue. twill brown. stripe sky. white wefts.



380 Pale green warps. white wefts.

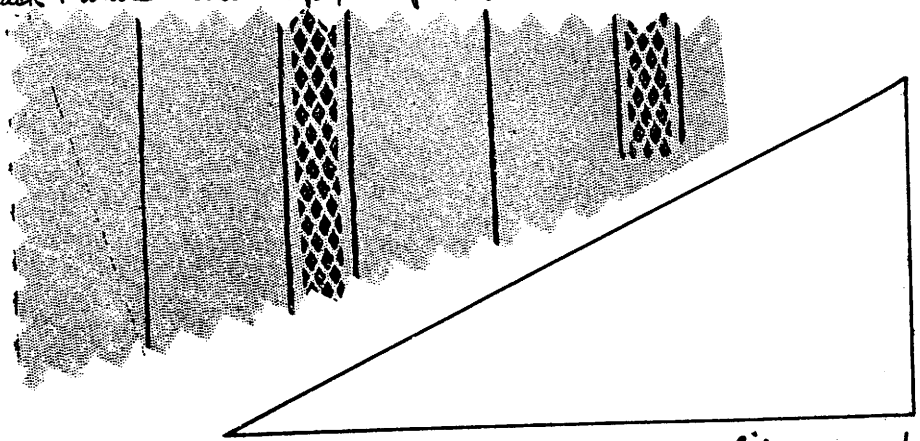


381 extra warp pink + Red. fawn + white stripes. white weft.

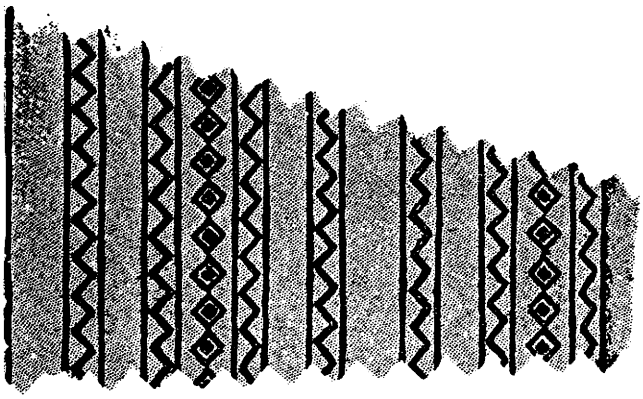


382 Black + chelio extra warp. grey + white stripe. white weft.

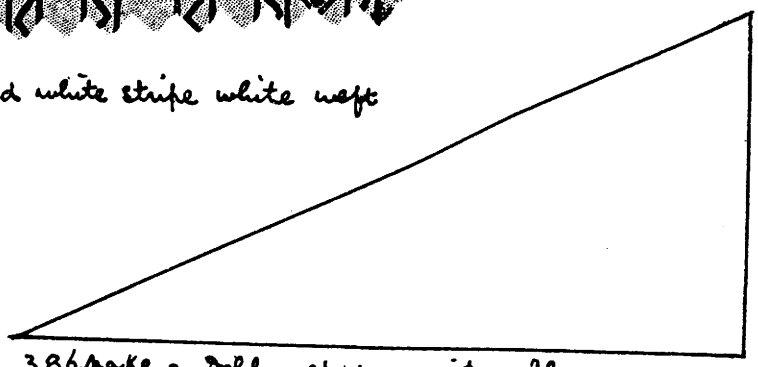
383 Black + white extra warp. pale green ground. white weft.



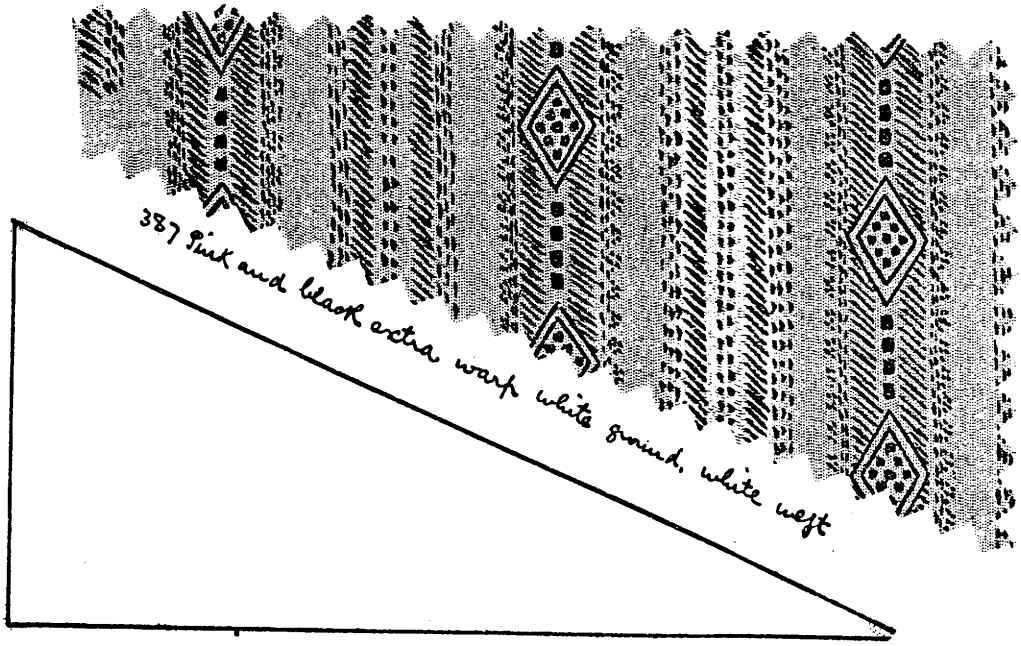
384 make a extra weft shot on a white ground



385 Black and white stripe white weft

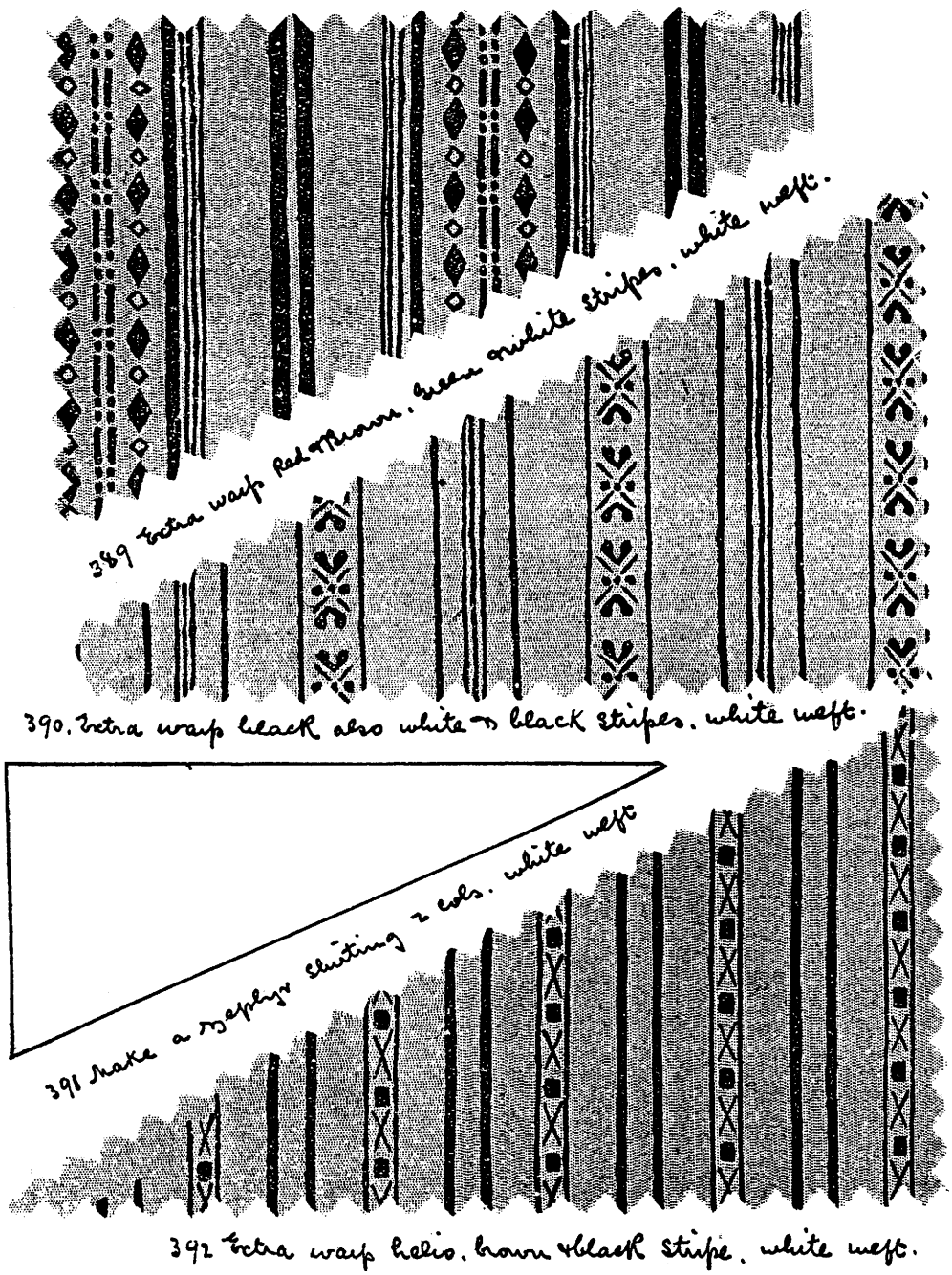


386 make a Dobby stripe winter blouse



387 Pink and black extra warp white ground, white weft

388 make a extra warp stripe 3 cols. white weft.

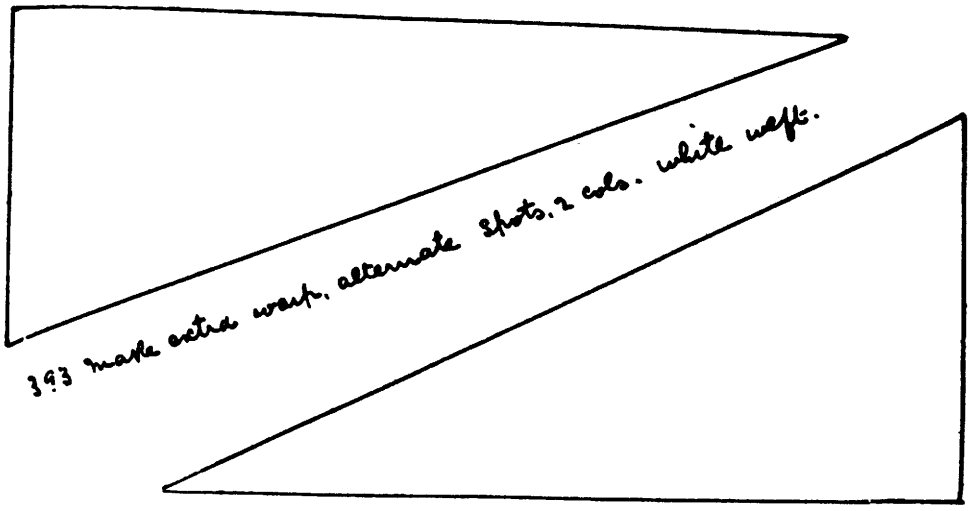


389 Extra warp Red-Brown. Green white stripes. white weft.

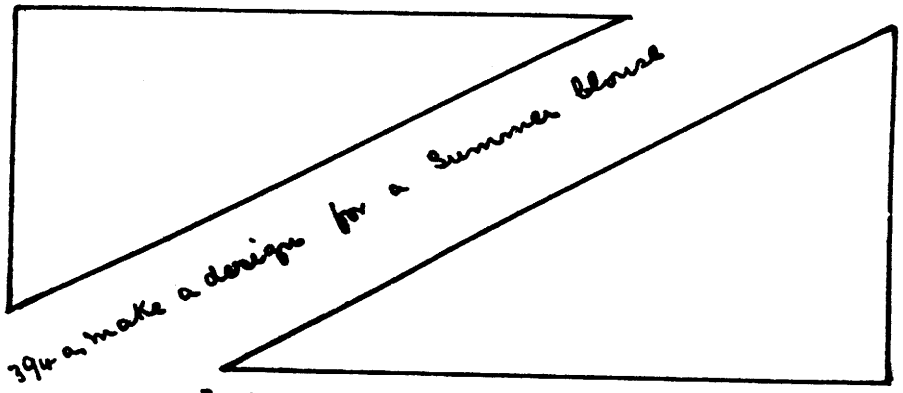
390. Extra warp black also white → black stripes. white weft.

391 Make a zigzag slanting 2 cols. white weft

392 Extra warp helio. brown black stripe. white weft.



394 make a extra warp stripe two col. white weft



395 b. make a design for a winter blouse.

The Plain Loom.

The first loom to run by power was invented in 1784 by Dr Cartwright a clergyman. A splendid marble statue of Cartwright is erected in the Cartwright memorial Hall at Bradford. Cartwright's loom was very much the same in its general principles as they are made to-day. Successive inventors have improved upon it, and additional accessories have been added in the form of Shedding motions as Dobbies and Jacquards; Changing shuttle box motions; Pick and Pick looms, Automatic weft supply looms which replenish the weft without any attention from the weaver and without stopping the loom. At this stage the construction of the Plain or Calico loom is of some importance. The naming of the principal parts and motions of the loom and the object of each motion. The three Primary movements in a loom, required to produce a piece of cloth are:-

Shedding, this is the separation of the warp ends for the passage of the shuttle, this is brought about by means of Tappets, Dobbies or Jacquards.

Picking, is the throwing in of the weft by means of the shuttle.

Beating up, is the carrying of the weft forward to the fell of the cloth by means of the sley and the reed.

The other minor motions, all of which are necessary for the successful working of the loom are:-

Weft fork motion, to stop the loom when the weft breaks.

The Brake, to prevent the loom running too far, after the strap is thrown on to the loose pulley

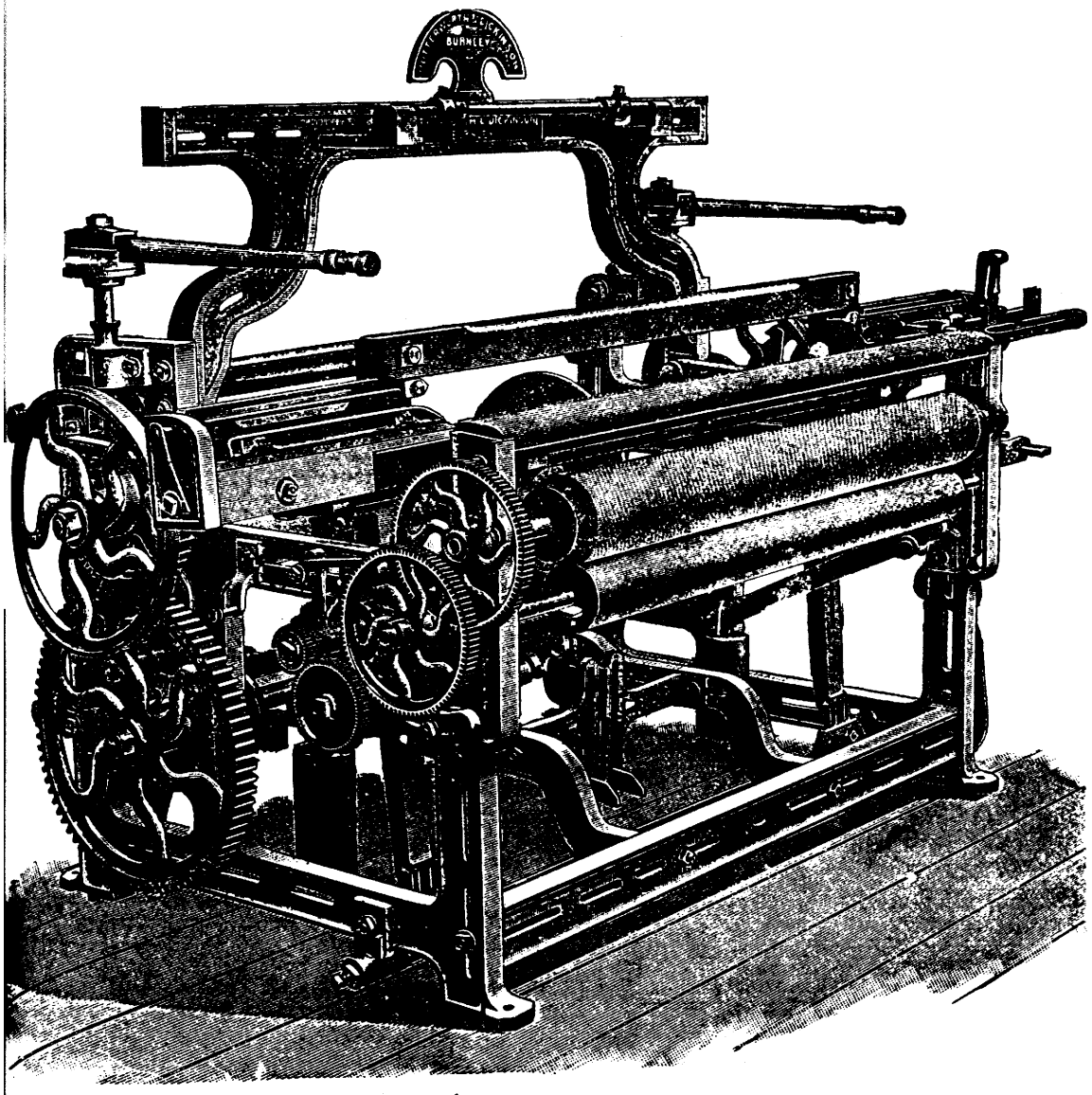
Stop rod and Loose reed motions, these prevent the breakage of the warp when the shuttle stops in the shed.

Shuttles to carry the weft.

Take up motions to regulate the picks per inch in the cloth.

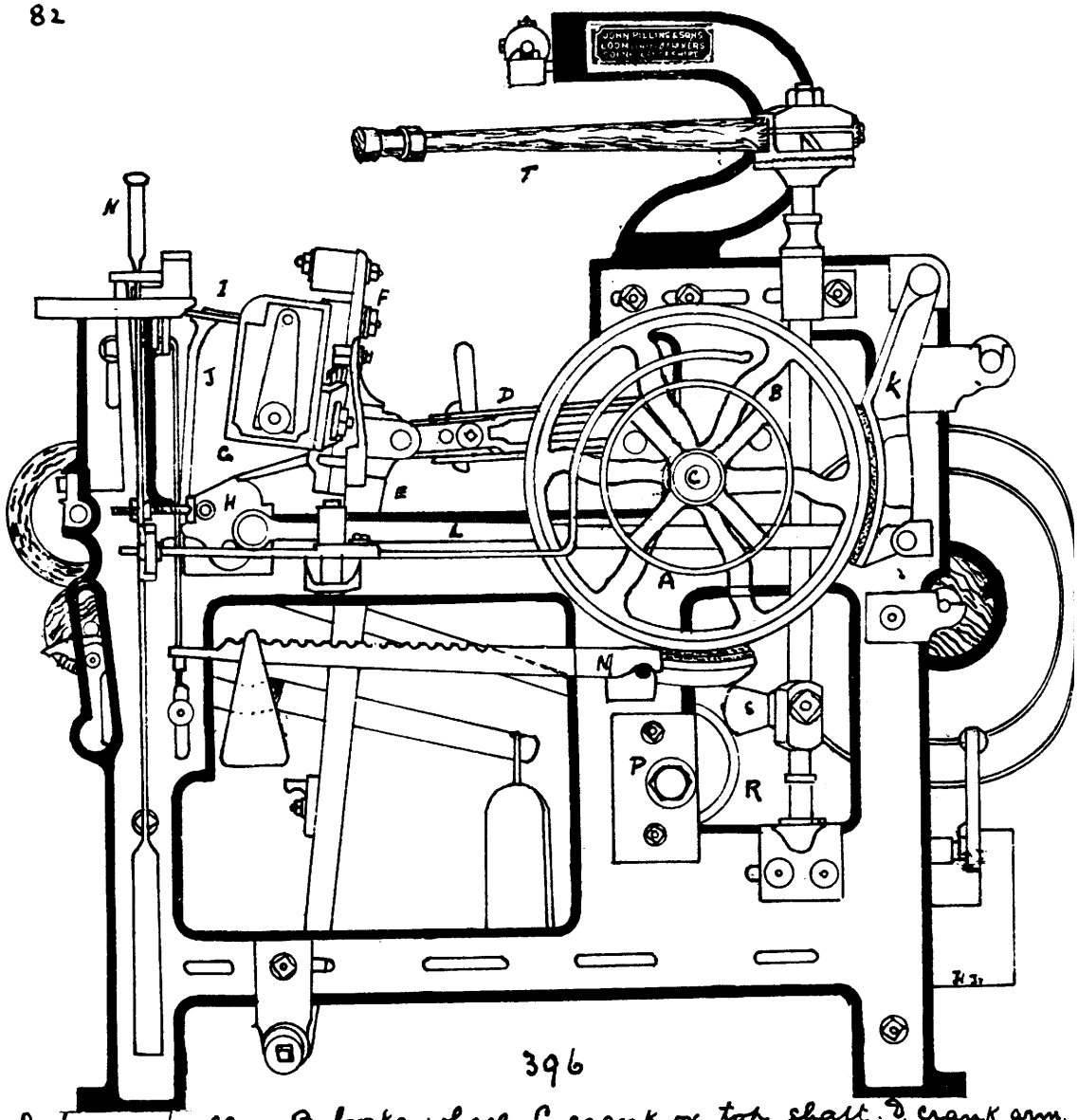
Temples for keeping the cloth stretched in the loom.

Fig. 395 is an illustration of a plain loom and 396 and 397 show the two sides in greater detail.

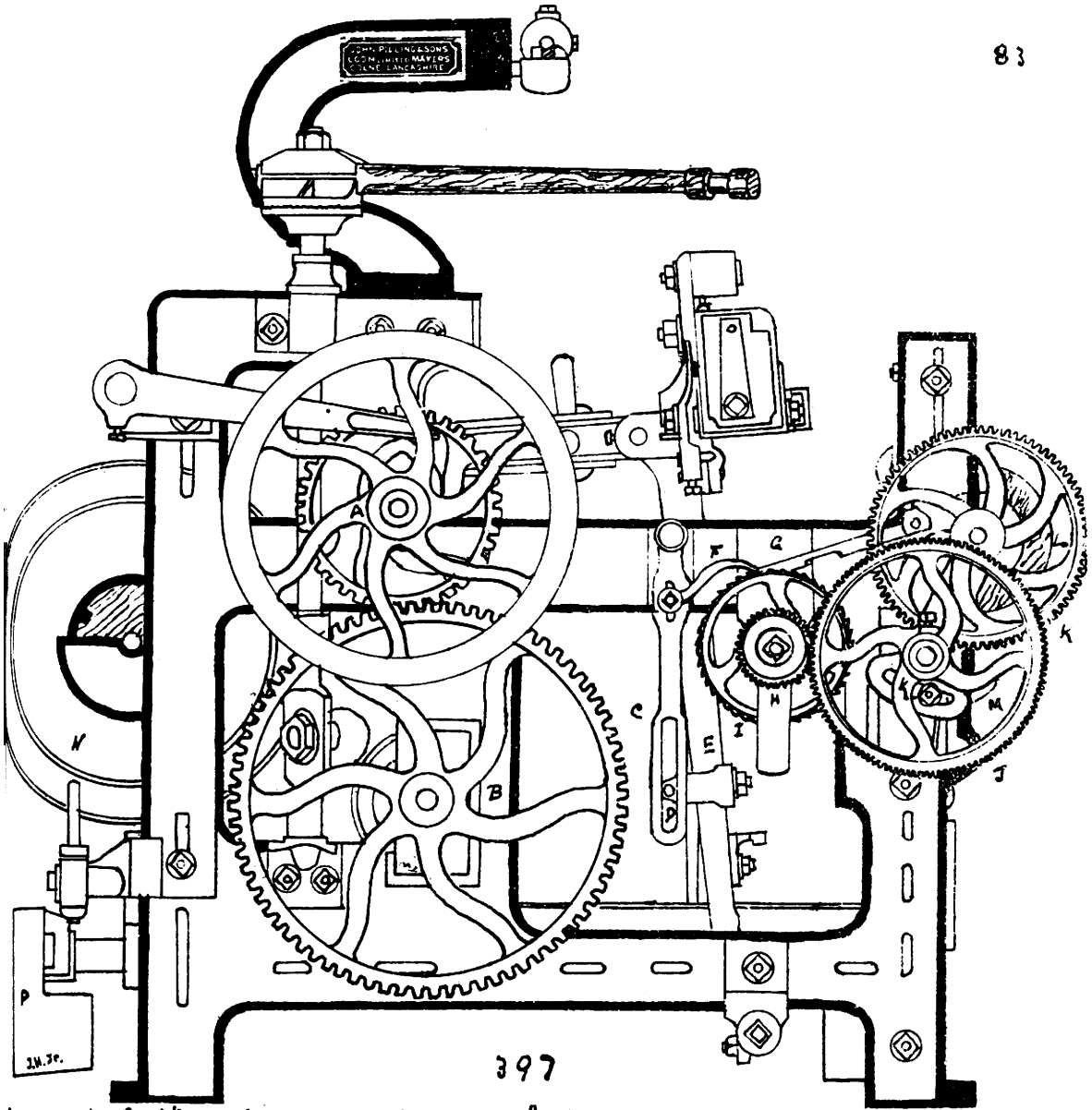


395

Plain Loom



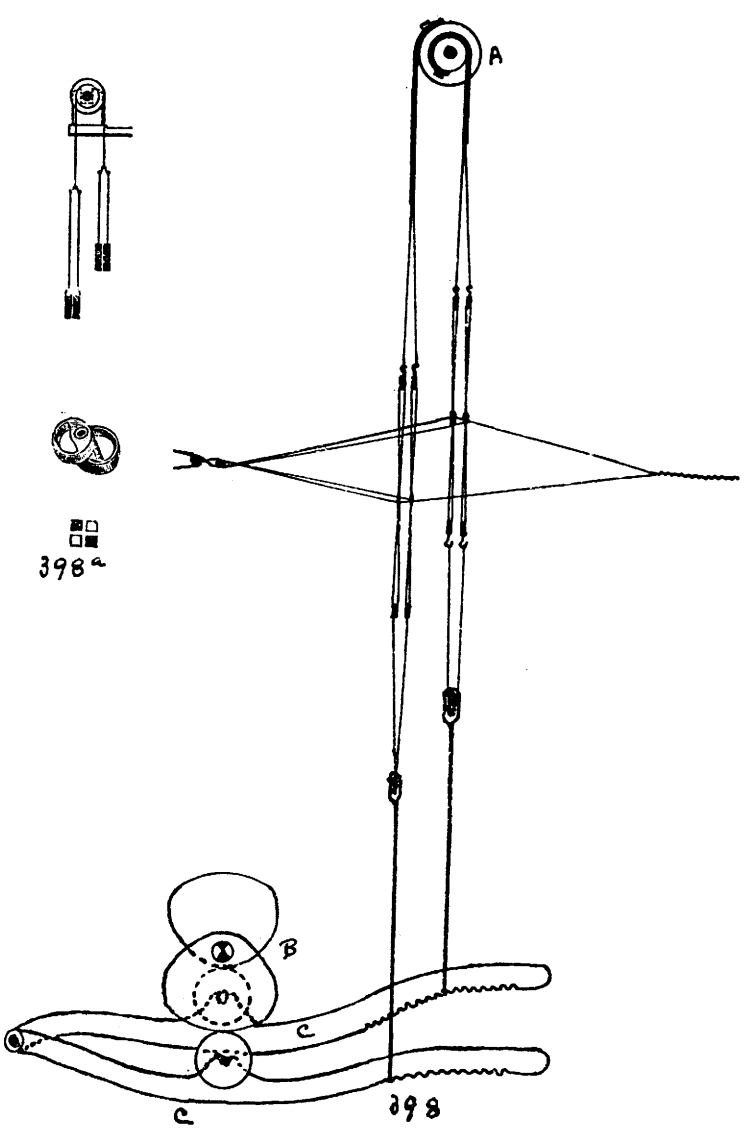
A. driving pulley. B. brake wheel. C. crank or top shaft. D. crank arm. E. sley sword. F. box end and sley. G. stop rod tongue for a fast reed. H. frog. I. weft fork. J. weft fork hammer and lever. K. back brake L. connecting rod from frog to back brake. M. brake connected with weft fork. N. starting handle. P. bottom shaft, on this shaft are fixed the tappets and picking tappet R. S. is the picking bowl. T. picking stic



A. Crank shaft or driving wheel. B. bottom Shaft wheel. C. setting-up lever for Take-up motion, it receives its motion from a bracket and pin D fixed to the slay sword. F. take-up lever catch. G. retaining catch. H. I. J. K a train of wheels (the take-up motion) they are connected with the roller L and L drives the cloth roller M by frictional contact. N. warp beam. P. beam weight.

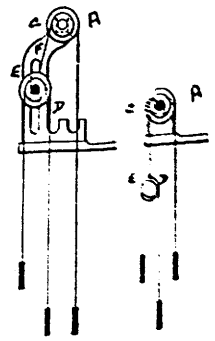
Shedding and Top rollers.

Tappets are used for working the healds when making plain cloth 398 illustrates the motion: the two healds are connected at the top by means of straps to the top roller A; this roller carries two bowls. the strap from the back heald passes round the larger bowl and the strap from the front heald round the smaller bowl. this arrangement enables the same size of shed to be made by both healds at a point in front of the shuttle. and. for the same reason the tappet working the back heald is made from $\frac{1}{8}$" to $\frac{1}{4}$" larger than the tappet working the front heald. The tappets B act upon the treadles C and through the heald connections with the top rollers shown. the sinking of one heald causes the top roller to turn round and lift up the other heald. Tappets up to 5 or 6 shafts are placed underneath the loom with top roller arrangements to enable a sinking heald to bring up a rising one. 399 shows the arrangement for working a 3 end twill (Jean) 2 down 1 up: the top rollers in this motion and the others to follow are worked on the lever principle: B is a roller in a fixed bearing carrying two bowls A and C, the diameters are in the ratio of 2 to 1. the larger bowl is working the back heald; fixed to the smaller roller C is a strap which supports the swing roller D. the bowls on which F E bear a ratio to each other of 1 to 1 (a swing roller is not in a fixed bearing, it is free to move up or down a slot or groove provided for it, at the same time it is free to turn round when required). Treating the rollers as levers 400 we assuming that the back heald is lowered 3". A goes up 1½" and lifts the centre of B. C ½" and the front heald at the end of C is lifted 3". 401 illustrates the 4 end twill 3 down 1 up. A, is a roller in a fixed bearing. B and C swing rollers. 400 shows the arrangement when treated as levers.

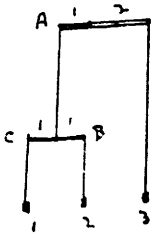


398

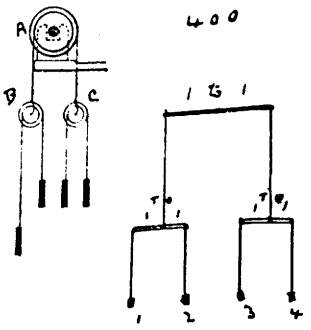
398a



399



400

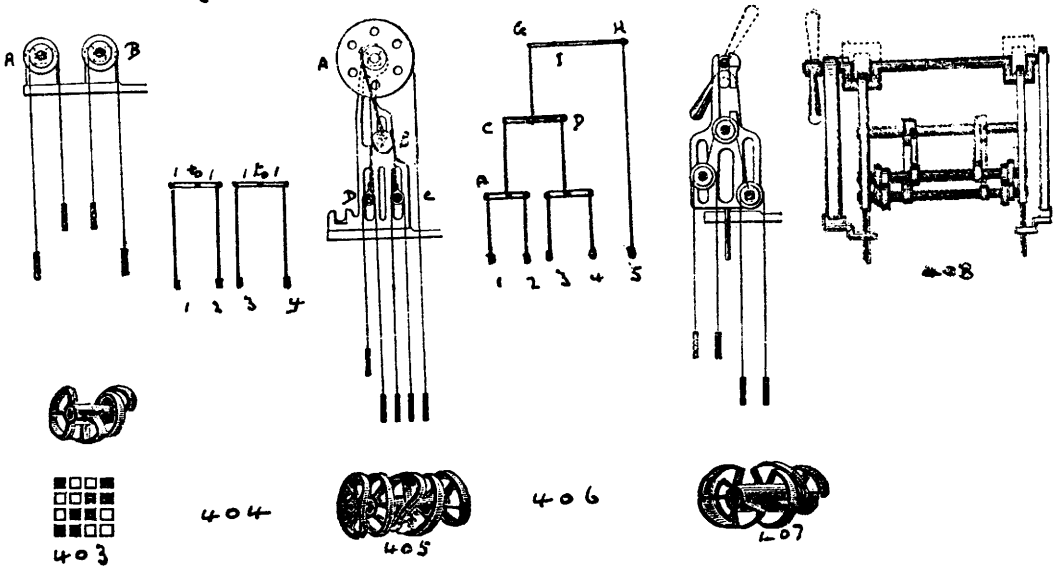


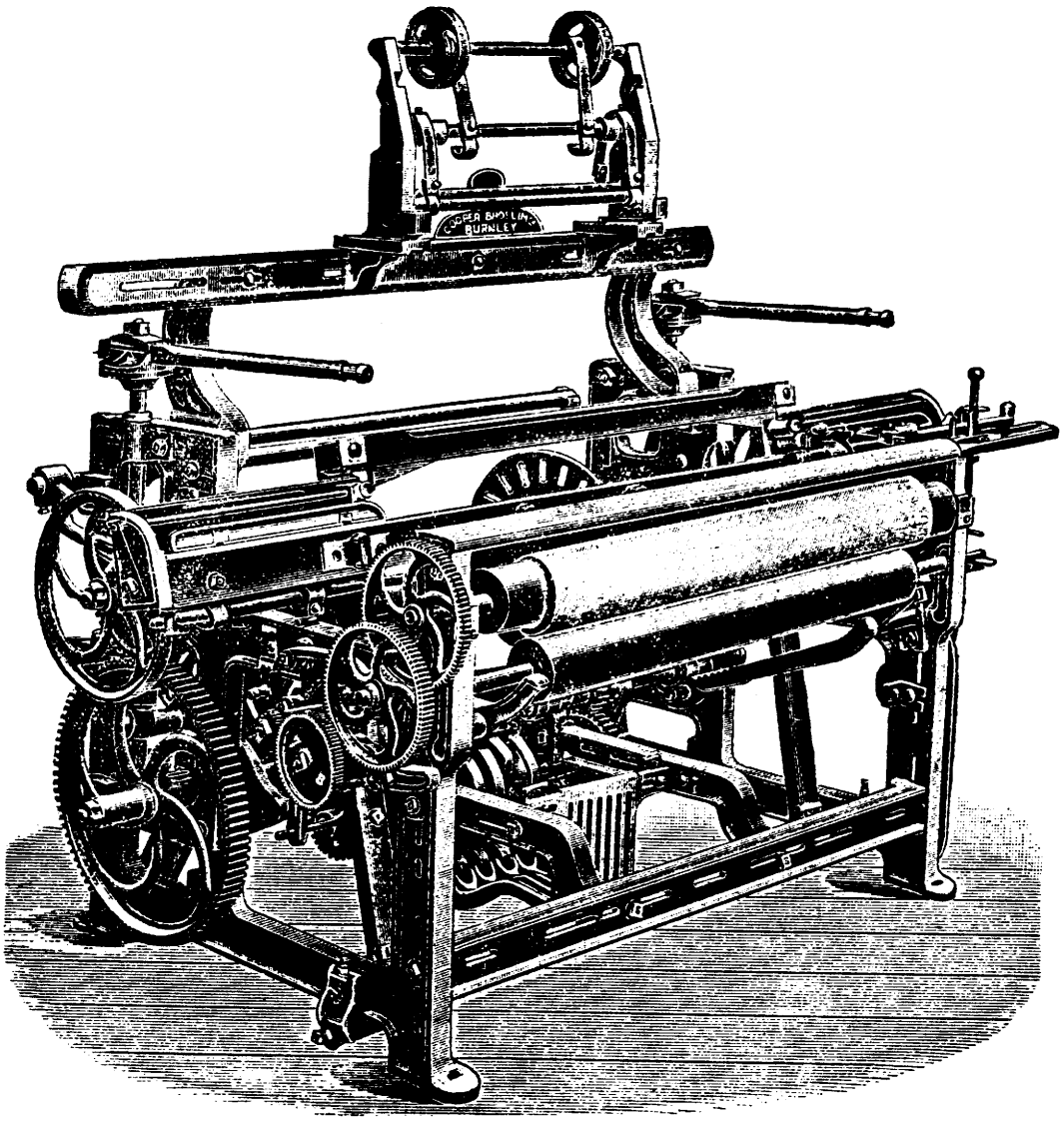
401

402

403 illustrates the 4 end twill 2 up 2 down on each pick. the two rollers A and B are in fixed bearings, the two healds from the same roller are never lifted or lowered at the same time. in the illustration the 1st and 3rd healds are down. the 2nd and 4th up, treated as levers the arrangement is shown in 404 these cloths are known as Double twills; Cashmere twills; Shalloon twills and 2 and 2 twills 405 illustrates the 5 end twill or 5 end Sateen 4 down 1 up on each pick; A. is a roller in a fixed bearing. B.C and D swing rollers. treated as levers their action is as follows 406 assuming that the 1st and 5th healds change their position. the 1st to go down 3" and the 5th to move upward the same distance. 2. 3 and 4 to remain stationary. A. comes down 3" and the middle of A 1½". bringing down C 1½". the middle of C. D. comes down ¾". bringing down G ¾" and moving on the fulcrum I. H takes up the back Reald 3".

407 shows top roller arrangement side view for four shafts; 408 front view with crank for levelling the healds when taking ends up.





409

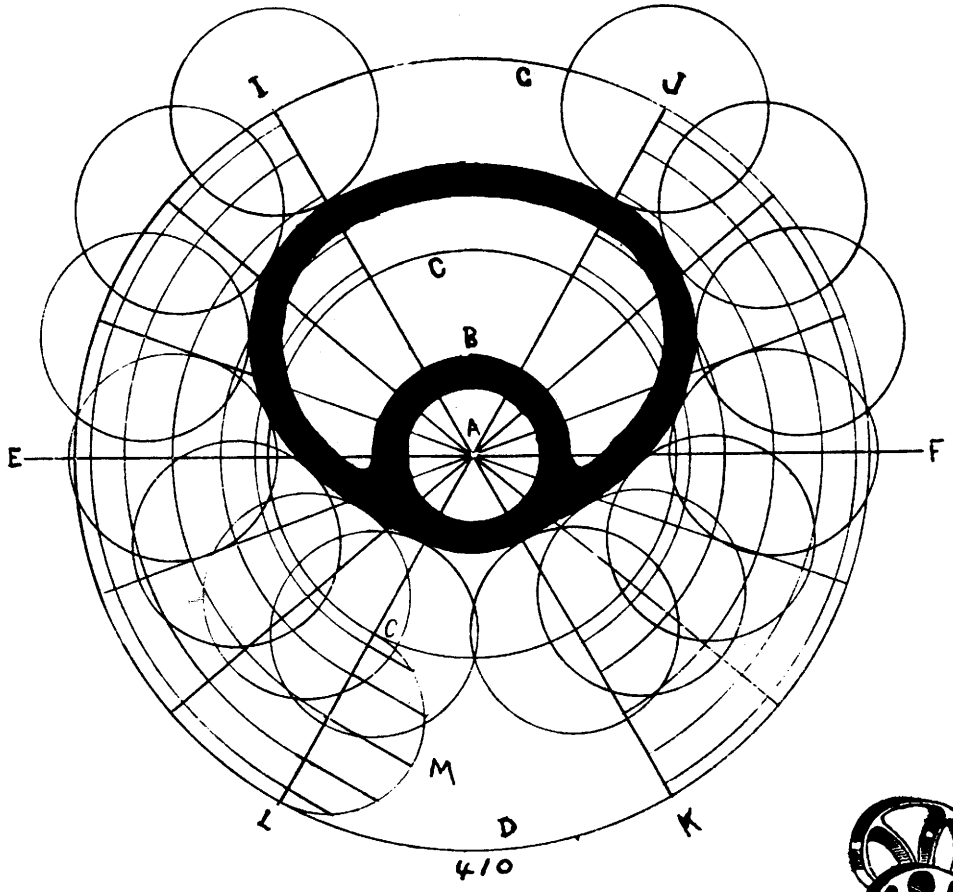
Twill Loom showing Top rollers arrangement for a 5 end Sateen or a 5 end Twill.

Shedding - Tappet Construction.

In the making of plain cloth, tappets are used for changing the position of the heald and forming the shed for the shuttle, these tappets are of such a shape, that they change the position of the healds slowly, then keep them stationary for a time sufficient to allow the shuttle to get into the opposite box; the length of time the healds are stationary is termed the dwell of the tappet, it varies from ½ to 1/3rd of a pick depending upon the width of the loom; in light running looms about 36" reed space it is generally ⅓rd of a pick.

410 shows how to construct a tappet to the particulars given. Let A equal the centre of the tappet shaft; at 1 inch from A describe the circle B, which equals nearest point of contact; at 1¼" from B, namely half the diameter of the treadle bowl, describe the circle C, which equals a line described by the centre of the treadle bowl as it revolves in contact with the nearest point of contact; at 2" from C, (the stroke of the tappet) describe the circle D, which equals a line described by the centre of the treadle bowl as it revolves in contact with the leaf of the tappet.

Let E.F. divide the circles into as many parts as there are picks to the round (repeat) namely 2. Divide each pick into three equal parts, the 1st pick is divided E I. I J. J F; the 2nd pick E L. L K. K F; the spaces I J and L K equals in the respective picks the dwell for one complete revolution of the tappet for two picks. Divide the space allowed for change on each side into 6 equal spaces, by means of lines from the centre; on the line L C describe the semicircle M, divide M into 6 equal parts and drop straight lines on to the line L C and describe arcs of circles shown from A as a centre. On the line I J describe circles 2½" dia. (treadle bowl) the inner edges of which gives the thick line for the "dwell" of the tappet. To obtain the shape for the change, at the points where the lines from the centre and the arcs of circles cut each other describe circles 2½" dia. the inner edges of these circles gives the thick line for change



scale ½ inch = 1 inch.

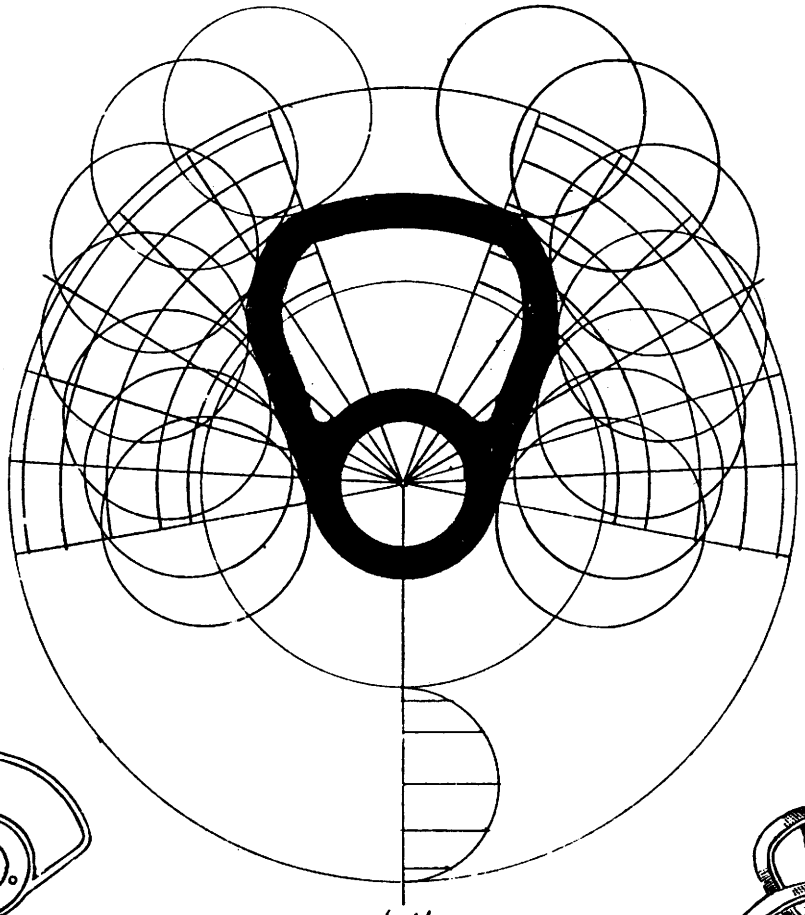
Particulars for construction. Plain Tappet 1 up 1 down.

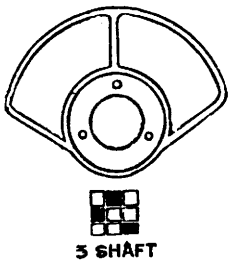
(1) Nearest point of contact with centre of tappet shaft = 1 inch generally written briefly N.P.C.

(2) Size of treadle bowl 2½" diameter. T.B.

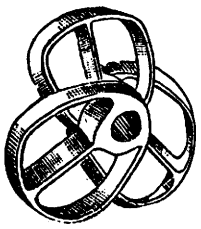
(3) Stroke of tappet 2" (this equals the distance through which the treadle bowl is moved)

(4) Dwell one third of a pick.



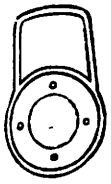


3 SHAFT

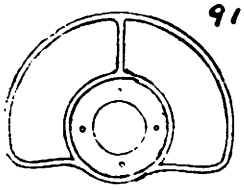


Scale ½" = 1 inch.

Particulars for construction: 3 end twill, 1 down 2 up.
Tappet under loom.
nearest point of contact = 1 inch
Size of treadle bowl 2½" dia.
Stroke of tappet 2 inches. Dwell ⅓ of a pick.



4 SHAFT



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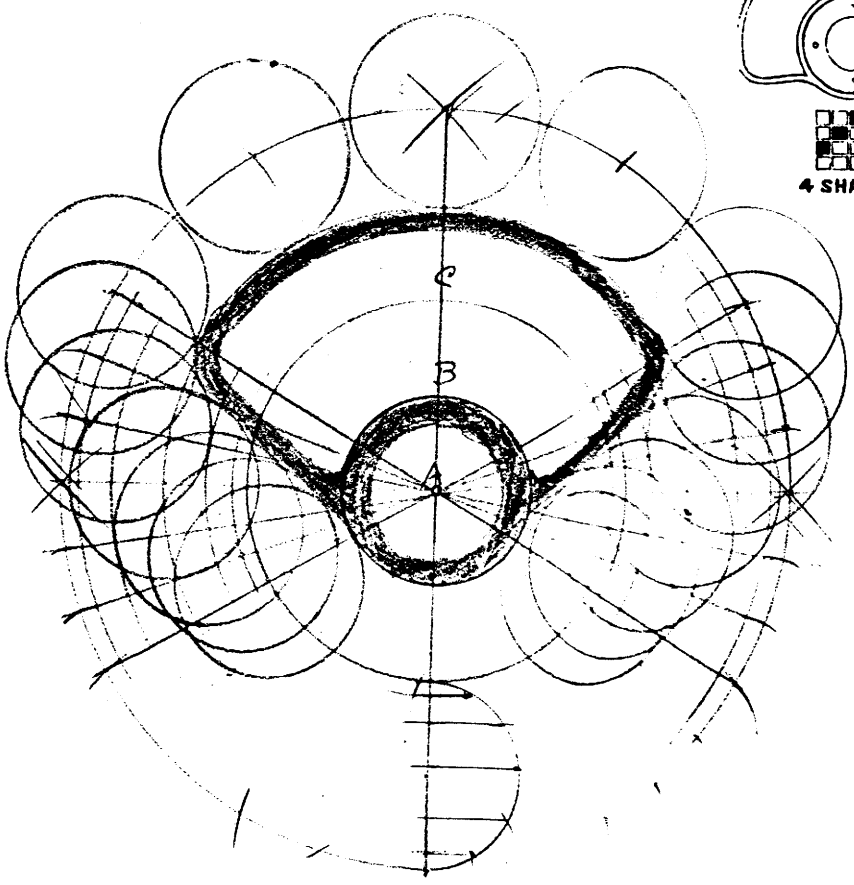
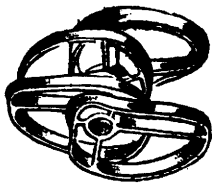


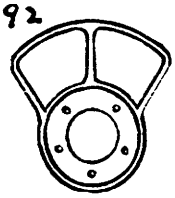
412

Construct a tappet to the following particulars.
Tappet under the loom. 2 up 2 down.
Nearest point of contact 1". Treadle bowl 2" dia.
Stroke of tappet 2". Dwell $\frac{1}{3}$rd of a pick.



Scale $\frac{1}{2}$" = 1 inch.

92



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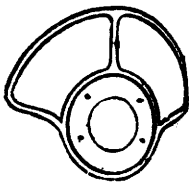

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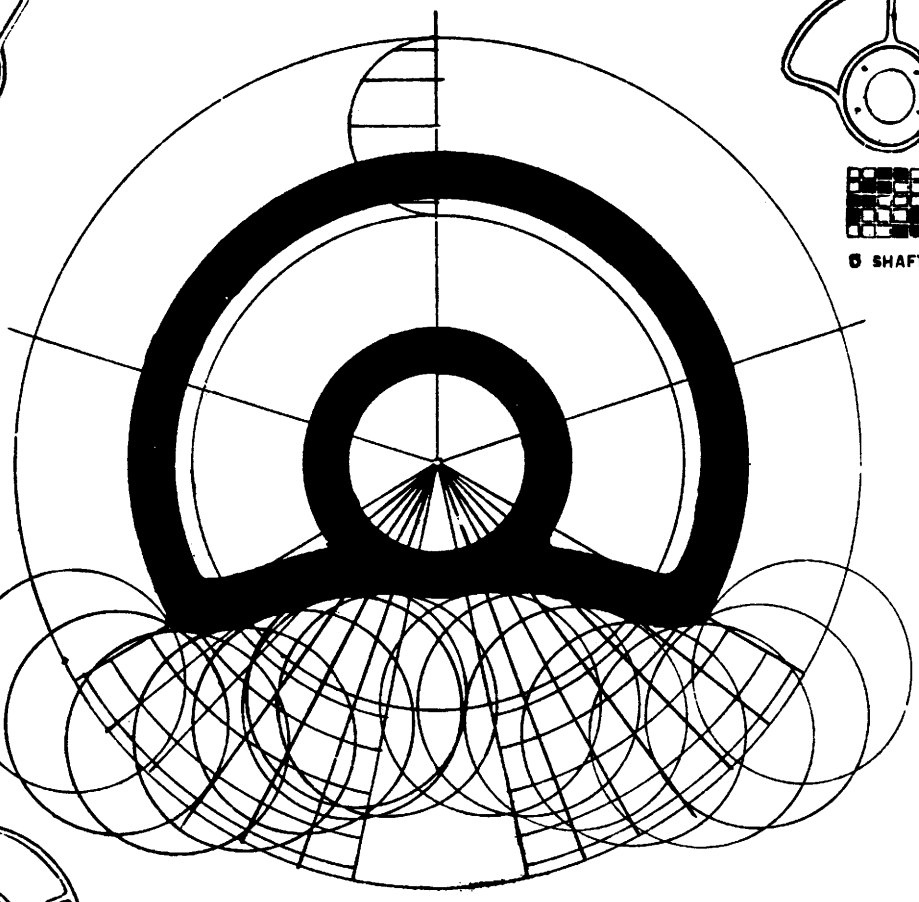
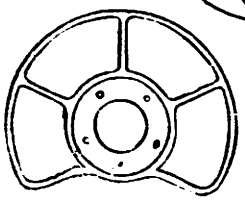


413



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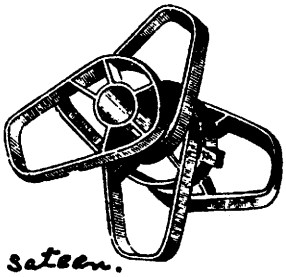
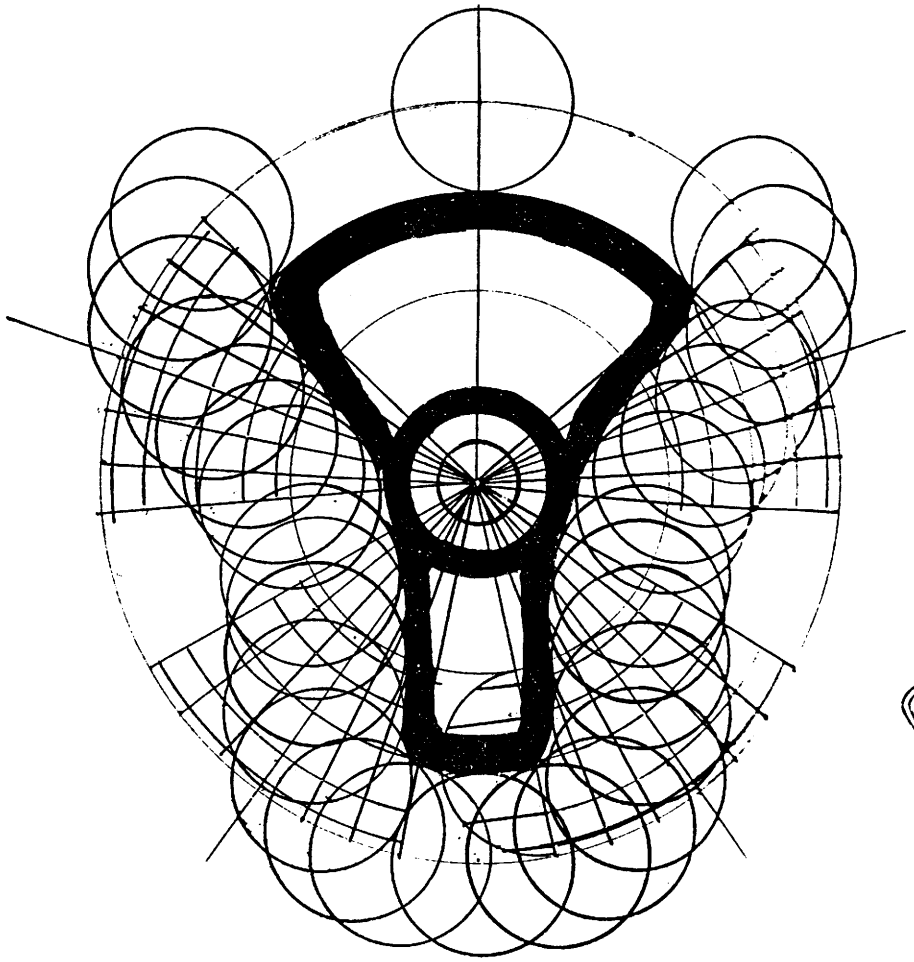
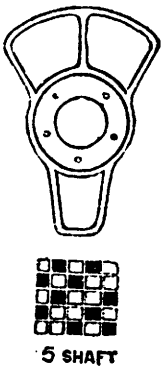


Scale ½" = 1 inch.

Particulars for construction. 6 end sateen.
Tappet under loom. 4 down 1 up.
nearest point of contact 1½". Treadle bowl 2½" dia.
Stroke 2". Dwell ⅓rd of a pick



414



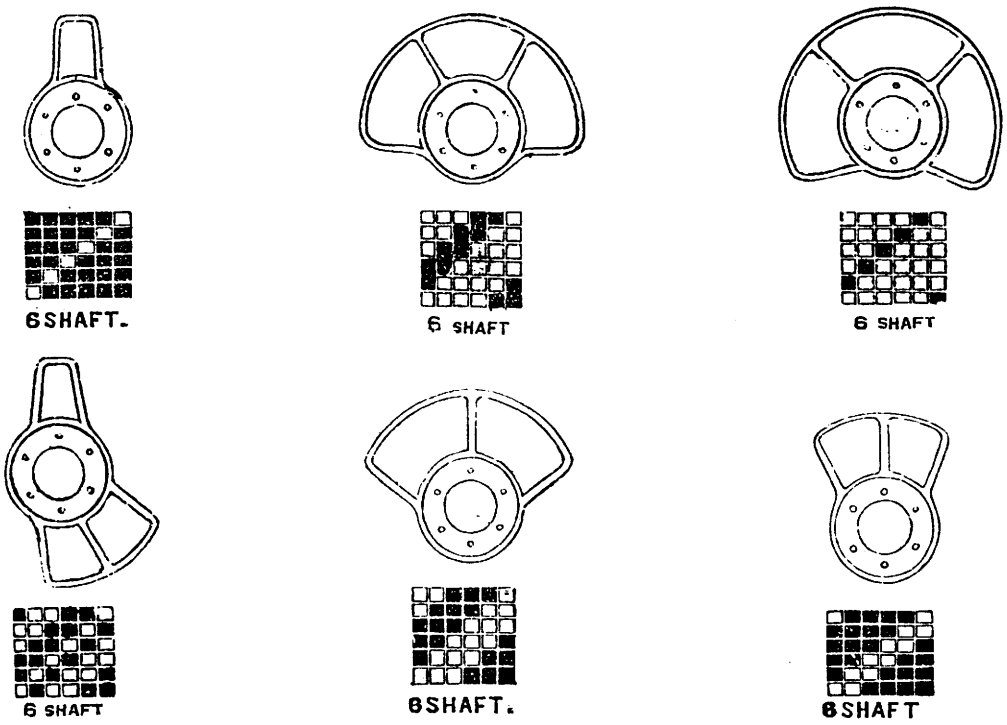
5 SHAFT

Scale ½" = 1 inch.

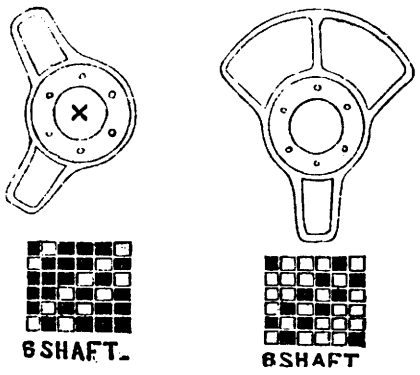
The above tappet for a 5 end twill, tappet under loom. the pattern is shown in the margin, is constructed to the following particulars

nearest point of contact 1"

Treadle bowl 2" dia. Stroke 2". Dwell ⅓ of a pick.



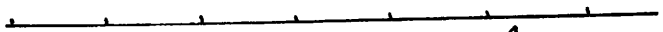
4 15



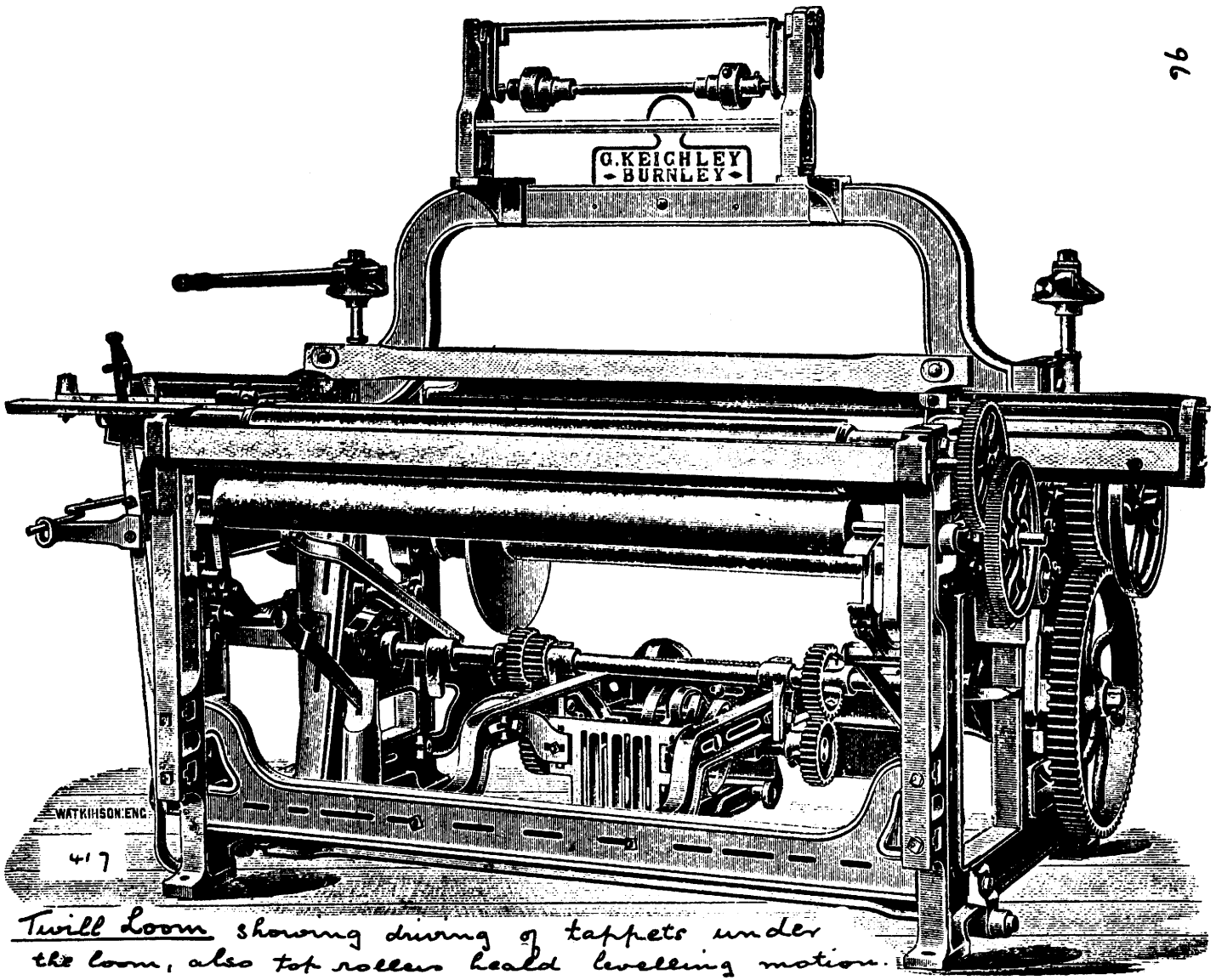
On this page are given a number of tappets for six shafts. the pattern in each case is for the tappet working under the loom.
Six shaft tappets are generally at side of loom.

4/6

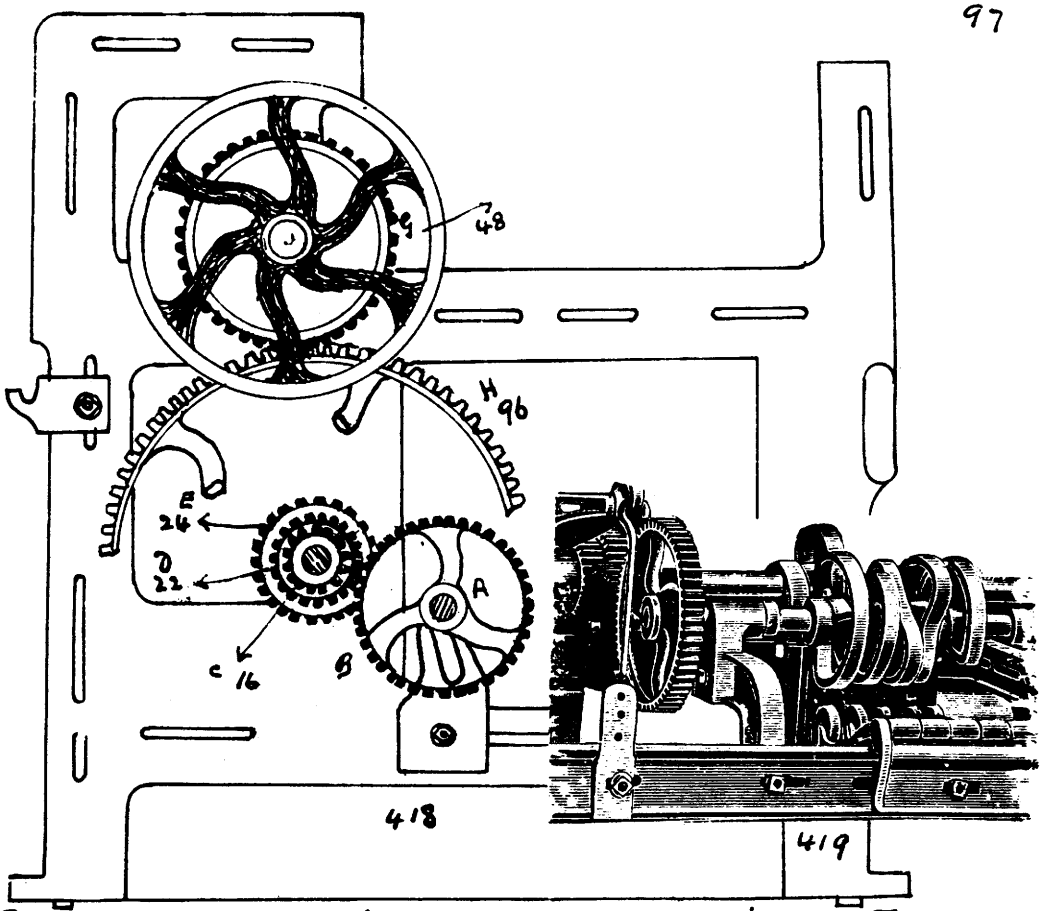
Construct a tappet to the following particulars
Six shafts; Pattern 3 up 1 down 1 up 1 down.
Tappet under the loom.
nearest point of contact 1". Treadle bowl 2" dia.
Stroke 2". Dwell $\frac{1}{3}^{rd}$ of a pick.
A sketch of the tappet required is shown at X
page 94



Scale $\frac{1}{2}$" = 1 inch.



Twill Loom showing driving of tappets under the loom, also top rollers heald levelling motion.



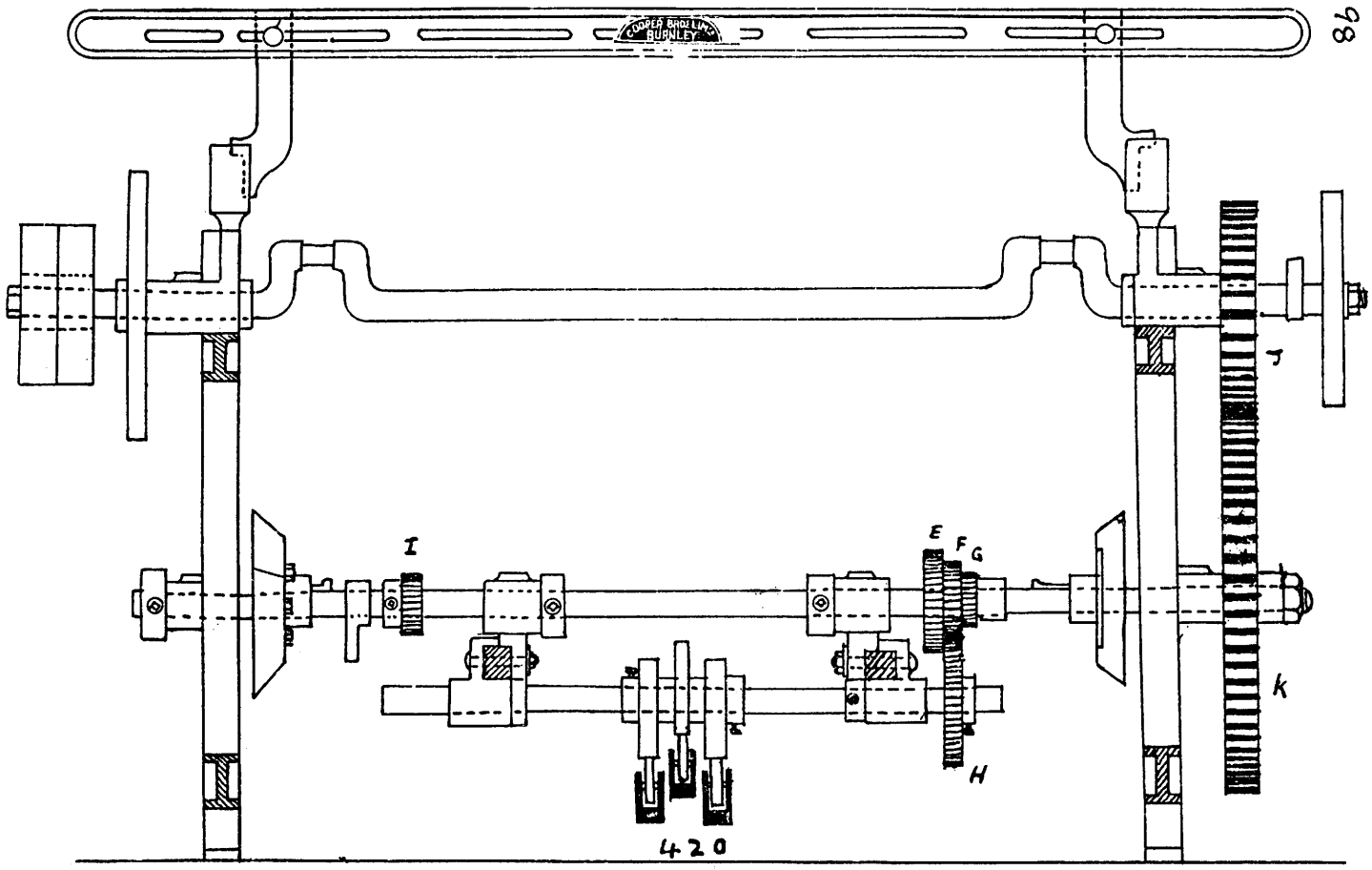
Tappets under the loom. Driving and Speed of Tappets.

When the tappets are fixed underneath the loom as illustrated in 417. 418. 419. 420 they are attached to a Counter shaft A (see 418) at the end of this shaft is a wheel B, which is driven by one of three wheels C. D. E fixed on the bottom shaft of the loom. the number of teeth in the wheels are respectively C 16. D 22. E 24. these three wheels are cast in one piece. G 48. H 96 teeth. The wheel B is changed to drive the tappet at the required speed. Thus on the principle of driving and driven wheels.

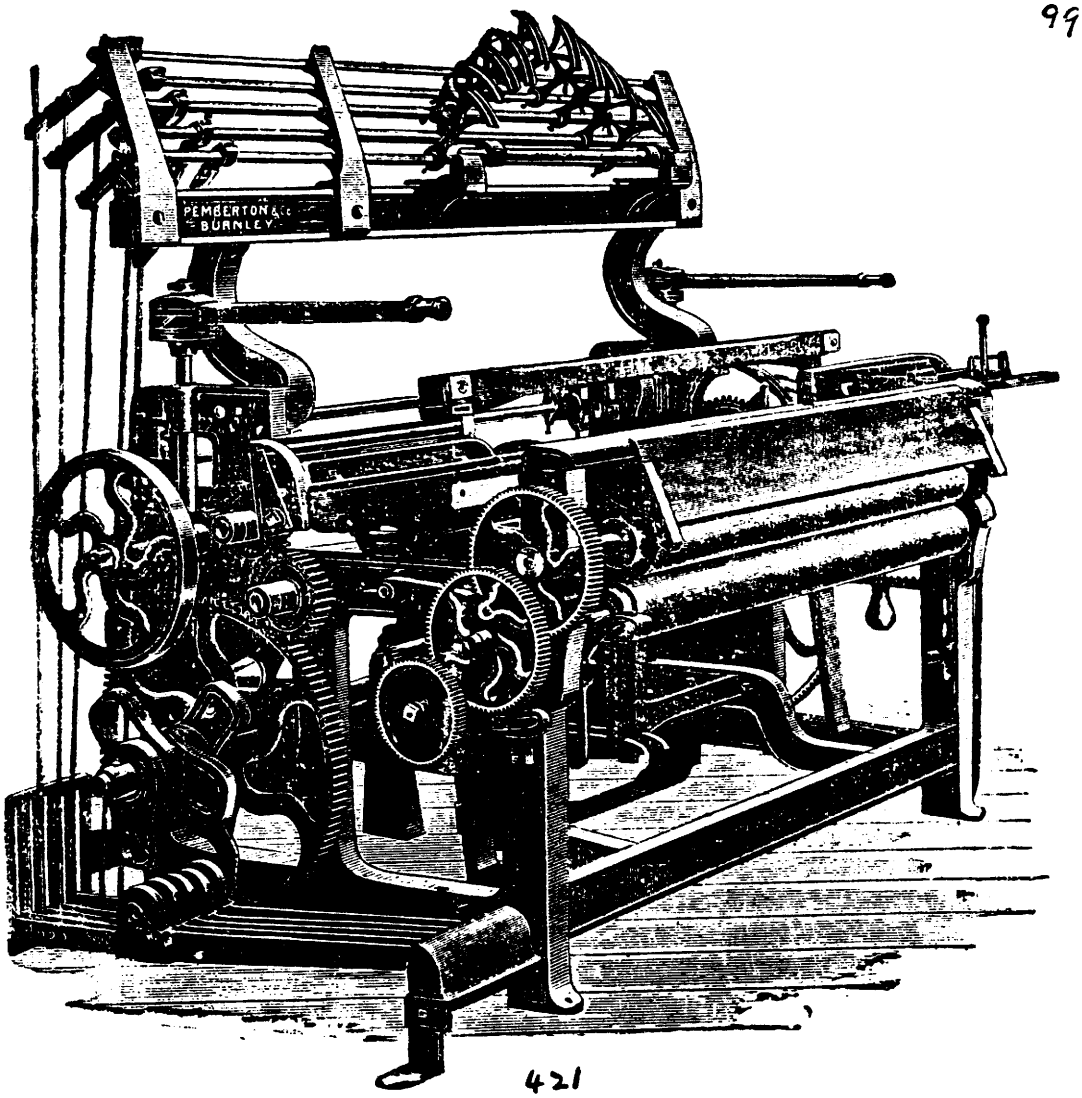
For 3 Picks to the round $\frac{3 \times 48 \times 24}{96} = 36$ wheel B

For 4 Picks to the round $\frac{4 \times 48 \times 22}{96} = 44$ wheel B

For 5 Picks to the round $\frac{5 \times 48 \times 16}{96} = 40$ wheel B.

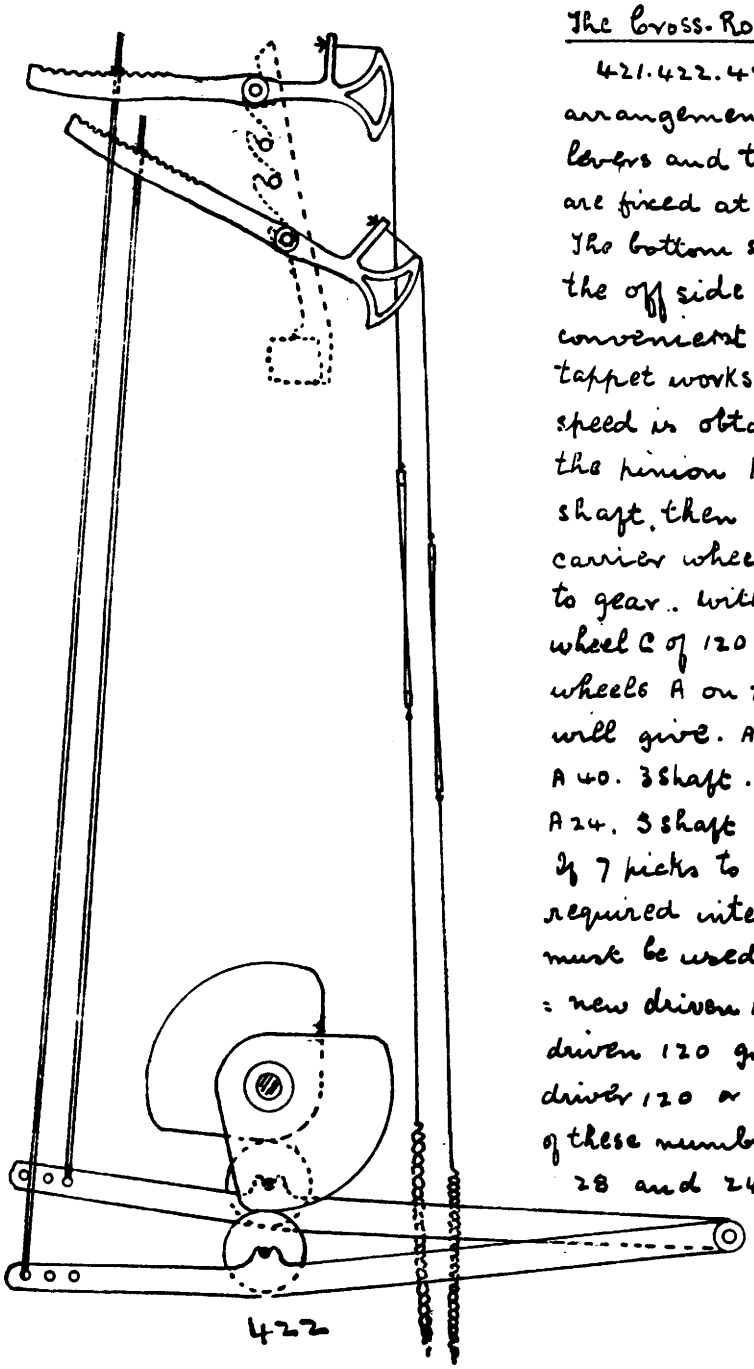


420 Gives a general drawing of loom with tappets underneath. The wheels are E 30 teeth for 2 shafts: F 24 teeth for 3 shafts; G 20 teeth for 4 shafts: I 16 teeth for 5 shafts. The wheel H can be obtained for each drive as shown on page 97. J. 48 and K 96 teeth.



421

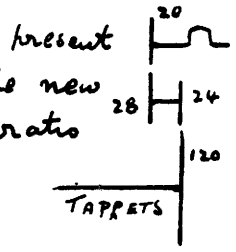
421. Cross-rod or Yorkshire Loom, showing the arrangement of levers and treadles and method of driving the tappets when fixed at the side of the loom.

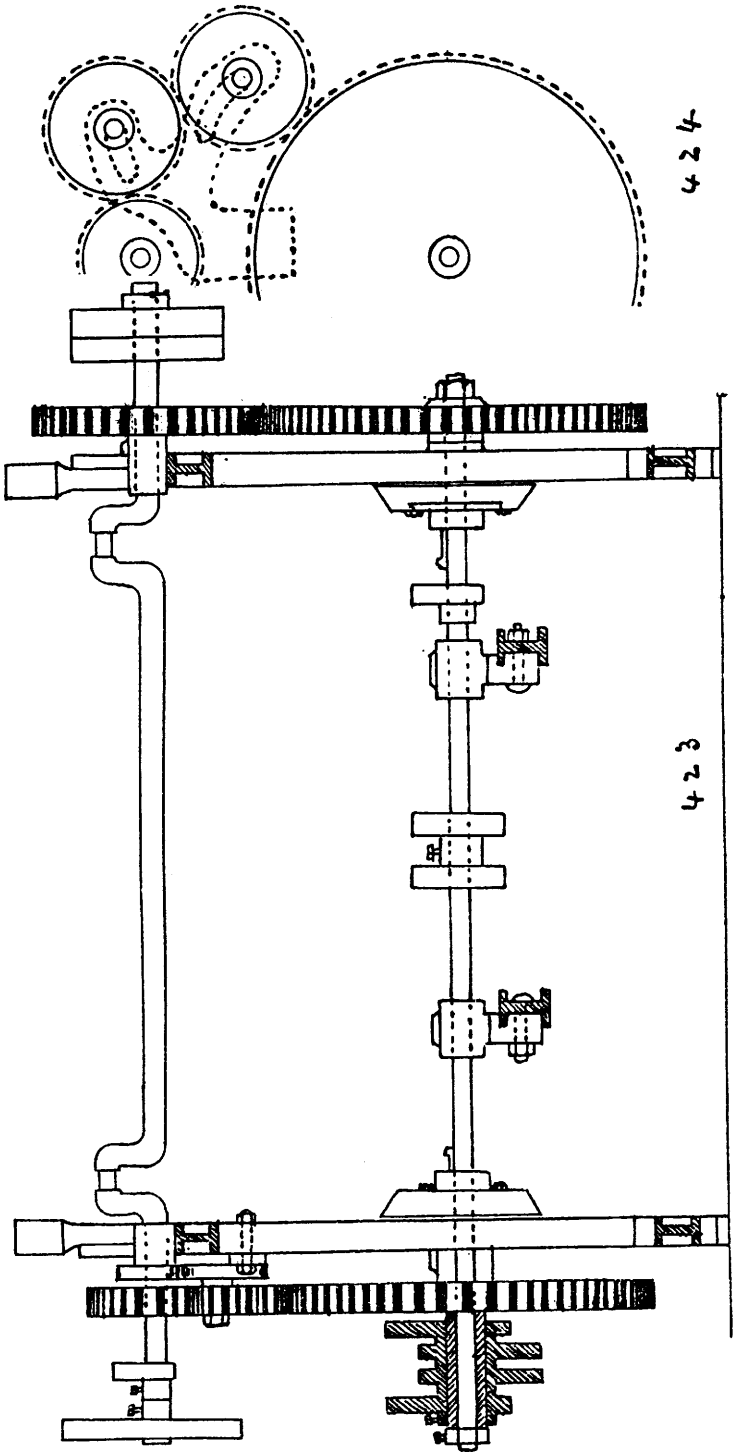


422

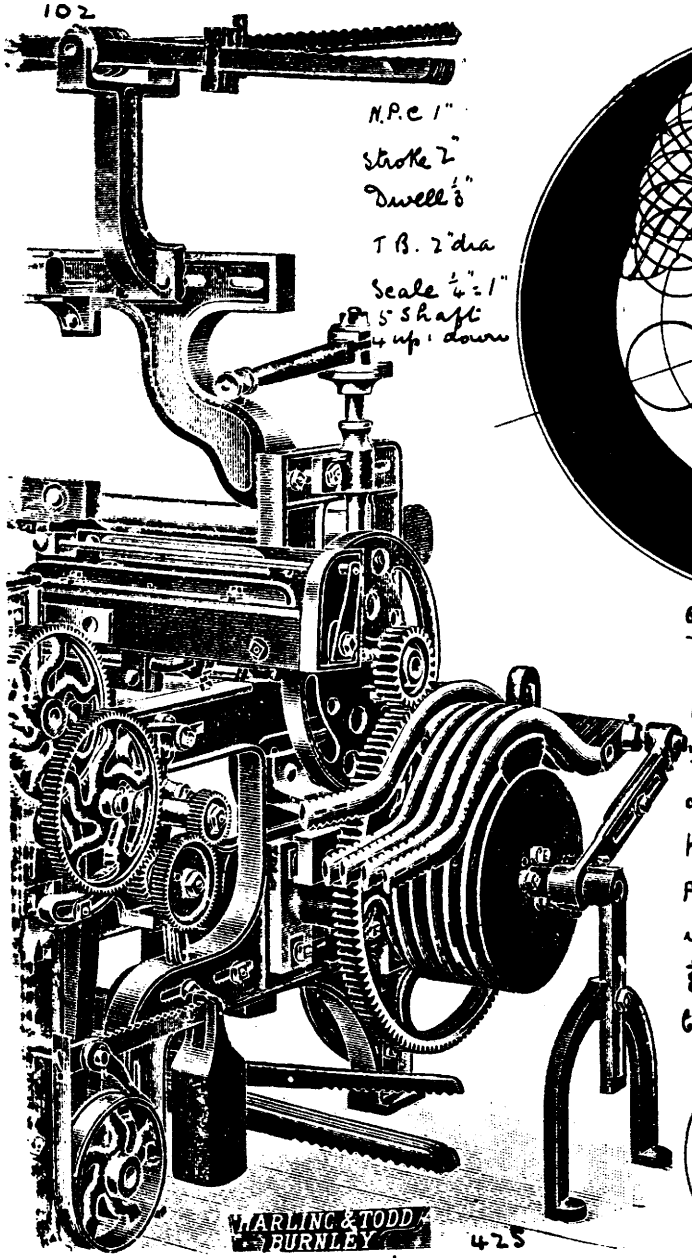
The Cross-Rod or Yorkshire Loom.

421.422.423 illustrates the arrangement of the driving levers and treadles when the tappet are fixed at the side of the loom. The bottom shaft is extended on the off side and serves as a convenient stud on which the tappet works. The proper rate of speed is obtained by changing the pinion A. fixed to the crank shaft, then introducing a carrier wheel B, to enable A and C to gear. with a constant tappet wheel C of 120 teeth, the following wheels A on the crank shaft will give. A 60. 2 shaft Plain A 40. 3 shaft. A 30. 4 shafts A 24. 5 shaft A 20. 6 shafts. If 7 picks to the round are required intermediate wheels must be used, thus 7×20 = new driven 140. the present driven 120 gives the new driver 120 or any ratio of these numbers say 28 and 24.



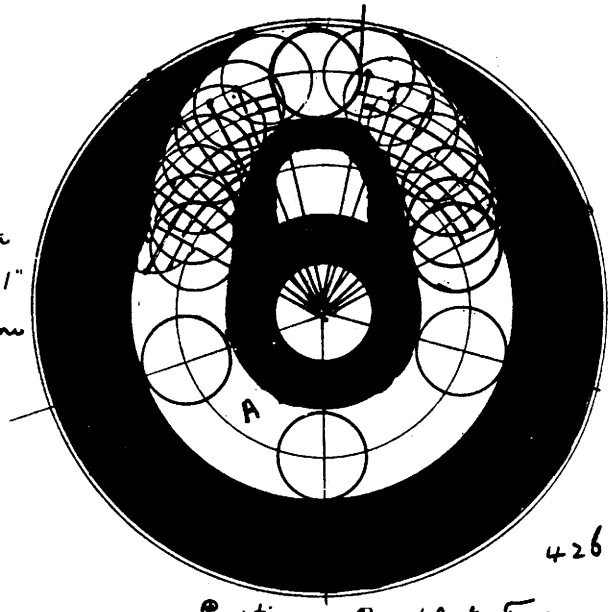


423.424 Gives a general drawing of a loom with tappets at the side of the loom.



425

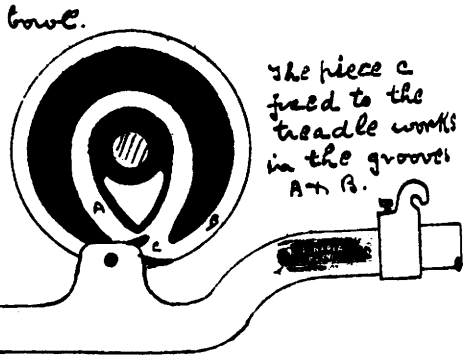
N.P.C 1"
Stroke 2"
Dwell ⅛"
T.B. 2" dia
Scale ¼" = 1"
5" shaft
4 up. down



426

Positive or Boxplate Tappets

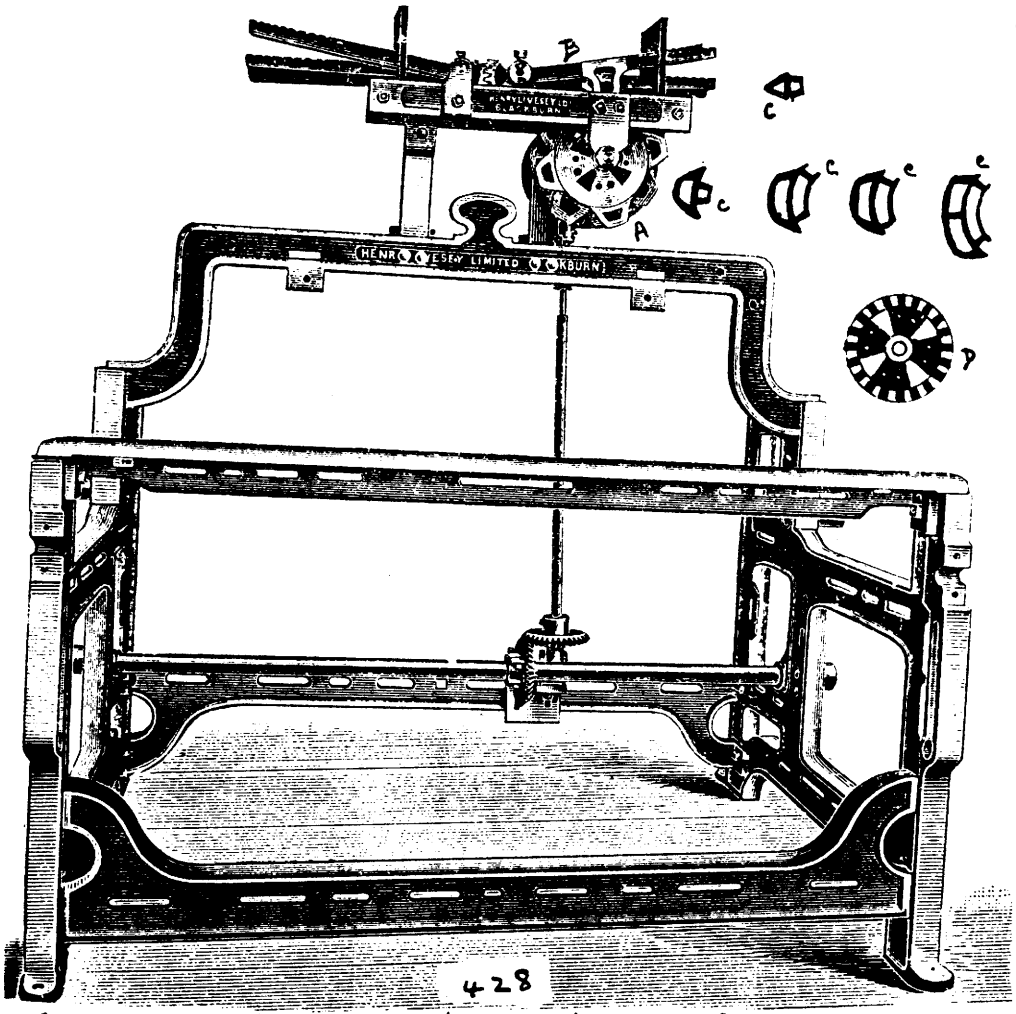
425. 426 control the healds both in rising and falling. They are constructed the same as a negative tappet, but made positive by forming a groove A in which the treadle bowl works. the working T. Bowl is ⅛" less in dia. than construction bowl.



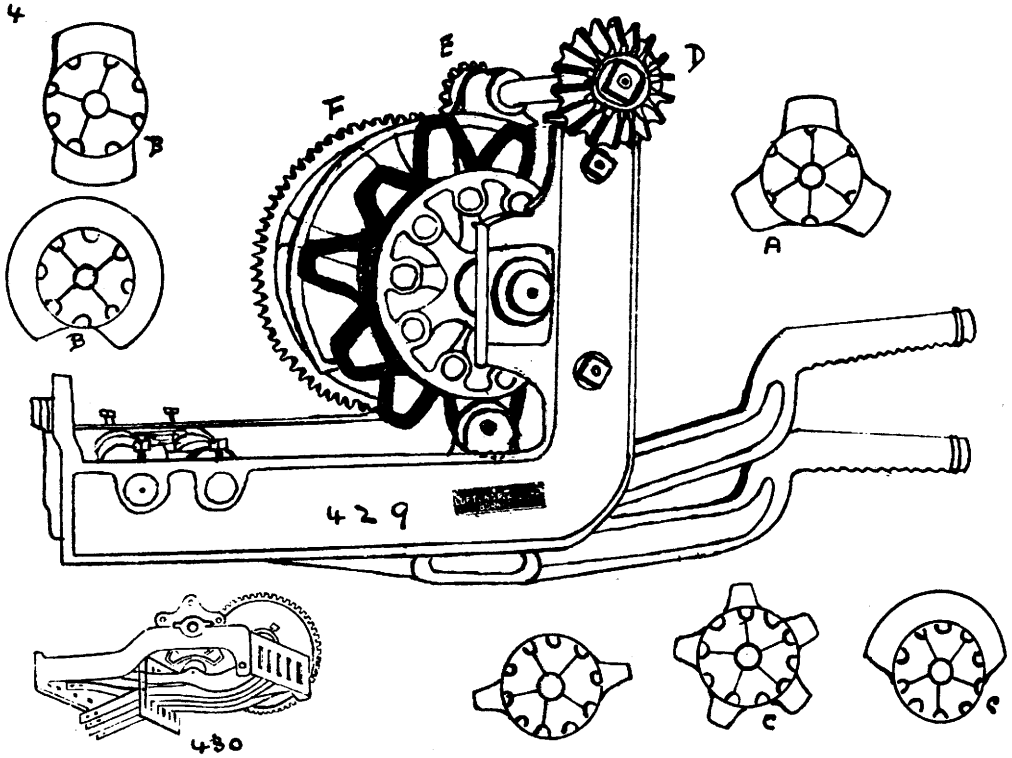
The piece C fixed to the treadle works in the groove A to B.

427

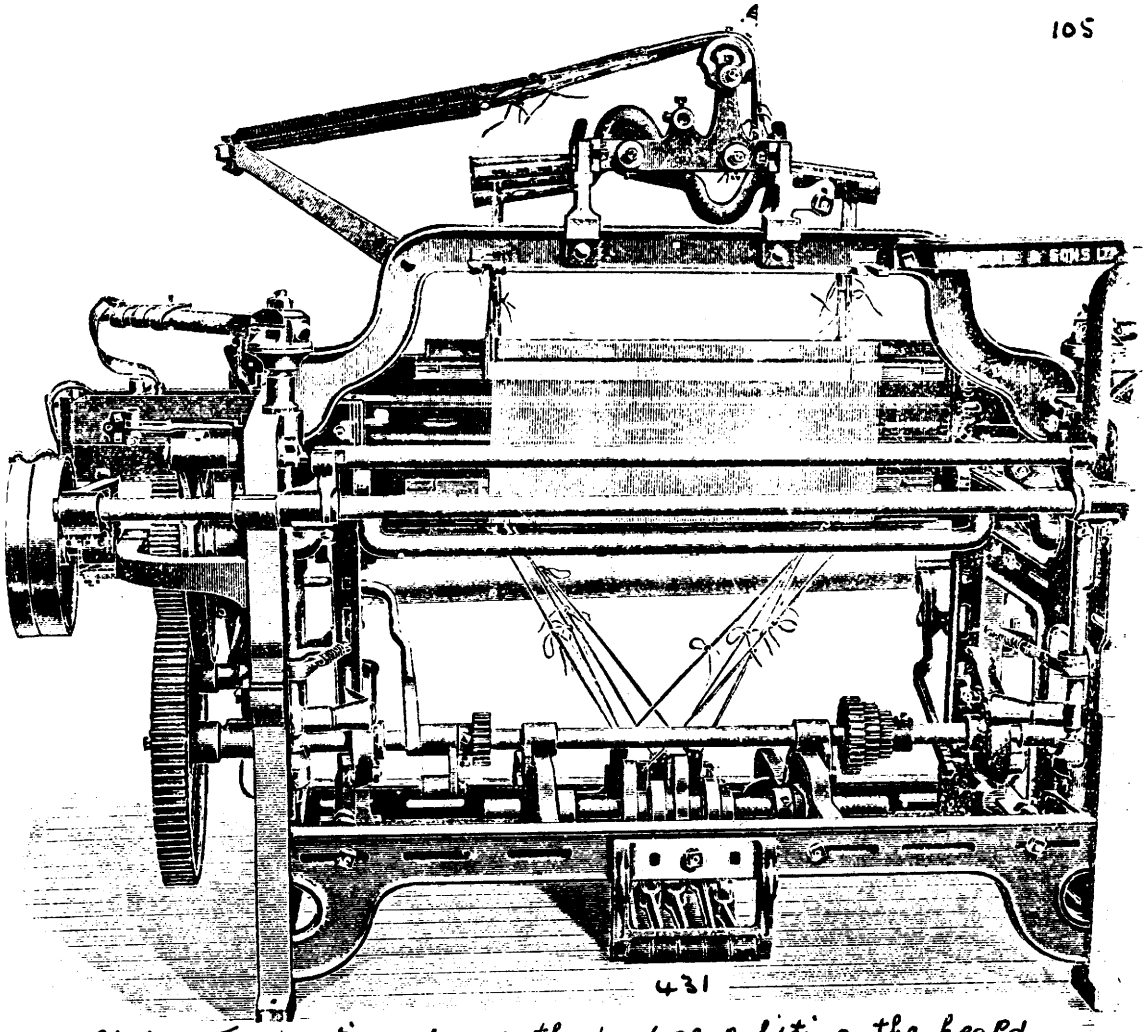
Scroll Tappet 427 for making Stitches 3 to 4 and 4 or 5 and 5



Jepson's and Smalley's tappet is of the barrel type 428 and works on the top of the loom, the tappets A are fixed to the loom top. Short treadles B are arranged above them to these the healds are attached, by means of small plates or rings C secured to plates D, any order of lifting of the healds may be obtained. To the lower part of the heald spiral springs are attached to pull them down, after being lifted. These tappets are used for making the lighter makes of Jeans, Drills, Sateens, and other similiar weaves.

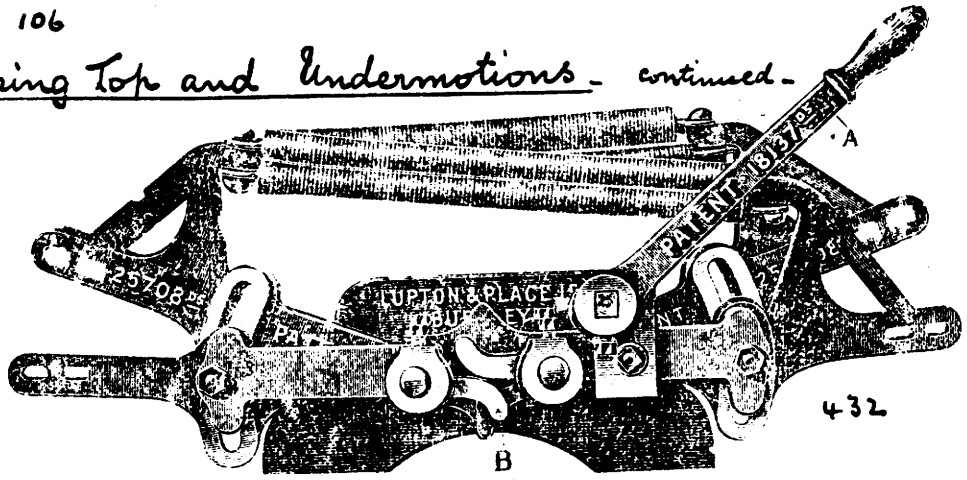


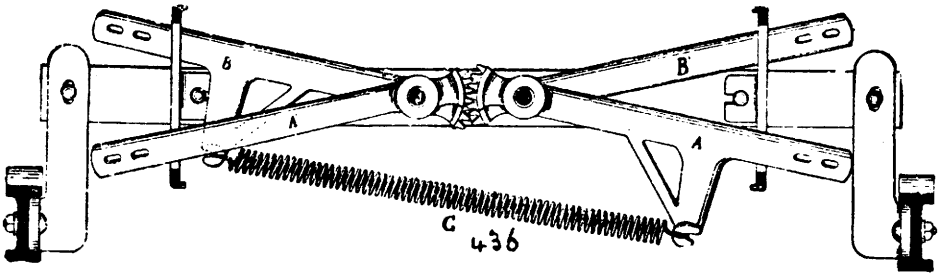
Jamiesons' Barrel Tappet 429 and 430 is fixed underneath the loom, it is made up of tappet plates. A. B and C. the tappet plates are bolted together side by side to suit the various patterns required and are driven at the required speed as shown in 429 A bevel wheel on the bottom shaft of the loom drives a bevel wheel D fixed on the end of a short shaft, to the other end of the shaft a small pinion E is fixed which drives the tappet wheel F at the required speed. Treadles are arranged beneath the tappet and the free ends of the treadles are attached by cords to the underside of the healds. Spring top motions are used to act in the opposite direction. A useful tappet for light fancy cloths which do not require a Dobby.

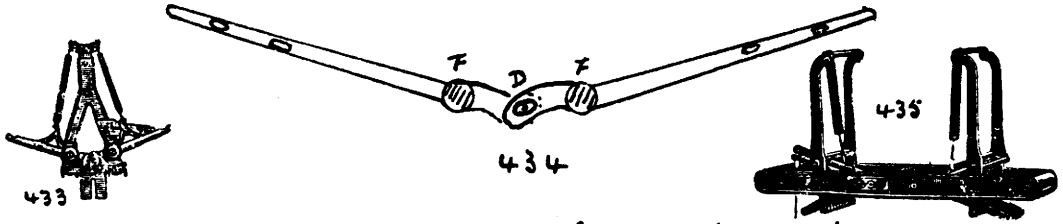


Spring Top motions serve the purpose of lifting the heald after the same has been pulled down by a tappet, many arrangements are in use 431. 432. 433. 434. 435 In many of these motions the spring is stretched a distance equal to the pull of the heald. In 431 "tip over cams" A are used. the advantage of this arrangement is that the spring is only stretched half the distance of the heald movement. the "tip over cam" A doing the other half. for as soon as the cam gets to the centre, the harder the pull the easier it goes

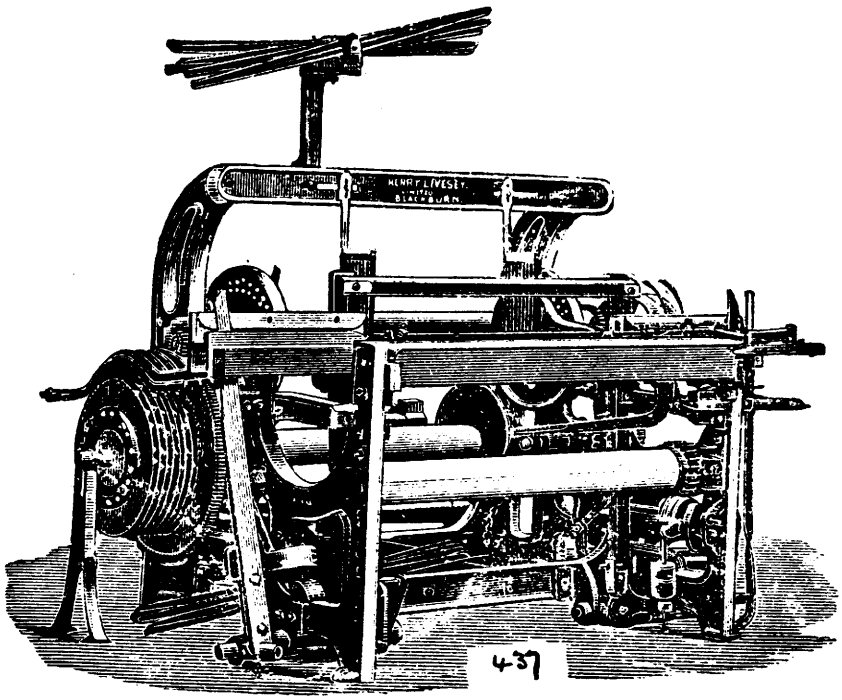
Spring Top and Undermotions - continued -





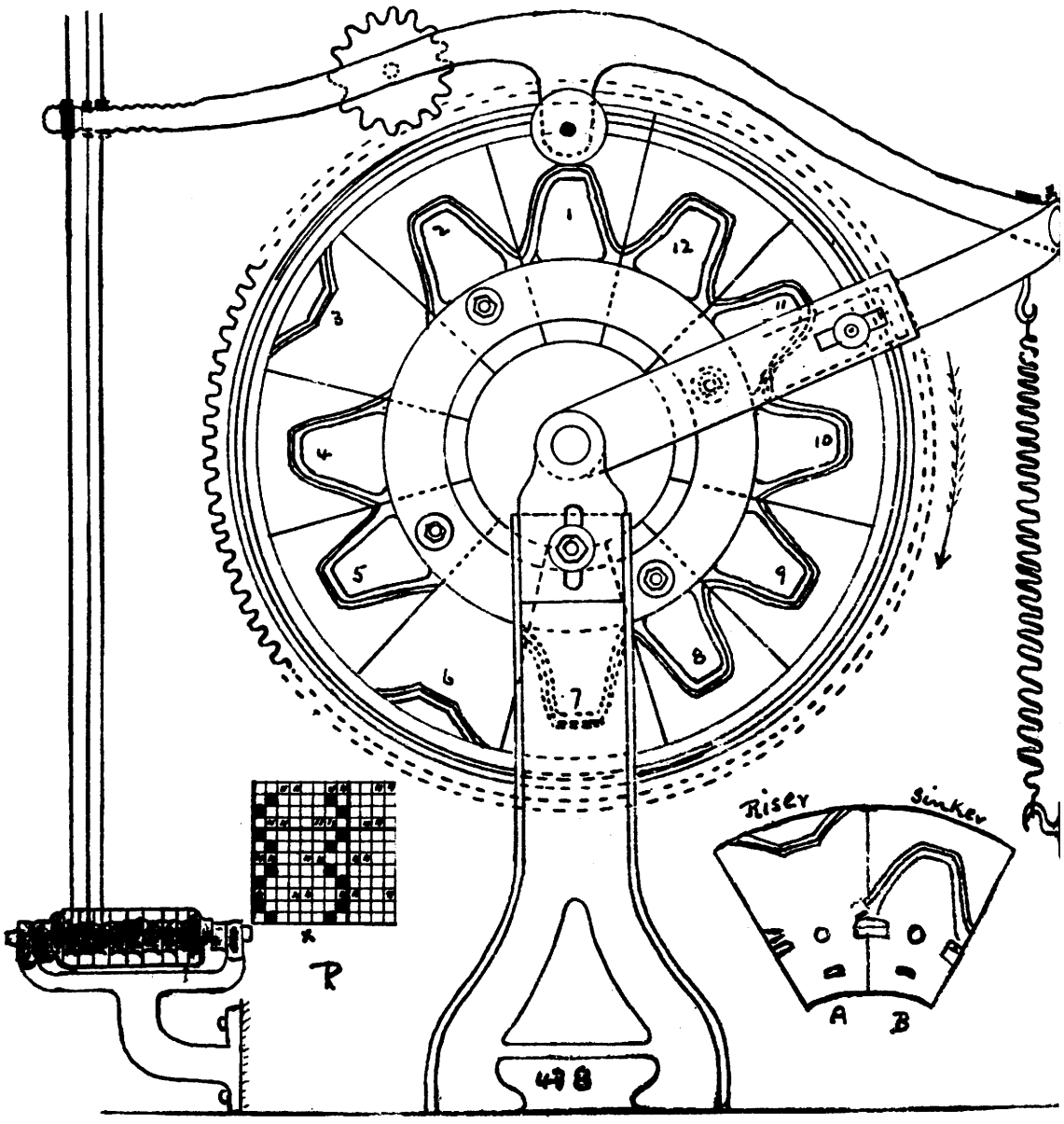


432 This spring top motion has been designed to work in conjunction with Plain, Jeans, Drills, Twills and Sateen Tappets and to serve all purposes now served by a Cross-rod loom. One spring serves for two healds and where the levers are working in contact as at B, teeth have been done away with and the bearing surfaces form a rolling contact with friction and wear practically eliminated. A, is a heald levelling motion for bringing all the healds level when taking ends up
433 434 435 are other types of spring top motions in 434 no teeth are used a slot and pin D serve the same purpose.
436 Gives an Undermotion, one spring serves for two healds.

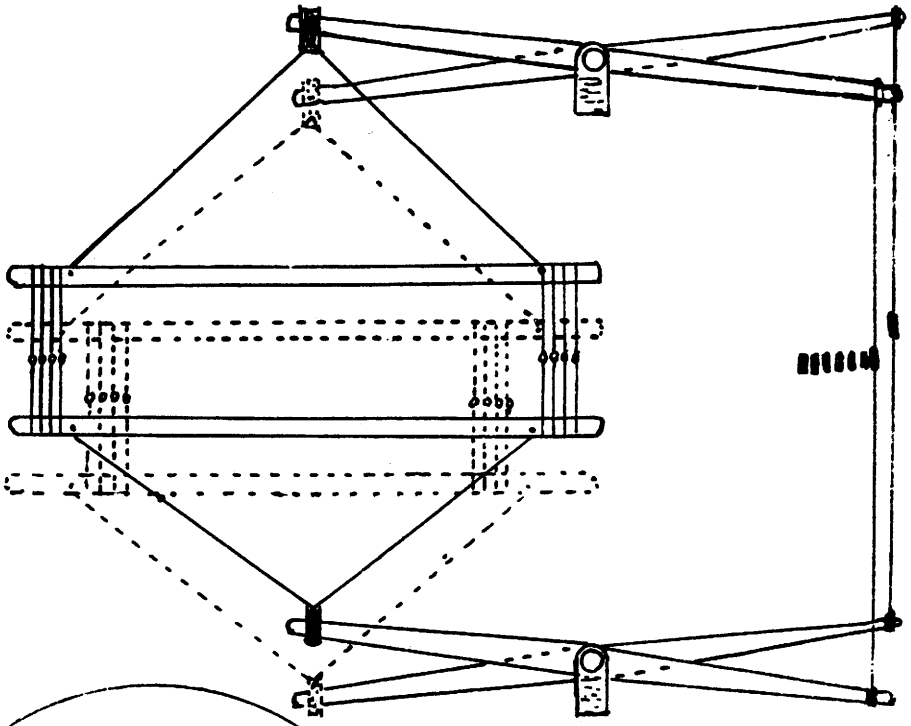


437

The Woodcroft Section Tappet is a strong, positive, centre shedding motion used for Fustians, Corduroys, Velvets, moleskins and other similiar cloths. A loom fitted with a woodcroft tappet is shown in 437 and detailed drawings are given in 438, 439. The tappets are made up of sections termed Risers" and Sinkers, there are built up to suit the pattern required and are secured to ring plates and the tappet wheel, the tappet wheel is driven at the required speed from a wheel fixed on the end of the crank shaft of the loom. The risers and sinkers, see A, B acting upon treadles causes them to rise and fall. this motion is communicated through cords, see 439 to long levers fixed at the top and the underside of the loom, the other ends of the levers are connected to the headds and gives motion to them.

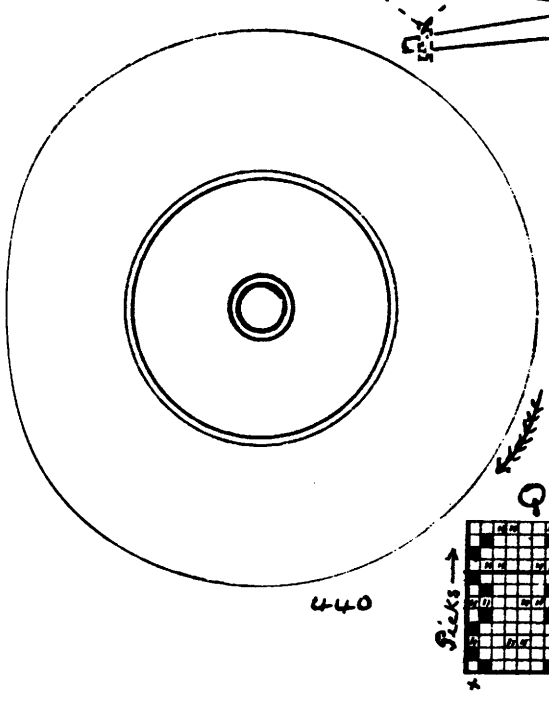


438 shows how a Woodcroft tappet is built up to suit one end of given pattern, namely x in pattern P.



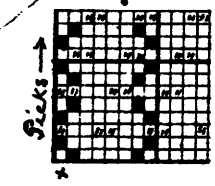
439

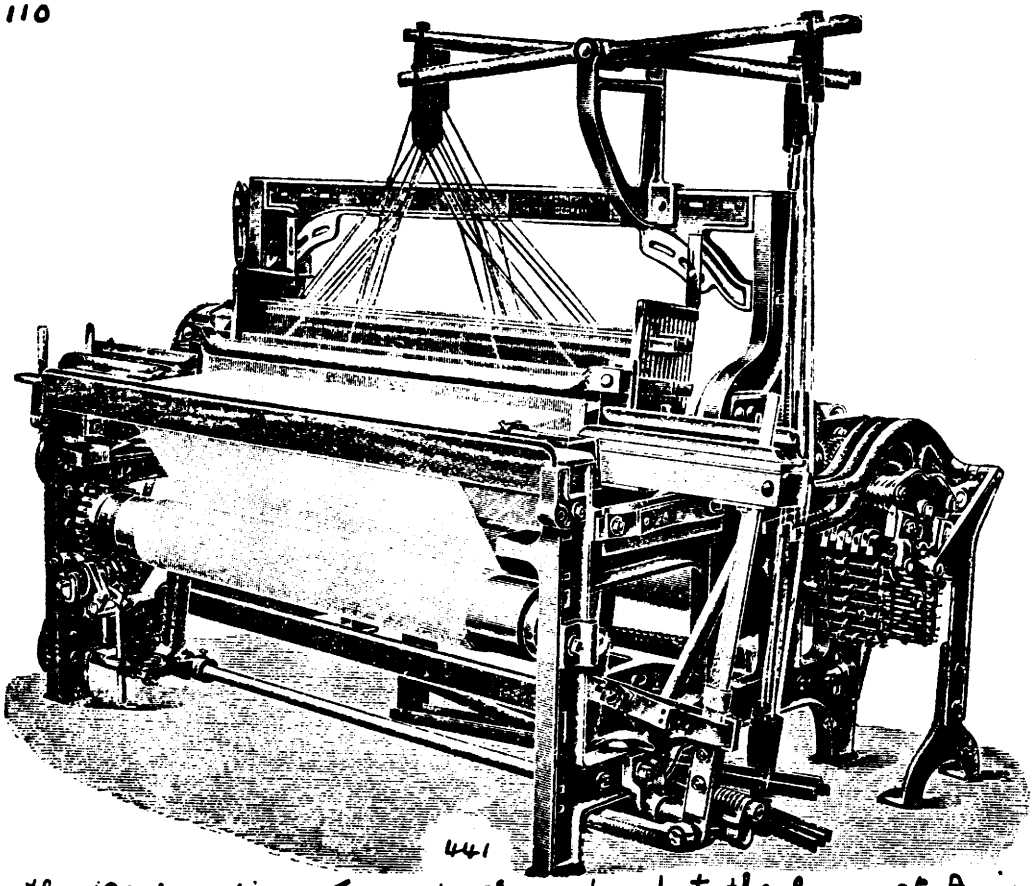
In 438 the tappet is built up to suit the thread marked with a x in pattern P. On 440 build up a tappet with "risers" and "Sinkers" to suit the thread marked with a cross in pattern Q



440

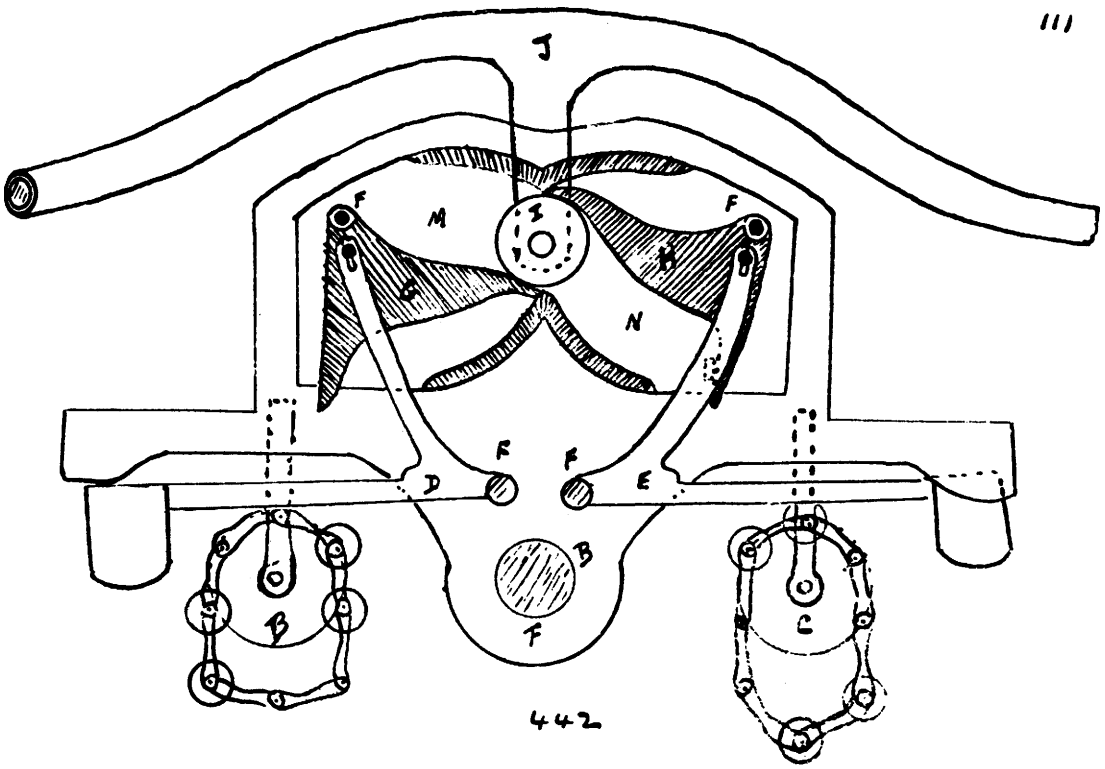
Q



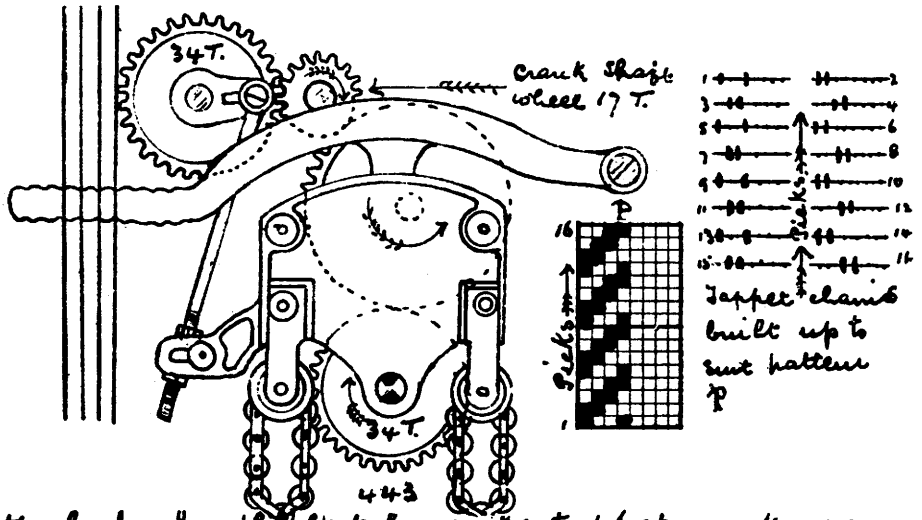


441

The Oscilleating Tappet. shown fixed to the loom at A in 441 and in detail in 442 and 443 is a useful tappet for a heavy cloth. it is more readily changed than the Woodcroft tappet. it is fixed at the side of the loom and receives an oscillating motion from wheel gearing and a crank as shown in 443. Referring to 442 B is the fulcrum on which the whole tappets rocks from side to side: beneath the two levers D and E are two cylinders B and C, each carrying a lattice made up of bowls and blanks; D and E are connected to the loose plates G. H and bowls or blanks of the lattice raise or lower G and H, in the sketch the bowl on C has lifted the plate H: I is a small bowl fixed to the treadle J. to the other end of this treadle the head



442



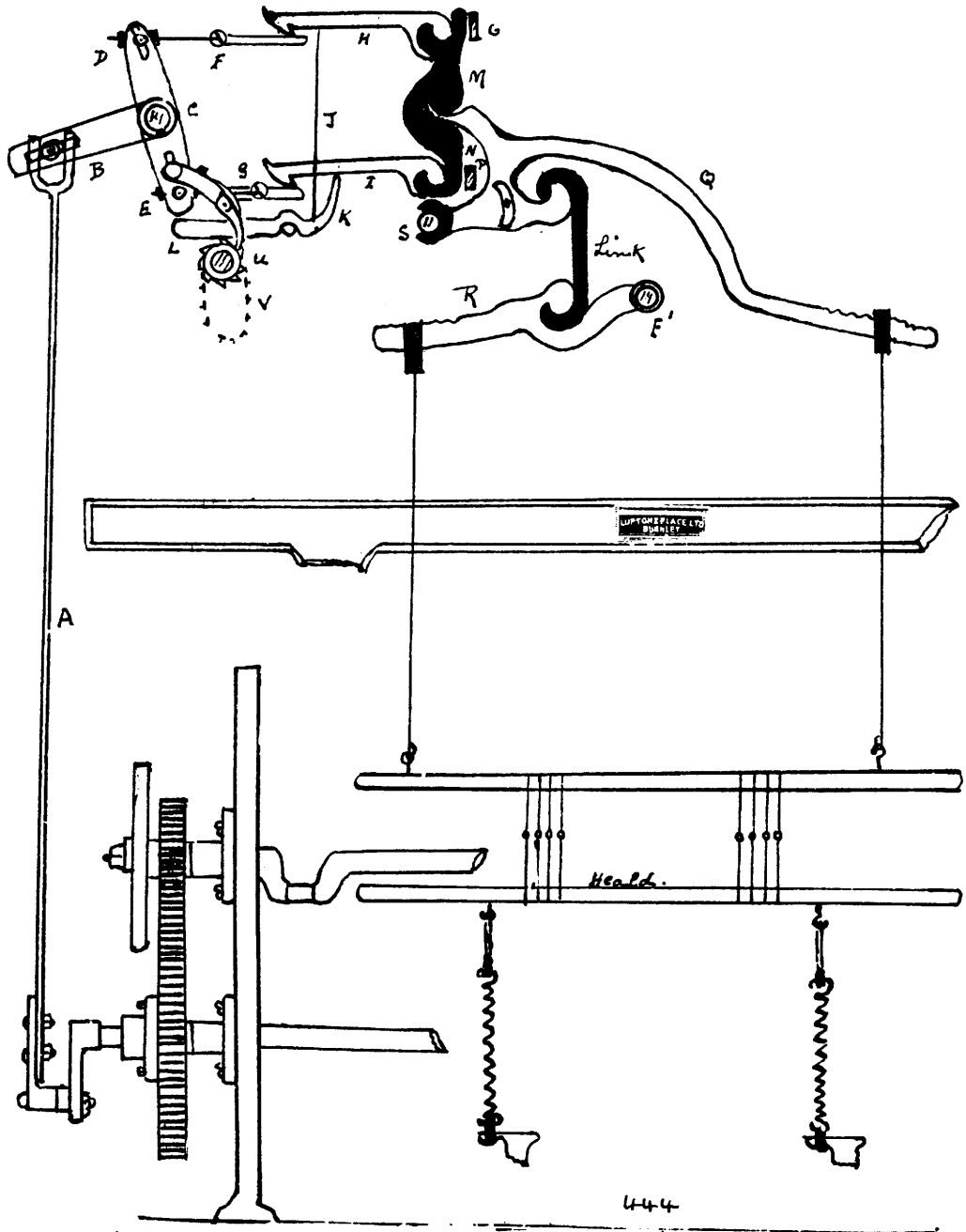
443

cords are attached. In the sketch if the tappet rocks over to the right the treadle bowl moves up the incline M and a heald is lowered. if it rocks to the left it moves down the groove or incline N and a heald is lifted.

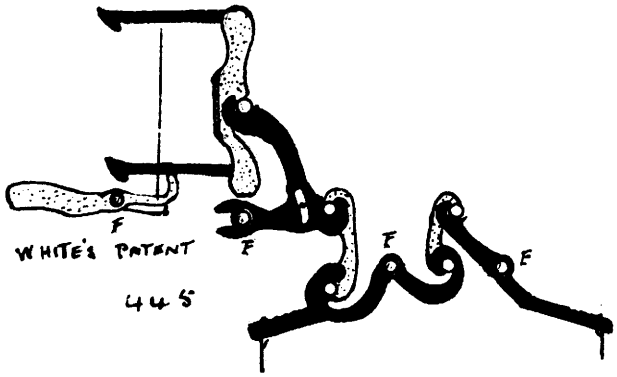
The Dobby machine.

The type of Dobby in most common use in Lancashire and Yorkshire. is the Keighley type of dobby: patented by Hattersley and Smith in 1868. Since the patent expired. nearly all loom makers have a special construction of this machine. Some machinists have made dobbies a speciality. notably Lupton & Place Ltd. Burnley. The dobby machine is a shedding motion. used for conveniently working the healds up to 24 shafts or for Dhooty borders up to 40. By the aid of pegs placed in a revolving lattice any heald can be selected and raised by the machine. a peg indicating a heald up and a blank a heald down. 444 illustrates the working parts of the machine, A. is a rod worked from a crank fixed on the end of the bottom shaft of the loom: A is attached to B with arms E. D working on the fulcrum C: to the ends of E and D are sliding knives F and G working in the grooves of the framing of the machine: resting over F and G are catches H and I. the ends of these are attached to the upright bar M. N: attached to M. N is the lever O with its fulcrum at S. this lever is connected by a link to the jack lever R. which carry the healds. L. is the barrel for carrying the pattern lattice V. it is constructed. so that 8 lags are required to go once round it. Resting on the topmost lag are a number of heavy ended levers L. just double the number of what there are levers O in the machine. the other ends of L. hold up catches H and I: the catch I is held up direct and H through the medium J: Y is a ratchet wheel fixed to the end of the barrel: T a pawl attached to E. its uses are to revolve the barrel one tooth every second pick.

Its action is as follows. if a lag is in gear without any pegs. all catches I and H are lifted out of the way of the sliding knives and no healds are lifted. if a lag is in gear with all the holes pegged all the healds are

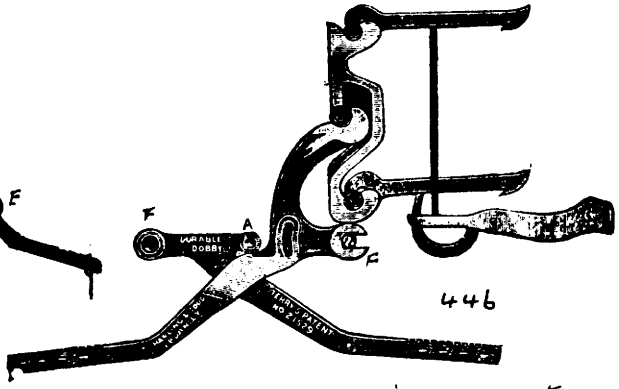


brought up on the next pick, so that by regging a lattice to suit a pattern, the healds are lifted to suit the pegs and blanks in the lattice



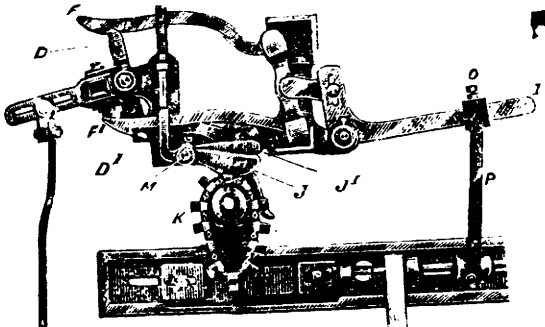
WHITE'S PATENT

445



446

Other types of lifting jack connections to give a straight and easy lift are shown in 445 and 446. F's give fulcrums of levers in each case.



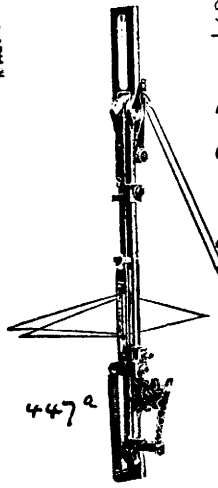
447

Fairbairn's patent. for Selvages. plain. Reps or twist. also for stitched. pegged like a dobby

Heald

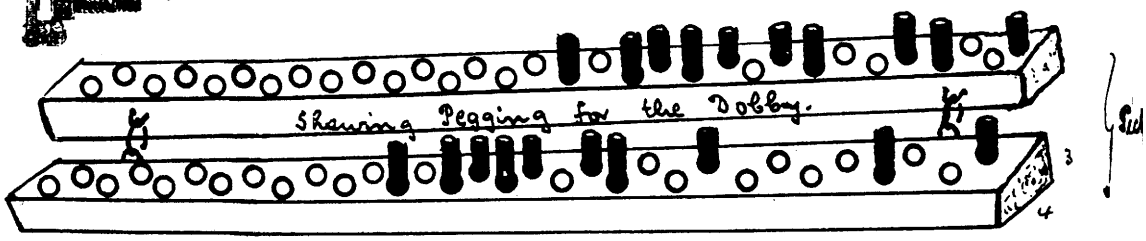
B

S F,F' catches
D,D' Knives . J,J' heavy ended levers centred at M. K pattern barrel.
6. Jack P. to top roller
Bottom shaft of loom.



447a

Fairbairn's patent Centre Selvage motion 447a is worked from the Sley cap of the loom. two fixed needles form one shed and the other shed is formed by the needles connected with the Sley cap. a side movement is given to one of the pair of needles to form the gauze crossing



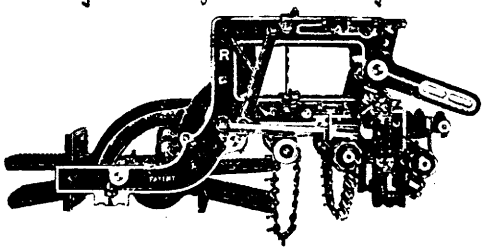
Shewing Pegging for the Dobby.

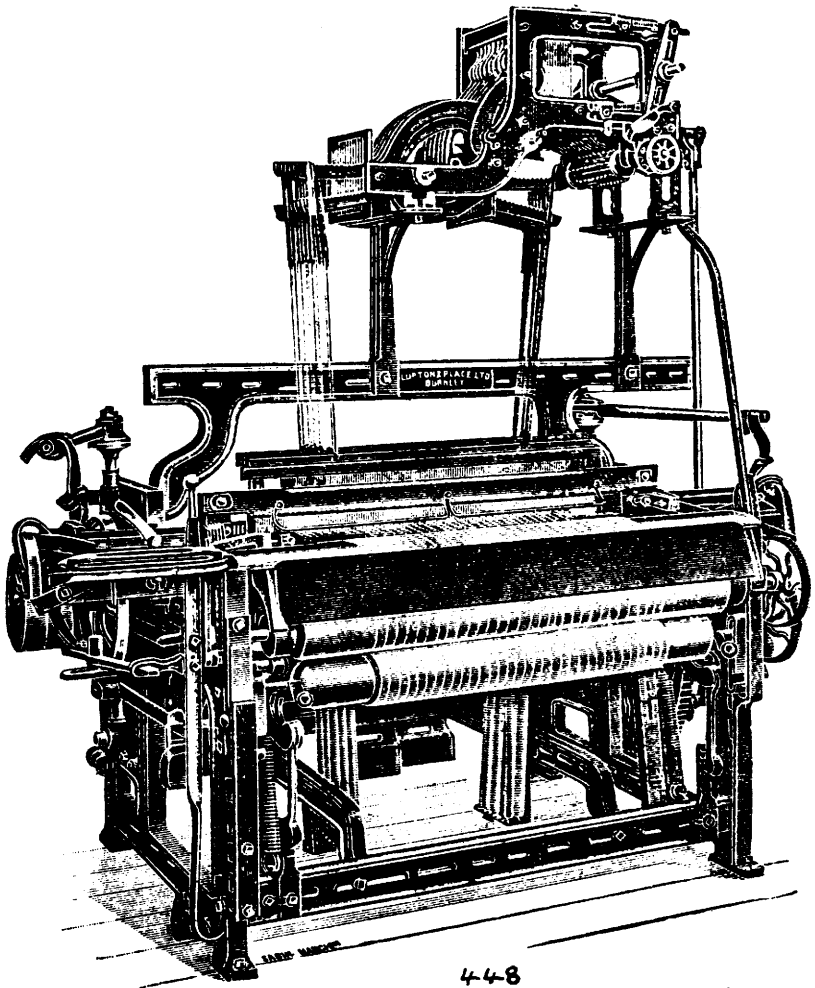
3

4

448a The two barrel dobby used for weaving towels, handkerchiefs &c

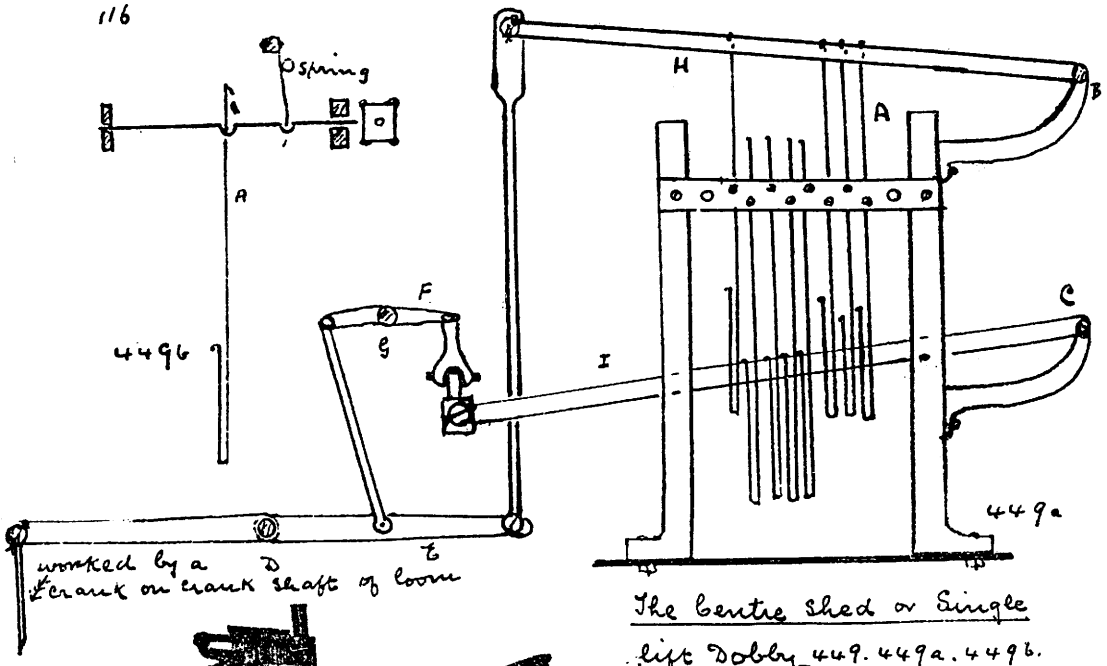
448a

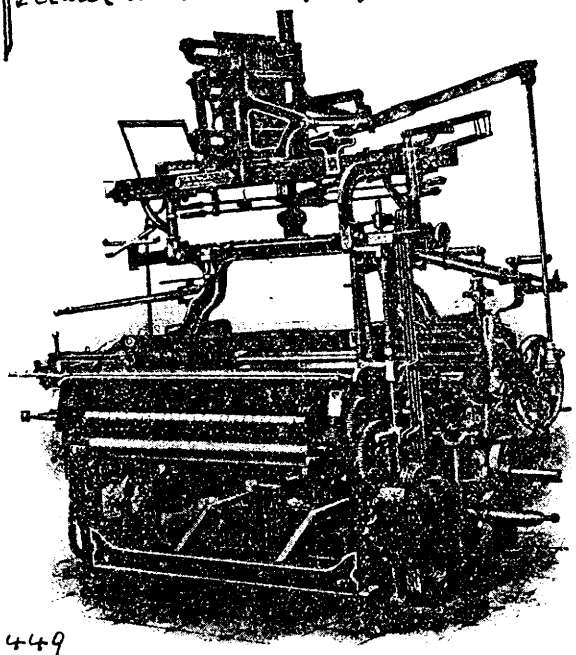




448

448 gives an illustration of the loom and dobby which is shown in detail in 444.

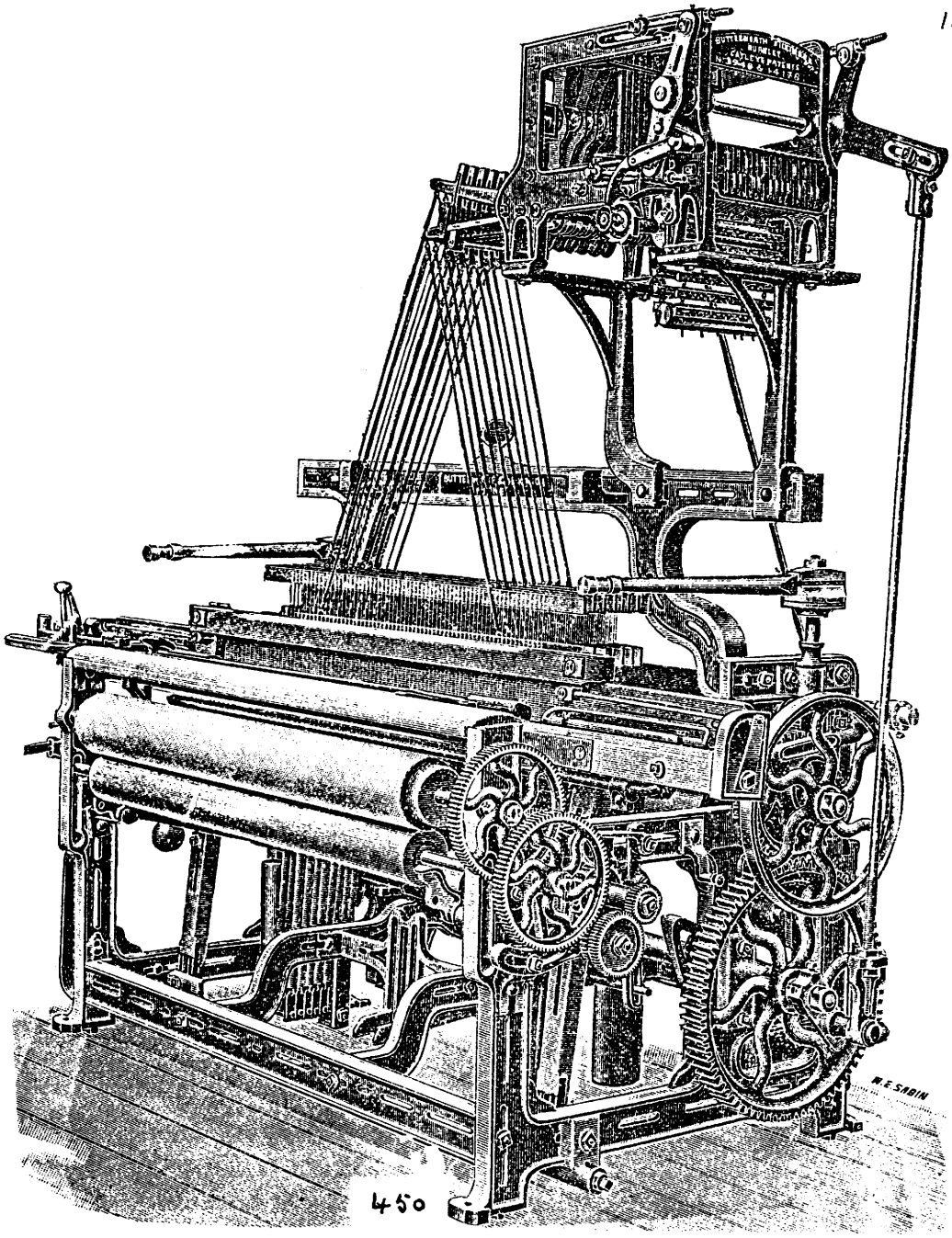




449

The Centre Shed or Single lift Dobby 449. 449a. 449b. is used when the nature of fabric will not allow high speeds and when closed is preferable to open shedding as in gauze fabrics. The parts consist of a griffe H centred at B and a grid I upon which the hooks A rest. I is centred at C. both the levers H and I 449a move at the same time but in opposite directions by means of the levers D. E. F and G.

The heards are attached by means of cords to the bottom of the hooks A, so that as the hooks are lifted or lowered by H and I, so are the heards moved. The hooks are pushed off by means of needles and a paper card 4496

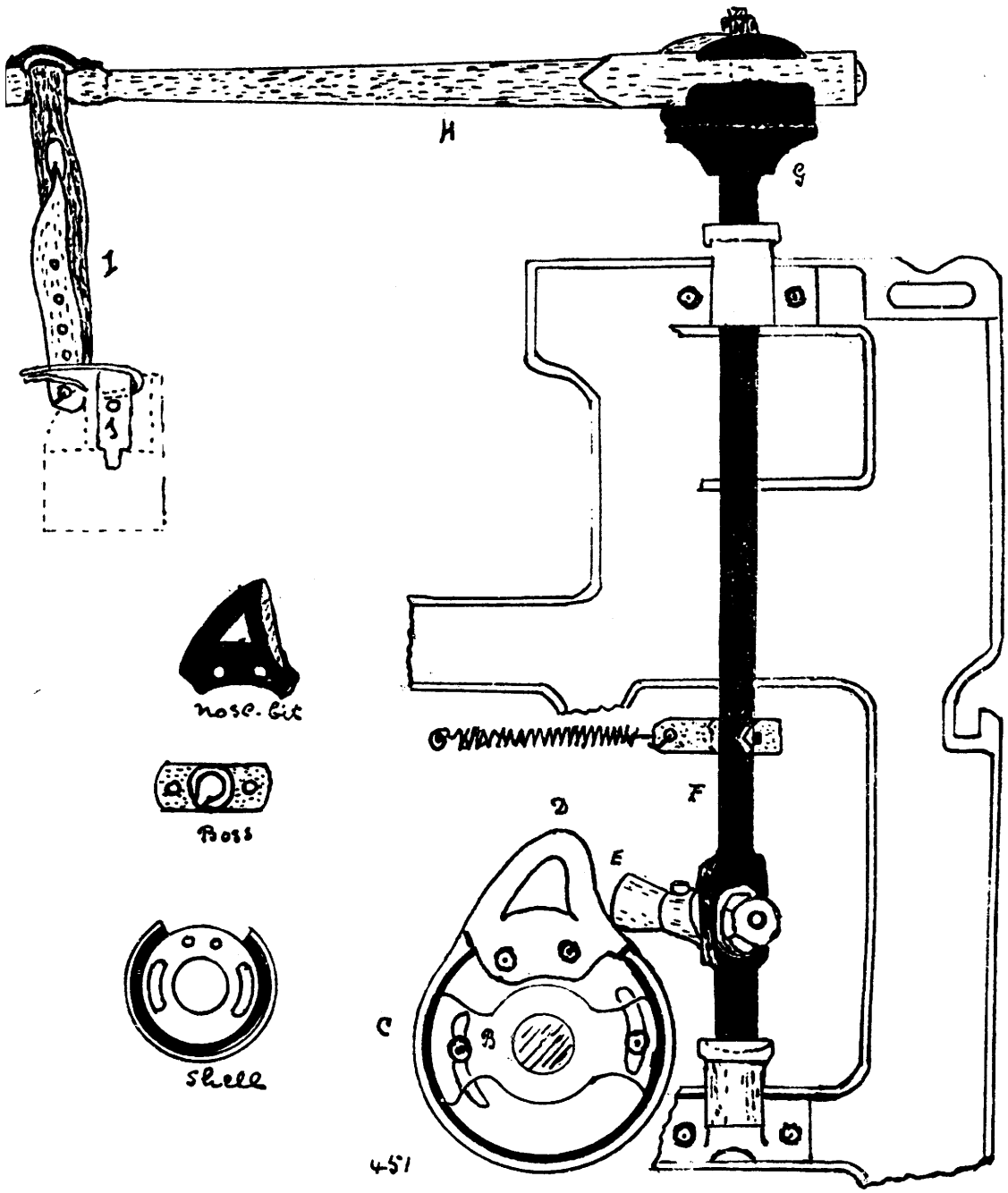


450

450 illustrates a type of dobby where the heald is lifted by a single jack.

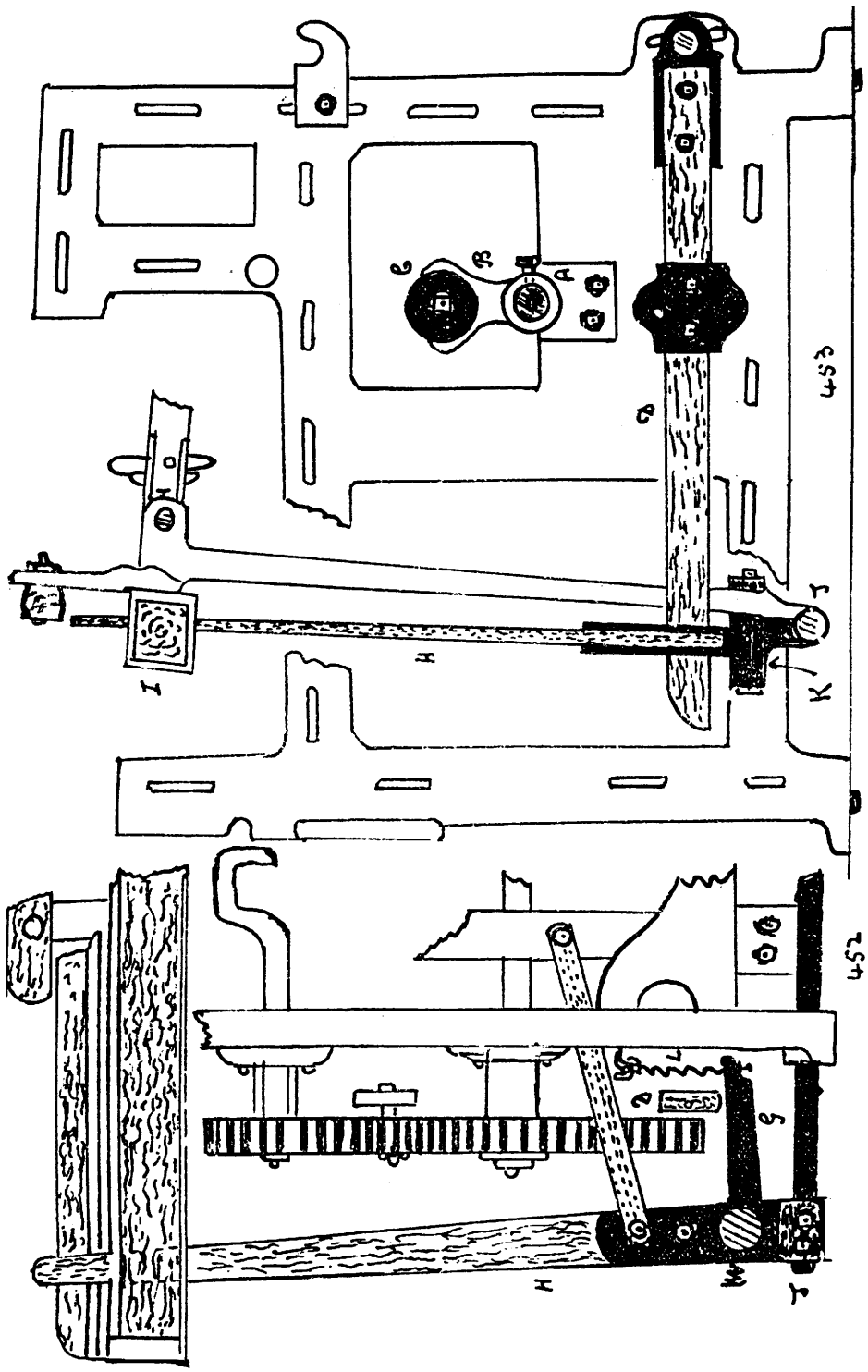
The Overpick or Cone pick

After the separation of the warp threads by the healds, the shuttle, carrying the weft, is thrown across the loom between the separated threads, this action is termed "picking". There are two methods of picking in common use namely the Overpick and the Underpick. of the Underpick there are two types, namely picking from the Crank shaft and picking from the bottom shaft of the loom. The Overpick is the most extensively adopted for quick running looms. 451 illustrates the parts and working of the motion. Fixed to the bottom shaft B of the loom are two picking plates C, one on each side of the loom, they are made up of the "boss" which is keyed to the shaft and the "shell" which is fixed by means of bolts to the boss (this allows the position of the shell to be altered, so as to pick sooner or later). D the "nose bit" which is bolted to the shell: fixed to the loom side is the upright picking shaft F: projecting from F and resting in contact with the picking tappet is the short lever E termed the "picking bowl"; on the top of F is a box G, made up of two parts, the surfaces which are in contact are furrowed, the top part holds the picking stick H, the whole is then firmly secured by a large nut and bolt, the furrowed surfaces prevent the position of the picking stick from altering by the repeated blows given to the shuttle, at the free end of the picking stick is the picking band I and secured to the end of this is the picker J, the picker slides freely on the spindle in the shuttle box. As the bottom shaft revolves, the nose bit D strikes the picking bowl E and turns F part way round, this action moves the picking stick towards the inside of the loom and throws the shuttle.

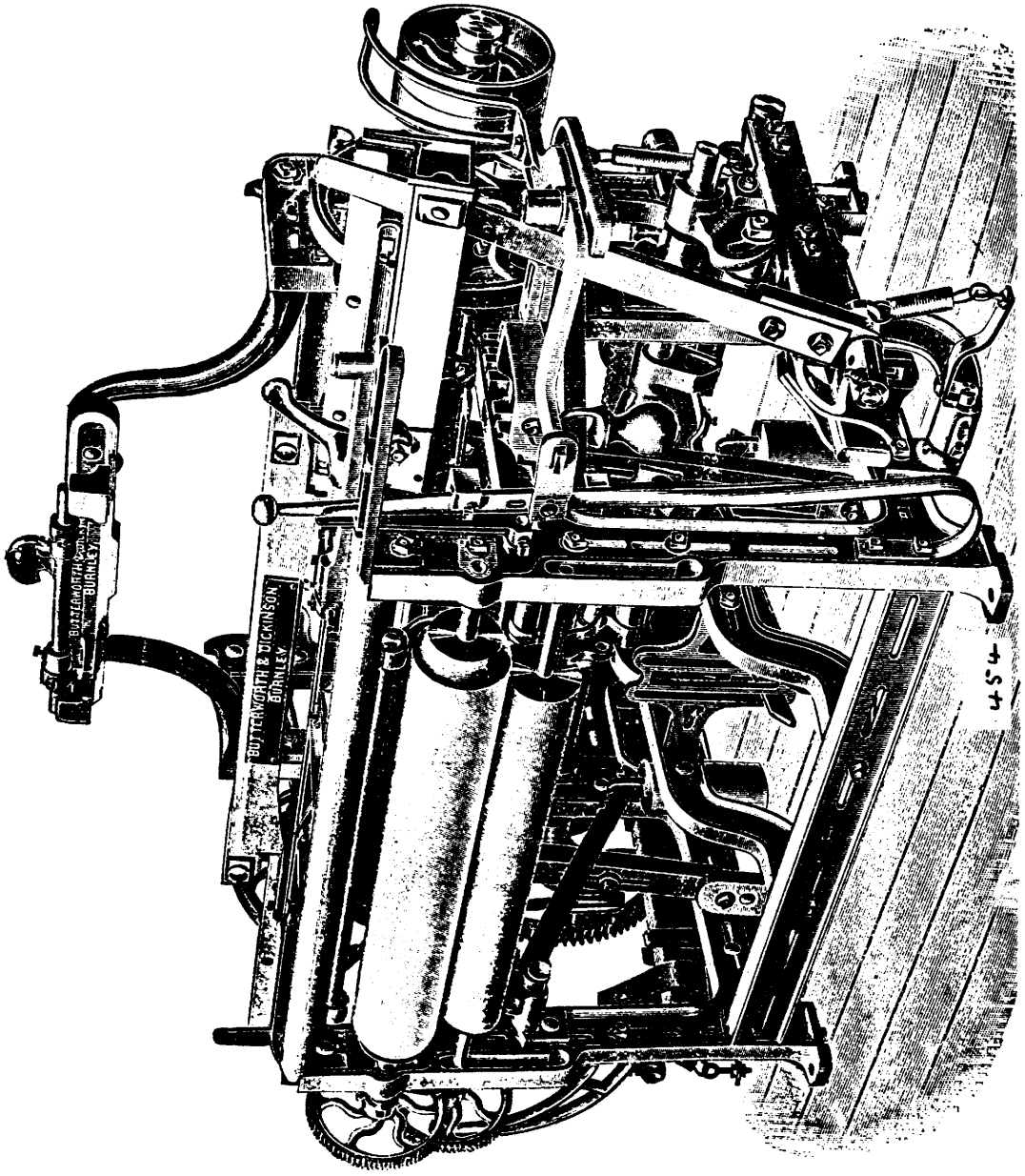

H
G
1
nose. bit
Boss
shell
D
F
E
C
B
4-51

The Underpick

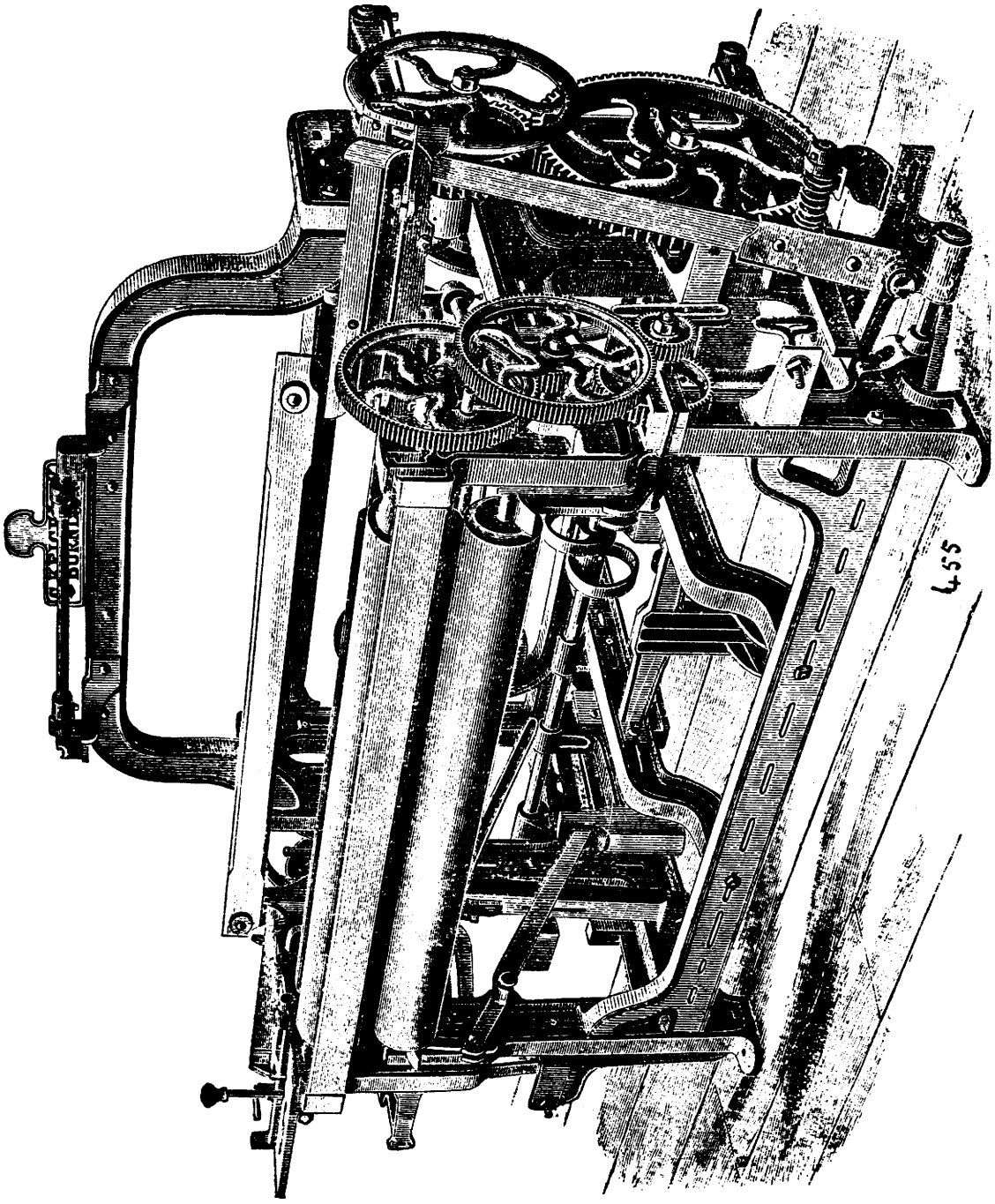
This picking motion is illustrated in 452. 453. 454 and 455
452 gives a front view and 453a side view 455 illustrates the end of the loom shown in 452 and 454 illustrates the end of the loom shown in 453. In 453 A. is the bottom shaft of the loom, to which is fixed a short arm B. to the end of B is fixed a bowl C; D is a wood lever shod with iron at E: the fulcrum of D is at F. the free end of D passes over and rests in contact with a short lever G at the foot of the picking stick H; seen much better in 452;
The picking stick H passes up through the shuttle box I; the lower part of H is fixed to J which forms part of the rocking rail of the loom. Referring now more especially to 452 The picking stick is fulcrumed at K; G is held up by means of the spring L; M is a short strap attached to the picking stick, the other end is fixed to the Sley sword. this is to prevent the picking stick from going against the end of the box. Slid on to the upper end of the picking stick and inside the shuttle box I is the picker  this sketch shows a plan of the picker. On the driving side of the loom see 452 and 455 the Striker bowl C is fixed to the bottom shaft wheel. Its action is as follows - for every revolution of the bottom shaft, the bowl C strikes D forcing it downward, see 452 and the picking stick working on the fulcrum K moves towards the inside of the loom and throws the shuttle; the spring L then comes into action and lifting up G takes the picking stick back to the end of the box. It is cleaner than the Overpick as no spindles or picking bands are used.

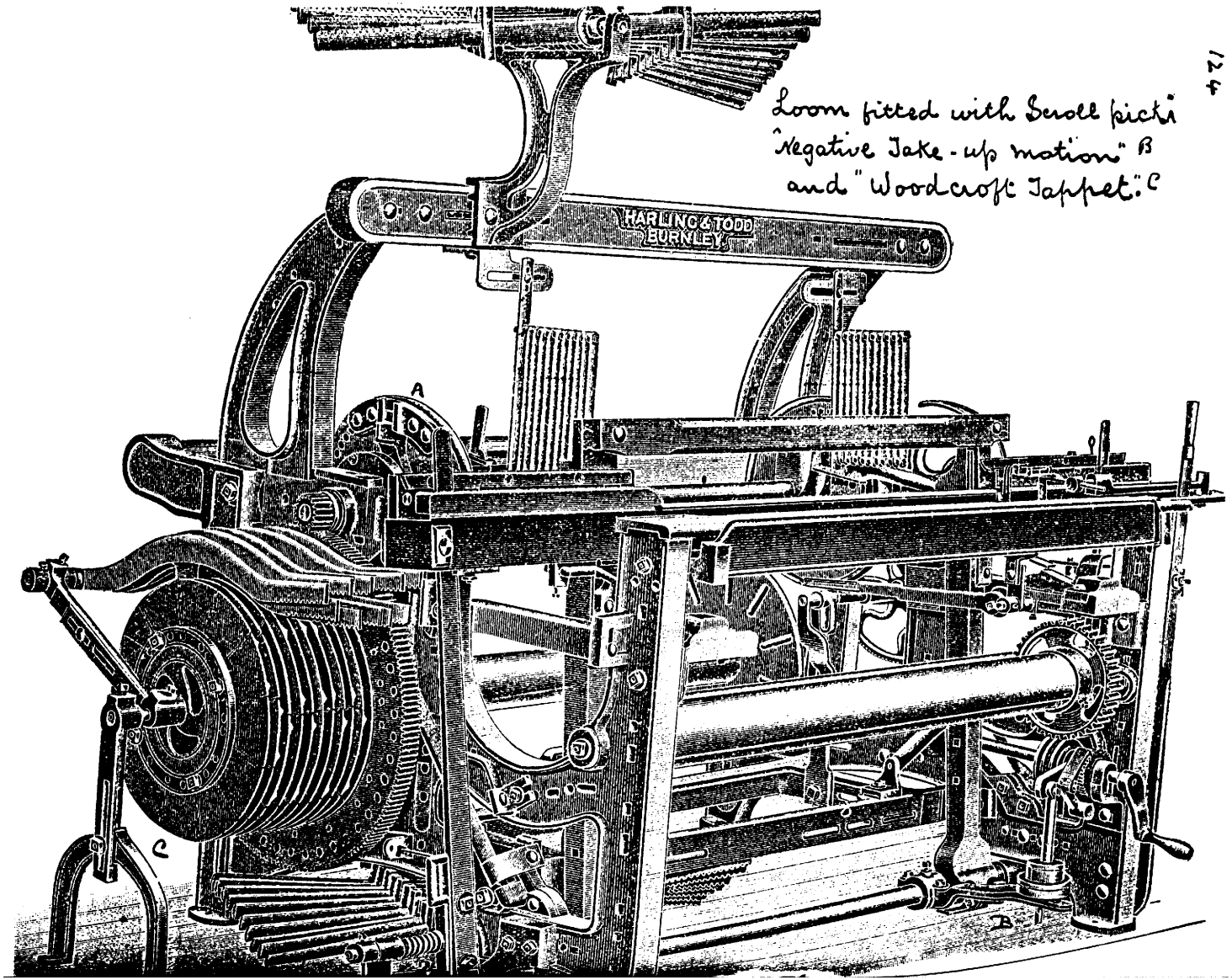


452 and 453 showing detailed drawings of the lever or Underpick motion.

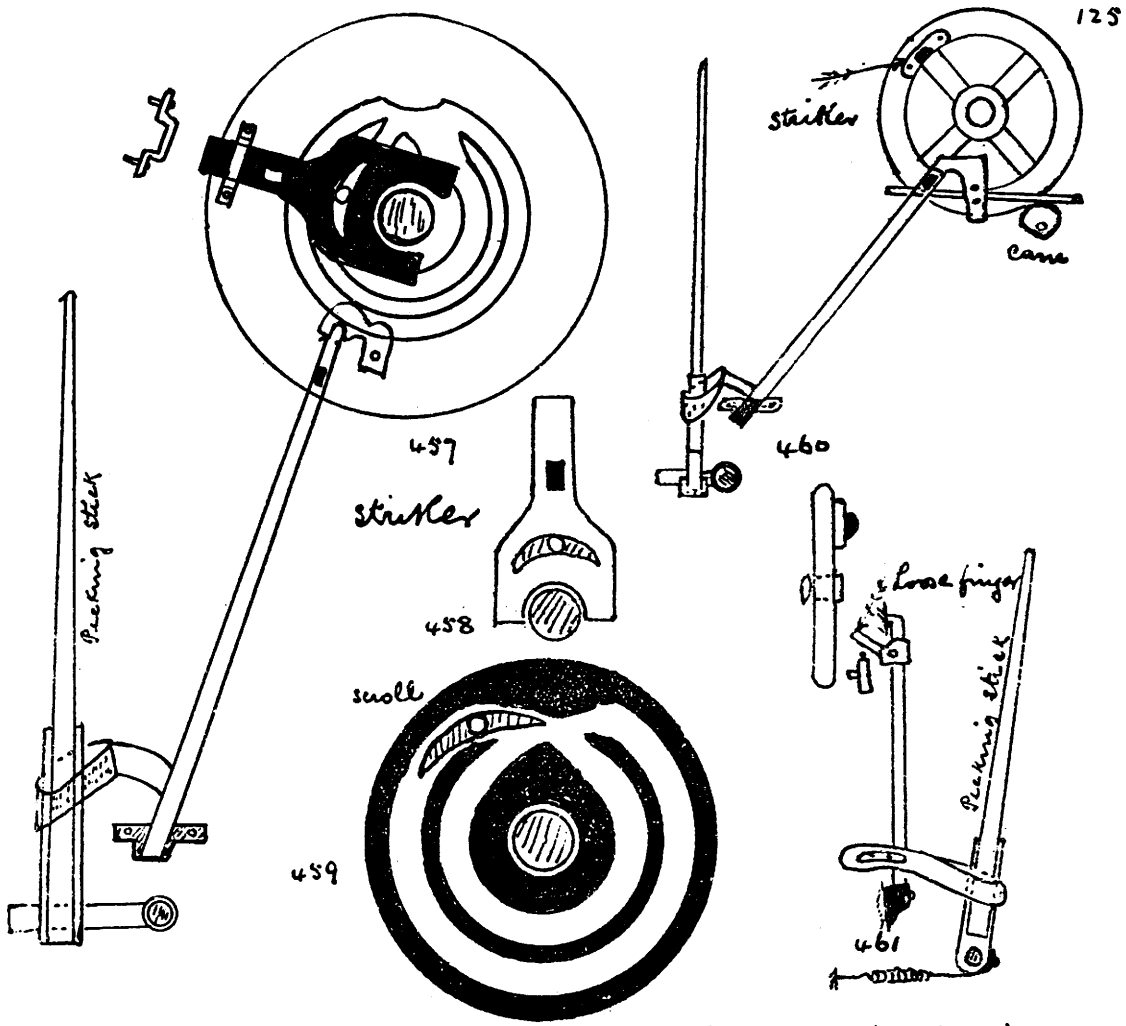

BUTTERWORTH & DICKINSON
BURNLEY
BUTTERWORTH & DICKINSON
BURNLEY

454


DUCATI
455



Loom fitted with Scroll picki
"Negative Take-up motion" B
and "Woodcroft Tappet" C

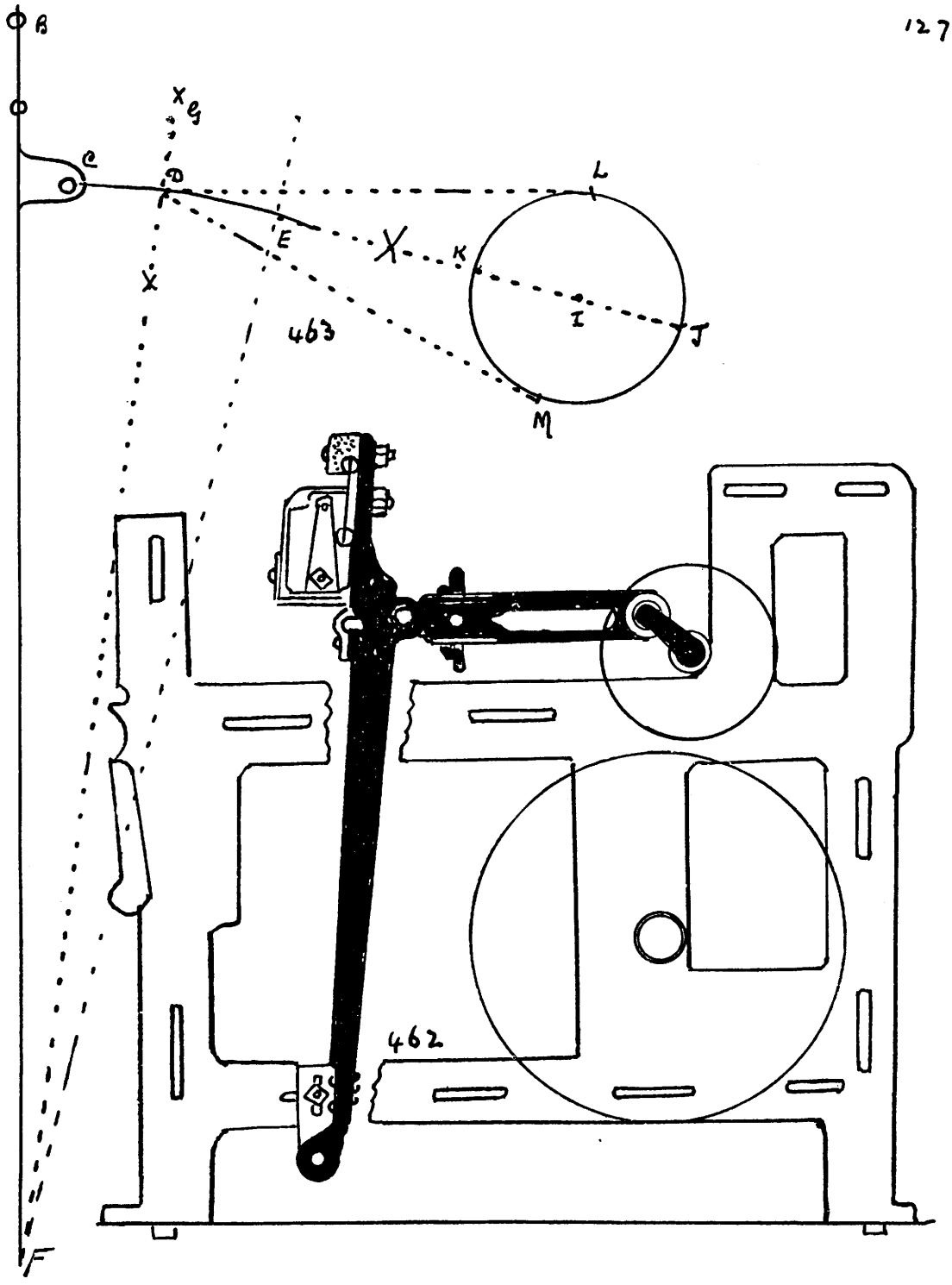


Picking from the Crank Shaft. 456.A. This form of picking is adopted in weaving strong cloths as Fustians and Velvets, with the object of giving a more powerful pick. There are two types namely. the loose striker or Scroll pick 457. 458. 459 and the loose finger pick. 460 461. In the Scroll pick the striker moves out of the way and in the Loose finger, the finger is lifted out of the way of the Striker on alternate picks: In 457 the position of the striker is controlled by Scroll 459 the ⊙ working in the inner and outer groove: in 460 the finger is controlled by a cam.

Beating-up

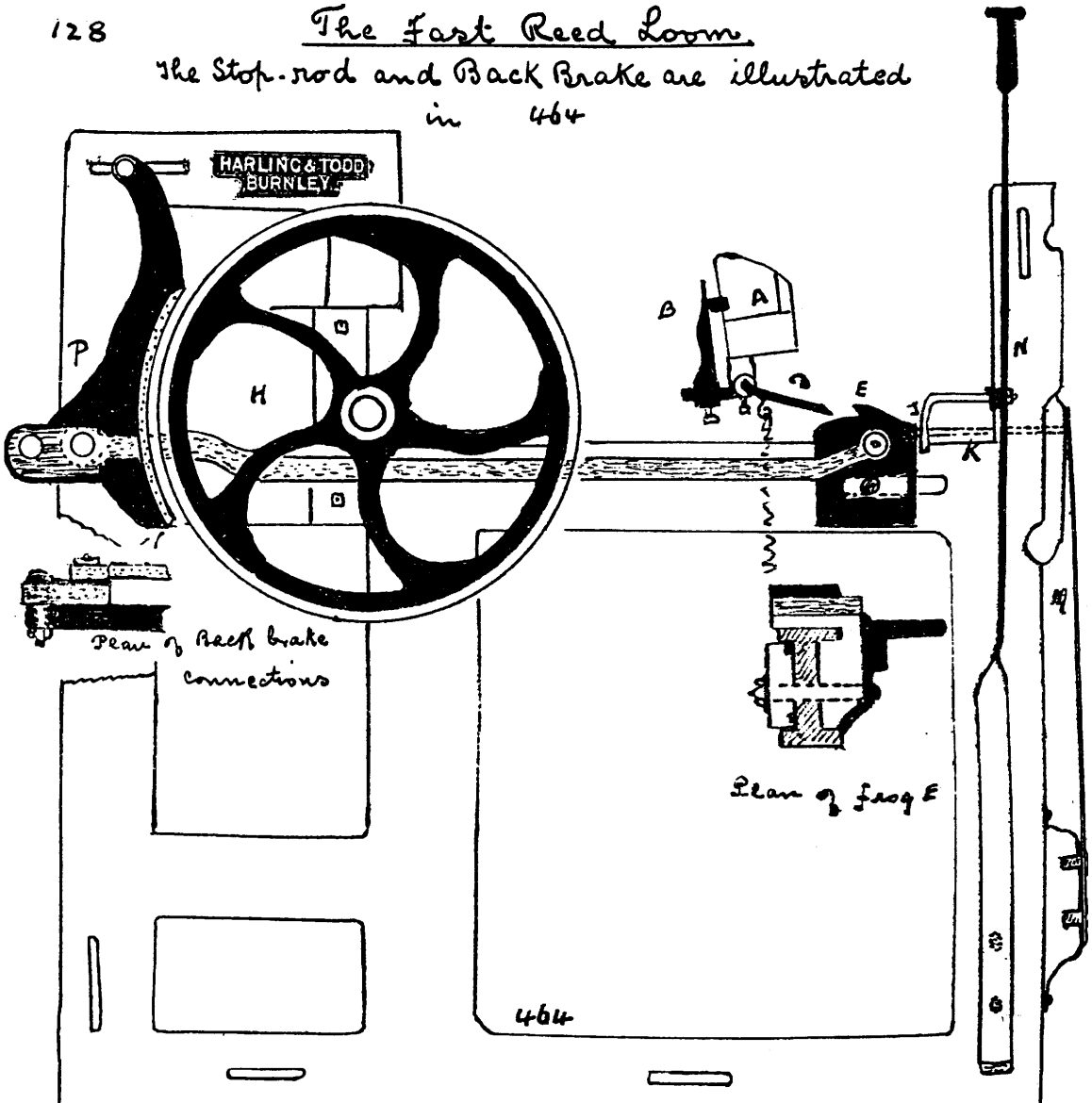
The reed serves the double purpose of guiding the shuttle and beating up the weft: this last operation is termed Beating-up. 462 they sley to which the reed is fixed is not uniform in its motion. it moves quickly when beating up takes place and slower when the reed is away from the fell of the cloth and the shuttle moving from box to box. this variation in speed is for the purpose of giving more time for the shuttle to move across the loom whilst the bottom shed is in contact with the shuttle race. and. as they sley moves quicker when beating-up, this extra speed gives additional force to beat up the weft.

463 gives a graphic illustration of the movement of the sley during one complete revolution of the crank. with a 10" crank arm and a 5" sweep. Let F.B equal the sley sword 26" long and C.E the sweep of 5 inches. bisect C.E at G: draw a line E J at right angles to H.E: at 10" less 2½" namely 7½" from E on the line E J. namely at I will be the centre of the crank shaft: from I as a centre describe the circle L. K. M. J. which equals a circle described by the crank in one revolution. To prove by means of this diagram that the motion of the sley is eccentric. The motion of the crank itself is uniform. it describes equal spaces in equal times: when the sley is at D the crank is at L (prove these by measurements) as the sley moves to C. the crank is at K, when the sley moves back again to D the crank is at N and the space L. K. M is less than the space M. J. L. therefore the sley moves quicker when beating-up. The eccentricity is increased by a shorter crank arm or a greater sweep. The sley swords are set perpendicular with the reed to the fell of the cloth.


B
C
D
E
F
L
K
I
J
M
463
462

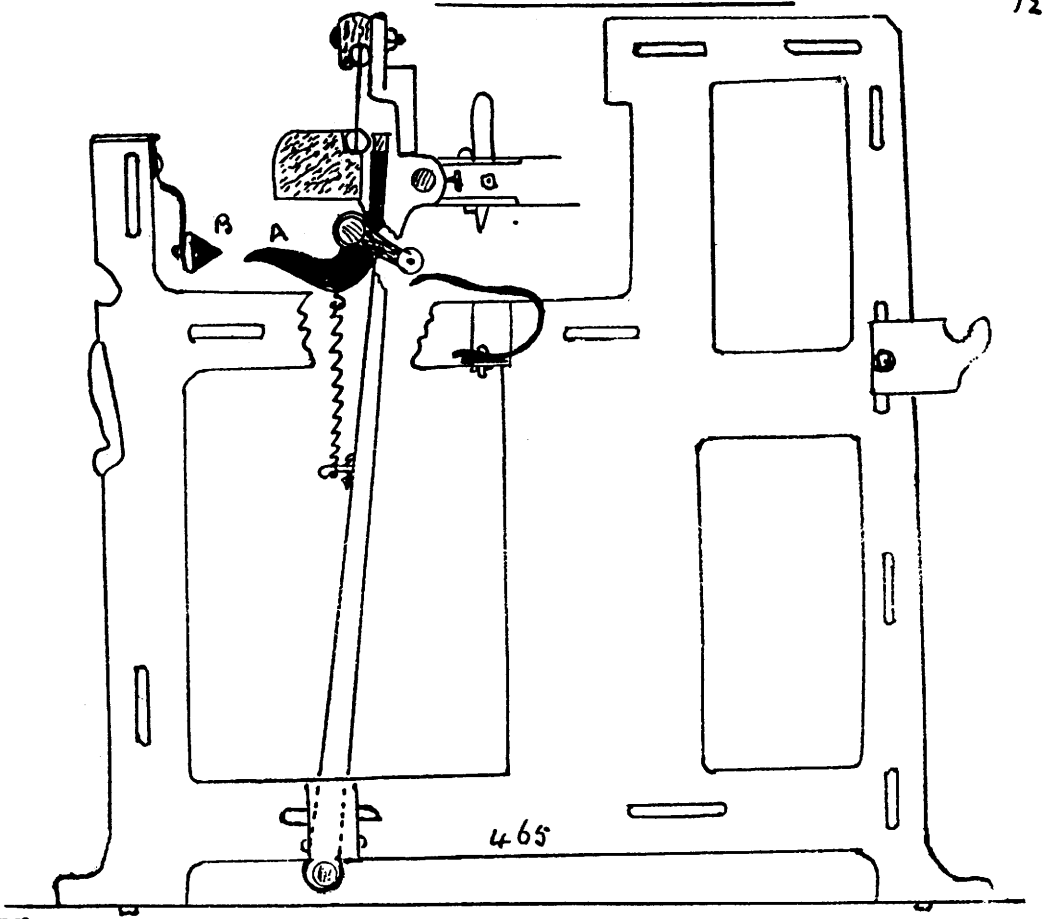
The Fast Reed Loom.

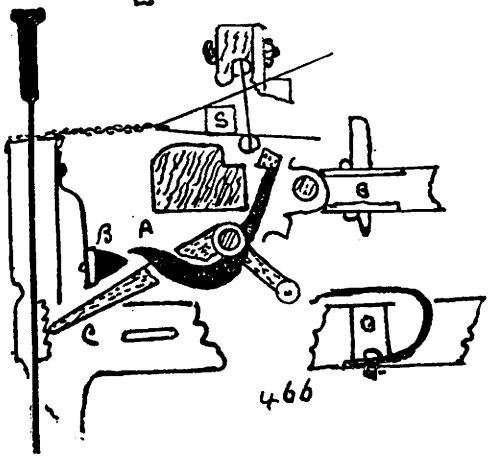
The Stop-rod and Back Brake are illustrated in 464



When the shuttle stops in the shed, some provision must be made to stop the loom; therefore, each time the shuttle enters the box A, B is pushed back and D is lifted clear of E: if D strikes E the loom suddenly stops; E is free to slide along the loom side and in doing so, brings the back brake P into action with wheel H. a pin J on E pushes starting handle out of position and a pin K on spring M reduces the concussion.

The Loose Reed Loom



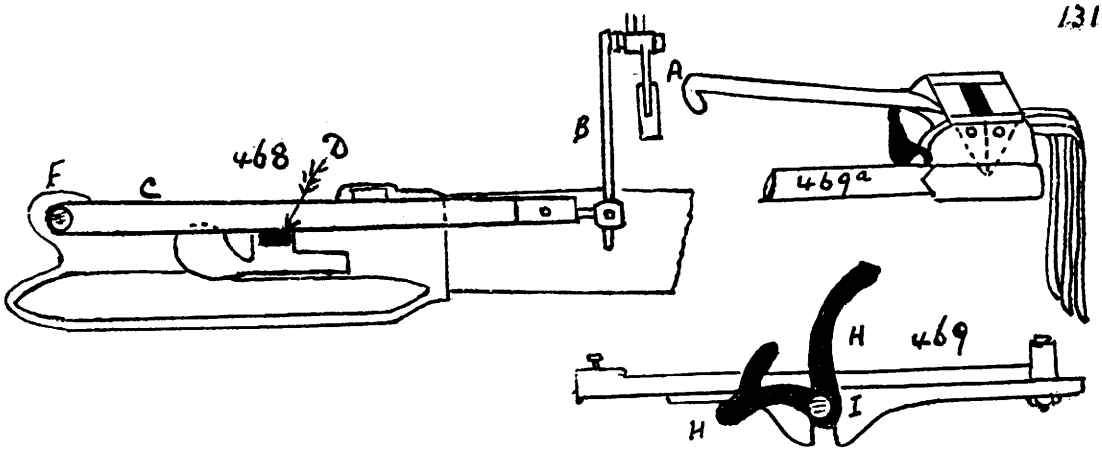


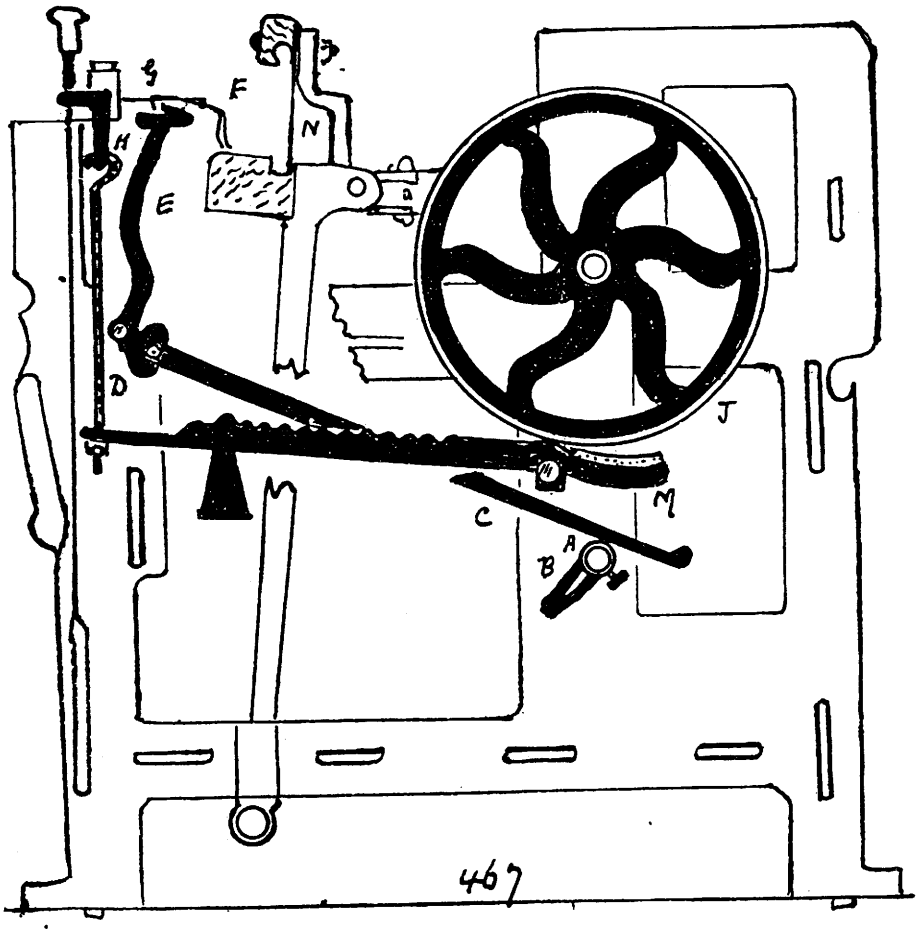
465. 466 In this loom if the shuttle is caught in the shed the reed gives way. The index letters are the same in both. Under ordinary conditions the lever A passes under the heater B at each beat up and holds the reed firm 465 If the shuttle is trapped 466 the reed gives way. A. passes over B and C is lifted and striking the starting handle knocks it out of position & stops loom

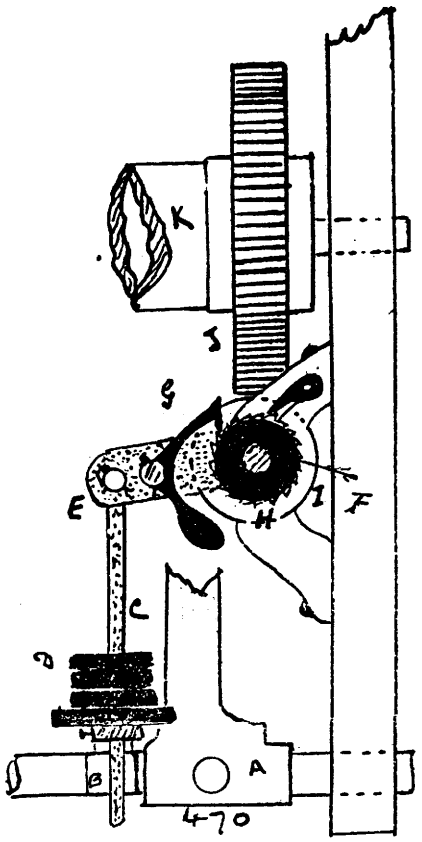
The Weft Fork motion.

When the weft breaks there must be some means of stopping the loom. otherwise a lot of time would be wasted. and the arrangement shown in 467 is for the purpose of stopping the loom when the weft breaks. Fixed on the bottom shaft A of the loom is a small tappet B. C. E form a lever with the fulcrum at D: the part E is known as the hammer: resting on the top of E is the fork G. with its fulcrum at F. Its action is as follows. on each pick if the weft is present on the fork side. the prongs of the fork are prevented from passing through the grid N due to the weft being drawn across it and the sneck end is tilted up. just at the same moment that the tappet B comes into action with the lever C: if the weft is absent the fork does not move and the notch in the top of the hammer E engages with the sneck in the fork and pulls the fork back. this action is more clearly shown in a plan view 468 A. the fork. B. the fork holder: C. the weft fork lever with fulcrum at F. D. the starting handle resting in the notch in the framing of the loom. when the weft fails and the fork remains down the hammer draws it back. this action pulls the starting handle out of the notch & stops the loom.

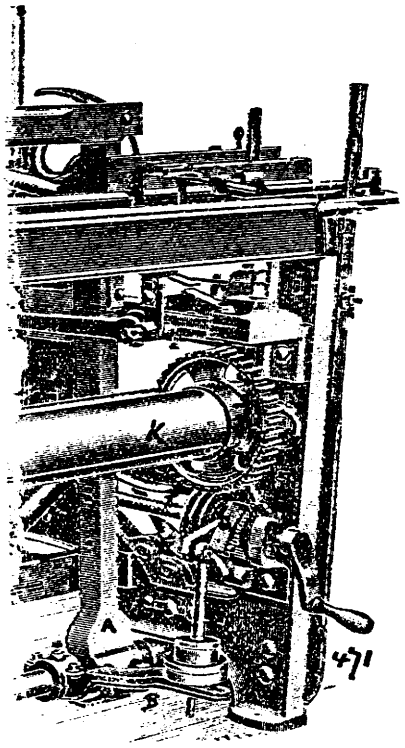
The Weft Fork Brake. For the purpose of stopping the loom by the time it has run two picks after the weft fork has acted. a brake is used as shown in 469 H is a bell crank lever with fulcrum at I. see 467 it is held up by the starting handle. and holds the brake K (leather covered) away from the brake wheel J: when the weft fork acts. H falls down and the brake acts. The Tandemite weft fork 469a invented by Thomas Pickles. Burnley. is a more sensitive fork which enables the finest weft to be woven with a minimum of breakages.


A
B
468
D
F
C
469a
H
469
I
H


G
F
H
N
E
D
J
M
C
B
A
467

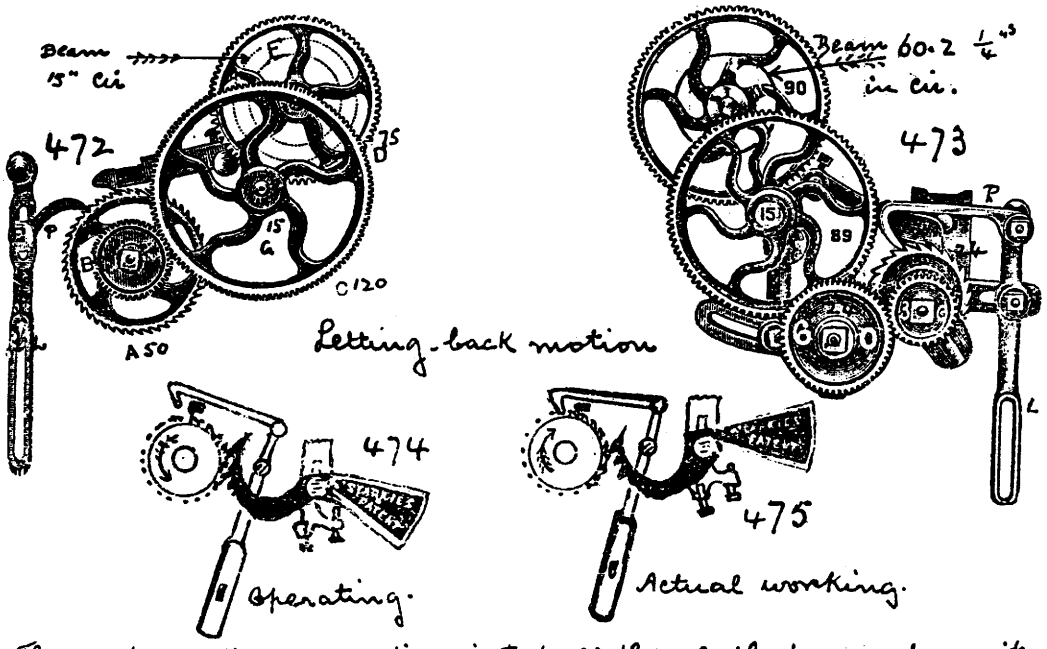


470



471

The Negative Take-up motion. This motion is used in Fustian and Velvet looms: the principle of its action is illustrated in 470 & 471 A. is the Sley sword to which is fixed a short bracket B: C a rod passing through a hole in B: D are weights secured to C: E. a short lever with its fulcrum at F: G, a pawl in gear with rack wheel H: I. a worm fixed to the same shaft as H: I. gears with the wheel J fixed to the end of the cloth roller. Its action is as follows: every time the Sley sword moves back the bracket B is tilted up, it lifts up the rod C and the weights D, the pawl G being in gear with the rack wheel H. when the Sley comes forward B comes down, leaving rod C and weight D. these fall with their own weight and the pawl G pulls round the rack wheel H. More weight there is put on D. the easier H is pulled round and fewer the picks & vice versa.



The work of a Take up motion is to pull the cloth forward as it woven, to wind it on to a roller and also to regulate the picks per inch. The "Old Take-up motion 472 consists of a train of wheels operated by a pawl P and a lever L, the latter being worked from the Sley Sword of the loom. The Dividend is obtained thus

$$\frac{\text{Rack}\ ^{A}\text{wheel } 50 \times \text{Stud}\ ^{C}\text{wheel } 120 \times \text{Beam}\ ^{D}\text{wheel } 75}{\text{Pinion } 15 \times 60 \text{ circumference of Beam in } \frac{1}{4}\text{"s}} = 500$$

500 + 1½% for contraction of the cloth between the loom and the counter = 507. and $\frac{\text{Dividend}}{\text{change wheel}}$ = picks per ¼"

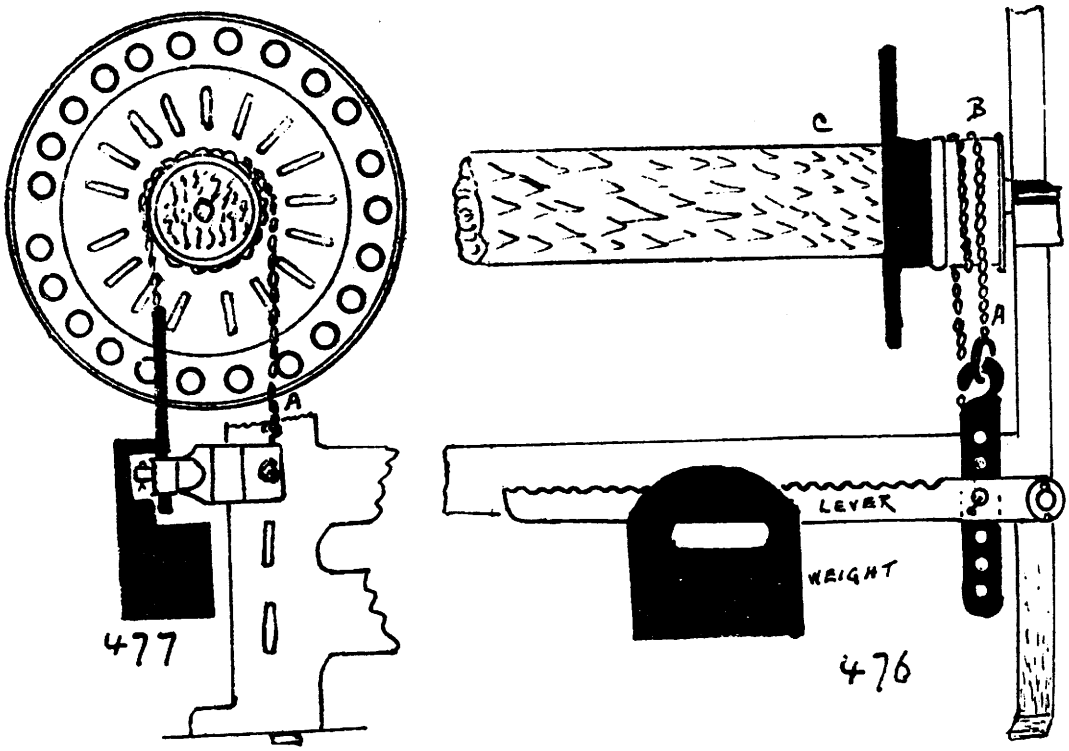
also $\frac{\text{Dividend}}{\text{Picks per } \frac{1}{4}\text{"}}$ = change W.

In Pickcas's motion 473

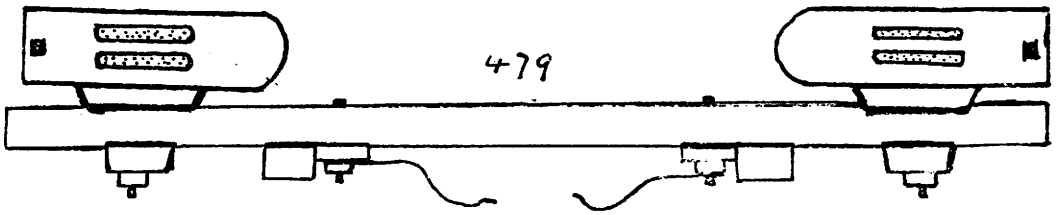
The Dividend is obtained thus

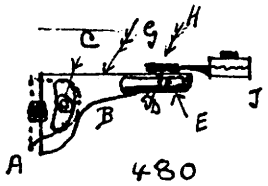
$$\frac{\text{Rack wheel } 24 \times \text{change W.O.} \times \text{Stud wheel } 89 \times \text{Beam wheel } 90}{\text{Rack Stud wheel } 36 \times \text{Swing pinion } 24 \times \text{Pinion } 15 \times \text{cir of Beam } 60.2\tfrac{1}{4}\text{"s}} = .2464$$

.2464 + 1½% for contraction = .25. The Dividend x C.W. gives picks per ¼" also Picks per ¼" divided by Dividend gives change W.

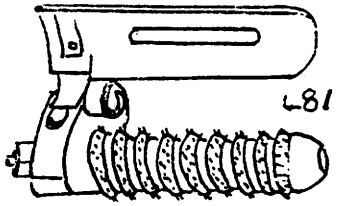


Warp Let-off motion. the simplest form of let-off motion and the one in most general use is the weight and lever as shown in 476 and 477. gives an end view showing a chain A passing round the collar B of the weavers beam C, one end of the chain is secured to the loom framing. the other end is connected to the lever and weight. (see back view 476) By moving the weight along the lever. the tension on the warp can be increased or diminished. The Patent "Easie" Weighting motion 478 is designed to dispense with heavy weights. the fulcrums of the levers are shown at F and a weight of 9 lbs is sufficient to serve all the purposes required





480



9 Ring Temple.

Loom Temples 479. 481 are for the purpose of keeping the cloth stretched in the loom the temples and fittings shown in 479 are in general use. Each temple box contains two rollers. cut with small projecting teeth. these grip the cloth and keep it stretched in width. There is always a certain amount of contraction takes place between the cloth measured close to the reed and the cloth on the counter, it varies under varying conditions. usually about 2 inches is allowed for a cloth 32" wide 16 x 16 per ½" 32's T 32's weft. Thicker the weft & less contraction in width, finer the weft and finer the reed and more bendings must take place in the weft and more contraction in width.
480 shows the points of adjustment. A is fixed to breast beam: B. temple bracket: C. adjustment for raising & lowering: D. E. adjustment for position of temple to reed. The principal makers are Lupton Bros. Accrington and J. Fairburn Burnley

Shuttle guards are bars fixed to the slay cap to prevent the shuttle from flying out.

The "Timing" and "Setting" of the parts in a Plain Loom.

The principal motions of a loom consists of the "Shedding"; "Picking"; "Beating-up"; "Weft fork motion"; "Take-up motion"; "Fast and Loose reeds"; "Brakes"; the adjustable leather fittings, the position of the "Back rest" and "Breast beam". The "Let-off motion". It is on the direct timing and setting of these parts that good cloth is produced with a minimum amount of labour on the part of the weaver. Each of these parts will be briefly dealt with.

Shedding. The warp is gaited with the crank on the top centre and the healds level, the position of the set screws on the top roller are  with the heald eyes a little above the level of the shuttle race. the sheds are regulated in size to suit the size of the shuttle used, but they must be no larger than is necessary. The larger tappet works the back heald.

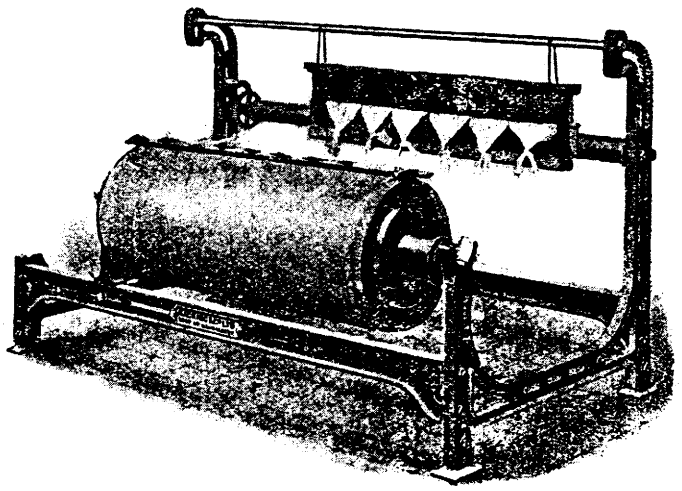
Picking is timed to suit the shedding, and it will generally be found that the shed is sufficiently open to receive the shuttle just as the crank goes on to the bottom centre.

Beating-up consists of the forward movement of the sley; the sley swords or "Lathe arms" are set perpendicular when the reed is to the fell of the cloth. it seldom requires any adjustment. It can be raised or lowered thus 

The Stop-rod on a Fast reed Loom. The stop-rod tongue is set to dovetail well into the frog; the spring must be sufficiently strong to obviate any danger of the tongue slipping over the frog. if it is too tight the loom will bang off.

The Loose Reed motion. The reed must be held firm at the moment of beating-up by allowing the "duck-bill" to to pass underneath the "heater". the reed is held firm when the shuttle travels across the loom by allowing the roller to run on the bent spring. at other times it must be held only lightly with a spring ready to give way if the shuttle "trips".

The Weft fork motion, the weft fork must be set to pass clear through the grid without touching it must also be free to "tilt" without touching the top or the bottom: the weft taffet is set to move the hammer at the same moment that the fork is tilted by the weft, namely about the time of beating-up.
Take-up motion, the pawl is set to take one tooth for each beat up of the weft, the wheels must not "bind" in any way: the "finger" must be set to prevent taking up when the weft fork acts.
Warp Let-off motion, the beam must be free to revolve without "binding" and the weights kept off the floor. The weights are moved on the levers to regulate the tension.
The Weft Brake must act promptly to stop the loom with the shuttle in the box on the fork side in two picks after the fork has acted.
The Back Brake must be kept well covered with leather and act promptly. Keep oil off the "brakes".
The Reed is set flush with the box back at each side of the loom, it is preferable to have it set a shade further back than the box back, for if it overfaces in the least the shuttle will "fly" out
The Shuttle is made to suit the bevel of the box back, some Overlookers prefer to have a shuttle a little lower at the front than at the back.
The Back rest and Breast beam are set 1½" to 2" higher than the shuttle race.
The check Strap is a useful regulator for controlling the shuttle and preventing it rebounding in the box.
The Buffer leather must be kept clear of the Spindle stud.
The Spindle is set slightly higher at the stud than at the box end. Keep the boxes clean.
The Temples are set as low as possible.



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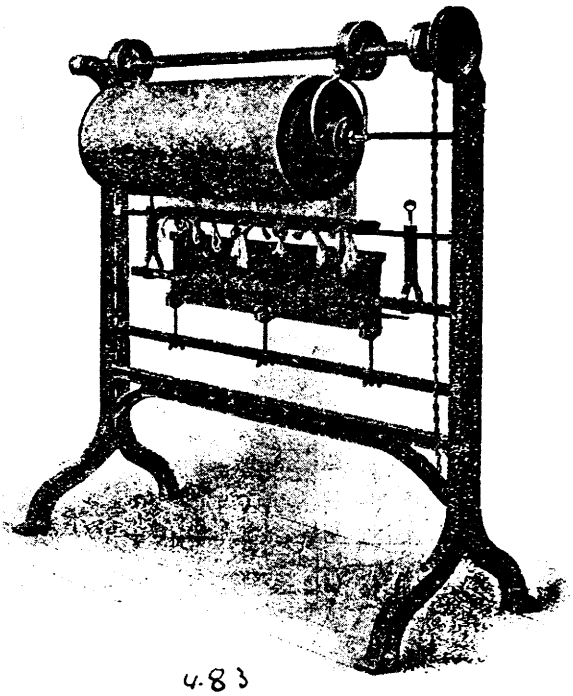
Twisting. The usual method of attaching a new warp to an old sett of healds is to have each thread twisted separately. by fixing the healds in a frame, on one side and the full weavers beam on the other side, the twister sitting between the two and twisting one thread of the warp to one thread in the healds. when completed the healds and reed are carefully drawn over the knots or twistings and the warp is ready for the loom. The machine is shown in

During recent years much attention has been given to a machine for uniting the warp ends more quickly. The Barber-Colman Warp tying machine does this work in a marvellous efficient manner, it is almost human in the selection of the threads. The ends from the new warp and the ends from the old sett of healds are clamped in a frame. and, a small motor sliding in a frame and carrying a knotter and selecting needles. picks up the threads and ties them with unfailing regularity at the rate of 200 per minute



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Drawing-in or Looming. when a sett of healds and a reed are used for the first time, the threads must be drawn each separately through the heald eyes and dents of the reed. the machine used for holding the warp, the healds and reed is shown in and a very convenient and compact machine it is for the purpose.

It is upon the infinite variety of ways that the ends are drawn through the healds that many and elaborate patterns are produced.

Healds may be made from cotton or worsted, but in the fancy trade slider healds made from wire have come much into use, as setts of healds can be easily made up to suit patterns. Jones Bros. Blackburn are the principal makers.

The different forms in which cotton yarn is supplied to the manufacturer.

In the Grey trade a manufacturer buys his yarn in the Cop:- namely Pin cops for weft and Twist cops for warp. the warp yarn is wound on to bobbins at the Winding frame. these bobbins are then taken by the Beam warper and the yarn from them wound on to Back beam for the Taper or Slasher. whose duty is to size and dry the yarn and wind it on to the weavers beam. this he does on the Slasher or Tape Sizing machine. If a manufacturer desires to use Ring twist (which is a better quality of yarn than Cop twist) and he is not his own Spinner he will buy the yarn on Back beams or in Ball warps.

In the coloured trade, the yarn may be bought in several ways. Weft. Coloured weft may be bought in pin cops. in which state it has been dyed or bleached. or it may be bought in the hank and afterwards wound on to wood or paper tubes. or it may be bought in the ball and afterwards wound on to paper tubes as in Thos. Holt & Co. Rochdale. Patent Pin Winding frame. Warp Yarn. is generally bought in the Ball warp. the advantages of this form of supply is that warps can be made to any practicable number of ends and length and sent direct to the dyers. with very little waste in the preparation, or yarn may be bought in the hank and afterwards wound on to bobbins to make warps at the Sectional Warping machine.

Yarn Testing all weft yarn arriving at the mill is tested for counts by taking four cops from each skip wrapping them on a Wrap reel namely winding off $4 \times 120 = 480$ yds and dividing the weight in grains into 4000. Thus if 4 leas of yarn weighs 50 grains the counts are $\frac{4000}{50} = 80^s$. If yarn is sent 29^s instead of 30^s there is a loss in length to the user of 840 yds on each lb of yarn.

James Holmes