

box with its pin for holding the needles in position. Each needle is connected to two tail-cords, as indicated in the drawing, one for figure and one for ground. H and L are the two guide-boards for the tail-cords. Distance from B to H , $7\frac{1}{4}$ inches, from H to L , $8\frac{1}{2}$ inches. Dimensions of each guide-board, $6\frac{1}{4}$ inches by $\frac{3}{4}$ inch. Each tail-cord is weighted by a small lead weight, as shown at K in drawing.

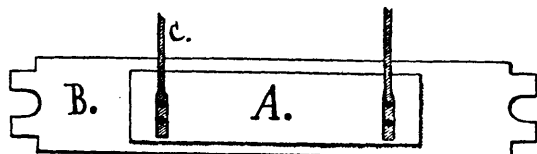


FIG. CVI.

pressing the needles, A . C shows the hanger, which is attached (movable) to the top of the machine. [See E , in Fig. CV.]

In this machine the springs for the needles are omitted, and a board large enough to cover the ends of all the needles, substituted. [See arrow, P .]

Fig. CVI. illustrates the rear view of the needle-box, B , and the board for

Tying-up of Jacquard Harness for Two-ply Ingrain Carpets.

WITH A GENERAL DESCRIPTION OF THE WORKING OF THE LOOM AND
CONSTRUCTION OF THE FABRIC.

Two-ply Ingrain Carpet is an article composed of two fabrics, produced on the regular double-cloth system. These two fabrics are arranged in the loom to form figures by a simple exchanging of positions. A great variety of colors may be put into each of these separate fabrics, (ground and figure), and the most elaborate designs may be used. On every part of the carpet where these two fabrics do not exchange, each works on the plain weave. The exchanging of these two fabrics binds both into one, thus forming the ingrain carpet. In the manufacture of this carpet four sets of warp-threads, and also four sets of filling-threads are generally employed; but, if occasionally more or less should be used, in warp or in filling, or in both, in the same fabric, the principle of exchanging is still observed. If employing four sets in warp and filling, two sets of each are used for forming the figure, the other two sets forming the ground, each of the figure-threads having as its mate one of the ground-threads. These threads are so arranged that when a figure-thread appears upon the face of the fabric its mate appears upon the back, and when the figure-thread appears upon the back the corresponding ground-thread appears upon the face.

To give a clearer understanding of the foregoing, a sectional cut of an Ingrain carpet fabric is given in Fig. CVII.

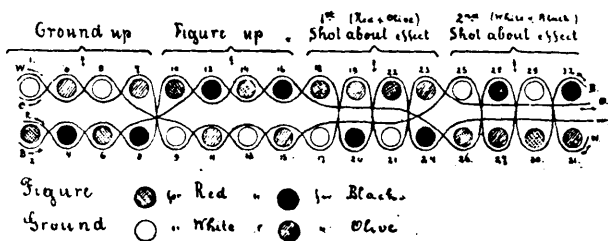


FIG. CVII.

Suppose the filling-threads for the figure to be :

RED, indicated by heavy shaded circles ; picks 2, 6, 10, 14, 18, 22, 26, 30.

BLACK, indicated by full black circles ; picks 4, 8, 12, 16, 20, 24, 28, 32.

And the filling-threads for the ground to be :

WHITE, indicated by empty circles ; picks 1, 5, 9, 13, 17, 21, 25, 29.

OLIVE, indicated by light shaded circles ; picks 3, 7, 11, 15, 19, 23, 27, 31.

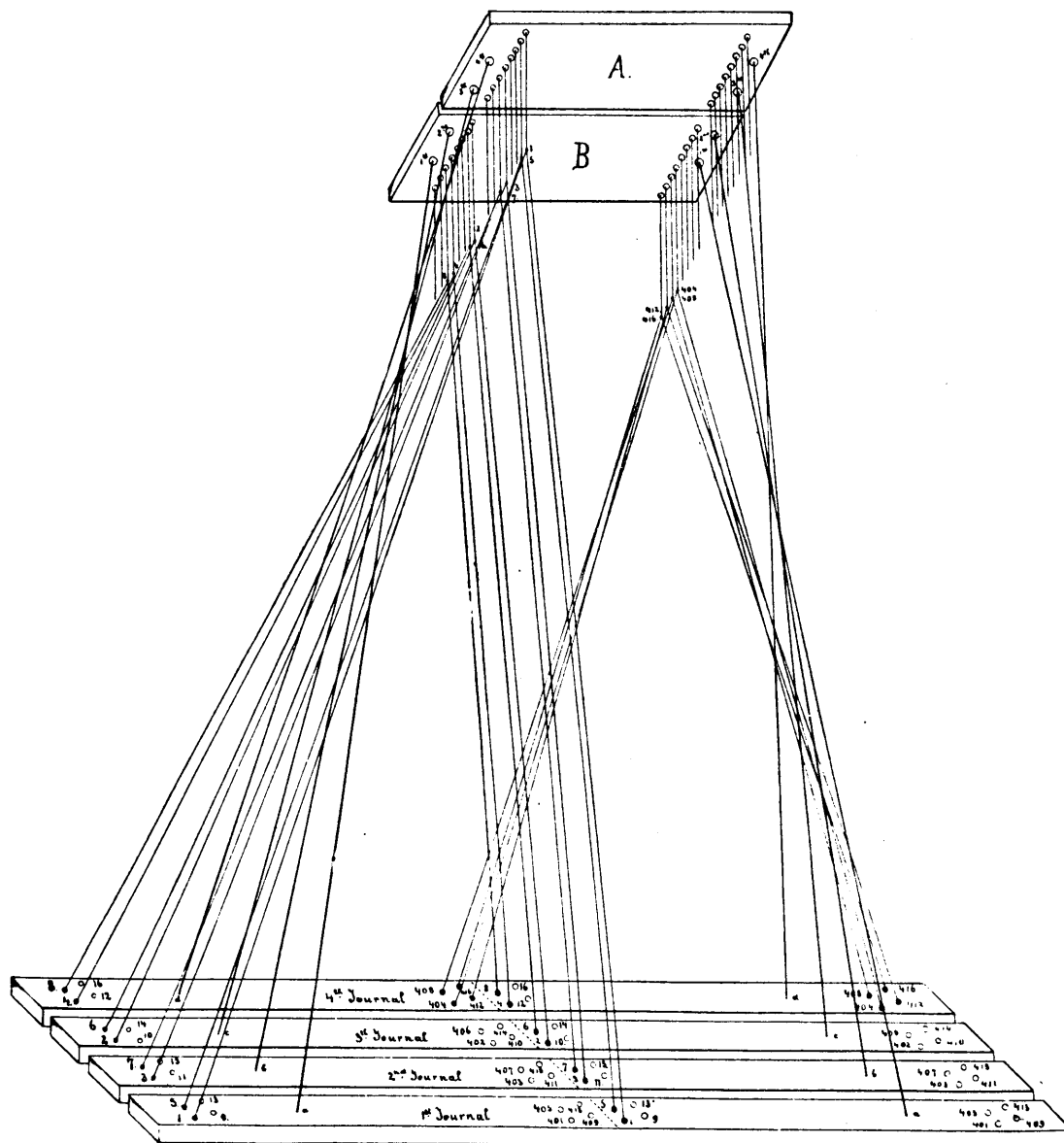


FIG. CVIII.

A careful examination of the drawing shows that the white threads mate with the red, and the black threads with the olive, so that when one of these colors shows upon the face the mating color will show upon the back, and *vice versa*.

As a general rule, these warp-threads are of the same color as the weft-threads ; hence, every filling pick, appearing either on face or back, is bound by a warp-

thread of the same color. The sectional cut represents four distinct effects with 32 picks, thus allowing 8 picks for the illustration of each part.

- 1st effect, picks 1 to 8, is ground up (white and olive).
- 2d " " 9 to 16, is figure up (red and black).
- 3d " " 17 to 24, is 1st effect in "shot about" (red and olive up).
- 4th " " 25 to 32, is 2d " " " (white and black up).

Two methods of tying-up Jacquard harness are in use:

- 1st, the "straight-through" principle, (known to the trade as "cross-point").
- 2d, the "point" method, (known to the trade as "centre-tiè").

I. The Straight-Through Tie-up for Ingrain Carpets.

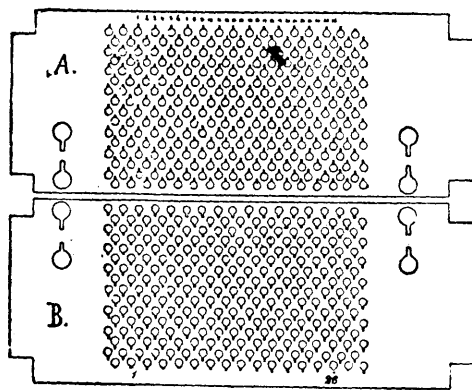


FIG. CIX.

Fig. CVIII., p. 73, represents the arrangement of the neck-cords with the heddles (through the harness-cords). There are two separate bottom boards in the machine, marked A, B, for ground and figure; also two corresponding lifter-boards, which are illustrated separately by Fig. CIX.

The four journals are clearly illustrated by Fig. CX. (each journal carrying its own set of threads).

The first thread in the loom (left side) will be found on the first journal.
 " second " " " " " " " third "
 " third " " " " " " " second "
 " fourth " " " " " " " fourth "

This arrangement of threads, 1, 3, 2, 4, is repeated throughout the fabric. For an example, a carpet is shown termed "extra fine," executed on 26 "designs,"

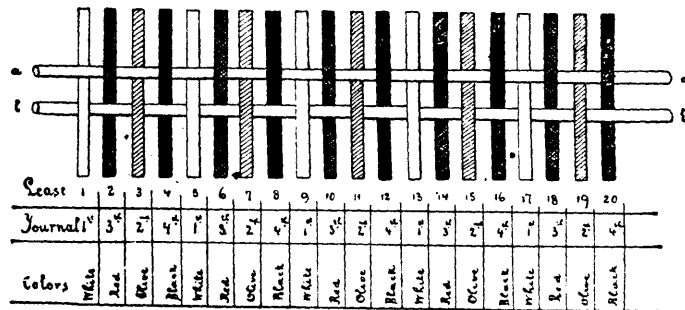


FIG. CX.

requiring 26×8 , or 208 small squares for warp on the designing paper. Ingrain carpets are generally woven one yard wide, having in this width two repeats or divisions; hence the number of harness-cords for the present example is as follows: $26 \times 8 = 208 \times 2$, for ground and figure; 416×2 , for two divisions, = 832 harness-cords (or 416 leashes) required for tying-up.

Fig. CXI. illustrates the adjustment of heddle (mail) and lingo through the journal, \mathcal{J} , by means of the heavy knot at b . This knot must be large enough not to pass through the hole of the journal. The average measures for the present drawing are as follows :

Lingo, f to g = 9 inches.
 Heddle, e to f = 8 "
 c to d = 10 "
 Mail, d to e = $\frac{6}{8}$ "
 Height of journal, b to c = $1\frac{1}{8}$ inches.

Connecting cord of heddle to harness-cord, a to b = 6 inches.

This drawing will explain the principle of raising the warp either by means of the harness-board, (arrow 1), or by means of the knot through raising the journal, (arrow 2). If raised by means of the harness-cord, the connecting heddle slides upwards in the hole provided for it in the journal; or the journal takes the place of a common comber-board; but if the journal be used for raising, the knot, b , will rise with it, carrying the heddle the same as before, the harness-cords becoming slack by this movement.

In Fig. CVIII., p. 73, the journals are arranged as follows :

1st journal,	} for ground,	{ White, 1st set of threads.	} For repeat, — 208 times over,
2d " "			
3d " "	} for figure,	{ Red, 2d " "	
4th " "		{ Black, 4th " "	

In the same drawing are also represented the first eight heddles (in both divisions), as connected with harness-cords 1, 2, 3, 4, 5, 6, 7, 8; also the last four heddles of the rear journal (fourth) connected with their corresponding cords, 404, 408, 412, 416.

The first row (1 to 8) illustrates the principle of tying-up the harness and the leasing of the heddles; whereas the four heddles in the rear (404, 408, 412, and 416) show the practical commencement of the tie-up, *i. e.*, four neck-cords in succession to four heddles of the journal.

A represents bottom-board in the machine where the neck-cords for the ground harness-cords pass through. B , the bottom-board in the machine where the neck-cords for the figure harness-cords pass through.

In Fig. CIX., showing the lifter-boards, A is also used for the ground, and B for the figure; 26 rows of the machine are shown for explaining the tie-up for a texture known as "extra fine," or equal to 832 heddles in the width of loom (one yard).

Jacquard machines for two-ply ingrain carpets are usually constructed with 34 rows, and $33\frac{1}{2}$ of these are used. $33\frac{1}{2}$ rows have $33\frac{1}{2} \times 8$, or 268 needles, which carry 1072 threads, the number actually used in what is termed a full "extra super." Should only 30 of these be used, having 30×8 , or 240 needles, and carrying 960

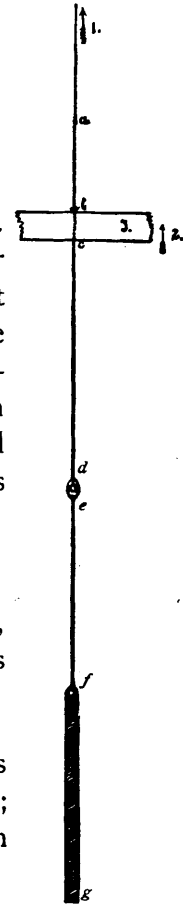


FIG. CXI.

threads for warp, the carpet is termed "super;" and if 25 rows, with $25 \times 8 = 200$ needles are used, carrying 800 threads, the product is called "fine" ingrain, and represents about the lowest grade of these carpets. It frequently happens that we

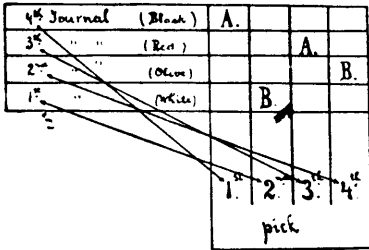


FIG. CXII.

find slight variations in the number of threads used in the various grades of carpet named. The pattern may require such a change, or economy in production may induce the maker to use a smaller number; or, as is done in a few instances, a manufacturer may always make his "extra super" on 32 rows; but all such changes are done by a corresponding depreciation of the value of the

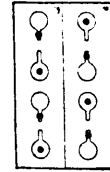


FIG. CXIII. FIG. CXIV.

fabric, as compared with a full "extra super" of $33\frac{1}{2}$ rows.

Fig. CIX., p. 74, illustrates the full 34 rows, and indicates 26 rows used for illustration of tie-up (4 rows empty on each side). In power-looms the raising of the different journals is generally accomplished by an arrangement of cams, but in hand-looms it is done by the lifter-boards.

In Fig. CIX. the four large holes on each side are made for this purpose, and the wires for raising the journals are shown by heavy lines in tie-up in Fig. CVIII., p. 73. Fig. CXII. represents the process of lifting the journals, as follows:

First pick raises lifter-board A, journal 4; second pick raises lifter-board B, journal 1; third pick raises lifter-board A, journal 3; fourth pick raises lifter-board B, journal 2.

The two positions of the four "tails" in these four picks are illustrated as follows: Fig. CXIII., hole in cylinder; CXIV., no hole in

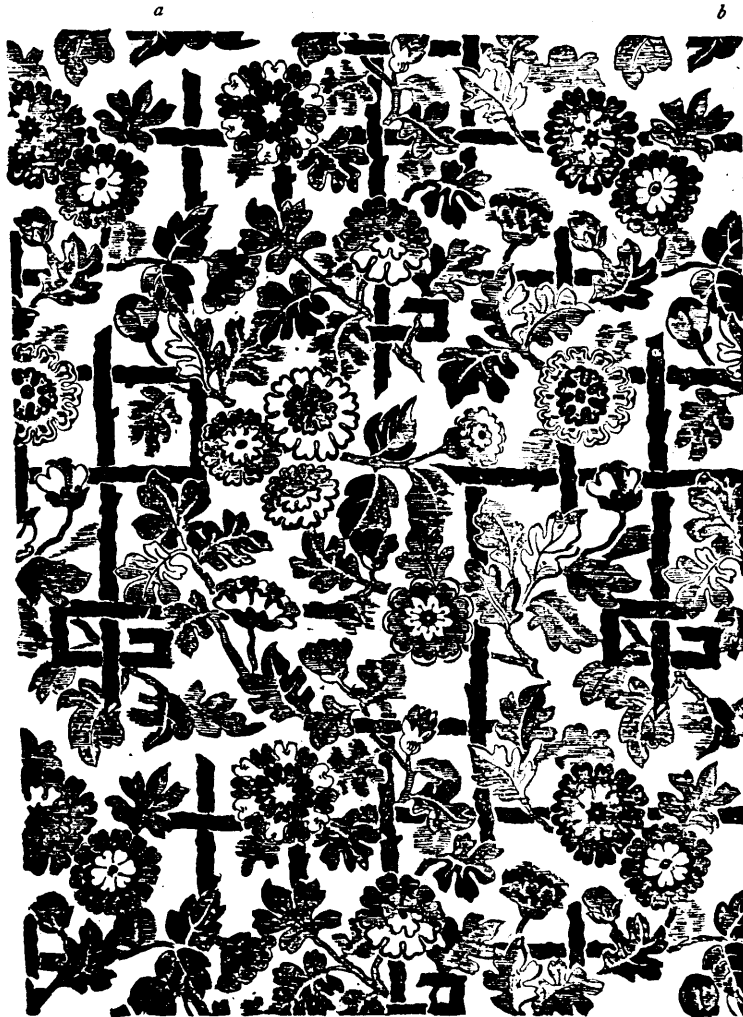


FIG. CXV.

cylinder. The black spots represent the knots, either as caught in the slot or passing free in the hole.

Looms tied-up on the foregoing principles have but one operation of the Jacquard needles for every two picks of the loom, there being an operation of the ground and figure lifter-boards in succession between the operations of the Jacquard needles. Each Jacquard needle controls two tails, one connected with the warp for the figure, (red and black in our example), and the other to the warp for the ground, (olive and white in our example). The drawing of the lifter-boards shows the slots for catching the tails in opposite directions from each other; hence, when the figuring tail of the needle is adjusted so as to be lifted by the figure lifter-board, the ground-tail will not be acted on by the ground lifter-board when it rises.

To give a clear understanding of the foregoing explanations, a detailed statement of the operations of the loom necessary in weaving a piece of the fabric is shown in sectional cut Fig. CVII., as follows:

Pick.	Color.	Lifter-board for figure.	Lifter-board for ground.	Journal lifts.	Threads down.
1	White.	Rises, no lift.	At rest	White to bind on face.	Red, black, olive.
2	Red.	At rest.	Lifts white and olive.	Red.	Black for binding on back.
3	Olive.	Rises, no lift.	At rest.	Olive to bind on face.	Red, black, white.
4	Black.	At rest.	Lifts white and olive	Black.	Red for binding on back.
5	White.	Rises, no lift.	At rest.	White to bind on face.	Red, black, olive.
6	Red.	At rest.	Lifts white and olive.	Red.	Black for binding on back
7	Olive.	Rises, no lift.	At rest.	Olive to bind on face.	Red, black, white.
8	Black.	At rest.	Lifte white and olive.	Black.	Red for binding on back.
9	White.	Lifts red and black.	At rest.	White.	Olive for binding on back.
10	Red.	At rest.	Rises, no lift.	Red to bind on face.	Black, white, olive.
11	Olive.	Lifts red and black	At rest.	Olive.	White for binding on back.
12	Black.	At rest	Rises, no lift.	Black to bind on face.	Red, white, olive.
13	White.	Lifts red and black.	At rest.	White.	Olive for binding on back.
14	Red.	At rest.	Rises, no lift.	Red to bind on face.	Black, white, olive.
15	Olive.	Lifts red and black.	At rest.	Olive.	White for binding on back.
16	Black.	At rest.	Rises, no lift.	Black to bind on face.	Red, white, olive.
17	White.	Lifts red and black.	At rest.	White.	Olive to bind on back.
18	Red.	At rest.	Rises, no lift.	Red to bind on face.	Black, white, olive.
19	Olive.	Rises, no lift.	At rest.	Olive to bind on face.	White, red, black.
20	Black.	At rest.	Lifts white and olive.	Black.	Red to bind on back.
21	White.	Lifts red and black.	At rest.	White.	Olive to bind on back.
22	Red.	At rest.	Rises, no lift.	Red to bind on face.	Black, white, olive.
23	Olive.	Rises, no lift.	At rest	Olive to bind on face	White, red, black
24	Black.	At rest.	Lifts white and olive.	Black.	Red to bind on back.
25	White.	Rises, no lift.	At rest.	White to bind on face.	Olive, red, black.
26	Red.	At rest.	Lifts white and olive.	Red.	Black to bind on back.
27	Olive.	Lifts red and black.	At rest.	Olive.	White to bind on back.
28	Black.	At rest.	Rises, no lift.	Black to bind on face	Red, white, olive.
29	White.	Rises, no lift.	At rest.	White to bind on face.	Olive, red, black.
30	Red.	At rest.	Lifts white and olive.	Red.	Black to bind on back.
31	Olive.	Lifts red and black.	At rest.	Olive.	White to bind on back.
32	Black.	At rest.	Rises, no lift.	Black to bind on face.	Red, white, olive.

Fig. CXV., p. 76, illustrates a fabric design for an ingrain carpet, straight-through tie-up, *a* and *b* forming one repeat, (or one division), equal to one-half yard.

II. The Point Tie-up for Ingrain Carpets.

This method of tying-up is based upon the straight-through tie-up principle, arranged as follows: The design in the fabric repeats from its centre equally towards each selvage.

Figs. CXVI. and CXVII. illustrate two fabric designs. *a* to *b*, the width of the fabric or one yard on the loom; *c* is the centre

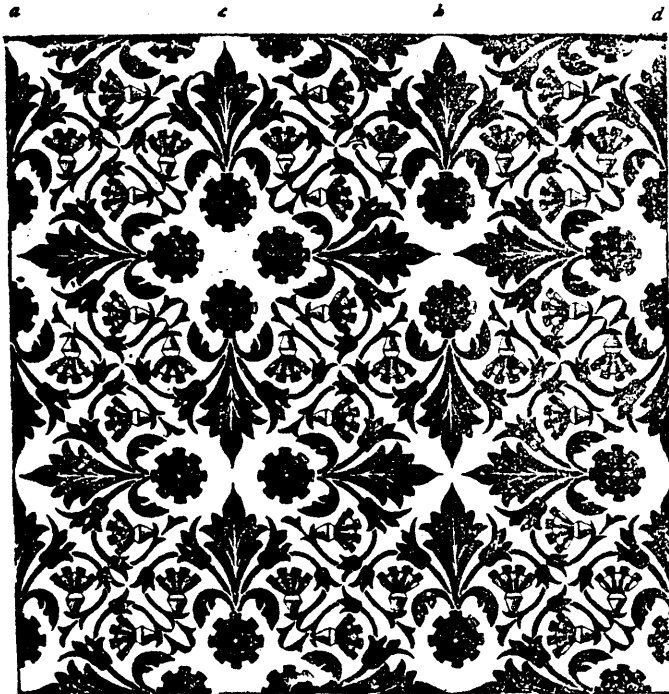
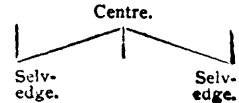


FIG. CXVI.

or point of the design; *b* to *d* is the repeat of *a* to *c*, where the widths are sewed together.

Fig. CXVIII shows the first and last rows, also the two centre rows of the journals threaded to the neck-cords (tail-cords) of the machine. Each cord is numbered to correspond. *a*, *b*, *c*, *d*, represent the cords for lifting the journals, on the same principle as in the straight-through tie-up. In power-loom this is done by a cam arrangement.

Fig. CXIX., p. 80, is designed to give a thorough understanding of the adjustment of harness-cords to heddles, as well as the leasing of the latter. The numbers selected for indicating the different cords correspond with those used in Fig. CXVIII.

Journal 1 = white,	} ground.
" 2 = olive,	
" 3 = red,	} figure.
" 4 = black,	

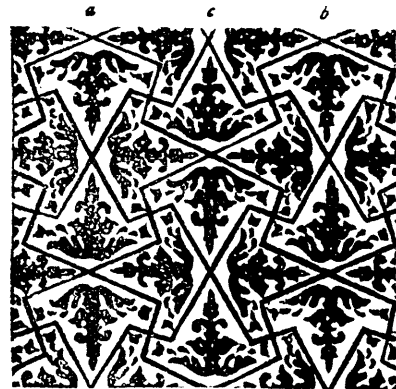


FIG. CXVII.

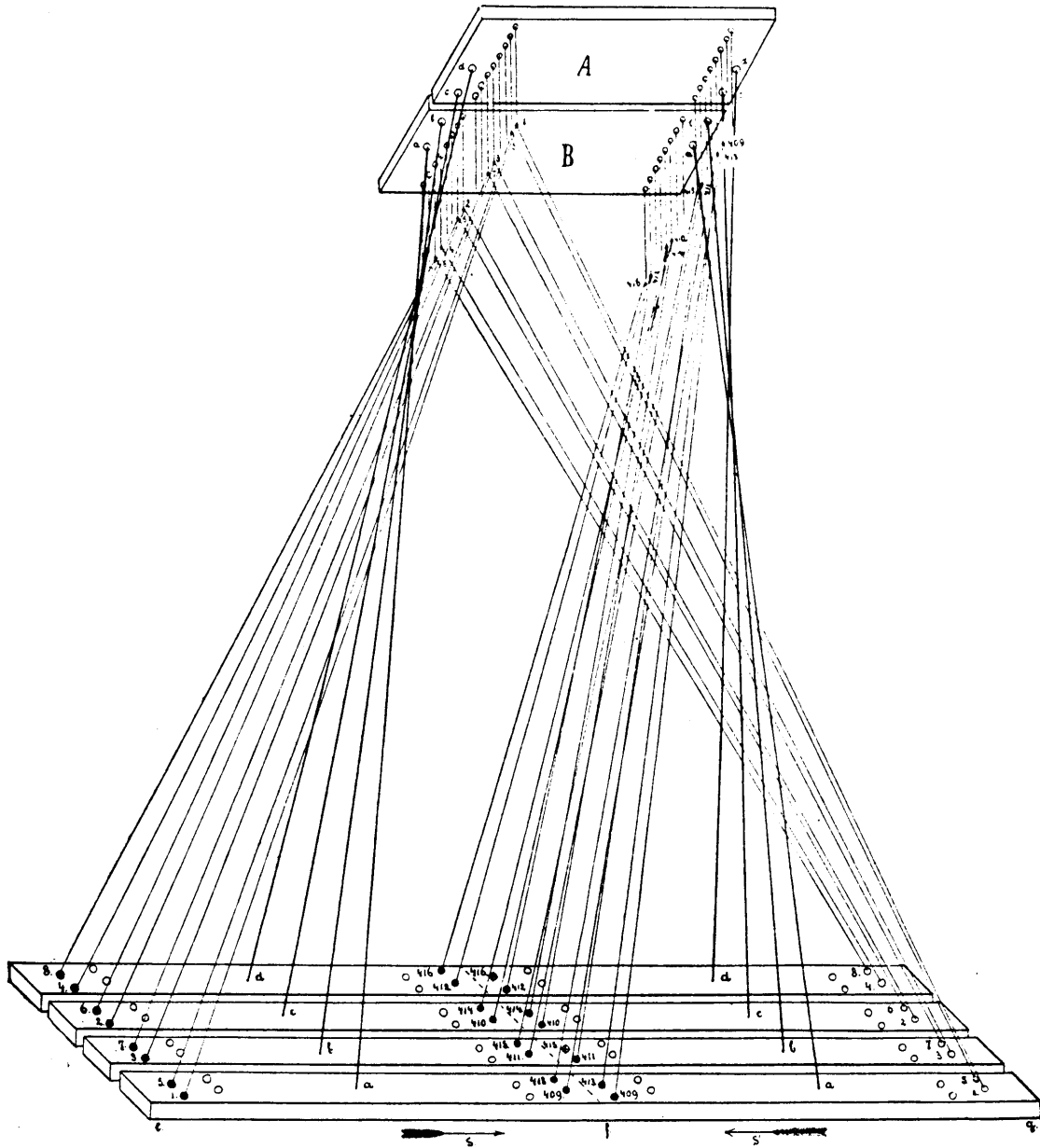


FIG. CXVIII.

Arrangement of threading; <i>a</i> to <i>b</i> , 51 times repeated,	= 408 cords.	
The last row in the half width illustrated separately by <i>c</i> to <i>d</i> , which is the same as <i>a</i> to <i>b</i> .	= 8 "	416
<i>S</i> forms the centre or point; <i>e</i> to <i>f</i> , first row of each journal, near centre, (repeat of centre-cord for ground or figure omitted; see <i>o</i> on journals 2 and 4),	= 6 "	
<i>g</i> to <i>h</i> , 50 times repeated,	= 400 "	
<i>i</i> to <i>k</i> , last row, same as <i>g</i> to <i>h</i> ,	= 8 "	414
Total number of cords used,		<u>830</u>

mechanism for carpet hand-looms. As already stated, the four journals in power-looms are lifted by cams or similar contrivances. In Fig. CXXI, (representing the Crompton carpet loom) this cam arrangement is clearly visible; the cams are situated above the journals, the latter being lifted by means of the journal rods from above. The loom carries four shuttle-boxes at each end of the lathe; any one of the series at either end can be brought into line with the shuttle-race at any pick.

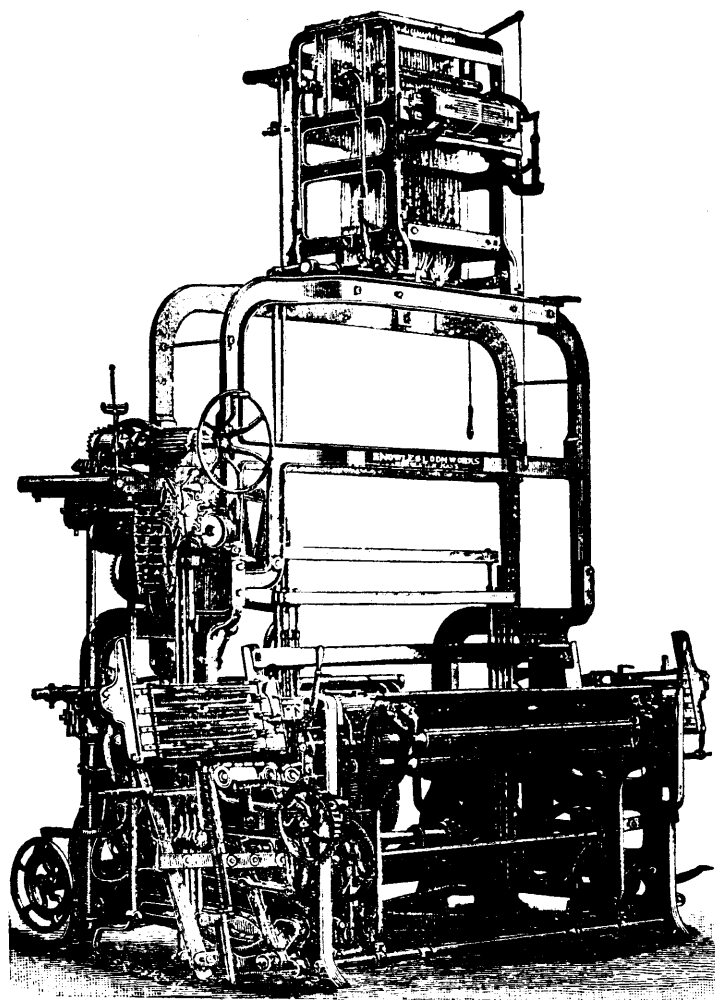


FIG. CXXII.

Fig. CXXII shows the well known Knowles Carpet Loom. Amongst its points of advantage are:—

The "Journals" are operated by cams on outside end of loom, thus of convenient access for fixer, resulting in a very easy lift and consequently permitting high speed for the loom.

The "Backing-off motion" of the loom is automatic, it being connected with the stop-motion of the loom, consequently when the loom stops for reason of the filling breaking, etc., the loom backs-off automatically and the proper shed is open without the weaver having to operate levers, etc.

The new loom is also supplied with a "Graduating Let-off," the same being arranged with a graduating-pad which follows the diameter of the beam and changes the condition of the let-off according to the variations of the diameter of the warp beam, keeping automatically a uniform tension from the start, i.e., the full beam, to end of warp, i.e., the empty beam. The action of the mechanism is automatic, after once set, tension on warp threads remains uniformly the same, right along, no matter as to size of warp beam, i.e., amount of warp on beam.

The "Take-up" is positive and runs with the loom, either forward or backward.

The loom is supplied with regular "Knowles stop motions" one on each side, and "Smash protector" preventing the lay from coming forward, when shuttle or shuttles are caught for one reason or the other in shed, thus preventing breakage of warp threads.

The "Box motion" is so constructed as to weave any usual shading called for; the chain motion being arranged to work from the Jacquard, either forward or backward, permitting the saving of chain stuff on large shading technically known as Block-patterns.

The Jacquard machine is supplied with a "Protector to the Cards" working in front of the needle board, making it absolutely impossible for the needles to tear the Jacquard cards. This protector is a guide (a duplicate-thin needle board we might say) in front of the regular needle board. The needles as extending out of the needle board in turn extend through and out of this guide, which has a to and fro motion in connection with the cylinder. When cylinder at rest the guide is close at needle board, when cylinder moves away from the needles the guide also moves out to the ends of the needles—returning again to its place at rest near needle board as soon as cylinder runs in again to the needles for operating the next pick. The guide, as mentioned before, is arranged to slide to and fro from the needle board to ends of the needles and back again, in turn steadying the needles at their points, preventing catching of cards on the needles and consequent damage of tearing them, thus this protector or guide greatly prolongs the life of a set of cards.

The loom of the present day is also built much heavier all around, compared to former patterns, thus adapting the loom for the manufacture of the heaviest kind of Ingrain Carpet work in the market.

Fig. CXXIII shows the "Murkland High-Speed Ingrain Carpet Loom" as built by the M. A. Furbush & Son Machine Co. of Philadelphia.

The loom was originally invented by Messrs. William and John W. Murkland, of Lowell, Mass., in 1869. In 1879 Messrs. M. A. Furbush & Son secured entire and exclusive control of the loom and since that time constantly improved its construction, adapting it to all the modern demands, requirements, speed, etc., until the loom has reached its present high state of perfection.

Examining our illustration we find five (5) boxes on each side permitting any usual shading. "The Box Motion" is geared positive in all its movements, cannot get out of order or time and is quickly adjusted to any shading required. The old-fashioned manner of backing-up loom to open the shed has been superseded by a

power backing-off attachment, for the lay or lathe, by means of which the weaver simply pulls on a lever when the loom automatically backs-off and thus the shed opens. This "power backing-off attachment," for the lay, makes the work much easier for the weaver compared to the older method when he had to do it himself by manual labor. We also find in the new Murkland loom a patent adjusting motion for the Brake, which can be regulated quickly and positive by the fixer, in turn making it much easier for the weaver to start the loom by the shipper-handle, compared to former constructions of this loom. The loom is also supplied with an ingenious "Smash-Protector"—operated automatically by the warp in case the shuttle strikes the reed, releasing the whip-roll, thereby slackening the shed, in turn preventing shuttle smashes and consequent imperfections to the fabric.

The gearing of the build as to secure higher than heretofore possible. construction of the lay re- firm woven carpets. As is adapted to weave any the market, both structures. If it —for extra heavy known revolving original Murkland this new loom also.

present loom is of such speed with less friction The heavy all iron con- sults in the production of mentioned before the loom "Ingrain weave" now in for 2 and 3 ply should be required shading—the well box-motion of the can be applied to

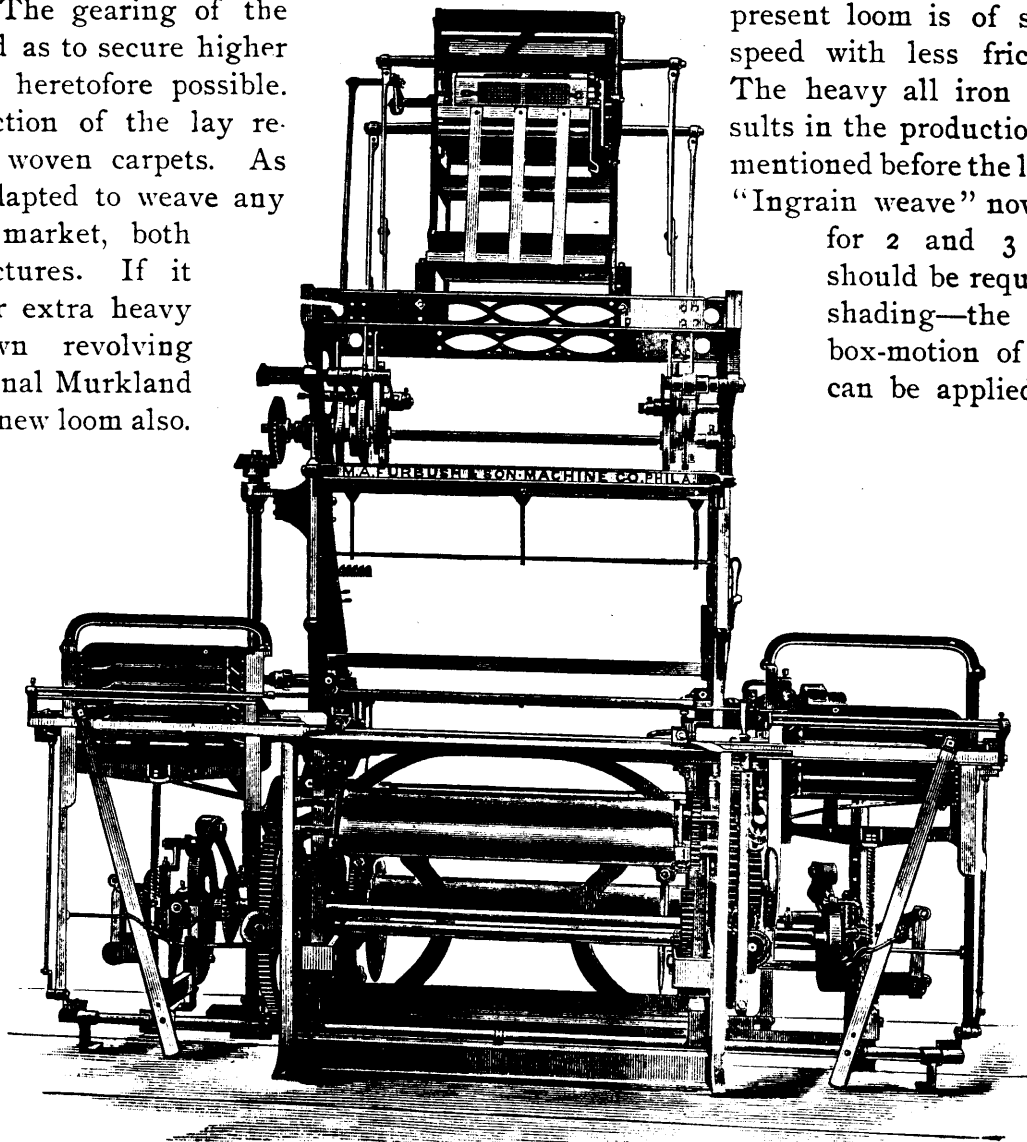


FIG. CXXIII.

SMITH-BROS. PHILA.

APPENDIX.

Preparing and Stamping of Jacquard Cards.

Preparing.

The Jacquard card consists of a strong, durable pasteboard cut to the exact size of the cylinder. For cutting or preparing the cards to the required size, a table is used with the different sizes of cards indicated on its surface. A sharp steel blade is adjusted to the side of the table. A heavy knife of sufficient length, and containing a second steel blade, is secured to a projecting bolt on the rear end of the table, allowing enough play for the knife to be easily raised and lowered. The blade of the knife works close against the blade fastened to the table; and when pressed down both blades rest close together. On the front side of the table is a long groove in which is a guide, fastened by a bolt and nut. This guide can be set to suit any of the marks on the table, thus regulating the size of the cards to be cut.

Two measures (the length and the width) are required to be cut for each set of cards: 1st. The sheets of pasteboard are required to be trimmed one way in sufficient number for the length of the cards. 2d. Each trimmed sheet is afterwards separated in strips of the required width.

Card Stamping.

The oldest method for stamping cards, now only occasionally used, consists of two perforated steel plates, between which the blank cards are placed, and the required holes stamped by hand by means of punches. It will easily be seen that this method is not up to the present advanced times, hence various machines have been introduced for arranging the punches. Among those most generally used are:

- I.—DOBBY CARD PUNCHING MACHINES.
- II.—PIANO CARD STAMPING MACHINES.
- III.—REPEATING MACHINES.

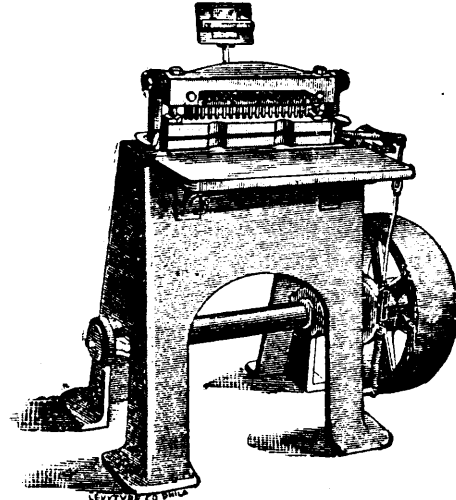


FIG. 1.

I. Dobby Card Punching Machines.

These machines, illustrated by Fig. 1., are used for stamping cards for the smaller Jacquard machines, technically termed "Dobbies." They are of very compact build, and operated by belt-power. The whole card is punched at one revolution or stroke. The rack on top of the machine holds the design. The punches for peg-holes and lace-holes are immovable, while the key punches act independently, at the will of the operator. Jacquard cards for these machines are generally composed of the strongest pasteboard, and require a very strongly constructed machine.

II. Piano Card Stamping Machines.

These are operated in two ways, either by the foot or by power, and are built for either "French Index," "American Index" or "Fine Index" cards.

Figs. 2 to 11 are drawn to one-half the actual size of the "Uhlinger Card Stamping Machine."

Figs. 13, 16, 17, 18, 19 are drawn to one-quarter the actual size of the "Royle Card Stamping Machine."

Figs. 2 and 13 (*E, F, G, H,*) represent the top view of the head (cover taken off), the twelve holes for holding the punches for one row, also the large hole for holding the peg, *P*. Each punch works vertically, and is guided by a key for stamping the hole.

Fig. 14 illustrates the punch (actual size) as used in the "Royle" machine: *a* to *b* = $\frac{3}{4}$ inch; *b* to *c* = $2\frac{7}{8}$ inches; $\frac{7}{32}$ inch diameter of punch, *d* to *c*.

Fig. 15 illustrates a corresponding key: diameter of key $\frac{3}{16}$ inch, *d* to *e*; diameter of head, $\frac{3}{8}$ inch, *a* to *b*; *c* is the hole for inserting the pin which holds the spring. The length of the keys vary from $1\frac{3}{4}$ to $2\frac{1}{8}$ inches, according to the position they occupy in the machine. The punch and key of the Uhlinger machine are shown (one-half of actual size) in Figs. 4 and 5.

A and *B*, in Figs. 2 and 13, represent the piston for guiding the head in its vertical motion.

Fig. 3 represents the front view of the head. The numbers and letters indicating the different parts correspond with Fig. 2.

The principle of construction and action of the heads in both kinds of machine are similar. Each key is provided with a fine spiral spring, which, after every action of the key, returns it to its original position. The key for the peg-hole is controlled by the larger spring, *S, D*, in Figs. 2 and 13. The arrows in these two drawings indicate the direction taken by the keys when under pressure.

When cutting cards eight rows deep, the thumb of the right hand works the key for the peg-hole; the eight keys in the rear of the machine (which are the ones to be used) are worked by the four fingers of each hand.

When cutting cards twelve rows deep, the eight keys in the rear are operated by the eight fingers in the same manner; but the thumb of the right hand operates

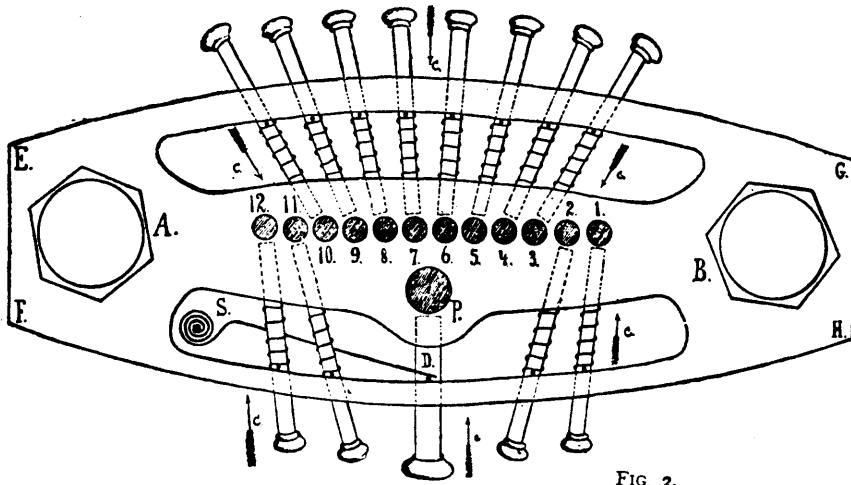


FIG. 2.

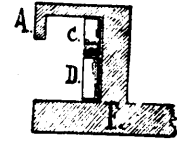


FIG. 7.

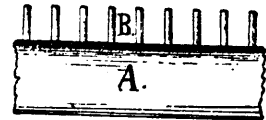


FIG. 8.

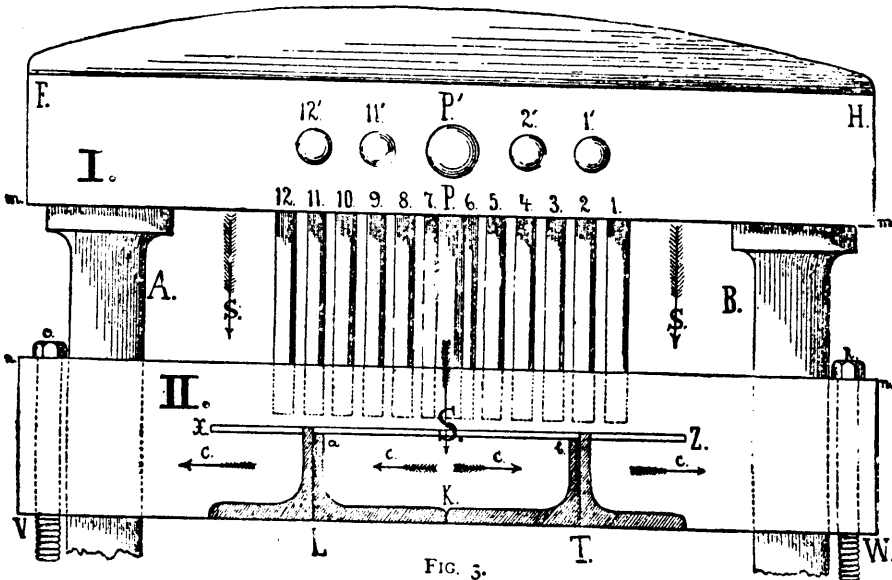


FIG. 3.



FIG. 9.

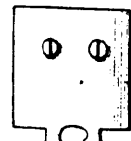


FIG. 11.

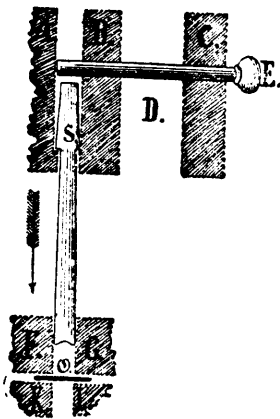


FIG. 4.

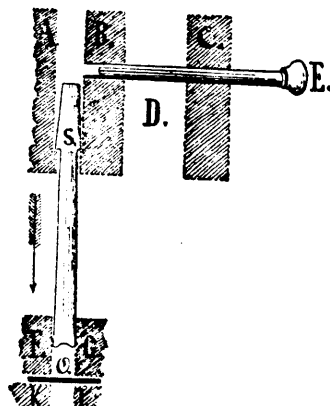


FIG. 5.

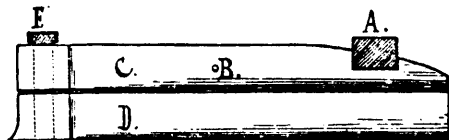


FIG. 6.

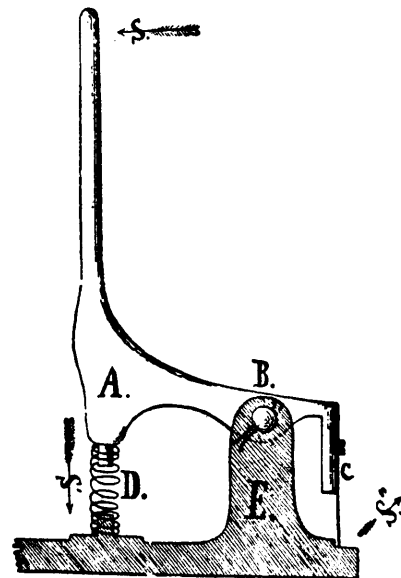


FIG. 10.

keys marked 1 and 2, and the thumb of the left hand operates keys marked 11 and 12.

During the cutting operation the fingers should not be removed from the keys; they should always be in readiness to press the required key into action, as this is the only way to become expert.

The eye of the card stamper must rest uninterruptedly on his design; and the keys are called at will by the fingers, without the eye leaving the design, to find out where a certain key or finger is situated at the time.

Fig. 4 shows relative positions of punch, *S*, and key, *E*, when ready for stamping a hole.

Fig. 5 shows the relative positions of punch and key when no hole is required.

O represents the Jacquard card as resting in the slot of the lower head. II. in Fig. 3, marked *X* to *Z*, shows a full width view of this card.

The space *D*, in Figs. 4 and 5 permits the spring to be inserted regulating the key. *A, B, C*, solid parts of the upper head, (I., in Fig. 3). *F, G, K, L*, solid parts of the lower head, (II., in Fig. 3).

The cards are passed into and through the stationary part of the head at *X, Z*, and are attached to a "carriage" in the rear of the punch head.

Two methods are employed for moving the carriage:

1st. By a "skipper" at its rear fastened to the carriage, which moves in a rack of pins secured to the cutting table. This method of construction is used by the Uhlinger machine. Figs. 6 and 7 are front and side views of this mechanism. Figs. 8 and 9, the top view and sectional cut of the rack.

2d. The rack is fastened to the carriage, and the skipper to the table, thus reversing the first method. [See Fig. 19, top view.] This method of construction is employed in the Royle machine.

The distance of the pins in the racks in both systems of construction (American and French) corresponds to the distance of the rows in the card. The racks are generally constructed for 600, 900, and 1200 Jacquard machines. Of these three sizes the 900 is the most advantageous, as cards can be cut for any smaller size machine. The rack of a 900 machine (French index) contains 88 pins, while that of a 1200 machine (French index) contains 114 pins.

Fig. 10 illustrates the "catch" for holding the cards in the Uhlinger machine. This is fastened to the carriage when pressed by the hand on top in the direction of arrow, *S*; this catch will compress spring, *D*, in the direction of arrow, *S'*, thus opening the "blade," *C*, (front view shown by Fig. 11), in the direction of arrow, *S''*, thus allowing the card to be inserted and held, securely fastened to the carriage.

Fig. 18 illustrates the side view of the carriage and its catch for holding the Jacquard card as used in the Royle machine. Arrow, *S*, indicates the pressure of the operator's hand on lever, *B*, when the card is inserted. This lever presses by means of presser, *D*, in the direction of arrow, *S'*, on the double-acting lever, *E*,

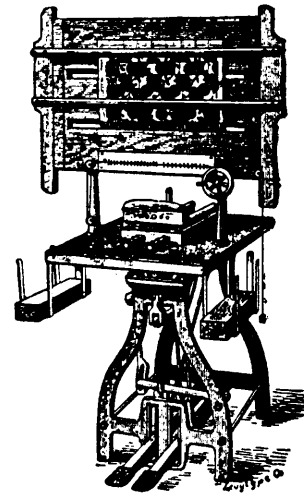


FIG. 12.

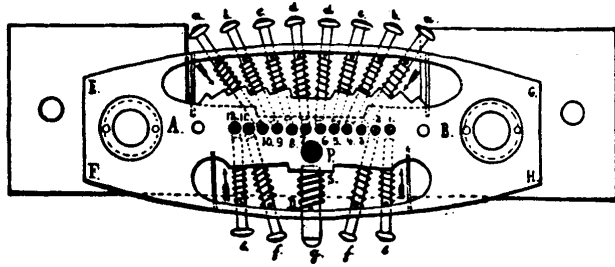


FIG. 13.



FIG. 14.

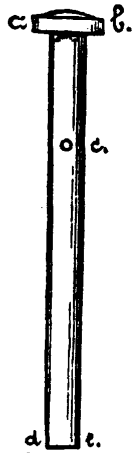


FIG. 15.

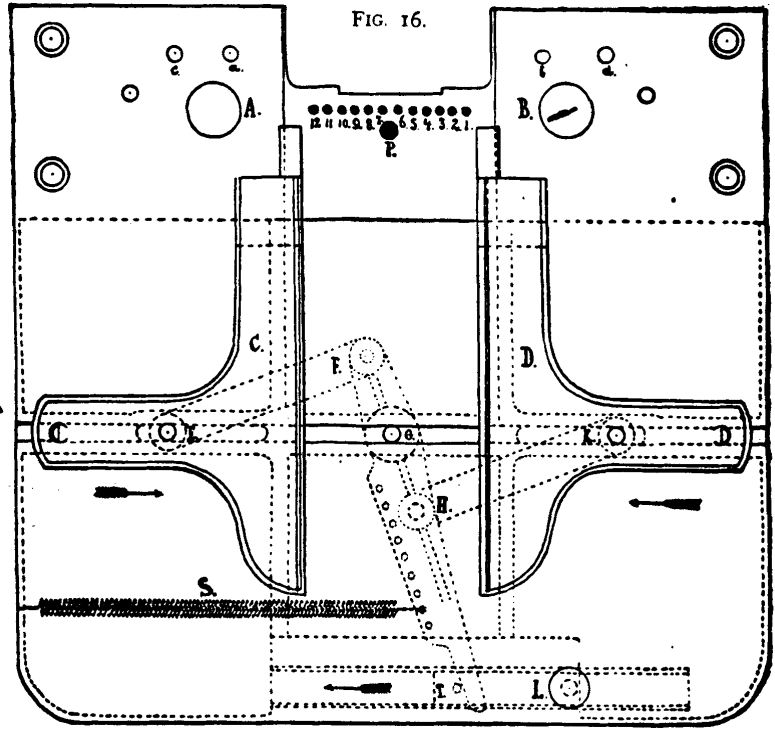


FIG. 16.

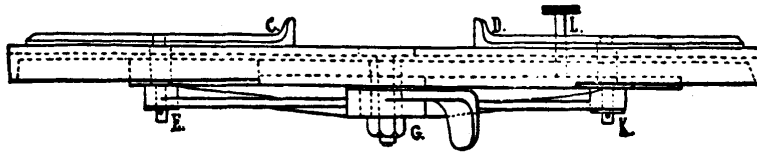


FIG. 17.

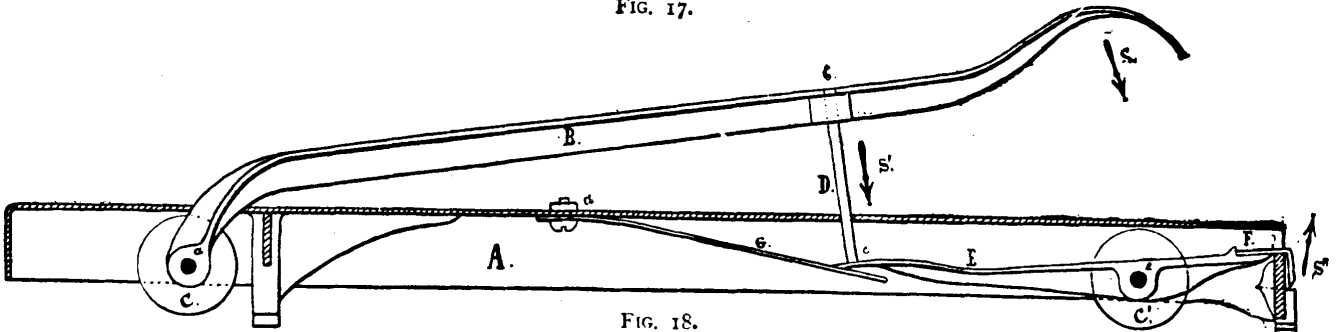


FIG. 18.

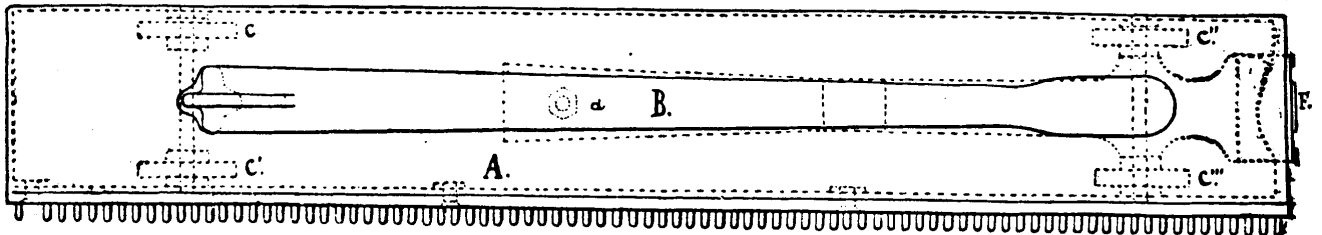


FIG. 19.

at e . This lever moving around its fulcrum, e , will lift catch, F , in the direction of arrow, S'' , thus allowing the card to be inserted. Spring, G , fastened to main part of carriage, A , by means of screw, a , secures the card to the catch. C, C' , are the carriage wheels, of which there are four.

Fig. 19 represents the top view of Fig. 18, and is designed to show the arrangement of levers, wheels, and catches of the complete rack as used for a 900 machine. The letters indicating the different parts correspond with the ones used in Fig. 18.

Fig. 16 shows top view and ground plan, and Fig. 17 the front elevation of the "card-guide," as constructed on the Royle machine. It is universal and self-adjusting to any width of cards from $\frac{3}{4}$ to $3\frac{1}{2}$ inches; both guide-plates, C and D , are caused to move equally toward or away from the peg-punch, thus accurately centering the peg-hole in all cards.

Letters A, B, P , and numbers 1 to 12, correspond to those used in Fig. 13. E, F, H, K , are the three levers moving around pin, G , (the latter in even line with the centre of the peg-hole, P). These levers are held by screw, L , in any required position. Spring, S , holds lever, F, H , against pin, T , which in turn is fastened to the same plate as screw, L .

Fig. 16 indicates the card-guide set for a 12-row card. Let us suppose it necessary to cut an 8-row card. Loosen screw, L , and spring, S , will instantly contract until each side of the guide has moved the required distance (two holes and two spaces between holes) towards the centre. Much valuable time is saved

by the use of this guide, as it instantly adjusts itself to any width of card, and at the same time centralizes each card passed through the machine. In factories where broken cards require to be constantly renewed, the value of this guide is especially noticeable, there being no material interruption of the regular work of the operator, who can replace the damaged card at the moment wanted.

Letters indicating the different parts in Fig. 17, correspond to those used in Fig. 16. As mentioned before, the pistons, A and B , of the cutting head are connected below the table to the cutting levers, and by a simple combination of levers,

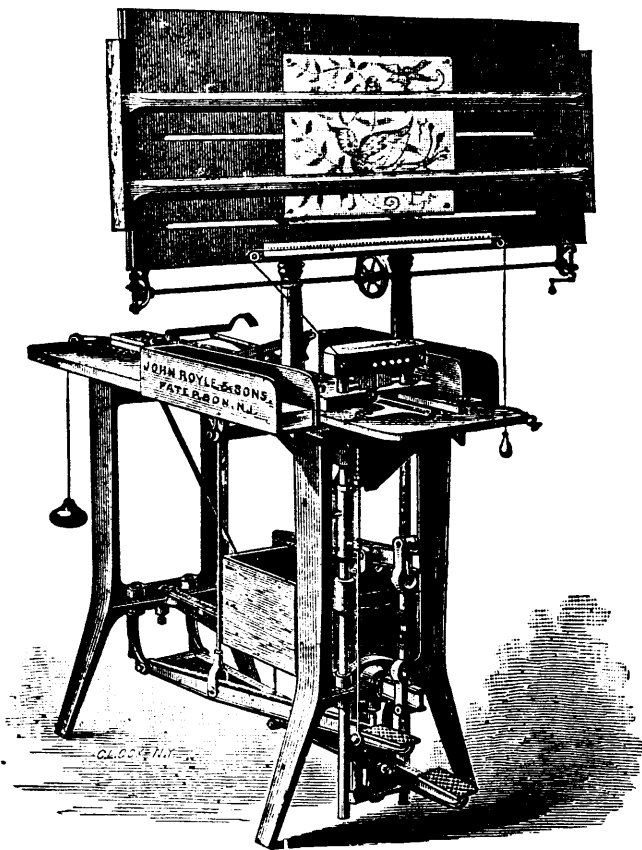


FIG. 20.

the cutting pedal is brought in direct relation to the cutting lever ; all of which are illustrated in the perspective view of the Royle machine in Fig. 20, and the Uhlinger machine in Fig. 12. The working of the cutting pedal is very simple. Pressing the pedal, situated at the right, causes the punch head to descend, and the punch penetrates the card. Transferring the pressure from the right to the left pedal raises the punch-head to its former position, (punches above card), ready for a repetition of these movements. The "skip" arrangement allows the carriage to advance the

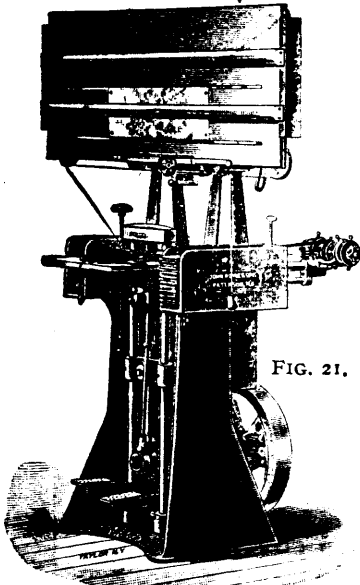


FIG. 21.

distance from one pin to the other in the card-rack, thus placing the card in proper position under the punches.

At the proper height above the punch-head is the reading-board, on which the guide-rules are moved across the design by screws, which are connected by gearing and operated by means of the hand-wheel or crank shown on the lower side of the board. As drawing-pins or thumb-tacks are generally used as fastenings for the design, the reading-board is made of soft wood, and its trimmings are made of hard wood. Fig. 21 illustrates the Royle Power Piano Machine. The power is controlled by pedals, and the machine can be stopped after each row or allowed to cut a number of rows continuously. The action is precisely like that of the foot-driven machine, consequently familiar to operators of that machine. The manipulation of the keys does not affect the power, hence no danger of cutting imperfect rows. This machine spares unnecessary labor, thus greatly increasing the daily output of cards.

The Stamping of Cards.

Before commencing this work a clear conception of the tie-up and leasing of the heddles is required. The holes in the cards for the needles to penetrate, or the spots in cards where no hole is to be stamped, must be arranged in an uninterrupted chain from one row to the other, until all the rows are taken up. As previously mentioned, the method observed in tying-up the loom is the guide for stamping the cards. The number of ends re-

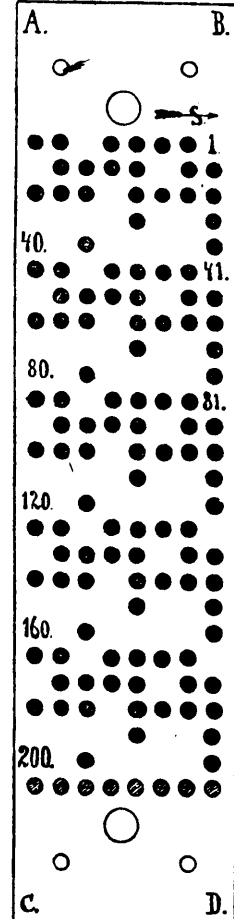


FIG. 22.



FIG. 23.

quired in a certain design may repeat only once in the number of hooks and needles employed in the Jacquard machine ; or they may repeat two, three, or more times.

Fig. 23 illustrates a design upon 40 warp-threads. Fig. 22 shows the corre-

sponding card, (French index), one-fourth of its actual size, for the first pick. In a 200 machine this design will repeat itself five times. The lace-holes and the peg-holes are blank. The reserve row (26th) is shaded, and the design as cut in card is indicated by black dots. This cut also shows the direction of reading each row to correspond with the numbering for the punch-heads, in Figs. 2, 3, 13, and card-guide in Fig. 16. The numbers 1 to 40, 41 to 80, 81 to 120, 121 to 160, 161 to 200, indicate the direction of stamping the design, as well as the five repeats to form the complete card. In this connection it will be of great advantage to examine Fig. XXIX., p. 28, under the head of the Jacquard Machine and its Tie-ups.

Fig. 24 illustrates a Jacquard card (American index) stamped for ingrain carpets, one-half of actual size. This card illustrates the stamping for two textures, 1' to 208' being for "extra fine." The 26 rows needed are shown full black, and marked to correspond. The peg-holes and lace-holes are left blank. In the other texture, or what is termed "extra super" ingrain carpet, the additional rows are represented by the shaded holes at the ends of the cards. Arrow, S, indicates the direction for commencing to read off each row.

III. Repeating Jacquard Pattern Cards by the Positive Action Repeater.

If several sets of cards of one design are required for starting a corresponding number of looms, and the first set has been produced by the "piano machine" exact duplicates can easily be obtained at small cost to the manufacturer by the "Repeating Machine." This machine is built by Messrs. John Royle & Sons, Paterson, N. J., and is illustrated by Fig. 25 in a perspective view.

Fig. 26, p. 94, represents a side elevation of the machine with its throat-piece through which the cards that are to be cut pass, the carriage on which the throat-piece is supported, and the mechanism employed for imparting a rising and falling motion to the carriage.

Fig. 27, p. 95, is a vertical longitudinal section of the upper portion of the machine.

Fig. 28, p. 95, gives a perspective view in detail of portions of a selecting-needle and key-wire and a lever connecting them.

The cards to be duplicated (*N, N*, Fig. 26, p. 94,) are arranged upon the card race-arms (*M, M*, Fig. 26,) in the same manner as upon a

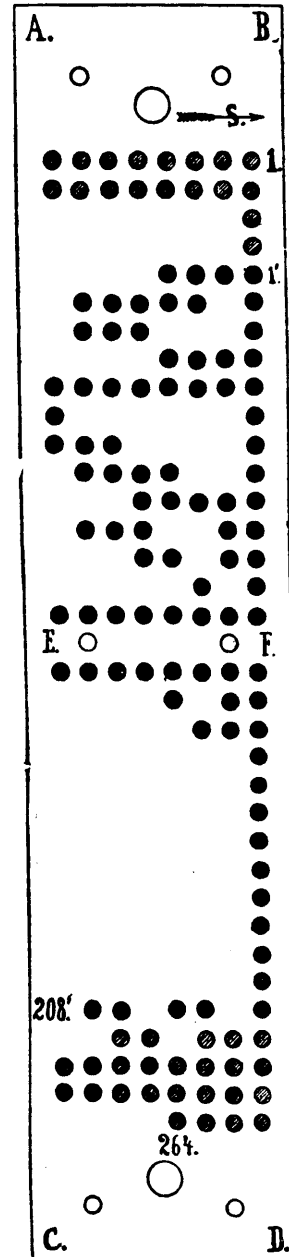


FIG. 24.

loom. The uncut or blank cards, having been previously laced together, (*E, E*, Fig. 26), are piled in the rear at the base of the column, and thence passed forward through the machine, and delivered finished in front.

The perforating of the cards is performed by a vertically reciprocating die, (*D*, Fig. 26), and a set of punches (*C*, Fig. 26,) carried in a fixed punch-head, and capable of being pushed upward when such movement is not prevented. The cards commonly used are of a size to receive 600 holes, and hence that number of punches are required.

The cards (*E*) to be cut are drawn over a "reel" or "idler" (*F*, Fig. 26,) at the back of the machine, and thence pass through openings in the base frame to the front of the machine, and over a square cylinder having a step-by-step rotary motion.

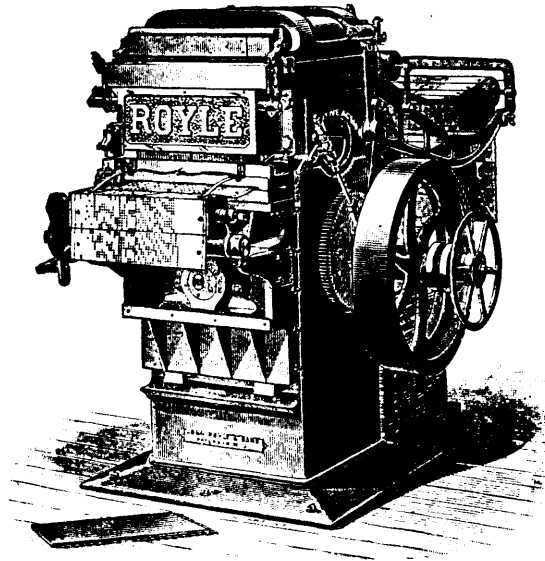


FIG. 25.

By each quarter turn of this cylinder, the chain of cards is drawn forward sufficiently to bring a new card in the die. By the rising movement of the die (carriage), which takes place as soon as the intermittent feed of the cards has ceased, the card in the throat of the machine is carried up against the lower ends of the punches, and is cut or perforated by all such punches as have their upward movement prevented by the keys; while such punches as are not arrested by the keys are carried upward, and do not puncture the card. The pieces of card cut off fall through a throat or opening in the carriage (*F*, Fig. 27,) into the hollow base frame, (*A*, Fig. 27), and can be taken out at the door, (*A*, Fig. 26).

It will therefore be apparent that the variations in the cards are produced simply by holding down different punches in successive punching operations. This is regulated by the original set of cards, (*N*, Fig. 26), which are passed over the pattern cylinder (*O*, Fig. 26). The latter has also a step-by-step rotary motion similar to the cylinder first described. Its four faces are covered with holes the same distances apart as the perforations in the pattern cards. This pattern cylinder is mounted in bearings in a carriage on the top of the machine, and is reciprocated back and forth between the successive rotary movements of the feed and pattern cylinders.

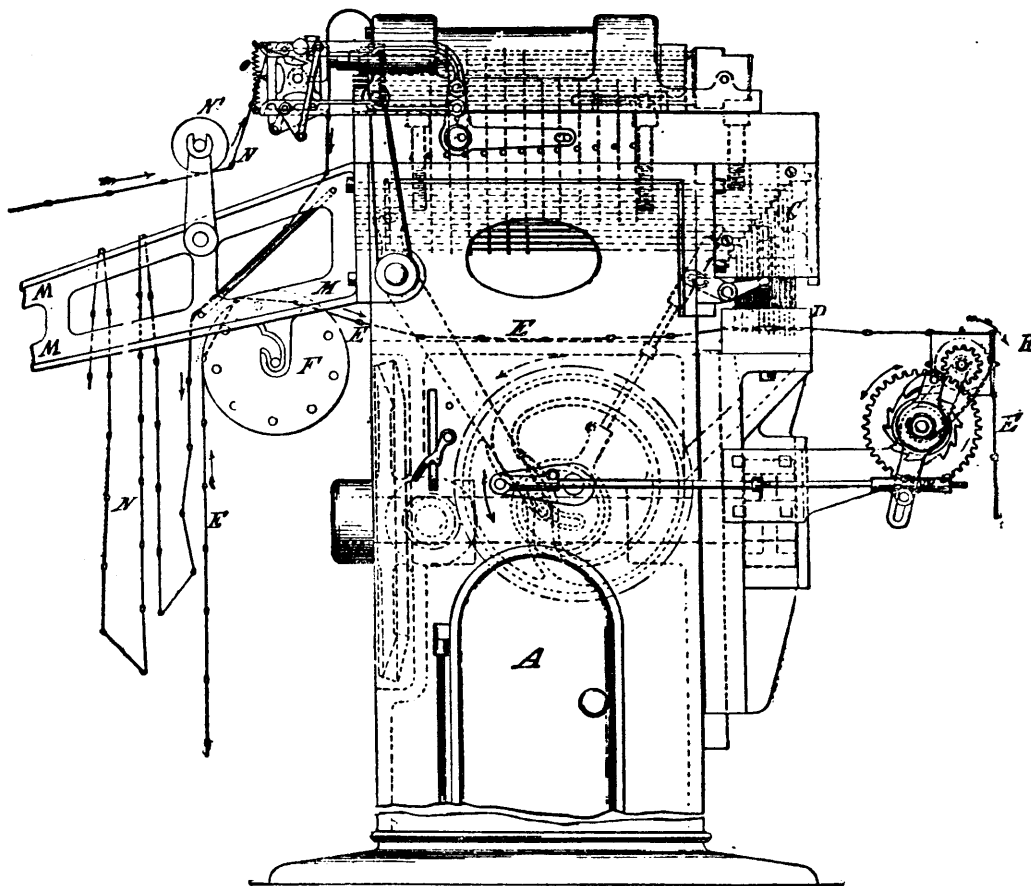


FIG. 26.

In the upper part of the machine are arranged what are termed selecting needles, (*C*, Fig. 27), which consist of wires arranged in horizontal rows, with their ends opposite to the pattern cylinder, and which are the same distance apart as the holes in the cylinder, so that if the cylinder were moved up by the carriage against the ends of the needles, the latter would enter the holes in the cylinder, and would not be moved longitudinally. There are the same number of selecting needles as punches in the machine—six hundred. When, however, a perforated pattern card is on the cylinder, and it is moved against the ends of the selecting needles, such needles as are opposite the perforations of the cards will enter them, and will not be moved, while such needles as are opposite the blank spaces of the cards will be moved longitudinally. [See Fig. 27 for illustration.] At the reverse movement of the

carriage, an "evener," which is secured to it at the end opposite the pattern cylinder, strikes against the ends of all the needles so moved and pushes them back to their original position. Above each of the punches before described is a horizontal sliding key (*D*, Fig. 27,) attached to a horizontal key-wire (*D'*, Fig. 27), and the 600 key-wires are arranged in horizontal rows below the selecting needles, and are each connected by a lever (*B*, Fig. 27,) with the corresponding selecting needle.

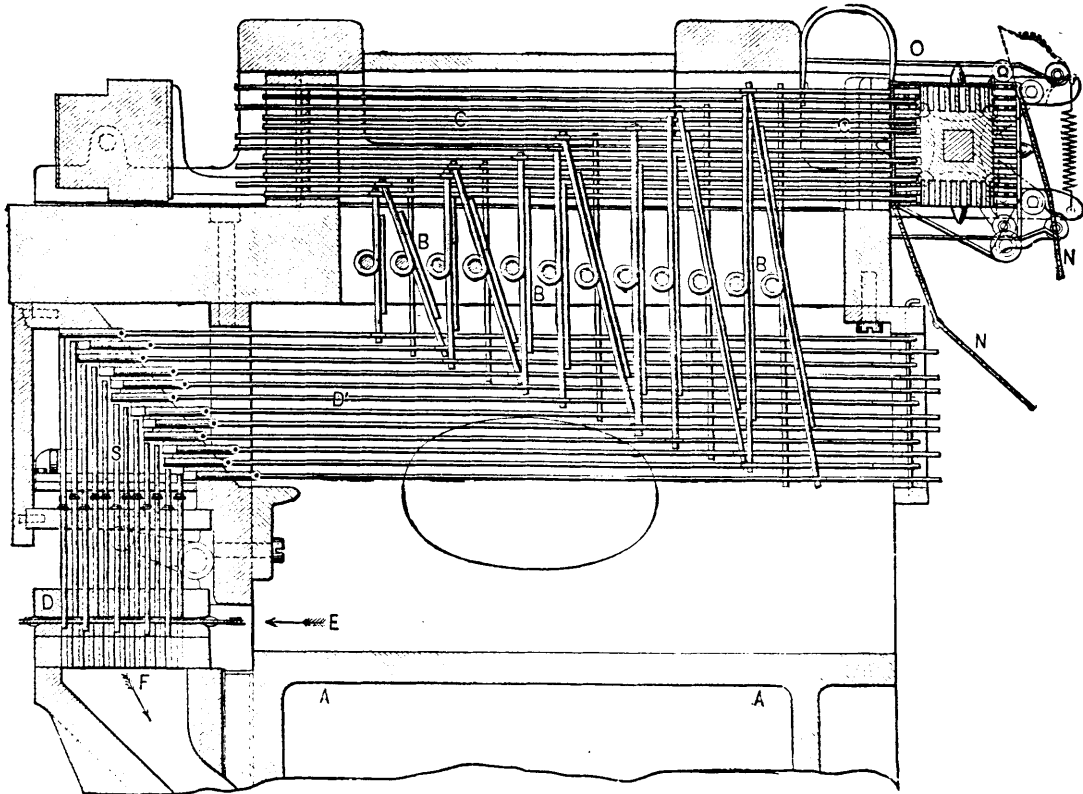
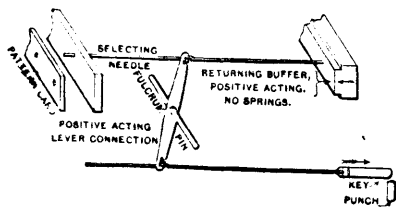


FIG. 27.

Consequently, a longitudinal motion of any selecting needle will move the key-wire with which it is connected in a reverse direction.

Fig. 28 gives a clear demonstration of the connection of a selecting needle, *a*, to the key-wire, *f*, by means of the lever, *c*, movable around the fixed pin, *d*. Each key (*D*, Fig. 27,) consists of a cylindrical plug of metal, which, projecting over a punch, forms an abutment to keep that punch from rising, but if withdrawn, allows the punch to rise without resistance.



A step arrangement of the punches and keys is adopted; that is, the upper ends of the outer rows of punches are highest and the punches in the several rows decrease in height till the inner row is reached, where the punches are the lowest. Hence, the keys of the upper rows, which correspond to the outer rows of punches, are carried over the inner rows of punches and terminate over the punches in the outer rows.

Normally, all the keys are above the punches, and all would punch when the die ascends, but when a pattern card is carried by the pattern cylinder against the ends of the selecting needles, certain needles are moved and produce a reverse movement of the corresponding key-wires, and draws certain keys out of reach of their punches; no resistance being offered to the upward movement of such punches, they do not perforate the cards.

The carriage on which the pattern cylinder is carried being mounted directly on the top of the machine, can be readily lifted off to afford access to the parts below, and it is provided with a movable hood, which may be lifted to inspect the selecting needles.

The keys and key-wires are arranged farther apart vertically than the selecting needles, thus enabling larger keys and heavier and stronger key bearings to be used, and avoiding any liability of the punches striking the keys in the tier next above when those of their own tier are withdrawn.

Instead of applying a separate spring to each punch to move it downward or return it as the die recedes, a positively operated returning plate is used, which moves down as the die recedes and acts on collars on the punches, and forces all the punches down. This is very important, for if any of the punches should fail to descend, the movement of their keys would be prevented, and thereby the machine would fail to properly repeat.

The bearings of the pattern cylinder are so constructed that the cylinder can be instantly changed to allow either a 400 or a 600-hole cylinder to be used, so that the bearings can be adjusted to adapt them for either size cylinder.

The bearings of the feed cylinder, whereby the chain of cards to be cut is moved, are constructed and supported so as to enable them to be readily adjusted to suit slight variations in the tightness with which the cards are laced, or in a greater degree to suit large or small cards, and the mechanism whereby the cylinder is operated is capable of ready adjustment for the same purpose.

The punches have a shear cut, which avoids excessive strains on the machine.

Lace Hole Press.

Where hand-laced cards, or hand-feed lacers, are used, an automatic machine, as shown in Fig. 29, for punching the peg and lace holes is indispensable. The cards being piled in the stack A, whence they are fed into the die B, where the peg and lace holes are cut, the cards being then delivered at the back in convenient shape for handling. The cards require no attention while in the machine, the feeding, punching and delivery movements being entirely automatic. This machine is a great improvement over older makes, being much more productive, while at the same time much easier to handle.

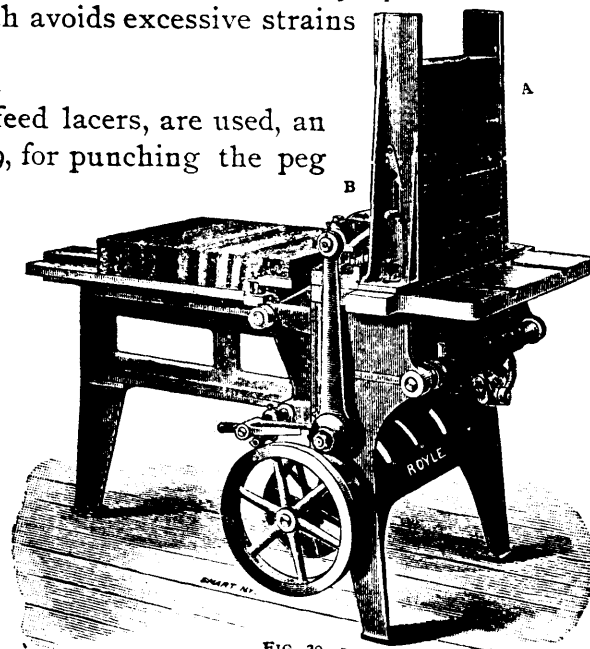


FIG. 29. -

The Lacing of Cards.

Two methods are observed for lacing Jacquard cards: *A*, hand-lacing on a common frame; *B*, lacing by power.

A. Lacing of Jacquard Cards by Hand.

For this purpose the cards are put on a common frame containing on its surface pegs of a corresponding size to those used on the cylinder. The pegs on the frame are made of hard wood, and the pegs of the cylinder of brass. These pegs on the frame are located at exact distances apart, and the frames are built to hold from 30 to 50 cards, superficially arranged.

Figs. 30 and 31 illustrate the frame under *S*, showing at *a* three cards arranged for a fabric, with a twill effect from left to right; and at *b* the same cards

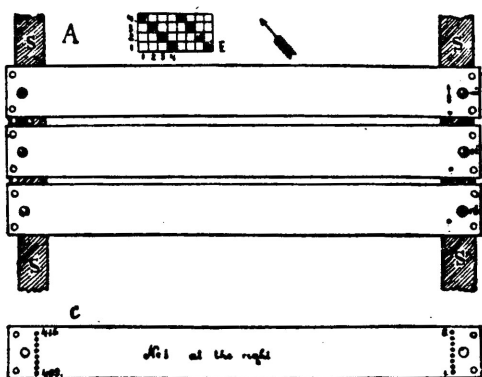


FIG. 30.

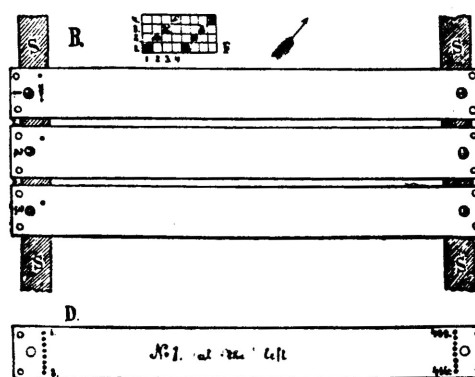


FIG. 31.

arranged for a twill in the opposite direction, from right to left. These frames are arranged to slide into each, so as to adapt them to the distances of the peg-holes in the cards. To give a clear understanding as to the distance of these pegs from each other a few measures most generally used for lacing frames are given.

1. FOR A 200 MACHINE (FRENCH INDEX).

The centre of the pegs are $2\frac{2}{16}$ " apart. Width of cards $2\frac{5}{16}$ ", allowing $\frac{1}{4}$ " for distance between the cards. Diameter of the pegs at the bottom, $\frac{3}{8}$ ". Distance of the centre of one peg to the centre of the corresponding one across the frame, $7\frac{1}{2}$ ". Length of card, $9\frac{5}{8}$ ".

2. FOR A 600 MACHINE (FRENCH INDEX).

The centre of the pegs are $3\frac{5}{8}$ " apart. Width of cards, $3\frac{3}{8}$ ", allowing $\frac{1}{4}$ " for distance between cards. Diameter of the pegs at the bottom, $\frac{3}{8}$ ". Distance of the centre of one peg to the centre of the corresponding one across the frame, $14\frac{5}{8}$ ". Length of card, $16\frac{7}{8}$ ".

3. FOR AN INGRAIN CARPET MACHINE (AMERICAN INDEX).

The centre of the pegs are 3" from each other. Width of cards $2\frac{3}{4}$ ", allowing $\frac{1}{4}$ " for the distance between the cards. Diameter of the pegs at the bottom, $\frac{3}{8}$ ". Distance of the centre of one peg to the centre of the corresponding one across the frame, $11\frac{3}{8}$ ". Length of card, $13\frac{1}{4}$ ".

B. Lacing of Jacquard Cards by Machine.

Different styles of machines are constructed for doing this work, among which we find machines requiring two needles for each series of holes in the Jacquard cards, and machines using one shuttle in connection with each needle. The Jacquard cards mostly needed are for machines containing 400, 600, etc., hooks and needles.

The Jacquard cards for these sizes have three series of lace-holes, and the number of needles, or needles and shuttles, used in the machine, is proportionally increased.

The Method of using Two Needles for Lacing each Series of Holes

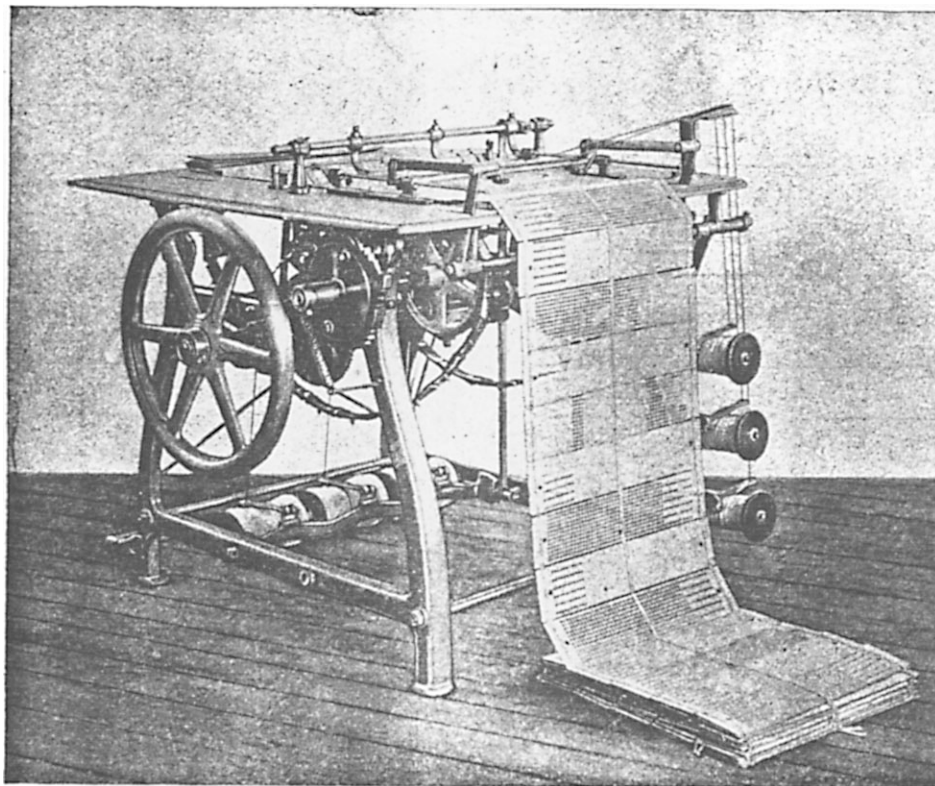


FIG. 32.

Fig. 32 represents the perspective view of a lacing machine for 600 Jacquard cards. The table is located at a convenient height, and is $33\frac{1}{2}$ by $36\frac{1}{2}$ inches. Two grooves, each $1\frac{1}{8}$ inches by $26\frac{1}{2}$ inches, are located five inches from front and rear respectively, and $9\frac{1}{8}$ inches from each side. A third groove of the same size is situated in the centre, $6\frac{1}{2}$ inches from the others. An endless chain runs in each groove, consisting of 24 links, corresponding in length to the width of the card to be laced. Each link of the two outside chains has a peg of a size corresponding to the one used on the cylinder in the Jacquard machine.

Fig. 33 illustrates the side view of a link, and the method of jointing: *a*, the peg; *c*, the joint of link; the length of each link being $3\frac{1}{2}$ inches, and the height

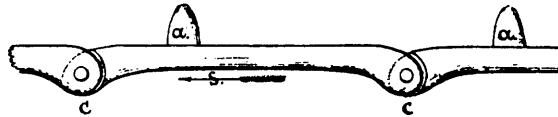


FIG. 33.

$\frac{1}{2}$ inch at the joint; the diameter of the pegs at the bottom, $\frac{3}{8}$ inch; the height of each peg, $\frac{1}{2}$ inch.

Fig. 34 shows the top view of Fig. 33, illustrating two complete links. The body of each link is $2\frac{3}{8}$ inches long; the head, $\frac{5}{8}$ inch long; the slot, 1 inch long. *a* represents the peg; *e* the empty spaces between each pair of links, to receive the

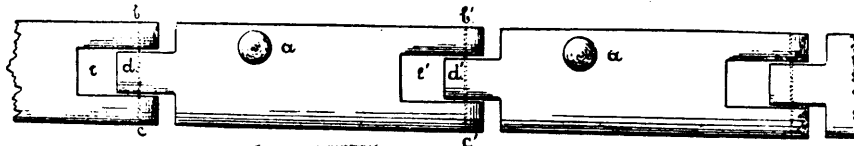


FIG. 34.

teeth ($\frac{1}{2}$ inch high) of wheel (8 inches diameter, Fig. 36). This wheel holds and guides the endless chain; also imparts the required movement to the cards. It is regulated by a cam arrangement. [See Fig. 35.]

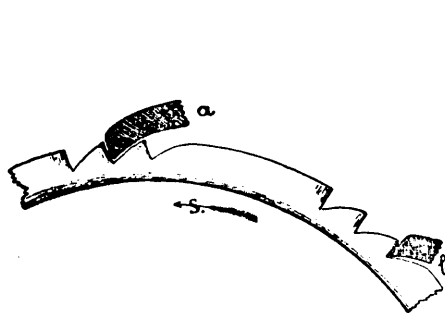


FIG. 35.

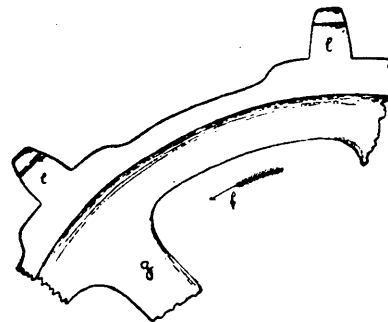


FIG. 36.

Two needles are required for each of the three series of lace-holes, or six needles in all. The process of lacing each series is the same; as the three horizontal working needles are connected to one rod; thus, by working this rod, they are operated correspondingly. The three vertical working needles are arranged in the same manner, and also the three loop-guides.

Fig. 37 shows a top view of one of the loop-guides, *d*, *a*, *c*. The dotted lines near *a* represent the position of the corresponding "presser" for the cards during the lacing process. Length of strip *c*, = 5 inches; length of strip *d*, = 13 inches; width of each strip, = $\frac{3}{4}$ inch; width of empty space, between *c* and *d*, = $\frac{3}{4}$ inch. *b* indicates the top view of the vertical working needle. Arrow, *S*, direction the cards run while being laced. As previously mentioned, two needles are required for each series of lace-holes.

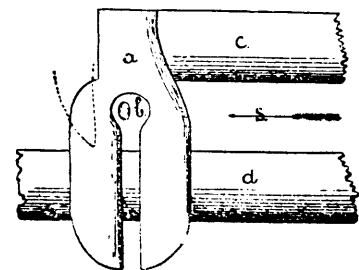


FIG. 37.

Fig 38 shows the top view of the needle, which works in a horizontal direction. Fig. 39 side view of the same. Fig. 38 is shown threaded, whereas Fig 39 is not threaded, so as to give a clear view of the eye. This needle is fastened to its holder by means of screw, *d*; the blade of the needle extends $3\frac{1}{2}$ inches; width of needle at bottom, $\frac{3}{16}$ inch.

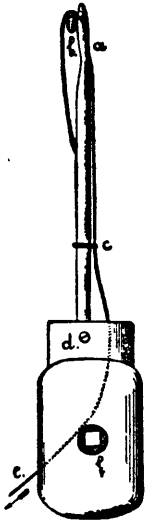


FIG. 38.

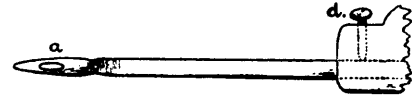


FIG. 39.

Two different sets of lacing twines are used, viz.:

1st. Set of fine thread running from three spools shown in a vertical position on the side of the machine, used for threading the needles running in a horizontal direction. In our explanation we denote this twine with "a." (7-ply, No. 14 soft laid mule yarn.)

2d. The set of heavy twine running from spools arranged horizontally near the bottom in rear of machine is threaded to the vertical needles. This twine is indicated by "b" in our explanations. (No. 24 braid banding.)

In Fig. 38, arrow, *e*, illustrates the twine, "a," as coming off the spools. On the bottom of the "holder" is an extension which is separately illustrated in its front view by Fig. 40. This extension contains a pin marked *k*, which guides the twine into the hole, *l*; (*e* and arrow in Fig. 38 correspond with *e* and arrow in Fig. 40).

The position of this twine in working is shown in Fig. 38. *C*, the crossing of the two twines preparatory to forming the loop, is illustrated. The mechanical construction is such that needle, *a*, is withdrawn from loop at the same time needle, *b*, commences to rise, placing the twines in position shown in Fig.



FIG. 41.

41. Needle, *b*, will in turn pull down as soon as needle, *a*, is ready for moving forward. By moving needle, *b*, down, its twine will form a loop, [see Fig. 42], held in its position by the "loop-guide," Fig. 37. Through this loop, needle, *a*, is again inserted. Needle, *b*, will leave the card below as soon as needle, *a*, is in its loop. At this juncture the cards will be moved by means of the catch and chain of links one hole or one space between cards, whichever may be required. After this is done, needle, *b*, will rise in its new place, and at the same time needle, *a*, commences its backward journey through the loop shown and explained in Figs. 38 and 41 at the beginning; thus ready for a repetition of the two movements.

The foregoing explanations will give the principle of this card-lacing machine as follows: "One needle holds the other's twine until the other needle has moved one point ahead."

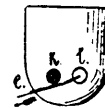


FIG. 40.



FIG. 42.

Fig. 43 illustrates a recent type of lacing machine designed by the Royles' and intended to lace cards in which the lace holes have not previously been cut, thus taking the place of the ordinary hand-feed lacer and the peg and lace hole press, shown in Fig. 29, the object of this combination being economy of time by performing two operations within the limits of one machine.

In the case of this machine, blank cards are piled in the stack A, the bottom card of the pile resting on a steel plate about the thickness of a card, which has a reciprocating motion imparted to it by the oscillating arm B. When the machine is put in motion, this arm withdraws the steel plate, whereupon the lowest card, being pressed down by the rest, falls into the place left vacant by the steel plate. On the return of the plate, it pushes the card into a punching die C, where the peg and lace holes are cut, and whence it is automatically passed on to the lacing section. With each revolution of the machine, this operation is repeated.

Immediately upon issuing from the die, the cards fall into place on a sprocketed carrier chain D, equipped with pegs which fit into the peg holes punched in the

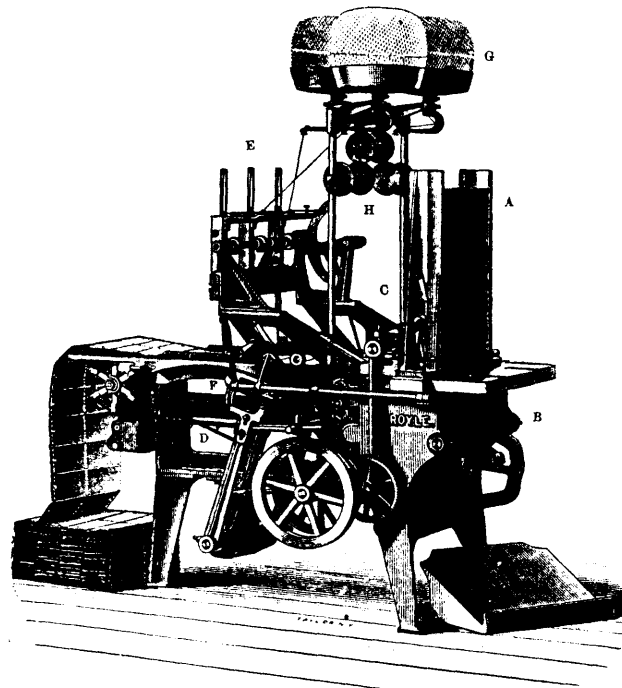


FIG. 43.

cards in the die C. As the machine continues to revolve, this chain is drawn forward with an intermittent motion until the cards are directly beneath the needles E. At the proper moment, and in harmony with the other motions of the machine, these needles descend, carrying the top lacing cord with them, which is threaded through eyes at the points. The needles descend to a sufficient depth below the card to form a loop. Through this loop a shuttle F, passes, carrying the locking thread. Immediately upon the passage of the shuttle through the loop, the needle is drawn up, tightening the cord and the shuttle (which is carried by a reciprocating

ing lever) is drawn back to its original position. The needles descend at properly timed intervals through the lace holes and the interstices between the cards, the shuttles, on each movement, passing through the loops, as described, the result of these operations being a perfectly formed and continuous lock stitch having a very close resemblance to hand lacing. The supply of cord for the needles can be drawn from one of two sources; from balls placed in the receptacles G, shown in the illustration or from bobbins H, held on brackets. The cord for the shuttles is carried within the shuttle in the form of cops; tightly wound, without bobbins, by a special Cop-winder (Fig. 44) furnished with the machine. The form and method of making the cops for these machines is such that an objectionable feature of some of the earlier lock-stitch machines, namely, the frequency with which the machine had to be stopped to renew cops, has been greatly lessened, the cops containing each sufficient cord to lace about 600 cards. During the operation of lacing, the cards are being continually carried along and delivered at the back of the machine, as shown.

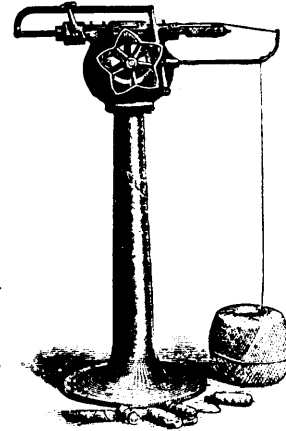


FIG. 44.

By the omission of the punching press, machines of this type can be converted into hand-feed lacers, but the advantages of the automatic method are so great and obvious that this plan can rarely be resorted to with advantage, save when it is necessary to lace cards in which the pattern and lace holes have already been cut.

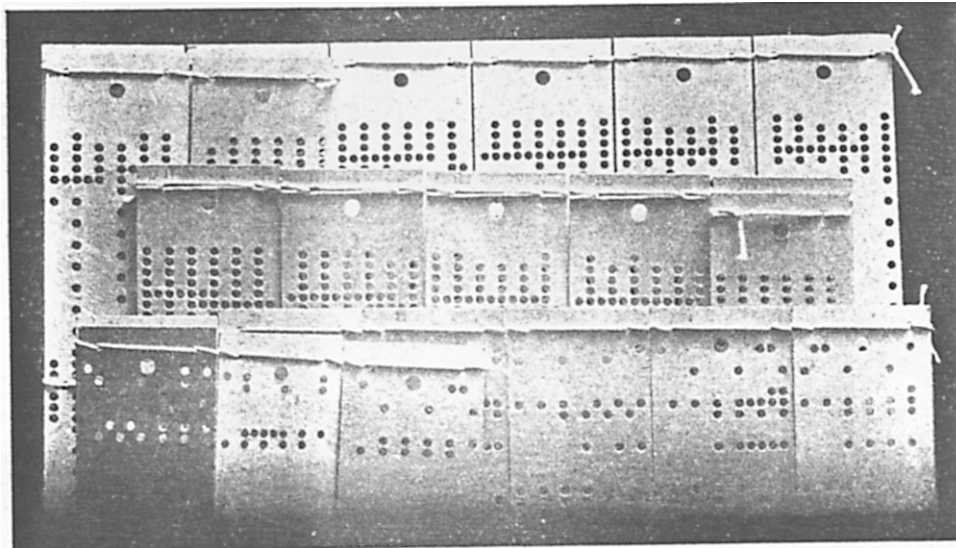


FIG. 45.

Fig. 45 illustrates the various styles of lacing referred to in the foregoing pages. The upper row shows machine laced, lock-stitched cards; the middle row, loop stitched cards, while the lower row illustrates cards laced by hand on a lacing frame.

PRACTICAL HINTS

TO

LEARNERS OF JACQUARD DESIGNING.

Designers for Jacquard work, in addition to being good draughtsmen, must be thoroughly acquainted with the three systems of weaves: plain, twills and satins, and their sub-divisions; also with the structure of double cloth, three-ply cloth, four-ply cloth, etc. He must know the influence of the texture upon the weaves and the fabric; the arrangement of the threads in the dents of the reed; the different systems of tying-up the Jacquard harness; and the stamping of the Jacquard cards for the various kinds of textile fabrics.

Squared Designing Paper for the Different Textile Fabrics Executed on the Jacquard Machine.

The classifying of the \square designing paper is done by enclosing a number of small rectangles, horizontal and vertical, within a certain distance by a heavy line. Such enclosures are known in practice as "squares." The spaces between the vertical lines indicate the warp-threads, and those between the horizontal lines the filling threads. As a rule the warp dimension is indicated first; and a design paper having five rectangles vertical with ten horizontal, is variously read and indicated as 5 by 10, 5×10 , or $5/10$.

Figs. 46 to 68 represent some of the styles of \square designing paper most frequently used. The size of the square may vary in each kind of paper, and must be selected according to the fabric to be sketched. For example: There are three styles of 8×8 \square designing paper in general use: One forming $\frac{1}{2}$ inch heavy squares, (Fig. 48), one forming $\frac{3}{4}$ inch heavy squares, (Fig. 64), and the other forming 1 inch heavy squares. These sizes may still be varied.

The principle of these three kinds of \square designing paper is identical, the size preferred being left to the pleasure of the designer. If a design is to be made for a great number of needles, say 600, 900, 1200, etc., it will be best to use the smallest size; whereas in a design for only 100 to 200 needles the larger sizes may be employed.

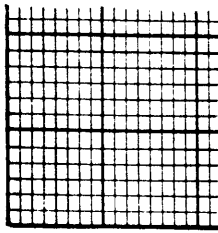


Fig 46 8x6

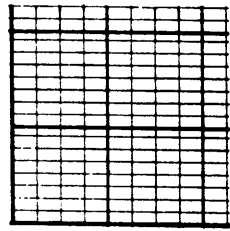


Fig 52. 4x8

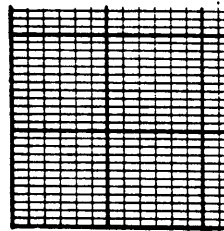


Fig 58. 6x12

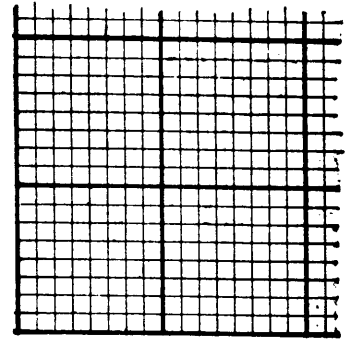


Fig 64. 8x8

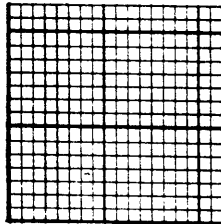


Fig 47. 8x7

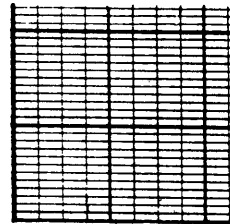


Fig 53. 4x12

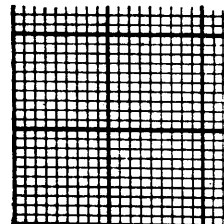


Fig 59. 9x10

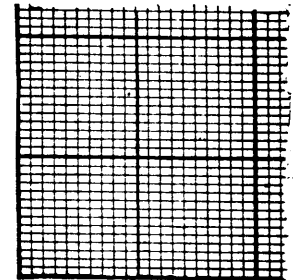


Fig 65 10x14

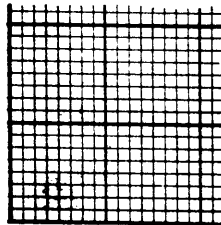


Fig 48. 8x8

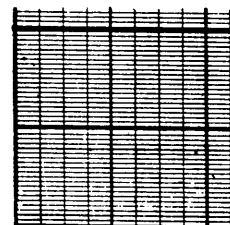


Fig 54. 4x20

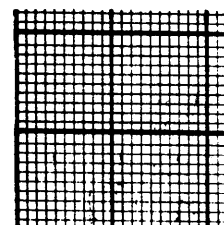


Fig 60. 10x10

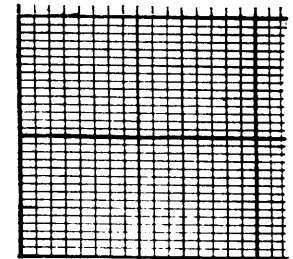


Fig 66. 8x15

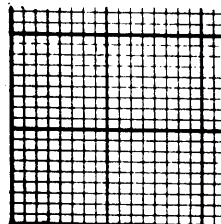


Fig 49. 8x9

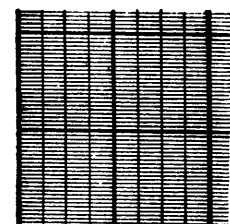


Fig 55. 4x24

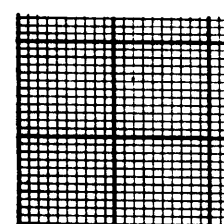


Fig 61. 10x12

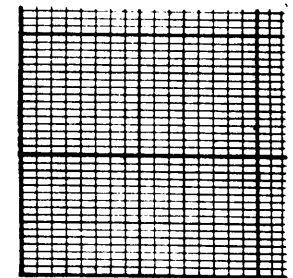


Fig 67. 8x16

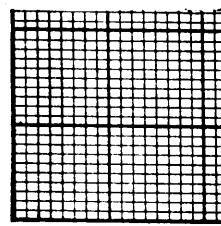


Fig 50. 8x10

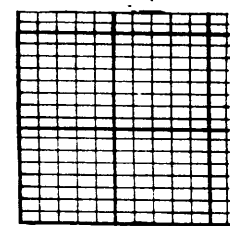


Fig 56. 5x8

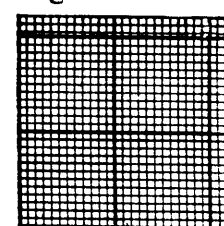


Fig 62. 12x12

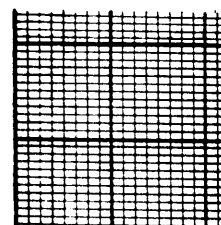


Fig 51. 8x12

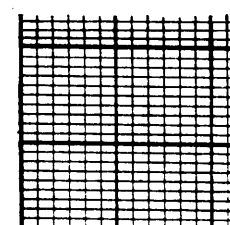


Fig 57. 6x10

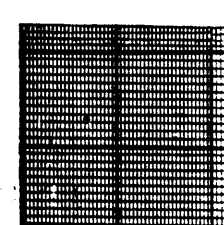


Fig 63. 24x12

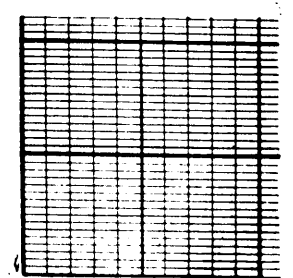


Fig 68. 5x16

Practical Use of the Heavy Square in Designing Paper.

The heavy square serves as a unit of measurement, as well as a means of calculation, and shows readily and exactly the size of the design. The eye becomes accustomed to grasping the meaning of this large square, and comprehends at a glance the situation. For instance:

On 8×8 paper, 25 squares means 8×25 , or 200 rectangles each way. 10×10 paper, 10×25 , or 250 rectangles each way. 10 by 12 paper, 10×25 , or 250 rectangles one way, and 12×25 , 300 rectangles the other way.

These rectangles in actual work represent threads or ends, thus:

200 ends on 8×8 paper require 25 squares.

300 " 10×10 " " 30 "

450 " 10×12 " " 45 squares one way, and $450 : 12$, or 37 squares + 6 lines the other way.

The squares will also assist in putting the weave in a design. For example: Suppose a design for a damask table-cover is required, having for weaves the 8-leaf satin. By using the 8 by 8 paper the "risers" or "sinkers" of the 8-leaf satin are found in the same place in each square, thus any error in forming the weave is at once detected. Sometimes more than one square is required for ascertaining this fact; suppose in the preceding example the paper to be 10 by 10, then the number of threads represented by four successive squares = 4 times 10, or 40, being five repeats of the 8-leaf satin, as 5 times 8 = 40.

Selection of Designing Paper for Single Cloth.

For single cloth the character of the designing paper is ascertained by the number of warp and filling threads required per inch in the finished fabric. For example: A damask fabric with a texture, when finished, of $80/120$ (80 ends warp and 120 picks filling per inch) will require a designing paper of corresponding proportion, or as 80 is to 120, = 8×12 .

In stripes, checks, etc., the texture in part of the fabric is changed; such changes require separate designs. If the difference is only slight, one kind of paper is used. Select the paper derived through the proportion of the two as required. For example: A dressgoods fabric forming two distinct effects in one repeat of 400 warp-threads (200 successive ends required for each effect).

The first effect made on a texture $60/80$.

" second " " " $80/80$.

Two distinct designs (one for each effect) are required:

For the first effect use a paper proportioned as 60 to 80, or 6×8 .

" second " " " " " 80 to 80, or 8×8 .

If only one kind of designing paper be used for both effects, find the average of the warp, thus: $6 + 8 = 14$, and $14 \div 2 = 7$, showing that paper 7×8 is the substitute. If using a designing paper under similar circumstances the sketch must be squared to correspond.

Selection of Designing Paper for Double Cloth.

In fabrics where one line (visible across the face) is produced by two or more different colored threads, (each pick forming part face, part body or back of the fabric), the designing paper to be used is shown by the proportion of the line effects to the warp-threads (figure) per inch. Example: Take a dress-goods fabric, extra figured in the filling, having the following texture: Warp, 60 ends per inch; filling, 100 picks per inch, double system, 1 pick for ground, 1 pick for figure. The paper required is as $60 : (100 \div 2)$ or as $60 : 50 = 12 \times 10$, or 6×5 .

The figure is painted upon the paper in various colors and by the card-stamping when cutting the ground cards. The extra colors are treated as if they were ground. When cutting for the extra figure, deal with it alone.

If a fabric has the double-cloth system applied to the warp, only using one filling for both kinds of warp, and the Jacquard-harness is tied-up for "single sections," the squared designing paper required is found from the proportion of the number of face and back warp-threads per inch, to the number of picks per inch. Example: Take a dressgoods fabric constructed on the following texture: 80 ends warp, 1 end ground, 1 end figure, and 60 picks to 1 inch. The proportion for the paper is as $80 : 60$, or 8×6 designing paper.

If the tie-up in the loom is for double sections, (Fig. LIV. or LVI.), the fabric in the previous example requires the comparison of the face-warp with the filling, and the answer is: $80 \div 2$ or 40 ends of face-warp per inch, 60 picks filling per inch, giving the proportion of 40 to 60, requiring 8×12 , or 4×6 designing paper for the figure. The ground part of the design is executed separately on the same kind of paper; or if the weave is of a short repeat, stamped without design.

In selecting the \square designing paper for double cloth, such as cloakings, coatings, etc., made with a back-warp, and executed on any of the single section tie-ups, use the lines between the squares to indicate the back-warp and back-filling. The proportion of ends of face-warp to face-filling in one inch of the finished fabric indicates the kind of paper needed.

Example: If a fabric has the following texture:

Warp, 2 ends face, 1 end back, 90 ends per inch.

Filling, 3 " 1 " 132 picks "

The kind of designing paper needed is found by dividing 90 by 3, and multiplying by 2, thus: $90 \div 3 \times 2 = 60$, number of ends of face-warp per inch, and $132 \div 4 \times 3 = 99$, number of picks filling per inch, giving a 60×99 paper, or its equivalent, 6×10 .

Face cards for these fabrics must be stamped twice, first for the face weave, and afterward for the binder. If using a 12-row machine, use punches 1, 2, 4, 5, 7, 8, 10, and 11, for face; 3, 6, 9, and 12, for the back of the fabric.

Selection of Designing Paper for Two-ply Ingrain Carpets.

Always observe the proportion existing between the number of warp and filling-threads. For instance, take a carpet having 1072 ends warp (536 ground and 536

figure) per yard, with 30 picks per inch (1 pick ground and 1 pick figure, or 15 pair). Then, $1072 \div 36 = 29\frac{28}{36}$ ends of warp per inch. The proposition is as $29\frac{28}{36} : 30$; or, what is practically the same, $30 : 30$, showing that the paper must be equally divided, and 8×8 may be used, as is usually done.

Again, take a carpet having 832 ends warp (416 ground, 416 figure) per yard with 20 picks per inch (1 pick ground, 1 pick figure, or 10 pair). Then $832 \div 36 = 23\frac{4}{36}$, and the proportion is as $23\frac{4}{36} : 20$, or as $7\frac{2}{27} : 6\frac{2}{3}$, practically $8 : 7$; and 8×7 paper may be used.

NOTE.—It will always be advantageous for the card stamping if the designing paper be selected so that the number of warp-ends in one square equals the number of griffe-bars used in the Jacquard machine.

Selection of the Proper Brush for the Different \square Designing Papers.

The brush used by the designer must be clipped according to the size of the rectangles of the paper. It should cover the rectangle in warp direction at one sweep of the hand; hence each size of the squared paper requires a specially prepared brush for quick, good, and perfect work.

Colors used For Painting Textile Designs.

For this purpose take common colors (in powder), and mix with water and mucilage to avoid rubbing off after application. Use no more mucilage than necessary, as too much will be followed by slow and imperfect work. Colors mixed in this manner must be kept moist by adding a few drops of water daily. The colors most generally used for painting textile designs are:

Vermilion.	White Lead.	Chrome Yellow.	Cobalt Blue.
Lamp Black.	Emerald Green.	Burnt Umber.	Carmine, etc.

A few drops of alcohol will greatly assist the mixing of vermilion, umber, and similar colors which have no affinity for water. Chloride of lime is used on colors having a vegetable basis (as carmine, etc.,) for correcting imperfections, applying weaves or changes in the colored part of a design.

If the designing paper becomes greasy, the colors will not adhere. To cure this take a moist sponge and wipe off the paper.

Preservation of Textile Designs.

To prevent textile designs (painted on the \square designing paper) from being soiled, apply a thin solution of white shellac varnish, which dries almost instantaneously. A design preserved in this manner can be cleaned off at any time with a wet sponge, and after years have passed will appear bright and distinct.

Fig. 75 shows the setting of two figures in the "six-leaf satin" style.

Fig. 76 illustrates the setting of one figure in the "eight-leaf satin" method.

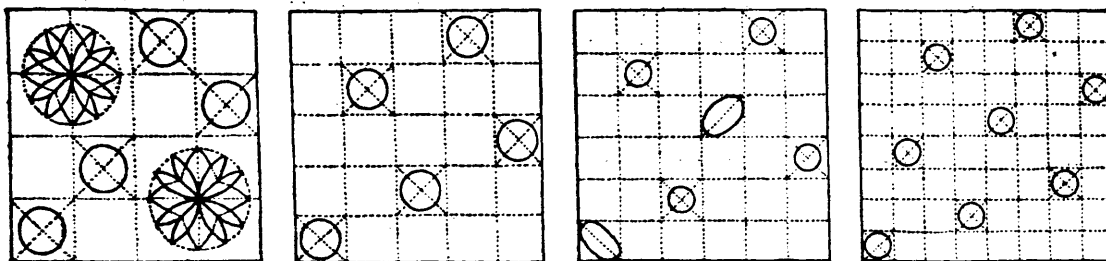


FIG. 73.

FIG. 74.

FIG. 75.

FIG. 76.

In setting figures in a sketch the appearance of "streaks" must be avoided. To do this it will be found advantageous to sketch more than one repeat of the pattern ; if possible, sketch two each way, that the streaking, if any, may show itself

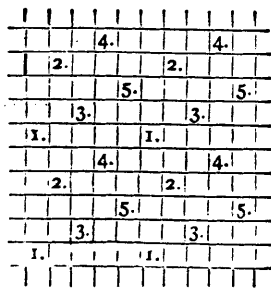


DIAGRAM FOR FIG. 74.

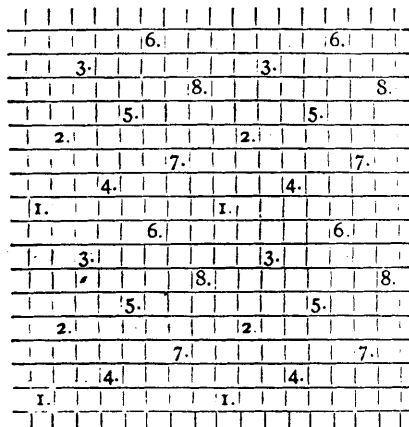


DIAGRAM FOR FIG. 76.

in the sketch, and be corrected there. Nearly all the patterns seen in fabrics which show streaks can be traced to designers who prepare their designs without sketches ; for if a sketch had been made, the streaking of the fabric might have been foreseen had the designer exercised proper care in the examination and perfecting of his sketch. Figures taken from plants, or from life, can be set in the same manner as explained for Figs. 69 to 76. For example, Fig. 77, the figure for design. Fig. XXXIV., p. 32, the latter being set after the method illustrated by Fig. 70.

Figs. XXV., XXVI., XXXIII., XXXVIII., XLI., XLIV., XLV., XLVII., XLVIII., LI., LV., LVII., LXI., etc., all show sketches for fabrics executed on one or the other methods of construction just explained.



FIG. 77.

Size of Sketch Required.

This is regulated by the number of harness-cords in one repeat or division, the method of tie-up employed, and the texture of the finished fabric. For example :

Take 400 harness-cords for one division. Texture of the fabric when finished 100/90. Tie-up employed, straight-through. *Required:* The size of one repeat for the sketch.

Answer: $400 \div 100 = 4$ inches. The figures may be arranged in this sketch to repeat one, two, three, four, or more times in the 4 inches thus available.

Enlarging and Reducing Figures for Sketches.

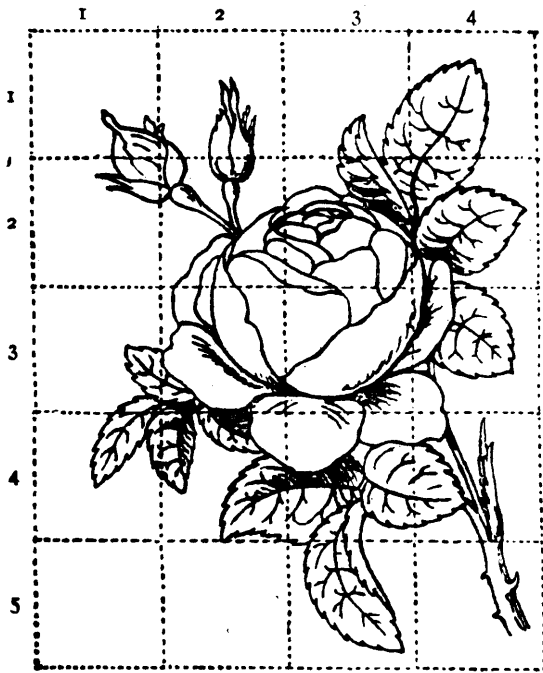


FIG. 78.

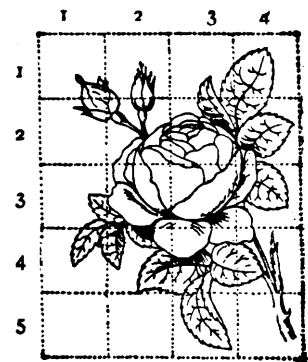


FIG. 79.

Figures are not always enlarged or reduced by free-hand drawing. Some designers always use the "squaring off" process. The latter is clearly illustrated by Figs. 78 and 79. Fig. 79 shows the reduction of Fig. 78, and Fig. 78 the enlargement of Fig. 79.

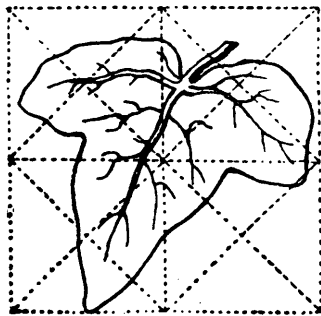


FIG. 80.

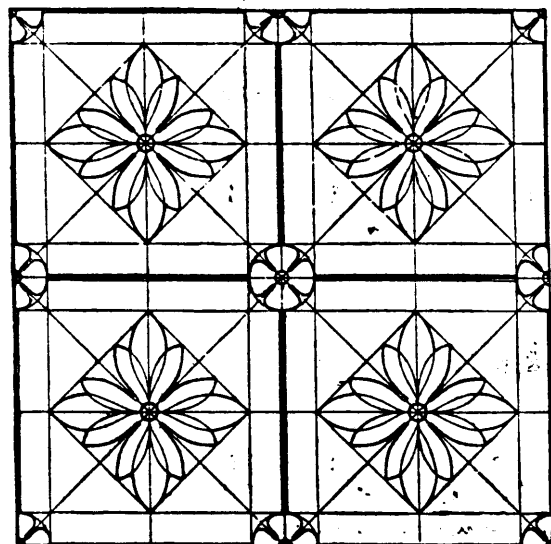


FIG. 81.

The method observed is of different size squares for each design. Each square of Fig. 78 containing the same proportion of the whole design as is shown by the corresponding squares of Fig. 79.

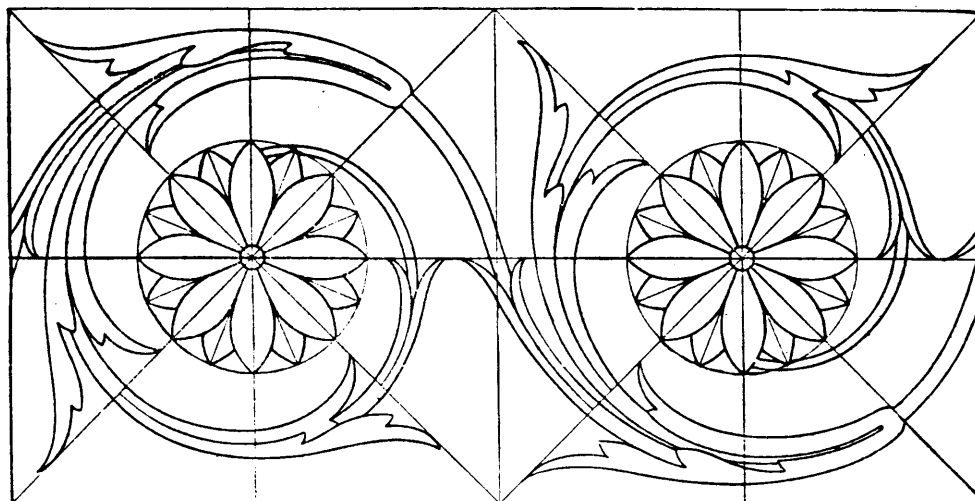


FIG. 82.

Fig. 80 illustrates another method of ruling off a figure preparatory to enlargement, reduction, or duplication.

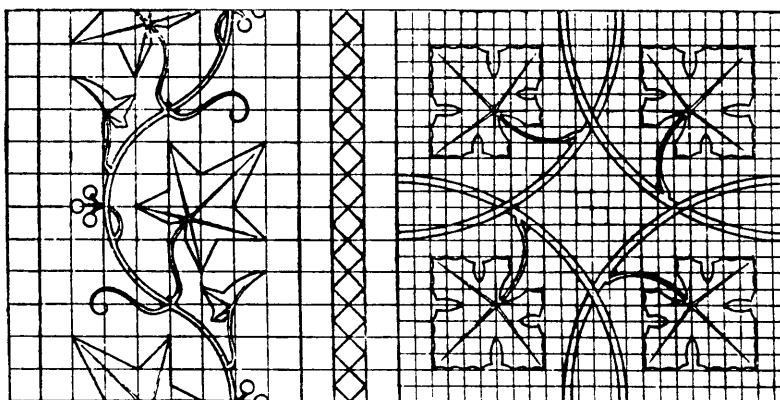


FIG. 83.

This "squaring off" is not always done in a sketch for the reasons just mentioned, it being frequently done to assist the designer in the original construction

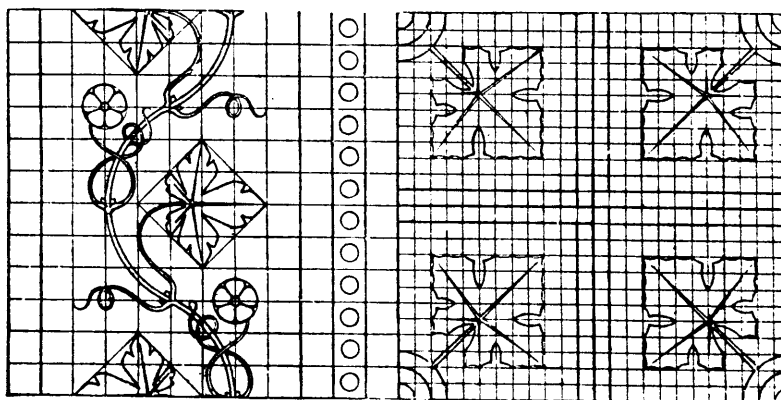


FIG. 84.

of his figure. Such an application of its utility may be observed in Fig. 81, centre for Damask; Fig. 82, border for Damask; and Figs. 83 and 84, sketches for Damask table-cover, centre, with side border. The design of a border for a centre, or *vice versa*, must be selected to correspond (Fig. 85).

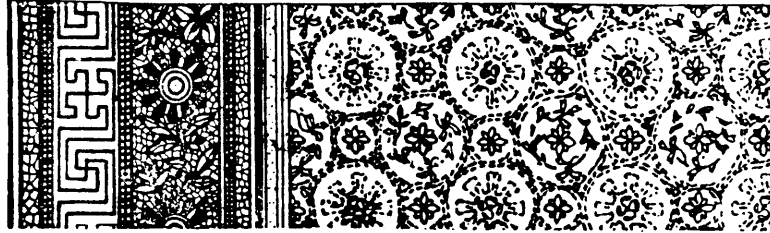


FIG. 85.

Fig. 86 shows a horizontal and vertical border, both of the same design. It is obvious that it would be a very imperfect design if either border should be allowed to form the corner, hence a union must be carefully constructed embodying the same general features as the design.

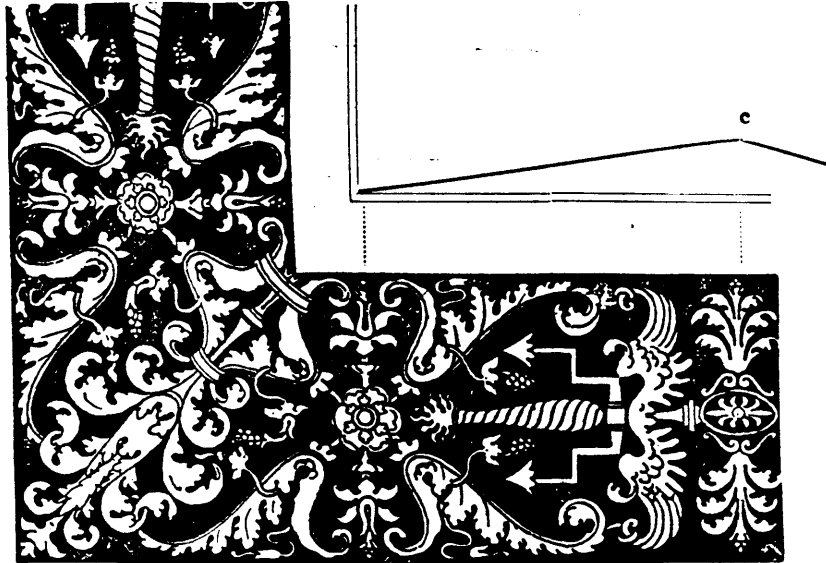


FIG. 86.

Transferring of the Sketch to the Squared Designing Paper.

Having obtained a perfect sketch of the design as it appears in the fabric, or as it is desired to show, the outlines are transferred to the \square designing paper. This always requires an enlargement of the design, and to accomplish this the sketch itself must be ruled proportionally to the heavy squares found on the \square designing paper. If these squares should be too small for the sketch, they may be enlarged by throwing 4, 9, or 12 of the "squares" into one large one; which is indicated by extra ruling off with pencil upon the required heavy lines. In this case the sketch is ruled off corresponding to these pencil lines. The transfer of the sketch to the required \square designing paper is governed by rules already explained for the enlargement of a design on the regular drawing paper. After the design is transferred to the \square designing paper it must be "*outlined in squares.*"

Outlining in Squares.

This consists in painting the small squares forming the outline of the figure as called for by the outline of the drawing. Two methods are observed: One "*outlining in squares*" *inside* the "*drawing outline*;" the other "*outlining in squares*" *outside* the "*drawing outline*."

If painting outside the outline, no small squares are taken, in which the drawing outline, taken from inside the figure, encloses more than one-half of their surfaces. If painting the "*outline in squares*" *inside* the "*drawing outline*," this rule is reversed, thus no small square can be taken which is overrun by the drawing outline more than one-half from the outside of the design. The most difficult part of the outlining in squares is to obtain the nearest possible reproduction of the drawing outline. If circles, curves, etc., are to be made, they must be reproduced as nearly correct as possible; no bunches, cuts, etc., should disturb its symmetry.

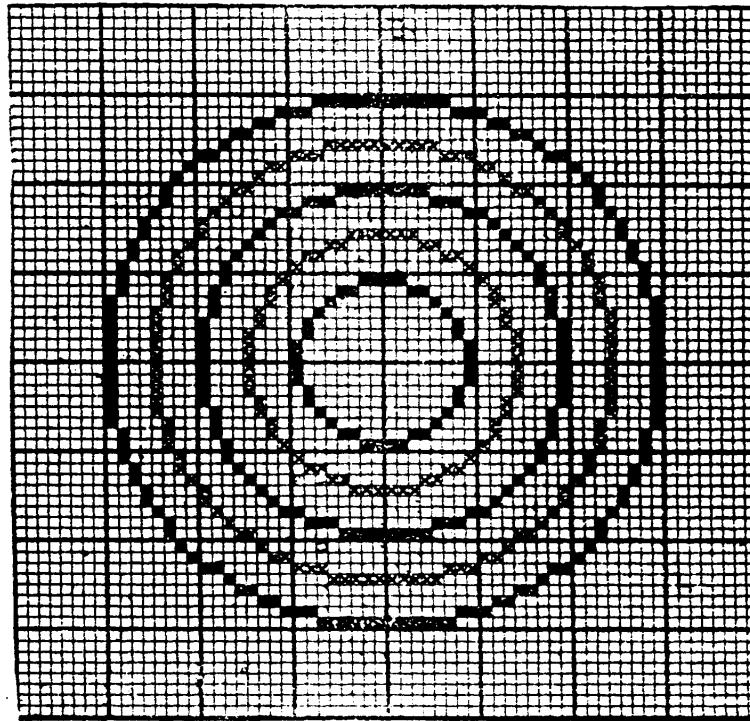


FIG. 87.

Fig. 87 shows the variations and methods to be resorted to in "*outlining by squares*" the five circles, each of different size.

Fig. 88 shows the formation of projected straight lines varying from a horizontal to a vertical direction. The full changes by 8^s , 7^s , 6^s , 5^s , 4^s , 3^s , 2^s , 1^s are shown in full black. The half changes between the 2^s and 3^s are formed of 2^s and 3^s taken alternately as shown by the shaded line. Another half change between 1^s and 2^s , also represented by the shaded effect, shows the change to be a repetition of the step 1, 1, 2. Between this last mentioned change and the regular 2^s change, we find the direction of a straight line as derived from a repetition of 2, 2, 1, indicated

by the • Below the regular change by 1^s the straight line is formed by using 7 times 1 and once 2 repeated. Above the regular change by 1^s as shown by the black diagonal, these same changes will form straight lines running from 45° to 90° .

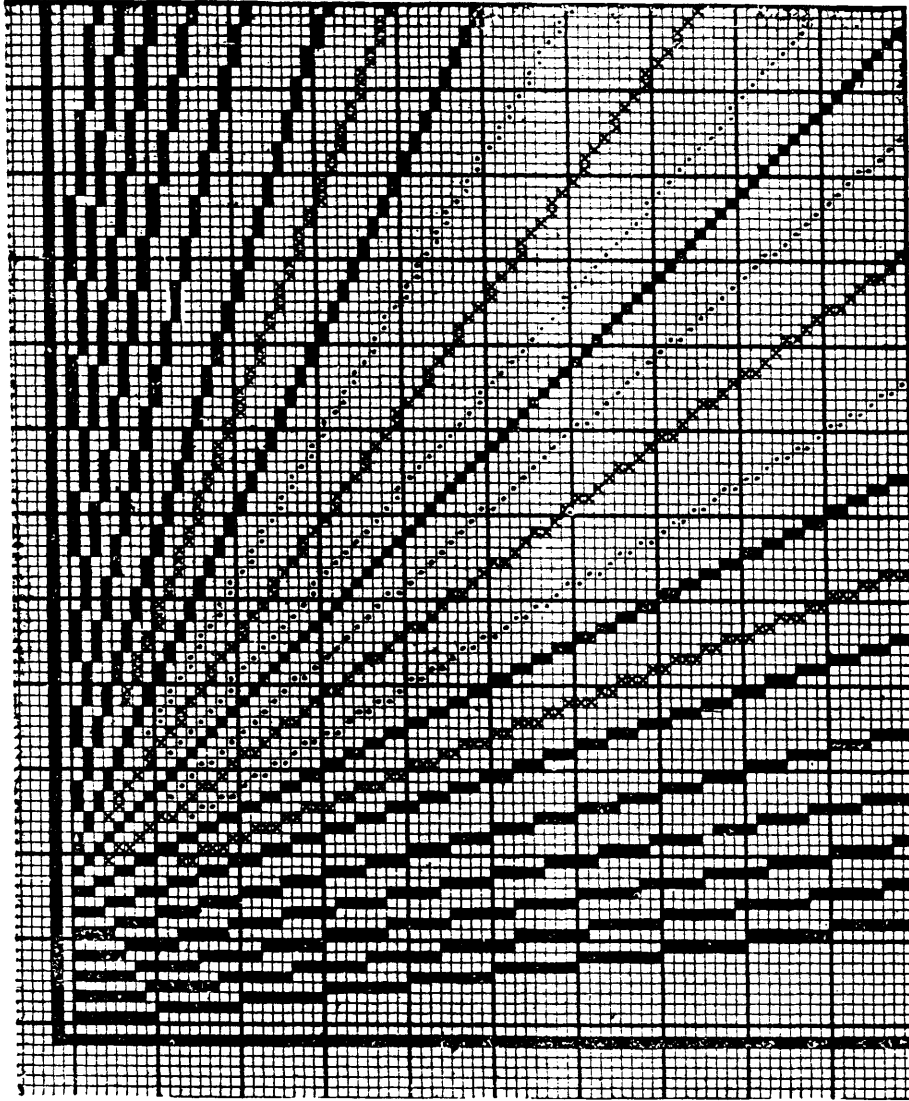


FIG. 88.

Rules for "Outlining in Squares" Inside or Outside the Drawing Outline.

The outlining in squares outside the drawing outline is observed in designs having the figure produced by the filling. The outlining in squares inside the drawing outline is observed in designs having the figure produced by the warp. By reversing these two rules, the figure in the design would be changed from the sketch, for if outlining in squares inside the drawing outline, using filling for figure, the figure would be reduced proportionally to the reduction made or taken away by the outline squares. Thus, also, if the warp formed the figure, and the "outlining

being done in squares," outside the drawing outline, the figure would increase proportionally the size of the squared outline. These rules refer to painting the squares for warp only. Some fabrics require also the painting of the filling squares.

The foregoing explanation may be reduced to the following *Rule*: If the figure is required to be in white, "outline by squares" outside the drawing outline; if the figure is required to be painted, "outline by squares" inside the drawing outline.

After the design is outlined by full small squares, either the figure or the ground (as required, but generally the figure) is painted all over. The paint required for this work has been previously described. It is only necessary to mention that it must have body enough to be clearly visible, but not sufficient to obscure the black ruled lines of the paper, which must show clearly through the paint. The weave, if necessary, is next put on the required spots, either in white or black paint.

Illustration of a Sketch.

Outlining on □ paper—finished design and fabric sample. For single-cloth fabrics, as damasks, dressgoods, etc.

To give a clear illustration of the entire process from sketch to finished design, Figs. 89, 90, and 91 are designed. Fig. 92 showing the effect of the design on the fabric after being woven.

Fig. 89 represents a sketch for a fabric supposed to be executed with 80 warp-threads in one repeat; thus, if using 8 by 8 □ designing paper, (texture in this example supposed to be equal in filling and warp), the sketch must be divided and ruled off into eight parts each way.

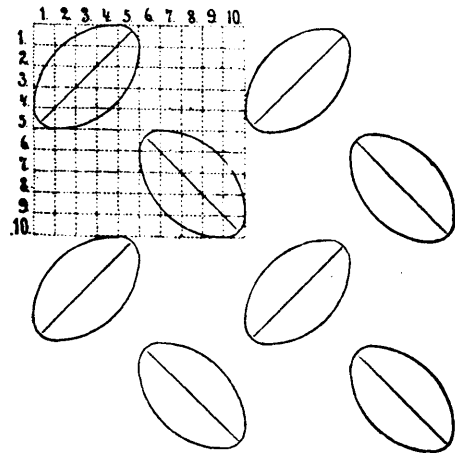


FIG. 89.

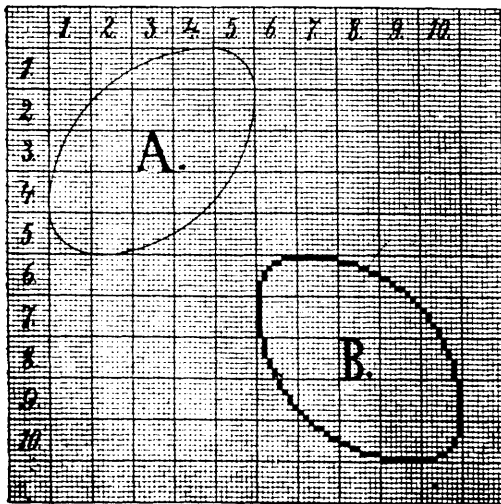


FIG. 90.

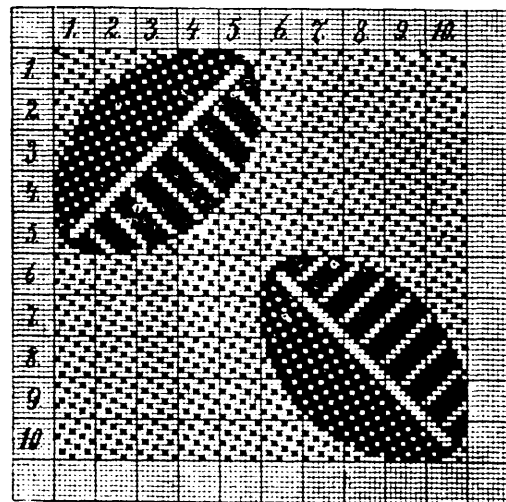


FIG. 91.

Fig. 90 illustrates the sketch transferred to the \square designing paper. Fig. *A* represents the "drawing in outline." Fig. *B*, the "outlining in squares." Fig. 91, the complete design; and Fig. 92, the fabric sample.

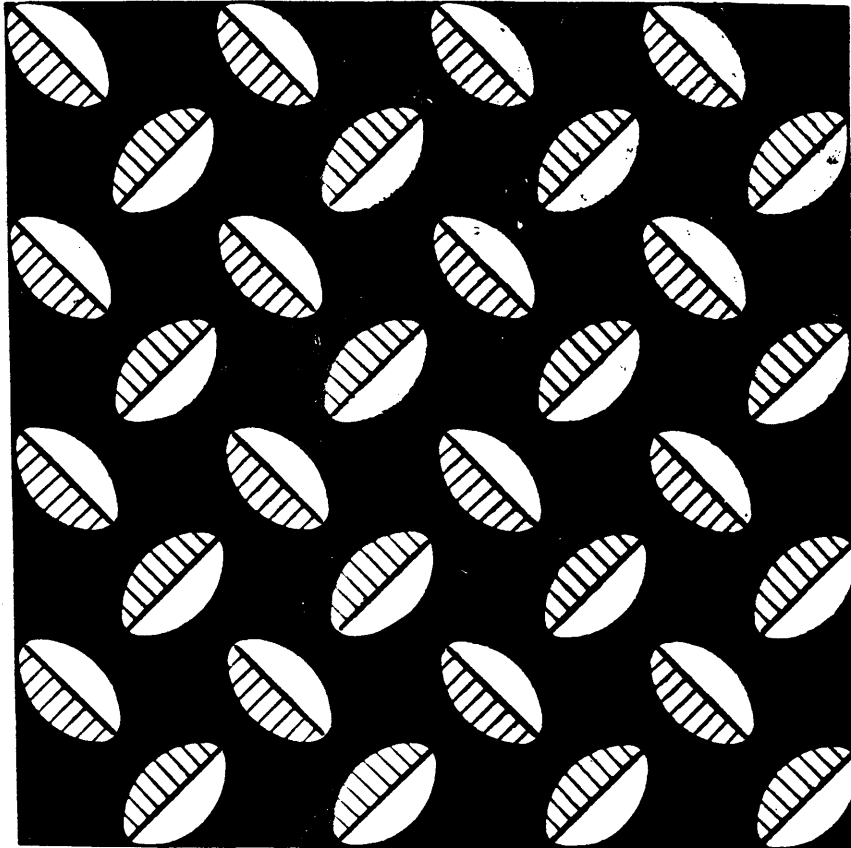


FIG. 92.

Design for Damask Fabrics to be Executed on a Jacquard Loom, with Compound Harness Attached.

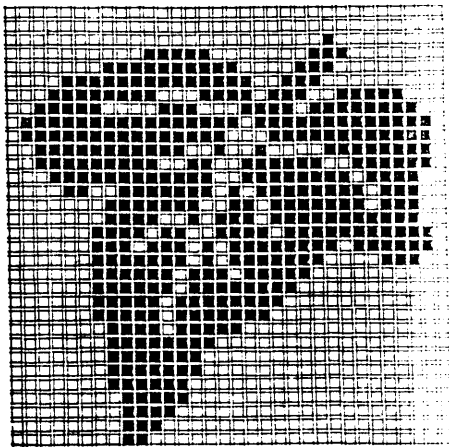


FIG. 93.

These designs require no special weave, as that is taken care of by the compound harness in front of the Jacquard harness, as explained in Chapter XII., page 58. After painting in the design, it is finished, ready for card-stamping. Fig. 93 shows us a leaf, taken from sketch (Fig. 80), which may be used in connection with a larger design, but will clearly illustrate this division of textile work.

Designs for Two-ply Ingrain Carpet.

In these fabrics, when the ground and figure are indicated in the design, the same is considered

as finished. As previously stated in the article devoted to these fabrics, a two-ply ingrain carpet is composed of two fabrics, in which the journals introduce the weave, and the double-acting Jacquard machine the exchange of ground and figure effect.

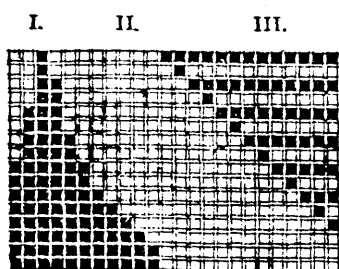


FIG. 94.

Fig. 94 represents a small portion of a design illustrating the three principal effects of this operation.

I. = figure up.

II. = ground up.

III. = effect technically known as "shot-about," derived from one pick, figure up; one pick, ground up; and repeated.

In Fig. 95 a detailed description or analysis of the interlacing warp and filling of Fig. 94 is given.

■ = figure up. } Produced by the
 ◇ = ground up. } Jacquard machine.
 × = weave for ground. } Produced by
 . = weave for figure. } journals.

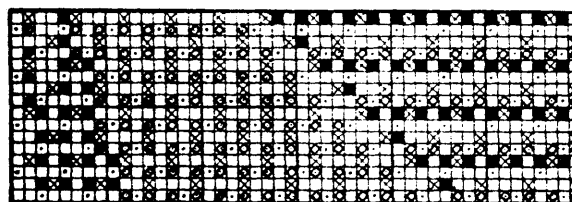


FIG. 95.

The two-ply ingrain carpet can also be made upon a Jacquard loom, tied up for double sections. [See Chapter VI., page 48.] This is also extensively used in the manufacture of upholstery fabrics; in fact, the latter mentioned method is almost exclusively used in Europe.

In Fig. 95 the weave of the "shot-about" effect calls for two picks face, and two picks back. An examination of this part of the draft shows that the warp-thread represented by the light pick $\frac{1}{3}$ is to be raised, or has been raised in the adjoining heavy pick $\frac{3}{1}$; further, we find the two light picks separated by the raising of a different warp-thread in each pick, which is also effected between the two heavy picks by the lowering of another warp-thread. This places the ground-thread below its corresponding figure or mate thread, or the figure thread below its corresponding ground-thread.

If these mate threads introduced in succession are required to show side by side, either on the face or the back of the fabric, these changes must be indicated on the design by different colors. If such effects are to be introduced when using the common ingrain Jacquard machine, the needles of the latter must be operated at each pick; this requires twice as many cards as are used in designs where the mate thread is always placed below or above its corresponding thread.

Designs for Dressgoods Figured with Extra Warp (one end Ground, one end Figure), and Executed on the Double Section Tie-up.

In the article explaining the double section tie-up, [see Chapter VI., p. 48], as well as the one on the selection of the proper squared paper required for these fabrics, the general character of these fabrics has been explained.

As mentioned in Chapter VI., the machine is divided in two parts, figure and ground; the Jacquard harness is leased one end figure, one end ground, and repeated.

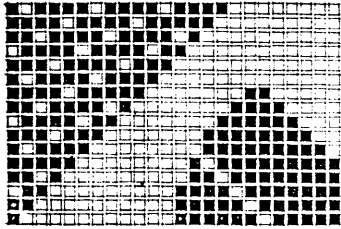


FIG. 96.



FIG. 97.

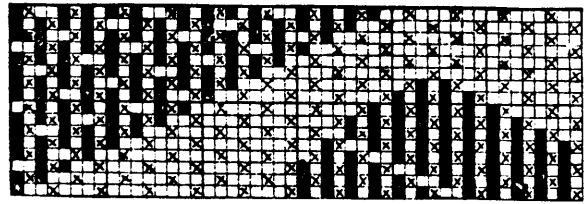


FIG. 98.

Fig. 96 illustrates a part of such a design, and is to be cut for the figure part of the needles.

Fig. 97 shows the plain weave, which is cut without a design in that portion of the card which operates the ground of the Jacquard harness.

Fig. 98 shows the analysis of the woven fabric for the design referred to in Fig. 96.

[N. B.—The plain weave used for explaining the present example may be substituted by other weaves, as a $\frac{2}{1}$ twill, $\frac{2}{2}$ twill, or the four harness broken twill; etc., without changing the figure design.]

Designs for Figured Pile Fabrics.



FIG. 99.—Shading of Flowers in Sketches for Damask Fabrics.

Designs for figured pile fabrics (terry or velvet), Plushes, Astrakhans, etc., are also executed without introducing a weave in the design. The design is only intended for the pile-threads, which are raised when introducing the wire; the front harness operating the ground-warp. The pile-warp, when raised over the wire, is bound by means of the previous pick, as well as by the pick following by the filling to the ground cloth.

The Shading of Textile Fabrics by the Weave.

This is generally done in the "figure" part (especially in flowers, leaves, etc.), of damasks and similar textile fabrics. The shading can be applied to the satin weaves to the best advantage.

Rule for Shading with Satin Weaves.

Put the ground weave (filling for face) over the entire part of the □ designing paper, which is required to be shaded; afterwards add one, two, three or more horizontal or vertical (connecting) spots to the one spot which forms the foundation or satin filling for face. The heaviness of the shade is regulated by the sketch or the fabric. For example: In an 8-leaf satin the difference between filling for face and warp for face may be made with three or four changes only; or with the entire seven changes.

For shading twill weaves no rule can be given.

Fig. 100 shows the shading of the 5-leaf satin, four changes, each eight threads, giving 4×8 , or 32 threads for the effect.

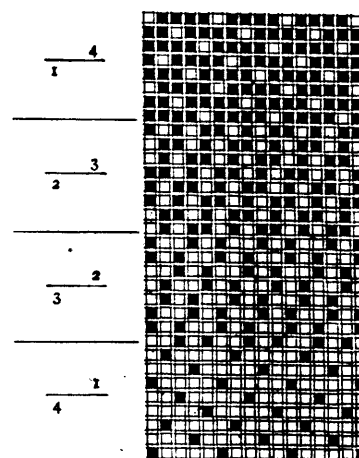


FIG. 100.—5-LEAF SATIN.

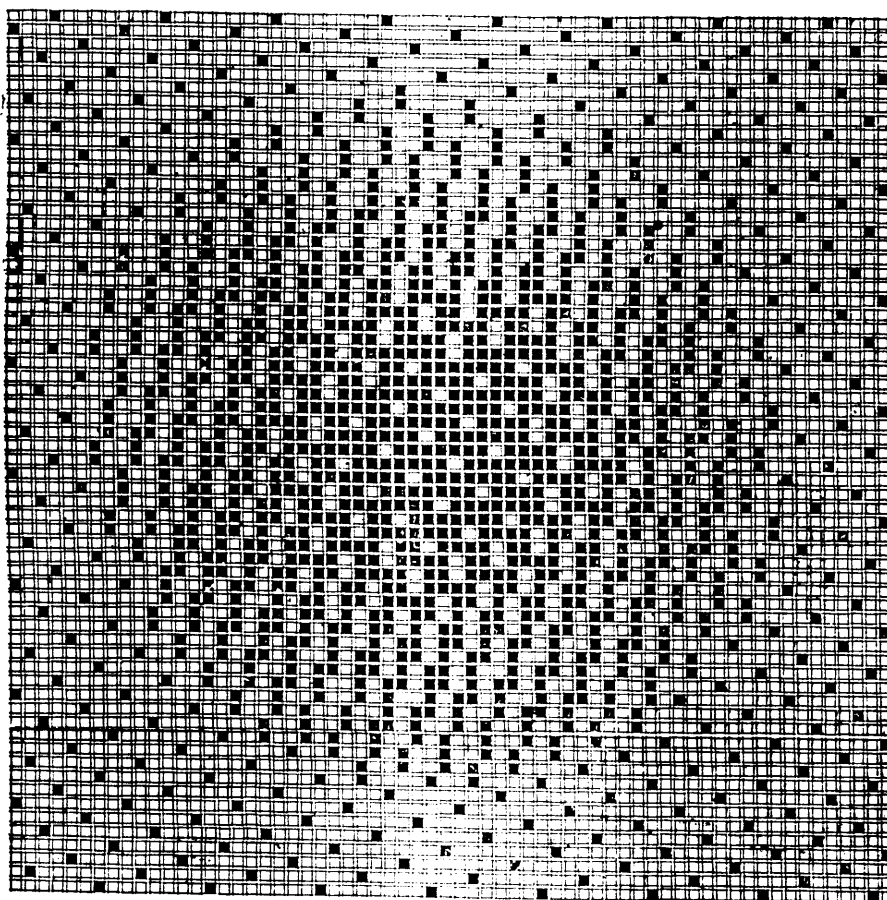


FIG. 101.—8-LEAF SATIN.

Fig. 101 illustrates the 8-leaf satin applied for shading a circle, using in rotation every possible change.

Fig. 102 illustrates the shading of the 10-leaf satin from filling for face ($\frac{1}{9}$), to warp for face ($\frac{8}{2}$), and back again to filling for face.

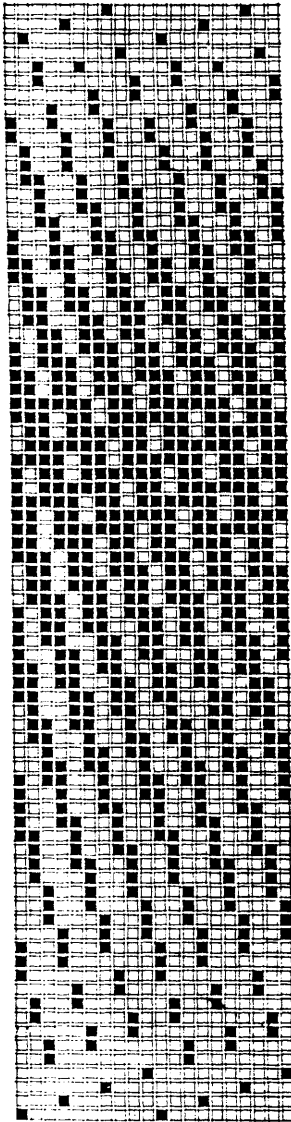


FIG. 102.—10-LEAF SATIN.

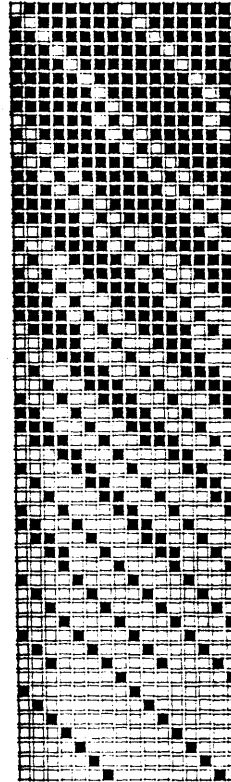


FIG. 103.
8-HARNESSTWILL.

Fig. 103 represents the ($\frac{7}{1}$) eight harness twill, shaded from the filling for face to the warp for face effect; the change occurring every eight picks.

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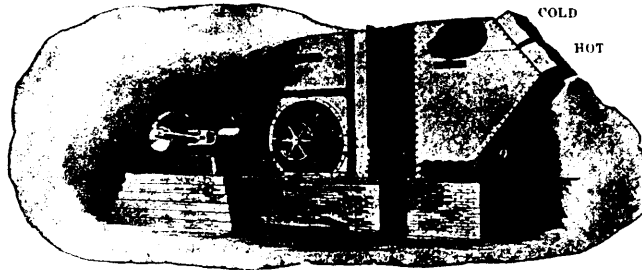
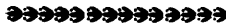
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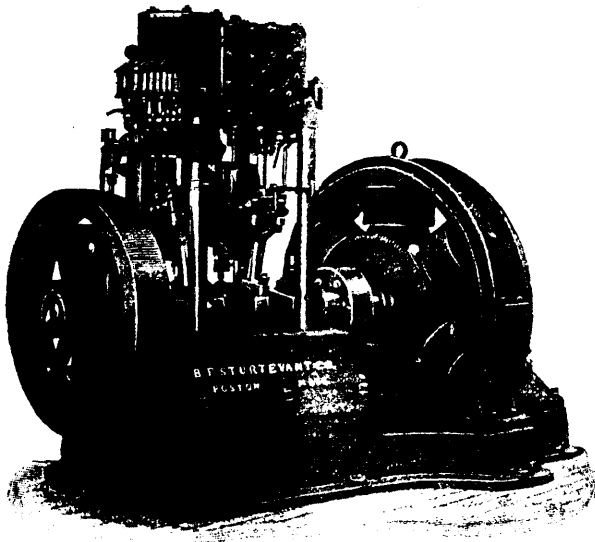
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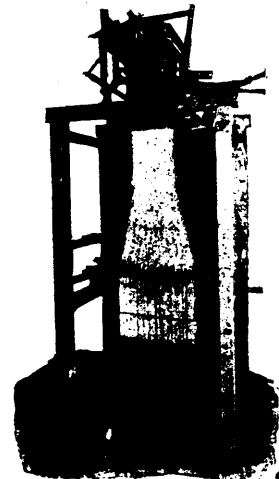
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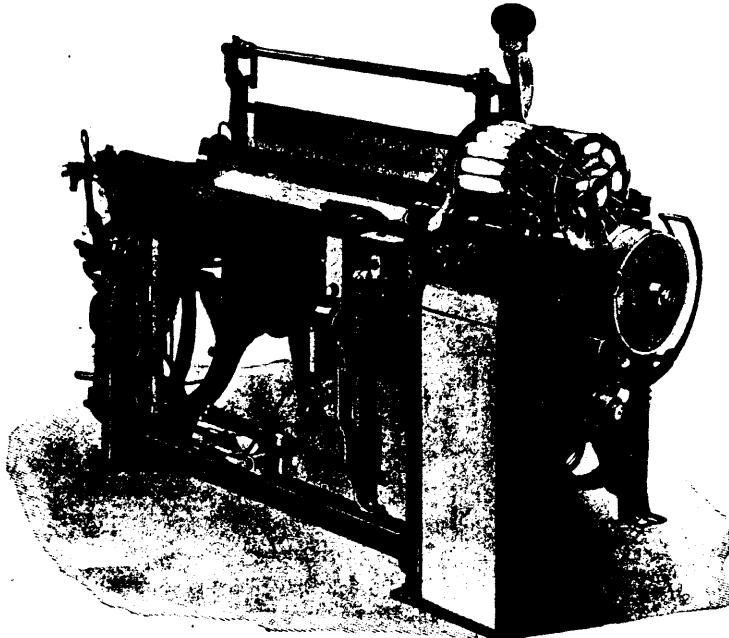
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Yours, W. W. WINDLE.

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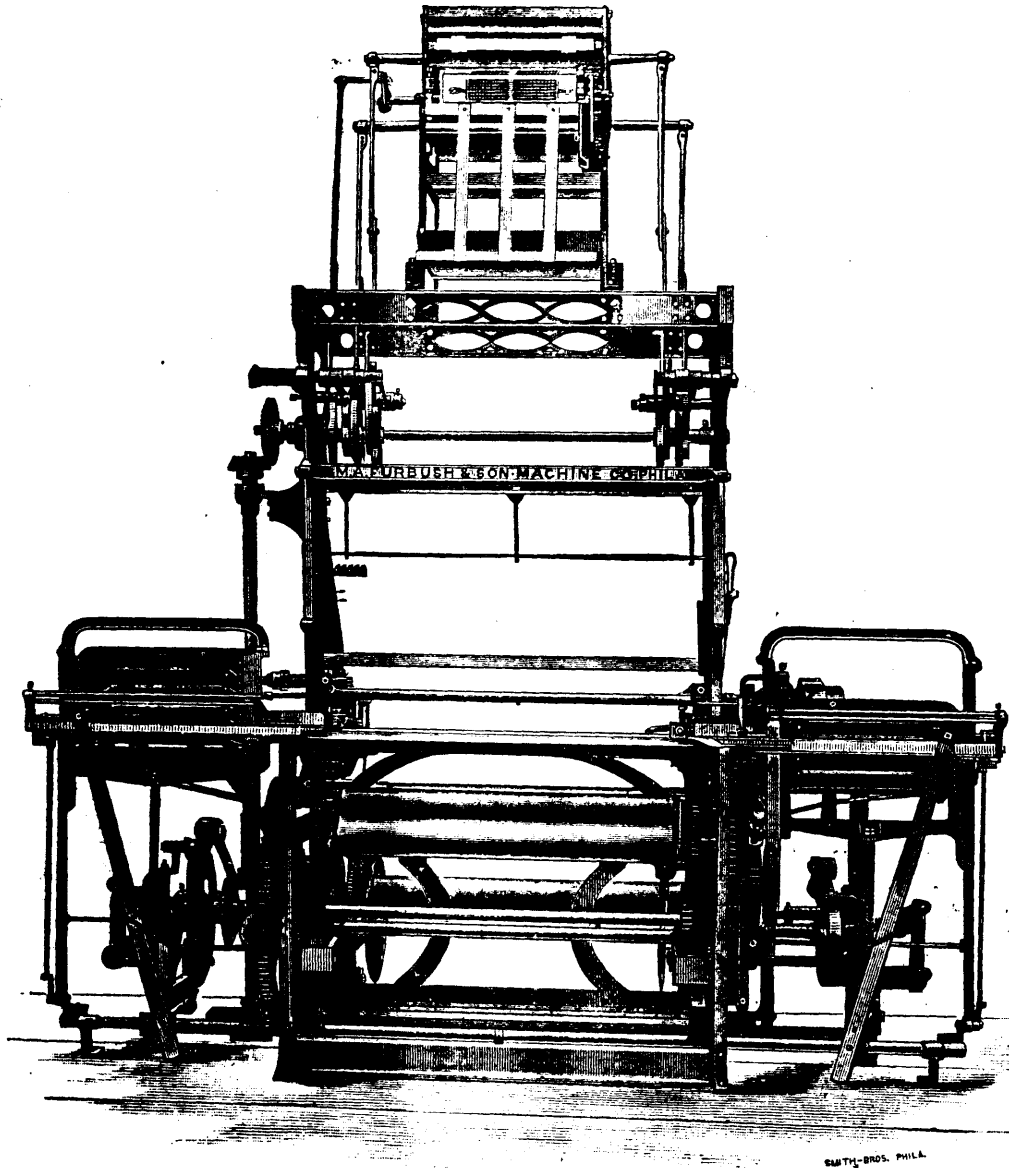
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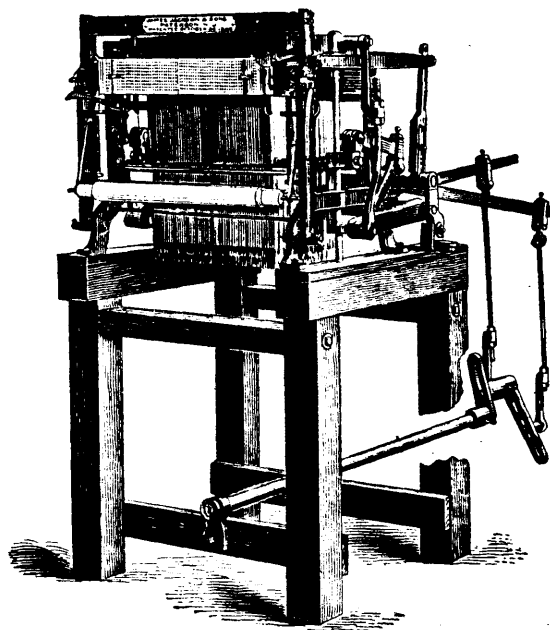
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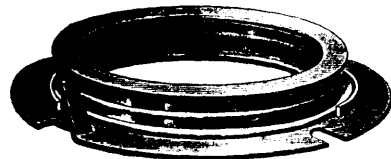
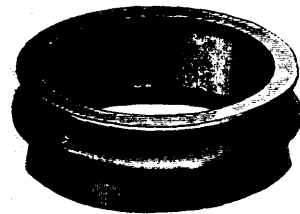
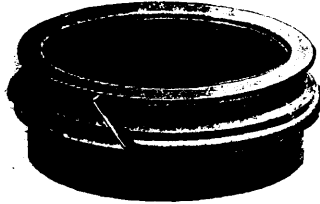
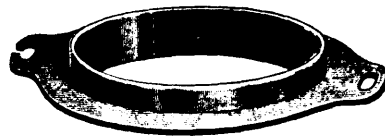
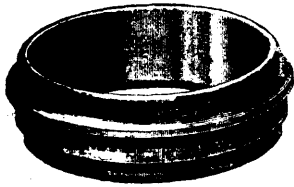
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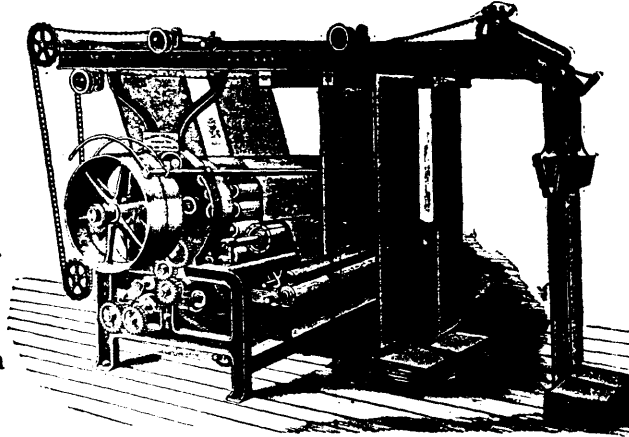
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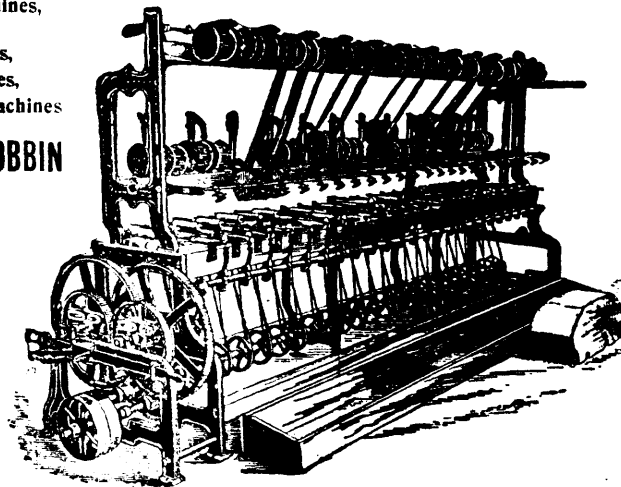
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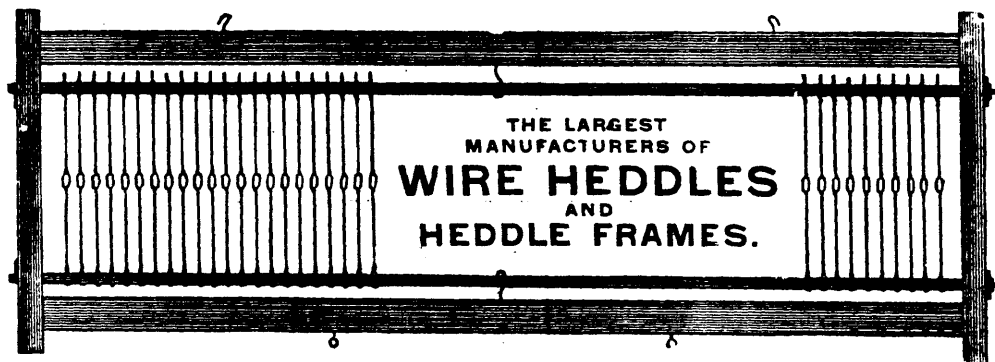
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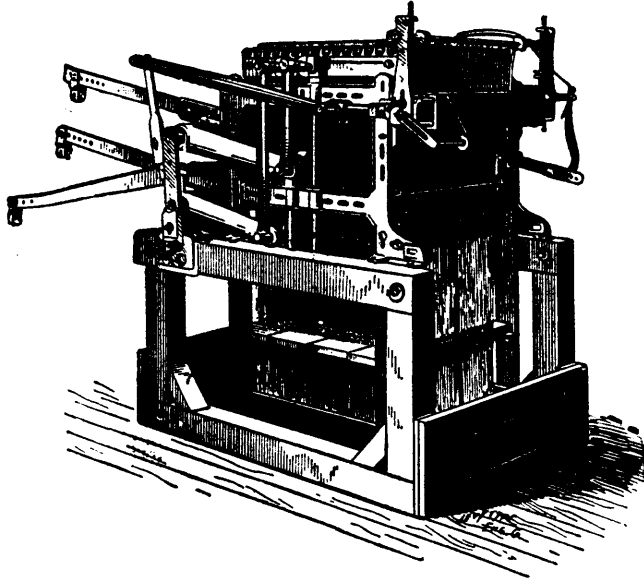
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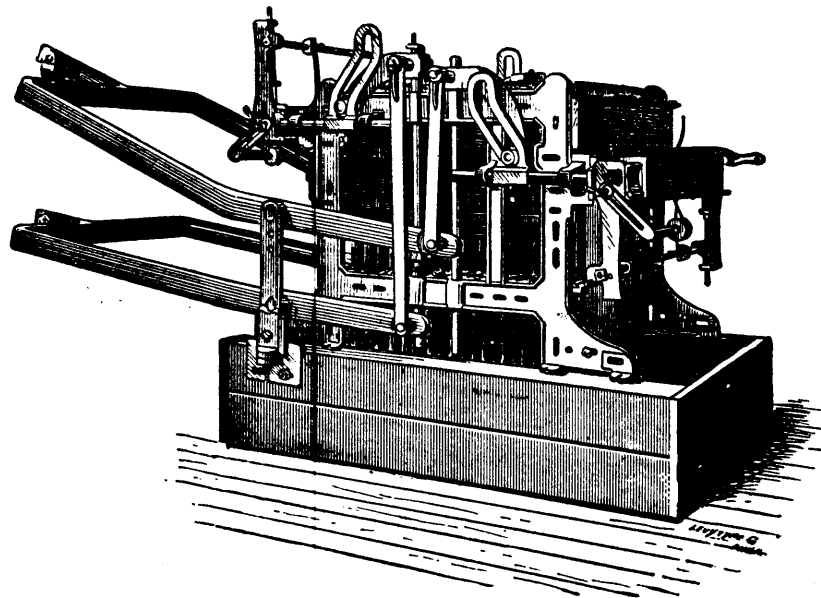
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