

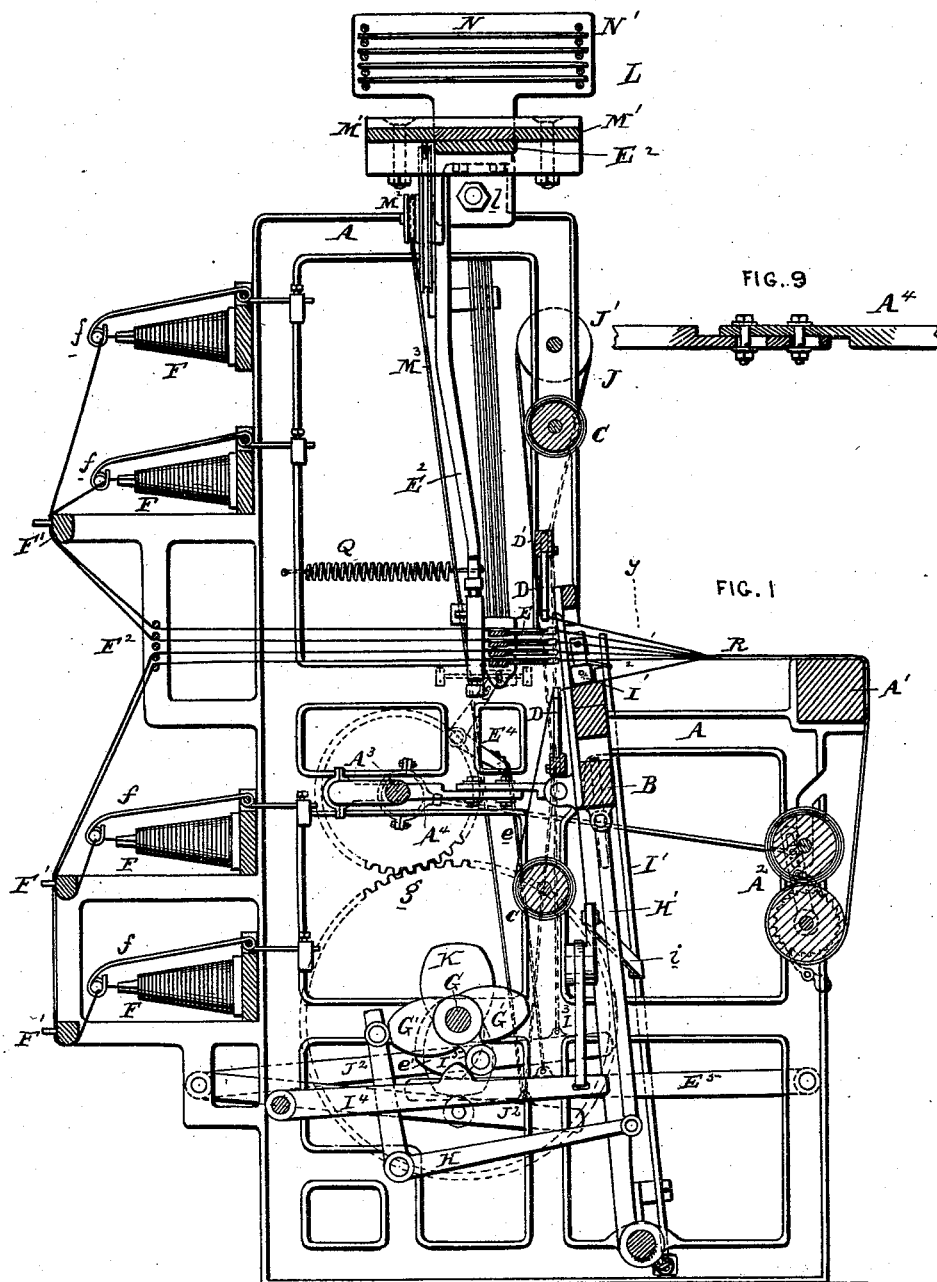
(No Model.)

5 Sheets—Sheet 1.

W. G. CONNELL.  
LOOM.

No. 522,554.

Patented July 3, 1894.



WITNESSES:

Henry D. Dwyer  
C. M. Dietterich.

INVENTOR:

Walter G. Connell  
By his atty  
*W. G. Connell*

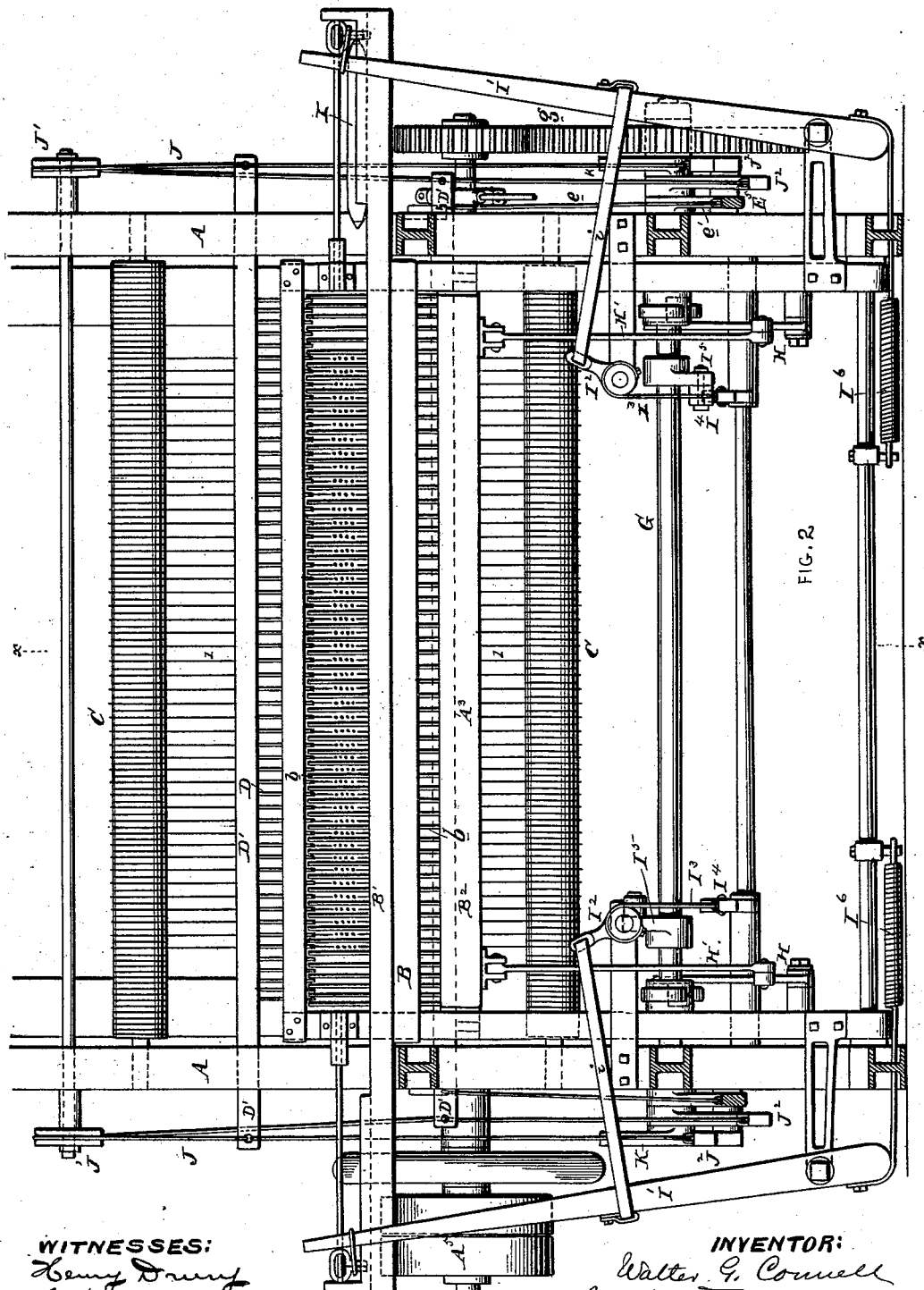
(No Model.)

5 Sheets—Sheet 2.

W. G. CONNELL.  
LOOM.

No. 522,554.

Patented July 3, 1894.



WITNESSES:

*Henry Denny*  
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W. G. CONNELL.  
LOOM.


No. 522,554.

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(No Model.)

W. G. CONNELL.  
LOOM.

5 Sheets—Sheet 4.

No. 522,554.

Patented July 3, 1894.

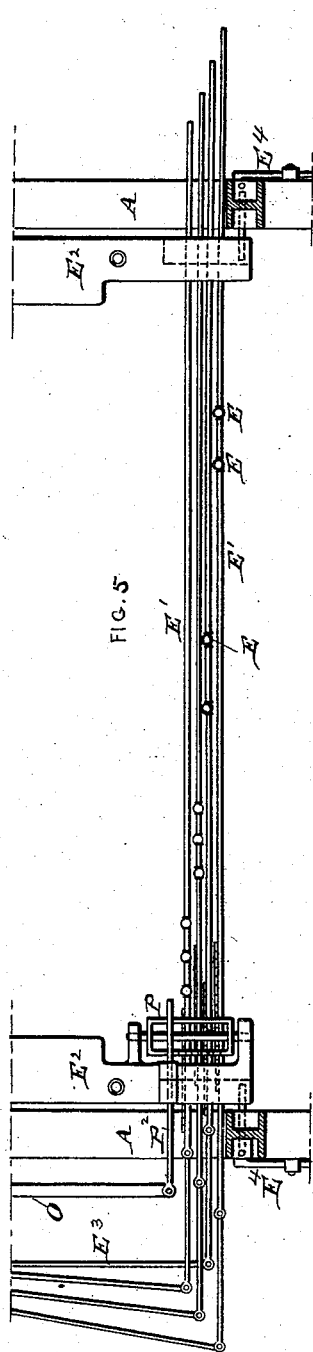


FIG. 5

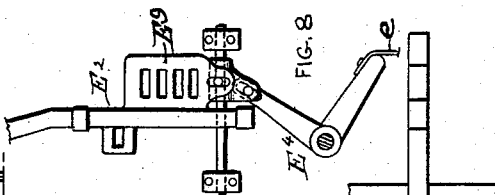


FIG. 8

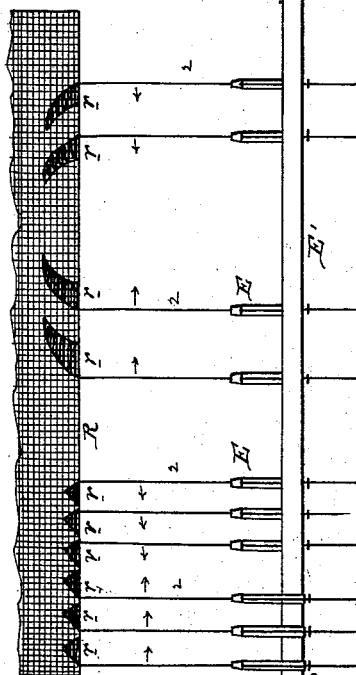


FIG. 6

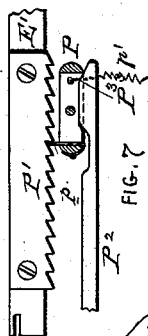


FIG. 7

C. M. Dittlerich.  
H. L. Matherell

Walter G. Connell  
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*[Signature]*

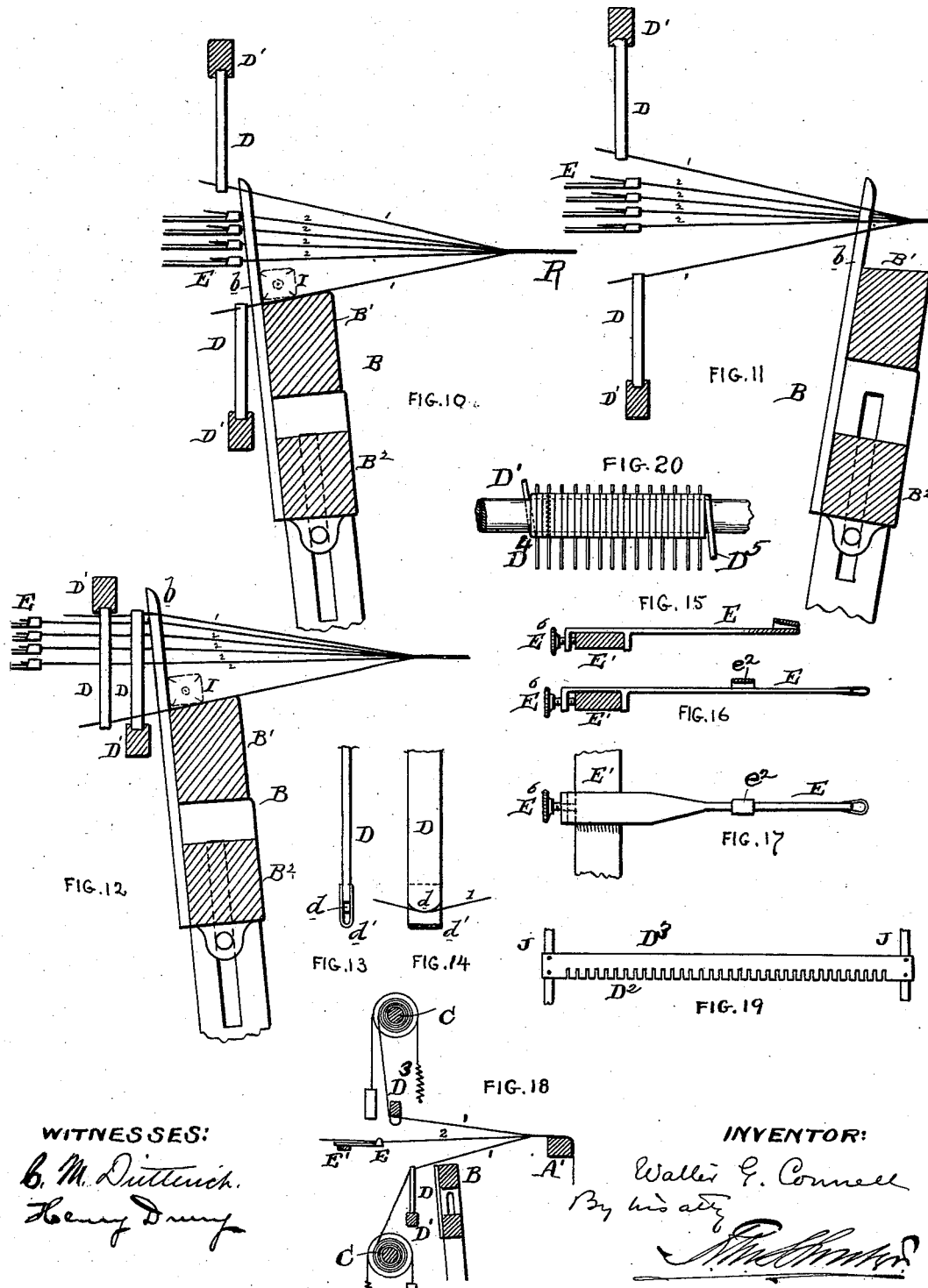
(No Model.)

5 Sheets—Sheet 5.

W. G. CONNELL.  
LOOM.

No. 522,554.

Patented July 3, 1894.



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# UNITED STATES PATENT OFFICE.

WALTER GLEN CONNELL, OF PHILADELPHIA, PENNSYLVANIA.

## LOOM.

SPECIFICATION forming part of Letters Patent No. 522,554, dated July 3, 1894.

Application filed November 17, 1892. Serial No. 452,264. (No model.)

*To all whom it may concern:*

Be it known that I, WALTER GLEN CONNELL, of the city and county of Philadelphia, and State of Pennsylvania, have invented an  
5 Improvement in Looms for Weaving Textile Fabrics, of which the following is a specification.

My invention has reference to looms for weaving textile fabrics, and consists of certain improvements which are fully set forth  
10 in the following specification and shown in the accompanying drawings which form a part thereof.

The object of my invention is to provide  
15 suitable mechanism for automatically weaving a fabric such as set out in my applications Serial No. 452,265, filed November 17, 1892, and Serial No. 464,682, filed March 6, 1893, wherein the body of the fabric is woven with  
20 warp and weft in any of the ordinary methods, and the design is worked into the said warp and weft by means of additional figuring filling threads which are bound in by the body threads of the fabric and form what  
25 may be termed sectional shots in the process of weaving, that is to say, the figuring filling threads are laid into the fabric in a more or less zigzag manner during its process of weaving, and the length of the said figuring filling  
30 threads constituting the design and lying parallel with or to the weft threads at any place in the fabric is only a portion of the full width of the fabric being woven, and in some cases an exceedingly small portion thereof  
35 according as the design may dictate.

The invention consists of a loom having among others the following parts: suitable warp beams or means to deliver the warp to the loom, a reciprocating lay having upwardly  
40 extending fingers or reeds open at the top so as to enter the warps at any point from below, suitable heddles adapted to control the warp threads of the body fabric and one or more of which consist of parallel fingers secured at one end to an arm or frame and at  
45 the other end unobstructed, a series of figuring filling thread guides and supporting mechanism for laying the figuring filling threads in the open sheds formed by the manipulation  
50 tion of the body warps, and suitable Jacquard

mechanism for properly controlling the figuring filling thread guides to insure the proper pattern in the finished fabric.

The mere details of construction of my improved loom may be modified or changed in a large variety of ways which will be self evident to any competent loom manufacturer, but the essential features are substantially those specified above which co-act to produce my improved fabric and which constitute a  
55 structure entirely new in the art and one which requires a peculiarly adapted machine for its manufacture.

The details of construction will be better understood by reference to the accompanying  
65 drawings.

Figure 1 is a sectional elevation of my improved loom on line  $x-x$  of Fig. 2. Fig. 2 is a front elevation of the lower part of my improved loom with the forward part of the frame broken away on the line  $y-y$  of Fig. 1. Fig. 3 is a rear elevation of the Jacquard mechanism. Fig. 4 is a plan view of the same. Fig. 5 is a rear elevation of the figuring filling thread guides which are adapted to be operated by the Jacquard mechanism. Fig. 6 is a plan view of same. Fig. 7 is a sectional plan view of the locking mechanism for the bars holding the guides for the figuring filling threads. Fig. 8 is an end elevation of part of the mechanism adapted to reciprocate the holders of the figuring filling thread-guide bars. Fig. 9 is a sectional elevation of the adjustable feature of the pitman for operating the lay. Figs. 10, 11, and  
75 12 are sectional elevations showing the manipulation of the lay, the heddles and the figuring filling thread guides. Fig. 13 is a rear elevation of one of the heddle needles or fingers. Fig. 14 is a side elevation of same with the lower loop broken away. Fig. 15 is a sectional elevation of one of the figuring filling thread guides. Fig. 16 is a similar elevation of a modification thereof. Fig. 17 is a plan view of the structure shown in Fig. 16. Fig. 18 is a sectional elevation of a suitable heddle and warp beam adapted to my invention, illustrating a modification in the construction of one of the heddles. Fig. 19 is a front elevation of the modified heddle shown  
80 85 90 95 100

in Fig. 18; and Fig. 20 is a similar view illustrating a modification in the construction of said modified heddle.

A is the main frame of the loom and may be constructed in any suitable manner.

B is the reciprocating lay and is pivoted at the lower part to the frame A in the usual manner, and has its upper end free to vibrate. The upper part of the lay is formed with a transverse beam B' constituting the shuttle race for guiding the shuttle I. Immediately below the shuttle race is a transverse vertical reciprocating beam B<sup>2</sup> which carries a series of vertical reed fingers *b*, the upper ends of which are free and preferably rounded to a point so that when they are projected upwardly through the warp they may readily pass through the same. This beam B<sup>2</sup> and the reed fingers *b* are reciprocated by means of links H', bell cranks H, and cams G' upon the shaft G. The shaft G is supported by the frame A and is rotated at half the velocity of the power crank shaft A<sup>3</sup>, from which it is driven by gearing *g*. The power shaft A<sup>3</sup> is operated by a band pulley A<sup>5</sup>, and reciprocates the lay by means of the pitman A<sup>4</sup> which is preferably adjustable as to its length in any suitable manner, one method of adjustment being shown in Fig. 9.

D', D', are two heddle beams and are respectively provided with a series of heddle fingers D, D, opening in opposite directions and having eyes formed in their free ends. The construction of these heddle fingers to form the eyes is clearly indicated in Figs. 13 and 14. The free ends of the fingers D are rounded as at *d*, and a flattened loop *d'* is secured over the end of the finger and brazed or soldered in position. By this means the fingers may be moved vertically through the warps so as to cross each other in making one of the sheds with the body warps, or moved apart to form another or open shed to permit the figuring filling thread guides to enter and properly lay the figuring filling threads in position to be taken up by the comb fingers *b* and beaten up with the body weft to the forward part of the machine. The body warps are marked 1. They pass from the warp beams C, C, through the eyes of the heddle fingers and thence over the guide beam A'. The warp beams C C are provided with the usual tension take up cords, weights and springs for properly paying off the warp threads and permitting the proper movement of the heddles (see Fig. 18). The heddles are operated in any suitable manner, as by the levers J<sup>2</sup> J<sup>2</sup> with which they are connected by cords J. In the drawings I have shown the cords extending from one lever J<sup>2</sup> to the bar heddle, thence around the roller J' down to the lower heddle, and then to the second lever J<sup>2</sup> (see Fig. 2).

In place of using both heddles with fingers D, one of the heddles may be formed of a transverse beam D<sup>3</sup> having a series of saw notches D<sup>3</sup>, around which the warp threads 1

are drawn. This kind of heddle may be used because the warps pass substantially vertically from the warp beam to the heddle and then around it to the lay. One warp lies in each saw cut. This is shown in Figs. 18 and 19. This modified heddle may be constructed as shown in Fig. 20, in which the bar D<sup>3</sup> is shown provided with a series of pins D<sup>4</sup> held in place and separated by a cord D<sup>5</sup> wrapped upon the bar D<sup>3</sup>. In some cases, as where weaving a ground of twill fabric, there will be three or more heddles, but in any case there can only be one of my improved notched heddles of the character shown in Figs. 18, 19, and 20 employed in the combination.

It is evident that I may use any number of heddles desired according to the particular body weave required.

R indicates the fabric in its woven condition and is drawn over the guide beam A', and wound upon the take up rollers A<sup>2</sup>, which are constructed and operated in any of the ordinary ways common to looms generally.

The picker staff I' for throwing the shuttle I may be of the usual construction and operated by a strap *i* connecting with a lever I<sup>2</sup>, in turn operated by a strap I<sup>3</sup> connected with a lever or treadle I<sup>4</sup> which is thrown down by the cam arm I<sup>5</sup> on shaft G. A spring I<sup>6</sup> returns the picker staff after having been thrown by the mechanism above described. Each picker staff is provided with a similar mechanism and they are so arranged that they operate alternately in the usual manner.

E<sup>2</sup> is a reciprocating or vibrating bar frame located in the rear of the heddles and adapted to be moved to and from them. In the drawings I have shown this bar frame composed of two depending side pieces united by a cross piece at the top and pivoted as at *l* to the upper portions of the sides of the main frame A. The bar frame may, however, be of any other convenient construction. The bar frame is provided with a series of guides E<sup>3</sup>, shown in the drawings in the depending side pieces, in which bars E' are supported and guided with freedom of longitudinal movement. The bars E' thus carried by the bar frame E<sup>2</sup> are located in the rear of the heddles and being movable longitudinally in the vibrating bar frame may thus be moved either laterally or longitudinally with reference to the warps. The bars E' are provided with adjustable guides E for the figuring filling threads 2. These guides E project from the bars E' toward the lay, and the figuring filling threads 2 extend through the eyes of the guides to the body of the fabric R. The figuring filling threads extend backward from the guides toward the rear of the loom and pass about guide rods F<sup>2</sup>, thence over guide beams F', thence through take up guides *f* of any suitable construction to the spools or supports F, which are carried upon framework at the rear of the loom. The take up guides *f* preferably consist of pivoted counterweighted wires as shown, which act automatically to

take up any slackness in the filling figuring threads caused by the movement of the guides E. The bar frame E<sup>2</sup> is drawn backward by means of a spring Q, and is thrown forward by means of a bell crank E<sup>4</sup>, a strap e, a lever E<sup>5</sup>, and a cam e' secured to the shaft G. It will thus be seen that the bar frame E<sup>2</sup> makes one reciprocation or oscillation for each two reciprocations of the lay.

The figuring filling thread guides E are adjustably clamped upon the bars E' by means of screws E<sup>6</sup> clearly shown in Figs. 15, 16, and 17. The guides may be made as shown in Fig. 15, or as indicated in Figs. 16 and 17. In the former case, the guides are provided with enlarged eyes upon their extremities which do not pass through the reed fingers b at any time, while in the latter case the guides are provided with guiding eyes e<sup>3</sup> upon their shanks and with flattened eyes upon their extremities, so that the reed fingers may ascend back of the guides E and remain up while being drawn forward over the eyes. This latter construction makes the action of the reed fingers b somewhat more positive in picking up the figuring filling threads from the guides E.

To suit any particular pattern or location of the figuring effect upon the body of the fabric, the guides E may be properly adjusted upon the several bars E'. The bars E' are operated by means of a Jacquard mechanism shown in Figs. 3 and 4. One end of the bars is connected to the lower ends of the levers E<sup>3</sup>, which are pivoted to an extension E<sup>4</sup> of the bar frame E<sup>2</sup>. Fig. 5, when placed immediately below Fig. 3, will give a very clear illustration of the connection between the bars E' and the Jacquard mechanism L. The upper ends of the levers E<sup>3</sup> are connected by links n with the lifter bars N of the jacquard, which has four of said lifter bars guided in suitable guides upon a frame N' which is shown carried on the cross piece of the bar frame E<sup>2</sup>. A spring S causes the levers E<sup>3</sup> to be returned to their original positions when unacted upon by the Jacquard mechanism, so as to normally return the bars E' to the left when looking at Fig. 5, or from the rear of the loom. The frame M<sup>4</sup> carries four rows of needles respectively adapted to act upon the four lifter bars N. There are preferably as many rows of needles as there are bars E'. Each row of needles M contains a series of needles of different lengths, as is clearly indicated in dotted lines in Fig. 4, and the cards L<sup>2</sup> which operate the needles have perforations corresponding to every needle of the four sets, except where such perforations are omitted for the purpose of moving the needles and the corresponding lifter bars.

M' is a reciprocating frame carried and guided upon the cross piece of the bar frame E<sup>2</sup>.

L' is a card operating cylinder carried by the frame M' and reciprocating with it.

Referring to Fig. 4, it is quite evident that with a given reciprocation of the frame M'

which carries the cylinder L' and the cards L<sup>2</sup>, those needles M will be projected backward which correspond to the uncut portions of the cards. In Fig. 4, four of the needles are shown as pushed back to different distances, and this is controlled by the fact that with a given movement of the cylinder, the distance the needle will be pushed back will be the total distance the cylinder is moved after reaching the longest needle less the difference between the length of the needle moved and the longest needle. The proper cutting of the cards will cause the proper selection of any needle, and consequently the desired throw to either one of the lifter bars N with a corresponding lateral throw to the respective guide bars E'. The cards L<sup>2</sup> are guided over cylinders F<sup>3</sup>, carried upon the frame M', and may be supported in any of the usual manners beyond these cylinders, as is customary in Jacquard mechanism where a large number of cards are employed. If the pattern is small, the cards may hang straight down in a loop. The cylinder L' is maintained in position by a spring-pressed dog L<sup>3</sup>, which permits the head to be turned under the action of the hooks m on each backward movement of the said cylinder and its frame M'. Ordinarily the lower hook m will alone be in operative position to act upon the cylinder, but by lowering the lower hook, as well as the upper hook, the upper hook may be alone in operation, and in that case the pattern cards will be moved in a reverse direction.

The frame M' is reciprocated by cables m' attached thereto and extending in opposite directions and connected to two pulleys M<sup>2</sup> having smaller diameters to which are connected straps M<sup>3</sup> extending down to the treadles J<sup>2</sup>. By this mechanism, the movement of the treadles J<sup>2</sup> causes the Jacquard mechanism to be operated to set a new position for the guides E carried by the bars E' when the heddles are moved farthest apart, or at any time when the figuring filling threads 2 may be set in their new positions. Immediately after the jacquard is moved to set the bars E' and the guides E, the cam e' operates the lever E<sup>5</sup> and through the mechanism hereinbefore described, shown in Fig. 8, throws the bar frame E<sup>2</sup> forward or toward the heddle bars so as to bring the ends of the guides E close to the reed fingers of the lay, as indicated in Fig. 1, and also in Figs. 10 and 11, so that when the reed fingers rise under the action of the cams G' they shall pass up close to the ends of the guides. The action of the treadles or levers J<sup>2</sup> is to cause the frame M' to be reciprocated back and forth at stated intervals.

When the frame M' is moved to the left as indicated in Fig. 3, it strikes a slide bar O arranged to operate a lever O' against the action of a spring o, and this lever operates a trip cam P<sup>2</sup> carried in the free end of the bar frame E<sup>2</sup>. The stop o' on the bar O limits the right hand movement of the bar so that



the last portion of the left hand movement of the frame M' alone acts upon the bar O.

The several bars E' are provided with racks P' corresponding to saw teeth and these are locked in position by a locking frame P having a tooth *p*. A spring *p'* keeps the tooth *p* in contact with the teeth of the rack P' and locks the bars E' against the return movement when the card cylinder is moving away from the needles to permit the next card to be turned into operative position. When the frame M' moves to the left sufficiently to strike the bar O, it causes the cam bar P<sup>2</sup> to be projected to the right so that its cam surface P<sup>3</sup> trips the locking frame P and liberates the teeth of the rack P'. This tripping of the locking frame P liberates the bars E' so that the springs S may come into play and move the bars to the left (Fig. 6) until the lifter bars N are arrested by coming in contact with any needle M which may be pushed back under the action of the cards. This locking mechanism, it will thus be seen, prevents the action of the springs S coming into play until after the cards have been reset and operate again upon the needles. Furthermore, it permits the bars E' to be locked in position for laying in the figuring filling threads without reference to further movements of the Jacquard mechanism, so that the manipulations of the jacquard for setting a new card may take place over the period required for the action of the lay and oscillation or vibration of the bar frame. It gives a longer period for the jacquard to reset itself than would be permitted in case the jacquard itself was required to hold the bars E' in their operative positions.

Instead of the Jacquard mechanism of the particular construction described, any other suitable Jacquard mechanism capable of imparting lateral movements of variable extent to the filling figuring thread guides may be employed without departing from my invention.

The operation of the loom will now be clearly understood. The order of the movements may be stated as follows:—The parts being in the positions shown in Fig. 1, the shuttle I is thrown, and the lay is then moved backward to beat back the weft thread and the several figuring filling threads 2 between the binder warps 1. The reed fingers are then lowered, the bar frame is moved back, the heddle fingers are closed to form a second shed with the warps 1, the lay is then moved forward toward the heddles, the reed fingers are moved upward, the shuttle is then shot in the reverse direction, and the lay is then moved toward the solid fabric R to beat back the weft thread. During this operation, the jacquard had brought a new card into play which has selected certain needles and moved the guide bars E' to bring the guides E into proper position for laying in the next portions or sectional shots of the figuring filling

threads 2. The reed fingers are then drawn down, the lay is returned to the position shown in Fig. 1, the heddles are separated to form an open shed at the rear, the bar frame is moved toward the heddles, the reed fingers are then raised to the position shown in Fig. 1, the shuttle is then shot, and the lay moved toward the solid fabric to beat back the sectional figuring filling threads and the weft threads. These operations are repeated.

The loom may be operated in any other manner desired so long as it permits the introduction of the sectional shots of the figuring filling threads. The heddles may be operated as in any ordinary loom as in a common hand loom jack frame or otherwise without departing from the essential feature of my invention.

It is evident that the mere details of construction may be modified in various ways without departing from the principles of my invention, and I therefore do not limit myself to the particular construction of loom here shown. Furthermore, in this application I make no claim to the particular construction of the Jacquard mechanism, as that forms the subject matter of my application, Serial No. 472,864, filed May 3, 1893. Instead of this Jacquard mechanism, any other Jacquard mechanism suitable for imparting the variable lateral movements to the thread guides may be employed.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a loom, the combination with heddles adapted to form an open shed, of thread guides located in the rear of the heddles to introduce filling figuring threads from the rear into the open shed, and Jacquard mechanism to move the thread guides a variable lateral distance with reference to the warps carried by the heddles.

2. In a loom, the combination with heddles adapted to form an open shed, of thread guides located in the rear of the heddles to introduce filling figuring threads from the rear into the open shed, Jacquard mechanism to move the thread guides a variable lateral distance with reference to the warps carried by the heddles, and power devices to move said thread guides to and from the heddles.

3. In a loom, the combination of heddles, one or more having fingers free at one end for operating the warp, means to reciprocate the heddles in opposite directions, a vibrating lay movable to and from the heddles and having a series of vertically movable reed fingers provided with free ends adapted to be readily introduced between the warps, power devices to intermittently reciprocate the reed fingers, one or more filling figuring thread guides arranged in the rear of the heddles movable laterally with reference to the warp and adapted to operate upon the filling figuring threads in conjunction with the reed fingers,

and Jacquard mechanism to move the thread guides a variable lateral distance with reference to the warps.

4. In a loom, the combination of heddles one or more having fingers free at one end for operating the warp, means to reciprocate the heddles in opposite directions, a vibrating lay movable to and from the heddles and having a series of reed fingers provided with free ends adapted to be readily introduced through the warp, power devices to intermittently reciprocate the said reed fingers, one or more figuring filling thread guides arranged to the rear of the heddles movable laterally with reference to the warp and adapted to operate upon the figuring filling threads in conjunction with the reed fingers, a Jacquard mechanism for controlling the movement of the said guides, and power devices for moving the guides to and from the heddles when the heddles are separated so as to pass into the open warp shed formed by the heddles to meet the reed fingers.

5. In a loom, the combination of heddles one or more having fingers free at one end for operating the warp, means to reciprocate the heddles in opposite directions, a vibrating lay movable to and from the heddles and having a series of reed fingers provided with free ends adapted to be readily introduced through the warp, power devices to intermittently reciprocate the said reed fingers, one or more figuring filling thread guides arranged to the rear of the heddles movable laterally with reference to the warp and adapted to operate upon the threads in conjunction with the reed fingers, a Jacquard mechanism for controlling the movement of the said guides, power devices for moving the thread guides to and from the heddles when the heddles are separated so as to pass into the open warp shed formed by the heddles to meet the reed fingers, suitable supports for the figuring filling threads, and automatic take up guides for guiding the figuring filling threads from the supports.

6. In a loom, the combination of heddles, one or more having projecting fingers provided with eyes for the warp threads, a reciprocating lay having reed fingers free at one end so as to be readily inserted through the warp, power devices for operating the shuttle at stated intervals, a series of guide bars arranged in the rear of the heddles, one or more figuring filling thread guides secured to the several guide bars, and suitable pattern mechanism for shifting each or any of the guide bars a variable lateral distance with reference to the warp.

7. In a loom, the combination of two heddles one or more having projecting fingers provided with eyes for the warp threads, a reciprocating lay having reed fingers free at one end so as to be readily inserted through the warp, power devices for operating the shuttle at stated intervals, a series of guide bars arranged in the rear of the heddles, one or more

figuring filling thread guides secured to the several guide bars, and suitable pattern mechanism for shifting the guide bars laterally with reference to the warp for the purpose of bringing the guides in predetermined definite positions with respect to the warp threads of the fabric, and power devices for moving the guide bars and their guides toward the lay after the said guide bars have been moved laterally by the pattern mechanism.

8. In a loom, the combination of two heddles, one or more having projecting fingers provided with eyes for the warp threads, a reciprocating lay having reed fingers free at one end so as to be readily inserted through the warp, power devices for operating the shuttle at stated intervals, a series of guide bars arranged in the rear of the heddles, one or more figuring filling thread guides adjustable upon said guide bars, and suitable pattern mechanism for shifting the guide bars a variable lateral distance with reference to the warp.

9. In a loom, the combination of heddles one or more having projecting fingers provided with eyes for the warp threads, a reciprocating lay having reed fingers free at one end so as to be readily inserted through the warp, power devices for operating the shuttle at stated intervals, a series of guide bars arranged in the rear of the heddles, one or more figuring filling thread guides secured to the several guide bars, suitable pattern mechanism for shifting the guide bars laterally with reference to the warp for the purpose of bringing the guides in predetermined definite positions with respect to the warp threads of the fabric, power devices for moving the guide bars and their guides toward the lay after the said guide bars have been moved laterally by the pattern mechanism, a lock to lock the guide bars in position after being set by the pattern mechanism, and a trip mechanism controlled by the pattern mechanism for releasing the said guide bars to permit them to adjust themselves to new positions governed by the pattern mechanism.

10. In a loom, the combination of heddles one or more having projecting fingers provided with eyes for the warp threads, a reciprocating lay having reed fingers free at one end so as to be readily inserted through the warp, power devices for operating the shuttle at stated intervals, a series of guide bars arranged in the rear of the heddles, one or more figuring filling thread guides secured to the several guide bars, suitable pattern mechanism for shifting the guide bars laterally with reference to the warp for the purpose of bringing the guides in predetermined definite positions with respect to the warp threads of the fabric, power devices for moving the guide bars and their guides toward the lay after the said guide bars have been moved laterally by the pattern mechanism, a lock to lock the guide bars in position after being set by the pattern mechanism, a trip mechanism controlled by the pattern mechanism

for releasing the said guide bars to permit them to adjust themselves to new positions governed by the pattern mechanism, and power mechanism connecting the several parts whereby the guide bars and their guides are operated once in every two operations of the lay and heddles.

11. In a loom, the combination of heddles one or more having fingers free at one end carrying the warp threads, a reciprocating lay having reed fingers, power mechanism for operating the shuttle, a pivoted bar frame arranged at the rear of the heddles, a series of laterally movable guide bars provided with figuring filling thread guides carried at the free end of said bar frame, a Jacquard or pattern mechanism to adjust the said bars laterally with reference to the warp also carried by the bar frame and movable with it, power devices for reciprocating the bar frame once in every two operations of the lay, and power devices for operating the heddles and lay.

12. In a loom, the combination of heddles one or more having fingers free at one end carrying the warp threads, a reciprocating lay having reed fingers, power mechanism for operating the shuttle, a pivoted bar frame arranged at the rear of the heddles, a series of movable guide bars provided with figuring filling thread guides carried at the free end of said bar frame, a Jacquard or pattern mechanism to adjust the said bars laterally with reference to the warp also carried by the bar frame and movable with it, power devices for reciprocating the bar frame once in every two operations of the lay, power devices for operating the heddles and lay, a lock to lock the guide bars in positions assumed under the action of the Jacquard or pattern mechanism, and means to liberate the said lock to free the bars after the Jacquard or pattern mechanism has been operated for the purpose of resetting the bars for the next pick of the loom.

13. In a loom, the combination of a reciprocating lay having movable reed fingers free at one end and adapted to be moved up through the warp threads, mechanism adapted to operate upon the warp threads to produce alternate sheds of which every alternate shed is open to the rear of the loom, shuttle operating devices, figuring filling thread guides projecting from the rear toward the forward part of the machine and adapted to lay in figuring filling threads in the shed open to the rear, and operating devices for the said thread guides for causing them to move a variable lateral distance with reference to the warp for laying in the figuring filling threads corresponding to every second reciprocation of the lay.

14. A heddle finger for a loom formed of a flat bar rounded upon its lower end as at *d* and having a flattened U-shaped plate *d'* arranged about the lower end and secured to the finger at its sides so as to form an eye with a rounded surface at the end of the finger.

15. A heddle finger formed of a flattened bar provided with an elongated eye at its end extending in the width of the flattened bar and having a curved internal surface.

16. In a loom, the combination of the heddles and lay, with one or more laterally movable thread guides for laying in figuring filling threads, a bar to move said thread guides, a lifter head and connecting mechanism to operate said bar, a series of needles of different lengths either one of which is adapted to operate the lifter head, and card devices adapted to operate either one of said needles for the purpose of moving the lifter bar to a variable distance for the purpose of varying the lateral movement of the thread guides.

17. In a loom, the combination with heddles adapted to form an open shed, of movable guide bars arranged to the rear of the heddles, filling figuring thread guides carried by the movable guide bars, and Jacquard mechanism to move said guide bars laterally with reference to the warps carried by the heddles for a variable distance as the pattern may require.

18. In a loom, the combination with heddles adapted to form an open shed, of thread guides arranged in the rear of the heddles to introduce filling figuring threads from the rear into the open shed, Jacquard mechanism to move the thread guides a variable lateral distance with reference to the warps, supports for the filling figuring threads, and automatic take up guides for guiding the threads from the supports.

19. The combination with the heddles of a loom adapted to make an open shed, of a movable carrier located in the rear of the heddles and movable transversely to the warps of the loom, a thread guide carried thereby, a movable needle actuated head, a series of independently movable needles arranged to actuate the head, card devices adapted to move any predetermined needle in the series, a connection between the movable carrier and the movable needle actuated head, whereby the movement imparted to the head by the needles will move the carrier and its thread guide transversely to the warps of the loom, an intermittently actuated lock to lock the carrier after it has been actuated and means to intermittently actuate said lock.

20. In a loom, the combination with heddles adapted to make an open shed, of a series of independently movable bars *E'* arranged in the rear of the heddles and movable transversely with reference to the warps, thread guides carried by the said bars, a series of independent movable heads *N*, connections between the bars *E'* and heads *N*, a series of needles arranged to actuate each head, and card devices to actuate any predetermined needle in any series and thus move the corresponding heads *N* and bars *E'*.

21. In a loom, the combination with heddles adapted to make an open shed, of a rocking frame, a series of independently movable bars

E' arranged in the rear of the heddles carried by the rocking frame and movable therein transversely with reference to the warps, thread guides carried by said bars, a series of  
5 independent movable heads N, connections between the bars E' and heads N, a series of needles arranged to actuate each head, and card devices to actuate any predetermined

needle in any series and thus move the corresponding heads N and bars E'.

In testimony of which invention I have here-  
unto set my hand.

WALTER GLEN CONNELL.

Witnesses:

ERNEST HOWARD HUNTER,  
H. L. MOTHERWELL.

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