(No Model.)

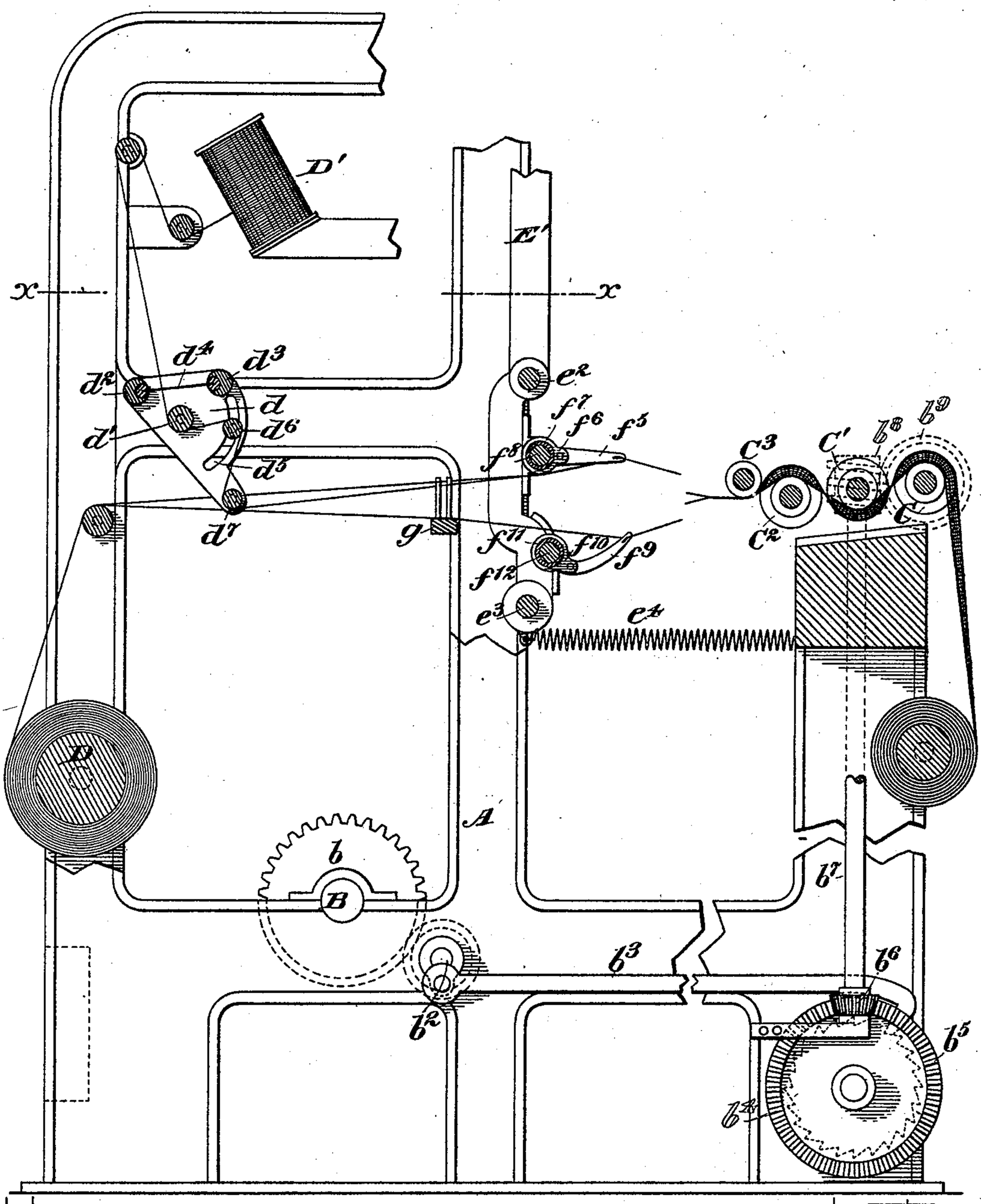
5 Sheets—Sheet 1.

I. E. PALMER.

LOOM FOR CROSS WEAVING.

No. 587,324. Patented Aug. 3, 1897.

FIG. 1.



Witnesses.
B. B. Seward.
George Barry.

Inventor:-
Isaac E. Palmer,
by attorneys.
Brown Seward

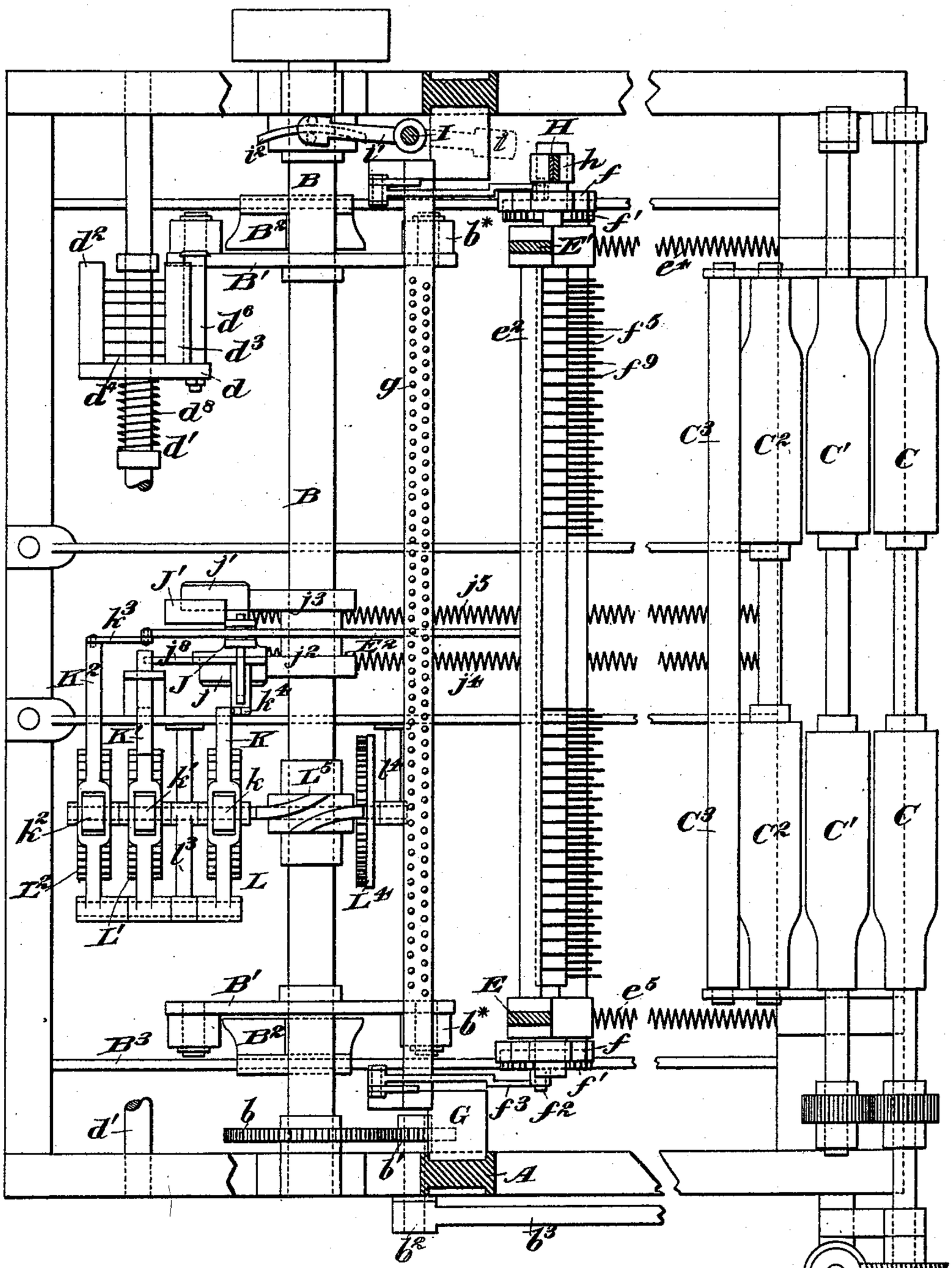
(No Model.) 5 Sheets—Sheet 2.

I. E. PALMER.

LOOM FOR CROSS WEAVING.

No. 587,324 Patented Aug. 3, 1897.

FIG 2.



Witnesses.
H. B. Linard.
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(No Model.) 5 Sheets—Sheet 3.

I. E. PALMER.

LOOM FOR CROSS WEAVING.

No. 587,324. Patented Aug. 3, 1897.

FIG. 3.

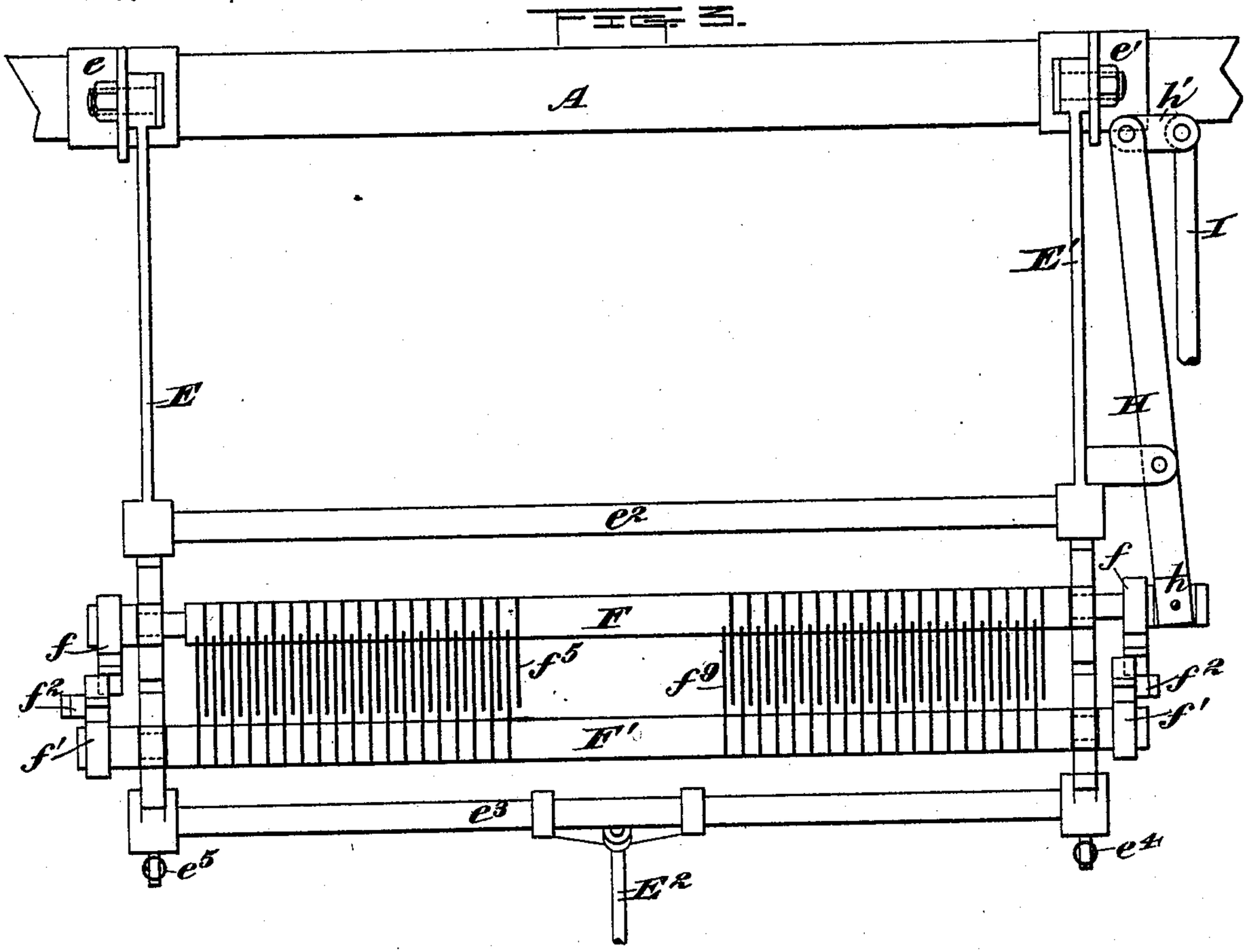


FIG. 4.

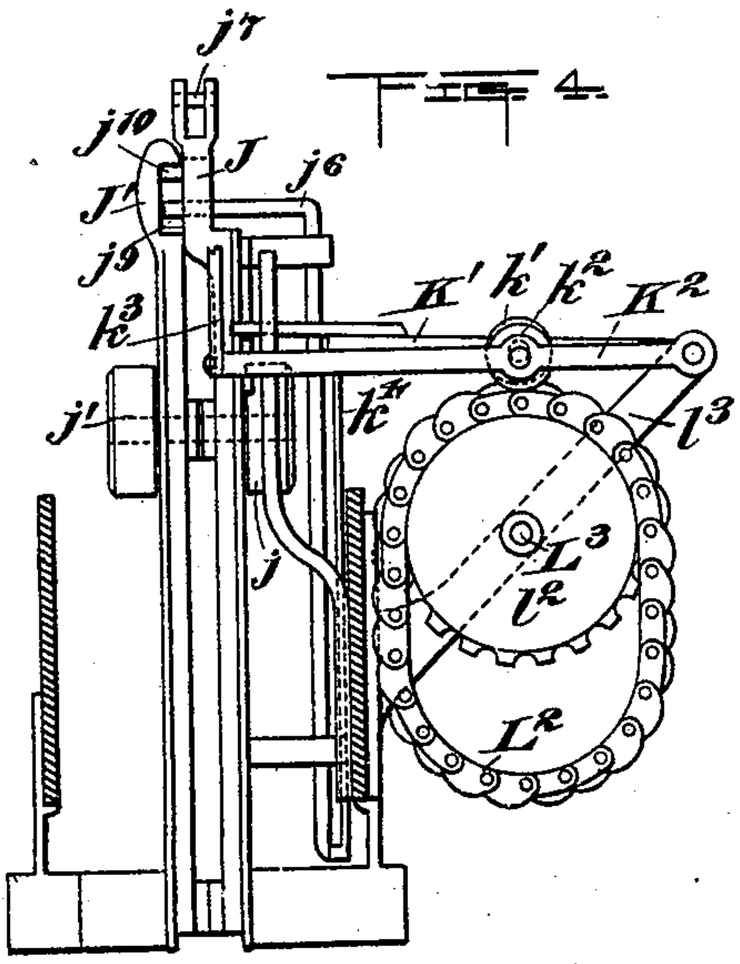
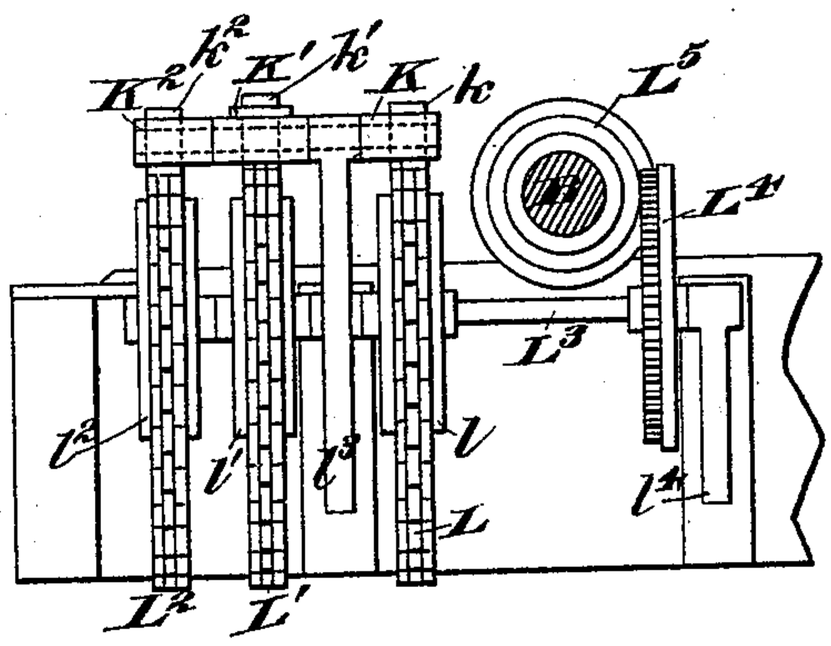


FIG. 5.



Witnesses.
A. B. Durand.
George Barry.

Inventor.
Isaac E. Palmer,
by Attorneys. Brown & Durand

(No Model.) 5 Sheets—Sheet 4.

I. E. PALMER.

LOOM FOR CROSS WEAVING.

No. 587,324. Patented Aug. 3, 1897.

FIG. 6.

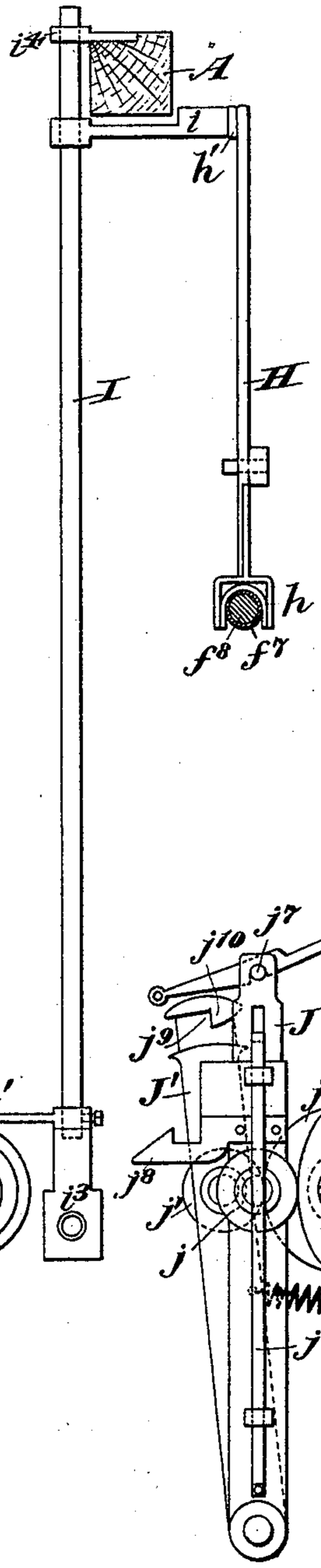


FIG. 7.

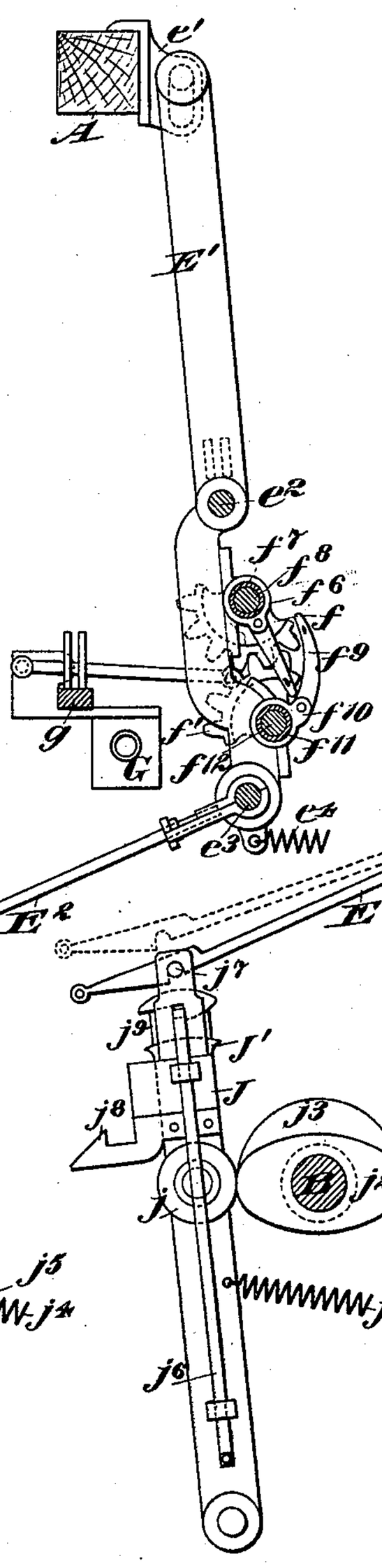


FIG. 8.

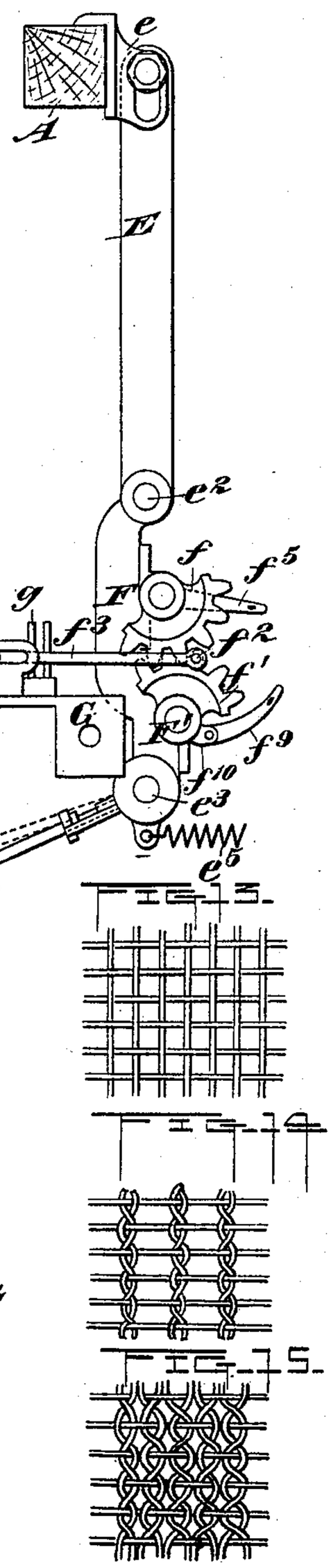


FIG. 5.

FIG. 10.

FIG. 15.

Witnesses.
R. B. Lenard.
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(No Model.)

5 Sheets—Sheet 5.

I. E. PALMER.

LOOM FOR CROSS WEAVING.

No. 587,324. Patented Aug. 3, 1897.

FIG. 9.

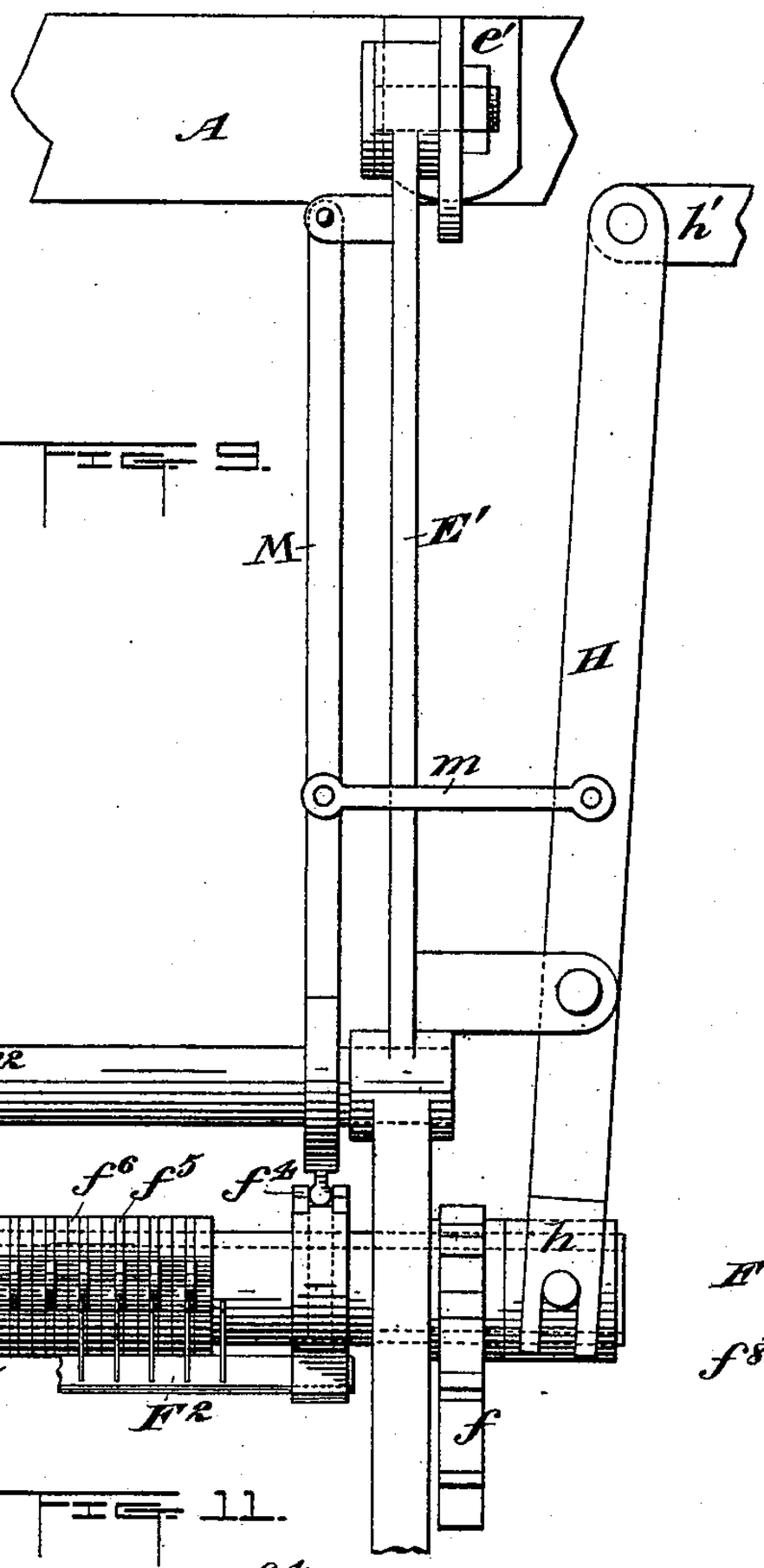


FIG. 10.

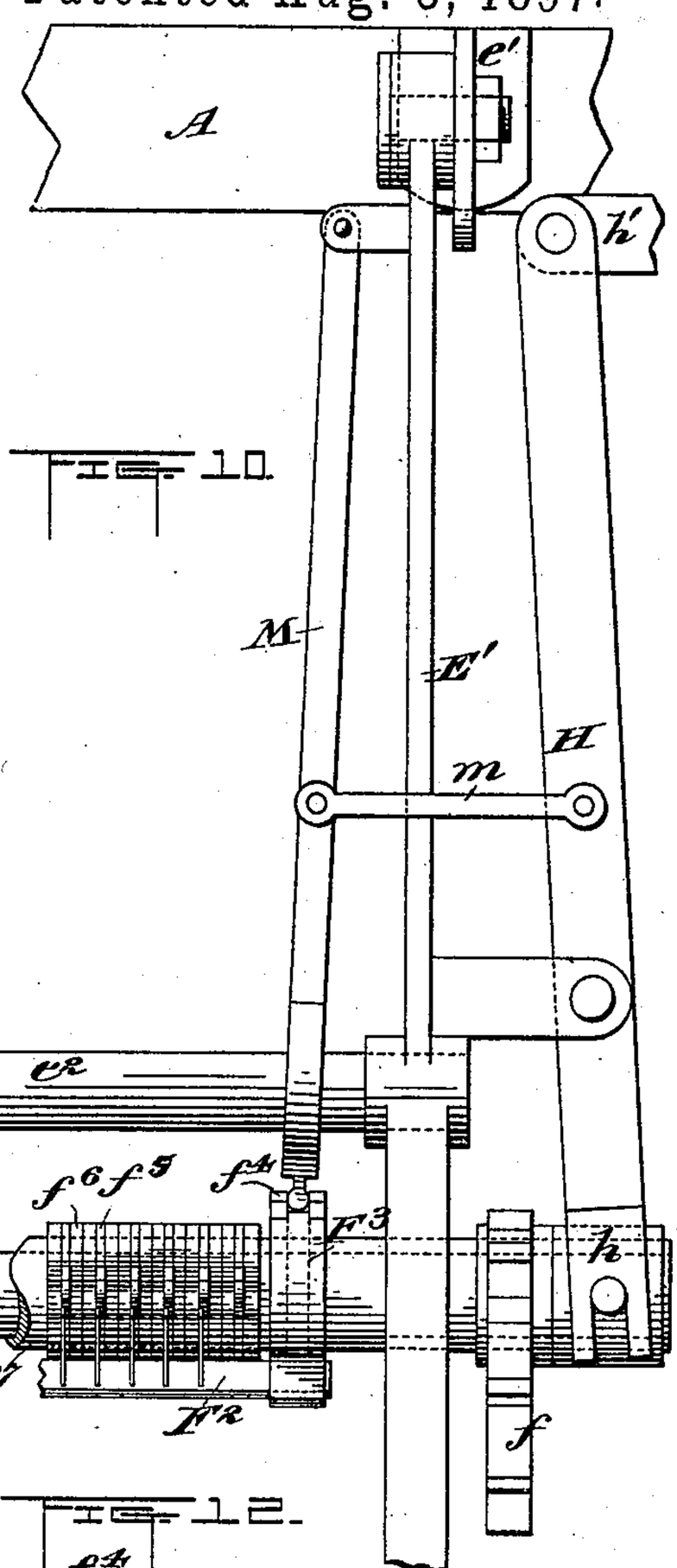


FIG. 11.

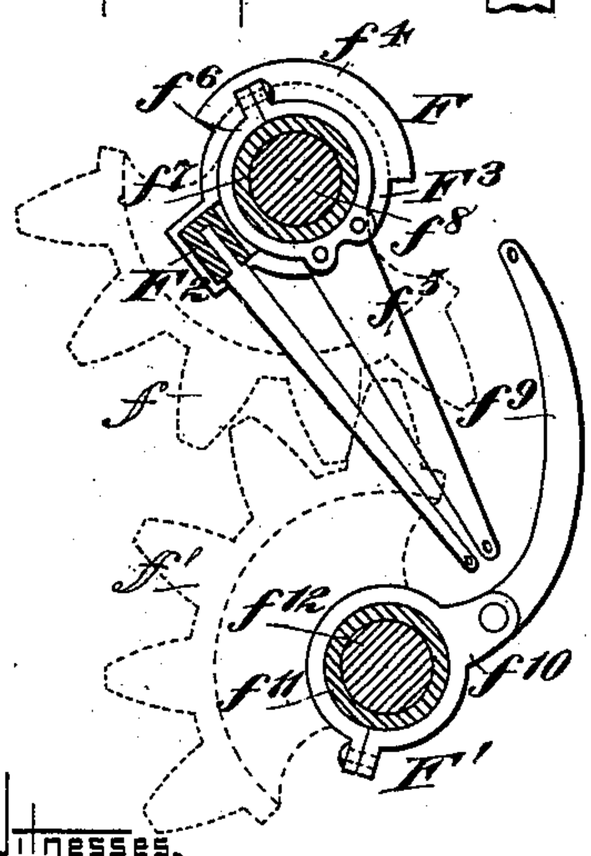
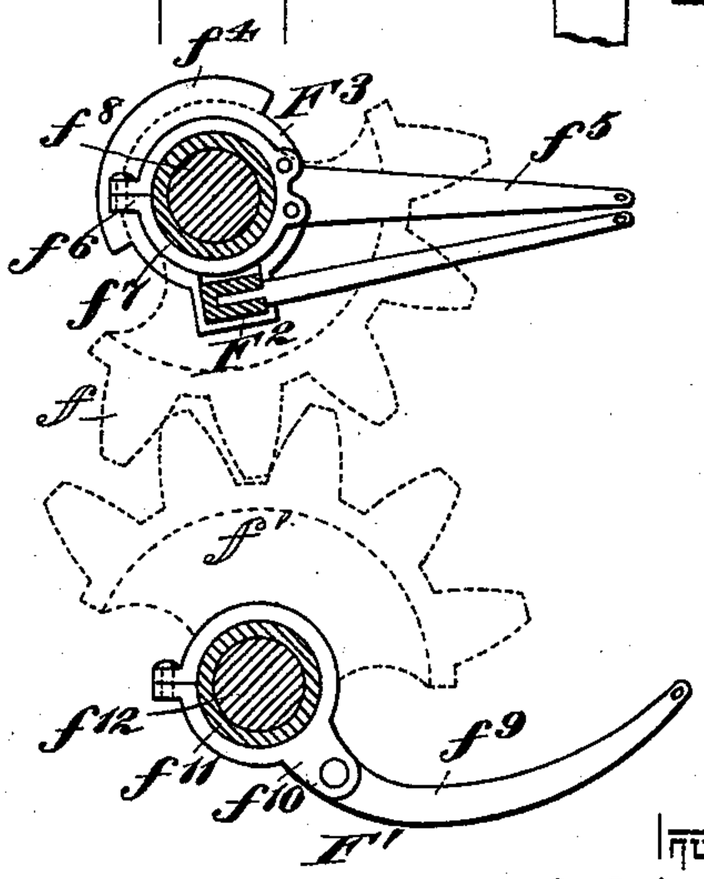


FIG. 12.



Witnesses.
F. B. Seward.
George Barry.

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UNITED STATES PATENT OFFICE.

ISAAC E. PALMER, OF MIDDLETOWN, CONNECTICUT.

LOOM FOR CROSS-WEAVING.

SPECIFICATION forming part of Letters Patent No. 587,324, dated August 3, 1897.

Application filed April 1, 1895. Serial No. 543,976. (No model.)

To all whom it may concern:

Be it known that I, ISAAC E. PALMER, of Middletown, in the county of Middlesex and State of Connecticut, have invented a new and useful Improvement in Looms for Cross-Weaving, of which the following is a specification.

My invention relates to an improvement in looms in which provision is made for weaving either plain or gauze weave at pleasure, with the object in view of facilitating the combination of different styles of weaving in connection with a continuous strip of fabric and, in general, in rendering the loom more efficient and increasing its scope.

With these ends in view my invention consists in certain features of construction and combinations of parts, as will be hereinafter described, and pointed out in claims.

In the accompanying drawings, Figure 1 is a view in side elevation, partly in section, of a portion of a loom, showing a tension device for controlling the warp which is intended to be fed at a different rate of speed from that at which other portions of warp are fed. Fig. 2 is a top plan view of the same, partly in horizontal section, taken on the line $x\,x$ of Fig. 1, showing the position of the chain and wheels for determining the style of weave. Fig. 3 is a view in front elevation of the banks of needles and their supporting and operating mechanism. Fig. 4 is a view in detail, showing the pattern-chains and the parts which they immediately operate in side elevation. Fig. 5 is a view in detail, showing the said chain-wheels and the shaft for operating them in end elevation. Fig. 6 is a view in detail, showing in end elevation the means for shifting one of the banks of needles with respect to the other. Fig. 7 is a view in detail, showing the tappets, the needle-sword, the needles, and the connection between the needles and the tappets for operating the needles, the needles in this view being shown at the extremities of their stroke toward one another. Fig. 8 is a similar view showing the needles at the limits of their stroke away from one another. Figs. 9, 10, 11, and 12 are views in detail of portions of the needle-operating mechanism and needle-shaft and needles, showing the combination with the two banks of needles of a third bank and means for operating it in connection with the two banks; and Figs. 13, 14, and 15 represent the positions of the warp and weft threads in the "plain," "gauze," and "diamond" or "double-gauze" weaves, hereinafter referred to.

The frame of the loom may be of any well-known or approved form suitable for supporting the several parts in the several positions for accomplishing their work and is represented in the present instance by A. The drive-shaft for imparting motion to the several operating parts of the loom is represented by B and is driven from a suitable source of power. (Not shown.) At or near one end of the drive-shaft B it is provided with a gear-wheel b, which meshes with a pinion b' on a crank-shaft b^2, connected by a hooked pitman b^3 with a ratchet-toothed wheel b^4 (see Fig. 1) for rotating a gear-wheel b^5, which engages a pinion b^6 on a shaft b^7, provided with a worm b^8, engaged with a worm-wheel b^9 on the shaft of one of the take-up rollers C. The roller C is geared to rotate with its companion roller C′, the third roller C^2 being left to rotate freely as the fabric passes over it from the guide-roller C^3.

In the present instance I have shown the take-up rollers as provided with tapered ends for use in connection with weaving a fabric fulled at the central portion, and in connection with such tapered-ended rollers I have shown the guide-roller C^3 for holding the fabric level prior to its passing onto the tapered rollers. This feature of taking up the fabric on the rollers provided with tapered ends is not, however, essential to the other features of the loom to which my present invention is particularly directed, the said take-up mechanism forming the subject-matter of another application, Serial No. 423,193, Patent No. 545,607, dated September 3, 1895.

The main warp-beam is denoted by D, and from it the warp is led to the upper and lower banks of needles. In addition to the main warp-beam D there is a series of spools D′, from which the warp-threads are led to the upper and lower banks of needles. In the present instance the warp-threads which are led from the spools D′ are so located as to be fed by the tapered portions of the rollers,

and hence at a speed varying from that at which the threads are drawn from the main warp-beam D by the cylindrical portions of the said take-up rollers.

In connection with the warp which is fed from the spools D', I provide a tension device as follows: Rocking plates d are mounted on a shaft d' and have projecting therefrom bars or pins d^2 d^3, connected by reeds d^4, between which the warp-threads pass. The said pieces d are further provided with an elongated slot d^5, within which the adjustable pin or bar d^6 may be secured in different positions relative to the central shaft d'. A guide bar or pin d^7 is also fixed to and projected from each plate d at a point at or near its lower end, so that the warp-threads, after passing through the reeds d^4, are led partially around the shaft d', then over the adjustable bar d^6, and thence downwardly and under the bar d^7, and thence to the needles, the plate d being free to rock on the supporting-shaft d' against the tension of a spring d^8, secured at one end to the shaft and at its opposite end to the plate d. By adjusting the pin or roller d^6 along the slot d^5 the warp-threads may be carried more or less away from a direct line between the shaft d' and the guide-bar d^7, and hence the tension may be thereby increased or diminished.

Upon the drive-shaft B, I locate suitable arms B', which carry suitable antifriction-rollers b^*, which rollers engage inclines B^2, which are mounted on shafts B^3, these shafts being connected to the shuttle-operating mechanism. (Not shown.)

Proceeding to describe the needles, their support and operating mechanism, the needle-sword consists of two swinging arms E and E', which are pivoted at their upper ends to the top of the frame A, preferably in suitable plates e e', which are secured to the frame A. These arms E E' are spaced apart by means of suitable cross-rods e^2 e^3.

The needle-sword is normally held at the limit of its forward movement by means of suitable tension-springs e^4 e^5, which are attached at one end to the arms E E' and at their other ends to the breast-beam of the frame A.

The upper bank of needles is denoted by F and the lower bank by F'. These banks of needles are so arranged that when the needles are rocked to and fro their ends through which the warp-threads pass are caused to overlap each other. The upper set of needles are denoted by f^5, and they are secured to suitable clips f^6, which clips are secured to a suitable sleeve f^7, which sleeve slides on the upper needle-bar f^8. The needles of the lower bank are denoted by f^9, and they are secured by suitable clips f^{10} to a sleeve f^{11}, which sleeve rocks on the lower needle-bar f^{12}. These two banks of needles are caused to rock by being geared together at their ends by means of suitable segmental gears f f', the former being on the upper needle-bar and the latter on the lower needle-bar. The lower segmental gears f' are provided with suitable lugs or pins f^2, to which corresponding ends of connecting-bars f^3 are pivoted, the other ends of the said connecting-bars f^3 being adjustably secured in suitable brackets G. It will thus be seen that as the needle-sword is swung forwardly and backwardly the ends of the banks of needles will be caused to rock up and down, so as to overlap.

A suitable grid g extends between the two brackets G and is supported thereby, which grid g serves to separate the warp-threads as they are being fed along, so as to straighten them out, as is usual.

The upper bank of needles F are caused to move laterally, so as to first bring each upper warp-thread down between a certain two of the lower needles, as they are rocked toward each other, at one time, and when desired will bring the warp-thread down between the next two of the lower needles when the banks of needles are again rocked. This is done in the following manner: A vibrating lever H is pivoted to the swinging arm E' of the needle-sword. The lower end of the said lever H is secured to the end of the needle-bar F by a universal connection h, which allows the upper bank of needles to rock and at the same time will shift it laterally when desired. The upper arm of the said lever H is connected to a forwardly-extended arm i of a suitable vertical rocking shaft I by means of a link h'. The rocking shaft I is provided with a rearwardly-extended arm i', which engages a suitable worm i^2 on the main drive-shaft B. This rocking shaft I is mounted at its lower end in a suitable supporting-bracket i^3 and at its upper end in a suitable bracket i^4, both of said brackets being secured to the main frame A. It will thus be seen that as the worm i^2 rocks the shaft I it will in turn vibrate the lever H and slide the bank of needles F laterally. This worm is so timed that it will cause the upper bank of needles F to slide laterally only when the needles are in their raised position, so that the upper warp-threads may be moved freely over the ends of the lower needles.

The needle-sword is swung forwardly and backwardly, so as to rock the two banks of needles at the proper time to form certain figures in the weave, in the following manner: The tappets are denoted by J J', and they are provided with suitable antifriction-rollers j j', which are in turn engaged at certain times by suitable cams j^2 j^3, which cams are secured to rotate with the main drive-shaft B. The tappets J J' are held against the cams j^2 j^3 by means of suitable tension-springs j^4 j^5. The cam j^2 is so formed that it will cause the tappet J to rock forward and back twice during one revolution of the main shaft B, unless it be locked to the tappet J' by the locking device j^6, hereinafter to be described, or locked in its backward position by the latch K', hereinafter to be described.

The cam j^3 is so formed that it will rock the

tappet J′ forward and backward only once during a single revolution of the main drive-shaft B.

The needle-sword is connected with the tappet J by means of a suitable hooked connecting-rod E^2, which is fastened to the brace-rod e^3 at one end and at its other end is provided with a recess which engages a suitable pin j^7 in the top of the tappet J.

K K′ K^2 represent three latches which carry suitable antifriction-rollers k k' k^2, which are adapted to be engaged by the pattern-chains L L′ L^2, respectively. As the latch K^2 is raised and lowered by its connection with the links in the pattern-chain L^2 it causes the hooked connecting-rod E^2 to be released from and engaged with the tappet J by means of a suitable link k^3, which connects the end of the latch K^2 with the end of the hooked rod E^2. This releasing of the rod E^2 from engagement with the tappet J is for the purpose of allowing the needle-sword to hang idly while a certain pattern is being woven, the swinging of the tappets J and J′ having no effect upon the said rod E^2.

The latch K′ is adapted to engage a suitable hook j^8 upon the tappet J when the latch is in its lowered position and the tappet is swung back by the cam j^2, so that when the cam j^2 further revolves the tappet J is held at the limit of its rearward movement by said latch K′. This latch K′ is raised and the tappet J thereby released by certain of the links in the pattern-chain L′, as will hereinafter more fully appear.

The tappet J′ is provided with a suitable recess j^9, extending transversely across its face adjacent to the tappet J, and a projection j^{10} extends into the said recess from the upper wall of the recess, so as to engage the locking device j^6, carried by the tappet J, when the said locking device is in its raised position and the tappets J J′ in alinement, thereby causing the two tappets J J′ to swing simultaneously. This locking device j^6 is raised and lowered by the raising and lowering of the latch K, which is connected to the locking device j^6 by a suitable rod k^4. This latch K is raised and lowered by engagement with different heights of links on the pattern-chain L.

The pattern-chains L, L′, and L^2 consist of links of varying heights, and they are caused to be advanced one after the other over suitable chain-wheels l l' l^2 into engagement with the rollers k k' k^2 on the latches K K′ K^2. These chain-wheels are secured to rotate together upon a suitable shaft L^3, which shaft is mounted in suitable bearings l^3 l^4, which are secured to the frame A. The bracket l^3 is preferably extended upwardly to form a support for the hinged ends of the latches K K′ K^2, as shown clearly in Fig. 2.

The chain-wheels are rotated by means of a suitable spur-wheel L^4, which is secured to the shaft L^3 and engages a suitable worm L^5 on the main drive-shaft B.

When it is desired to weave a pattern of more intricate design than that capable of being woven by the two banks of needles heretofore described, I provide a third bank of needles F^2, which is secured to rock with the needle-bar F and is located just beneath the upper bank of needles. This form is shown in Figs. 9 to 12, inclusive. This third bank of needles F^2 is caused to have a lateral sliding movement independent of the sliding movement of the upper bank of needles in the following manner: Just within the arm E′ of the needle-sword and on the upper needle-bar F, I secure a suitable sliding sleeve F^3, which is provided with a groove f^4, which is adapted to engage the lower end of a vibrating lever M, which lever M is pivoted to the arm E′ at its upper end and is caused to vibrate laterally by means of a suitable connection m between it and the lever H, which slides the upper bank of needles longitudinally on the needle-bar.

Certain of the warp-threads are passed through the ends of the needles in the bank F^2, and as the upper bank F is slid back and forth the bank F^2 will be caused to be slid back and forth in the opposite direction, thereby twisting the warp-threads and forming a more fanciful design than when the two banks of needles only are used.

It is to be understood that the weft-threads may be inserted and beaten up in any well-known or approved manner.

In operation as the drive-shaft B is rotated it will cause the pattern-chains to be advanced and thereby raise and lower certain of the latches K K′ K^2. At the same time the cams j^2 j^3 will engage the tappets J J′ and swing them forward and backward. When the latch K^2 is in its lowered position and the latch K′ held raised, the tappet J will swing back and forth and thereby swing the needle-sword back and forth, causing the banks of needles to be rocked up and down twice during one revolution of the shaft B. This will cause the loom to weave what is known as the "gauze weave." (See Fig. 14.)

If the latch K should be held raised by means of its engagement with the chain L, the locking device j^6 will engage the tappet J′, and so will cause the two tappets to swing simultaneously. This arrangement will cause the needle-sword to swing back and forth only once during a single revolution of the drive-shaft B and will cause the loom to weave what is known as the "plain weave," since the transverse movement of the upper bank of needles will have no effect upon the weft so long as the needles themselves are not swung toward and away from each other, which only occurs once during a revolution of the drive-shaft. When the third bank of needles is used, it will cause the gauze weave to develop into a more complex figure, which might be called the "diamond weave," which is substantially a double-gauze weave. (See Fig. 15.) It will thus be seen that by arranging

the several pattern-chains with higher and lower links they will be caused to control the figure of the weave by means of their engagement with the latches K K′ K², which latches in turn control the swinging movements of the tappets J J′. The rotary movement of the shaft B furthermore rotates the take-up rollers and thereby advances the fabric as it is woven. It will be seen that the tension device will as the warp-threads are being advanced to the needles regulate the tension upon them at that point where the fabric is being gathered, the said tension device allowing the threads to be fed at different speeds. It is obvious that slight changes might be resorted to in the construction and arrangement of the several parts without departing from the spirit and scope of my invention. Hence I do not wish to limit myself strictly to the structure herein set forth, but

What I claim is—

1. In combination, a take-up roll, independent supply-rolls, means for manipulating the sheds of warp and a tension device for the reception of the warp from the different supply-rolls, the said tension device comprising a rocking plate and tension-pins extending from said rocking plate, one of said pins being adjustable to vary the tension of the warp-threads, substantially as set forth.

2. A tension device for looms, comprising a rocking plate, a spring for actuating the plate, tension-pins on the plate, and a reed for separating the warp-threads, one of the said tension-pins being adjustable to vary the tension of the warp-threads, substantially as set forth.

3. In combination, means for feeding sheds of warp, a take-up mechanism, a lower bank of needles for controlling a shed of warp, an upper bank of needles for controlling a shed of warp, and an auxiliary bank of needles for controlling an auxiliary shed of warp and means for rocking the different banks of needles, substantially as set forth.

4. In combination, means for feeding sheds of warp, a take-up mechanism, a lower bank of needles for controlling a shed of warp, an upper bank of needles for controlling a shed of warp, an auxiliary bank of needles for controlling an auxiliary shed of warp, means for moving the auxiliary bank of needles laterally with respect to one of the other banks and means for rocking the said banks, substantially as set forth.

5. In combination, means for feeding sheds of warp, a take-up mechanism, a lower bank of needles for controlling a shed of warp, an upper bank of needles for controlling a shed of warp, and an auxiliary bank of needles for controlling an auxiliary shed of warp, means for moving the upper bank of needles and the auxiliary bank of needles transversely simultaneously in opposite directions and means for rocking the said banks, substantially as set forth.

6. In combination, banks of needles having a rocking movement toward and away from each other, gear connecting the banks of needles, a swinging support for the needles, swinging tappets, means for interlocking the tappets at predetermined intervals, one of said tappets being connected with the swinging support, a drive-shaft carrying cams adapted to engage the tappets to swing them, and pattern-chains for further controlling the movement of the tappets, substantially as set forth.

7. In combination, banks of needles having a rocking movement toward and away from each other, gear connecting the banks of needles, a swinging support for the needles, swinging tappets, one of said tappets being connected with the swinging support, a drive-shaft carrying cams adapted to engage the tappets to swing the needle-support and thereby rock the banks of needles and means for interlocking the tappets at predetermined intervals, comprising latches for locking and releasing the tappets, and pattern-chains engaging the latches, substantially as set forth.

8. In combination, banks of needles geared together so as to have a rocking movement toward and away from each other, a swinging support for the banks of needles, a drive-shaft having cams thereon, swinging tappets engaged by the said cams, a hooked connecting-bar between the swinging support and one of the tappets, pattern-chains for controlling the movement of the tappets, and an auxiliary pattern-chain for releasing the hooked connecting-bar from engagement with the tappet at intervals, substantially as set forth.

9. In combination, a frame, a needle-support hinged thereon, means for swinging the needle-support, banks of needles provided with gear-wheels which intermesh, a connection between one of the gear-wheels and the frame, whereby as the needle-support is swung, the banks of needles are caused to rock toward and away from each other, substantially as set forth.

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Witnesses:
FREDK. HAYNES,
IRENE B. DECKER.