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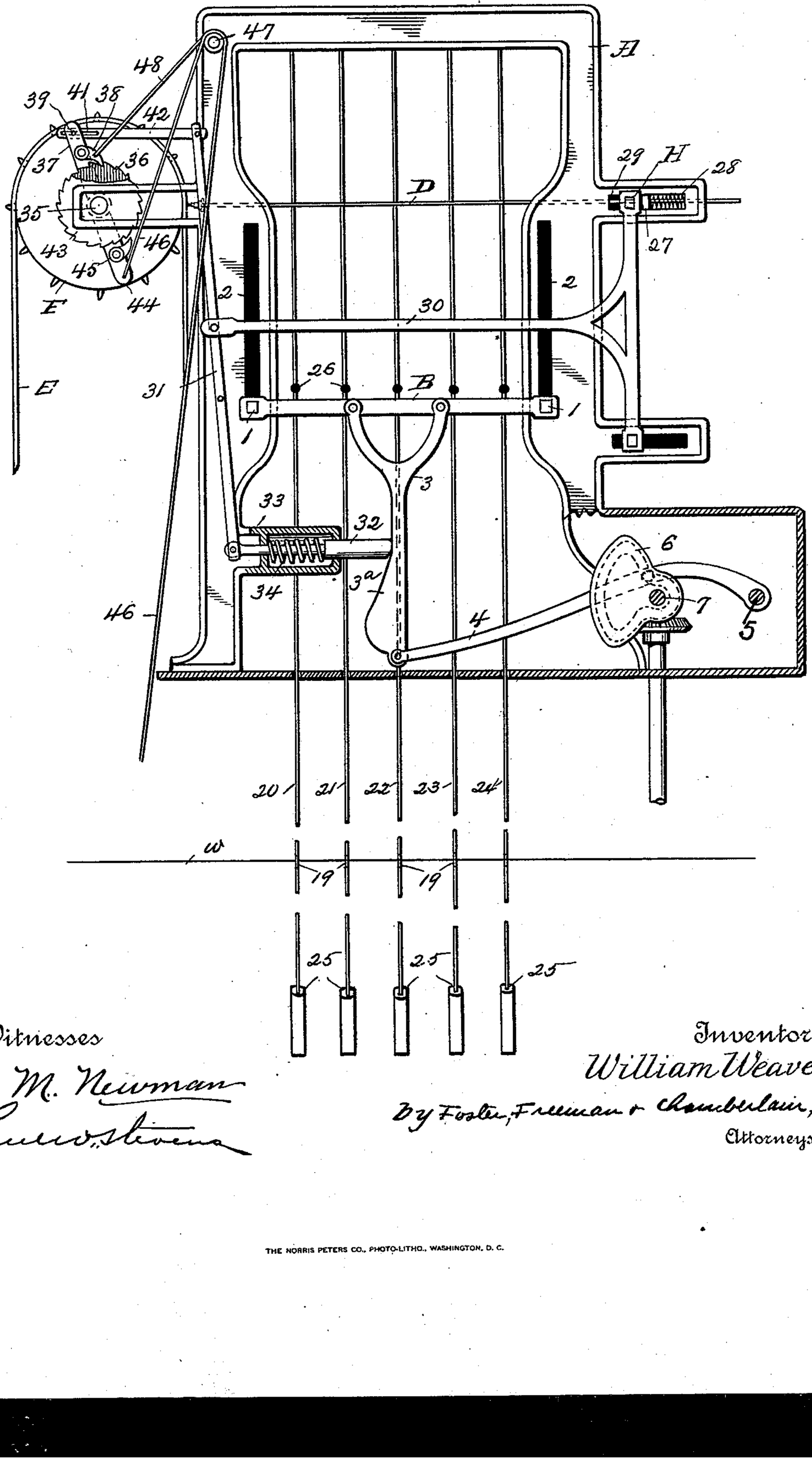
W. WEAVER.

JACQUARD MECHANISM FOR LOOMS.

No. 541,644. Patented June 25, 1895.



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(No Model.) 5 Sheets—Sheet 2.

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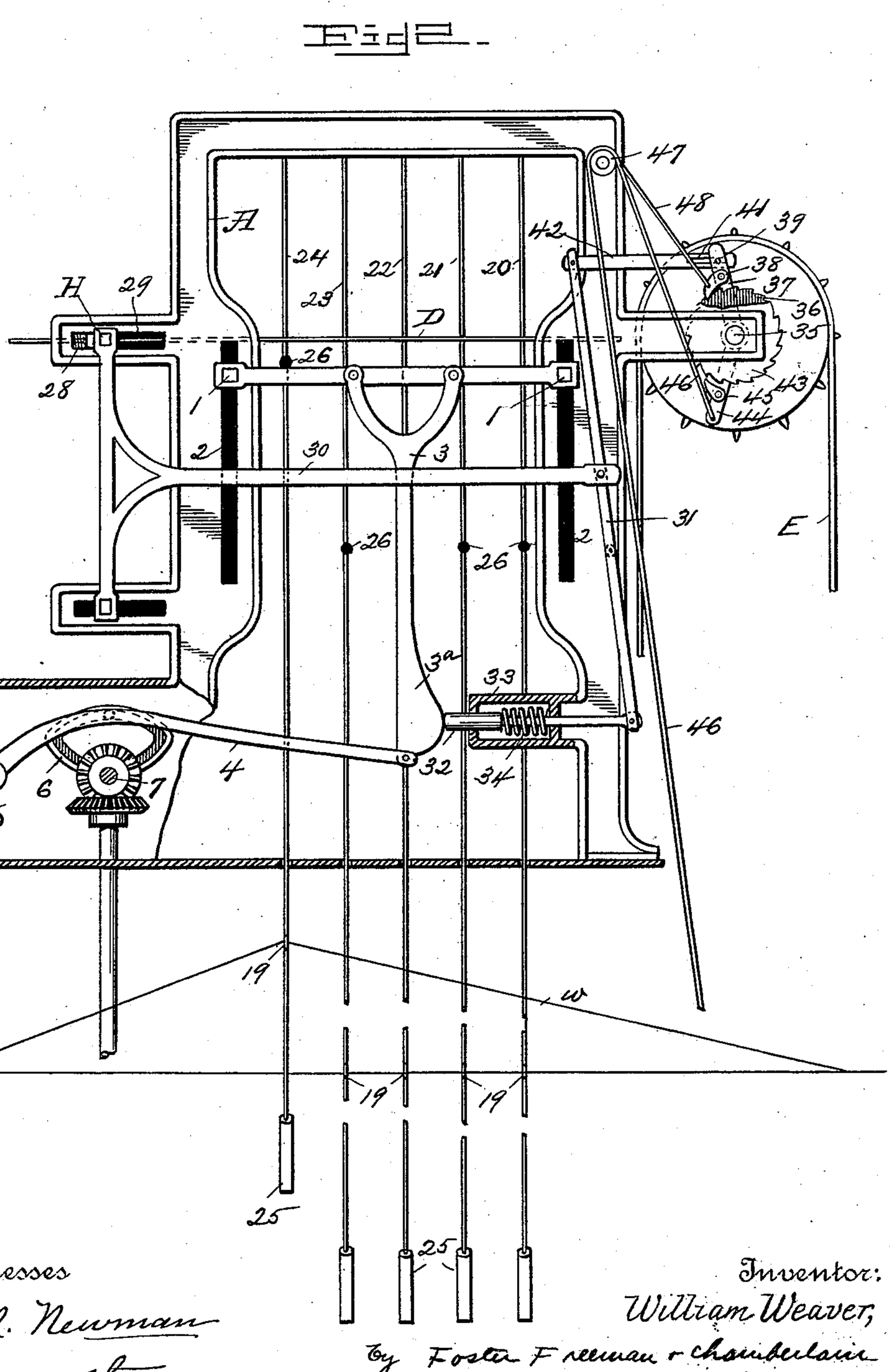

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(No Model.) 5 Sheets—Sheet 3.

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JACQUARD MECHANISM FOR LOOMS.

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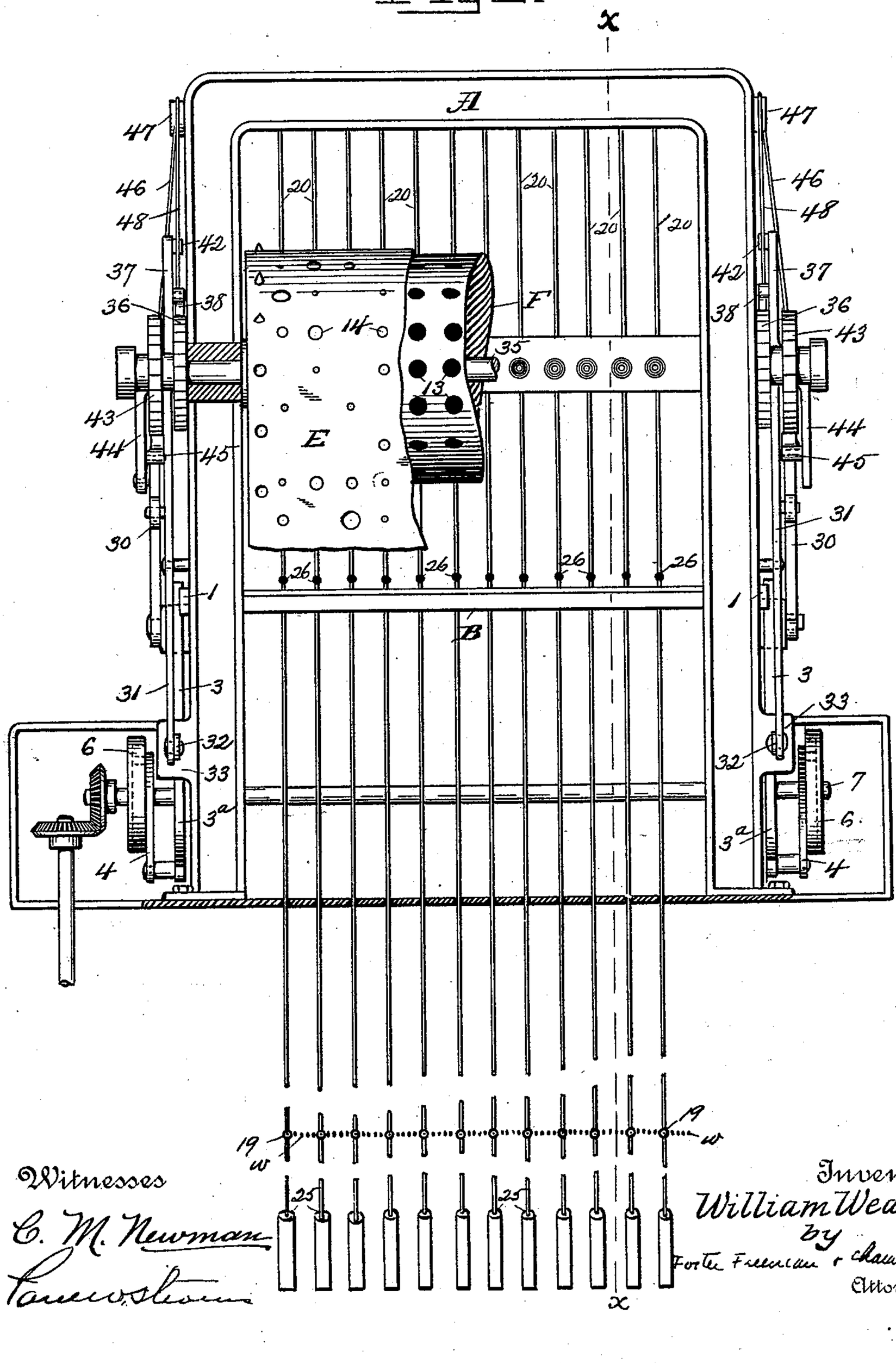
FIG. 3.



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(No Model.) 5 Sheets—Sheet 4.

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JACQUARD MECHANISM FOR LOOMS.

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FIG. 1.

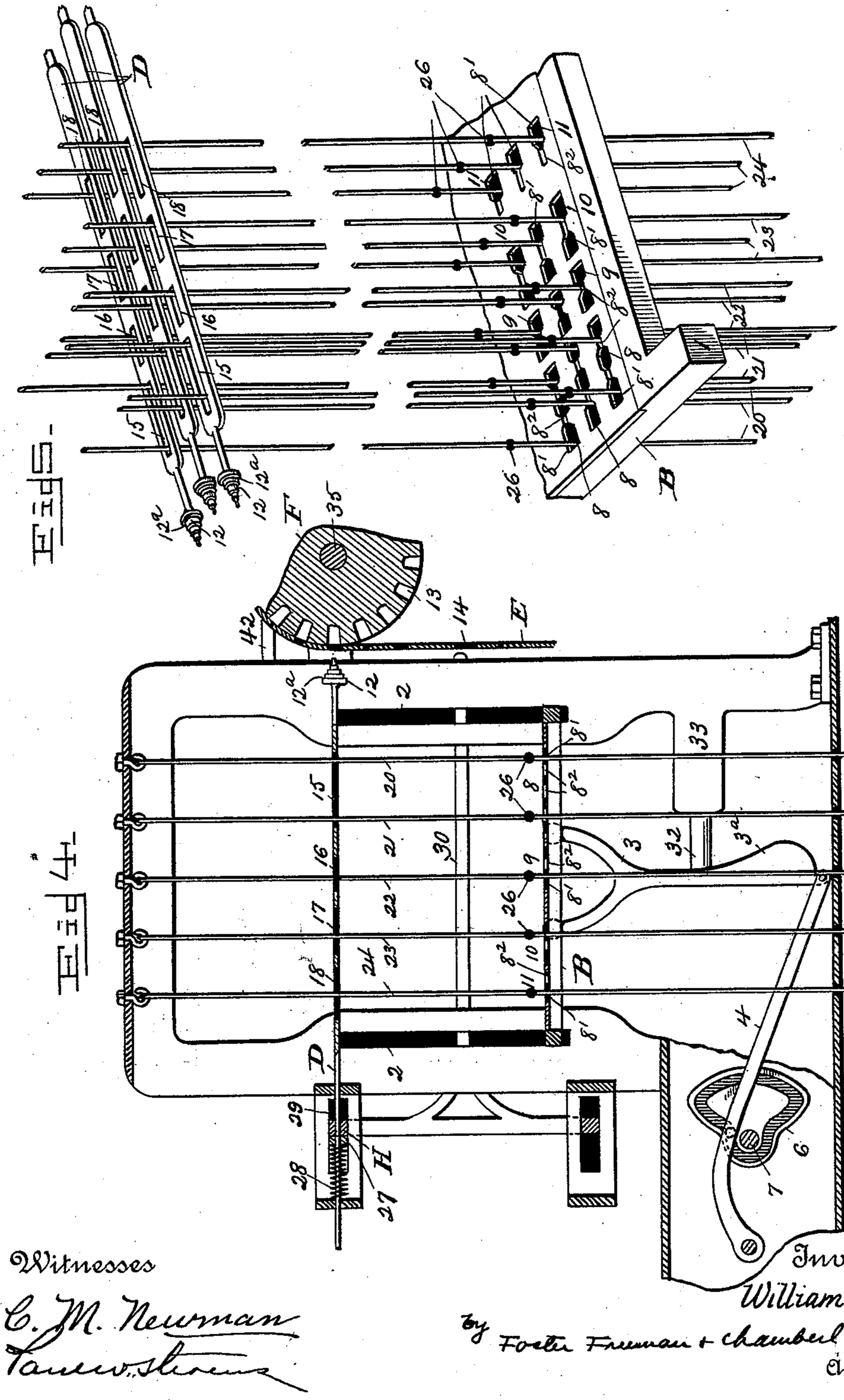

FIG. 4.

Witnesses

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(No Model.) 5 Sheets—Sheet 5.

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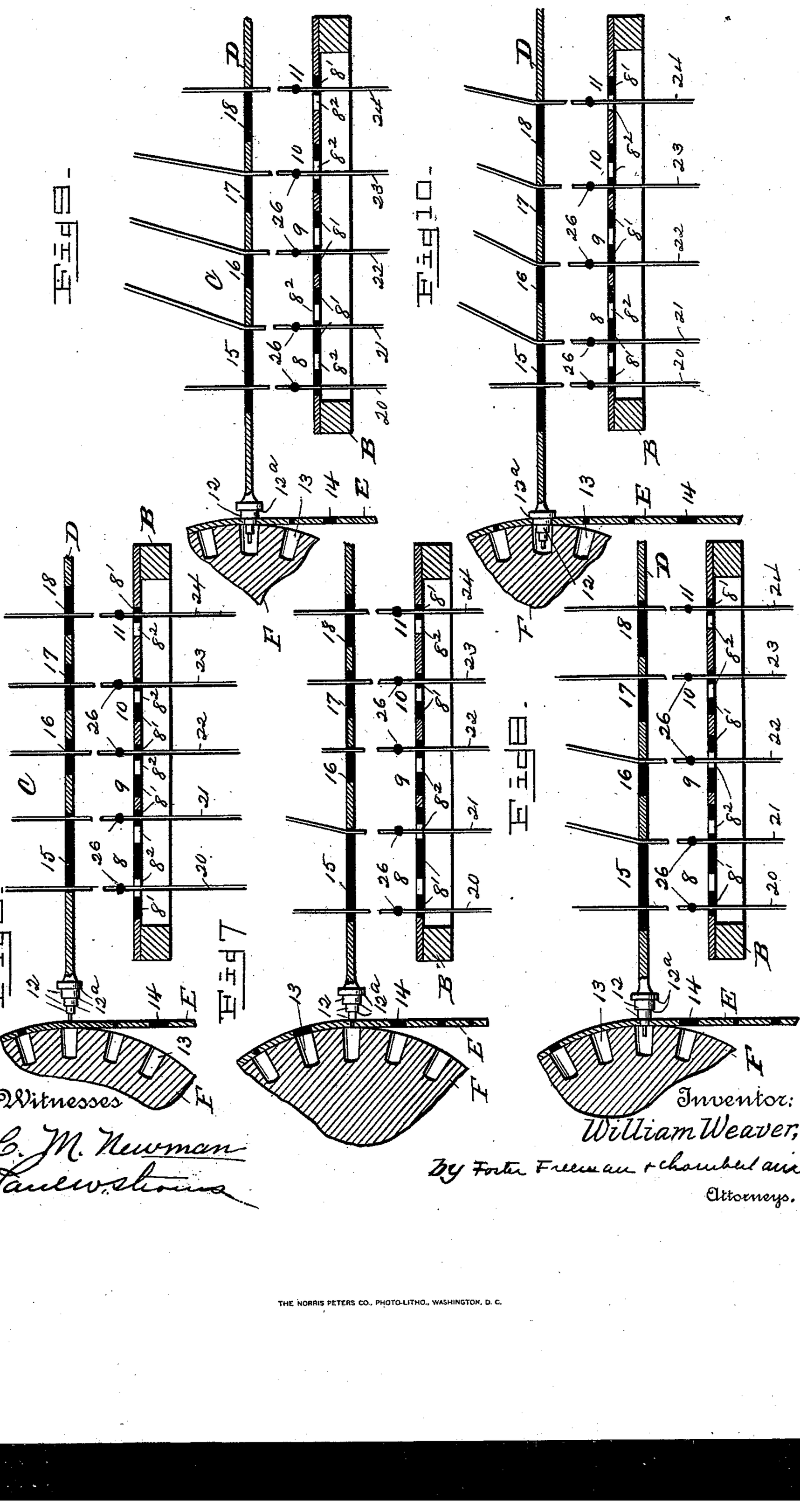

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UNITED STATES PATENT OFFICE.

WILLIAM WEAVER, OF NORWALK, CONNECTICUT, ASSIGNOR TO THE WEAVER JACQUARD AND ELECTRIC SHUTTLE COMPANY, OF SAME PLACE.

JACQUARD MECHANISM FOR LOOMS.

SPECIFICATION forming part of Letters Patent No. 541,644, dated June 25, 1895.

Application filed July 19, 1894. Serial No. 518,047. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM WEAVER, a citizen of the United States, residing at Norwalk, county of Fairfield, and State of Connecticut, have invented certain new and useful Improvements in Jacquard Mechanism for Looms; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to an improvement in Jacquard mechanism for looms.

It has for its object to provide a machine of the character described, which shall be entirely automatic in its action and which may be adapted to any loom of ordinary construction.

With these objects in view my invention resides in the general construction and arrangement of the parts shown and claimed whereby the purposes of the invention are attained.

In the accompanying drawings, forming a part of this specification, and in which like letters and figures of reference indicate corresponding parts, Figure 1 is a side elevation of my invention, the parts being in their initial positions. Fig. 2 is a reverse side elevation showing the position of the parts when the lifting-board is elevated. Fig. 3 is a front elevation of the invention. Fig. 4 is a vertical sectional view of the same on the lines *x x* of Fig. 3, the lifting-board occupying its normal position and the needles being withdrawn from engagement with the pattern-cylinder. Fig. 5 is a detail perspective view showing the relative positions of the warp-supporting or tail cords in the shifting needles and in the slots of the lifting-board when the needles are shifted as shown. Figs. 6, 7, 8, 9, and 10 are vertical sectional views, parts being broken away, of the pattern-cylinder and its belt, the shifting needles, the lifting-board, and the warp-supporting or tail cords, illustrating the different positions assumed by the latter in the slots of the lifting-board and needles.

In the accompanying drawings, A represents the frame of the machine, adapted to be secured upon or adjacent to any ordinary loom. (Not shown.)

B is a vertically reciprocating lifting board guided in its movement by means of projections 1 which engage vertical slots 2 in each side of the frame A. Connected to the lifting board, on opposite sides thereof, are Y-shaped arms 3, which project vertically downward therefrom and are pivotally connected to the ends of lever-arms 4, which are in turn pivoted at 5 to the frame A. The lower end of the Y-shaped arms 3 are provided with cam faces 3^a, the purpose of which will presently appear. A reciprocating movement is imparted to the lever-arms 4 and from them to the Y-shaped arms 3 and lifting board B, by means of cams 6 secured at each side of the machine upon a transverse shaft 7. The cams 6 are designed to elevate the lifting board B and maintain it in its elevated position for a brief space of time, before returning it to its normally lowered position.

As more particularly pointed out hereinafter, the warp-supporting devices are arranged in series, each series comprising as many warp-supporting devices as there are colors in the warp, and the lifting-board is provided with means for operating the warp-supporting devices so constructed and arranged that any one warp-supporting device of each series of warp-supporting devices may be engaged by the lifting-board at each operation thereof, the particular warp-supporting device of a series to be engaged at any particular operation of the board being determined by the shifting needles and pattern devices. Thus, as shown in the drawings, the lifting-board is provided with series of slots corresponding to the number of spaces in the reed of the loom. (Not shown.) The slots have enlargements through which the warp-supporting devices may pass without being engaged by the lifting-board and narrower portions which engage the warp-supporting devices, and the enlargements extend on each side of the narrower portions, so that the warp-supporting devices may pass from the narrower portions to the enlargements on either side of the narrower portions.

In the present instance, the lifting-board is shown as provided with series of slots adapted to operate with five warp-supporting cords, the slots being independent of each other and of different relative lengths. Thus, the slots may be said to be of varying widths

and lengths. In this particular instance the slot 11, is shown as having an enlargement at one side only of the narrower portion, as with this particular number of threads and the peculiar arrangement of the shifting needles, it is not necessary to provide means for moving the warp-supporting cord 24, to both sides of the narrower portion to carry out the principles of my invention. The slots 8, 9 and 10, of each series are formed with enlargements 8′, which are connected by narrower portions 8^2, which merge into said enlarged portions to form a continuous and unobstructed passage between them.

Arranged above and parallel to the lifting-board B are a series of slotted shifting needles D, the slots or bearings in which vary in length. One of these shifting needles is provided for each series of slots C. These needles are guided and supported near their front and rear ends in the frame A and are adapted to be moved independently into engagement with a perforated pattern-belt E passing around a pattern cylinder F. This cylinder is supported upon a shaft 35 which is journaled in the frame A.

The front end of each shifting needle D is provided with a series of steps 12, each step being of equal length. The diameters of the steps 12 increase toward the rear end of the needles, thus forming vertical shoulders 12^a between each pair of steps.

The pattern cylinder F is provided in its face with recesses 13, said recesses being of the same depth and diameter and being equally spaced from each other. The pattern belt E passes over the pattern cylinder and is provided with a series of perforations 14, each of which registers with a recess 13 of the pattern cylinder F. These perforations are formed in the pattern belt in accordance with the pattern to be woven, and are of different diameters.

The shifting needles D are adapted to engage the perforations 14 of the pattern belt E and recesses 13 of the pattern cylinder, respectively, the extent of the engagement being determined by the size of the perforation in the pattern belt E, it being apparent that when a perforation of the smallest diameter is in alignment with the needle D the point of the needle will be allowed to pass through the perforation until the first shoulder 12^a comes in contact with the face of the pattern belt. In event, however, of a perforation 14 of the second largest diameter being in front of one of the needles D the point of the needle will be permitted to enter the perforation until the second shoulder 12^a on said needle comes in contact with the face of the pattern belt, and so on, the size of the perforations in the pattern belt E presented in front of the needles D determining the extent of the forward movement of said needles, and the extent of the forward movement of the needles determines the color or character of the warp threads to be raised, as will appear farther on. A step by step rotary motion is imparted to the pattern cylinder to bring the perforations in the pattern belt successively in alignment with the points of the shifting needles D by mechanism described farther on.

As stated above, the shifting needles D are each provided with a series of slots 15, 16, 17 and 18 which vary in length and normally coincide with the slots 8, 9, 10 and 11 respectively, in the lifting board B. (See Fig. 5.)

By constructing the shifting needles as above described the warp-supporting cords are subjected to very little friction for the reason that the larger portion of them remain stationary while others are being shifted by the needles.

I have illustrated my machine as being adapted for weaving a fabric of five colors, although it will be understood that this number may be lessened or increased by slightly modifying some of the parts. In weaving a fabric of five colors the warps *w* are separated into series, each of which contains one thread of each color used, and each series is passed through one space in the reed. (Not shown.) The warp threads *w* are supported in eyes 19 of the vertical warp supporting or tail cords 20, 21, 22, 23 and 24 (see Figs. 1, 2 and 3,) one of said cords being provided for each warp thread of a different color. The warp threads are designed to be raised to open the shed and permit the passage of a thread-carrier or pile wire therethrough, by the action of the lifting-board B upon the warp-supporting or tail cords 20, 21, 22, 23 and 24, in the manner described farther on. The warp-supporting or tail cords are secured to the top of the machine in any suitable manner and extend vertically downward. Upon the lower ends of each of these cords 20, 21, 22, 23 and 24 lingoes 25 are secured, as is usual.

The warp-supporting or tail cords are each provided with knots 26, which are located thereon at a point just above the lifting-board B, when in its normally lowered position. The knots 26 are sufficiently small to permit of their easy passage through the enlargements 8′ of the slots 8, 9, 10 and 11, but are too large to pass through the narrower portions 8^2 of said slots. The cords 20, 21, 22, 23 and 24 are designed to be shifted in the slots 8, 9, 10 and 11 through which they pass, by the action of the reciprocating shifting needles D thereon, and it will be apparent that whenever one of said cords is shifted into one of the narrow portions 8^2 of the slots 8, 9, 10 and 11 it will be raised at the next elevation of the lifting board B, by reason of the failure of the knots 26 therein to pass through the lifting board. It will be noted, however, that the construction of the shifting needles D is such that only one of each series of warp-supporting or tail cords 20, 21, 22, 23 and 24 can be shifted at the same time into a narrow portion 8^2 of the slots 8, 9, 10 and 11, the remaining four cords passing through the enlarged portions 8′ of the slots 8, 9, 10 and 11

in order to permit their knots 26 to pass through the lifting-board at its next elevation. From this it will be seen that only one of the warp-supporting or tail cords and its corresponding warp thread can be elevated at a time, but different cords of each duplicate series of said warp-supporting cords may be elevated simultaneously.

The warp-supporting or tail cords 20 and 21 pass through the slots or bearings 15 in the needles D at opposite ends thereof, and through the slot 8 in the lifting-board B. The warp-supporting cords 22 pass through the slots or bearings 16 in the needles D and through slot 9 in the lifting board, respectively. The warp-supporting cords 23 pass through the slot or bearings 17 in the needles D and thence through the slot 10 in the lifting-board B; and the warp-supporting cords 24 pass through the slots or bearings 18 in the needles D and through the slots 11 of the lifting-board B, respectively. The relative arrangement of the warp-supporting or tail cords 20, 21, 22, 23 and 24, the needles D, and the lifting-board B is best illustrated in Figs. 5, 6, 7, 8, 9 and 10 of the drawings.

As has already been stated, the positions of the warp-supporting or tail cords 20, 21, 22, 23 and 24 in the slots 8, 9, 10 and 11 of the lifting-board B just previous to the elevation of said lifting-board, determines which one of each duplicate series of said cords is to be raised at the next elevation of the lifting-board, and as has also been previously stated, the warp-supporting cords are shifted in the slots 8, 9, 10 and 11 by the action thereon of the shifting needles D through the slots of which they pass. These needles D are horizontally and independently reciprocated into engagement with their pattern belt E at each return of the lifting-board B to its normal position, and are withdrawn simultaneously from engagement with said pattern belt E to permit it to be rotated one step, just subsequent to the starting of the lifting-board on its upward movement. A description of the mechanism for accomplishing this will presently appear.

When the points of the shifting needles D engage the outer face of the pattern-belt E, as shown in Fig. 6, they occupy their initial position, and when in this position the warp-supporting cords 20 are moved into a narrow portion 8^2 of the slots 8 of the lifting-board B, in order that when the lifting-board is next elevated said cord and the warp thread, which it supports, will be moved correspondingly. When a perforation 13 of the smallest diameter is moved into alignment with the points of the shifting needles D, said needles will pass into said perforation until the first shoulders 12^a thereon, come in contact with the outer face of the pattern belt, as shown in Fig. 7, whereupon the cords 21 will be shifted into the narrow portions 8^2 of the slots 8 of the lifting-board to the end that their knots 26 will be engaged by the lifting-board at its next elevation, to raise said cords.

In Fig. 8 of the drawings, one of the shifting needles is shown engaging a perforation 13 of the pattern belt E, of the second greatest diameter, thus permitting said needle to pass into said perforation until its second shoulder 12^a comes in contact with the outer face of the pattern belt. When the needles thus engage the pattern-belt E the warp-supporting or tail cords 22 are moved into the narrow portions 8^2 of the slots 9, in order that they may be engaged by and raised at the next elevation of the lifting-board B. The point of one of these needles D is illustrated in Fig. 9 as engaging a perforation 13 of the pattern-belt E of the third greatest diameter, which allows said needle to pass through said perforation until the third shoulder 12^a thereon comes in contact with the outer face of the pattern belt E and stops its further forward movement. When the needles D occupy this position the cords 23 are shifted into the narrow portions 8^2 of the slots 10, to cause them to be lifted at the next upward movement of the lifting-board B.

In Fig. 10 of the drawings one of the shifting needles D is illustrated as engaging a perforation 13, of the pattern belt E, of the greatest diameter, permitting said needle to pass through said perforation a distance corresponding to the length of its full forward movement. When the needles D thus engage the pattern-belt E the warp-supporting or tail cords 24 are carried into the narrow portion 8^2 of the slots 11, in order that the knots 26 on said cords will be engaged by the lifting board at its next upward movement and the warp-supporting or tail cords themselves moved correspondingly.

Various means for imparting a step by step rotary motion to the pattern-belt E and its cylinder F, and for withdrawing the shifting needles D simultaneously from engagement therewith just previous to each movement of the pattern-belt and cylinder, will suggest themselves to skilled mechanics, but I will now describe those which in practice I have found to be the most effective.

The shifting needles D near their rear ends pass through a cross-head H, and are each provided with a collar 27, secured thereon between the cross-head H and the rear of the frame A. Each needle is encircled by a spring 28, which is interposed between the collar 27 and the frame A, and tends to throw said needles into engagement with the pattern-belt E.

The cross-head H is guided in slots 29 in opposite sides of the frame A, and is secured to horizontal frames 30 arranged on each side of the machine and extending parallel therewith to the front thereof. The front ends of the horizontal frames 30 are pivoted to levers 31, which are arranged on opposite sides of the frame A and are pivoted thereto at a point below that of their connection with the frames 30. These levers 31 extend downward parallel to the sides of the frame A and have their

lower ends pivoted to the ends of transverse rods 32, the forward ends of which engage the cam-faces 3^a of the Y-shaped arms 3. The rods 32 are guided in boxes 33 located at opposite sides of the frame A and are encircled by springs 34 which tend to keep them in contact with the cam faces 3^a, of the arms 3.

From the above it will be seen that whenever the Y-shaped arms 3 are elevated the rods 32 will be moved forward and the upper ends of the levers 31 rearwardly. The rearward movement of the levers 31 will move the horizontal frames 30 and their attached cross-head H correspondingly, which movement of the cross-head will cause it to engage the collars 27 on the needles D, and thus move said needles backward against the action of their springs 28, causing them to be withdrawn simultaneously from engagement with the pattern belt E.

Secured upon the shaft 35 of the pattern cylinder F near the opposite ends thereof are ratchet wheels 36, and short levers 37, are journaled upon said shaft adjacent to the ratchet wheels, and each lever carrying a pawl 38 which engages the adjacent ratchet wheel 36. The ends of the levers 37 are provided with pins 39 which engage slots 41 in the ends of horizontal links 42. These links are connected at their ends to the extreme upper ends of the levers 31, in order that when these levers are moved rearwardly the levers 37 will be moved correspondingly and their pawls 38 caused to rotate the ratchet wheels 36, and the pattern cylinder F one step, to bring a new line of perforations 13 of the pattern belt E into alignment with the needles D.

As it may sometimes be desirable to turn the pattern cylinder F and its belt E backward to cause a certain portion of the pattern to be rewoven, I have provided mechanism for accomplishing this. This mechanism consists of ratchet wheels 43 journaled upon the ends of the shaft 35, and which are designed to be rotated in an opposite direction to the ratchet wheels 36. Lever arms 44 are journaled upon the shaft 35 adjacent to the ratchet wheels 43 and hang diametrically opposite to the levers 37. These levers are each provided with a pawl 45 which normally hangs out of engagement with the ratchet wheels 43, and which are designed to be drawn up into engagement with said ratchet wheels by means of cords 46, which pass over pulleys 47 and extend downward at the sides of the frame A to a point within easy reach of the operator. At the same time the pawls 45 are thrown into engagement with their ratchet wheels 43 to move them, and the pawls 38 are lifted from their ratchet wheels 36 by means of a branch 48 of the cord 46, to allow the pattern cylinder to be turned backward. (See Figs. 1, 2 and 3.)

The operation of the machine as described above is as follows: Assuming the lifting-board B to be in its normally lowered position and the needles D into engagement with the pattern-belt E (as shown in Fig. 1) the lifting-board B will be elevated, causing one of each series of cords 20, 21, 22, 23 and 24 to be lifted. When these cords are lifted the warp threads *w*, which pass through the eyes 19 thereof, will be drawn upward (as shown in Fig. 2) thereby opening the shed to permit a thread-carrier or pile wire to be passed therethrough. Simultaneously with the elevation of the lifting-board B the needles D will be withdrawn from engagement with the pattern belt E and the pattern cylinder F and belt E will be rotated one step to bring a new series of perforations into alignment with the points of the needles D.

The advantages of the several parts of my improvements will be appreciated by those skilled in the art to which it appertains; and within the scope of my invention, modifications may be made in the form, construction and position of the parts and some features of my invention used without others, as for instance, ordinary shifting needles, having eyes at equal distances apart could be used in connection with the improved lifting-board, accomplishing some of the advantages of my invention, but as in that case all the warp-supporting cords of the series would have to be moved at each movement of the needles, the full advantages of the invention would not be attained, since

What I claim is—

1. In Jacquard mechanism for looms, the combination with suitable lifting mechanism, of shifting needles, warp-supporting devices arranged in series each series being under the the control of a single shifting needle, and pattern devices controlling the movements of the shifting needles, the shifting needles being adapted to move different distances to bring any one warp-supporting device of each series of warp-supporting devices into position for engagement with the lifting mechanism, substantially as described.

2. In Jacquard mechanism for looms, the combination of the lifting-mechanism provided with slots of varying widths and lengths, suitable warp-supporting devices, the shifting-needles provided with bearings of different lengths, arranged to shift the warp-supporting devices into engagement with the lifting-mechanism, and the needle-engaging devices for regulating the forward movement of the shifting-needles, substantially as described.

3. In Jacquard mechanism for looms, the combination of the lifting-board provided with slots of varying widths and lengths, means for operating the lifting-board, warp-supporting devices, the shifting-needles provided with bearings arranged to shift the warp-supporting devices in the slots of the lifting-board and pattern-devices for regulating the movement of the shifting-needles, substantially as described.

4. In Jacquard mechanism for looms, the combination of the lifting-board provided

with slots of varying widths and lengths, means for operating the lifting-board, warp-supporting cords, the shifting-needles provided with bearings of different lengths arranged to shift the warp-supporting-cords in the slots of the lifting-board, and pattern-devices for regulating the movement of the shifting-needles, substantially as described.

5. In Jacquard mechanism for looms, the combination of a lifting-board provided with slots of varying widths and lengths, means for operating said lifting-board, the reciprocating shifting-needles provided with slots of varying lengths, the warp-supporting cords engaging the slots of the shifting-needles and lifting-board, and means for reciprocating the shifting-needles to cause them to shift the warp-supporting cords in the slots of the lifting-board, substantially as described.

6. In Jacquard mechanism for looms, the combination of a lifting-board provided with series of slots of different widths and lengths, means for operating the lifting-board, warp-supporting cords engaging the slots of the lifting-board, and means for shifting the warp-supporting cords in the slots of the lifting-board, substantially as described.

7. In Jacquard mechanism for looms, the combination of the shifting-needles having stepped ends, and each being provided with bearings of varying lengths, warp-supporting devices engaging said bearings, pattern devices for regulating the movement of the shifting-needles, and mechanism adapted to operate the warp-supporting devices as they are brought into engagement therewith, substantially as described.

8. In Jacquard mechanism for looms, the combination of a pattern-device provided with perforations of different sizes, the shifting-needles having stepped ends and each provided with bearings of varying lengths, warp-supporting cords engaging said bearings, and the lifting-mechanism adapted to lift the warp-supporting cords as they are brought into engagement therewith, substantially as described.

9. In Jacquard mechanism for looms, the combination of the lifting-board provided with slots of varying widths and lengths, means for operating the lifting-board, a series of shifting-needles, having bearings of different lengths, warp-supporting cords engaging the bearings of the shifting-needles and lifting-board, pattern-devices, adapted to be engaged by the shifting-needles and means for moving the shifting-needles into and withdrawing them from engagement with the pattern-devices, substantially as described.

10. In Jacquard mechanism for looms, the combination of the lifting-board provided with transverse series of slots, the slots forming a series being of different widths and lengths, means for operating said lifting-board, pattern-devices arranged adjacent to the lifting-board, a series of shifting-needles having bearings of different lengths, the movement of which is regulated by the pattern-devices, and the warp-supporting cords engaging the bearings of the shifting-needles and lifting-board respectively substantially as described.

11. In Jacquard mechanism for looms, the combination of suitable lifting-mechanism, the shifting-needles, the warp-supporting cords arranged in series, each series being under the control of a single shifting-needle, said shifting-needles being provided with bearings of different lengths whereby the warp-supporting cords are brought successively into engagement with the lifting-mechanism, and pattern devices for regulating the movement of the shifting needles, substantially as described.

12. In Jacquard mechanism for looms, the combination of suitable lifting-mechanism provided with slots of different widths and lengths, warp-supporting devices engaging the slots of the lifting-mechanism and means for shifting the warp-supporting devices in the slots of the lifting-mechanism, substantially as described.

13. In Jacquard mechanism for looms, the combination of the lifting-mechanism, provided with slots of varying widths and lengths, the warp-supporting devices, the shifting-needles provided with bearings of different lengths arranged to shift the warp-supporting devices successively into engagement with the lifting-mechanism, and pattern-devices for regulating the movement of the shifting-needles, substantially as described.

14. In Jacquard mechanism for looms, the combination of a pattern-device provided with perforations of different sizes, the shifting-needles having stepped ends, the warp-supporting devices and lifting-mechanism provided with slots of varying widths and lengths, substantially as described.

15. In Jacquard mechanism for looms, the combination of the lifting-mechanism, suitable warp-supporting devices arranged in series, each series being under the control of a single shifting-needle, the shifting-needles provided with bearings of different relative lengths whereby the warp-supporting devices are moved successively into engagement with the lifting-mechanism, and pattern-devices adapted to move the shifting-needles to predetermined points to cause the desired warp-supporting device to be moved into engagement with the lifting mechanism, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WILLIAM WEAVER.

Witnesses:
PAUL W. STEVENS,
ELBERT O. HULL.