No. 785,679. PATENTED MAR. 21, 1905.

C. NOVET.

JACQUARD LOOM.

APPLICATION FILED AUG. 8, 1902.

7 SHEETS—SHEET 1.

Fig. 1.

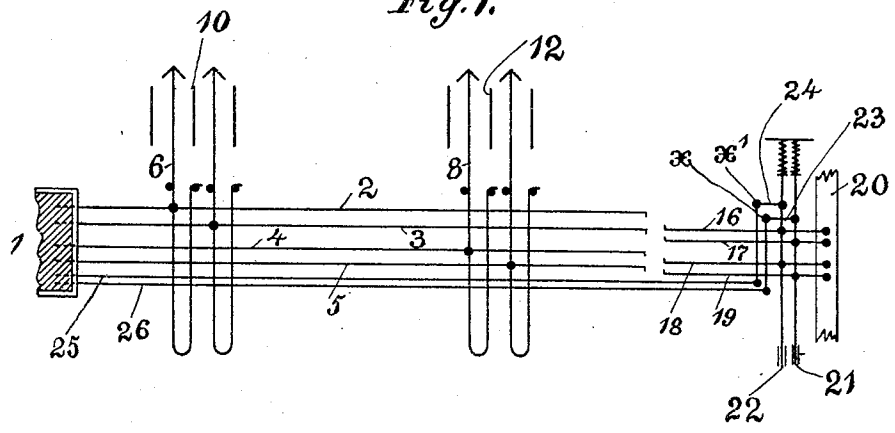
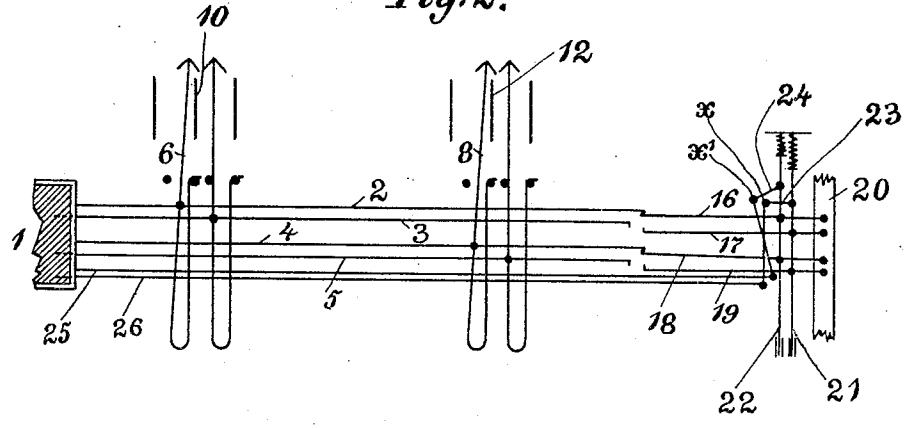


Fig. 2.



Witnesses:

John A. Paulson

F. Modest.

Claude Novet Inventor

by Schreiter & Mathews.

his Att'ys

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7 SHEETS—SHEET 2.

Fig. 3.

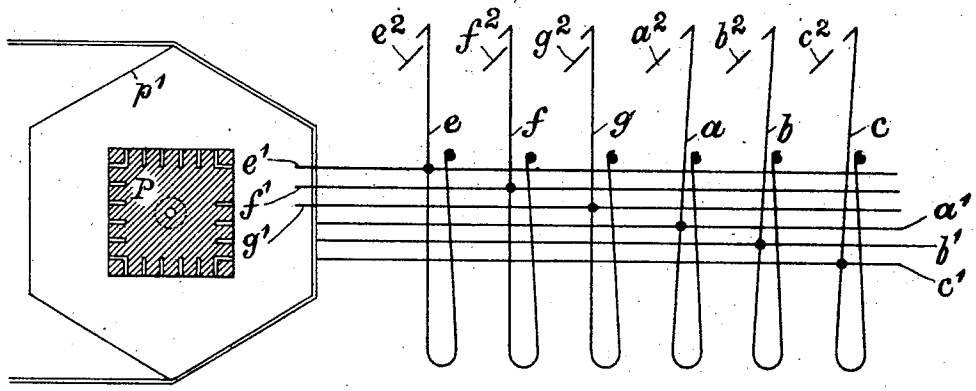
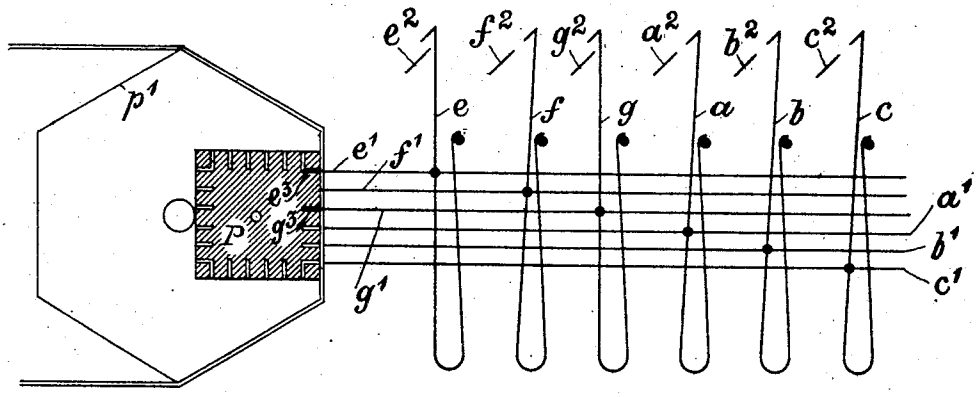


Fig. 4.



Witnesses:
John A. Paulsen
F. Modest.

Claude Novet Inventor

by Schreiter & Mathews,
his Att'ys

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No. 785,679. PATENTED MAR. 21, 1905.

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7 SHEETS—SHEET 3.

Fig. 5.

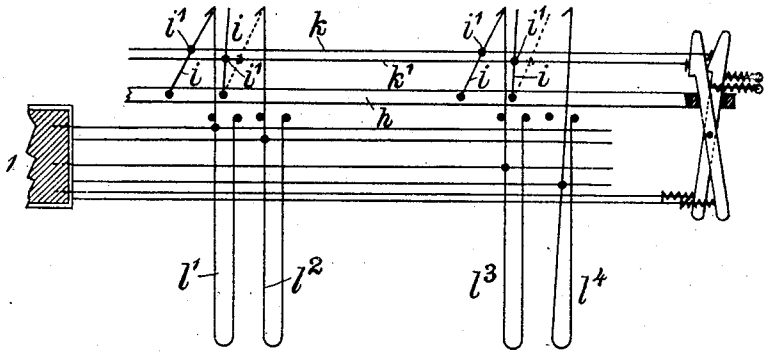


Fig. 6.

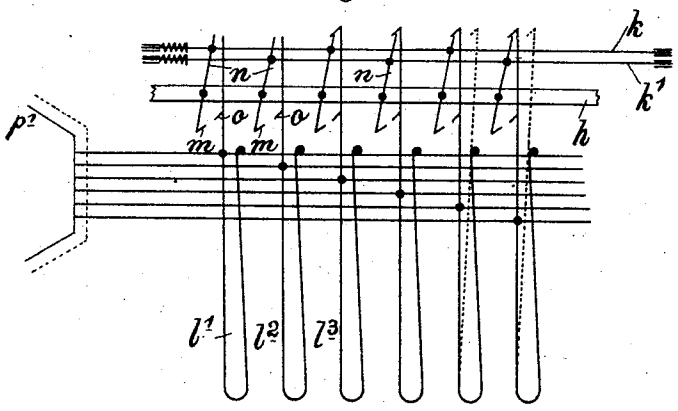
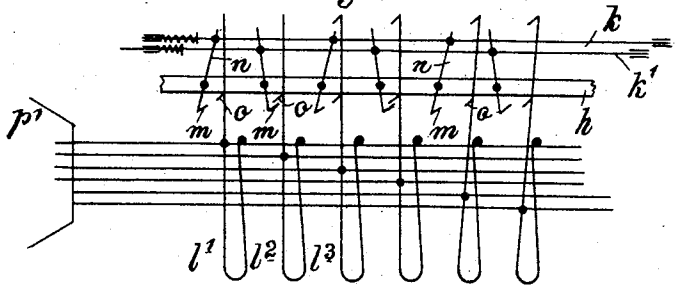


Fig. 7.



Witnesses:

John A. Faulson

F. Modest.

Claude Novet, Inventor

by Schreiter & Mathews,

his Att'ys

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C. NOVET.

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APPLICATION FILED AUG. 8, 1902.

7 SHEETS—SHEET 4.

Fig. 8.

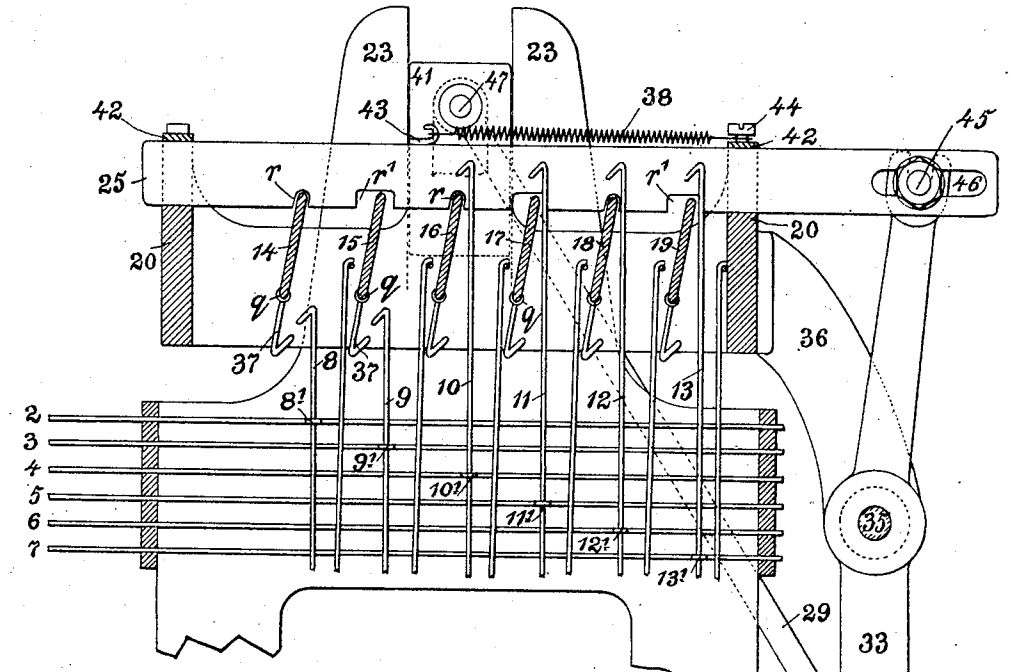
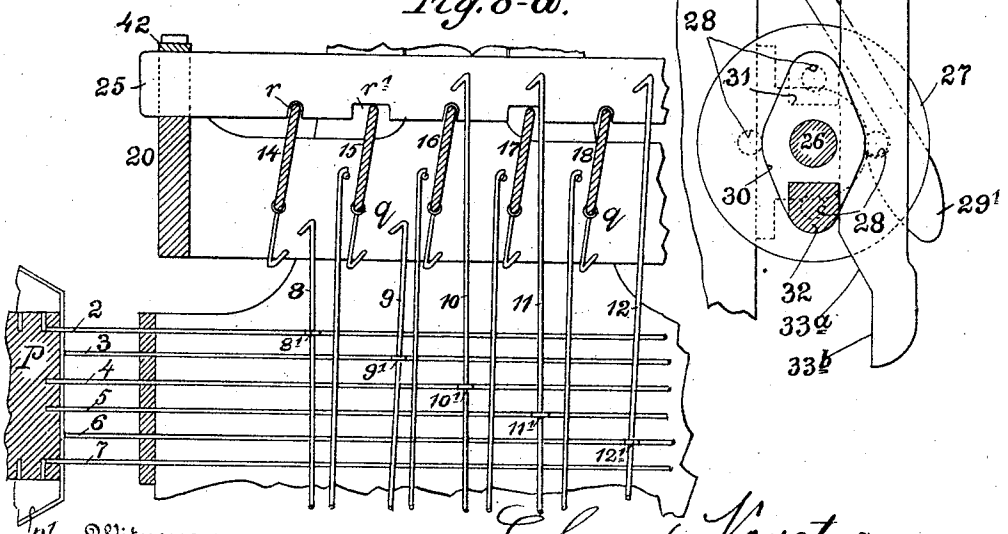


Fig. 8-a.



Witnesses:

John A. Paulson

F. Modest.

Claude Novet, Inventor

By Schreiter & Mathews,

his Attys

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C. NOVET.

JACQUARD LOOM.

APPLICATION FILED AUG. 8, 1902.

7 SHEETS—SHEET 5.

Fig. 9.

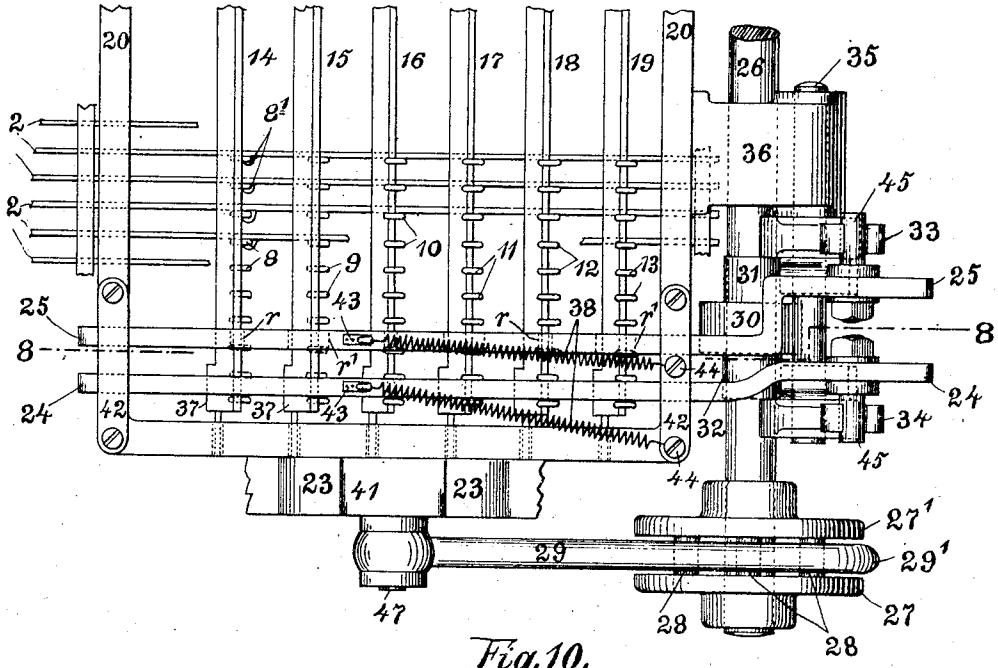
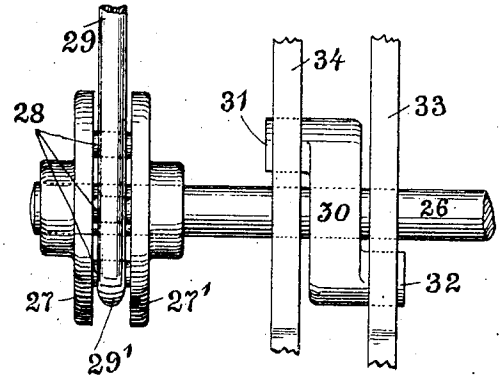


Fig. 10.



Witnesses:

John A. Paulsen

F. Modest.

Claude Novet, Inventor

by Schreiter & Mathews,

his Att'ys

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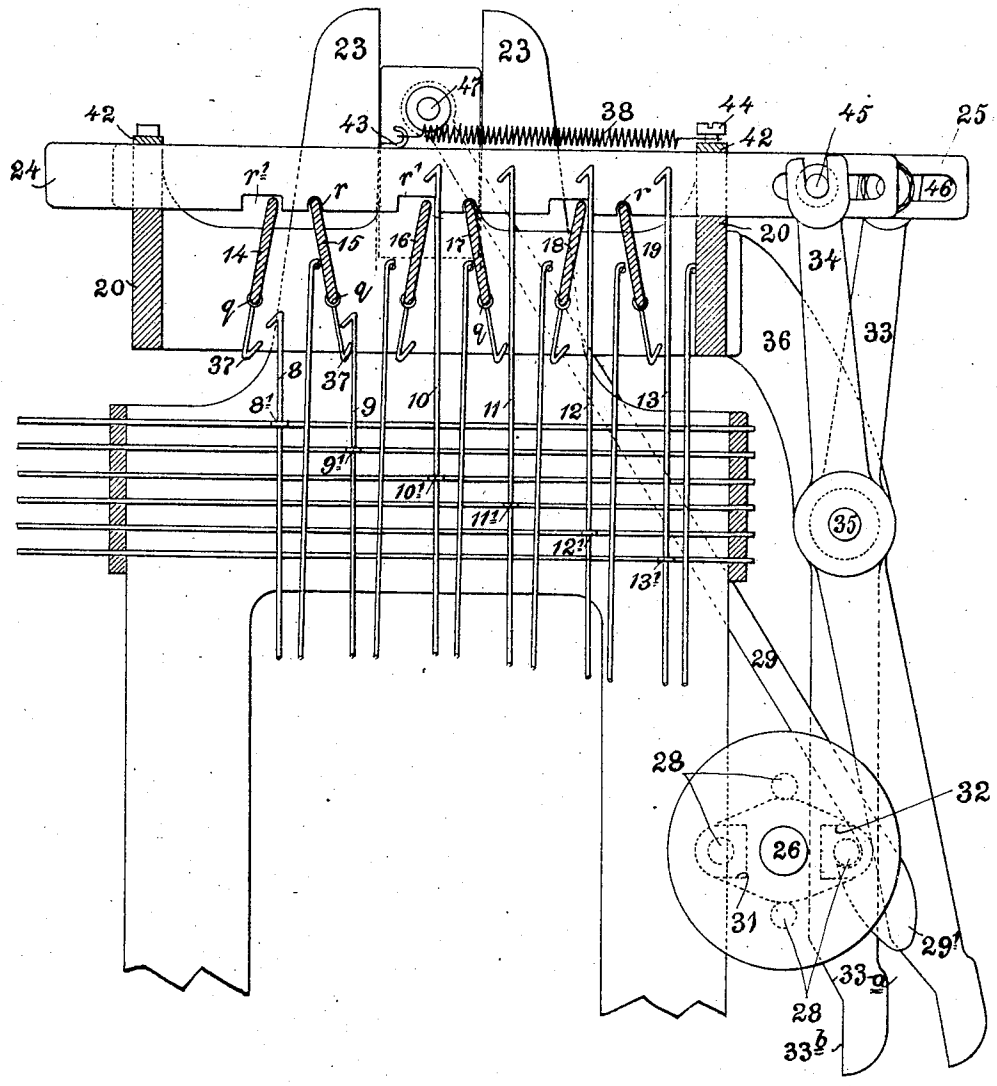
C. NOVET.

JACQUARD LOOM.

APPLICATION FILED AUG. 8, 1902.

7 SHEETS—SHEET 6.

Fig. 11.



Witnesses:

John A. Faulon

F. Modest.

Claude Novet

Inventor

by Schreiter & Mathews,

his Att'ys

No. 785,679. PATENTED MAR. 21, 1905.

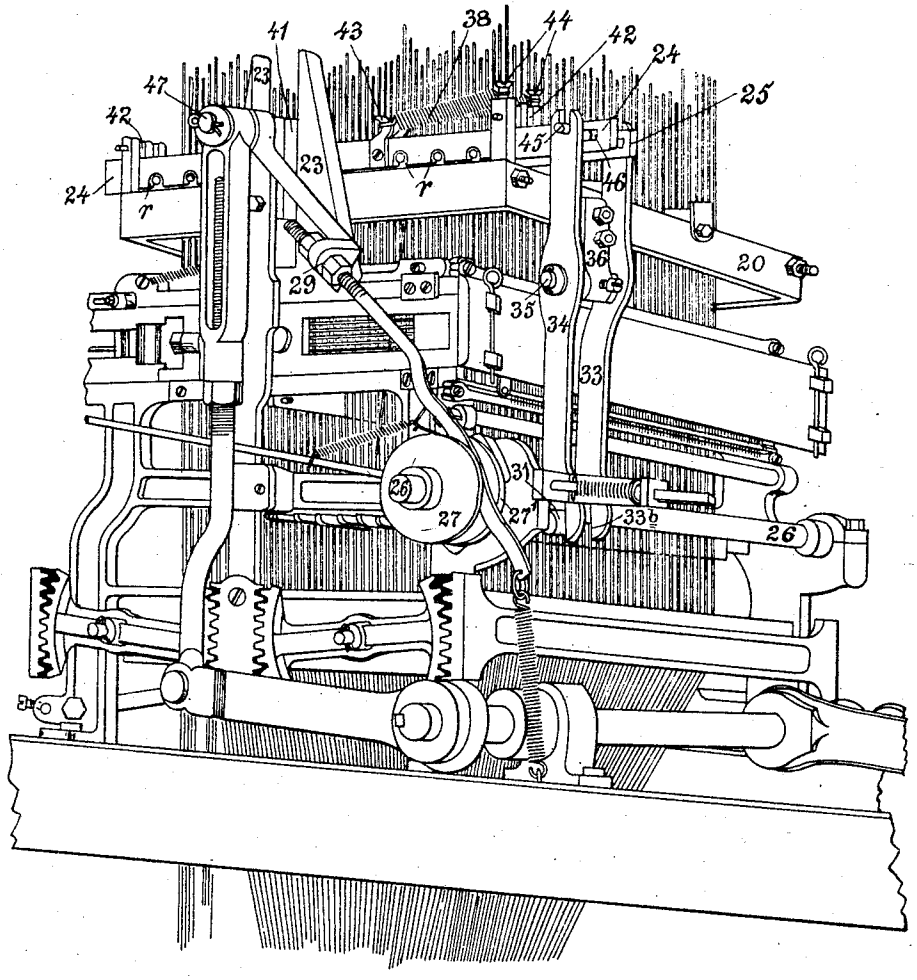
C. NOVET.

JACQUARD LOOM.

APPLICATION FILED AUG. 8, 1902.

7 SHEETS—SHEET 7.

Fig. 12.



Witnesses:

John A. Paulson

F. Modest.

Claude Novet, Inventor

by Schreiter & Mathews, his Att'ys

No. 785,679. Patented March 21, 1905.

UNITED STATES PATENT OFFICE.

CLAUDE NOVET, OF ZURICH, SWITZERLAND.

JACQUARD LOOM.

SPECIFICATION forming part of Letters Patent No. 785,679, dated March 21, 1905.

Application filed August 8, 1902. Serial No. 118,941.

To all whom it may concern:

Be it known that I, CLAUDE NOVET, a citizen of France, residing at Hönggerstrasse 23, Zurich, in the Canton of Zurich, Switzerland, (whose post-office address is No. 23 Hönggerstrasse, Zurich,) have invented a new and useful Improvement in Jacquard Looms, of which the following is a full, clear, and exact specification.

My invention relates to looms for weaving fabrics, wherein the warp-threads are separated for shedding as required for the weaving of any particular pattern by lifting the wires to which the said warp-threads are *seriatim* connected by cords. The wires are engaged by needles, singly or in series, and are provided with hooks on their upper ends. These hooks are in position to engage with knives set in a movable frame, and thereby the wires carrying the warp-threads are lifted as the pattern to be woven requires. The needles are manipulated by "pattern-cards." The pattern-cards used for effecting the desired separation are perforated in positions corresponding to the positions of the needles which engage the lifting-wires carrying the warp-threads that are to be lifted in the upper shed. The perforations of the cards, which are arranged to produce the desired design, permit these needles to pass while all other needles are pushed inwardly by the unperforated part of each card. The warp-threads carried by the wires engaged by these needles remain in the lower shed, because by the pushing back of the needles the wires engaged by them are shifted so as not to be engaged by the knives.

In weaving pattern fabrics on jacquard-machines as heretofore constructed only one shedding is produced by each pattern-card, and thus one pattern-card is required for each shot. As it is not always necessary to change all warp-threads for each shot, and, in fact, is required that for the so-called "woven" shoot some series of warp-threads separated for the preceding so-called "floating" shoot shall remain, respectively, in the upper and lower sheds, I have devised the herein-set-forth improvements in the mechanism of such machines, whereby the second change (for the woven shot) is produced without the action of a pattern-card, thus saving wholly one-half of the requisite number of pattern-cards and one-half of actions of the mechanism for operating the corresponding implements of the loom. I attain this object of my invention by combining with the jacquard-machine a mechanism whereby either the lifting-wires or the blades (knives) whereby these lifting-wires are operated are so manipulated that on the raising of the knife-frame from each second shot the lifting-wires carrying threads required to be lifted in the upper shed for this second shot are retained or brought in engagement with the blades. By means of either of these mechanisms (whether for operation of the needles or of the blades) one-half of the number of the otherwise necessary pattern-cards and one-half of the motions of the pattern-card mechanism are saved, and a more rapid operation (greater number of picks) of the loom is rendered possible.

My invention is illustrated in the accompanying drawings, wherein—

Figures 1, 2, 3, 4, 5, 6, and 7 are diagrammatical representations of the means for the accomplishment of the object of my invention and of their method of operation. Fig. 8 is an elevation partly-sectional view of a jacquard-machine made according to my invention. The parts are shown in position before the lifting-wires were set by the action of the pattern-card. Fig. 8ª is a part of Fig. 8, showing the parts set by the action of the pattern-card. Fig. 9 is a plan view of the machine in the position shown in Fig. 8. Fig. 10 is a detail view, and Fig. 11 is the same view of the machine as Fig. 8, showing the lifting-blades shifted and the parts of the mechanism in their respective positions immediately before the lifting of the blade-frame for the second shot; and Fig. 12 is an isometric view of such machine as shown in Figs. 8 to 11 and including also parts of the mechanism for operating the corresponding parts of the loom.

Referring now to Figs. 1 and 2, they represent the idea of means for accomplishing the object of my invention by retaining the lifting-wires (or some of them) in the position

(in the path of the blades) into which they were brought by the action of the pattern-card and prism on the needles. These means comprise hooks on the ends of needles 2, 3, 4, and 5; hooks 16, 17, 18, and 19; bar 20, to which the hooks are movably attached; reciprocating eyebars 21 and 22; reciprocating bars 25 and 26, and bell-crank levers 23 and 24, connecting the reciprocating bars. Bell-crank levers 23 and 24 are pivoted at x and x', respectively, to the frame of the machine and are alternately actuated, as shown in Fig. 2, by the motions of the pattern-prism acting upon bars 25 and 26. Hooks 16 and 18 pass through the eyes in bar 22, and hooks 17 and 19 pass through the eyes provided in bar 21. Fulcrum-points x and x' of the bell-crank levers 23 and 24 are fixed.

In Fig. 2 hooks 16 and 18 are shown to be lifted, (by the push of prism 1 on the bar 25,) and thereby brought in position to be engaged with the hook ends of needles 2 and 4 when pushed inwardly by the card. Thus the lifting-wires 6 and 8 (and all other lifting-wires actuated by those needles) are held deflected from their normal position after the prism 1 receded and in the path of blades 10 and 12, respectively. Consequently at the next lifting motion of the knife-frame the warp-threads attached to the lifting-wires 6 and 8 are again lifted into the upper shed, while the threads attached to the other lifting-wires that were raised in the preceding motion by the action of the pattern-card remain in the lower shed. Figs. 3 and 4 illustrate a modified form of means for the accomplishment of the same purpose. Here, as in the diagram Figs. 1 and 2, the object of my invention is accomplished by action upon the lifting-wires; but while in the former device means are provided to retain the desired lifting-wires in a position bringing them again in engagement with the blades, in the device illustrated in Figs. 3 and 4 means are provided for pushing the lifting-wires of those threads that are to be dropped into the lower shed out of engagement with the blades. In the device shown in Figs. 3 and 4 a reciprocating and rotatably-mounted prism P is employed. This prism P is located within the pattern-prism p'. Fig. 3 illustrates an example of the action of the pattern-cards on the lifting-wires. In this example lifting-wires a, b, and c, connected to needles $a' b' c'$, are pushed away from blades $a^2 b^2 c^2$, while lifting-wires $e f g$, connected to needles $e' f' g'$, are left in their normal position, which brings them in engagement with blades $e^2 f^2 g^2$. The pattern-card acting in this example is perforated in points opposite to the ends of needles $e' f' g'$. Prism P is provided with perforations at the points where needles e' and g' project through the pattern-card; but there is no perforation opposite to needle f'. Therefore when prism P is moved from the position shown in Fig. 3 into that shown in Fig. 4 needles e' and g' remain in their position, their ends entering into the corresponding perforations e^3 and g^3 of the prism P, but needle f' is pushed back by the prism P. Thereby lifting-wire f is pushed from its position of engagement with plate f^2, and therefore at the next motion of the blade-frame only the threads connected to lifting-wires e and g are raised into the upper shed. The perforations in prism P must of course be arranged to correspond with the requirements of the design to be woven.

Figs. 5, 6, and 7 illustrate means for accomplishing the object of my invention by mounting the lifting-blades movably in the frame and for manipulating them correspondingly with the requirements of the pattern to be woven. In Fig. 5 the lifting-blades i are pivotally mounted in frame h and pivoted to bars k and k' at i'. The figure illustrates the position of the parts at the moment of the second shedding—that is, the shedding following the one effected by the action of the pattern-card. It will be seen that by the action of the pattern-card lifting-wire l^4 was pushed out of position and out of engagement with its corresponding blade i, whereas the other three lifting-wires, l', l^2, and l^3, were retained in that position. Thus on the first shedding after the action of the pattern-card the threads connected to lifting-wires l', l^2, and l^3, were raised in the upper shed, while the threads connected to the lifting-wire l^4 were left in the lower shed. At the next upward motion of the blade-frame the same action would occur; but owing to the deflecting of the blades pivoted to bar k' the blade-engaging lifting-wire l^2 is moved out of reach of the hook of lifting-wire l^2, and therefore at this second shedding only the warp-threads connected to lifting-wires l' and l^3 are raised in the upper shed. The same idea of means as shown in Fig. 5 is illustrated in Figs. 6 and 7, showing the application of these means to a jacquard-machine having lifting-blades n provided with tringles m and the lifting-wires with spurs o in position to engage with the tringles. Here again the lifting-blades are pivotally mounted in frame h and pivotally connected to bars k and k'; but the lifting-blades extend beneath the frame h and on their ends are formed into hooks (tringles) m, that engage with corresponding hooks o, provided on the lifting-wires $l' l^2 l^3$, &c., when the lifting-blades are swung toward them, as shown in Fig. 7.

A machine constructed according to my invention and wherein the blades are movably mounted in the frame and mechanism provided for so operating the blades, as explained with reference to Figs. 5, 6, and 7, is shown in Fig. 12, and details thereof, illustrating the parts of the several mechanisms devised and combined for the purposes of my invention, are shown in Figs. 8, 8ª, 9, 10, and 11.

Referring to Fig. 8, numerals 8, 9, 10, 11,

12, and 13 designate the lifting-wires, and numerals 2, 3, 4, 5, 6, and 7 designate the needles, of the jacquard-machine, engaging with the lifting-wires at 8′, 9′, 10′, 11′, 12′, and 13′, respectively. Above the needle-frame is located the blade-frame 20, which is secured to cross-beam 41, sliding between guides 23, and which is lifted by the usual treadle or lever mechanism connected with the driving-gear of the loom. It is understood that these wires and needles represent series of such wires and needles arranged parallel in the frame of the jacquard-machine and in the same relative position to each other and to the lifting-blades 14 15 16 17 18 19, &c. Lifting-wires 8 9 10, &c., are normally in position to be engaged by the blades, and needles 2 3 4 5, &c., manipulate them according to the perforations of the pattern-card, pushing those which are not to be raised out of their normal position.

Thus far as described is the ordinary structure of the jacquard-machine, and the following is the new mechanism devised for the purpose of my invention. Blades 14, 15, 16, 17, 18, and 19 are pivoted in the frame and their upper edges engage in notches r of cross-bars 24 and 25. The arrangement is such that alternate blades engage with the bars—that is to say, blades 14, 16, and 18, as shown in the drawings, engage with bar 25, whereas blades 15, 17, and 19 engage with bar 24. To permit independent manipulation of the series of blades engaging with each bar without interference with the other bar, wide recesses r' are provided at those places in bars 24 and 25 where they pass over the blades engaging with the other bar. Bars 24 and 25 are longitudinally movable in bearings 42 and are so operated by levers 33 and 34. These levers are fulcrumed on stud 35, mounted in bracket 36, which is affixed to the blade-frame. The upper arms of levers 33 and 34 are forked and engage studs 45, adjustably secured in slots 46 of bars 24 and 25, respectively. Springs 38, connected to hooks 43, affixed one to each of the bars 24 and 25 and to the screws 44 of the bearing 42, are set to draw the bars against the action of levers 33 and 34. They return the bars to their normal position and by reason of the connection of the bars with the upper arms to levers 33 and 34 hold the downwardly-depending arms of these levers against the crank-pins 31 and 32, respectively. The downwardly-depending arms of levers 33 and 34 engage, respectively, with the pins 31 and 32 of crank 30, rigidly secured to shaft 26. This shaft is mounted in bearings affixed to the stationary part of the frame of the jacquard-machine, (indicated in dotted lines in Fig. 8,) and on its forward end are rigidly secured thereto cam-disks 27 and 27′. These disks are set some distance apart and are connected by cross-pins 28 at points ninety degrees apart from each other. Connecting-rod 29, hung on shaft 47 and having on its other end an enlarged head 29′, provided with a semicircular recess fitted upon the pins 28, engages, owing to its position, successively with each of the four pins, thus turning the shaft 26 from right to left one-quarter of a circle with every lifting motion of the blade-frame. Crank 30 turns with the shaft, and as the pins 31 and 32 are set diametrically opposite each other the downward-depending arms of each lever 33 and 34 (engaging with them) are during each full revolution of shaft 26 once swung to the right and back again. Thus each of the bars 24 and 25 is during each revolution of shaft 26 pushed once to the left, thereby shifting the blades connected thereto and again returned to its normal position. While the turning of the shaft 26 occurs when the blade-frame moves upwardly, the shifting of the bars 24 and 25 and of the blades connected thereto must occur while the blade-frame moves down again. For this reason the ends of the downward-depending arms of levers 33 and 34 are recessed, as shown in Fig. 8 at 33^a and 33^b. The recesses 33^b are provided to compensate for the motion (to the right) of the crank-pins 31 and 32, respectively, produced by the rotation of shaft 26 during the upward motion of the blade-frame, and thus to prevent the oscillating motion of levers 33 and 34. By these means bars 24 and 25 are kept stationary while the blade-frame moves upwardly; but when the blade-frame is returning to its lowermost position the downwardly-depending arm of lever 33 (or 34, whichever it may be) slides on the crank-pin 31, (or 32,) and when the slanting surface 33^a reaches the crank-pin 31 (or 32) this arm of the lever begins to swing to the right (and its upper arm corresponding to the left) until the blade-frame reaches its lowermost position, at which moment the pin 31 (or 32) holds against the edge of the lever some distance above the slanting surface 33^a. Thereby the bar 24 (or 25, as the case may be) is pushed to the left, and all blades engaged by it are turned on their pivots q and brought in a position as shown, for instance, in Fig. 11 in respect to blades 15, 17, and 19. This described action of the mechanism occurs at each second upward motion of the blade-frame. As explained above, shaft 26 is rotated at each upward motion of the blade-frame ninety degrees. The pins 31 and 32 of crank 30 are one hundred and eighty degrees apart, and therefore at each alternate upward motion the crank will be brought in the position shown in Fig. 8. In this position of the crank neither of the levers 33 or 34 is actuated. The mechanism for actuating the blades is so timed relatively to the pattern-prism-operating mechanism that the upward motion of the blade-frame during which the bars 24 and 25 are not operated occurs when the lifting-wires were set by the action of the

pattern-card, and the pattern-prism-operating mechanism is so arranged that the change of the pattern-card occurs always after the second upward motion of the blade-frame. Thus the manipulations of the lifting-wires by means of the pattern-card and of the blades by means of the mechanism herein described, occur alternately. The mechanism for operating the lifting-blades effects not only such disengaging of the lifting-blades from the lifting-wires, but also the engaging of lifting-wires by the lifting-blades as were not engaged in the previous shedding. This is effected by the following mechanism: As shown in Fig. 8, blades 14 15, &c., are extended beyond the pivot *q*, and their lower edges are formed into hooks 37, which I have designated as "tringles." The object of this device (tringles) is to bring the blades in engagement with those of the short lifting-wires (see wires 8 and 9 in Figs. 8, 9, and 10) which were not displaced by the action of the pattern-card on the needles engaging with them for the second upward motion of the blade-frame. Instead of such short wires, as shown at 8 and 9 in Figs. 8, 9, and 10, wires of ordinary length may be used, provided with such spurs as shown at Q in Figs. 6 and 7. Either of these arrangements permits of still greater variation in the manipulation of the warp-threads without the change of the pattern-card.

The mechanism for swinging the blades may be variously constructed and may also be combined with the pattern-prism—as, for instance, indicated in Fig. 5. The mechanism illustrated in Figs. 8, 8ª, 9, 10, and 11 is, however, best suited for the purposes of my invention. It is preferable to the mechanism for manipulating the series of needles illustrated in Figs. 1 to 4, because it affords a greater scope of selection in maniplating the warp-threads and also in that its parts may be made more substantial, and thus better able to withstand the wear resulting from forcible vibratory motions of the Jacquard loom.

The specific constructions of mechanism for so manipulating the lifting-wires as I have explained with reference to Figs. 1, 2, 3, and 4 and other specific forms of other mechanisms for manipulating the blades are made the subject-matter of subdivisional applications, and therefore no detailed description of these particular mechanisms is made herein.

I claim as my invention—

1. The combination with a jacquard-machine having the blades for raising the lifting-wires movably mounted in a frame and mechanism for reciprocating the frame, of means for operatively connecting the blades in series, of mechanism for moving the blades in such series, one series after each lifting of the frame, following the setting of the lifting-wires by the pattern-card, and of means for actuating the mechanism for moving the blades.

2. The combination with a jacquard-machine having the blades for raising the lifting-wires movably mounted in the frame and mechanism for reciprocating the frame, of means for operatively connecting the blades in series and for moving the series of blades successively, one series after each lifting of the frame, following the setting of the lifting-wires by the pattern-card, and of means for actuating the mechanism for moving the blades.

3. A jacquard-machine comprising a needle-frame, needles set in and horizontally movable therein and vertically-movable lifting-wires, having hooks on their upper ends, engaged with the needles; a pattern-prism rotatably and movably mounted on one side of the needle-frame, opposite the ends of the needles; a train of pattern-cards hung to travel over the prism, a frame set above the needle-frame, lifting-blades pivoted in the frame in position to engage with the hooks of the lifting-wires; bars movably mounted on the frame approximately at right angles to, and engaging each with a series of, the lifting-blades; mechanism for reciprocating the bars successively, one after each lifting of the frame, following the setting of the lifting-wires by the pattern-card; and means for actuating the mechanism reciprocating the bars.

4. A jacquard-machine comprising a stationary needle-frame, needles set in and horizontally movable therein; and vertically-movable lifting-wires, having hooks on their upper ends; engaged with the needles; a pattern-prism rotatably and movably mounted on one side of the needle-frame, opposite the ends of the needles; a train of pattern-cards hung to travel over the prism, a frame set above the needle-frame, lifting-blades pivoted in the frame in position to engage the hooks of the lifting-wires with their upper edges, and having their lower edges angularly deflected toward the hooks of the lifting-wires; bars movably mounted on the frame approximately at right angles to, and engaging each with a series of, the lifting-blades; and mechanism for reciprocating the bars successively, one after each lifting of the frame, following the setting of the lifting-wires by the pattern-card.

5. A jacquard-machine comprising a stationary needle-frame, needles set in and horizontally movable therein; and vertically-movable lifting-wires, having hooks on their upper ends engaged with the needles; a pattern-prism rotatably and movably mounted on one side of the needle-frame, opposite the ends of the needles; a train of pattern-cards hung to travel over the prism, a frame set above the needle-frame, lifting-blades pivoted in the frame in position to engage the hooks of the lifting-wires with their upper edges, and having their lower edges angularly deflected toward the hooks of the lifting-wires; bars mov-

ibly mounted on the frame approximately at ight angles to, and engaging, each with a se- ies of the lifting-blades; mechanism for re- iprocating the bars successively, one after ach lifting of the frame, following the set- ing of the lifting-wires by the pattern-card, nd means for actuating the mechanism recip- ocating the bars.

In testimony that I claim the foregoing I have hereunto set my hand this 26th day of July, 1902.

CLAUDE NOVET.

Witnesses:
HERMANN HUBER,
A. LIEBERKNECHT.