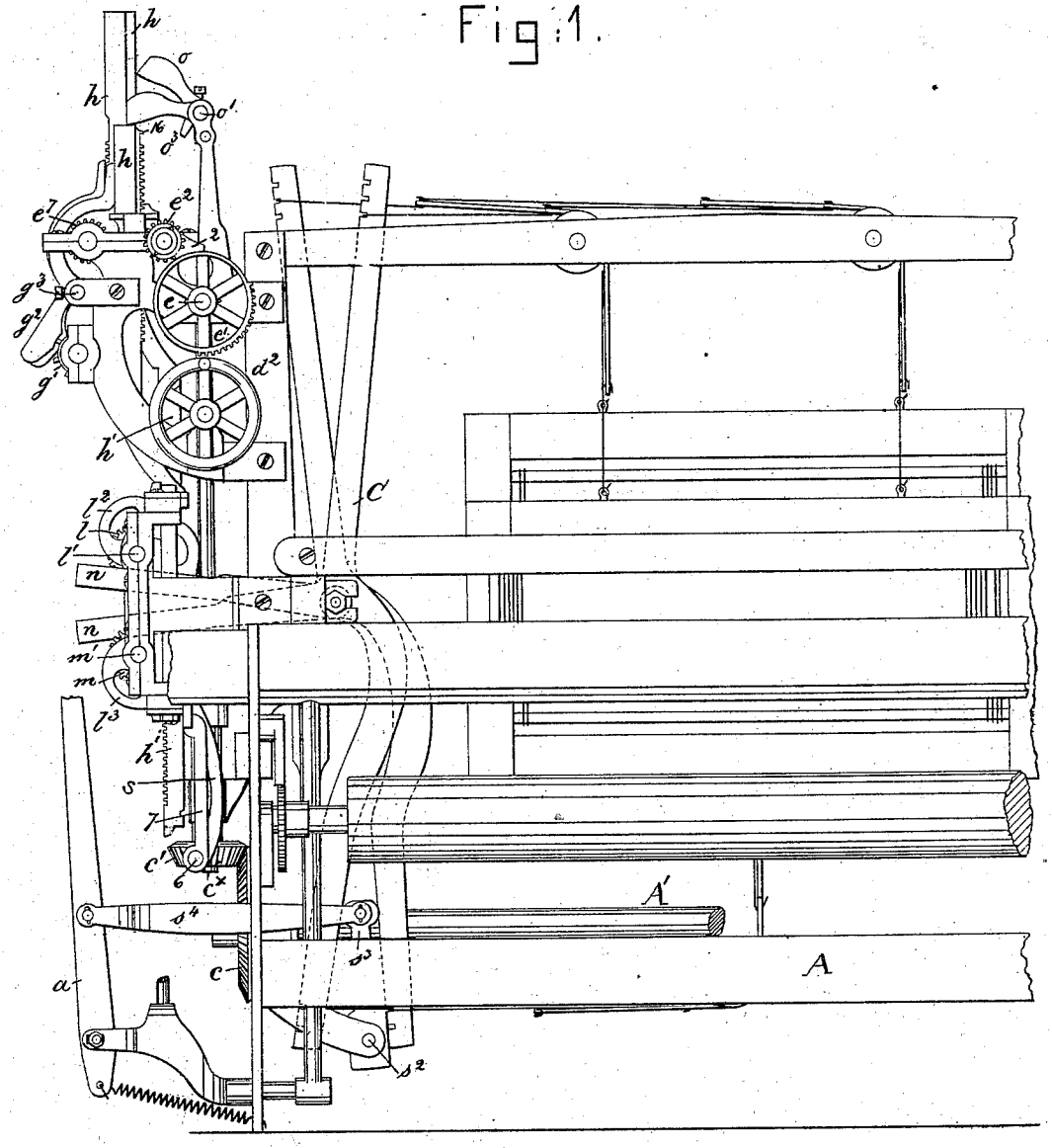
(No Model.) 4 Sheets—Sheet 1.

G. CROMPTON.

LOOM.

No. 274,913. Patented Apr. 3, 1883.

Fig. 1.



Witnesses.
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(No Model.)

4 Sheets—Sheet 2.

G. CROMPTON.

LOOM.

No. 274,913.

Patented Apr. 3, 1883.

Fig: 3.

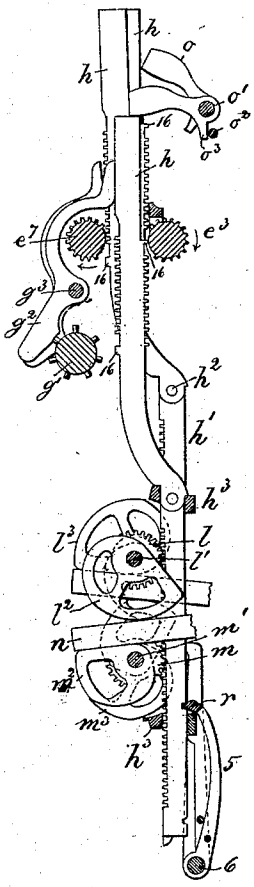


Fig: 2.

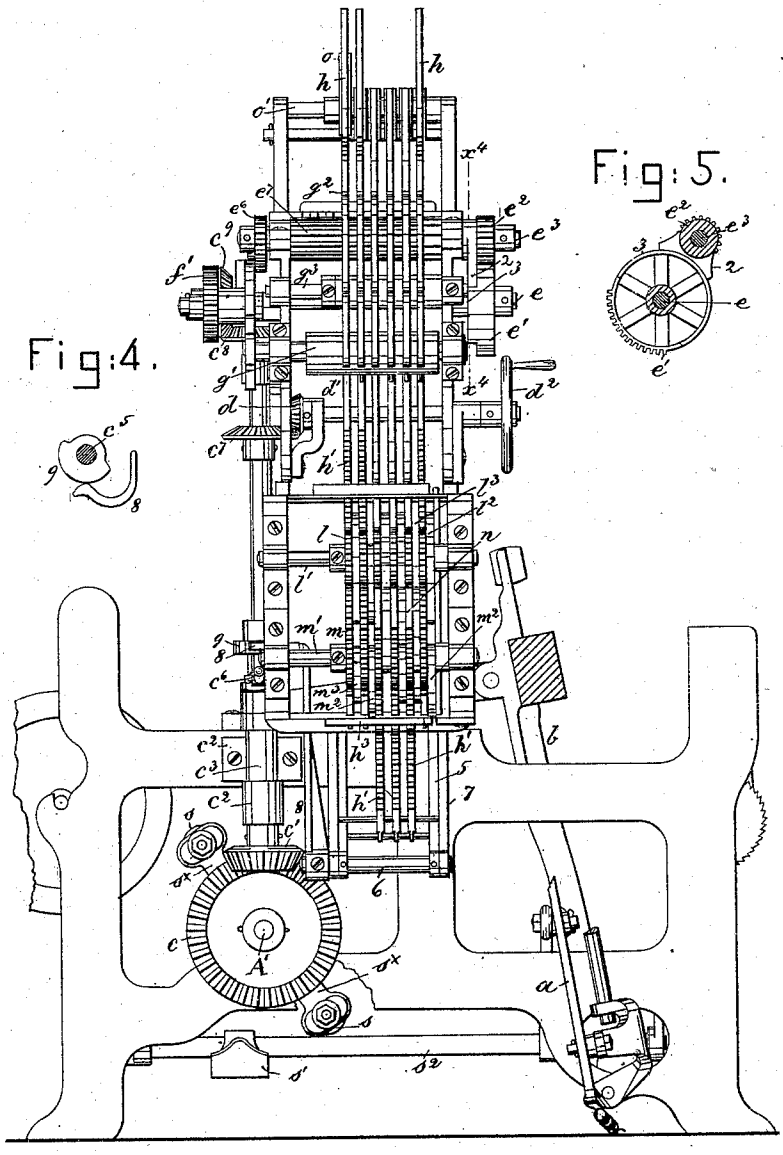


Fig: 4.

Fig: 5.

Witnesses.

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G. CROMPTON.

LOOM.

No. 274,913. Patented Apr. 3, 1883.

Fig: 6.

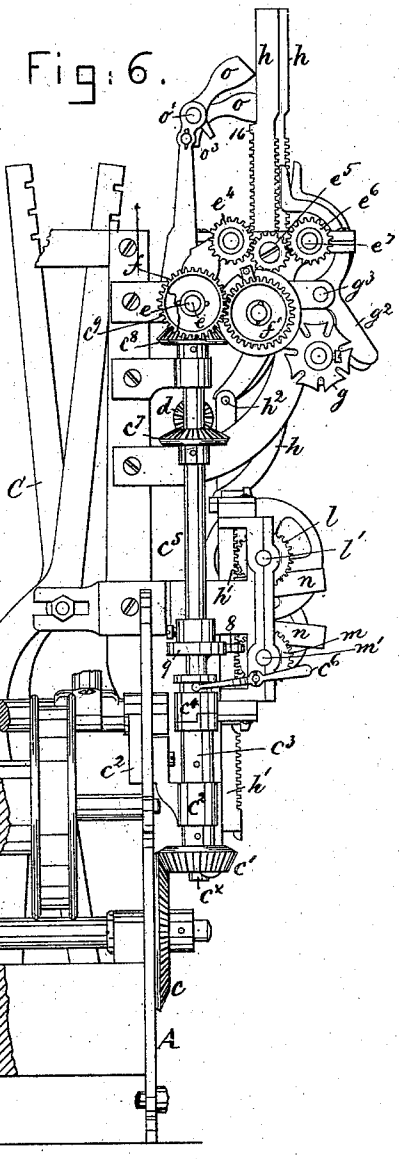


Fig: 9.

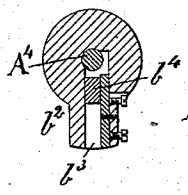


Fig: 10.

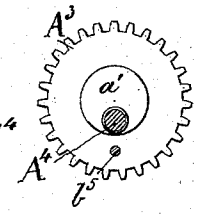


Fig: 8.

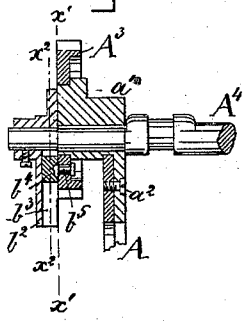


Fig: 7.

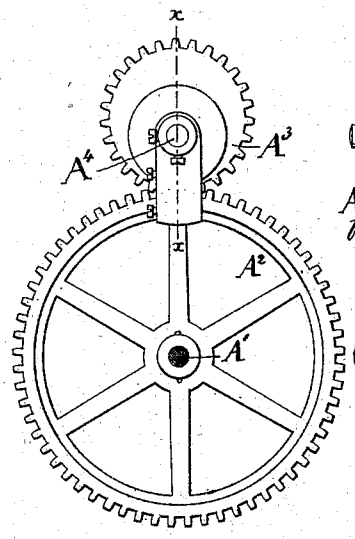
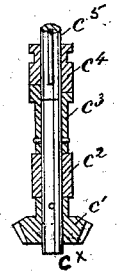


Fig: 13.



Witnesses

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4 Sheets—Sheet 4.

G. CROMPTON.

LOOM.

No. 274,913.

Patented Apr. 3, 1883.

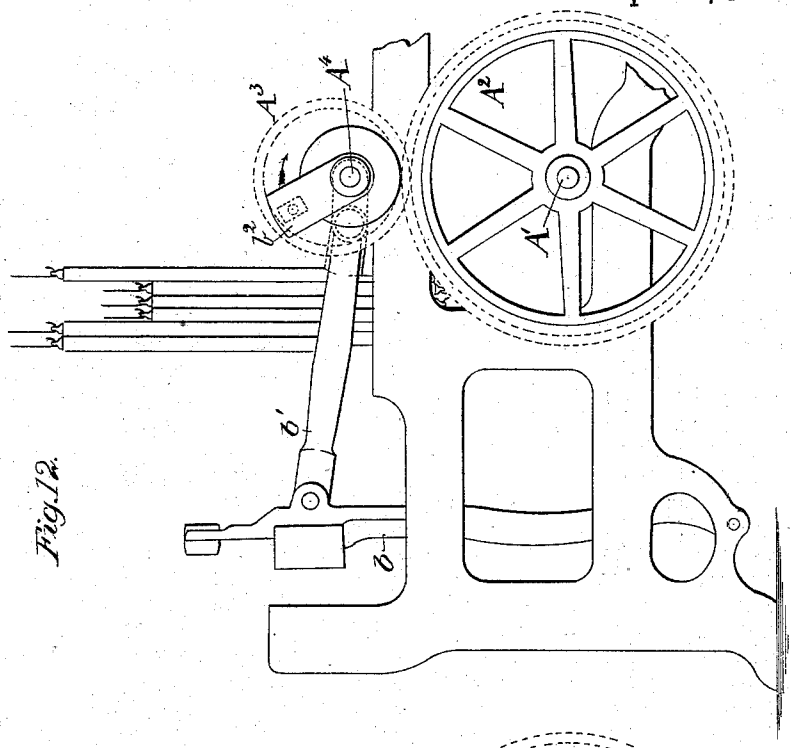


Fig. 12.

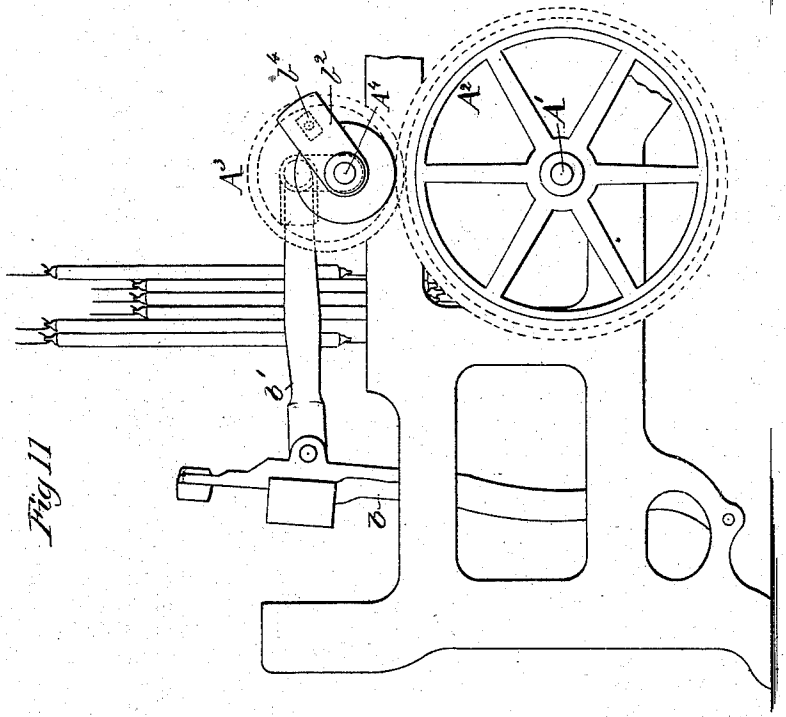


Fig. 11.

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UNITED STATES PATENT OFFICE.

GEORGE CROMPTON, OF WORCESTER, MASSACHUSETTS.

LOOM.

SPECIFICATION forming part of Letters Patent No. 274,913, dated April 3, 1883.

Application filed December 9, 1881. (No model.)

To all whom it may concern:

Be it known that I, GEORGE CROMPTON, of the city and county of Worcester, State of Massachusetts, have invented an Improvement in Looms, of which the following description, in connection with the accompanying drawings, is a specification.

In ordinary open-shed fancy-looms, wherein the lay beats up the filling while that portion of the warp-threads which are required to be shifted are passing from one plane to the opposite plane of a shed, it frequently happens that certain of the threads remain in one plane of the shed for a number of consecutive picks—sometimes as many as sixteen to twenty picks—before being shifted, which results in such threads becoming longer than those which are interwoven into the fabric with more frequency, and when the said longer or less frequently moved threads are finally crossed and interwoven they have a tendency to form loops on the surface of the fabric, or else, by reason of their slackness, form an indistinct pattern by moving aside out of a straight line under the influence of improper deflection, filling up the interstices on the face of the fabric, which interstices form part of the pattern.

In the usual open-shed loom, when the pattern requires that nearly all the warp-threads be shifted from one plane to the opposite plane of the shed, the beat of the lay takes place when the majority of the warp-threads are midway between the two planes, and consequently slack, so that the blow of the lay or its reed is brought almost entirely upon the few threads which are held taut and are not being shifted, and these latter threads are thus unduly stretched and frequently broken.

When the lay or reed beats a weft-thread into the fell between a small number of threads so held taut while the main body of the warps are loose, the loosely-held warps are liable to have loops formed in them on the face of the fabric, as before stated.

In seeking to remedy some of these difficulties the sheds have been opened and closed earlier in the movement of the lay, so as to cross the warps upon the filling and enable the lay to beat up the filling after the formation of the next shed back of that in which the said filling rests; but such timing is very objectionable, because of "gridironing" the filling, and thus greatly increasing the formation of loops in those of the warp-threads which have become somewhat longer by reason of not having been so frequently crossed into the shed.

When the filling is beat or pressed into a partially-open shed the drag of the filling between the warp-threads which are passing to the upper and lower planes of the shed, or from one to the other plane when forming a new shed, "gridirons" the filling, as it is called, as it is being beat up to the fell, and frequently draws the warp-threads which are being changed, they being at such times slack, toward the fell, resulting in throwing up loops in the loose warp-threads or making a rough appearance in the cloth, which is objectionable.

In weaving, the shed for the passage of the shuttle with the filling is formed by separating the warps into two planes, and to secure the best results the harness-frames carrying the heddles the eyes of which contain the warp-threads have successively a little more movement, commencing with the first harness-frame toward the lay and proceeding backward through the series of harness-frames, to thus bring all the warp-threads between the heddle-eyes and the fell of the cloth, or the line of the last crossing of weft or filling over the warps, in two compact even planes, or substantially so, thus forming what is denominated an "even shed."

In "close-shed" looms of the class shown, for instance, in United States Letters Patent No. 491, granted November 25, 1837, to William Crompton, the harness-frames, after each passage of the weft or filling through the shed formed in the warp, are moved to bring all the warp-threads into one line or level, to "even the warp," as it is called, and then those warps to appear in the upper part of the new shed are lifted from the common level of all the evened warp-threads. In this class of loom each warp-thread, during the extent of its movement in forming a shed and being evened into one plane, is subjected to the same strain as each of all the other threads; or, in other words, some of the warp-threads are not held taut and some looser, as in the so-called "open-

shed" loom. In the latter class of loom, upon which my present invention is an improvement, the warps are separated into two planes to form a shed for the passage of the filling, and the shed having been fully opened, all the warp-threads are held equally taut. In a loom of this class, when a succeeding shed is to be formed, all the warp-threads are not brought into the same plane or evened, as stated when referring to the close-shed loom; but only those threads of the warp are changed from one to the other of the two planes of the shed which in the new shed are to appear upon the opposite face of the fabric to that on which they last appeared, or to be concealed in the body of the fabric, this depending upon the pattern. In this plan it will be noticed that in forming the new shed a part of the warp-threads—viz., those threads which are not being moved by the heddles, but held in the two extremes or planes of the shed—are held taut, while all the warp-threads that are being changed or moved from one to the other plane of the shed by the heddles are slack or loose. During such time, if the filling is carried forward between the moving warps by the reed of the lay as it approaches its fell, the filling will be gridironed, the loose warps will be dragged forward and buckled up at the fell, and the blow of the reed on the filling at the fell will excessively strain the distended or taut warps.

In all open-shed fancy-looms as heretofore commonly made, so far as I am aware, the picking has been commenced when the lay was substantially half-way back, and the shuttle has finished its flight when the lay was moved about half-way forward, and in such looms the formation of each new shed has been commenced just as the shuttle reached the end of its flight; but the shed has not been fully completed until after the reed, in the forward movement of the lay, has beat up the filling in the old shed. In this way it will be seen that each crossing of filling, before it is beat in, is pressed at bottom and top by the warp-threads then being changed to form the next shed, such threads crimping the filling and producing such a pressure on the latter as it is beat up that it frequently acts to drag forward with it the warp-threads then being changed from one to the other plane of the shed, as stated, they being at such times somewhat loose or slack, causing the formation of loops both in the warps and filling and making rough the face of the fabric.

In this my invention I propose to remedy these difficulties by pressing the filling into the fell of the open shed when all of the warp-threads are fully distended, after which those warp-threads which in the production of the pattern are required to be shifted in the formation of the next shed are crossed as the lay is being moved backward, and with the lay in its backward position the filling is again inserted into the new shed, and is beat up into that same shed while the warps are held stationary and distended. By pressing or beating the filling into the open shed when every thread is equally distended or held under greatest strain by the harness, all the warp-threads receive about an equal amount of tension, and are not liable to be broken or unduly stretched, which prevents the buckling or looping of the threads, and indistinctness of the pattern is obviated.

It is a well-established fact that some patterns of cloth produced on close-shed looms cannot be satisfactorily woven upon open-shed looms as heretofore constructed; but in an open-shed loom organized to operate in the manner herein described it is possible in open-shed looms to weave any desired pattern, and by my improvements, hereinafter set forth in the claims at the end of this specification, the capacity of open-shed looms is greatly increased.

I have provided between the crank or lay-shaft and the cam-shaft, which is the source of motion for both the picking and shedding mechanisms, a variable or fast and slow speed mechanism or device which will operate the parts of the open shed-loom in such relative time and order that the shed will remain open and at rest until the reed of the lay beats in the filling to the fell, and as the lay commences to retire from the fell the change of warp for the next shed to receive filling commences, and the said shed, the formation of which was not commenced until after the weft-thread had been fully beat in at the fell, is completed for the commencement of the picking by the time the lay is half-way on its back stroke from the fell, and the shed so opened is held open during the further rotation of the crank-shaft until the filling is beat in at the fell, as first stated. If the crank or lay-shaft and the cam-shaft were operated at the same relative speed from the commencement to the ending of each shed, as heretofore done in open-shed fancy-looms, this very desirable and advantageous order of shedding, beating in the weft or filling, and of picking could not be so well or rapidly accomplished because of lack of time.

As herein shown, I have applied to the crank-shaft certain appliances whereby the speed of the crank-shaft is reduced from just about the time when the lay strikes the filling at the fell until the lay is half-way back, or, in other words, about one-third the time taken for each rotation of the crank-shaft is consumed in moving the crank-shaft over a space of substantially ninety degrees, thus giving ample time for the commencement of the shed as the lay commences to retire from the fell, and its completion by the time the cranks of the crank-shaft are half-way back or on their top centers, when the picking is to be commenced, in order that the shuttle may complete its flight by the time that the cranks of the crank-shaft arrive at their bottom centers, as now practiced.

In fancy-looms the same harness-frames, in weaving some patterns, are frequently lifted and lowered in succession, and their warps are crossed in pairs—as, for instance, when weaving basket-patterns and moving in unison in

the same direction the projecting fibers of contiguous warps sometimes get stuck together. To obviate such difficulties I have herein so arranged the cams which operate the heddle-levers that the series of levers which are to be employed to lift the harness-frames and those which are to be employed to depress the harness-frames for any shed each move in a different time or order with relation to the other levers of the same set—as, for instance, the independent levers of each set of levers to be employed to lift or depress the harness-frames are started one a little in advance of the other, so that no two sets of warps in independent harness-frames start in the same direction at the same time; hence the warp-threads do not mat or cling together by reason of contact of their projecting fibers. To this end the invention includes novel devices and organizations of devices for actuating the harness-frames.

Figure 1 represents in front elevation a portion of an open-shed fancy-loom. Fig. 2 is a view of the left-hand end of the loom shown in Fig. 1; Fig. 3, a sectional detail, showing the racked jacks and usual fluted elevator and depressor gears to actuate them, the pattern-surface, and the cams actuated by the jacks to operate the three-armed upright harness-levers; Fig. 4, a detail showing the cam on the shedding-shaft and the arm moved by it to operate the locking device which holds the jacks in place after the completion of each shed; Fig. 5, a section on the line x^4 x^4 of Fig. 2, showing the gearing which intermittingly operates the fluted or toothed elevator and depressor gears. Fig. 6 is a rear side elevation of the loom, its central portion being broken out to show both end frames of the loom and the gearing for connecting the crank-shaft with the cam-shaft below it, which latter actuates the shedding-shaft and the devices for forming the shed, and also the picking-sticks. Fig. 7 is a view of only the left-hand end of Fig. 6. Fig. 8 is a vertical section on the line x x, Fig. 7, through the variable-speed device, the crank-shaft being in elevation. Fig. 9 is a section of part of the variable-speed device in the line x^2 x^2, Fig. 8; Fig. 10, a view of the loose gear and its bearing placed eccentrically to the crank-shaft, as it will appear when looking at Fig. 8 from the left of the dotted line x' x', Fig. 8. Fig. 11 is an end view of the loom, showing the variable-speed device, the cranks of the crank-shaft being in their highest positions; Fig. 12, a similar view with the lay substantially in its farthest position forward; and Fig. 13 is a sectional detail taken through the notched collar c^3 and the notched hub c^4, the lower end of the shaft c^5 and the shaft $c^\times$ being shown in elevation.

The loom-frame A, of proper shape to contain the working parts, has suitable bearings to hold the cam-shaft A′, which will be driven in any usual manner, the said shaft being provided in practice with arms $s^\times$, having rolls s to strike shoes s' on shafts s^2 at each side of the loom, each shaft s^2 having an arm, s^3, connected by link s^4 with and to actuate the usual picking stick, a, only one shaft s^2 and its connected picker-stick being shown. The shaft A′ has a gear, A^2, which engages a toothed ring or annulus, A^3, bored centrally, as shown at Fig. 10, to fit a circular hub-like bearing, a', secured to the loom-frame by a screw, a^2. This bearing a' receives through it, at one side of its center, or eccentrically, as in Figs. 8 and 10, the end of, and forms a bearing for, the crank-shaft A^4. The cranks of the crank-shaft are connected, as usual, with the lay b by links b'. The end of the crank-shaft outside the bearing a' has fixed to it an arm, b^2, grooved at its rear side, as at b^3, (see Figs. 8 and 9,) in the direction of its length, to receive the swiveling block b^4, held by the pin b^5 in the annulus or toothed ring A^3, mounted loosely in the bearing-hub a'.

As the toothed ring A^3 is rotated about the bearing-hub a' by the gear A^2 of the cam-shaft A′, the swiveling block b^4, carried by the ring A^3 and resting in the groove b^3 of the arm b^2, fast on the end of the crank-shaft, (which latter is placed eccentrically with relation to the bearing a',) causes the said arm and crank-shaft to turn with the said ring, but at a variable speed from that imparted to the ring by the gear A^2 on the cam-shaft A′, for the swiveling block, during each revolution of the ring A^3, will, it will be seen, travel from the position shown in Fig. 8 to the outer end of the groove b^3 of the arm b^2 and back again. When the block b^4 is in the groove b^3 nearest the crank-shaft, as in Fig. 8, the crank-shaft will be moved at its greatest speed, and vice versa.

In Fig. 12 the arm b^2 is supposed to be moving gradually and the crank-shaft has nearly reached its slowest speed, and the lay is just about to commence its backward movement; but in Fig. 11 the lay has been moved halfway back and has commenced its fast movement, and the fast motion continues until the parts assume the position shown in Figs. 7 and 8.

The ring A^3, its swiveling block, the bearing a', and the grooved arm b^2, secured to the crank-shaft, constitute what I denominate the "variable" or "fast or slow" speed device; and I desire it to be understood that in place of the said device shown I may employ any other usual or well-known variable-speed mechanism.

The cam-shaft A′, at its left-hand end, looking at the front of the loom, has on it a bevel-gear, c, meshing with a bevel-gear, c', secured to a short shaft, $c^\times$, (see Fig. 13,) held in bearing c^2, and provided at its upper end with a collar, c^3, the top of which is notched, as shown in Fig. 6, to be engaged by a sleeve, c^4, splined to and so as to slide on but rotate with the vertical shedding-shaft c^5, with which the shaft $c^\times$, holding the bevel-gear c', is in line. The short shaft $c^\times$, collar c^3, and sleeve c^4 are substantially as in United States Patent No. 177,323. The collar c^3 and sleeve c^4 enable

the shed-forming devices and their pattern-chain to be disconnected, when desired, from the control of the shaft A′, and when such devices are disconnected the shed-forming shaft may be turned by hand through the hand-wheel d^2, shaft d', and bevel-gear d, which latter, (see Fig. 2,) engages the bevel-wheel c^7 on the shedding-shaft. The clutch may be disengaged by the lever c^6, the forked end of which engages a groove of the sleeve c^4. The upper end of shaft c^5 has on it a bevel-gear, c^8, which engages a bevel-gear, f, on the shaft e, said shaft e having at its opposite end a wheel, e', (see Figs. 1 and 2 and detail Fig. 5,) having a toothed and a plain or smooth surface. The toothed surface of the wheel e' engages intermittingly the small toothed gear e^2 on the shaft of the long elevator-gear or fluted cylinder e^3 and turns it once and leaves it at rest. The gear e^2 has one of its teeth omitted, (see Fig. 1,) and is provided with a connected holding device, 2, which strikes a smooth part, 3, (see Figs. 2 and 5,) of the wheel e' just as the tooth of the gear e^2, next ahead of the space left therein by omitting a tooth, ceases to act, thus enabling the device 2 to hold the elevator-gear e^3 at rest until the toothed portion of the wheel e' again arrives in position to engage the gear e^2. The elevator-gear e^3, at its opposite end, has on it (see Fig. 6) a pinion, e^4, which, through an idle-wheel, e^5, engages a pinion, e^6, on the shaft of and rotates the long fluted or toothed depressor-gear e^7, the two gears e^3 and e^7 (shown clearly in Fig. 3) thus moving at the same time, but acting upon the jacks, as shown, in opposite directions, to enable one to lift and the other to depress the racked jacks h h', herein shown as each consisting of two bars jointed together at h^2. The upper portions, h, of the jacks are, from a short distance below their upper ends, toothed at each edge to be engaged by the fluted gears e^3 e^7, and each row of teeth at one end has an isolated tooth, 16, to permit the gears to run out, as described in United States Patent No. 239,939, April 12, 1881. The lower portions or tails, h', of the jacks are toothed only at their front edge, and the teeth of each lower portion, h', are sufficient in number to engage two gears, l m, of equal size, held loosely on parallel studs or rods l' m'. Each gear l has attached to it a cam, l^2 l^3, and each gear m a cam, m^2 or m^3, shaped with relation to each other as shown in Fig. 3, so as to enable both of the said cams l^2 and m^2, or l^3 and m^3, to remain constantly in contact with the horizontal arm n of that one of the three-armed vertical harness-levers C with which the said cams co-operate. One of these cams, l^2 or l^3, acts on the upper side of an arm, n, while a cam, m^2 or m^3, acts against the under side of the said arm, and the harness-levers are thus moved positively in both directions. Viewing Fig. 3, it will be seen that cam l^2 is a little larger and a little differently shaped than its opposed fellow cam m^2. It will also be noticed that the next cam (marked m^3) at the rear of cam m^2 is of slightly-different shape between its toe and heel, and that the same difference exists between the cam l^2 and the cam l^3 next at the rear of it. The rods l' m' thus receive upon them two rows of the cams described, which are of such slightly-different shape as to operate the harness-frames in substantially the order hereinbefore stated, in order that the harness-levers which for the same shed are to be moved in the same direction will be moved in a different time between the commencement and end of their movement, to separate from each other all contiguous warps. The pairs of cams l^2 m^2 and l^3 m^3 will preferably be set with their points of greatest throw one ahead of the other, so that the cams of the series of cams which are to operate the harness-levers to raise the harness-frames, connected therewith by the usual cording, will act first to start and move one of the levers which is to raise one of the frames, and then start and move another of the said levers; but the cams are so shaped and operated that, notwithstanding they start at different times the levers which are to move in the same direction, they subsequently bring all the said levers into the same line as the shed is completed.

The upper ends of the jacks (see Fig. 3) are acted upon by the weighted pushers o, strung loosely on a rod, o'. The pushers have toes o^3, which act against the rod o^2. These pushers, when up, as shown by the second pusher in Fig. 3, insure the engagement of an elevated jack with the depressor, provided the weighted finger g^2, pivoted at g^3 and opposite the said jack, is not then supported by a pin or protuberance of the pattern-surface. The finger g^2 acts to throw the jack into engagement with the elevator e^3 only when the upper end of the jack is below the pusher opposite it, as shown by the first jack and pusher in Fig. 3.

The jacks, at their rear sides, are notched at two places, (see Fig. 3,) to be engaged by a jack-locking device, r, both when the jacks are fully lifted and when fully depressed, thus locking the jacks in place until the shed is to be again changed. This locking device or holder is composed of a bar carried by arms 5, secured to a rock-shaft, 6, held in brackets 7, secured to the end frame of the loom. The said shaft 6 has at its end an arm, 8, bent at its upper end, as shown in Figs. 2 and 4, to be acted upon, as each shed is to be started, by a cam, 9, on the shedding-shaft c^5. The pattern-surface g' derives its movement from the gear f, (see Fig. 6,) gear f', and the usual pin-wheel and star-wheel, g, the latter being on the shaft of the pattern-surface.

I am aware that a hand-operated loom having shedding devices carried by and moving backward and forward with the lay while the shed is open has been used for weaving window-blind material, wherein the filling was of wood or straw, and the warp was employed only at distant intervals, and that in such

loom the shed has been held open and distended while the lay, in its forward movement, packed the filling into the fell. In that loom the warp was crossed and the shed formed before the lay retired from the filling; but a blind-slat loom such as referred to, if organized as a power-loom and run by power, could not be employed to weave fancy fabrics having fine warps, for the eyes or parts of the heddles which in the said loom travel backward and forward over the stationary warps of the open shed would instantly destroy warps such as employed in fancy-looms of the class upon which this my invention is an improvement.

I claim—

1. The combination, with the lay, the reed, the picking-sticks, and the harnesses of a fancy-loom, of mechanism for operating such lay, picking-sticks, and harnesses in the order specified, and a pattern mechanism for governing the selection of said harnesses, whereby the warp is moved to form the shed during the backward passage of the lay, and all the warp-threads are held taut or stretched and the shed open while the filling is being inserted and pressed into the fell of the cloth, substantially as described.

2. The combination of the following instrumentalities, viz: the cam-shaft, its connected shedding-shaft, harness-levers, jacks, elevator and depressor, and intermediate connections between the jacks and harness-levers to move the harness-levers, a pattern-surface and means to move it, picking-sticks and intermediate devices between them and the cam-shaft to move the picking-sticks, the lay, crank-rods b', the crank-shaft, and a variable-motion or fast and slow speed mechanism, substantially as described, between the cam-shaft and crank-shaft to automatically change the relative speed of the cam and crank-shafts during a portion of each rotation thereof, substantially as set forth.

3. The pattern-surface, means to operate it, racked jacks, elevator and depressor, means to move the said elevator and depressor, the three-armed harness-levers, and the harness-frames and cording, combined with the double sets of cams and their gears, actuated by the said jacks, the cams being constructed and arranged as described, whereby they are adapted to move at a different speed or order the harness-levers of each set of levers which are to be moved in the same direction for the same shed, substantially as described.

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

GEO. CROMPTON.

Witnesses:
H. L. ADAMS,
J. B. SYME.