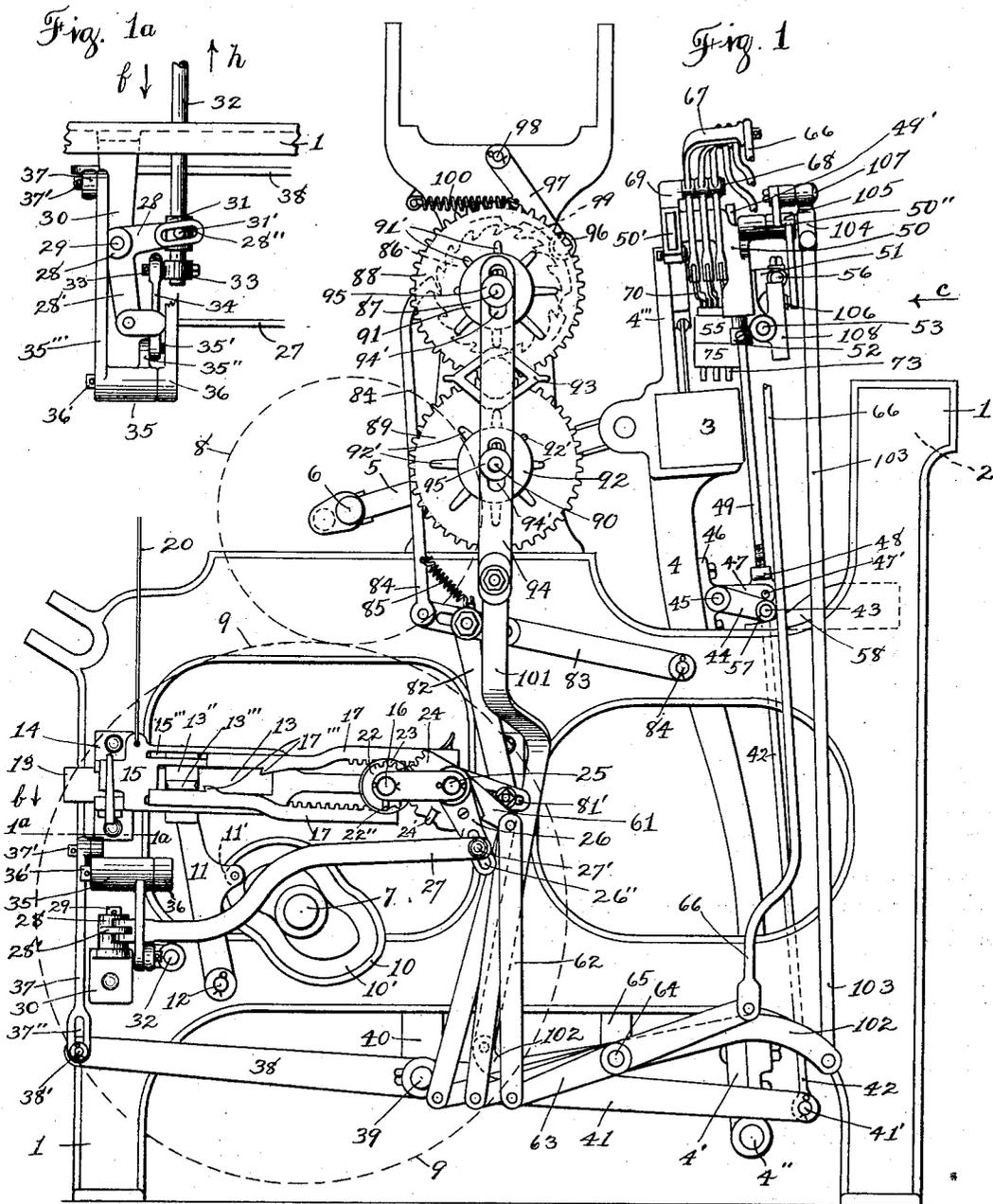


E. H. RYON.
SWIVEL LOOM.

NO MODEL.

APPLICATION FILED MAR. 26, 1902.

3 SHEETS—SHEET 1.



Witnesses
S. G. Kinsley
M. O'Leary

Inventor
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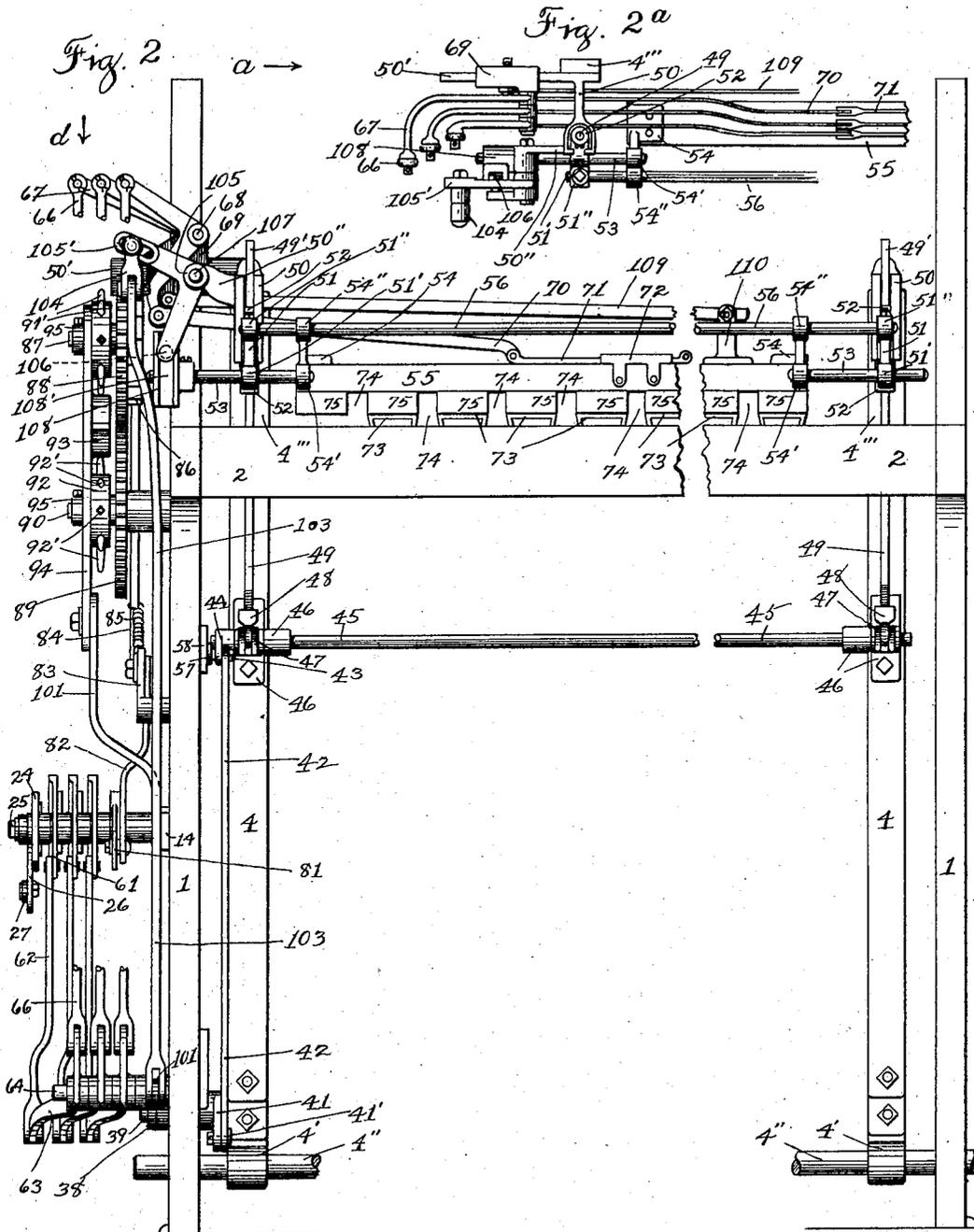
By
John C. Dewey. Atty

E. H. RYON.
SWIVEL LOOM.

NO MODEL.

APPLICATION FILED MAR. 26, 1902.

3 SHEETS—SHEET 2.



Witnesses
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John C. Dewey Atty.

No. 753,741.

PATENTED MAR. 1, 1904.

E. H. RYON.
SWIVEL LOOM.

APPLICATION FILED MAR. 26, 1902.

NO MODEL.

3 SHEETS—SHEET 3.

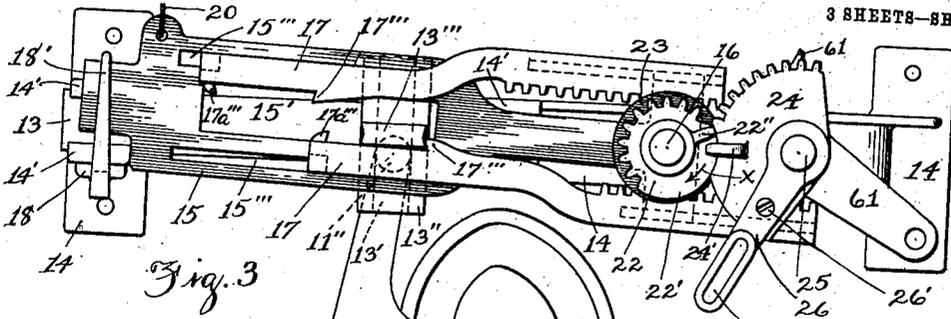


Fig. 3

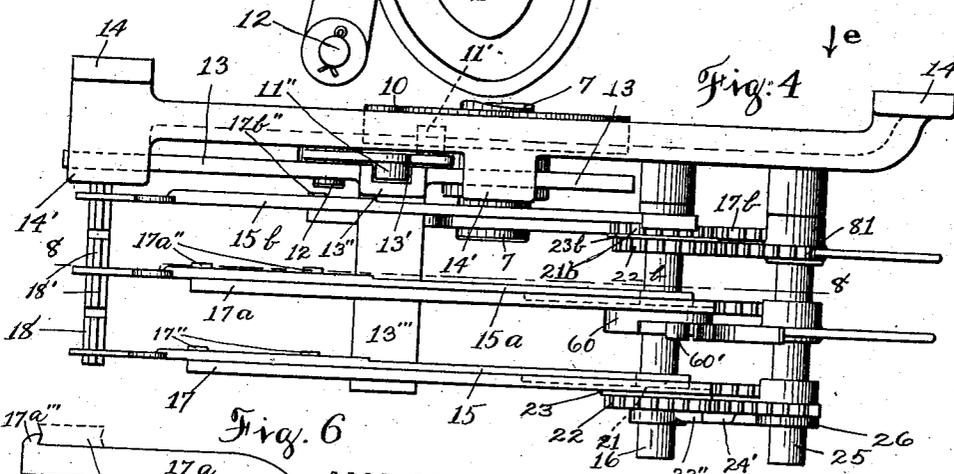


Fig. 4

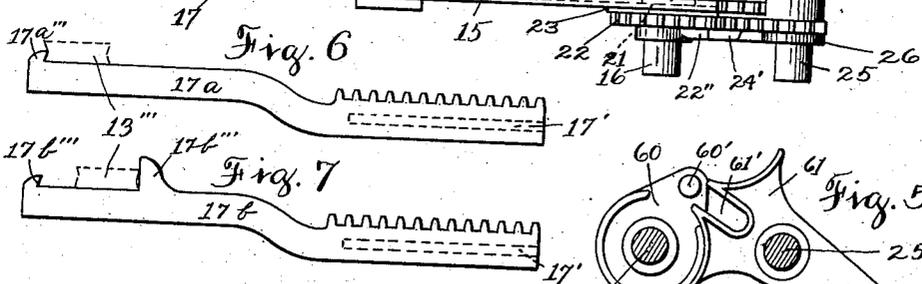


Fig. 5

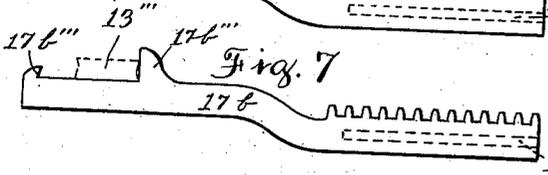


Fig. 6

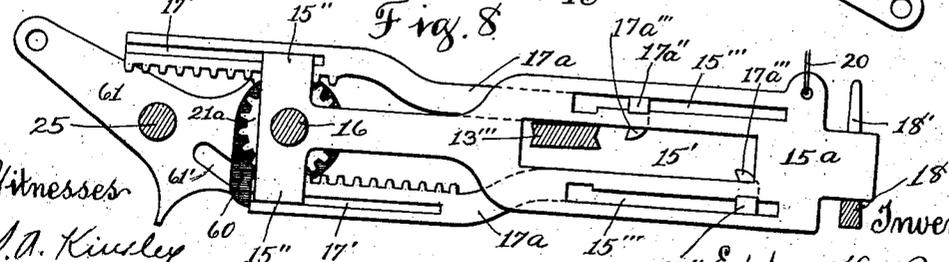


Fig. 7

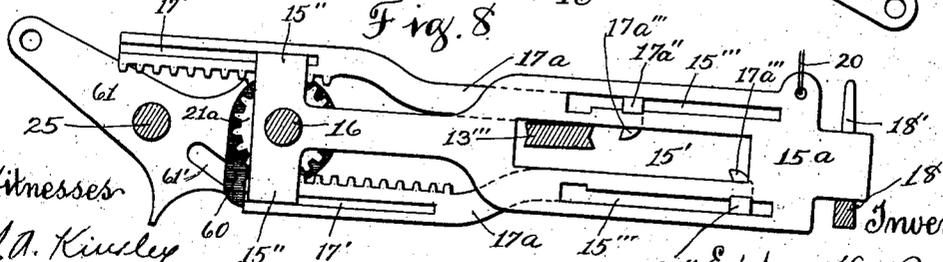


Fig. 8

Witnesses
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By
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UNITED STATES PATENT OFFICE.

EPPA H. RYON, OF WORCESTER, MASSACHUSETTS, ASSIGNOR TO CROMPTON & KNOWLES LOOM WORKS, OF WORCESTER, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

SWIVEL-LOOM.

SPECIFICATION forming part of Letters Patent No. 753,741, dated March 1, 1904.

Application filed March 26, 1902. Serial No. 100,081. (No model.)

To all whom it may concern:

Be it known that I, EPPA H. RYON, a citizen of the United States, residing at Worcester, in the county of Worcester and State of Massachusetts, have invented certain new and useful Improvements in Swivel-Looms, of which the following is a specification.

My invention relates to swivel-loom in which, in addition to the ordinary fly-shuttle for weaving the body of the fabric, one or more sets or series of swivel-shuttles arranged in parallel rows are used to weave spots or small figures on the face of the fabric, the swivel-shuttles being supported over the race-way on the lay and positively raised and lowered at the proper time from below and each set of shuttles moved transversely of the fabric independently and all the sets of shuttles moved simultaneously transversely of the fabric on the transverse movement of the swivel-shuttle rail.

The swivel-loom to which my improvements particularly relate is shown and described in United States Letters Patent No. 624,039, dated May 2, 1899, to which reference is hereby made. In said patent the well-known Knowles harness-shedding or shuttle-box-operating mechanism described in United States Letters Patent No. 134,992, of January 21, 1873, is used for operating the swivel-shuttles, and in said patent the shuttle-rail carrying the swivel-shuttles can have only two positions transversely of the fabric.

In my improvements I provide mechanism in place of the Knowles shuttle-box-operating mechanism of said patent for moving the swivel-shuttles, and I provide mechanism for operating the sliding-pick mechanism (which controls the action of the fly-shuttle mechanism) and mechanism for raising and lowering the swivel-shuttle rail carrying the swivel-shuttles different from the mechanism for the same purpose shown and described in said patent. I also provide mechanism for moving the swivel-shuttle rail and the swivel-shuttles transversely of the fabric, by which the swivel-shuttle rail may occupy the two extreme positions, as in said patent, and also

any intermediate position, which cannot be done on the loom shown and described in said patent.

My invention consists in certain novel features of construction and certain novel combinations of parts of my improvements in swivel-shuttle looms, as will be hereinafter fully described.

I have shown in the drawings only such portions of a fly-shuttle loom with my improvements applied thereto as will enable those skilled in the art to which my invention belongs to understand the construction and operation thereof.

I have not shown in the drawings the sliding-pick mechanism for controlling the action of the fly-shuttle mechanism, as the same may be of any ordinary and well-known construction ordinarily used in swivel-loom of the class above referred to—for example, the sliding pick mechanism shown and described in United States Letters Patent No. 474,170, of May 3, 1892.

I have shown in the drawings three sets or series of swivel-shuttles arranged in three parallel rows on the swivel-shuttle rail. Each set of swivel-shuttles is operated by independent mechanism controlled by the jacquard or pattern surface; but as the mechanisms are of the same construction and operation I have only shown in the drawings and described herein one of the mechanisms for operating the swivel-shuttles.

Referring to the drawings, Figure 1 is a side or end elevation of a portion of a loom with my improvements applied thereto looking in the direction of arrow *a*, Fig. 2. Fig. 1^a is a detached plan view of parts shown at the left in Fig. 1, connected with the sliding-pick mechanism (not shown) and taken at a point indicated by line 1^a 1^a, Fig. 1, looking in the direction of arrow *b*, same figure. Fig. 2 is a front elevation of my improvements shown in Fig. 1 looking in the direction of arrow *c*, same figure. Fig. 2^a is a detached plan view of some of the parts shown at the left and in the upper part in Fig. 2 looking in the direction of arrow *d*, same figure. Fig. 3 is a de-

tached view of some of the parts shown in Fig. 1 in a different position. Fig. 4 is a plan view of the parts shown in Fig. 3. Fig. 5 shows a pin-wheel and segment star-wheel detached. Fig. 6 shows a rack-bar shown in Fig. 3 detached. Fig. 7 shows a modified construction of the rack-bar shown in Fig. 6; and Fig. 8 is a cross-section on line 8-8, Fig. 4, looking in the direction of arrow *e*, same figure. Figs. 3 to 8, inclusive, are on an enlarged scale.

In the accompanying drawings, 1 is the loom side or frame; 2, the breast-beam; 3, the lay; 4, the lay-swords, attached at their lower ends to the plates 4', mounted on the shaft 4". The lay-swords 4 have the upwardly-extending lay-sword horns 4".

5 is the crank-connector, which connects the lay 3 with the crank-shaft 6.

7 is the bottom or driven shaft, which is geared to the crank-shaft 6 through gears 8 and 9. (Shown by broken lines in Fig. 1.)

All of the above parts are of the ordinary construction.

On the bottom shaft 7 is a cam 10, which has a grooved track 10' on one side, in which travels a pin or roll 11' on the lever 11, pivoted at its lower end on a stud 12 on the frame 1. The upper free end of the lever 11 carries a pin or roll 11", (see Figs. 3 and 4,) which engages a vertical groove 13' in the vertically-extending extension 13" on the horizontal reciprocating bar 13. The ends of the bar 13 are guided in grooves or ways in the offsets 14' on the stand 14, secured to the loom-frame 1.

The bar 13 has a side extension 13''' extending out at right angles therefrom. (See Fig. 4.)

The cam 10 rotates with the bottom shaft 7 and operates, through the lever 11, to communicate a reciprocating motion to said bar 13 in a horizontal plane. The extension or arm 13''' on the bar 13 has a free passage through the horizontal slots 15' in the three plates 15, 15^a, and 15^b, which plates are pivotally mounted at one end on a stud 16, fast in the stand 14, bolted to the loom side. (See Fig. 4.)

The plates 15, 15^a, and 15^b each have opposite side extensions 15'' at their pivoted ends, which extensions are bent at their ends to enter and engage ways or recesses 17' in the sides of the toothed bars or racks 17, 17^a, and 17^b. In the plates 15, 15^a, and 15^b at their free ends and parallel to the central slot 15' and on each side of said slot is the slot 15'''', in which travels the offset projections or key 17'', 17''', and 17'''' on the racks 17, 17^a, and 17^b, respectively. The slot 15'''' is enlarged at one end, as shown in Fig. 8, to permit the entrance through the slot of the key 17'', 17''', and 17'''' on the racks 17, 17^a, and 17^b, which key has an overhanging outer edge or lip to engage the plate and hold the racks in position adjacent to the plate. The free ends of the plates 15, 15^a, and 15^b are guided between

the upright teeth 18' on a comb 18, fast to the stand 14.

The lower end of a flexible connector 20 (see Fig. 1) is attached to the free end of each plate 15, 15^a, and 15^b, and the upper end of said connector is connected with the jacquard or other pattern-indicating mechanism (not shown) for the purpose of raising the plates 15, 15^a, and 15^b when desired.

I will first describe the mechanism connected with the outer plate 15, Figs. 1, 3, and 4, the raising and lowering of which plate at its free end, (by the connector 20, according to the indications of the pattern-surface,) through intermediate mechanism, controls the operation of the sliding-pick mechanism, (not shown,) which controls the action of the fly-shuttle mechanism and also controls the operation of the mechanism for raising and lowering the swivel-shuttle rail and swivel-shuttles at the proper time.

The two racks 17, connected with the front plate 15, as above described, have a reciprocating motion in a horizontal plane simultaneously in opposite directions through the arm 13''' on the bar 13, which extends freely through the slot 15' in the plate 15 and engages a projection 17''' on the upper or lower rack 17, (see Fig. 3,) according to whether the plate 15 is in its raised or lowered position at its free end.

The teeth on each rack 17 mesh with the teeth of a pinion 21, (not shown,) loose on the stud 16, to operate said pinion first in one direction and then in the other. Connected with the pinion 21 is the mutilated pinion 22, (see Fig. 3,) and between the pinion 21 and the pinion 22 is a thin disk 23, which operates to guide the toothed ends of the racks 17 and prevent their engagement with the partial or mutilated pinion 22.

The pinion 22 has a dwell portion 22' thereon adapted to engage the concave recess in the partial or mutilated segment gear 24, loosely mounted on a stud 25, fast in the stand 14. (See Fig. 3.) An offset tooth 22'' on the outer face of the pinion 22 is adapted to engage an offset tooth 24' on the outer surface of the segment-gear 24 to start the rotation of the gear 24 when the pinion 22 revolves in the direction of the arrow *x*, Fig. 3, and the engagement of the teeth on the pinion 22 with the teeth on the segment-gear 24 completes the partial rotation of the segment-gear 24 to move it from the position shown in Fig. 3 to the position shown in Fig. 1.

A lever or arm 26, mounted on the stud 25, is secured to the segment-gear 24 to move with it by a screw 26'. (See Fig. 3.) The outer end of the lever 26 has a slot 26'' therein, which is connected by a bolt 27' with one end of the connector 27. (See Fig. 1.) The other end of said connector 27 is pivotally connected to one arm 28' (see Fig. 1^a) of an angle-lever 28, pivotally mounted on a stud 29 on a

stand 30, fast to the frame. The other arm of the angle-lever 28 has a slot 28'' therein, into which loosely extends and travels a pin 31' on the collar 31, fast on the shaft or rod 32.

5 The movement of the angle-lever 28 on its pivot-stud 29 by the connector 27, through the partial rotation of the segment-gear 24, above described, will cause the shaft 32 to have a motion in the direction of its length. 70
10 The shaft 32 is connected with the sliding-pick mechanism, (not shown,) which controls the action of the fly-shuttle mechanism, which, as above stated, may be of the construction and operation shown in United States Letters
15 Patent No. 474,170 or of any other usual construction.

It will be seen in Fig. 3 that the arm 13''' on the bar 13, through the operation of the cam 10 and the lever 11, has been moved to its
20 extreme forward position or its extreme position to the right, and the lower rack 17 by engagement of the arm 13''' with the projection 17''' on said rack has also been moved to its extreme forward position or its extreme
25 position to the right, Fig. 3, the plate 15 being in its raised position at its free end to cause the arm 13''' on the bar 13 to engage the projection 17''' on the lower rack 17 and cause said rack to move with said arm 13'''.

30 The movement of the rack 17 to the position shown in Fig. 3 has caused the pinion 21, partial pinion 22, and the segment-gear 24 to move to the position shown in Fig. 3 and also caused the upper rack 17 to be moved to its extreme outward position.

In the continued revolution of the cam 10 through the lever 11 the arm 13''' on the horizontal bar 13 will be moved to the left, Fig. 3—that is, from the position shown in Fig. 3 to the position shown in Fig. 1—leaving the
40 lower rack 17 stationary, and consequently the pinion 21, partial pinion 22, and the segment-gear 24 and parts operated thereby. If on the following pick or any succeeding pick

45 it is desired to again rotate the partial gear 24 and move it into the position shown in Fig. 1 to operate the sliding-pick mechanism, an indication of the jacquard or other pattern-indicating mechanism through connector
50 20 will cause the plate 15 to be lowered at its free end and bring the upper rack 17 in such a position that the projection 17''' thereon will be engaged by the arm 13''' on the bar 13. The movement of the bar 13 forwardly,
55 or to the right, will cause the upper rack 17, Fig. 3, to be moved to the right, and, through its engagement with the pinion 21, rotate said pinion and the pinion 22 in the direction of arrow *a*, Fig. 3, to move the segment-gear 24
60 from the position shown in Fig. 3 to the position shown in Fig. 1 and operate, through intermediate connections, the shaft 32.

I will now describe the mechanism in this instance connected with the shaft or rod 32 and
65 operated by the movement of said shaft 32 to

positively raise the swivel-shuttle rail and swivel-shuttles and hold them in their raised position during the operation of the fly-shuttle and to lower the swivel-shuttle rail and swivel-shuttles into operative position when the fly-shuttle is not in operation. On the end of the shaft 32 is fast a collar 33, (see Fig. 1^a,) having a pin 33' thereon, to which is pivotally connected one end of a connector or link 34. The other end of said connector 34
70 is pivotally connected with a pin 35', fast in the arm 35'' of the angle-lever 35, the hub of which is loosely mounted on a stud 36' in the stand 36, secured to the frame. (See Fig. 1.) The other arm, 35''', of the angle-lever 35 is
75 pivotally connected at its end by a pin 37' to the upper end of the connector or link 37. The lower end of said connector 37 has a slot 37''' therein, through which extends loosely a pin 38' on the outer end of a lever 38, fast on
80 a rock-shaft 39, mounted in a stand 40, secured to the frame. (See Fig. 1.) Also fast on the rock-shaft 39 is one end of the lever 41, which has a pin 41' thereon at its other end, to which is pivotally connected the lower end
85 of the connector 42. The upper end of the connector 42 is connected by a stud 43 with the end of a crank-arm 44, which is fast on a rock-shaft 45, which extends transversely across the loom and has bearings in the stands
90 46, secured to the front of the lay-swords in Fig. 2.

Fast on the rock-shaft 45 are the inner ends of the two crank-arms 47, (see Fig. 2,) which are forked at their outer ends and carry a pin
95 47', (see Fig. 1,) on which are pivotally mounted a plate or coupling 48, into which is screwed the lower end of the upright rods 49, which at their upper ends 49' pass loosely through a guide-plate 50, secured to each lay-sword
100 horn 4'''. (See Fig. 2.) On the upper part of each rod 49 is a plate 51, held in position by collars 52 above and below the plate 51. On each plate 51 are hub-like extensions 51' and 51'', and in the lower hub, 51', is loosely
105 mounted a sliding rod 53, the inner end of which is fast in the hub 54' on a stand 54, secured to the upper side of the shuttle-rail 55. A rod 56 extends parallel to the rods 53 and is loosely mounted in the hubs 54'' on the
110 stand 54 and is secured at its ends in the hubs 51'' of the plates 51 (see Fig. 2) and acts to hold the swivel-shuttles in proper position.

On the stud 43, which connects the upright connector 42 with the crank 44 on the rock-shaft 45, is loosely mounted a roll 57, which
115 travels on a cam-surface 58, secured to the loom-frame, (see Fig. 1,) so that on the beating-up of the lay the rock-shaft 45 will be rotated, and through the upright rods 49 and
120 their connections the swivel-shuttle rail and swivel-shuttles will be positively raised out of the shed.

I will now describe the operation of the mechanism above described for raising and
125 130

lowering the swivel-shuttle rail and the swivel-shuttles carried thereon.

As shown in Fig. 1, the lay is in its rearward position and the swivel-shuttles have been lowered into the warp. (Not shown.) The movement of the shaft 32 by the mechanism above described in the direction of the arrow *f*, Fig. 1^a, will, through link 34, move the angle-lever 35 and cause the connector 37, attached to the end 35''' of said angle-lever, to move downwardly in the direction of arrow *b*, Fig. 1, and with it the lever 38, fast on the rock-shaft 39, to rock said shaft 39 and cause the lever 41, also fast on the shaft 39, to be moved upwardly and the connector 42 to be moved upwardly to raise the crank-arm 44 to rotate the rock-shaft 45. The rods 49, through the forked crank-arms 47, are also moved upwardly to move the plates 51 in their guide-plates 50 and raise the swivel-shuttle rail 55 through the rods 53, mounted in the hubs 51' on the plates 51 and fast in the hubs 54' on the stands 54, secured to the shuttle-rail. The movement of the shaft 32, Fig. 1^a, in the opposite direction or the direction of the arrow *h*, same figure, will, through the intermediate mechanism above described, lower the swivel-shuttle rail and the swivel-shuttles into operative position. (Shown in Figs. 1 and 2.)

I have shown in the drawings three sets or series of swivel-shuttles arranged in parallel rows, and I will now describe the means for operating the separate sets or series of shuttles to communicate a reciprocating motion thereto and carry them across the openings between the blocks on the under side of the shuttle-rail in the usual way.

The mechanism for operating each set of swivel-shuttles is the same—that is, they are duplicates of each other—and therefore it will only be necessary to describe one of the mechanisms. There is a plate 15^a, (see Fig. 4.) which corresponds to the plate 15, above described. There are two racks 17^a, similar to the racks 17, above described, except that the projections 17''' are on the extreme ends of the racks 17^a, as shown in Fig. 6, and are engaged by the rear edge of the arm 13''' on the bar 13. The racks 17^a engage the teeth on a pinion 21^a, (see Fig. 8.) loose on the stud 16 and fast to a pin-wheel 60, also loose on said stud 16. The pin-wheel 60 has a pin 60', which is adapted to enter the slot or recess 61' in the segment star-wheel 61, loose on the stud 25, to move said star-wheel 61 in one direction or the other, according to the direction of rotation of the pin-wheel 60 through the rotation of the pinion 21^a, caused by the movement of the racks 17^a, operated by the arm 13''' on the bar 13. To the outer end of the segment star-wheel 61 is pivoted the upper end of the connector 62. (See Fig. 1.) The lower end of said connector 62 is pivotally attached to one end of the lever 63, centrally pivoted on a stud

64 on a stand 65, secured to the loom-frame. The opposite end of the lever 63 is pivotally attached to the lower end of an upright rod 66. (See Fig. 1.) The rod 66 is shown broken away at its upper part. The upper end of said rod 66 is pivotally attached to one end of an angle-lever 67, (see Fig. 2,) mounted on a stud 68, fast in the upper end of a sliding plate 69, which has a rectangular slot therein and is mounted on the arm 50' on the guide-plate 50 (see Fig. 1) to move with said plate 50 and to have a movement in a horizontal plane on the arm 50' independent of the movement of said plate 50. To the other arm of the angle-lever 67 is pivotally attached one end of a connector 70. The other end of said connector is attached to the sliding bar 71, guided in the plate 72 on the swivel-shuttle rail, and connected with a rack engaging pinions (not shown) to move the swivel-shuttles 73 to the right and left across the opening 74 between the block 75 on the under side of the swivel-shuttle rail 55 in the usual way and as fully shown and described in Patent No. 624,039, above referred to. It will be seen that when the plate 15^a is moved into its raised position by the connector 20 the arm 13''' will engage the projection 17''' on the lower rack 17^a and move said rack to the left, Fig. 3, to cause it to rotate the pinion 21^a and the pin-wheel 60 and move the segment star-wheel 61 from the position shown in Figs. 3 and 5 to the position shown in Fig. 8, and through the intermediate connections from the star-wheel 61 to the set of swivel-shuttles connected therewith move the set of swivel-shuttles to the left in Fig. 2. When the plate 15^a is lowered, then the arm 13''' on the bar 13 will engage the projection 17''' on the upper rack 17^a, as shown in Fig. 8, and move said rack and through the pinion 21^a and the pin-wheel 60 move the star-wheel 61 from the position shown in Fig. 8 to the position shown in Fig. 3 and through intermediate connections move the swivel-shuttles in the opposite direction or to the right in Fig. 2. Each row of swivel-shuttles will thus be independently moved according to the indications of the pattern-surface, which control through connector 20 the raising and lowering of the plate 15^a.

In addition to the raising and lowering of the swivel-shuttle rail and the swivel-shuttles and the independent movement of each set of swivel-shuttles the swivel-shuttle rail and all the swivel-shuttles may be simultaneously moved transversely of the warp-threads to their extreme end positions or to intermediate positions.

I will now describe the mechanism for moving the swivel-shuttle rail and the swivel-shuttles transversely of the warp-threads.

The plate 15^b, Fig. 4, corresponds to the plates 15 and 15^a, above described. A pinion 21^b is loosely mounted on the stud 16 and is engaged and rotated by a rack-bar 17^b, which

in this instance corresponds to the lower rack 17 and 17^a, above described, except that it has two projections 17^{b''}. (Shown in Fig. 7.)

An upper rack is not used in this instance with the plate 15^b. The arm 13^{'''} of the bar 13 engages a projection 17^{b''} on the rack 17^b on its forward or backward stroke. The pinion 21^b is fast to a pinion 22^b, loose on the stud 16, and a disk 23^b extends between the pinions 21^b and 22^b. The pinion 22^b is similar to the pinion 22, above described, except that the dwell 22' on the pinion 22 is not required. The pinion 22^b is in mesh with the teeth on a partial or segment gear 81, loose on the stud 25 and having the slotted arm 81', to which is pivoted the lower end of the connector 82. (See Fig. 1.) The upper end of the connector 82 is pivotally connected to the slotted end of the lever 83, pivotally supported on a stud 84. On the extreme end of the lever 83 is pivotally mounted the lower end of a pawl 84, held by a spring 85, attached to the pawl 84 and the lever 83 in engagement with the teeth on the ratchet-wheel 86. (Shown by broken lines in Fig. 1.) The ratchet-wheel 86 is loosely mounted on a stud 87 on the loom-frame and has attached thereto a gear 88, the teeth of which engage the teeth of the gear 89, loosely mounted on a stud 90 on the loom-frame. Fast to the gears 88 and 89 are the pattern disks or surfaces 91 and 92, having in this instance removable pattern-pins 91' and 92', extending out from their peripheries and forming pattern-indicating surfaces to control through intermediate mechanism the longitudinal or transverse motion of the swivel-shuttle rail and swivel-shuttles. The projecting ends of the pattern-pins 91' and 92' are adapted to engage the upper and lower inclined edges of the diamond-shaped cam 93, fast upon the inside of the upright movable bar 94. Said bar 94 has vertical slots 94' therein, through which the studs 87 and 90 loosely extend, and collars 95 on said studs hold the upright movable bar 94 in proper position as it is raised or lowered.

As a check device for holding the ratchet-wheel 86 and gear 88 after each partial revolution a roll 96, mounted on a stud on the free end of the lever 97, pivoted on the loom-frame at 98, extends into a recess in the periphery of the disk 99, fast to the ratchet 85. A spring 100, attached at one end to the lever 97 and at its other end to the frame, acts to hold the roll 96 in engagement with the periphery of the disk 99 (shown by broken lines in Fig. 1) to hold said disk and the ratchet after each partial rotation thereof.

Attached to the lower end of the vertically-moving bar 94 is a connector 101, which is inwardly bent, as shown in Figs. 1 and 2, to avoid contact with the other parts. The lower end of the connector 101 is attached to one end of a lever 102, centrally pivoted on the stud 64. The other end of the lever 102 is pivotally at-

tached to the lower end of the upright rod 103. The upper end of said rod 103 is pivotally attached to the forked end of a link 104, as shown in Fig. 2. The upper end of the link 104 is connected with the slotted arm 105' of the angle-lever 105, which is pivotally mounted on a stud 107 on the arm 50'', extending from the side of the guide-plate 50. The other arm of the angle-lever 105 carries a pin or roll 106, (shown by dotted lines in Fig. 2,) which travels in a vertical slot 108' in the plate 108, fast on the outer end of the rod 53, loosely mounted in the hub 51' on the plate 51 and secured at its end in the hub 54' on the stand 54, fast on the swivel-shuttle rail 55.

I will now describe the operation of the mechanism above described for moving the swivel-shuttle rail and the swivel-shuttles transversely of the fabric.

The plate 15^b is raised or lowered by the connector 20, according to the indications of the jacquard or other pattern surfaces, and the rack-bar 17^b is moved by the arm 13^{'''} on the horizontally-moving bar 13 in one direction or the other to rotate, through pinion 21^b and pinion 22^b, the gear-segment 81, and through connector 82 and lever 83 move down the pawl 84 to rotate the ratchet-wheel 85 and gears 88 and 89 and pattern-disks 91 and 92. The rotation of the disks 91 and 92 causes the radial pins 91' and 92' thereon to engage the opposite peripheries of the cam 93 on the upright bar 94 and cause said bar to be raised or lowered. The length of the radial pins 91' and 92' vary; but the total length of any two pins operating at the same time upon the cam 93 will equal the total possible amount of movement given to the bar 94. The vertical movement of the bar 94 operates, through connector 101, lever 102, and upright rod 103, to move the lever 105 and through the plate 107 and rod 52 move the shuttle-rail 55, carrying the swivel-shuttles transversely or to the right or left, as desired, according to the length of the pattern-pins 91' and 92'. When the shuttle-rail 55, carrying the swivel-shuttles, is moved transversely in the direction of its length, it is necessary that the other parts, and particularly the stud 68, on which the lever 67 is mounted, should move with it, and therefore a connector 109 is pivotally attached at one end to the sliding plate 69 (see Fig. 2) and at its other end to a stand 110, fast to the upper side of the shuttle-rail.

It will be understood that the details of construction of my improvements may be varied, if desired, and my improvements may be applied to fly-shuttle looms of ordinary construction and made to cooperate with the usual operating mechanism of such looms.

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

1. In a swivel-loom, mechanism for moving a set of swivel-shuttles transversely of the

5 fabric, comprising a lever or plate, adapted to be moved, through connections to a jacquard or other pattern mechanism, two toothed bars or racks connected to said plate and moving therewith, and moved independently of said plate, and means for moving said racks simultaneously in opposite directions, a pinion meshing with and moved by said racks, and connections intermediate said pinion and the swivel-shuttles, substantially as shown and described.

15 2. In a swivel-shuttle loom, mechanism for moving a set of swivel-shuttles transversely of the fabric, comprising a lever or plate, adapted to be moved through connections to a jacquard or other pattern mechanism, two toothed bars or racks connected to said plate and moving therewith, and moved independently of said plate, and means for moving said racks simultaneously in opposite directions, a pinion meshing with said racks, a pin-wheel operated by said pinion, a segment star-wheel operated by said pin-wheel, a connector to a centrally-pivoted lever, and said lever, a connector to an angle-lever, and said angle-lever, and connections therefrom to a set of swivel-shuttles, substantially as shown and described.

30 3. In a swivel-shuttle loom, mechanism for operating the sliding-pick mechanism, and for raising and lowering the swivel-shuttle rail, comprising a lever or plate, adapted to be moved through connections to a jacquard or other pattern mechanism, two toothed bars or racks connected to said plate and moving therewith, and moved independently of said plate, and means for moving said rack simultaneously in opposite directions, a pinion meshing with said racks, a second pinion operated by said pinion and meshing with a gear-segment, and said gear-segment, and connections therefrom to a sliding shaft or rod connected with the sliding-pick mechanism, and connections from said sliding shaft or rod, operated thereby, to the swivel-shuttle rail to positively raise and lower said rail, substantially as shown and described.

40 4. In a swivel-shuttle loom, mechanism for operating the sliding-pick mechanism, comprising a lever or plate, adapted to be moved through connections to a jacquard or other pattern mechanism, two toothed bars or racks connected to said plate, and moving therewith, and moved independently of said plate, and means for moving said racks simultaneously in opposite directions, a pinion meshing with said racks, a second pinion operated by said pinion and engaging and operating a segment-gear, and said segment-gear having an arm thereon, and a connector from said arm to an angle-lever, and said angle-lever connected with a sliding shaft or rod, and said rod connected with the sliding-pick mechanism, substantially as shown and described.

55 5. In a swivel-shuttle loom, mechanism for positively raising and lowering the swivel-

shuttle rail and the swivel-shuttles, comprising a lever or plate adapted to be moved through connections to a jacquard or other pattern mechanism, two toothed bars or racks connected to said plate and moving therewith, and moved independently of said plate, and means for moving said racks simultaneously in opposite directions, a pinion meshing with said racks, a second pinion operated by said pinion and meshing with and operating a segment-gear, and said gear having an arm thereon, a connector from said arm to an angle-lever, and said angle-lever connected with a sliding shaft or rod, and said rod, and a connector therefrom to a second angle-lever, and said angle-lever, and a connector therefrom to a lever, and said lever, and a second lever moving therewith, and a connector therefrom to a crank-arm on a rock-shaft, and said rock-shaft, and arms on said shaft, and upright rods from said arms to sliding plates, and said plates, and a sliding shaft loosely mounted in a bearing on said plates, and fast to a stand on the swivel-shuttle rail, and said stand, substantially as shown and described.

60 6. In a swivel-shuttle loom, the swivel-shuttle rail carrying swivel-shuttles, rotatable disks or surfaces carrying removable pattern-pins, and said pattern-pins, and means for rotating said disks, and connections intermediate said pattern-pins and the swivel-shuttle rail, to positively move the swivel-shuttle rail, transversely of the fabric, to its two extreme positions, and also to positions intermediate its extreme positions, substantially as shown and described.

70 7. In a swivel-shuttle loom, a lever or plate adapted to be moved through connections to a jacquard or other pattern mechanism, a toothed rack or bar connected to said plate and moving therewith, and moved independently of said plate, and means for moving said rack, a pinion meshing with said rack, and intermediate connections from said pinion to a pawl for actuating a ratchet-wheel, and said ratchet-wheel and pawl, and two gears actuated by said ratchet-wheel, and pattern-surfaces connected with and rotating with said gears, and connections intermediate said pattern-surfaces and the swivel-shuttle rail, to move the swivel-shuttle rail and swivel-shuttles transversely of the fabric to its two extreme positions, and also to positions intermediate its extreme positions, substantially as shown and described.

80 8. In a swivel-loom, a lever or plate connected with a jacquard or other pattern mechanism, and adapted to be raised or lowered, a rack guided by said plate, a pinion moved by said rack, mechanism for moving said rack and pinion, and connections from said pinion to a swivel-shuttle rack, to move said shuttle-rack back and forth, substantially as shown and described.

90 9. In a swivel-loom, the swivel-shuttle rail carrying swivel-shuttles, mechanism for posi-

tively moving the swivel-shuttles transversely of the warp, said mechanism consisting of two series of pattern-surfaces, a follower or cam interposed between said pattern-surfaces, and connections between said follower and the swivel-shuttle rail, substantially as shown and described.

10 10. In a swivel-loom, the swivel-shuttle rail carrying swivel-shuttles, pattern mechanism consisting of a series of changeable pattern-surfaces, oppositely disposed, and operatively

connected, a double cam-surface interposed between said pattern-surfaces, and connections between said double cam-surface and the swivel-shuttle rail to positively move said swivel-shuttle rail, in opposite directions, transversely of the warp, substantially as shown and described. 15

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