Sheet 1, 2 Sheets.

L. J. Knowles.

Shuttle Box.

No. 110,146. Patented Dec. 13, 1870.

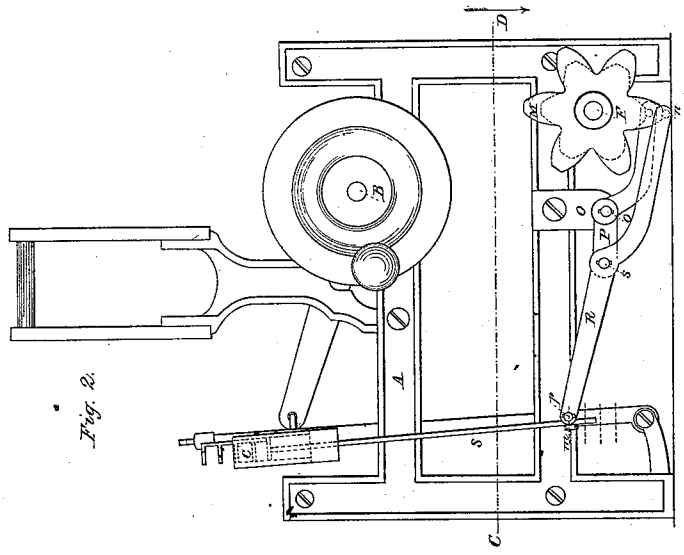

Fig. 2.

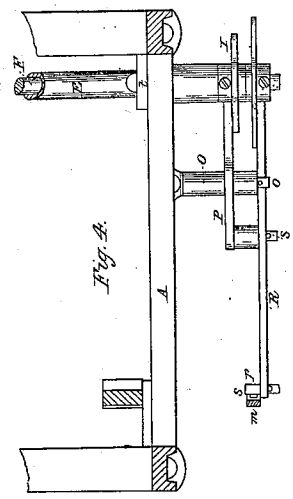

Fig. 4.

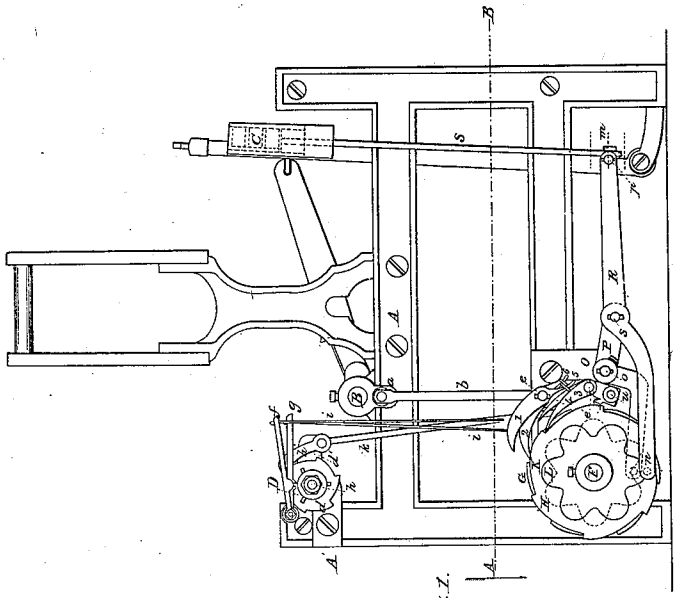

Fig. 1.

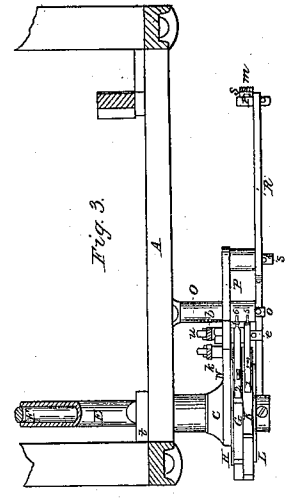

Fig. 3.

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Sheets, 2 Sheets.

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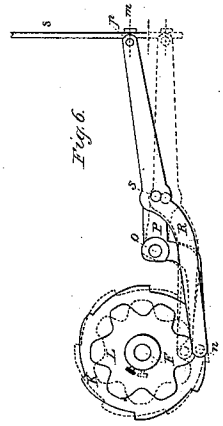

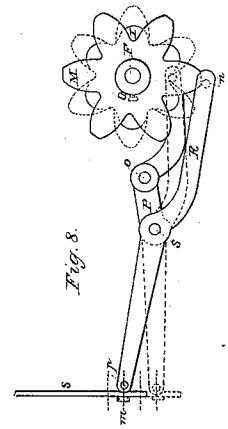

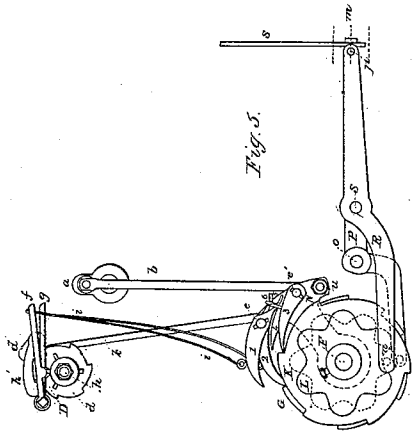

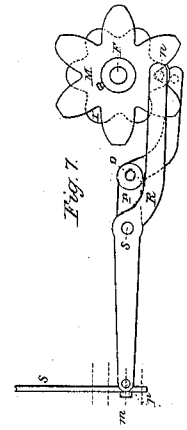

Witnesses.
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UNITED STATES PATENT OFFICE.

LUCIUS J. KNOWLES, OF WARREN, MASSACHUSETTS.

IMPROVEMENT IN MECHANISM FOF OPERATING SHUTTLE-BOXES IN LOOMS.

Specification forming part of Letters Patent No. **110,146**, dated December 13, 1870.

To all whom it may concern:

Be it known that I, L. J. KNOWLES, of Warren, in the county of Worcester and Commonwealth of Massachusetts, have invented certain new and useful Improvements in Fancy Looms; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, in which—

Figure 1 represents an end view of my improvements in fancy looms as applied to looms with three boxes. Fig. 2 represents an end view of my improvements as applied to looms with four boxes. Fig. 3 represents a section on line A B, Fig. 1, with a part of the frame-work and shafting broken off. Fig. 4 represents a section on line C D, Fig. 2, with a part of the frame-work and shafting broken off. Fig. 5 represents the working parts shown in Fig. 1, after the main shaft has made one-half revolution. Fig. 6 represents different positions of the operating levers, cams, and ratchet-wheels shown in Fig. 5. Fig. 7 represents in different positions the operating levers and cams shown in Fig. 2, and Fig. 8 represents further changes of the same.

To enable those skilled in the art to which my invention belongs to make and use the same, I will proceed to describe it more in detail.

The nature of my invention consists, first, in the peculiar construction and combination of the levers and cams which move the boxes, as will be hereinafter described; second, in the peculiar construction, combination, and arrangement of the ratchet device employed for operating the shuttle-boxes.

The nature of my invention also consists in the combination and arrangement of the ratchet-wheels and their respective cams and shafts in the manner hereinafter explained.

In the drawings, A is the frame of the loom, B the main shaft, C the shuttle-boxes, and D the pattern-wheel, all of which are arranged in the usual form and manner, and therefore require no further description.

At the lower part of the frame, near the back, is a hollow shaft, E, supported by bearings *t*, attached to the frame of the loom, inside of which hollow shaft is supported and turns a shaft, F, both extending the length and beyond the ends of the loom, the ends of shaft F projecting beyond the ends of shaft E.

At one end of shaft E is fastened a ratchet-wheel, G, and a star-shaped cam, H, (shown in full lines in Fig. 3 and by dotted lines in Figs. 1 and 5,) and at its other end is fastened a similar cam, I, as shown by dotted lines in Fig. 1 and in full lines in Figs. 4, 7, and 8.

To one end of the shaft F is fastened a similar ratchet, K, and cam L, while to its other end is shown fastened a somewhat larger cam, M, for the purpose hereinafter explained.

Upon the hollow shaft E, between the cam H and the bearing *t*, is slipped the hub *e* of arm N, which extends forward to beyond the circumference of the ratchet-wheels G and K.

Projecting from near the forward end of arm N is a stud, *u*, connected to the main shaft B by means of the crank *a* and connecting-rod *b*, by which the arm N is caused to oscillate when the loom is in motion, swinging freely on the shaft E.

From the outside of the front end of arm N, which is made T-shaped, project two studs or pivots, *e* and *e'*, upon which are hung and swing freely the pawls 1 2 3 4. The pawls 1 and 2 are made with small spurs or projections 5 and 6, extending downward through hooks or loops placed in the tops of the pawls 3 and 4, as shown in the drawings, and so arranged that when pawls 1 and 2 engage the ratchets the pawls 3 and 4 are raised, and when pawls 1 and 2 are raised pawls 3 and 4 engage the ratchets, pawls 1 and 3 operating the ratchet-wheel K and shaft F, and pawls 2 and 4 operating the ratchet-wheel G on shaft E. The pawls 1 and 2 are connected by means of cords, chains, or rods *i i* to the levers *f* and *g*, which rise and fall with the changes of the pattern-wheel D. The pattern wheel D, ratchet *d*, and pawl-supporting arm *d'* are all supported and work upon the stud *h*, which projects from the piece A', fastened to the frame A. The ratchet *d* and pattern-wheel are operated by the pawl-hook *h'*, pivoted to the arm *d'*, which is connected to the arm N by the rod *k*.

From the frame at each end of the loom projects a stud, O, upon which work levers P, their fulcra being at *o*.

In the ends of the levers P are fixed pins which engage with the cams H and I upon the hollow shaft E, the other ends being furnished

with studs projecting outward, which form fulcra for the long levers R, as shown in the drawings.

To the forward ends of levers R are secured pivots *p*, to which are fastened the lower ends of rods S, which support the drop or shuttle boxes C, the rods S being slotted at their lower ends and secured to the pivots *p* by means of the set-screws *m*, which pass through their slotted ends, as fully indicated in the drawings, whereby the rods S can be adjusted to support the boxes C at any desired height. Pins *n* in the other ends of the levers R engage with the cams on the shaft F.

The ratchet-wheels G and K are so constructed that the distance between the ratchets is twice the length of the arc described by the movement of the pawls. Therefore, when the ratchet-wheels have been move forward by the pawls 2 and 3 to the position shown in Fig. 5 they will remain in that position until the pawls 1 and 4 are lowered so as to engage the ratchets; hence it will be seen that each time the pawls are changed the ratchet-wheels and cams are moved forward a distance of one-half tooth only, and there remain until the positions of the pawls are again changed, when they are moved one-half tooth farther. The pawls 1 and 2 always give the boxes an upward and the pawls 3 and 4 a downward motion.

The operation is as follows: A cam the size of cam I being substituted for the large cam M, (which is shown upon shaft E in the drawings for a purpose which will be hereinafter described,) the loom will be arranged for weaving with three boxes. The parts being in position as shown in Fig. 1, the end of the lever P being in the hollow of cam H, and the end of lever R at the point of cam L, the center box is now in position to receive the shuttle. (The blue lines in the drawings indicate the different positions.) The loom being started, the shaft B, making one-half revolution, brings up the arm N, with the pawls 1 2 3 4, by means of the crank *a* and connecting-rod *b*, to the position shown in Fig. 5, the pawl 3 engaging the ratchet-wheel K and pawl 2 engaging the ratchet-wheel G, thereby turning the cams H and L one step, which brings the lever P to the point of cam H and lever R to the hollow of cam L, which operation does not change the position of the boxes, as will be seen in Fig. 5. The remaining half-revolution of the shaft again carries the arm N back to the position shown in Fig. 1, the rod *k* and pawl-hook *k'* moving the pattern-wheel D one step, which raises both the levers *f* and *g*, bringing up the pawl 2 and letting down pawl 4, which, as the arm N again rises, moves forward the ratchet-wheel G and cam H, while the ratchet-wheel K and cam L remain stationary. This movement brings both the levers P and R into the hollows of their respective cams and moves the box to its lowest point, as shown in red lines, Fig. 6. The changes of the pattern-wheel D ther bringing both of the levers *f* and *g* down, the pawls 1 and 2 engage the ratchet-wheels G and K, moving both to the position shown in black lines, Fig. 6, which brings the levers P and R both to the points of the cams H and L, thereby raising the boxes two steps to their highest point.

In applying my improvements to a loom with four boxes, large cams, like M, are applied to shaft F, in lieu of the small cams used in operating the boxes above described, thereby moving the boxes two steps with the motion of the lever R from the hollow to the points of the cam M.

In Fig. 2 the boxes are represented at their highest position, the end of both levers P and R being at the points of the cams M and I. Now, by moving the cams M one step the boxes are brought down two steps by the lever R, as shown in Fig. 7. Then by moving the cam L one step the levers are brought to the position shown by red lines in Fig. 8, the ends of both levers in the hollow of the cams and the boxes are brought to their lowest position. Again, by moving the cams M one step farther the ends of the levers R are brought to the points of cams M, while the ends of the levers P remain in the hollow of cams I, and the levers are in position, as shown in black lines, Fig. 8, the boxes being moved to the position next to the highest. Again, the boxes may be moved regularly up or down one step or box at a time, an illustration of which may be given as follows: Commencing with the boxes in the highest position, as shown in Fig. 2, cams I are moved forward, so that the pins in the rear ends of levers P will rest in the hollows of said cams, thereby lowering the boxes one step or box, as shown in dark lines, Fig. 8. Both sets of the cams M and I are now moved forward one step, which brings the pins of levers R in the hollows of cams M, and the pins of levers P to the points of cams I, thus lowering the boxes one step or box more, as indicated in Fig. 7. The cams I are now moved forward one step, bringing the pins in levers P to the hollows of said cams, while cams M remain stationary, whereby the boxes are lowered one step or box farther, to the position shown by red lines in Fig. 8.

From the foregoing it will be seen that any box can be brought into the proper and desired working position without a back motion of the cams. It will also be noticed that lever R is made to move one or more boxes, either up or down, as may be desired, by reason of the peculiar action of lever P, to which it is fulcrumed.

In the second change of the boxes in the illustration last above given, the effect of the movement of the cam M upon lever R would have lowered the boxes two steps, but for the action of cam I upon lever P, which raised at the same time the fulcrum of lever R, thereby producing what I call a "discount" of one step, which resulted in the lowering of the boxes one step only. Again, if the boxes are

down, as shown in red lines, Fig. 8, and it is desired to raise them gradually one step at a time, cams I are moved forward one step, thereby raising one box, as shown in Fig. 7. Both sets of cams are now moved forward one step, thereby raising the shuttle-boxes one step more, or to the position indicated in dark lines, Fig. 8. The "discounting" operation taking place, cams I are now moved forward one step, which raises the boxes one step more, or to the highest point, as shown in Fig. 2.

Having described my improvements in fancy looms, what I claim therein as new and of my invention, and desire to secure by Letters Patent, is—

1. The combination, with each cam for operating the boxes, of a ratchet with half the number of teeth there are steps in the cam, and two oscillating pawls, each of which will move the ratchet forward a distance equal to one-half the length of the ratchet-tooth, serving the one to raise and the other to lower the boxes, substantially as shown and described.

2. In combination with the cams, ratchets, and pawls, operating together, as claimed in the preceding clause, the compound lever for raising and lowering the drop-box composed of two levers pivoted one to the other, and actuated by their several cams in the manner set forth, the cams and levers being constructed and arranged as specified, so that the range of movement of one of the levers shall be double that of the other, to admit of the discounting operation herein described.

3. The combination of the spurs or projections 5 and 6 on the pawls 1 and 2 with the loops or hooks on the pawls 3 and 4, substantially as shown, and for the purposes described.

4. The combination and relative arrangement of shafts E F, ratchets G K, cams H L, pawls 1 2 3 4, arms N, and connections *b k i i*, substantially as and for the purposes set forth.

5. The combination and relative arrangement of the levers P R, cams H L, ratchet-wheels G K, and arm N, with shafts E F, pawls 1 2 3 4, rod S, and connections *b k i i*, substantially as and for the purposes set forth.

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