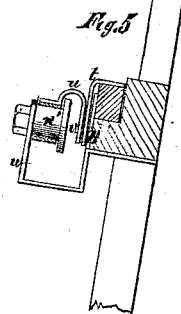
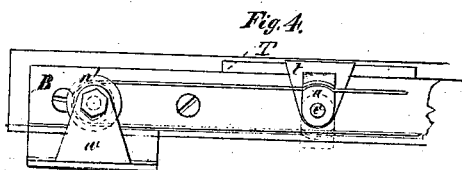
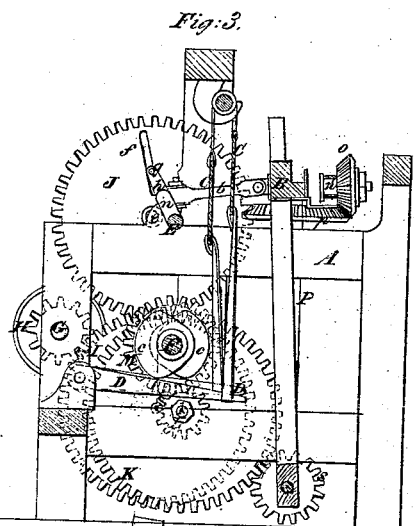
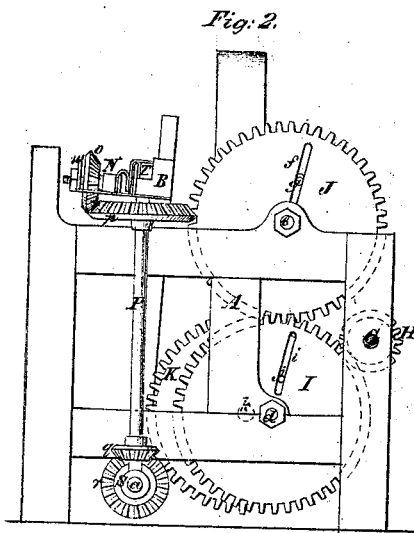
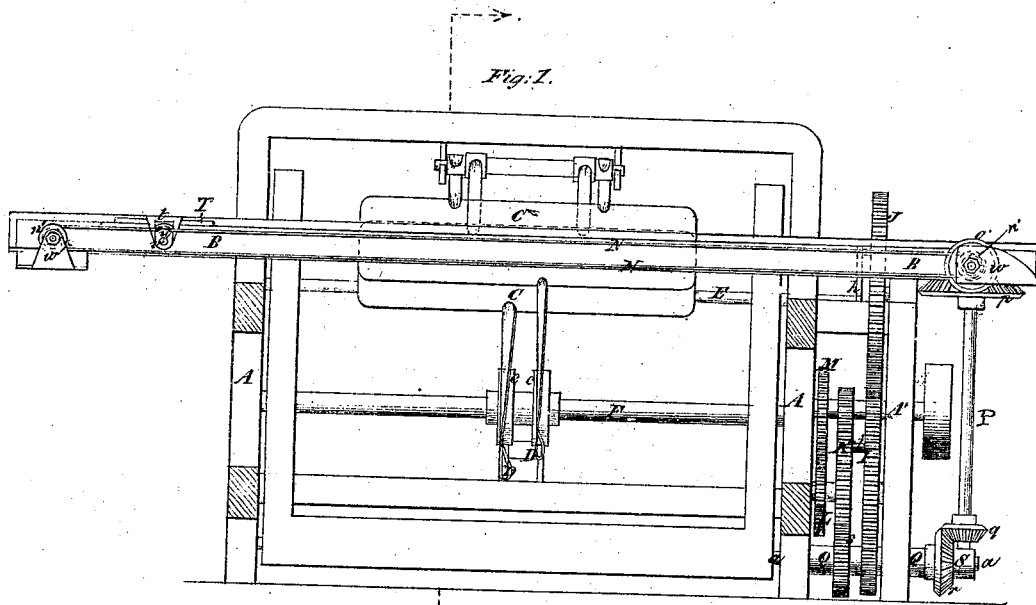


*R. Whitehill,*

*Shuttle Motion*

*No. 110,524.*

*Patented Dec. 27, 1870.*



*Witnesses*  
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# United States Patent Office.

ROBERT WHITEHILL, OF NEW YORK, N. Y., ASSIGNOR TO THE POSITIVE-MOTION LOOM COMPANY, OF SAME PLACE.

Letters Patent No. 110,524, dated December 27, 1870.

## IMPROVEMENT IN LOOMS.

The Schedule referred to in these Letters Patent and making part of the same.

*To all whom it may concern:*

Be it known that I, ROBERT WHITEHILL, of the city, county, and State of New York, have invented a new and useful Improvement in Power-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 drawing forming part of this specification, in which—

Figure 1 is a front elevation of a power-loom, having the breast-beam and front portion of the frame removed to show some of the working parts.

Figure 2 is a right-hand end view of the same.

Figure 3 is a vertical section of the same, at right angles to fig. 1, in the plane indicated by the line *x x* in the latter figure, and showing the parts on the right of that plane.

Figure 4 is a front view of a part of the shuttle-operating mechanism, on a larger scale than the other figures.

Figure 5 is a transverse section corresponding with fig. 4.

Similar letters of reference indicate corresponding parts in the several figures.

This invention relates in part to means of driving the lay, the harness, and the shuttle of a loom, with alternately-accelerated and retarded velocities, the velocity of each being retarded at the proper stages of the operation of the loom to obtain time for the working of other parts of the loom, and being accelerated during those stages in the operation in which acceleration is desirable or permissible.

The invention also relates in part to what is known as a positive shuttle-motion, and consists in novel means of imparting motion to the shuttle-carrier from an endless band.

To enable others skilled in the art to make and use my invention, I will proceed to describe it with reference to the drawing.

A A are the ordinary side frames of the loom, and A' is an additional side frame provided on the right side for the support of some of the driving gearing, as will be presently described.

B is the lay, arranged to swing in the usual manner. Its right-hand pivot *a* is extended across the space between the additional side frame A' and the adjacent side frame A, and is extended through the exterior of the said frame A' for the reception of gears, which will be presently described.

C C are the heddle-frames, hung in the usual manner, and connected below with treadles D D, arranged in the manner common to most looms.

E is the crank-shaft, and F is the harness cam-shaft, both arranged in bearings in the side frames A A in the usual way, but not directly geared together.

The cranks *n* of the shaft E are connected with the lay by connecting-rods *b*, as in other power-loom.

The cams *c c* on the shaft F, for operating on the treadles D D, are or may be of ordinary form.

G is the driving-shaft, which is nearly long enough to be supported and to work in bearings in the back parts of the outer side frame A' and of adjacent side frame A.

This shaft carries a small spur-gear, H, which gears with a larger one, I, turning loosely on a fixed stud, *d*, which is firmly secured in the lower part of the side frame A'.

The gear I gears with a gear, J, of the same size, turning loosely on a fixed stud, *e*, which is firmly secured in the outer side frame A' a short distance in rear of the line of the axis of the crank-shaft. The gear H on the driving-shaft produces the motion of the gears I and J, in opposite directions but at corresponding velocities.

The gear J contains a radial slot, *f*, which receives the wrist *g* of a crank, *h*, which is fast upon the end of the crank-shaft E, and the direction of which is coincident with that of the ordinary cranks *n* which connect with the lay.

The gear I contains a radial slot, *i*, which receives a crank-pin, *j*, secured in a spur-gear, K, which turns loosely on a fixed stud, *k*, which is secured firmly in the right-hand side frame A, a little forward of the line of the axis of the stud *d*.

The gear K carries a small spur-gear, L, which gears with a spur-gear, M, having twice the number of teeth, on the cam-shaft F.

The gear J drives the crank-shaft through the agency of the slot *f* and crank-pin *g*, above described. In the revolution of the said crank-pin and crank-shaft, owing to the eccentricity of the axis of the gear J and crank-shaft, the said crank-pin working in the said slot, approaches the center of the wheel J during one-half of each revolution, and recedes from it during the other half; and the consequence is, that as the lay is thrown forward by the cranks, its velocity is gradually accelerated, and as it is thrown back its velocity is gradually retarded, and its movement both back and forth, while it is near its most backward position, is so slow that ample time is afforded for the passage of the shuttle through the warp, which takes place while the lay is thrown back.

The gear I drives the gear K by means of the slot *i* and crank-pin *j*, and the gear L, which is carried by K, drives the gear M on the cam-shaft, and so imparts rotary motion to the said shaft, such rotary motion being alternately accelerated during one-half and retarded during the other half of each revolution of the gears I and K by the pin *j*, working in the slot

*i* from and toward the center of the gear I, owing to the eccentricity of the axis of the gears I and K.

As the cam-shaft makes two revolutions for every one of the gear I, the acceleration and retardation of the velocity takes place twice during each revolution.

The slot *i* and pin *j* are so arranged with respect to the crank-wrist *g* and slot *f* in the gear J, which drives the crank-shaft, that the acceleration of the velocity of the cam-shaft commences just after the lay has commenced moving back, and while the velocity of the latter is being retarded, and that the retardation of the velocity of the cam-shaft commences just after the lay has commenced moving forward; and the cams *c c* are so arranged with respect to the crank-pin *j* and slot *i*, that the velocity of the cam-shaft is at the minimum at the time the harness is crossing the shed of the warp, and that the shed opens gradually and with an increasing velocity.

The above-described system of gearing for driving the crank-shaft, and through it the lay, and for driving the cam-shaft also with alternately accelerated and retarded velocities, is applicable to all kinds of power-loom, whether the shuttle is actuated by pickers or by a carrier, with what is termed a "positive motion."

When pickers are used for driving the shuttle, and the picker-staves are driven by the crank-shaft, a properly-timed accelerated and retarded velocity of the picker motion is obtained by the same eccentric slot and pin-connection *f g* which is applied to the crank-shaft for driving the lay; and a similarly-accelerated and retarded motion of the shuttle-carrier, properly timed, may also be obtained through an eccentric slot and pin-connection, similar to *f g* or *i j*, in a loom with a positive shuttle-motion, as will be presently described.

N is an endless band arranged parallel with the lay-sole upon two pulleys *n n'*, carried by brackets *w w*, attached to the front of the lay near the end thereof for the purpose of driving the shuttle with a positive motion.

The pulley *n'*, near the right hand of the lay, has attached to it a bevel-gear, *o*, which gears with a bevel-gear, *p*, fast on a shaft, P, the upper end of which works in a bearing under and attached to the sole of the lay, and the lower end of which works in a box, S, secured firmly on the end of the pivot *a* of the lay. This shaft rocks with the lay.

On its lower part there is secured a bevel-gear, *q*, which gears with a bevel-gear, *r*, which is fast on a sleeve, Q, which turns loosely on the pivot *a* of the lay.

To this sleeve there is attached a spur-gear, *s*, which gears with the gear K, before described, as employed for driving the cam-shaft.

This gear K gives rotary motion to the gear *s* and to the bevel-gear *r*, attached to the same sleeve, Q, and, by means of the latter gear, gives rotary motion to the shaft P, and thus, by means of the bevel-gears *p* and *o*, gives motion to the right-hand pulley *n'*, and so gives constant motion to the endless band N.

The several gears above described are so proportioned that the endless band makes a complete circuit round the two pulleys *n n'* during two revolutions of the gear K, and, consequently, during two revolutions of the crank-shaft and two beats of the lay; and hence the motion of the said band is, owing to the action of the slot *i* and crank-pin *j*, twice accelerated and twice retarded during each circuit.

T is a shuttle-carrier, arranged to work in a suitable way or track upon the lay for the purpose of giving motion to the shuttle. This carrier may be like that used in other looms having a positive shuttle-motion, or of other construction suitable for carrying the shuttle through the warp without itself passing through.

This shuttle-carrier is attached to the endless band N by means of the driver, the construction of which

will be best understood by reference to figs. 4 and 5, where it is represented on a larger scale.

This driver consists of two plates, *t* and *u*, pivoted together by a pivot, *v*.

The plate *t* is rigidly connected with the shuttle-carrier T, and projects over the front of the lay between it and the endless band N.

The plate *u*, which is situated in front of *t*, is hook-shaped in its transverse section, as shown in fig. 5, in order to enable it to pass the flanges of the pulleys *n n'*, and is arched, as shown in fig. 4, to conform to the peripheries of the said pulleys. It is connected securely with the band by rivets or by any suitable clasp.

The pivot *v*, connecting the plates *t* and *u*, is situated opposite the center of the opening of the band or in a plane passing directly through the axis of the two pulleys *n n'*.

The plate *u* moves round the pulleys and from one to the other with the band, and whether the part of the band to which it is attached is above or below the pulleys, it carries the plate *t* and shuttle-carrier along with it across the loom; the movement being in one direction while the said plate *t* is above the pulleys, as shown in dotted outline in fig. 4, and in the other direction while it is below the said pulleys, as shown in full outline in the same figure, and hence every complete circuit of the band carries the shuttle back and forth across the loom.

The movement of the carrier is entirely suspended at each end of its traverse of the lay while the plate *t* is passing around either pulley, the pivot *v* being at that time opposite the axis of one of the pulleys *n n'*.

The pulleys *n n'* should have their peripheries so constructed, or such other provision should be made, as to prevent the band N from slipping, as it is obvious that the carrier *t u* must occupy a proper relation to the driving-gearing, to insure a properly-timed action of the shuttle, and to make certain that the acceleration and retardation, before spoken of, of the movement of the band should take place at the proper stages of its action.

The plate *t* should pass the pulleys at the time the band is moving at the slowest velocity, and when the lay is in its most forward position; and the carrier should be moving at its highest velocity when it is opposite the center of the loom and carrying the shuttle through the center of the warp, at which time the lay is thrown back. The shuttle will then commence its motion slowly and have its velocity gradually increased to the maximum as it approaches the center of the warp, and then diminished toward the end of its movement. This gradually accelerated and retarded movement of the band enables the shuttle to be started and stopped easily, and yet to pass with great velocity and in a short time through a broad warp, and this with the total suspension of the motion of the carrier, which takes place while the plate *t* is passing the pulleys, obviate the necessity of making the lay so much longer than the width of the warp as would otherwise be necessary.

This shuttle-operating mechanism may be simplified by so arranging the shaft P and providing a pulley upon its upper end and a corresponding pulley at the other end of the lay, that the band N may run upon the said pulleys. This will dispense with the bevel-gears *o p*. The planes of motion of the band will then be horizontal instead of vertical.

Instead of having the plates *t u* of the shuttle-carrier permanently pivoted together, they may be connected by a pin in one entering an open-ended slot in the other. This will provide for the instantaneous detachment of the shuttle-carrier, and for the use of two or more carriers and shuttles, enabling a shuttle and its carrier to be left at either end of the loom.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The gears I K, having the slot and pin-connec-

tion, and arranged on different axes, in combination, substantially as described, with the shuttle and treadle-operating mechanism.

2. The combination, with the crank-shaft for operating the lay, of the slotted gear J, arranged in relation to said shaft, and engaging the pin *g*, as and for the purpose described.

3. The combination of the gears I, J, K, L, and M, and their slot and pin-connection *f g* and *i j*, with the crank-shaft E and cam-shaft F, substantially as herein described.

4. The endless shuttle-driving band, attached to the lay and driven through a shaft, P, which is attached to and oscillates with the lay, and which gears with a sleeve, Q, on one of the pivots *a*, on which the lay swings, substantially as herein specified.

5. The shuttle-driver, consisting of a plate or piece, *t*, attached to the shuttle-carrier, a plate or piece, *u*, attached to the endless band carried by the lay, and a connecting-pin or pivot, *r*, the whole combined and arranged to operate substantially as herein specified.

6. The combination of the gearing for operating the shuttle-driving band with the mechanism for driving the other parts of the loom by means of a slot and pin-connection, substantially as described, whereby the said band is made to move with an alternately-accelerated and retarded velocity, as and for the purpose herein specified.

ROBERT WHITEHILL.

Witnesses:

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HENRY PALMER.