2 Sheets
Sheet 1

J. Greenhalgh.

Loom.

No. 9377. Patented Nov. 2. 1852.

Fig: 3.

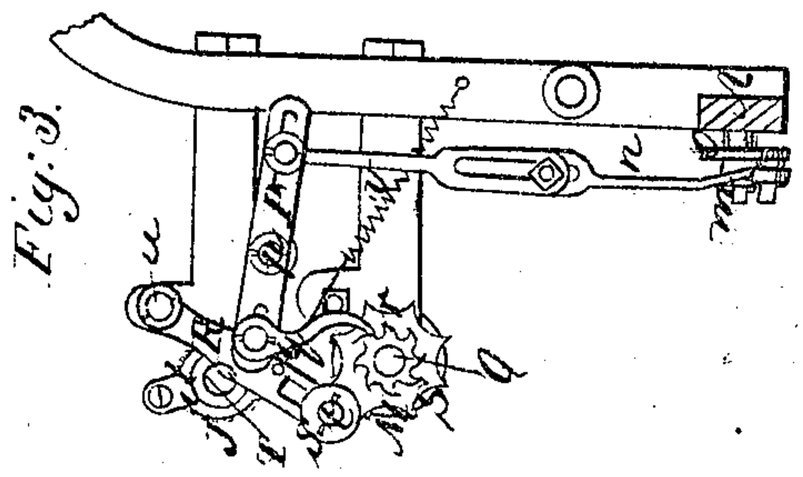
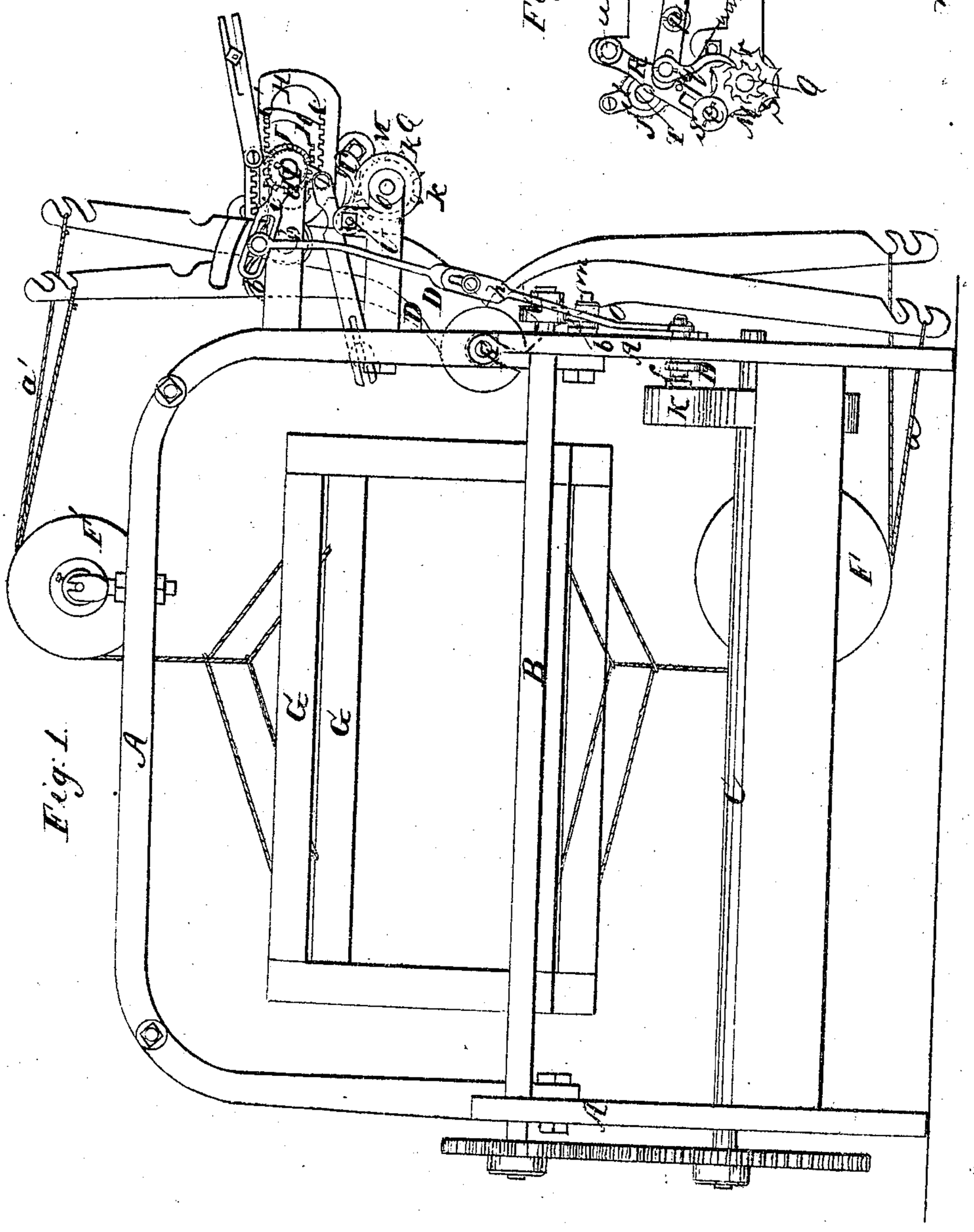


Fig: 1.



2 Sheets
Sheet 2

J. Greenhalgh.

Loom.

No. 9377. Patented Nov. 2. 1852.

Fig. 4.

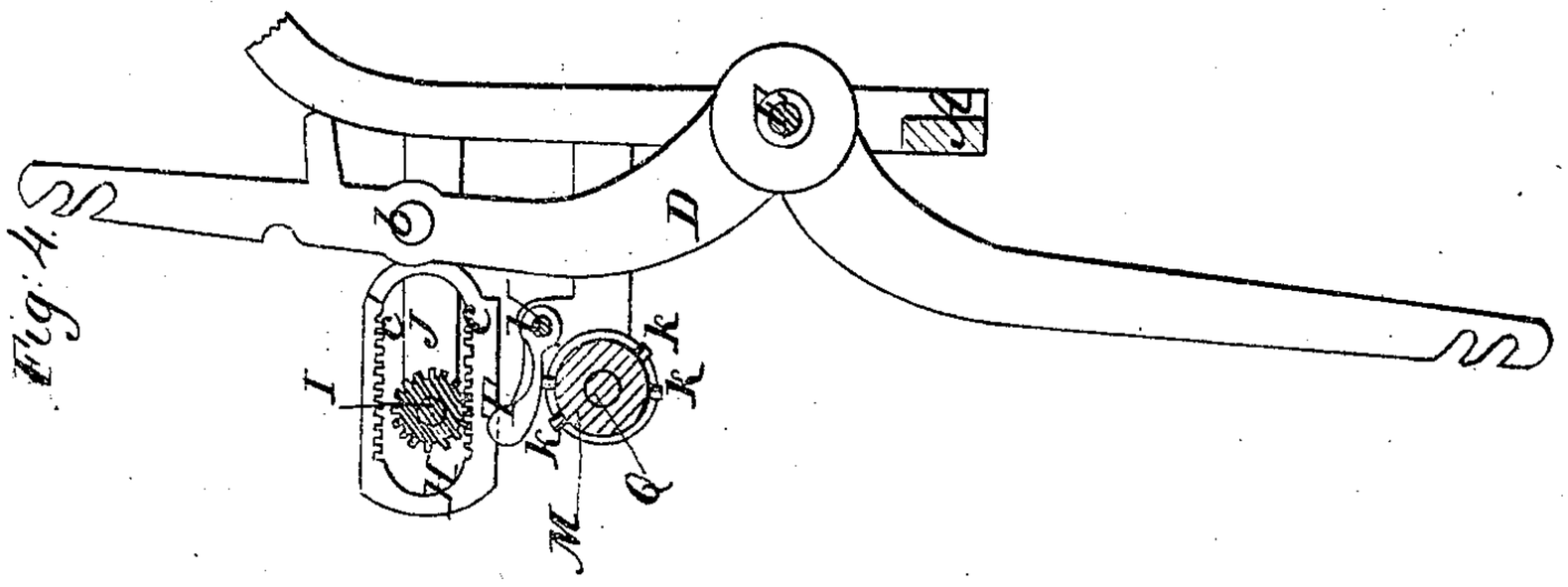
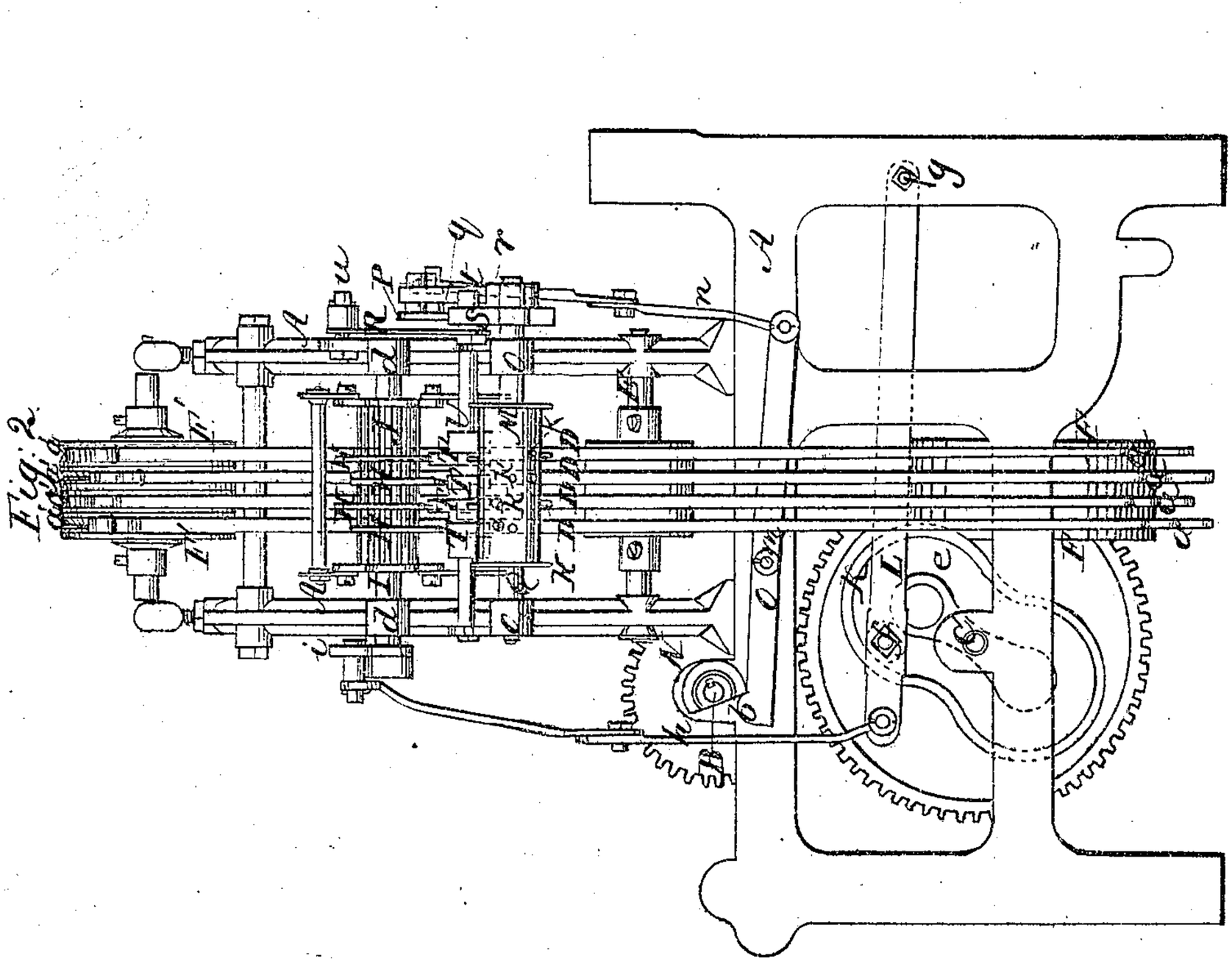


Fig. 2.



UNITED STATES PATENT OFFICE.

JAMES GREENHALGH, OF WATERFORD, MASSACHUSETTS.

MODE OF COUNTERBALANCING HARNESSES IN LOOMS.

Specification forming part of Letters Patent No. 9,377, dated November 2, 1852; Reissued January 15, 1867, No. 2,451.

To all whom it may concern:

Be it known that I, JAMES GREENHALGH, of Waterford, in the county of Worcester and State of Massachusetts, have invented certain new and useful Improvements 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 drawings, forming part of this specification, in which—

Figure 1, is a back elevation of a power loom having my improvements applied. Fig. 2, is a side elevation of the same. Fig. 3, is a front view, and Fig. 4, is a section of some of the parts in which the improvements consist.

Similar letters of reference indicate corresponding parts in each of the several figures. Those parts of the loom to which the invention has no reference are for the most part omitted in Figs. 1, and 2.

These improvements relate to the harness motion, and consist, first, in a mode of hanging the treadles or jacks, whereby they balance the harness, and raise or lower it with equal facility.

To enable others skilled in the art to make and use my invention I will proceed to describe fully its construction and operation.

A, is the framing of the loom, B, is the main shaft: C, the cam shaft which is driven in the usual way by gearing from the main shaft.

D, D, are a series of long upright double treadles or jacks hanging on an axle E: the lower ends being connected by cords *a a*, passing under pulleys F, F, to the bottom of the leaves of heddles G, G; and the upper ends being connected by cords *a' a'* passing over pulleys F' F', to the top of the heddles. These treadles or jacks are hung at about the middle of their length as is usual with treadles of this description, but instead of being straight they are bent inward at their half lengths, or the points of suspension. (See Figs. 1, and 4.) By thus bending the jacks inward at the point of suspension their weight is thrown inside of a vertical plane passing through said point.

By increasing or diminishing the weight of the jacks—or increasing or diminishing the distance between the vertical planes passing through the point of suspension and through the center of gravity of the jacks, I can increase or diminish the counterpoise to the harness.

By balancing the harness, and hanging the treadles or jacks as above described, the usual vibratory motion given the treadles, will raise and lower the harness (as will be hereafter described) at an expense of very little power: and with a regularity and steadiness of motion, which it is impossible to obtain when the treadles are not counterpoised: as in that case in raising the harness, all its weight has to be lifted, while in lowering it, its weight is all in its favor and drags on the treadles, but in this case the harness will neither have a tendency to ascend or descend, the raising of it is performed as easily as the lowering.

Attached to each treadle D, there is a "double rack" H, which consists of a small frame, hanging on a pivot *b*, secured in the treadle and having two rows of teeth *c*, *c'*, inside it, one on its lower and one on its upper side.

A horizontal shaft I, hung in bearings *d*, *d*, in the frames runs through all the double racks, and carries a toothed pinion J, which is of sufficient length to gear into all of the racks. This pinion is of such size that when it is in gear with one row of teeth, it is out of gear with the opposite row of the same rack. The pinion J, receives a rocking or reciprocating circular motion, which causes it to act on the racks, and give the vibratory motion to the treadles. It depends upon whether the upper or lower row of teeth are in gear with the pinion, whether the treadle is caused to give the necessary movement to the harness, to raise or depress the threads of the warp, to open the shed.

The rocking motion is given to the pinion J, by a cam K, on the shaft C, the said cam having a groove *e*, in its outer side, in which runs a roller, which is hung on a stud *f*, which is secured in a lever L, having its fulcrum on a pin *g;* the said lever receiving a rising and falling vibratory motion. The end of the lever L, opposite the fulcrum is connected by a rod *h*, whose length is adjustable, to a crank arm *i*, on the pinion shaft I.

The racks are raised and lowered to bring the lower row of teeth *c*, or the upper row *c'*, into gear with the pinion J, by a cylinder M, whose shaft O, is hung in bearings *o*, *o*, in

the framing parallel with the pinion shaft I, and which has a number of studs *k*, *k*, on its periphery, arranged according to the pattern to be woven. This cylinder has an intermittent rotary motion communicated to it by means of a cam N, on the side of the shaft B. This cam operates on a shoe *l*, at one end of a lever O, which hangs on a fulcrum *m*, outside the loom framing, the said lever being connected, at the other side by a rod *n*, to one end of a lever P, (see Fig. 3,) which hangs on a fulcrum *p*, in the upper part of the framing, the opposite end of the said lever P, carrying a pawl *q*, which by means of the vibratory motion of the lever P, derived from the motion given by the cam N, to the lever O, acts at intervals on the ratchet wheel *r*, upon the cylinder shaft Q, and gives the cylinder part of a revolution. The cylinder is prevented moving too far by a roller *s*, which hangs on a pin *t*, in an arm R, which hangs on a stationary stud *u*, the said roller taking into a series of recesses in the periphery of a wheel S, on the cylinder shaft, to which it is kept close by a spring *v*, which is attached to the arm R, and to the framing; the spring allowing the roller to pass over the projections between the recesses on the wheel, when the cylinder is turning, but drawing it into the recesses and causing it to hold the wheel stationary, except at such times as the pawl is in operation upon the ratchet wheel.

The cylinder acts upon the double racks H, H, through a series of lifters T, T, whose form is best shown in Fig. 4, they hang loosely on a stationary axle U, which is parallel with I, and Q, one under each rack; the racks resting in notches in the ends of the lifters (see Fig. 2). The lifters rest upon the cylinder M, and are raised by the studs *k*, *k*, on the cylinder, when they come in contact with them, sufficiently to lift the racks H, H, which rest on them, and throw the lower sets of teeth *c*, into gear with pinion J, but when they rest on the periphery of the cylinder, the upper sets of teeth *c'*, are in gear.

The pinion J, works twice for every revolution of the cam shaft C, or once for every revolution of the main shaft B, and consequently gives one vibration to every treadle, for every beat of the lay, and flight of the shuttle; and the cylinder moves once between every two movements of the pinion. When the upper set of teeth *c'*, of either rack are in gear with the pinion the movement of the pinion causes the treadle to which it is attached, to make the necessary movement, to raise the leaf of heddles attached to it, that is to say it moves from nearly a vertical position, to the position indicated by the nearest treadle seen in Fig. 1, the upper end being thrown outward, and the lower end inward, but when the lower set of teeth are in gear, the treadle makes the necessary movement to lower the leaf, moving from the vertical position, to that indicated in Fig. 4, and by the hindmost treadle visible in Fig. 1, the upper end being thrown inward, and the lower outward; the treadle in either case is returned to its nearly vertical position by the pinion. The movements of the cylinder are regulated so as always to take place when the shed is closed, or between the movements of the pinion, so that all the racks are properly in gear before the motion of the pinion takes place. If the pattern should require extending beyond what would be practicable with the cylinder M, it can be done by passing an endless chain over the cylinder, the said chain being provided with studs or other projections, which would operate on the lifters and racks, and govern the operation of the harness in the same manner as the studs on the cylinder.

I do not claim the mere upright position of the jacks, or the mere counterbalancing of the harness: but

What I do claim and desire to secure by Letters Patent, is—

The construction of the long double heddles or jacks D, D, in such a manner, and so hanging them on the axle E, by a short arm, or its equivalent, that in their vibrations, neither end of them shall pass beyond a vertical plane passing through the axle on which they rock or oscillate, so that the weight of the jacks shall be thrown outside of their points of suspension—thus counterbalancing the weight of the harness.

In testimony whereof I have hereunto signed my name.

JAMES GREENHALGH.

Witnesses:
WILLIAM HOLMES,
OLIVER A. VIELBY.

[FIRST PRINTED 1912.]