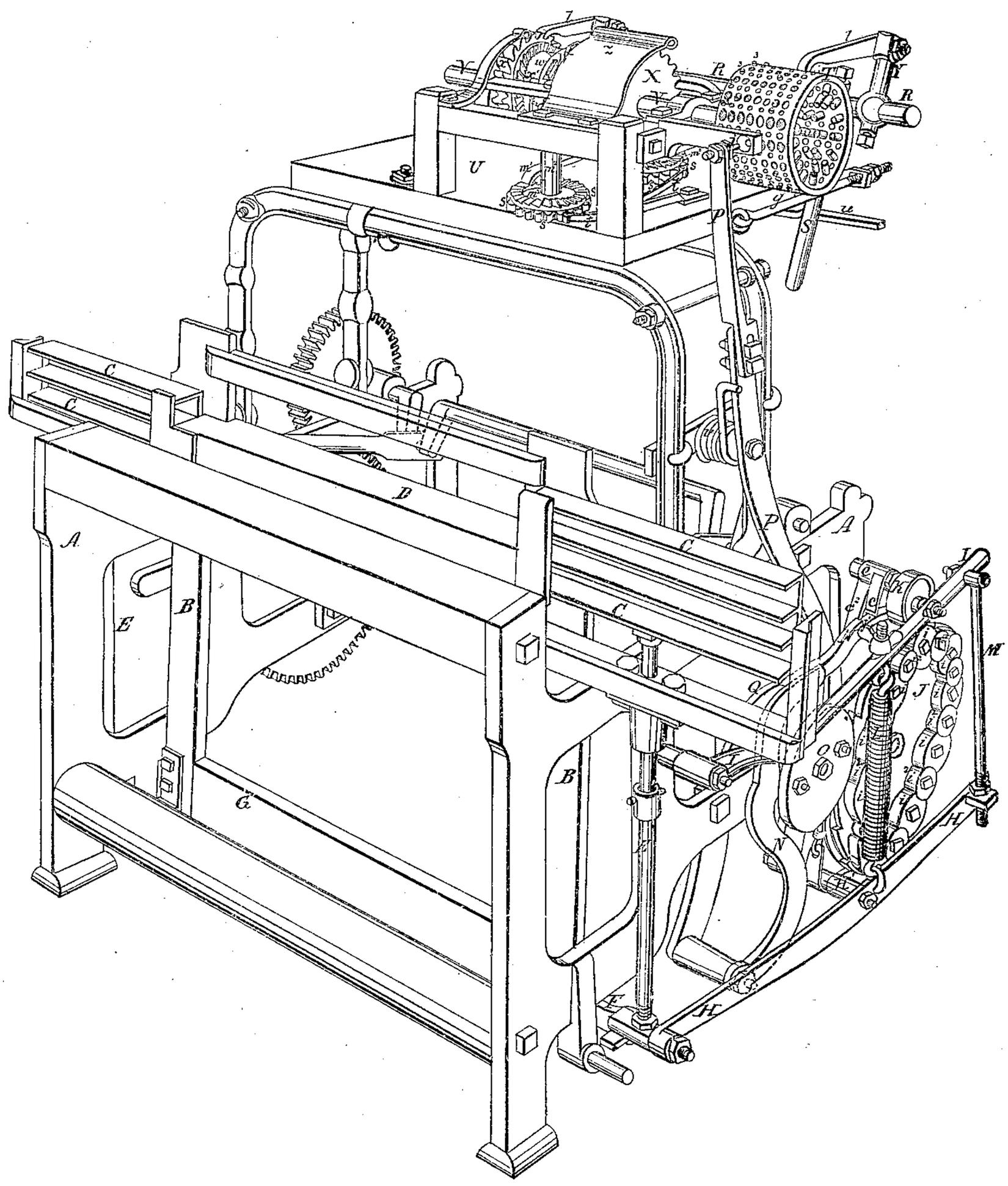
Sheet 1-4 Sheets.

O. A. Kelly.
Shuttle Box.

No. 10,252. Patented Nov. 22, 1853.

Fig. 1.



Sheet 2 - 4 Sheets.

O. A. Kelly.

Shuttle Box.

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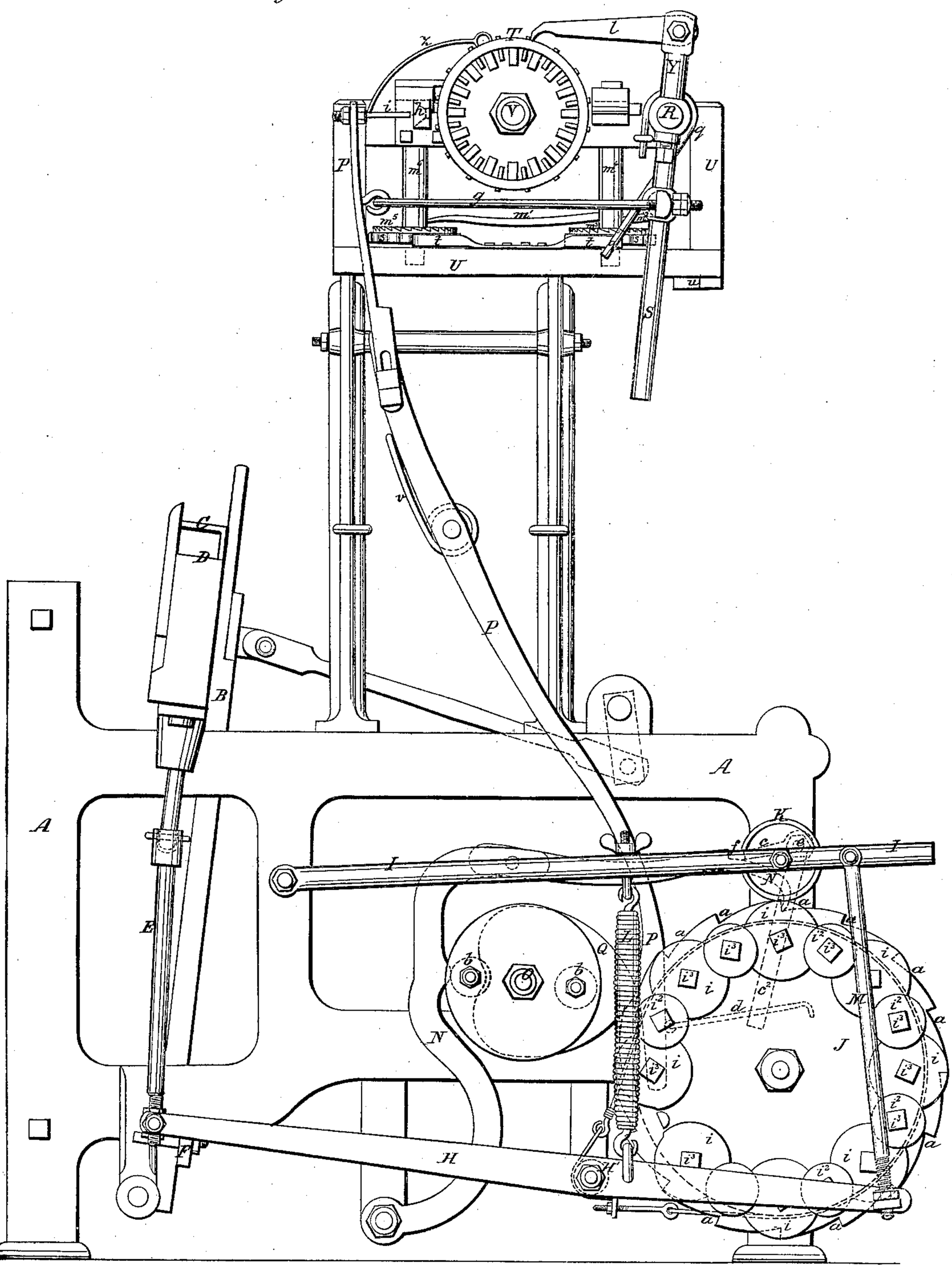
Fig. 2.



O. A. Kelly

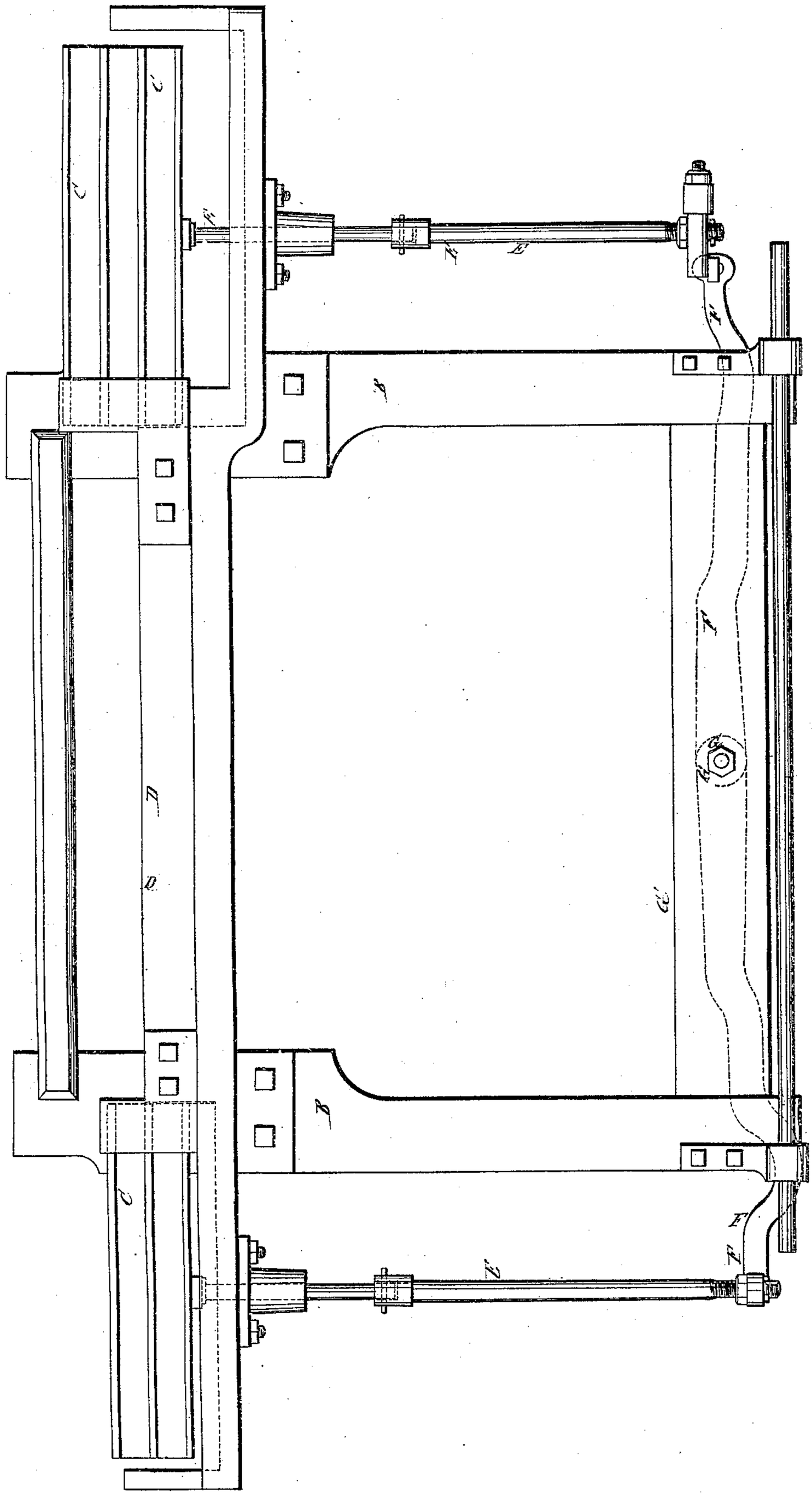
Sheet 3 - 4 Sheets.

Shuttle Box.

No. 10,252.

Patented Nov. 22, 1853.

Fig: 3.



O. A. Kelly.

Sheet 4-4 Sheets.

Shuttle Box.

No. 10,252.

Patented Nov. 22, 1853.

Fig. 4.

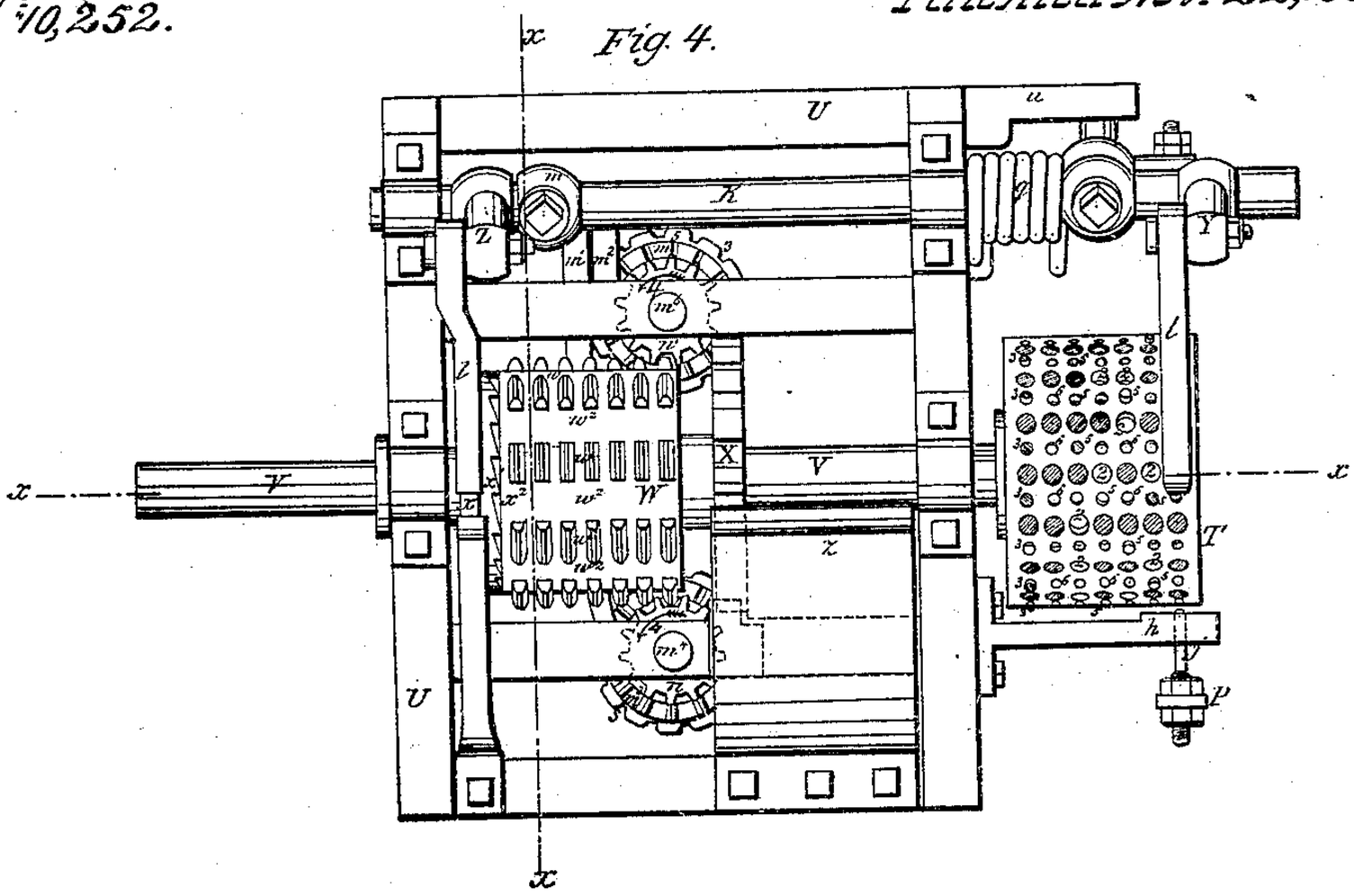


Fig. 5.

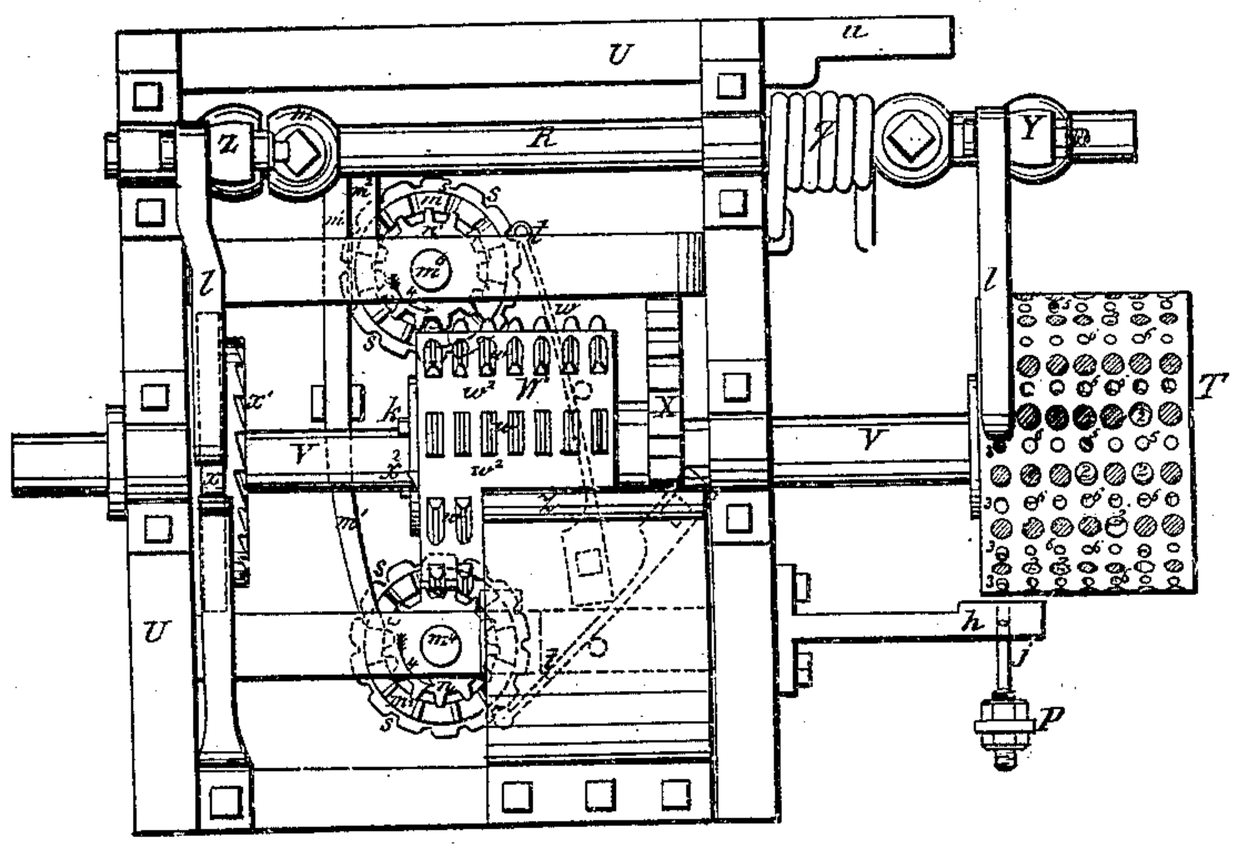


Fig. 7.

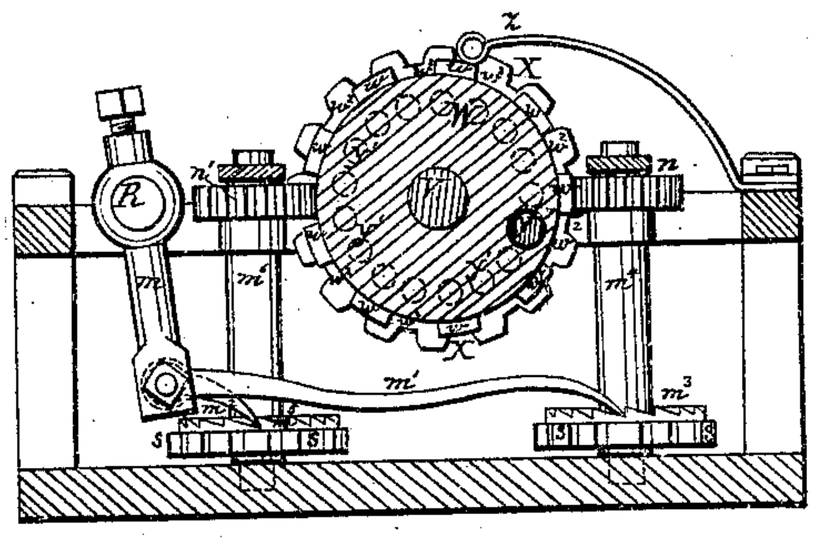
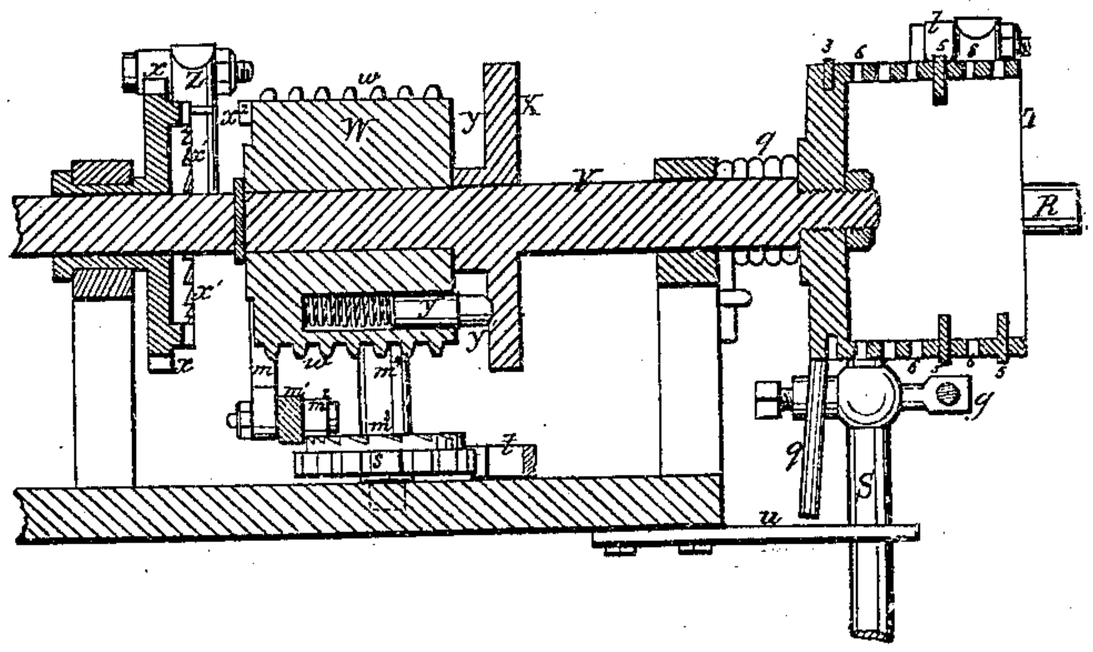


Fig. 6.



UNITED STATES PATENT OFFICE.

OLIVER A. KELLY, OF WOONSOCKET, RHODE ISLAND.

LOOM.

Specification of Letters Patent No. 10,252, dated November 22, 1853.

To all whom it may concern:

Be it known that I, OLIVER A. KELLY, of Woonsocket, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Looms, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, which form part of this specification, and in which—

Figure 1 represents a view in perspective of the loom; Fig. 2, an end elevation of the same; Fig. 3, a front elevation of the lay with the shuttle boxes and the balance beam on which they rest; Fig. 4, a top view of the mechanism which determines the changes in position of the shuttle boxes, certain sliding devices being at the extreme of their left hand movement; Fig. 5, a similar view, those parts which in the last figure are shown at the extreme left being in this represented at the extreme right; Fig. 6, a vertical section of the changing mechanism at the line *x x* of Fig. 4; and Fig. 7 a like section of the same at the line # #.

My invention and improvements relate to the mechanism for raising and lowering a series of shuttle boxes, and for varying the order of throwing the shuttles as may be required to form the figure or ornamental device on the cloth.

The first part of my invention consists of a combination of levers with an elastic or spring connecting rod, the same being actuated by a tappet wheel, whereby the shuttle boxes are raised and lowered by a mechanism that will yield, with a view to avoid the breakage that so frequently results from the employment of a positive motion for this purpose.

The second part of my invention consists in balancing the two series of shuttle boxes on a lever pivoted to the lay so that however heavy they may be it is only necessary to employ power equal to overcoming their inertia on their momentum to move them or to arrest their motion.

The third part of my invention consists of a cylinder whose periphery is perforated with numerous rows of holes parallel to its axis; every alternate row of holes being fitted with pins, and designed to change the position of the intermediate rows, with reference to a pin on a lever that effects the changes of the shuttles, when the holes determine what those changes shall be.

The fourth part of my invention consists of a mechanism which I term a "rack-cylinder", for giving to the pattern or perforated cylinder just referred to, a longitudinal reciprocating motion to bring each of its holes in succession into the proper position to perform its function.

The fifth part of my invention consists of the combination of a series of equidistant pins or teeth on the end of the pattern cylinder with a loose wheel on the axis of the rack-cylinder, whereby the axial motion of the pattern and rack-cylinder is reversed at each extremity of their vibrations.

The sixth part of my invention consists of the method of uniting the pattern cylinder or its equivalent, with the rack cylinder or its equivalent by a yielding or slip coupling substantially as specified, whereby all danger of breakage is avoided by the slipping of the coupling when the strain becomes too great.

The seventh part of my invention consists of the method of working the same row of holes in the pattern cylinder to the right and left in succession, in case the cylinder should not have holes enough to work the ornamental design in the cloth by working the holes once, whereby a figure of considerable elaboration may be produced with a cylinder of small size.

The frame (A) of the loom as represented in the drawing is of the usual form and proportions. The mechanism for supplying the warp, and taking up the woven cloth, and that for operating the harness and the pickers I have not represented, as my improvements do not relate to either of these parts.

The lay (B) is constructed in the manner in which drop-box lays as they are termed usually are, and the shuttle boxes (C) at each end of the race (D) are fitted in guides in which they are free to slide up and down, so as to bring any one of the series which is required to receive or discharge a shuttle, opposite to the race board (D). Each shuttle-box is supported on a stem (B) that rests on a foot, which at one end is attached to, and at the other rests on the end of a balance beam (F) whose fulcrum is a pivot (G) on the middle of the foot rail (G′) of the lay. By this arrangement when the series of shuttle boxes at one end of the lay is raised the other series is lowered. The raising and lowering of the shuttle boxes is effected by a

lever (H) hung on a pivot (H′) at the side of the loom which derives its motion from a second lever (I) raised by tappets (*i*) on a disk (J) and descending by its own weight.

The cam lever (I) is pivoted at its front extremity to the side of the loom and near its rear extremity carries on a pivot projecting from its side a friction wheel (K) which runs upon the faces of the tappets (*i*′ and *i*²). This lever is connected to the lifting lever (H) by a spring (L) that tends constantly to pull the two levers together which however it is prevented from accomplishing by a cross rod (M) which has a stop nut to regulate the distance of the levers from each other. The tension of the spring (L) is such that it will without expanding hold the levers in position to perform the ordinary duty of elevating and depressing the shuttle boxes, but if any obstruction should be interposed to the raising or lowering of either series of shuttle boxes, then the spring will yield to allow the tappet (*i*) to pass the friction wheel (K) without breaking anything.

The disk (J) to which the tappets (*i* and *i*²) are affixed is mounted on a pivot at the side of the frame; on the back of this disk a friction brake pulley is formed, or attached as shown by blue lines in Fig. 2 to prevent the disk from turning too easily. On the face of the disk a number of long tappets (*i*) and short tappets (*i*²) are secured. The long tappets have each a segment bored out of its edges adjacent to the next short tappets, of the proper size to receive the periphery of the latter, so that when the long and short tappets are all secured to the disk they shall mutually interlock and support each other, and although each one is attached to the disk by but one central pin (*i*³) yet it cannot be forced out of place without also displacing the adjacent tappets which make it as secure as if it were itself fastened by several bolts instead of but one. The periphery of the disk is formed into notches or ratchet teeth (*a*) corresponding in number to that of the tappets, so that as the disk is turned at intervals one tooth at a time, it will cause the tappets in succession to elevate or depress the wheel (K) and through it the intermediate levers and the shuttle boxes. The disk (J) is turned by means of a pawl (N) which is hinged to a bent upright lever pivoted to the side of the frame and turned in one direction by a pair of wipers or tappets (*b* and *b*) on the cam shaft (O) and in the other by its own weight, which cause it to vibrate every time the lay beats; but the mere vibration of the pawl is not sufficient to give motion to the disk, as it strikes a stop (&) when about half its motion is complete, that arrests it and prevents it from hooking over another tooth, and thus the pawl is kept working upon the same tooth, and gives no motion to the disk until the stop is moved, when the pawl makes a full stroke, catches another tooth, and turns the disk so as to move one tappet out, and bring the next one into operation. As this movement of the stop (&) must be effected every time a change in the position of the shuttles is required to be made, and the stop must be allowed to remain undisturbed so long as changes in the position of the shuttle boxes are not required, I have contrived a mechanism for performing this operation which moves the stop (&) or allows it to remain and arrest the pawl (N) as required. This mechanism operates through a bent upright lever (P) pivoted to the side of the frame (A). This lever receives a constant vibratory motion from a spring (*v*) which constantly presses it in one direction, and a cam (Q) on the cam shaft which moves it in the opposite direction, these cause it to vibrate with half the frequency of the lay. The lower extremity of this lever is connected by a rod (*d*) having a hooked end with the vertical arm (*c*²) of the stop (V) which turns on a pivot (*e*) at the side of the loom, and whose horizontal arm (*c*) except when lifted, is in the range of motion of a shoulder (*f*) on the pawl (N) so as to meet it. When the lower end of the lever (P) is permitted to move to the full range of its motion toward the front of the loom, the rod (*d*) pulls the vertical arm (*c*²) of the stop (V) forward and raises its upper arm (*c*) so that it will permit the pawl to move back to catch a tooth of the ratchet wheel (*a*).

When the lever (P) does not vibrate far enough to lift the catch (*c*) it nevertheless has a sufficient length of stroke given to it, to give a regular oscillating movement to a rock shaft (R) with an arm (S) depending, from which it is connected by a rod (*g*). The upper extremity of the lever (P) is fitted with a pin (*j*) that passes through a guide (*h*) and which is of such a size that it will readily pass into the large holes (2) in the periphery of the hollow cylinder (T). When the pin (*j*) passes into one of these holes of the cylinder, it permits the lever to vibrate a full stroke, raise the stop (*c*,) and allow the pawl (N) to reach forward and turn the tappet disk (J) to change the shuttle boxes. All the holes (2) in the cylinder (T) which it is required the pin (*j*) shall not enter are plugged up with wooden pegs, so that the only holes left open are those required to effect the changes in the shuttle boxes, and as the holes (2) in the cylinder are in general equal to the whole number of the double throws of the shuttle necessary to form the design or pattern required; all the holes could be left open, and the stop would be kept up at every movement of the pawl (N) and the shuttle boxes would consequently be changing constantly. This is the

extreme of change. By stopping less or more of the holes, the changes can be rendered proportionally less or more frequent.

In order that the changes in the shuttles may be effected according to the order determined by the plugging up of the cylinder, every hole (2) in the cylinder is brought in succession opposite the pin (*j*) which enters the open holes and permits the lever (P) to make a long vibration, but is stopped by the plugs which thus shorten its vibration. The upright lever (P) is thus kept constantly oscillating with vibrations of unequal length, but every vibration whether long or short is sufficient to communicate an oscillating movement to the rock shaft (R) which gives motion to the pawls, and the long vibrations which occur only when the pin (*j*) enters one of the holes (2), in addition to actuating the rock shaft, lift the stop (*c*) and permit the pawl (N) to turn the ratchet wheel to change the position of the shuttle boxes.

The mechanism which determines the intervals and times of change of the position of the shuttle boxes is mounted in the frame (U) secured to the top of the loom frame. This mechanism is represented of about one half the linear dimensions of the full working size while the frame, shuttle boxes and lay are only about one sixth of the linear dimensions of one of full size, this gives the changing mechanism a bulky and unwieldy appearance, while in point of fact it is an exceedingly compact and miniature thing, vastly less than any other mechanism heretofore used for the purpose. The frame of this mechanism supports two parallel shafts (V) and (R) the former carries the perforated or pattern cylinder (T) and the rack cylinder (W) the former of which is keyed fast to it, but the latter is free to turn although prevented from moving longitudinally by a toothed wheel (X) at one end and a pin (*k*) at the other; a double ratchet (*x*) is also mounted loosely on this shaft and held in the end of the frame at which it is mounted by a bearing that permits it to turn freely but prevents it from sliding with the shaft. The shaft (V) has a longitudinal reciprocating movement in its bearings, the range of which is equal to the length of the rows of holes (2) in the pattern cylinder (T) in order that every hole of each row by means of this reciprocating motion may in succession be brought opposite the pawl (*l*) and pin (*j*). This reciprocating motion of the shaft (V) with its cylinders as well as an intermittent rotary motion to be presently described are derived from the vibratory movement of the upright lever (P) through a link rod (*g*) which connects with an arm (S) of the rock shaft (R), and gives to the same an oscillating motion corresponding to that of the lever (P). This rockshaft carries two arms (Y and Z) which project upward, to each of these arms a pawl (*l*) is jointed, whose office it is at the proper time to turn the rack cylinder (W) through the intervention of the cylinder (T) and ratchet wheel (*x*), an angular distance equal to the length of the teeth of the racks (*w*) or of the spaces between the same. A fourth arm (*m*) projects downward from the rock-shaft (R), to the lower extremity of this arm two pawls (m', m^2) are jointed one (m') extending to a horizontal ratchet wheel (m^3) on the upright shaft (m^4), and the other (m^2) to the corresponding ratchet wheel (m^5) on the upright shaft (m^6), and as the reciprocating movement of the pawls turn these ratchet wheels, the upright shafts (m^4 and m^6) are rotated in the same direction. Each of these ratchet wheels has a series of notches (*s*) on its rim, into which a spring detent (*t*) presses, to prevent the retrograde movement of the pawls (m' and m^2) from turning the wheels. The upper extremities of the shafts (m^4 and m^6) have pinions (*n* and n') mounted on them the adjacent peripheries of which move in opposite directions as shown by the arrows (4). These pinions have cogs to match those of the racks (*w*) on the cylinder (W) into which they gear alternately, that is one of them is at all times in gear with one of the racks (*w*) and the other is in the space or interval (w^2) between the racks, therefore wherever a rack (*w*) is in gear with one pinion, the cylinder will be moved endwise in the opposite direction to that in which it will be moved when the other pinion is in gear with the rack, as the cogs of the two pinions which respectively gear into the racks move in opposite direction as they are turning on opposite sides of their respective shafts. It is obvious from this arrangement that to reverse the longitudinal motion of the cylinder (W) it is only necessary at each extreme of its motion to turn it on its axis the width of a rack (*w*) so as to throw the pinion which at the time is driven out of gear into a space (w^2) and the pinion which was out of gear in a space (w^2) into gear. This is effected when the rack cylinder (W) at the extremity of its range of motion in one direction is brought into contact with the wheel (*x*) by the rack teeth (x') on its side gearing into a projecting tooth (x^2) on the end of the cylinder, and turning the latter, when the ratchet wheel (*x*) is turned by the pawl (*l*) acting on its teeth (x'). The turning of the cylinder (W) without turning the notched disk or wheel (X) is effected by the yielding of the spring detent or bolt (*y*) sufficiently to permit it to slip out of one of the series of conical cavities (y') in the side of the disk. The turning of the shaft (V) and disk (X) by the pressure of the ratchet wheel (*x*) in

turning the rack cylinder is prevented by a spring detent (z) the rounded edge of which takes into the notches of the disk (X), but it is so rounded that when a degree of pressure is applied to the disk, beyond what is required to cause the detent (y) to slip, this detent will also slip. Each of the ratchet wheels is provided with a similar detent which takes into notches on its periphery. When the rack cylinder approaches the other extreme of its longitudinal motion, so as to carry the pattern cylinder (T) to the greatest distance out from the frame (U), the row of pins (3) on the inner end of the cylinder will be brought into range with the reciprocating pawl (l), which will catch on one of the pins and turn the cylinder (T) with its shaft (V) and the disk (X) the proper distance to turn a rack out of gear with one of the pinions (n') and in gear with the other, the disk (X) transmits this motion to the rack cylinder by one of its cavities (y') acting upon the pin or detent (y), which will not slip with the light pressure required to turn the racks, when all the mechanism is in proper order, but in case anything should be out of order or any obstruction in the way of turning the rack, the detent (y) would slip, the rigidity of the system be interrupted and breakage prevented, which, would be inevitable, but for some elastic compensation of this nature.

In case the ornamental design being woven, requires a change in the position of the shuttle boxes more frequently than could be obtained by allowing the perforated cylinder to traverse its entire length in both directions, pins (5) are inserted in one of the holes (6) which when brought within the range of the reciprocating pawl (l) will engage with the same and the cylinder will be turned and its motion reversed as it would be at the end of the extreme range of motion of the cylinder. By this means the amount of longitudinal motion of the shaft (V) and its cylinders can be varied to any extent that may be required.

In order that the pattern cylinder (T) may not be moved during the entrance of the pin (j) on the lever (p) into any of the holes (2) the rod (q) is so constructed and arranged that it only acts upon the arm (S) of the rockshaft when the upper extremity of the lever (P) is moving from the cylinder and the pin (j) has been withdrawn therefrom, the movement of the arm (S) and rockshaft (R) in the opposite direction being caused by a spring (q) and arrested by a stop (u) at the moment the cylinder T has been turned the proper distance, while the lever P may continue to move forward by pushing the rod (q) through an opening in the bracket q^4, until the pin j has reached the required position.

When the rack cylinder is reversed by bringing it into contact with the ratchet wheel or disk (x) this is effected without turning the cylinder (T) so that in case a pin (5) is not placed so as to come within the range of motion of the pawl (l) at the outer end, or between that and the inner end of the pattern cylinder, the same row of holes (6) will be caused to traverse twice in succession in front of the pin (5) so that the same row is thus caused to perfom duty and repeat which adds greatly to the capacity of the apparatus.

I have described the construction and operation of the mechanism which I have essayed for carrying into effect my improved method of changing the position of the shuttle boxes, but it is obvious that much of it admits of great variation in form and arrangement and many of the devices may be substituted by other mechanical equivalents, and wherever changes of this nature are deemed for any cause expedient I propose to make them. For example a vibrating rack which when turned in one direction will gear with a pinion that will move it to the right, and when turned in the other direction will gear with a pinion that will move it to the left may be substituted for the rack cylinder above described, and numerous other substitutes might in this way be adopted, for it is immaterial what mechanism is used provided the turning of the pattern cylinder will change the reciprocating rack gear in such manner as to reverse its motion. Again the perforated reciprocating cylinder instead of having two series of holes might be constructed with two series of protuberances capable of being made to project more or less, and the pawls, and upright vibrating lever upon which the pins would act to effect the regulation of the shuttle boxes, would of course have to be changed to adapt them to pins instead of holes. But changes of this kind it is obvious would not in any way change the principle of operation.

Having thus described my improved mechanism for shifting the shuttle boxes; what I claim as new and desire to secure by Letters Patent is:

1. The arrangement of levers herein described connected by a spring or elastic connecting rod, in combination with the tappet wheel, whereby the shuttle boxes are raised and lowered by a yielding mechanism, which diminishes greatly the liability to breakage as herein specified.

2. The method of balancing the shuttle boxes on the lay, in combination with mechanism for simultaneously raising one set, and depressing the other substantially as specified.

3. The reciprocating and rotating pattern cylinder in combination with the vibrating lever or the equivalent thereof for the pur-

pose of rendering the intervals between the changes of the shuttles regular or irregular, substantially as herein set forth.

4. The rack cylinder or the equivalent thereof in combination with the two pinions, and the mechanism for throwing them alternately into or out of gear or the equivalent thereof, whereby the racks are moved in alternately opposite directions with a variable range of motion as required for operating the pattern cylinder.

5. A series of pins or the equivalent thereof on the inner end of the rows of holes in the pattern cylinder, a disk having a corresponding number of pins or teeth on its periphery, placed loosely on the axis of the rack cylinder, and the pawls which turn the disk and pins in combination with the rack cylinder whereby the latter is turned at each extreme of its vibration, so as to throw one pinion out of gear with the rack, and the other in, to reverse the motion.

6. The method of uniting the pattern cylinder or its equivalent, with the rack cylinder or its equivalent by a yielding or slip coupling operating substantially as specified, whereby the danger of breaking the mechanism when it happens to become deranged is greatly lessened.

7. The method of working the same row of holes in the pattern cylinder to the right and left in succession, in case the cylinder should not have holes enough to work the ornamental design in the cloth by working the holes once only, whereby a cylinder of a given size will be capable of producing a much more elaborate design or larger figure than if the holes could be used but once in the production of the same figure.

In testimony whereof, I have hereunto subscribed my name.

OLIVER A. KELLY.

Witnesses:

JOHN M. KUEGGER,

WM. HOLMES, JR.