Sheet 1-5 Sheets.

E. B. Bigelow.

Loom.

No. 546. Patented Jan. 6, 1838.

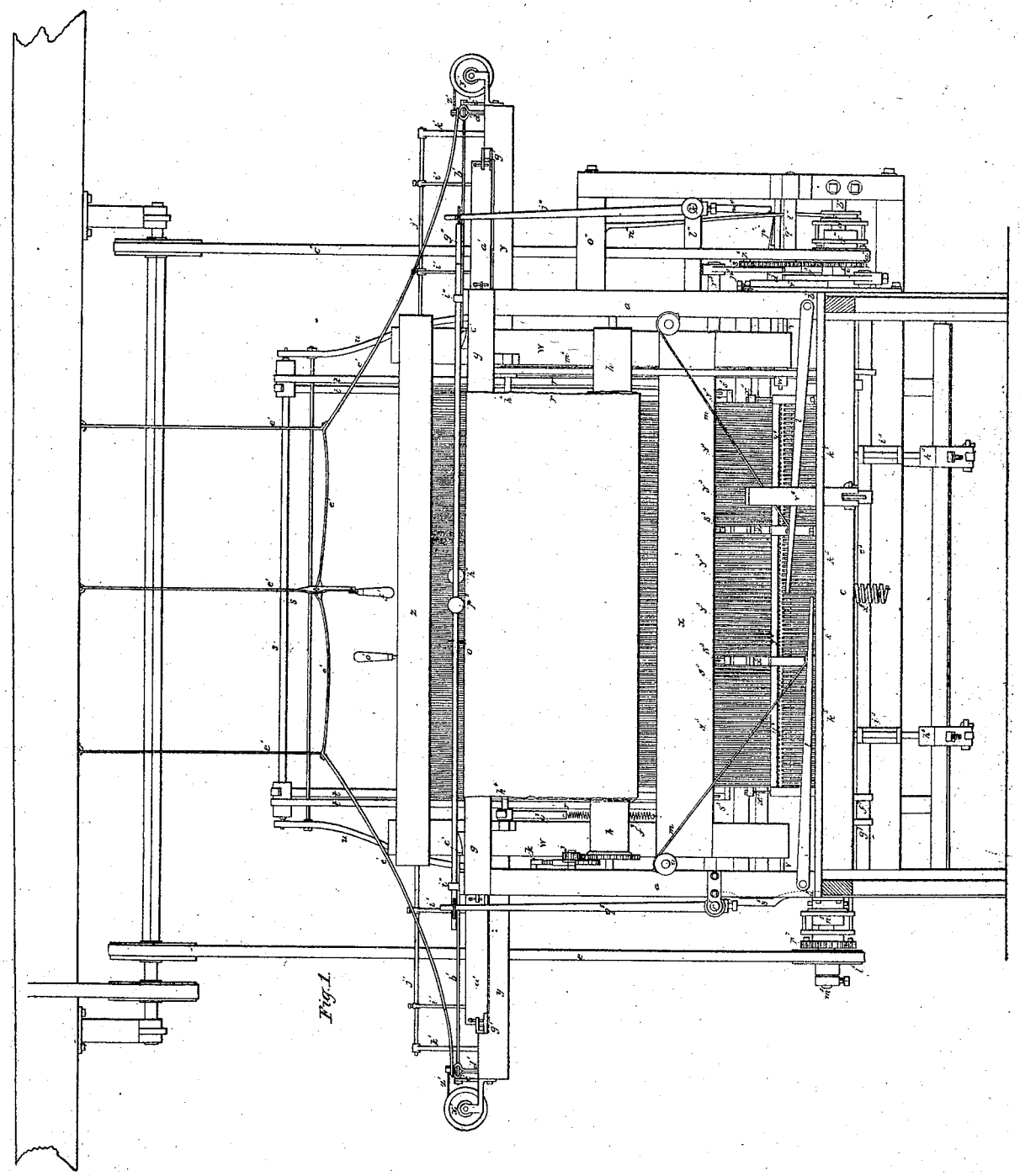

Fig. 1.

Sheet 2 - 5 Sheets.

E. B. Bigelow.

Loom.

No 546. Patented Jan. 6, 1838.

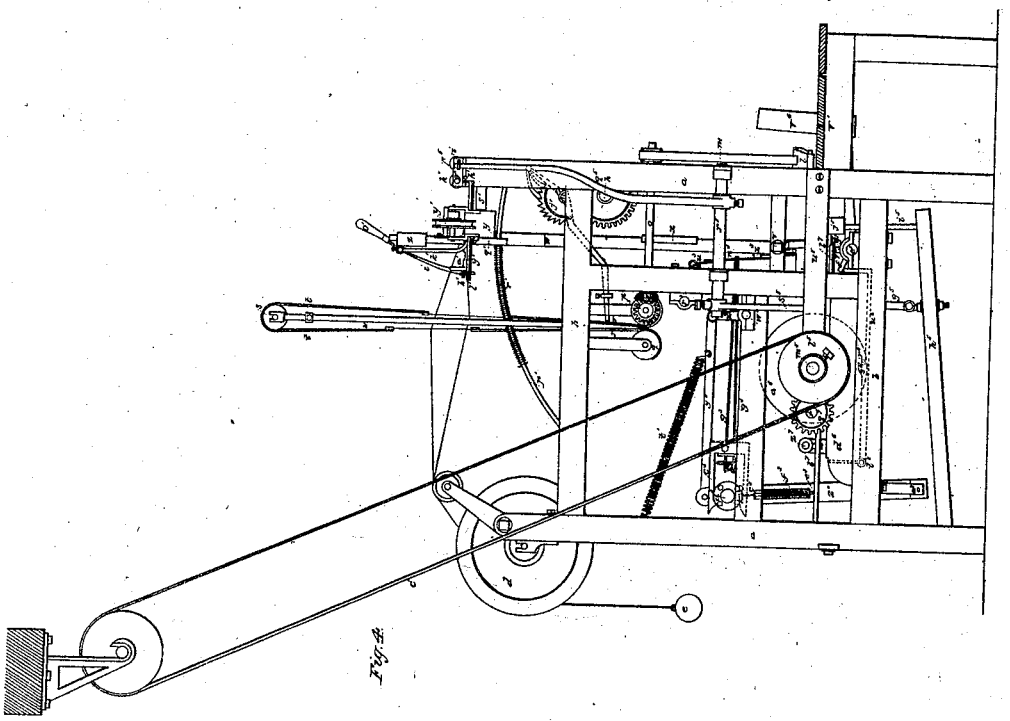

Fig. 1.

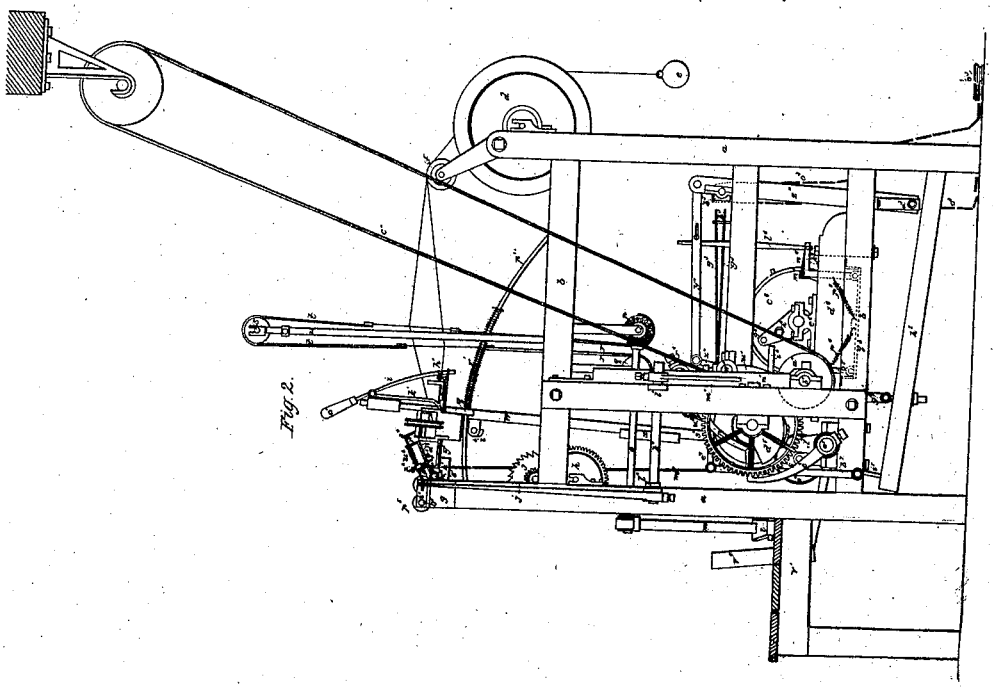

Fig. 2.

Sheet 3 - 5 Sheets.

E. B. Bigelow.

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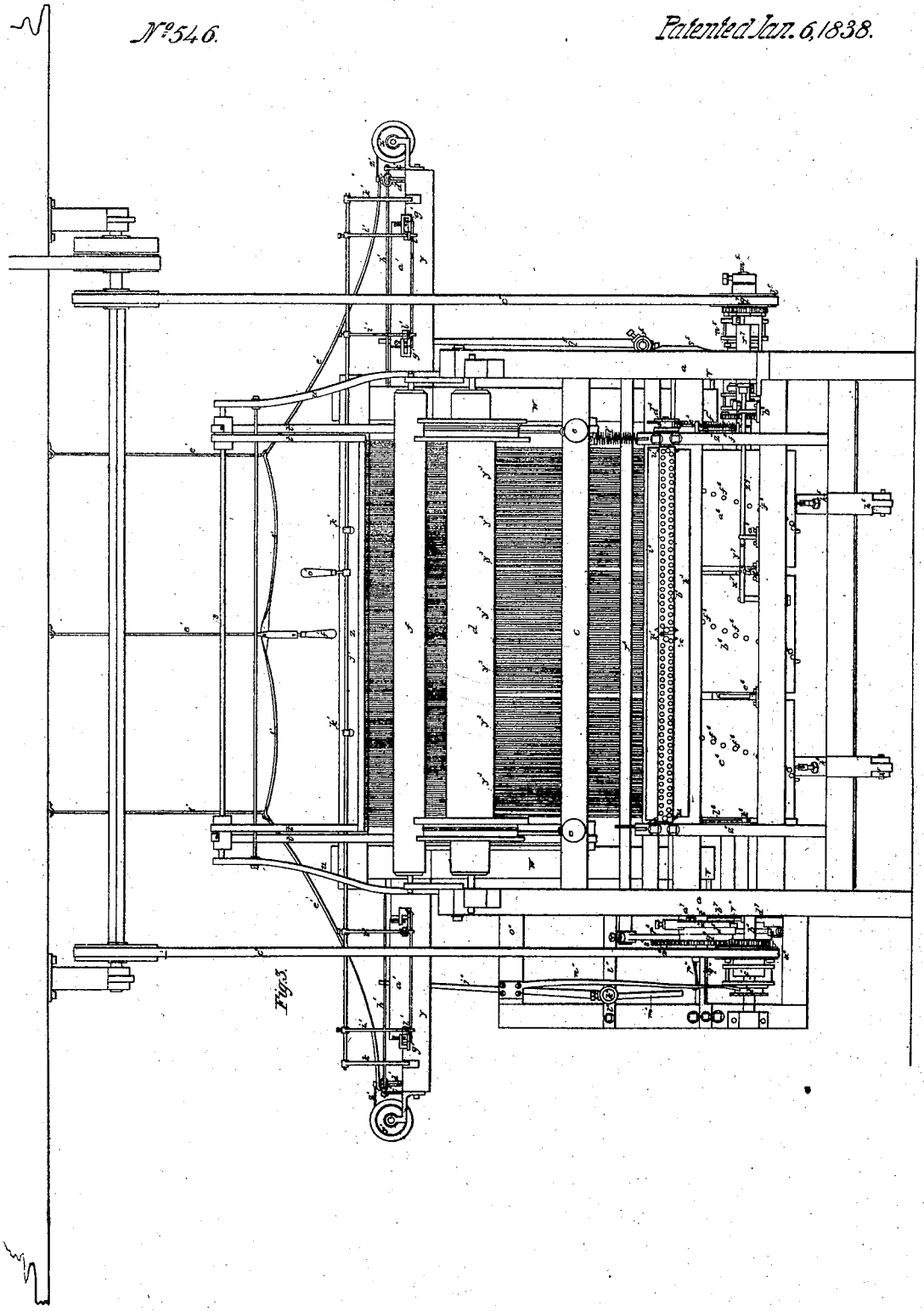

E. B. Bigelow.

Sheet 4 - 5 Sheets.

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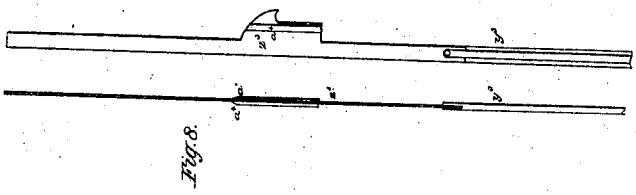

Fig. 8.

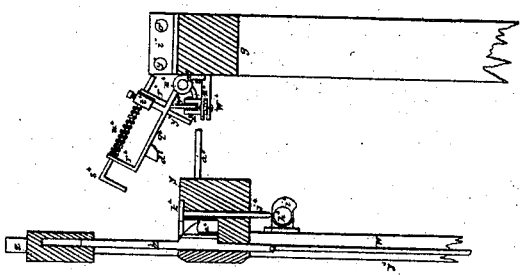

Fig. 7.

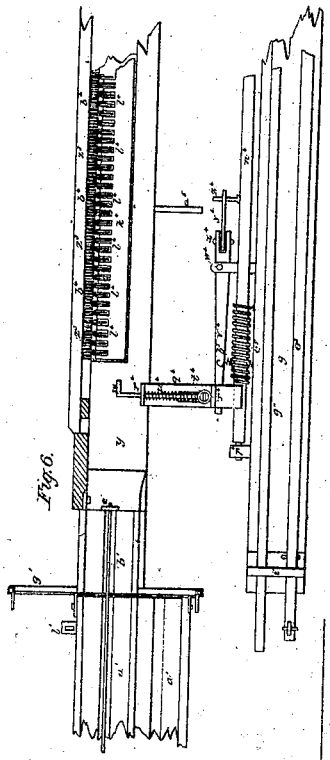

Fig. 6.

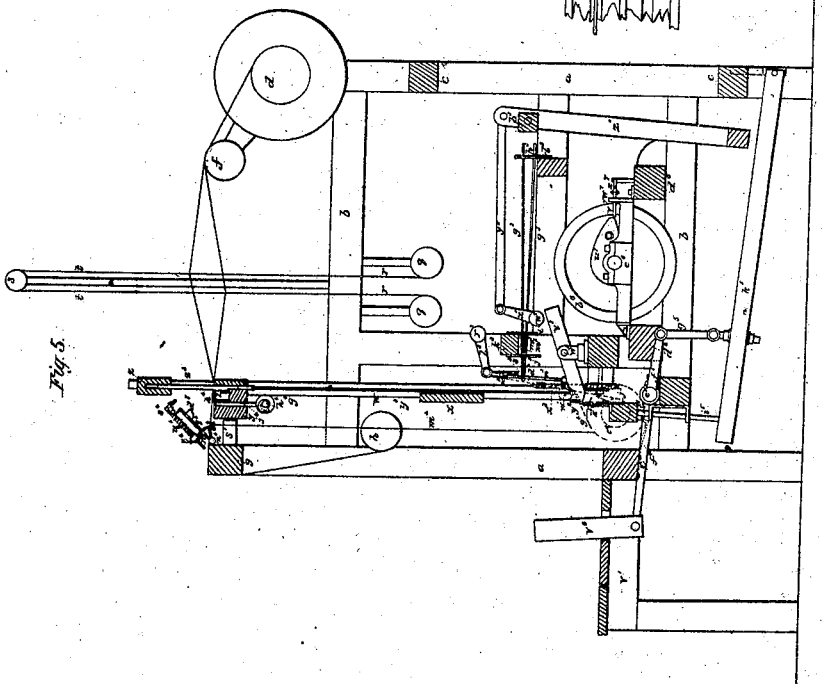

Fig. 5.

Sheet 5 - 5 Sheets.

E. B. Bigelow.

Loom.

No. 546. Patented Jan. 6, 1838.

Fig. 9.

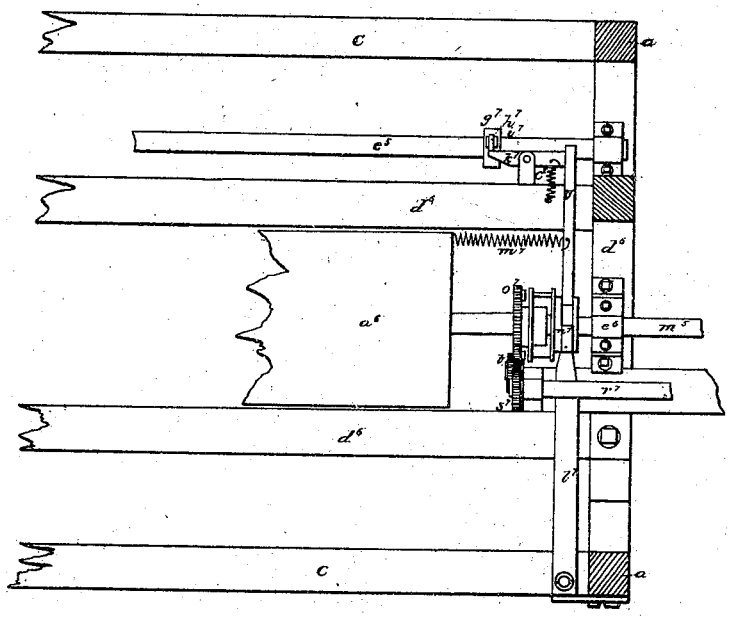

Fig. 11.

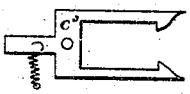

Fig. 10.

UNITED STATES PATENT OFFICE.

E. B. BIGELOW, OF WEST BOYLSTON, MASSACHUSETTS.

LOOM FOR WEAVING KNOTTED COUNTERPANES AND OTHER FABRICS IN WHICH THE WOOF IS RAISED FROM THE SURFACE.

Specification of Letters Patent No. 546, dated January 6, 1838.

To all whom it may concern:

Be it known that I, ERASTUS BRIGHAM BIGELOW, of West Boylston, county of Worcester, and State of Massachusetts, have invented, made, and applied to use new and useful Improvements of Machinery for the Purpose of Weaving Knotted Counterpanes and Such other Figured Fabrics Where the Woof is Raised from the Surface as may be manufactured by the said machinery.

The said improvement, the principles thereof, and mode of using the same, I have fully described in the following words and annexed drawings, which, combined together, form my specification.

The loom properly consists of two parts or divisions First, that which weaves the cloth or forms the fabric. Second, that by which the figures are wrought. The first part or division of the loom is described as follows. The frame consists of four upright posts *a a a a* Figures 1, 2, 3 and 4 5, 7, 9, 10, *b b b b* Figs. 2 and 4, 5, 10 are cross rails which connect the posts together. *c c c* Figs. 1 and 3, 5, 9, 10 are cross horizontal rails for the same purpose of connecting the ends of the frame work. *v* Figs. 2, 4, 5 is a platform for the weaver to stand upon. *d* Figs. 2, 3, 4, 5 represents the beam or roller on which the yarn is wound before weaving. *e, e,* Figs. 2, 3, 4, are weights suspended by friction straps passing over the heads of the beam *d*, to keep the warp at a proper degree of tension, and allow it to unwind as fast as it is filled by the woof, when beaten up by the lay. *f* Figs. 2, 3, 4, 5 is a roller, over which the yarn passes to change its direction; *g* Figs. 1, 2, 5, 6, 7 is the breast beam, over which the cloth passes; *h* Figs. 1, 2, 4, 5 is the cloth roller for receiving what has been completed, *j* Figs. 1, 2 is a ratchet wheel and pinion. *i* Figs. 2, 4, is a lever for communicating motion from the lay to the cloth roller, *k, k* Fig. 1 are catches to secure the roller, while the lever *i* is acted upon by the lay; *l, l* Figs. 1, 2, 4, are treadles which are acted upon by the weavers feet. *m, m,* Figs. 1, 2, 4 represent straps which communicate motion from the treadles *l, l,* to the shafts *o, o,* Figs. 1, 2, 4, which shafts continue the motion, by means of the bevel gears *p, p,* Figs. 2, 4, to the rollers *q, q,* Figs. 2, 4; *r, r,* Figs. 1, 2, 4, 5, are straps for connecting the rollers *q, q,* with the heddles which raise and depress the warp, to receive the shuttle. *t, t* Figs. 1, 2, 3, 4, 5, are straps by which the heddles are suspended from the roller *s*, Figs. 1, 2, 3, 4, 5, supported by the stands *u, u,* Figs. 1, 2, 3, 4. The roller *s* turns on its axis in opposite directions, as the heddles are raised or depressed. *v* Figs. 1, 3, 4 is the axis on which the lay vibrates. The supporting parts of the lay, called swords, appear at *w, w* Figs. 1, 2, 3, 4, 5, 7. *x* Figs. 1, 2, 4, 5 is a cross rail between the swords. *y*, Figs. 1, 3, 4, 5, 6, 7, represents the race beam, upon which the shuttles slide, and to which the lower edge of the reed is attached. *z* Figs. 1, 3, 4, 5, 7, is the top shell of the lay which receives the upper edge of the reed. *p′ p′* Figs. 2, 4, are rods bent as represented in the drawing with their extremities made fast to the post *a* Figs. 2, 4, and the cross rail *b* Figs. 2, 4, *q′*, *q′* Figs. 2, 4, are stands screwed to the race beam, playing on the rods *p′ p′*, Figs. 2, 4. *r′*, *r′*, Figs. 2, 4, represent springs encircled on the rods *p′ p′*, Figs. 2, 4. One extremity of each spring abuts against the pin inserted in the rods *p′*, *p′*, Figs. 2, 4; the other extremity presses against the stands *q′*, *q′*, Figs. 2, 4. The object of the springs is to counteract the weight of the lay, and render it more easily moved by the weaver. *s′*, *s′* Figs. 2, 4, 5, are studs extending from the breast beam *g* Figs. 1, 2, 5, 6, 7, to prevent the lay passing beyond a given point, when it is brought forward to beat up the woof. The double shuttle boxes are visible at *a*, Figs. 1, 3, 4, 6. *b′*, *b′* Figs. 1, 3, 6, are the pecker rods or spindles made fast in the stands *c′*, *c′* Figs. 1, 3, on which the peckers or drivers *d′ d′* Figs. 1, 3, slide. *e′*, *e′*, *e′* Figs. 1, 3, are pecker strings which connect the drivers *d′ d′*, Figs. 1, 3, with the handle *f′*, Figs. 1, 3. The drivers are drawn forward alternately by the weaver grasping the handle *f′* the force of which motion lodges the shuttle in the box at the end of the lay opposite to the driver that is drawn forward. *x′*, *y′* Figs. 1, 3, 4, are pulleys with springs encircled on their axes. The object of the springs and pulleys is to take back the peckers, after

they have been drawn forward by the weaver. z' z' Figs. 1, 3, are strings which connect the peckers with the pulleys x', y', Figs. 1, 3, 4.

From what has been explained, it would appear that only one shuttle would be put in motion; but two are employed, an apparatus is added, by which they are brought alternately before the drivers d', d', Figs. 1, 3, being described as follows. g', g' Figs. 1, 2, 3, 4, are V's upon which the shuttle boxes slide with a horizontal reciprocating motion; h' h' Figs. 2, 4 are screws to regulate the degree of motion of the shuttle boxes; i' i' i' i' Figs. 1, 3 represent arms extending from the shaft j', Figs. 1, 3 with their lower extremities passing through mortises made in pieces of iron l' l' Figs. 3, 4 screwed to the bottom of the shuttle boxes. k', k' Figs. 1, 2, 3, 4 are stands which support the shaft j' Figs. 1, 3. o' Figs. 1, 2, 3, 4 represents the handle which the weaver grasps, and by giving to it an oscillating motion shifts the boxes.

We now come to the second part or division of the loom, which accomplishes its object by three principal operations. 1st. that which regulates the variations in the pattern or figure, adjusts the spring and stop bar raises the hook, or dent, and prepares the woof to be acted on by them. 2d. that which sinks the hooks to form the knots which compose the figure. 3d. that which releases the hooks from the knots, and allows them and other parts of the machinery to return to their former positions.

The first operation is described as follows:—a'' Figs. 1, 2, 3, is a pulley revolving on the first shaft b'' Figs. 1, 2, 3, receiving motion from the mill work by the belt c'' Figs. 1, 2, 3, and giving motion to the machinery to produce the first operation, when the clutch d'' Figs. 1, 3, connects it with the shaft b'' Figs. 1, 2, 3. The clutch d'' Figs. 1, 3, by its reciprocating motion through the chuck f'' Figs. 1, 3, which is made fast to the shaft b'', Figs. 1, 2, 3, connects and disunites the shaft b'', Figs. 1, 2, 3, with the pulley a'' Figs. 1, 2, 3. Motion is given to the clutch d'' Figs. 1, 3, to form this connection, by the shifting rod g'' Figs. 1, 4, which the weaver grasps at the ball h'' Figs. 1, 4, and slides in the stands i'' i'' Figs. 1, 2, 4, toward the right. This gives motion to a lever, whose long arm j'' Figs. 1, 2, 3, is connected with the rod g'' Figs. 1, 4, by means of a mortise through which it passes.

The shaft k'' Figs. 1, 2, 3, turning on bearings in stand, l'' l'' Figs. 1, 2, 3, is the fulcrum of the lever. m'' Figs. 1, 2, 3, is the short arm which by pressing against the spring n'' Figs. 1, 2, 3, overcomes its elastic force. The upper part of the spring is made fast to the cross rail o'' Figs. 1, 3, while its lower extremity plays in a groove in the clutch d'' Figs. 1, 3. p'' Figs. 1, 3, is a spring attached to the spring n'' Figs. 1, 2, 3, and locks or catches on the stand q'' Figs. 1, 3, when the clutch d'' Figs. 1, 3, is brought in contact with the studs extending from the pulley a'' Figs. 1, 2, 3, and thus secures the connection between the pulley a'' Figs. 1, 2, 3, and the shaft d'' Figs. 1, 3. r' Figs. 1, 3, represents a cogged wheel which takes into the cogged wheel s'' Figs. 1, 2, 3, and revolves the shaft t'' Figs. 1, 3, on its axis. Attached to the shaft t'' Figs. 1, 3, are three wipers or cams, from which the three principal motions of the first operation are derived. The first motion has for its object, to regulate the variations made in the pattern or figure, which is effected in the following manner—

The arm w'' Figs. 2, 3, receives an oscillating motion from the wiper v'' Figs. 1, 3, and turns the shaft w'' Figs. 2, 4, on its axis. x'' x'' Figs. 2, 4, 5, are arms extending from the shaft w'' Figs. 2, 4, 5, which oscillate as the shaft w'' Figs. 2, 4, 5, turns on its axis alternately in different directions. y'' y'' Figs. 2, 4, 5, are connecting bars which communicate the oscillating motion from the arms x'' x'' Figs. 2, 4, 5, to the prism frame z'' Figs. 2, 3, 4, 5. a^3 Figs. 2, 4, is the axis on which the prism frame vibrates—t' Figs. 3, 4, represents a spring, attached at one end to the bar y'' Figs. 2, 4, 5, and at the other extremity to the cross rail c Figs. 5, 3, 9, 10. The object of this spring is to take back the prism frame, after it has been drawn forward by the cam v Figs. 1, 3. b^3, Figs. 2, 3, represents a four sided prism, having as many holes bored in each side, as there are knots to be raised in any thread of the woof, and to correspond in number with the hooks or dents which act on the filling. It also has projecting points or teeth u', u', u', Fig. 3, the object of which is to enter holes made in the pattern card, so as to bring the remaining holes in the pattern card directly over the holes in the prism. c^3 Figs. 4, 11, is a double pawl, shaped as seen in Fig. 11 and vibrates on a pin which connects it to a stand on the frame work of the machine. The prism is made to turn one quarter revolution at each oscillation, by means of the upper hook of the double pawl c^3 Figs. 4, 11, retaining one corner, while the other part is carried out.

When the figure to be woven is half completed, it is necessary to reverse the motion of the prism, to turn back the pattern card. This is effected by attaching a spring to the projecting arm of the double pawl c^3 Figs. 4, 11 which brings the lower hook of the double pawl c^3 Figs. 4, 11, to act on the prism. The hooks of the double pawl c^3

Figs. 4, 11, turn the prism, by acting on the friction rollers of a wheel d^3 Figs. 3, 4, on the extremity of its axis. This wheel may be constructed of two parallel plates, having four holes drilled in each opposite to each other, and corresponding in position with the corners of the prism, to serve as bearings for four small cylinders or friction rollers which serve the same purpose as the teeth of a ratchet wheel.

e^3 Figs. 3, 4, is a piece of iron or other metal shaped in the form of a T and moving in proper supports attached to the prism frame. f^3 Figs. 3, 4, is a spiral spring encircled on the upright part of the T e^3 Figs. 3, 4, and forces it against the friction rollers in the wheel d^3 Figs. 3, 4, to prevent the prism from turning except by the action of the hooks of the double pawl c^3 Figs. 4, 11. g^3, g^3, g^3, Figs. 2. 4. 5, represent as many horizontal wires as there are holes bored in each side of the prism. They are so arranged as to slide in holes drilled in the plates of iron h^3 Figs. 2, 4, 5, i^3 Figs. 3, 5, j^3 Figs. 2, 4, 5, screwed to the cross rails k^3, l^3, Fig. 5.

Between the plates of iron screwed to the cross rail k^3 Fig. 5, a spiral spring m^3 Fig. 5, is encircled around each horizontal wire g^3, g^3, g^3, Figs. 2, 4, 5, and attached thereto at one end by a pin inserted in the horizontal wire g^3 Figs. 2 4, 5. This pin also serves the purpose of a shoulder to prevent the return of the horizontal wire beyond a proper distance.

The opposite end of the spring m^3 Fig. 5 abuts against the plate of iron j^3 Fig. 5. This spring yields to any gentle pressure on the end of the horizontal wire g^3 Figs. 2, 4, 5, projecting beyond the cross rail l^3 Fig. 5 and returns to its place again when that pressure is removed. In the end of each horizontal wire projecting beyond the cross rail k^3 Fig. 5, is an eye, through which a wire n^3 Figs. 4, 5, passes, hooked at one end, and arranged vertically over the lifting bar s^3 Fig. 5. The wire n^3 Figs. 4, 5, is more particularly described hereafter.

The ends of the horizontal wires projecting beyond the cross rail l^3 Fig. 5, are so arranged as to enter the holes of the prism, as it swings toward them. If this was the whole of the apparatus, it is evident that the prism b^3 Figs. 2, 3, could produce no effect on the horizontal wires g^3, g^3, Figs. 2, 4, 5, for the ends of them, being received at each swing of the prism into the corresponding holes of the prism, all pressure on the same would be avoided. If we cover each face of the prism as it is brought successively against the ends of the horizontal wires, with a piece of pasteboard o^3 Fig. 2 called a pattern card, pierced with holes corresponding to those of the prism, and opposite to certain of the horizontal wires, which it may be necessary to have remain at rest, it is evident that all the other horizontal wires will be pushed forward, thus withdrawing the hooked wires n^3 Fig. 5, n^3 Figs. 4, 5, with which they are connected, from the action of the lifting bar, which when raised, will carry up with it only those hook wires n^3 n^3 Figs. 4, 5, which have not been pushed back, or in other words, those the horizontal wires of which were opposite to the holes in the pattern card o^3 Fig. 2. Thus any variation may be made in the figure or pattern, by a corresponding variation in the pattern card.

The object of the next motion is to raise the hooks and prepare the woof to be acted on by them. This is accomplished as follows; an oscillating motion is given to the arm p^3, Figs. 1, 2, 3 by the wiper or cam q^3 Figs. 1, 3. This turns the shaft r^3 Figs. 1, 2, 3, 4, 5 on its axis, and raises the lifting bar s^3 Fig. 5, which is connected to the shaft r^3 Figs. 1, 2, 3, 4, 5, by the arms t^3, and the bars u^3 u^3.

When the lifting bar s^3 Fig. 5 is raised, it carries with it the hooked wires n^3, n^3, Figs. 4, 5, which were not pushed forward by the horizontal wires, as before described. The hooked wires n^3 n^3 Figs. 4, 5, are connected by a joint with the levers v^3, v^3, Fig. 5, and raise those ends of them to which they are attached. w^3, w^3, Fig. 5, are the fulcra on which the levers turn. x^3, Figs, 1, 4, 5, represents a rack having suitable guides, between which the ends of the levers are inserted and play during their motion up and down.

y^3, y^3, y^3, Figs. 1, 3, 5, 7, 8, represent vertical wires which are attached at their lower ends by a hinge joint to the levers v^3, v^3, Fig. 5, and at their upper ends to the hooks or dents z^3, z^3, Figs. 5, 6, 7, 8. They communicate motion from the levers v^3, v^3, Fig. 5, to the dents or hooks z^3, z^3, Figs. 5, 6, 7, 8. The hooks z^3, z^3, Figs. 5, 6, 7, 8, compose every fourth dent of the reed, and are made to slide in the bands of the reed with a vertical reciprocating motion. The movable hooks z^3, z^3, Figs. 5, 6, 7, 8, are more particularly shown in Fig. 8 and are shaped and formed as therein seen. On each side of the hook is a piece of copper or other metal a^4, Fig. 8, beveled at the top, its object being to separate the threads of the warp, when the hooks are raised, so as to prevent any accident which might occur by the points of the hooks catching the threads of the warp, while going down.

The reed is similar in construction to those in common use in other looms, with the exception, that next to every third dent is placed one of the movable dents which act on the woof or filling. The number of movable dents, and of course the number of fast dents between them, are regulated by

the kind of fabric to be manufactured; thus instead of three fast and a movable dent, as above mentioned, there may be four or more at pleasure, and a movable dent next in order as seen in Fig. 6 where b^4, b^4 b^4, Fig. 6, represent the fast, and z^3, Figs. 6, 8, the movable dents. The construction of the reed or that part of it which relates to securing the dents, differs somewhat from the mode usually adopted in reeds in common use. There are two strips or bands of iron at the upper and lower edge of the reed, between which the ends of the dents are inserted. A notch is formed on the under and upper edge of each band on either side of each movable dent. The dents are then secured in the bands by means of a wire properly wound between them around the bands, which, being received into the notches, prevents the movable dents from becoming misplaced by the operation of the loom or otherwise. The fast dents are soldered or otherwise fastened together at the top, to prevent them dropping out, in case they are not made secure by the wire wound between them.

An arm c^4 similar to the arm t^3, Fig. 5, extends from the shaft r^3, Figs. 1, 2, 3, 4, 5, (being hid in the drawing by the arm t^3, Fig. 5.) Attached to the arm c^4 is a strap d^4, Fig. 5, which when the shaft r^3, Figs. 1, 2, 3, 4, 5, turns on its axis, communicates motion to the pulley e^4, Figs. 2, 5. f^4, Fig. 5, represents a spring which locks or catches into a notch made in the circumference of the pulley e^4, Figs. 2, 5, when it has completed that part of a revolution it is caused to make by the strap d^4, Fig. 5, and prevents it from turning, when the strap d^4, Fig. 5, is slackened, as the shaft r^3, Figs. 1, 2, 3, 4, 5, turns, to depress the lifting bars^3, Fig. 5.

g^4, Fig. 5, is a strap which communicates motion from the pulley e^4, Figs. 2, 5, to the shaft h^4, Figs. 1, 5, 7. w', Figs. 1, 5, is a small pulley on the axis of the lay, to guide the strap g^4, Fig. 5, so that during the vibrations of the lay, it shall preserve an uniform tension. Attached to the shaft h^4, Figs. 1, 5, 7, are three wipers or cams l^4, l^4, l^4, Figs. 2, 5, 7, which impart an upward motion to three vertical rods j^4, j^4, j^4, Figs. 5, 7, placed over them. Attached to the top of the rods is a piece of metal k^4, Figs. 5, 6, 7, called the race piece, which is raised by the rods j^4, j^4, Figs. 5, 7, to touch the lower shed of the warp, while the movable dents or hooks are acting on the filling. Grooves l^4, l^4, Fig. 5, are made in that edge of the race piece presented to the reed, corresponding in number and position with the movable dents, the hooked parts of which pass through the grooves as the dents move up and down in the bands of the reeds.

The race piece k^4, Figs. 5, 6, 7, supports the woof as it is acted on by the hooks and thus makes the knots of a uniform length. m^4, Figs. 1, 2, 5, is a strap which receives motion from the pulley e^4, Figs. 2, 5, and communicates it to the shaft n^4, Figs. 2, 5, 6, 7, by means of the arm o^4, Fig. 5, to which it is attached. n^4, Figs. 2, 5, 6, 7, is a shaft extending horizontally across the loom, supported by the stands p^4, p^4, Figs. 6, 7. To this shaft are attached the pieces of metal q^4, q^4, Figs. 2, 5, 6, 7, shaped and formed as seen in Figs. 6 and 7. Attached to their upper surface are upright pieces r^4, r^4, Figs. 2, 5, 6, 7, to serve as supports and guides for the wires s^4, s^4, Figs. 2, 5, 6, 7. The wires s^4 s^4 slide in holes in the top of the pieces r^4, r^4, Figs. 2, 5, 6, 7. t^4, t^4, Figs. 2, 5, 6, 7, are arms affixed by a screw to the wires s^4, s^4, Figs. 2, 5, 6, 7, and slide in slots made in the pieces of metal q^4, q^4, Figs. 6, 7. u^4, Figs. 2, 5, 6, 7, is a spiral spring which encircles the wire between the arm t^4, Figs. 2, 5, 6, 7, and the upright piece r^4, Figs. 2, 5, 6, 7. v^4, Fig. 6, is a lever whose fulcrum is at w^4, Figs. 6, 7, having one arm jointed at x^4, Figs. 6, 7, to the piece y^4, Figs. 6, 7.

The joint x^4, Figs. 6, 7, is so constructed that the piece y^4, Figs. 6, 7, cannot fall below a horizontal line; z^4, Figs. 6, 7, is a projection from the shaft n^4, Figs. 2, 5, 6, 7, and a^5, Figs. 6, 7, is another from the race beam y, Figs. 1, 3, 4, 5, 6, 7. b^5, Fig. 6, is a spiral spring with one end attached to the lever v^4, Fig. 6, and the other to the breast beam. c^5, Fig. 6, is a spiral spring encircled around the shaft n^4, Figs. 2, 5, 6, 7, having one end attached to the shaft, and the other to the breast beam.

The object of this apparatus is to push the filling under the hooks to be acted on by them to form the knots; this is effected as follows: The strap m^4 Figs. 1, 2, 5 brings down the apparatus to a level with the top of the race beam, thereby causing the points of the wire, S^4, S^4, Figs. 2, 5, 6, 7 to pass down behind the woof. At the same time the shaft n^4, Figs. 2, 5, 6, 7 turning, allows the short arm Y^4 Figs. 6, 7 of the lever V^4 Fig. 6 to fall to a horizontal position. The lay coming forward until it meets the stops d^8, d^8 projecting from the underside of the pieces of metal g^4, g^4 Figs. 2, 5, 6, 7 causes the projection A^5 Fig. 6, 7 to strike against the side of the arm y^4, Figs. 6, 7 which pushes the other arm of the lever and the wire, s^4 s^4 Figs. 2, 5, 6, 7 forward toward the reed, carrying the filling along with it under the hooks.

The third motion adjusts the stop bar and the springs which support and prevent the levers from falling by their gravity, when the lifting bar by which they are raised, returns to its place. The arm e^8 Figs. 1, 2, 3 receives motion from the wiper or cam d^5 Figs. 1, 2, 3 and turns the shaft e^5 Figs. 2, 5, 9, 4. g^5, g Figs. 2, 4, 5 are connecting bars, jointed at one end of each to the arm f^5, f^5,

Fig. 5 and at the other end to the lever h^5, h^5 Figs. 1, 2, 3, 4, 5. l^5, l^5 Figs. 1, 2, 4, 5 are upright rods which slide with a vertical reciprocating motion in suitable stands, and serve to support the stop bar j^5 Figs. 4, 5. This stop bar j^5 Figs. 4, 5 receives the ends of the levers as they are forced down by the cylinders, and regulates the degree of motion thus given to the hooks or dents z^3, z^3, Figs. 5, 6, 7, 8.

k^5, k^5 Fig. 5 represent springs arranged vertically before the levers v^3 Fig. 5 and made fast at the bottom to the stop bar j^5. The ends of the levers v^3, v^3 Fig. 5 rest upon the ends of the springs, and are supported by them. The springs yield to any upward pressure made on the opposite ends of the levers v^3, Fig. 5 and allow them to sink down to the stop bar. When the levers strike the top bar j^5 Figs. 4, 5, the shoulders of the springs lock or catch on the ends of them, and prevent them from being raised by the resistance of the woof, as it is acted on by the movable hooks or dents z^3 Figs. 5, 6, 7, 8. As the hooks are forced down by the motion of the levers, they act on the woof, and force it into their corresponding grooves in the race piece, thus making the knots, which compose the pattern or figure.

The cams or wipers on the shaft t^{11}, Figs. 1, 3, are so shaped as to give the three principal motions of the first operation relatively as follows; The prism is first brought forward to push back the hooked wires; then the lifting bar, the springs and stop bar rise up simultaneously and immediately as the lifting bar arrives at its destination, it returns again to the place from whence it started. When the lifting bar has descended, the prism returns to its former position.

The first operation being completed, the stud z^6 Figs. 1, 3 projecting from the cog wheel s^{11} Figs. 1, 2, 3 unlatches the spring p^{11} Figs. 1, 3, thereby releasing the spring n^{11}, Figs. 1, 2, 3 which by its elastic force withdraws the clutch d^{11} Figs. 1, 3 from the studs extending from the pulley a^{11} and thus destroys the connection between the pulley a^{11} Figs. 1, 2, 3, and the shaft b^{11} Figs. 1, 2, 3. After this connection is destroyed the stud a^7 Fig. 3 projecting from the cam or wiper v^{11} Figs. 1, 3 strikes against a shoulder projecting from the upright bar b^7 Figs. 1, 2, 3 and prevents the cams from passing beyond a given point by their momentum.

As it is evident that so much of the woof must draw in from the shuttle as is required to form the knots, it is necessary, in order to prevent the movable dents from cutting it off by their downward motion that each should act on the woof successively; that is one after the other.

The second operation of the machinery accomplishes the above object, and may be understood as follows:—l^5 Figs. 1, 3, 4 is a pulley which revolves on the shaft m^5 Figs. 1, 3, 4, 9 receiving its motion from the mill work.

n^5 Figs. 1, 3 is a clutch which slides with a horizontal reciprocating motion, and connects and disunites the pulley l^5 Figs. 1, 3, 4 with the shaft m^5 Figs. 1, 3, 4. Motion is given to the clutch n^5 Figs. 1, 3 to form this connection, by means of the shifting rod o^5, Fig. 1 which the weaver grasps at the ball p^5 Figs. 1, 3 and slides toward the right. This moves a lever when long arm g^5 is connected with the rod o^5 Fig. 1 by means of a mortise, through which it passes. The shaft r^5 Figs. 1, 3, 4 is the fulcrum. s^5 Figs. 1, 3, 4 is the short arm which presses against the spring u^5 Figs. 1, 4, 10, and overcomes its elastic force. The spring u^5 Figs. 1, 4, 10 is made fast to the post of the frame, with the other extremity playing in a groove in the clutch n^5 Figs. 1, 3. v^5 Fig. 10 represents a lever which extends across the loom with its fulcrum w^5 Fig. 10 in the center. Fig. 10 attached to the frame. x^5 Fig. 10 is a spiral spring which exerts an upward force on that arm of the lever to which it is attached.

When the spring u^5 Figs. 4, 10 is acted on by the short arm s^5 Figs. 1, 3, 4, to bring the clutch n^5 Figs. 1, 3 in contact with the pulley l^5 Figs. 1, 3, 4, the lever v^5 Fig. 10 is drawn upward, and abuts against the stud z^5 Fig. 10, extending from the side of the spring u^5, Fig. 10 and thus secures the connection between the pulley l^5 Figs. 1, 3, 4 and the shaft m^5 Figs. 1, 3, 4.

a^6 Figs 1, 3, 4, b^6, Figs. 3, 5 c^6, Figs. 2, 4 represent cylinders which are arranged horizontally across the loom in the frame d^6 Figs. 2, 4, 9, resting on the cross rails b b Figs. 2, 4, 5, 10. e^6, e^6, e^6 Figs. 2, 5, 9 are stands which support the ends of the axes of the cylinders. f^6 f^6 Fig. 3 represent teeth or spurs which are inserted in suitable positions relative to each other in the surface of each cylinder.

When the cylinder, a^6, Figs. 3, 4, 9 revolves on its axis, the first tooth or stud in the cylinder a^6, Figs. 3, 4, 9, strikes the first or outside of the series of levers v^3, v^3, Fig. 5 and forces the reverse end down to the stop bar. The tooth inserted next in order to the first strikes the second lever at another instant of time, and so on, until each tooth has acted on its corresponding lever, and forced each movable dent connected with it successively into its corresponding groove in the race piece, and formed the knots.

For all the purposes of the loom, one cylinder only would be necessary, provided we could make use of one of a suitable size. It will be seen as each tooth on the surface

of the cylinder must be at a certain distance both horizontally and longitudinally from the next succeeding tooth, and as their longitudinal distance apart from their center must be equal to the distance between the center of their corresponding levers, and as each tooth is obliged to move through a certain arc of a circle, to give a suitable degree of motion to the lever on which it acts, before the next succeeding tooth begins to act on the next succeeding lever, that where a great number of levers are employed, the cylinder must be very large; therefore we make use of three or more according to their size, or the width of the loom.

The first of these cylinders on completing its revolution is succeeded by the revolution of the second, which last as soon as completed, is succeeded by the revolution of the third cylinder. Each cylinder must perform an entire revolution before the other commences, in order that the action of the teeth of the second cylinder shall not take place until that of the first is fully completed.

On the end of the axis of the first cylinder is fixed a dog or piece of metal with a projection from its end or a pin inserted and projecting therefrom. To the end of the axis of the second cylinder, which lays directly against the end of the axis of the first, is affixed a circular plate having a projecting rim. In this rim is formed a slot or opening of such a size as to allow the end of a click the reverse end of which vibrates on the axis, to move through a sector of a circle, which in reversing the motion of the cylinder would be lost by the dog and click, if the dog struck as the cylinder a^6, Figs. 3, 4, 9 revolve in either direction against a fixed stud or projection from the plate.

It will be seen by the construction of the dog and click, that when the motion of the cylinder is reversed, the click is in a certain position against one end of the slot, and that when the cylinder a^6, Figs. 3, 4, 9 move in an opposite direction, the dog comes around and strikes against the opposite side of the click, which moves forward to the opposite end of the slot and allows the center of the dog to complete an entire circumference of a circle before it moves the cylinder b^6, Figs. 3 and 5.

Between the second and third cylinders are also another dog and plate, similar to the one above described. The first cylinder on completing its revolution communicates motion to the cylinder b^6, Figs. 3, 5, which after acting on all the levers corresponding with its teeth, in a similar manner to the first cylinder, or in other words, when it has completed one entire revolution, communicates motion to the cylinder c^6, Figs. 2, 3. The cylinder c^6, Figs. 2, 3, operates on the levers similarly to the aforesaid cylinders, and when it has completed its revolution, the stud g^6, Fig. 2, in the end of the piece of metal h^6, Fig. 2, acts on the lever l^6, Fig. 2, which by means of the connecting wire j^5, Figs. 4, 5, raises one arm of the lever v^5, Fig. 10, depresses the reverse arm, and releases the spring u^5, Fig. 10, which by its elastic force withdraws the clutch n^5, Figs. 1, 3, from the stud, extending from the pulley l^5, Figs. 1, 3, 4, and destroys the connection between the pulley l^5 and the shaft m^5, Figs. 1, 3, 4, 9, k^6, Fig. 3, is a catch which receives a shoulder of the stop m^6, Fig. 2, and prevents the cylinders from turning beyond a given point by their momentum, after the connection is cut off between the pulley l^5, Figs. 1, 3, 4, and the shaft m^5, Figs. 1, 3, 4.

l^6, Figs. 1, 3, is a vertical lever where fulcrum is connected with the framework, and its lower end with the said catch k^6, Figs. 2, 3. The object of the lever l^6, Figs. 2, 3, is to withdraw the catch k^6, Fig. 2, from the shoulder of the stop m^6, Fig. 2 in order to allow the revolution of the cylinder, when it is again employed to act on the levers. The lever l^6, Figs. 2, 3, is put in motion by means of a stud attached to the connecting bar y^{11}, Figs. 2, 4, 5.

n^6, Fig. 2, is a spring, attached to the catch k^6, Figs. 2, 3, to prevent the catch k^6, Fig. 2 from returning under the shoulder of the stop m^6, Fig. 2, when the stud from the connecting bar y^{11}, Figs. 2, 4, 5, is withdrawn from the lever l^6, Figs. 2, 3. O^6, Fig. 2, is a catch which locks under another shoulder of the stop m^6, Fig. 2, and prevents the cylinder c^6, Figs. 2, 3, from rebounding, when the shoulder of the stop m^6, Fig. 2, strikes against the catch k^6, Figs. 2, 3, as above described. p^6 p^6, Fig. 2, are springs having one extremity of each attached to the stand g^6, Fig. 2, and the other end of each connected with the catches k^6. o^6, Figs. 2, 3, 7, to bring them under the shoulder of the stop m^6, Fig. 2. The cylinder a^6, Figs. 3, 4, 9, is prevented from rebounding by means of a stud r^6, Fig. 4, projecting from its right end, which strikes against a projection s^6, Fig. 4, from the upper side of the lever u^6, Fig. 4, when fulcrum is at f^6, Fig. 4. The lever u^6, Fig. 4, is held up by a spring attached to it, and the framework.

The third operation which consists in releasing the hook from the knot, and allowing them and other parts of the machinery to return to their former positions is described as follows. The weaver presses his foot on the treadls v^6, Figs. 1, 2, 4, 5, and raises the stop bar j^5, Figs. 4, 5, which act on the ends of the levers v^3, v^3, Fig. 5, resting upon it, pushes them upward and the movable dent, connected with them. But before the weaver presses his foot on the treadles v^6, Figs. 1, 2, 4, 5, he crosses the

threads of the warp to secure the knot, and prevent the hooks during their upward movement from carrying any portion of the filling with them. The lug is then moved back to carry the hooks away from the filling, that they may not act on it when they return down to their places. The weaver next removes his foot from the treadle v^6, Figs. 1, 2, 4, 5, and allows the stop bar to descend, which is assisted in its motion downward by the action of the spring x^6, Fig. 1, y^6, Figs. 1, 5, is a bar attached to stands made fast to the stop bar, and arranged horizontally over the ends of the levers v^3, v^3, v^3, Fig. 5.

The object of the bar y^6 Figs. 4, 5 is to insure the downward motion of the lever v^3, Fig. 5 should any of them be obstructed by the hook connected with them binding in the reed or warp.

As the weaver pushes down the treadle v^6, Figs. 1 2 4 5 he performs two other operations; the first brings down the race piece k^4 Figs. 5 6 7 and raises the apparatus which guides the woof under the hook; the second releases the cams from the stop bar b^7, Figs. 1 2 3, turns them a little, to allow the arm e^8 Figs. 1, 3 to pass down to its lowest position on the cam.

The depressing of the race piece k^4, Figs. 5, 6 7 and raising the apparatus which guides the woof under the hooks, may be described as follows. The arm c^7 Figs. 1, 5 moving with the shaft e^5 Figs. 1, 2, 4, 5 presses on the spring f^4, Fig. 5 and releases it from the pulley e^4, Figs. 2, 5. The spring c^5, Fig. 6 being thus relieved, acts on the shaft n^4 Figs. 2, 5, 6, 7 and causes the apparatus which guides the woof under the hooks to fly upward. At the same time the spring f^8 Fig. 1 draws down the welt g^8, Fig. 1 and thus turns back the shaft h^4 Figs. 1, 5, 7 and cams i^4 Figs. 2, 5, 7 and allows the race piece to fall by its own gravity.

The releasing of the cams from the bar b^7 Figs. 1, 3 and turning them a little, to allow the arm e^8 Figs. 1, 2, 3 to pass down to its lowest position on the cam, is thus described. The wiper d^7 Fig. 2 turning with the shaft c^5, Fig. 6 acts on the upright bar b^7, Figs. 1, 2, 3 and pushes it off, and releases the stud a^7 Fig. 3 from the projection on the bar b^7 Figs. 1, 2, 3. The bar b^7, Figs. 1, 2, 3 by means of a hook e^7 Fig. 2 jointed to the top of the bar b^7, which locks on a stud extending from the wiper v'', Figs. 1, 3 turns the cams or wipers a little on their axes, and allows the arm e^8 Figs. 1, 2, 3 to pass down to the small part of its cam, when the weaver removes his foot from the treadle v Figs. 1, 2, 4, 5 to sink the hooks. As the weaver removes his foot from the treadle v^6, Figs. 1 2 4 5 two other operations are also performed. The first is to relieve the projection s^6 Fig. 4 of the lever u^8 Fig. 4 from the stud r^6 Fig. 4 to allow the revolution of the cylinder a^6, Figs. 3, 4, 7 when its motion is reversed. The second is to form a connection between certain parts of the machinery, to communicate a reversed motion to the cylinders a^8, Figs. 3 4 9 b^6, Figs. 3, 5. The projection s^6 of the lever u^6 is thus released from the stud r^6, Fig. 4 as the shaft e^5 Figs. 2, 4, 5, 9 turns, the arm f^7 Fig. 4 presses downward the bent end of the lever u^6 Fig. 4 and releases the stop r^6 from the projection s^6.

The mode of forming a connection between certain parts of the machinery, to communicate a reversed motion to the cylinders a^6 Figs. 3, 4, 9, b^6 Figs. 3 5 is thus described. On the shaft e^5 Figs. 2 5 9 is fixed a projecting arm g, Figs. 4 9 having in its end a tongue h^7, Fig. 9 acted on by a spring i^7, Fig. 9 in a similar manner to a blade and spring of a penknife, which spring, when the shaft turns, by the weaver's foot being pressed on the treadle, yields and allows the tongue to pass under the end of the lever k, Fig. 9.

On the return movement of the shaft e^5 Figs. 2, 4, 5, 9 as the weaver removes his foot from the treadle, the end of the tongue n^7 Fig. 9 strikes against the end of the lever k^7 Fig. 9, pushes the reverse arm in an opposite direction, and releases the lever l^7 Figs. 2, 9, which lever is drawn sideways by the spring m^7, Fig. 9 and brings the clutch n^7 Figs. 9 in contact with the studs extending from the cogged wheel o^7, Fig. 9 thus attaching the shaft m^5 Figs. 1, 3, 4, 9 to the cogged wheel o^7 Fig. 9, which otherwise revolves on the shaft.

The lever l^7 Figs. 2 9 turns on a fulcrum attached to the post a Figs. 2 9, and has a projection in its center, playing in a groove in the clutch n^7 Fig. 9.

p^7 Fig. 1, is a cogged wheel attached to the pulley b^5 Figs. 1, 3, 4 and takes into another cogged wheel q^7 Figs. 3, 4, attached to the end of the shaft r^7 Figs. 3 4 9. Attached to the opposite end of the shaft r^7 Figs. 3 4, 9, Fig. 9 is another cogged wheel s^7 Fig. 9 which takes into a small cogged pinion t^7 Fig. 9, which pinion takes into the cogged wheel o^7 Fig. 9, and turns it in a direction opposite to the motion of the cogged wheel p^7 Fig. 1. This plan is adapted to produce a reverse motion, in preference to using bevel gears, in order to reduce the velocity of the reversed motion.

From the above it will be seen, when the gear o^7 Fig. 9 is connected with the shaft m^5 Figs. 1, 3, 4, 9 by the clutch n^7 Fig. 9, a reversed motion is communicated to the cylinders. The peculiar object of turning back the cylinders is to reverse the position of the dogs against the click, playing in slots in the circular plates between the cylinders, in order that the first cylinder put in motion, when it is again employed to move the hooks,

may perform an entire revolution, before it communicates motion to the second, and that the second may also complete a revolution, before it moves the third and so on, through any number of cylinders, employed. Therefore, it is evident that the last of the series of cylinders does not require to be turned back.

The next portion of machinery to be described is that which withdraws the clutch n^7, Fig. 9 from the cogged wheel o^1, Fig. 9 and destroys the connection between the shaft m^5 Figs. 1, 3, 4, 9 and the cogged wheel o^7 Fig. 9. u^7 Fig. 5 is a cam attached to the shaft of the cylinder next the last of the series of cylinder—v^7 Fig. 5 is a pitman sliding in a bearing w^7, Fig. 5—One end of this pitman is presented to the cam u^7 Fig. 5 the reverse end being connected with two toggles x^7 Figs. 3, 5 y^7 Fig. 3. The end of the toggle x^7, 3 is jointed to a stand attached to the framework. The end of the toggle y^7 Fig. 3, is jointed to the end of a long rod z^7 Fig. 3 sliding in stand a^8, b^8 Fig. 3. The opposite end of the rod z^7 Fig. 3 is connected by a joint to the lever l^7, Fig. 9. Just as the cylinder, with which the cam u^7 Fig. 5 is connected completes its revolution, the cam u^7 Fig. 5 pushes out the pitman, thus straightens the toggle, and slides the rod z^7 Fig. 3 lengthways. The rod z^7 Fig. 3 moves the lever l^7 Figs. 4 9 which withdraws the clutch n^7 Fig. 9 from the stud of the cogged wheel o^7 Fig. 9. When the lever l^7 Fig. 9 is moved sidewise, as above described, the spring c^8 Fig. 9 draws the lever k^7 Fig. 9 inward, and thus brings the end of it to abut against the extremity of the lever l^7 Fig. 9 and prevents the return of the clutch n^7 Fig. 9 against the stud of the cogged wheel o^7, Fig. 9.

The mode of operating the loom is as follows: The weaver mounts the platform in the middle of the loom and grasps the top shell of the lay at the handle o^1 Figs. 1, 2, 3 4 with his left hand, and the handle f Fig. 13 with his right hand. When thus stationed, he opens the warp to receive the shuttle by the action of his feet upon the treadle l, l Figs. 1, 2, 4 throws the shuttle with his right hand, and moves the lay, and shifts the shuttle with his left hand, in a manner similar to common weaving. When he has inserted the number of threads of woof to be introduced between them to be raised; he lodges the shuttle containing the coarse woof in the shuttle box at the right hand of the lay, or in other words, at the end of the lay opposite to that at which the hook, or movable dent, begins to act on the filling, and continues to press on the harness treadle with his foot, to secure a large opening between the threads of the warp.

When the first division of the loom is in this stage of its operation the weaver grasps the ball h Figs. 1, 4 with his right hand, and forms a connection between the driving pulley and the machinery which regulates, the variation in the pattern or figure, adjusts the springs and stop bar, raises the hooks, and prepares the woof to be acted on by them. Just as this operation is completed, he moves forward the lay, until it strikes against the projections b^5 b^5 Fig. 6 to bring the hook over the woof; he then grasps the ball p^5 Figs. 1, 3 and communicates motion to the cylinder, which sinks the hooks. Immediately after this operation is completed, he crosses the warp with his left foot to secure the knot, and with his right foot presses on the treadle v^6 Figs. 1, 2, 4, 5, to raise the hooks from them. After he moves back the lay, to carry the hook away from the knot, he removes his foot from the treadle v^1, Figs. 1, 2, 4, 5 and allows them to return to their former position. Then he proceeds to operate the first part of the loom as before.

Having described my improvements in machinery to weave knotted counterpanes and such other figured fabrics, where the woof is raised, as may be woven by the said machinery, and shown by the accompanying drawings and foregoing description the best mode of constructing and adapting the same with which I am acquainted, I desire to be understood that I do not intend to confine myself to that particular form, material, and arrangement of the part shown in the drawing by which I effect my improvement in weaving, as different from and arrangement of mechanism may be found capable of effecting the same object; and although I have herein above described many parts of machinery in common use, as applied in connection with my improvement and invention for raising the knot, or figure from the surface of the cloth, yet I only claim the combination of such part with, and their application to, my improvements.

Separately and singly I claim as my invention and improvement as follows.

1. Raising the knots which compose the figure from the surface of the cloth, by a series of movable dents or teeth or hooks.

2. Supporting the woof during the operation of the movable dents or teeth or hooks, and thereby regulating the length of the knots by a bar, beam or race piece, as herein above described.

3. Separating or dividing asunder the thread, of the warp by means of beveled pieces of metal on the sides of the movable dents or hooks or teeth, to prevent them from catching into and breaking the thread.

4. A toothed cylinder or cylinders acting on machinery intervening between them and the dent, or teeth or hooks and operating

the dents or teeth or hooks, successively, to raise the knots which compose the figure.

5. The application of a prism and pattern card, to regulate the operation of the hooks or teeth or dents to produce the variations in the pattern or figure.

In testimony that the above is a true specification of my said invention and improvement, I have hereto set my hand this seventeenth day of June A. D. 1836.

ERASTUS B. BIGELOW.

Witnesses:

R. H. EDDY,

EBENEZER RHOADES.