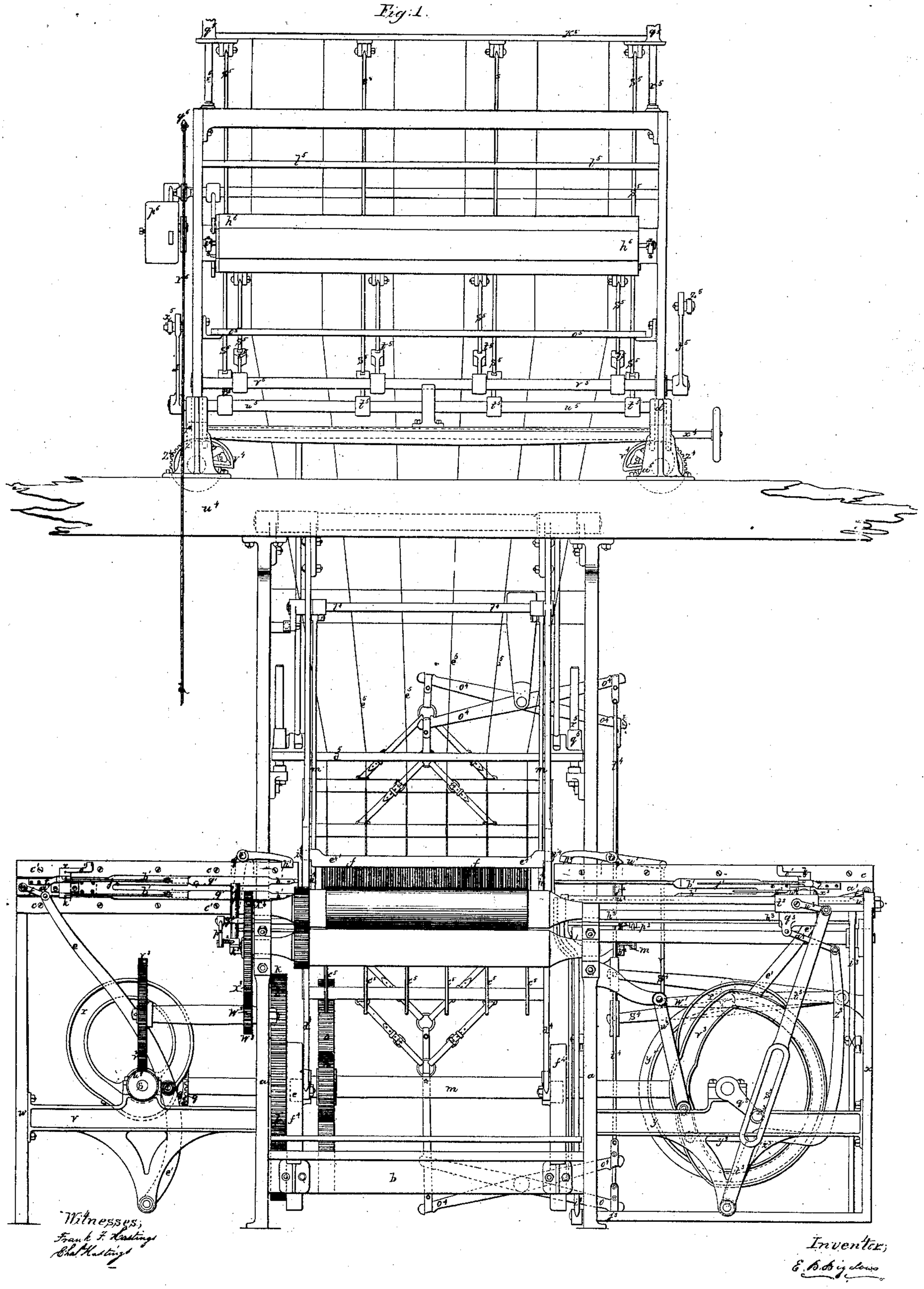
Sheet 1. 6 Sheets.

E. B. Bigelow.
Weaving Pile Fabric.

No. 16,370. Patented Jan. 13, 1857.

Fig: 1.



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Sheet 2. 6 Sheets.

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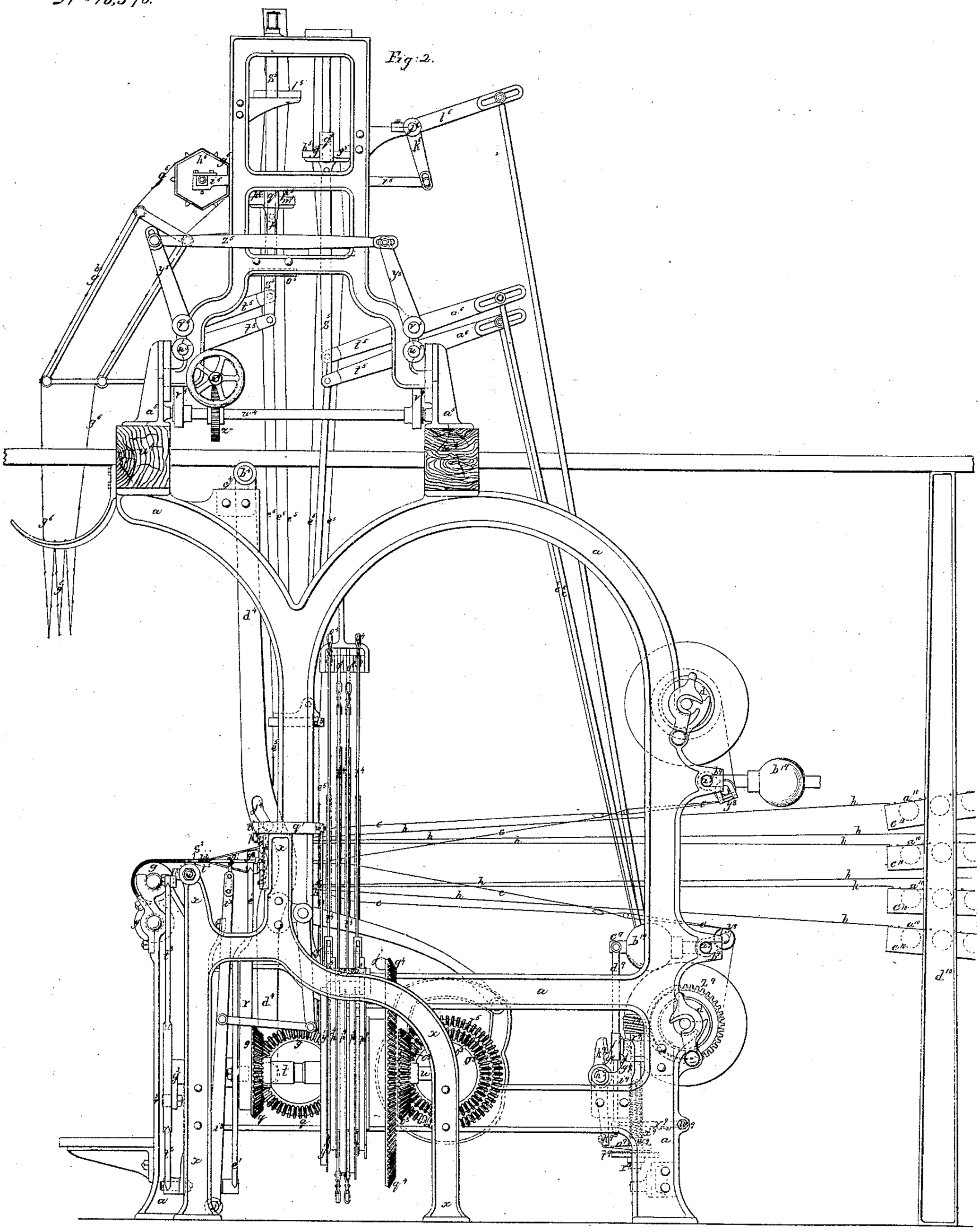
Fig: 2.



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Sheet 3. 6 Sheets.

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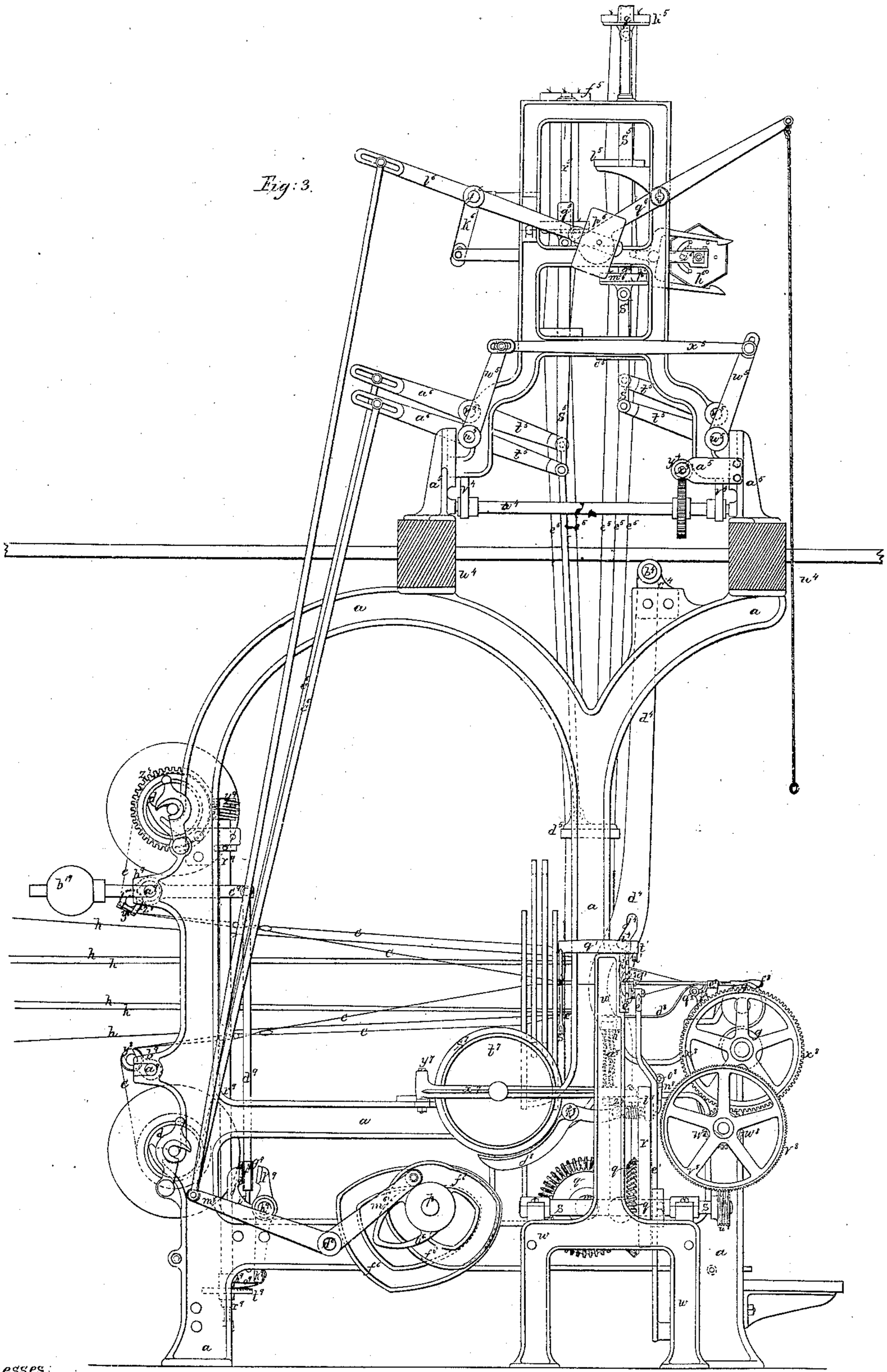
Fig: 3.



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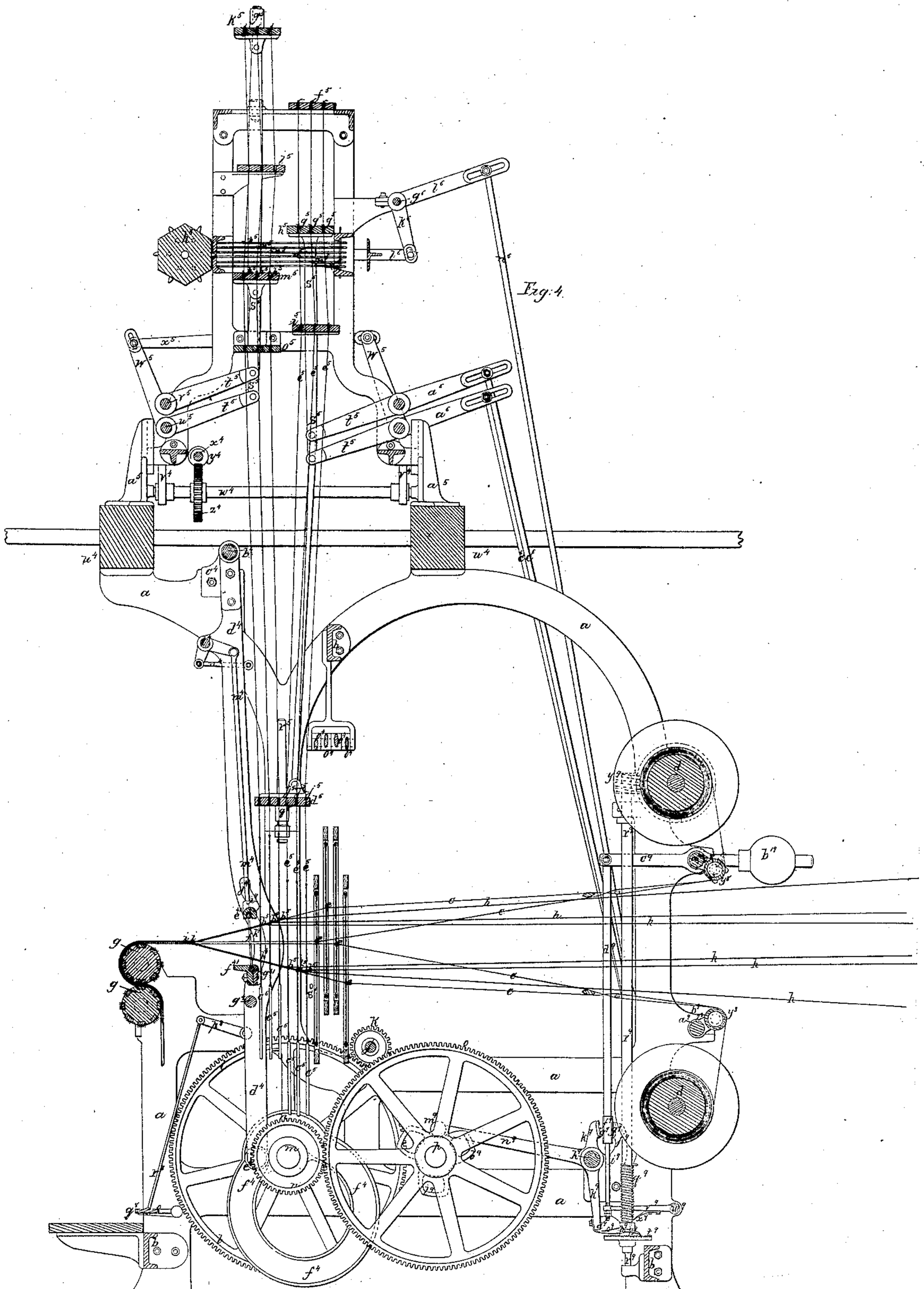

Fig. 4.

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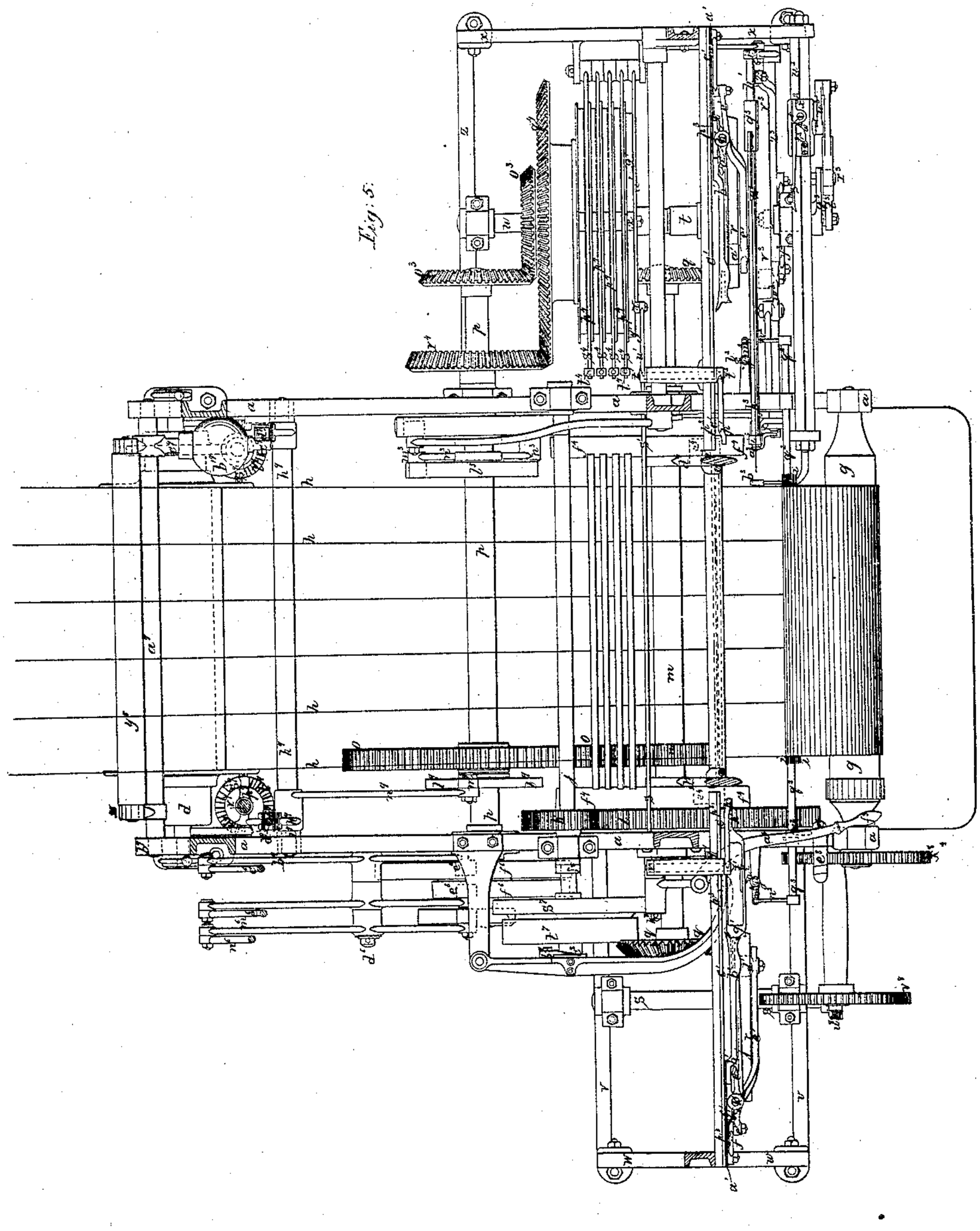
Fig. 5.



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UNITED STATES PATENT OFFICE.

E. B. BIGELOW, OF BOSTON, MASSACHUSETTS.

LOOM FOR WEAVING PILE FABRICS DOUBLE.

Specification of Letters Patent No. 16,370, dated January 13, 1857.

To all whom it may concern:

Be it known that I, ERASTUS B. BIGELOW, of Boston, in the county of Suffolk, in the State of Massachusetts, have invented new and useful Improvements in Power-Looms for Weaving Cut Pile Fabrics Double; and I hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings and to the letters of reference marked thereon.

Figure 1 is a front elevation of the loom; Fig. 2 a right hand end elevation; Fig. 3 a left hand end elevation; Fig. 4 a vertical section; Fig. 5 a horizontal section; and Figs. 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 and 16 are details.

These improvements relate to the manufacture of such pile fabrics as are first woven double, that is, two fabrics at one operation face to face, the figuring warps being woven in between them and then cut apart by intersecting knives or cutters, thus producing a velvet or cut pile face on each fabric.

In weaving at one operation two fabrics of the character just alluded to, it is necessary, in order to make an even pile, to keep them a given distance apart during the formation of the cloth—this has heretofore been done by longitudinal intersecting bars, the forward ends of which are woven in between the said two fabrics, while their rear ends extend back through the reed and out through the warp to a rod or frame to which they are permanently attached, the upper edges of said intersecting bars forming the race or support for the upper shuttle. These bars, however, are objectionable as they impede the free movement of the warps and also render it inconvenient to mend the broken threads. Instead of these longitudinal intersecting bars for keeping the two fabrics apart, I employ transverse intersecting pile wires, which are woven in between the two fabrics, and successively withdrawn and inserted during the operation of weaving; and as the employment of said intersecting pile wires in lieu of the said intersecting bars, leaves the upper shuttle without any proper race, or support, I pass the shuttles through the warps by means of a positive mechanical motion, and thus insure their proper action and avoid the liability to "smashes" incident to the use of fly shuttles in double cloth looms. I employ the positive shuttle motion, also to overcome another difficulty incident to weaving two fabrics at one operation viz: the pile warps in passing from one fabric to the other, cross at a line considerably forward of their respective cloth forming points, so that, to make good selvages it is necessary to give a certain pull to the filling, which the ordinary fly shuttle will not effect.

The first part of my invention, therefore, consists in the employment of transverse intersecting pile wires in power looms for weaving two fabrics at one operation, when said intersecting pile wires are woven in between the two fabrics, to keep them the required distance apart to form the pile.

Another part of my invention consists in the application or employment, in power looms for weaving two fabrics at one operation, of a double positive shuttle motion in combination with transverse intersecting pile wires for keeping the two fabrics apart, said double positive shuttle motion being so constructed and operated that the shuttles may (instead of being fly shuttles as heretofore) have a positive mechanical motion given to them as they are passed from side to side of the loom, thus securing their proper action without an upper race, and suitably pulling the filling to form the selvages of the cloth as aforesaid.

Another part of my invention relates to stopping the loom when the filling fails and consists in the mode of arranging the parts which connect the shuttle or shuttles with the loom shipper, whereby the loom, when the filling fails in either shuttle, is thrown out of gear. The beating up of two heavy fabrics at once causes much strain on the reed, and as the dents of the reed are necessarily long to clear the double shed, and as the path of the lathe is such as to bring them against the cloth near the middle between the two bands or ribs, the part of them the least capable of bearing the strain.

Another part of my invention, therefore, consists in elevating the reed, as the lathe advances to beat up the cloth, so as to bring the dents of the reed against the cloth near its lower band, and depressing it again as the lathe recedes so as to allow the shed to be formed.

Another part of my invention consists in the mode of arranging the cams, whereby the combined action of the lathe, shuttles,

intersecting pile wires, and ground warps is effected. And the last part of my invention relates to the delivery or giving out of the ground warps of the two fabrics and taking up the double cloth, and consists in the mode of arranging the double let off motion in connection with one take up motion having a regular and positive motion for taking up both fabrics at one operation whereby the delivery of the ground warp of each fabric is regulated by its respective tension, and held firmly by a vise, brake, or holder at the beat of the lathe.

(a, a) represents the side framing of the loom, and (b, b,) the cross girths.

(c, c) represent the ground warps, each fabric having separate warps which are put on to their respective warp beams (d, d) and pass from thence through their respective heddles (e, e) and reed (f,) to the take up rollers (g, g.)

(h, h) represent the figuring warps which pass from their respective spools through their respective heddle eyes in the jacquard harness, to be taken up in the cloth according to the figures required thereon. The two fabrics are kept the required distance apart for a suitable length of pile by intersecting pile wires (i, i) which are successively withdrawn and inserted at appropriate periods of time during the operation of weaving. (j) represents the driving shaft which through the medium of the pinion (k) and cogged wheel (l) turns the lathe shaft (m); and the lathe shaft (m) through the medium of the cogged wheels (n and o) turns the cam shaft (p); said cogged wheels (n and o) being in the ratio of one of the former to three of the latter. The lathe shaft (m) through the medium of the miter gears (q, q) turns their respective shuttle cams (r, r) for operating the shuttles, the said shuttle cam (r) on the left hand side of the loom being carried by the cross shaft (s), while the said shuttle cam (r) on the right hand side of the loom is carried by the tube (t) which turns on the cross shaft (u) hereinafter to be described.

The cross shaft (s) is supported by bearings on the girths (v, v), said girths being secured at their inner ends to the side framing (a, a) of the loom and at their outer ends to the stand (w).

(x) represents a stand on the right hand side of the loom which is connected with the main frame by the girths (y and z).

(a', a') represent sliding bars to which the shuttle arms (b' b') are respectively attached which sliding bars slide to and fro on their respective ways or guide plates (c' c'). The said guide plates (c' c') are secured to their respective bed plates (p^3 p^3) which are supported at their inner ends by the side framing (a, a,) of the loom, and at their outer ends by their respective stands (w and x). The sliding bars (a' a') have a simultaneous motion toward and from the center of the loom to carry the shuttles across the web, and are actuated by the shuttle cams (r r) through the medium of their respective cam rollers (d' d'), levers (e', e') and connecting bars (f' f'). Two shuttles (g' g') are employed, one for each fabric, and each of the sliding bars (a', a') before mentioned, carry two shuttle arms, one for each shuttle, so that the two shuttles are operated simultaneously by the same moving parts. The shuttles (g' g') are provided at either end with handles (h', h') which engage with sockets in the ends of the said shuttle arms (b' b') suitably formed to receive them. The said sockets are made bell shaped at their openings to facilitate the ingress of the said shuttle handles (h', h'), and wedged shaped guards (i' i') extend beyond the mouth of said sockets on the back side of said shuttle arms (b', b') to freely clear the warps as they enter the shed. The manner in which the shuttle handles (h' h') engage with their respective sockets in the shuttle arms (b', b') is represented in Figs. 1 and 7.

(j' j') represent latch levers which are affixed at their outer ends to their respective shafts (k', k'), while the springs (l' l') constantly tend to throw the hook (m' m') on their inner ends into action, so that when the said shuttle handles enter their sockets the said hooks glide over the points thereof and lock into the openings (n' n') in said shuttle handles, and securely hold them until they are released. As the hooks of both sets of shuttle arms have a tendency to engage with their respective shuttle handles as they come together in the middle of the web, it is necessary that they should be alternately held back or released in order that the shuttles may take the right direction. This is effected as follows: The arms (o' o') are affixed to the upper ends of their respective shafts (k' k') and have their projecting ends bent back in a suitable manner to act on the cam-like projections on the arms (p' p'). The arms (p' p') are affixed to their respective rock shafts (t' t') which extend back through the stands (q' q') and have the arms (r' r') projecting downward from their rear ends, which arms (r' r') are connected together by the rod (s'). From the rear end of the rock shaft (t') on the right hand side of the loom, the arm (u') extends, which is connected by the rod (v') to the lever (w'). The lever (w'), through the medium of the roller (x') receives motion from the tappet (y'), attached to the heddle tappets hereafter to be described, said tappet being so shaped as to alternately depress and elevate the arms (p' p') and bring the cam like projections thereon alternately into action.

The construction of the shuttle is represented in Figs. 1, 5, 6 and 7. The filling bobbin (z') being placed on a skewer in the usual way, the filling passes from the bobbin (z') through the eye (a^2) under the tension binder (b^2) around the guide (c^2) between the grid and filling stop fork (d^2) out through the eye (e^2) in the side of the shuttle.

The filling stop fork is formed as represented in Figs. 6 and 7 and swings on the stud pin (f^2). The spring (g^2) constantly tends to force the tines of the filling stop fork through the openings in the grid, but when a thread of filling is between said tines and said grid, the double hook (h^2) is kept within the line of the shuttle, but when the thread of filling fails, said tines pass through said grid and cause the said double hook (h^2) to project beyond the line of the shuttle as shown by the dotted lines in Fig. 7.

The manner in which the figuring warps cross each other as they pass from one fabric to the other is represented in Fig. 8. The filling as it passes from the shuttle being acted on by the tension binder (b^2) as just described, the positive motion of the shuttle will suitably pull the filling to draw the figuring warps to the cloth forming point and form the selvages.

The mode of connecting the shuttles with the loom shipper to throw the loom out of gear when the filling fails is as follows: (j^2 j^2) represent rock levers which rock on studs extending upward from their respective stands (k^2, k^2). Each of said rock levers (j^2) has a wide arm (l^2) extending toward the shuttles, and another arm (m^2) extending from the center of the loom, the arms (m^2 m^2) being connected by their respective rods (n^2 n^2) to the arms (p^2 p^2) on the rock shaft (q^2). The rock shaft (q^2) rocks in bearings, one on either side of the loom and has on its left hand end an arm (r^2) which is so placed under the shipper, as, when raised, to throw the loom out of gear. When therefore the shuttles are properly provided with filling the double hook (h^2) passes clear of the wide arms (l^2 l^2) and produce no action, but when the filling fails the said double hook acts on one or other of the said wide arms, according to the direction the shuttle may be moving, and throw the loom out of gear. The wide arms (l^2 l^2) being wide enough at their extremities to receive the double hook (h^2) of either shuttle, the loom will be stopped by the failure of the filling of either one of them.

The mode of operating the intersecting pile wires (i i) is as follows: They are formed with a head and eye on one end as represented in Fig. 12, and the body thereof may be oval round or flat according to the character of the cloth to be wrought. The latch or hook for drawing the said pile wires from the cloth is represented by (s^2) and may be distinctly seen in Figs. 5 and 16. It has a movement toward and from the selvage of the cloth and is carried by the bar (t^2), which traverses on the sliding bar (u^2). The latch or hook (s^2) has also a vibratory motion on the stud (v^2), and is pressed toward the pile wires (i, i) by the spring (w^2) and is prevented from swinging too far for its proper action on said pile wires by the stop pin (x^2). When the said latch or hook approaches the selvage of the cloth, the beveled part of said latch or hook glides over the head of the pile wire to be acted upon and locks or hooks on to the straight part (y^2) of the eye; then as the said latch or hook recedes from the selvage of the cloth it draws the said pile wire out from between the two fabrics. When the said pile wire has nearly completed its outward movement, and its inner end is about to drop from the cloth, its outer or head end is received from the latch or hook (s^2) by the carrier (z^2) and its inner end by the forked bar (a^3), then when said carrier and forked bar are thus armed with a wire, they move in unison back with the latch to the point where they are to be inserted between the warps of the two fabrics, as represented in Fig. 5 then the said forked bar stops and the said carrier moves toward the selvage of the cloth, sliding the said pile wire through the guide (b^3) and over the said forked bar (a^3) until it is fairly introduced between the warps, then the said forked bar drops down to make way for the said carrier which completes the insertion of the said pile wire, and moves forward with it to the fill of the two fabrics respectively and holds it in position until it is secured by the tying in of the warps by the filling. The guide (b^3) just alluded to, is formed with a slot through which the wires slide, said slot having an opening forward to allow the said wires to be brought to the cloth forming line; but as said guide forms no part of my present invention, a further description of it is deemed unnecessary.

A half sized end view of the carrier (z^2) is given in Fig. 10 and a front view thereof in Fig. 11 an end view of the socket in said carrier which receives the heads of the pile wires is represented at (c^3) and (d^3) represents an opening in the front side thereof to allow the latch or hook (s^2) to pass as it draws in a pile wire.

Fig. 11 represents a pile wire after it has been drawn into the socket.

(e^3) represents a spring binder provided with a bulge or convex projection (f^3) on its lower end which sinks into the eye of the pile wires as they are drawn into the socket

and holds them in position; and though the spring (e^3) is stiff enough to keep the pile wires in the socket during their movement it is not so stiff but that the said socket can be withdrawn from the said wires, after they have been secured by the warps without displacing them.

The carrier (z^2) is attached to the bar (g^3) which traverses the sliding bar (h^3) at the upper ends of the upright arms (i^3 i^3) said arms being attached at their lower ends to the rock shaft (j^3). The forked bar (a^3) slides up and down in the guides (k^3 k^3) and is actuated by the cam (l^3), which imparts its motion to the bar (a^3) through the medium of the roller (m^3) and treadle (n^3). Motion is given to the aforesaid latch or hook and carrier by the cross shaft (u) which is supported by bearings on the cross girths (y and z), and connected with the cam shaft (p) by the miter gears (o^3 o^3.) The crank (q^3), through the medium of the roller (r^3) and connecting bar (u^3), moves the latch or hook; and the cam (v^3), through the medium of the depending lever (w^3) connecting bar (y^3) upright lever (z^3) and connecting bar (a^4) move the carrier.

The mode of operating the lathe and of raising the reed to prevent the beat from bending the dents is as follows: The lathe is suspended from the rock shaft (b^4 b^4) which rocks in the bearings (c^4 c^4). The swords (d^4 d^4) of the lathe, extend downward below the warps and are provided with cam rollers (e^4 e^4) which receive the proper vibratory motion from the double cams (f^4, f^4).

(g^4) represents a round girth to connect the swords (d^4 d^4) together.

The reed (f) is placed in a frame in which ($e^{4\prime}$) represents the reed cap and ($f^{4\prime}$) the race beam or its equivalent, and ($g^{4\prime}$) the reed binder,—the reed cap ($e^{4\prime}$) and the race beam ($f^{4\prime}$) being connected together by the two end pieces (h^4, h^4).

(i^4 i^4) represent studs projecting from either end of the end pieces (h^4, h^4) which ply in their respective grooves (j^4, j^4 and k^4, k^4) in the lathe swords (d^4, d^4).

(l^4) represents a rock shaft which rocks in projections on the lathe swords and has two arms extending forward from it, which are connected by their respective rods (m^4 m^4) to the reed frame just described; and from the left hand end of said shaft another arm extends downward and is connected by the rod (n^4) to the girth (b) so that as the lathe advances to beat up the cloth the same reed frame is raised so as to cause the reed to strike the cloth near its lower band where the dents are firm and well supported, then as the lathe recedes, the said reed frame descends to allow the shed to be formed as represented in the drawings. A part of the upper grooves (j^4 j^4) is formed diagonally so as to bring the reed to a vertical position when it strikes the cloth, for by thus vibrating the top of the reed, and keeping it nearly vertical during the beating up of the cloth and the passing of the shuttles, the shuttles may be passed with less traverse of the lathe than would be otherwise required.

The heddles (e, e) for the ground warps are arranged in frames and connected by straps above and below, to jack levers (o^4, o^4) in the usual way.

(p^4 p^4) represent the heddle tappets which are connected with the hub of the bevel gear (q^4) which turns loosely on the cross shaft (u) before mentioned. The heddle tappets (p^4 p^4) receive motion from the cam shaft (p) through the bevel gear (r^4) acting on the said gear (q^4) the size of the latter being twice that of the former. The heddle tappets (p^4, p^4) communicate motion to their respective jack levers (o^4, o^4) through the medium of the levers (s^4, s^4) and connecting rods (t^4, t^4).

The jacquard machine and its connection with the figuring warps will now be described. This machine rests on the cross beams (u^4, u^4) and is adjusted in its vertical position to the varying length of the harness, by the cams (v^4 v^4) on the shafts (w^4 w^4), which shafts are connected together by the shaft (x^4), and are turned and held in position by the worms (y^4 y^4) acting on their respective worm wheels (z^4 z^4). The stands (a^5 a^5) support the ends of the shafts (w^4 w^4) and guide and steady the feet of the jacquard frame. The jacquard harness is divided into two parts, one of which is connected with the figuring warps which work in connection with the upper fabric, and the other part, with the figuring warps which work in connection with the lower fabric. The heddle eyes (b^5 b^5) through which the figuring warps (h, h) before mentioned pass, and the weights (c^5 c^5) are suspended from both portions of the said jacquard harness in the usual way. Each portion of the said jacquard harness has its separate trap board, suspension board, and guide boards, but both pass through one comber board which is represented by (d^5).

The part of the harness connected with the figuring warps of the lower fabric, is arranged and operated in the usual way, that is to say, the cords (e^5, e^5) are suspended from the suspension board (f^5) and are provided with knots (g^5, g^5) by which such of the cords as are required from time to time to form the figure, are lifted by the trap board (h^5) through which they pass, and from thence they pass through the eyes of their respective needles (n^5 n^5), down through the guide board (i^5), and comber board (d^5) to the heddle eyes (b^5, b^5) before mentioned. This part of the harness is also provided with knots (j^5, j^5) by which

the heddle eyes (b^5, b^5) are lifted by the comber board as hereinafter to be explained.

The part of the harness which is connected with the figuring warps of the upper fabric, operates in a reverse manner from that just described, for when the harness cords are acted upon to form the figure, they descend in the one case and ascend in the other. The cords of this part of the harness are suspended from the movable suspension board (k^5) and pass down through the guide board (l^5) the eyes of their respective needles (n^5 n^5), trap board (m^5), guide board (o^5) and the comber board (d^5) to their respective heddle eyes (b^5 b^5). These cords are provided with knots (p^5 p^5) by which such of the cords as are not required to descend from time to time to form the figure are held up by the said trap board (m^5). The comber board (d^5), trap board (h^5) suspension board (k^5) and trap board (m^5) are provided at either end with guide tubes (q^5 q^5) which slide up and down on their respective guide rods (r^5 r^5); and the said guide tube (q^5 q^5) have respectively jointed to them one end of the lifting rods or bars (s^5 s^5), while the other ends of said lifting rods or bars (s^5 s^5) are jointed to their respective levers (t^5 t^5) which extend from their respective rock shafts (u^5, u^5, and v^5, v^5). As the trap board (h^5) ascends while the suspension board (k^5) descends, and vice versa, the rock shafts (u^5 u^5) to which they are respectively attached are connected together by the arms (w^5 w^5) and bar (x^5), so that one cam will operate both; and as the same is true of the comber board (d^5) and trap board (m^5), the rock shafts (v^5 v^5) to which they are attached respectively, are also connected by the arms (y^5 y^5) and bar (z^5) so that one cam will operate them also.

(a^6, a^6) are arms which extend from their respective shafts (u^5 and v^5) and are connected with their respective rock levers (m^6 m^6) by the connecting bars (c^6 c^6). The rock levers (m^6 m^6) rock on the stud (d^6), and through the medium of the rollers (e^6 e^6) receive motion from their respective double cams (f^6 f^6) which actuate the jacquard harness.

The loom is orgnaized and the cams (f^6 f^6) so formed as to put three shots of filling into each fabric, for every one of the pattern cards brought into action, that is, one shot on the back, and two on the face of the cloth.

The loom is represented in that stage of its operation when the last of the three shots of filling is about to be introduced, a pile wire inserted, and a new pattern card has just been brought against the needles, and pushed into the holes of the trap board (m^5), the cords connected with the figuring threads of the upper fabric which are required to form its portion of the figure, and pushed into the slots of the trap board (h^5), the cords connected with the figuring threads of the lower fabric, which are required to form the remaining portion of the figure, so that the next movement of the jacquard machine will be to form the sheds for a new series of filling threads, beginning with the back or ground shot. For this object, the trap board (h^5) and the suspension board (k^5) begin to move a little in advance of the trap board (m^5) and comber board (d^5) to secure the trapping of the cords the cards has acted upon to form its part of the figure; then when the trapping of the cords has been thus secured, the said suspension board (k^5) and the trap board (m^5) descend simultaneously until all the figuring warps of the upper fabric are brought down midway between the two ground warps; and while this has been taking place, the said trap board (h^5) and comber board (d^5), have ascended to bring all the figuring warps of the lower fabric up to the same position; now the back or ground shot of filling is introduced; then, the trap board (m^5) ascends and takes back to the upper part of the shed all the figuring threads of the upper fabric whose cords have not been pushed into its holes as aforesaid, and the comber board (d^5) descends with all the figuring warps in the lower fabric whose cords have not been pushed into the slots of the said trap board (h^5) as aforesaid; and simultaneously with these movements, the suspension board (k^5) continues its descent carrying down its selected figuring warps to the shed of the lower fabric, and the trap board (h^5) continues its ascent, carrying up its selected figuring warps into the shed of the upper fabric; now the second shot of filling is introduced to bind into their respective fabrics the figuring warps which have been transferred from one fabric to the other as aforesaid; then the suspension board (k^5) and trap board (h^5) return to their original position carrying the figuring warps connected with them back to their respective fabrics, when the third shot of filling is introduced to bind them therein, and the operation repeated as before.

The order of motions just described is such as answer well for some descriptions of carpets, but they may be varied to suit any other description of goods to be made. The needles (n^5 n^5), pattern card (g^6), and card prism (h^6), are constructed and operated in the usual way. The card prism (h^6) is supported by the sliding bars (i^6 i^6) which are connected with the rock shaft (j^6) by the arms (k^6 k^6). The arm (l^6) on the said rock shaft (j^6) is connected to the rock lever (m^6) by the rod (n^6), and the cam (o^6) through the medium of the parts

just described, move the card prism (h^6) out to change the cards while the weight (p^6) draws it into action again. (g^6) represents a lever, by which the weaver, by pulling the cord (r^6) can turn the said card prism (h^6) to set the pattern card without moving the trap board.

The mode of driving the loom may be understood as follows: (s^7) represents the friction cone affixed to the driving shaft (j); and (t^7) the belt cone which is made to engage with said friction cone (s^7) to drive the loom, and is withdrawn from it to stop the loom. A cross section of these cones and the shipping lever—hereafter to be described—is given in Fig. 9, the face of said friction cone being covered with leather as represented by (u^7).

(b^8, b^8) are projections cast on the cones to keep the oil from working from the journal up on to their friction surfaces.

To facilitate the oiling of the belt cone when the belt is in motion and to retain the oil on the shaft, the outer end of the shaft hole in the hub of said belt cone is partly covered so as to form a sort of oil cup, as seen at (v^7) into which the oil may be introduced through the tube (w^7) in the shipping lever (x^7). Partly covering the shaft hole in the hub of the belt cone, also furnishes a fair wearing surface for the shipping lever (x^7) to act on to press said cones together when in action. The cavity in the side of the shipping lever which acts on said hub may be lined with Babbitt metal. The shipping lever vibrates at its rear end on the stud (y^7) and at the forward end is connected and supported by the arm (z^7) on the upright rock shaft (a^8). (b^{81}) represents a lug attached to the inner side of the said shipping lever which plys in the groove (c^8) and draws the belt cone out of action when the shipping lever is moved for that purpose. To the upper end of the rock shaft (a^8) the shipper (d^8) is attached and extends forward and works on the stand (e^8) in a similar manner to shippers in common looms, except it is in a horizontal instead of a vertical position. The weaver by the handle of (f^8) draws the belt cone into action to start the loom, and when the shipper (d^8) is released from the notch (g^8) the spiral shipper spring (h^8) on the said rock shaft (a^8) draws the said belt cone out of gear to stop the loom. The collar (i^8) is put on to the driving shaft (j) to resist the pressure of the shipping lever on the belt cone.

(j^8) represents the friction brake, for overcoming the momentum of the loom when thrown out of gear, which vibrates on the stud (k^8) and has one end curved to conform to the brake surface of the friction cone, while the other end extends forward under the cam (l^8), (on the rock shaft (a^8) before mentioned) and carries the roller (m^8). The cam (l^8) is so shaped that, when the weaver draws the shipper (d^8) toward the loom to start it, it relieves the roller (m^8) and sets the loom free, but when said shipper (d^8) is thrown outward to stop the loom, the said cam (l^8) acts on said roller (m^8) and brings the said brake into action.

It will be seen from this description that the brake will come into action whenever the shipper is released to throw the loom out of gear; but it is sometimes necessary for the weaver to turn the loom by hand, without moving the shipper, and for this purpose the said brake may be liberated as follows: (n^8) represents an arm, the lower end of which is formed like a fork to act on the outer end of the roller (m^8) while its upper end is affixed to the rock shaft (o^8) which extends through the loom frame and has the arm (p^8) on its inner end.

(q^8) represents a foot treadle which extends along the front side of the loom, and is connected to the arm (p^8) by the rod (r^8).

To set the loom free, the weaver as she approaches it, has only to step on the treadle (q^8), which forces the roller (m^8) from under the cam (l^8) and releases the brake while the projection (s^8) prevents the said roller (m^8) from rising above the small part of the cam (l^8), so that when the loom is again started the spring (t^8) will force said roller (m^8) under said cam for another operation.

The mode of arranging the double let off motion in connection with the take up motion is as follows: Each fabric of the double cloth has its separate ground warp (c, c) which is placed upon its respective warp beam (d, d,) one of which warp beams is placed above the plant of the warp and the other below it as represented in the drawings. From the warp beams (d, d) the ground warps pass to their respective tension rollers (y^8 y^8), the lower warps passing upward and the upper warps passing downward from their respective warp beams, around their respective tension rollers, and from thence through the harnesses to form their respective fabrics of the double cloth; said double cloth being taken up by the take up rollers (g, g,) a given length for every given number of filling threads introduced.

The take up rollers (g, g) are provided with spurs to prevent the cloth from slipping as it passes between them, and receive a regular and positive motion from the shaft (s) through the medium of the worm (u^8) worm wheel (v^8), pinion (w^8) and wheel (x^8). The tension rollers (y^8, y^8) are carried by the arms (z^8 z^8) extending from their respective rock shafts (a^9 a^9) which rock shafts, when the said tension rollers act on

their respective warps, rock in the bearings (b^9 b^9) in the loom frame. A separate tension is given to each ground warp by the tension weights (b^{19}) which may be adjusted on their respective arms according to the tension required on each warp. Each of the rock shafts (a^9 a^9) is provided with a regulating rod (d^9 d^9) for regulating the delivery of the warps, and holding them at the beat of the lathe; said regulating rods being connected to their respective rock shafts by the arms (c^9 c^9). The warp beams are turned to deliver out the warps by their respective let off shafts (r^9 r^9)—one on either side of the loom—which impart their motion through the medium of the worms (y^9 y^9) and worm wheels (z^9 z^9).

(h^9) represents a rock shaft which extends across the loom and receives motion from the cam (l^9) through the medium of the arm (n^9) and roller (m^9) and performs the double duty of turning the let off motions, and holding the warps at the beat of the lathe. It turns the let off motions as follows: (k^9 k^9) represent arms extending downward from the said rock shaft (h^9)—one arm for each left off motion on either side of the loom—which are connected by the straps (o^9 o^9) to their respective rock levers (p^9 p^9) on said let off motion shaft (r^9 r^9). The inner ends of said rock levers (p^9 p^9) are provided with pawls (s^9 s^9) which act on their respective ratchets (t^9 t^9) and through the connections just described, are drawn forward to turn the let off shafts by the said rock shaft (h^9) and drawn back again for renewed action thereon by their respective springs (g^9 g^9). The separate tension of each warp is made to regulate its delivering as follows: The outer ends of the said rock levers (p^9 p^9) are provided with a series of notches (u^9 u^9), successively rising one above the other as represented in Fig. 2.

(v^9 v^9) represent levers, the rear ends of which vibrate on their respective studs (w^9 w^9) while their forward ends are connected with their respective aforesaid regulating rods (d^9 d^9); and (x^9 x^9) represent pawls projecting from the under side of the levers (v^9 v^9) which suitably engage with the notches (u^9 u^9) before mentioned; so that when more warps are required than are being given out, from either warp beam, its tension roller raises its respective pawl (x^9), and allows its rock lever (p^9) an increased range of motion; then when more warps are being given out than are for the time being required, the said tension roller depresses said pawl (x^9) and diminishes the range of motion of said rock lever (p^9) and thus the delivery of each of the ground warps becomes self regulating.

The rock shaft (h^9) above mentioned, holds the warps at the beat of the lathe as follows: (f^9 f^9) represent bars which have their side faces covered with leather and are secured to their respective regulating rods (d^9 d^9). From the stands (i^9 i^9) which support the said rock shaft (h^9), the arms (j^9 j^9) extend upward and terminate in the form of a jaw, each arm forming one side of a vise, and (k^9 k^9) represent other arms extending upward from the said rock shaft (h^9) and terminate in a similar manner, each arm forming the other side of a vise, that is, one vise for each regulating rod, and as the leather covered bars (f^9 f^9) are between their respective vises they are firmly grasped and held whenever the cam (l^9) brings said rock shaft (h^9) into action, and thus the warps are prevented from yielding at the beat of the lathe.

The figuring warps (h, h) may be put onto spools (a^{10} a^{10}) and delivered out in the usual way. The spools may be arranged in creels or frames (c^{10} c^{10}) and supported by ports (d^{10} d^{10}) as represented in Fig. 2.

After the cloth has been woven, it may be taken from the loom and divided, by a separate dividing machine such as is described in my patent for improvements in the mode of dividing pile fabrics granted the fourth day of December eighteen hundred and fifty-five, or the cutting apparatus may be applied to the loom and the cutting operation performed during the process of weaving.

It will be obvious to machinists that many modifications may be made in the form and arrangements of the parts of the machinery without altering the character of my invention, as for example, instead of employing the latch or hook, (s^2) to draw the intersecting pile wires from between the two fabrics as above described, pincers or pliers may be employed. Instead, also, of the said latch or hook (s^2) being employed merely to draw out the pile wires and then deliver them to the carrier (z^2) by which they are inserted as above specified, the said latch or hook (s^2) may be so constructed and operated as to perform both operations, in which latter case, the said latch or hook should be provided with a socket or guard which shall secure the head of the wire to it while it is being transferred from one position to the other. I sometimes employ, also, a guard in connection with said latch or hook (s^2) when said latch or hook (s^2) is merely employed to draw out the wires and deliver them to the carrier (z^2) as aforesaid, the object of said guard being to prevent the release or disengagement of the latch or hook from the wire when the loom is stopped during its action thereon. This guard may be attached to the bar (t^2) which carries the latch or hook (s^2), as represented in Figs. 16 and 15, the former being a top view, and the latter a back side view thereof.

(e^{10}) represents the guard which vibrates on the stud (f^{10}) and has a groove (j^{10}) in the upper side of its inner end to secure the head of the pile wires.

(g^{10}) represents a spring which has a constant tendency to raise the inner end of said guard (e^{10}) until arrested by the stop pin (h^{10}). As the latch, or hook approaches the cloth to act on a wire, the cam like projection (i^{10}) strikes against a stud, suitably placed on the loom frame for that purpose, and forces the guard down under the head of the pile wires, then as the said latch or hook, recedes from the cloth with a wire, the guard (e^{10}) rises up and shuts the groove (j^{10}) upon the under side of the head of said wire and thus prevents its untimely release from said hook; then as the said latch or hook (s^2) has nearly drawn out the wire from the cloth and is about to transfer it to the carrier (z^2) the cam surface (h^{10}) strikes against the end of the said carrier (z^2) and depresses the guard (e^{10}) so as to allow the head of said wire free ingress into the socket of said carrier.

In weaving some fabrics, I also employ bars, to draw the figuring warps from the point where they cross, forward of the cloth forming points, (as represented in Fig. 8) forward to the cloth, to aid in forming the selvages. These bars are introduced into the sheds back of the point where the said figuring warps cross, simultaneously with the shuttles, and then moved forward to the cloth, carrying the figuring threads with them, and withdrawn again, when the filling has been properly drawn in at the selvages.

Having described my invention and pointed out some of the modified forms in which I intend to use it, what I claim as new therein, and desire to secure by Letters Patent is—

1. The employment, in power looms for weaving two fabrics at one operation such as herein described, of transverse intersecting pile wires, when said transverse intersecting pile wires are woven in between the two fabrics substantially in the manner and for the purpose specified.

2. I also claim the application or employment, in power looms for weaving two fabrics at one operation, of a double positive shuttle motion in combination with transverse intersecting pile wires for keeping the two fabrics apart, substantially as described.

3. I also claim the mode of arranging the parts which connect the shuttle or shuttles with the loom shipper whereby the loom is thrown out of gear when the filling fails in either shuttle, substantially as specified.

4. I also claim, elevating and depressing the reed substantially in the manner and for the purpose above set forth.

5. I also claim, the mode of arranging the cams whereby the combined action of the lathe, shuttles, intersecting pile wires, and ground warps, is effected; that is to say, placing the cams (f^4 f^4) for operating the lathe, on the shaft (m), and the cams (r, r) for operating the shuttles, on their respective counter shafts (u and s), all said cams moving at the same relative velocity; while the crank (q^3) and cam (v^3) for operating the pile wires, and the cams or tappets (p^4 p^4) for operating the ground warps are placed on the said counter shaft (u) but move at different relative velocities; the said crank (q^8) and the said cam (v^3) being affixed to the said counter shaft (u), while the said shuttle cam (r) and the said ground warp cams or tappets (p^4 p^4) turn loosely thereon, the whole being geared together, and operating substantially as described.

6. And finally I claim the mode of arranging the double let off motion in connection with one position take up motion whereby the delivery of the ground warp of each fabric is regulated by its respective tension, and held at the beat of the lathe substantially as specified.

ERASTUS B. BIGELOW.

Witnesses:
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