Sheet 1- 4 Sheets.

E. B. Bigelow.
Wire Cloth Weaving

No. 18,320. Patented Oct. 6, 1857.

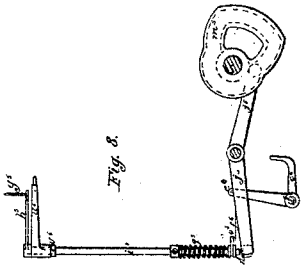

Fig. 8.

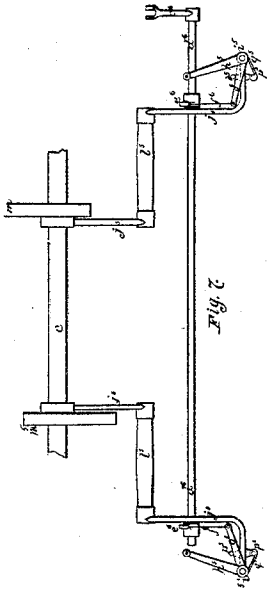

Fig. 2.

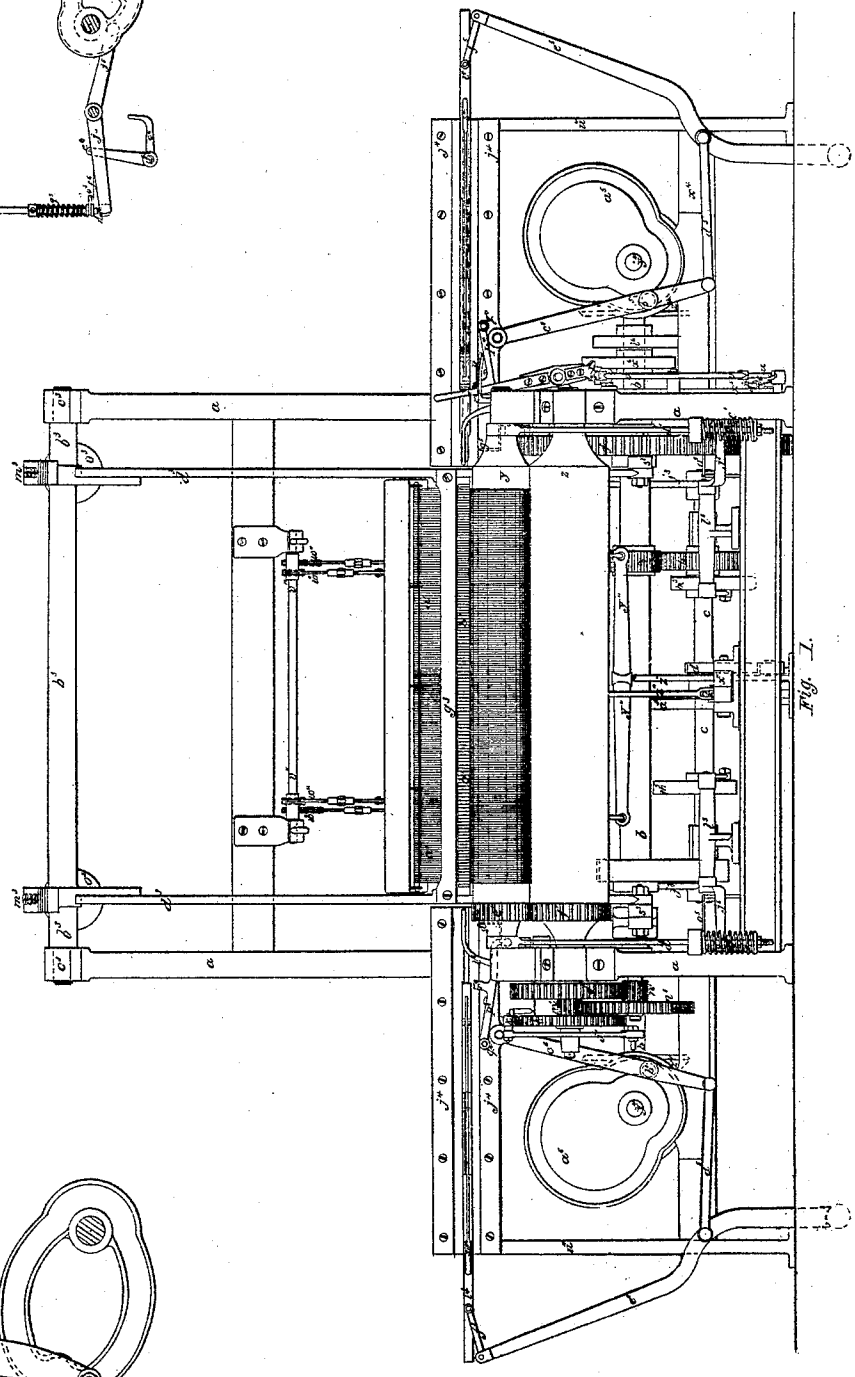

Fig. 1.

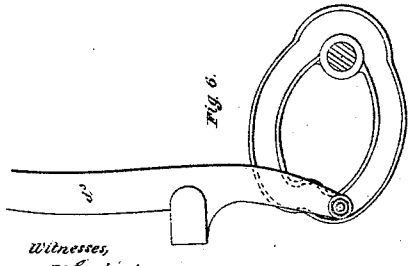

Fig. 9.

Witnesses,
Frank F. Hastings
Chas. Hastings

Inventor,
E. B. Bigelow

Sheet 2 - 4 Sheets.

E. B. Bigelow.
Wire Cloth Weaving.

No. 18,320

Patented Oct. 6, 1857.

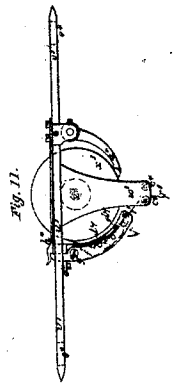

Fig. 11.

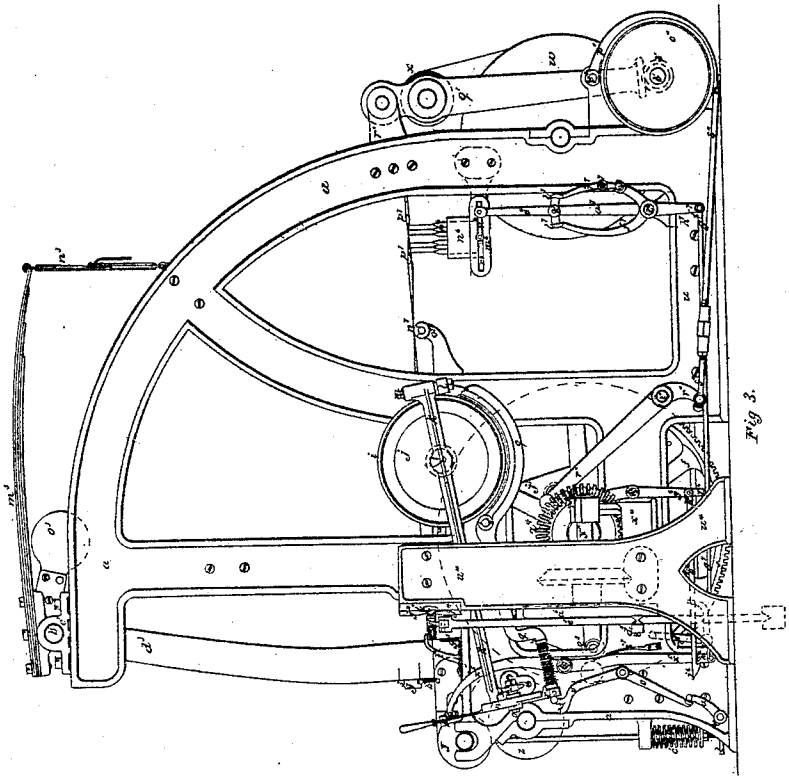

Fig. 3.

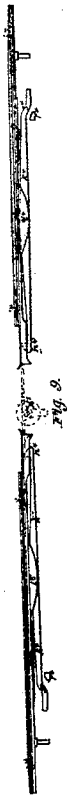

Fig. 8.

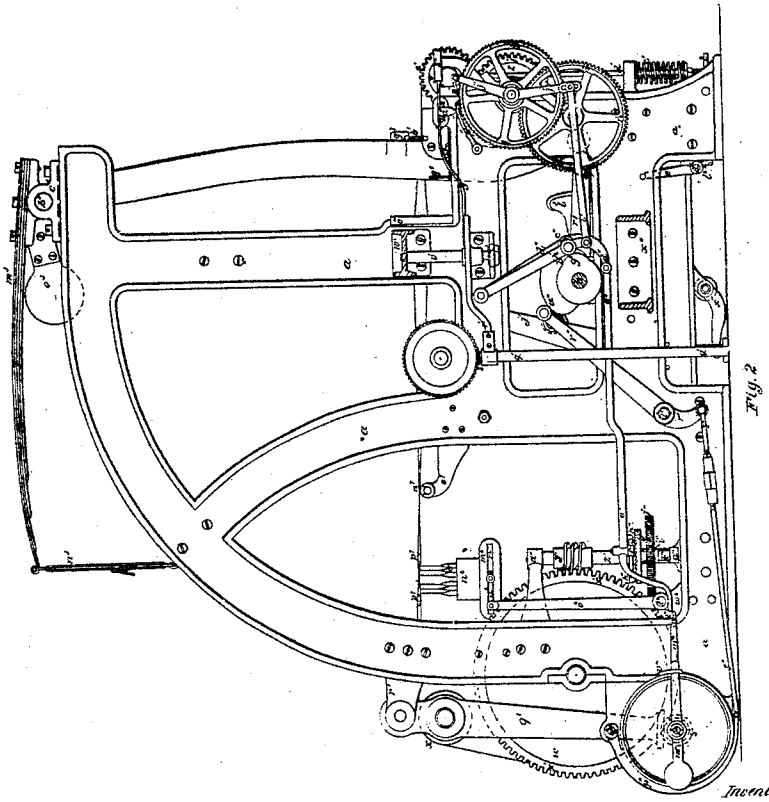

Fig. 2.

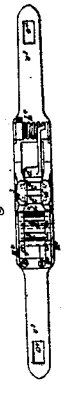

Fig. 10.

Witnesses,
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Sheets-4 Sheets.

E. B. Bigelow.
Wire Cloth Weaving.

No. 18,320. Patented Oct. 6, 1857.

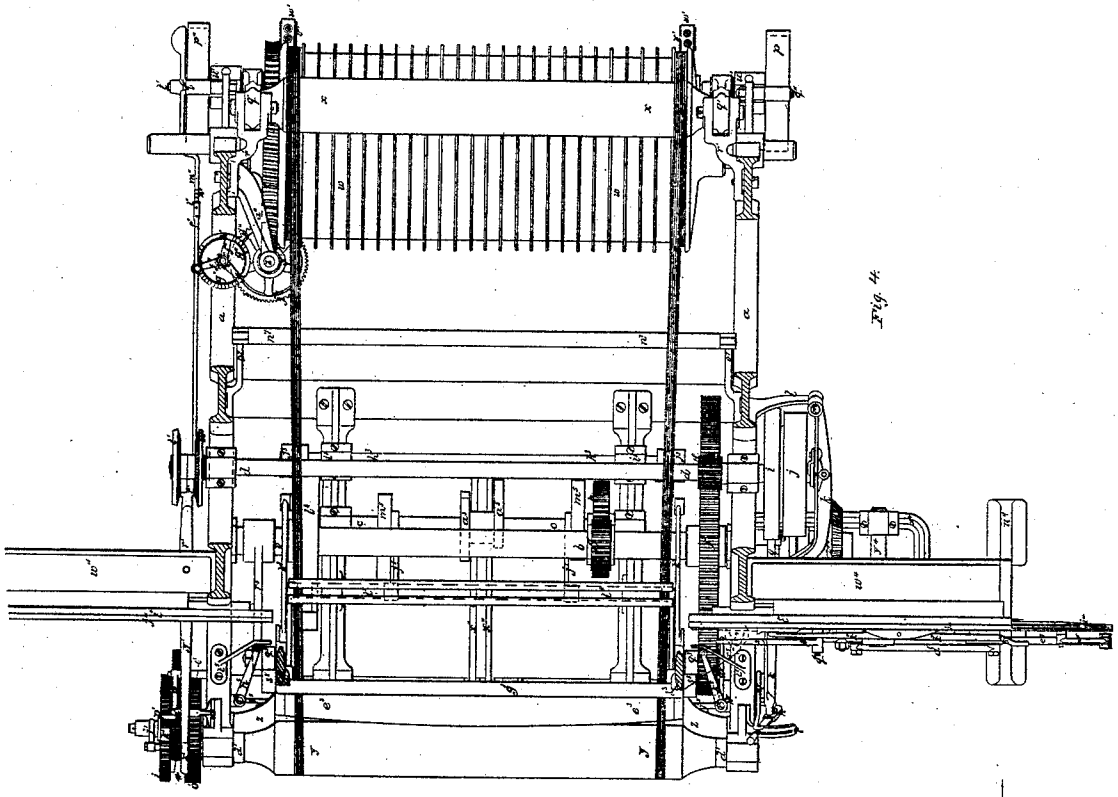

Fig. 4.

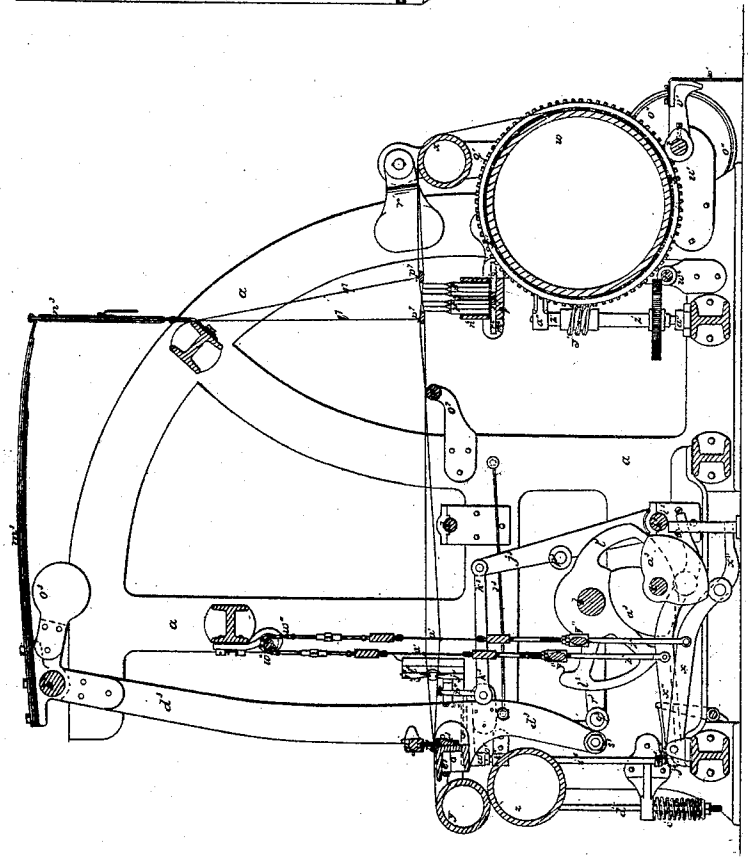

Fig. 5.

Witnesses:
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Sheet 4. 4 Sheets

E. B. Bigelow.
Wire Cloth Weaving.

No. 18,320. Patented Oct. 6, 1857.

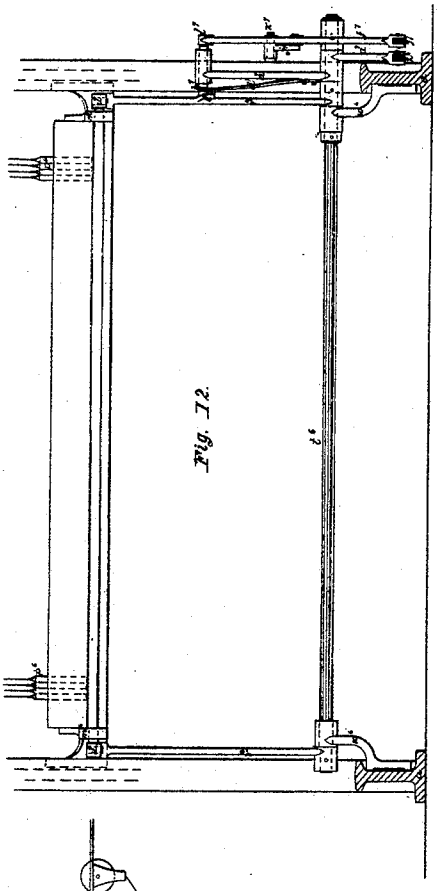
Fig. 12.

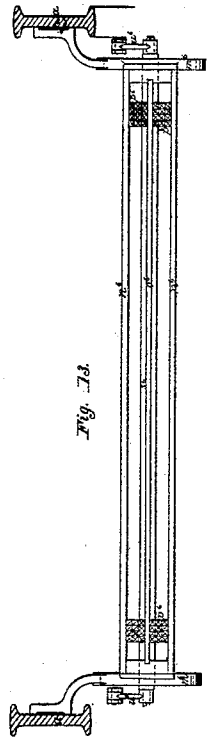
Fig. 13.

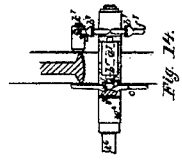
Fig. 14.

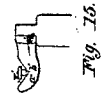
Fig. 15.

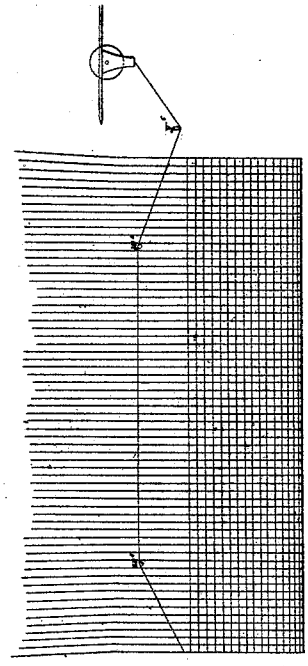
Fig. 16.

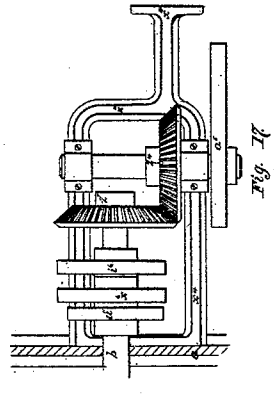
Fig. 17.

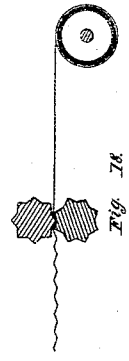
Fig. 18.

Witnesses,
Frank F. Harding
Chas. Harding

Inventor,
E. B. Bigelow

UNITED STATES PATENT OFFICE.

ERASTUS B. BIGELOW, OF BOSTON, MASSACHUSETTS.

IMPROVEMENT IN POWER-LOOMS FOR WEAVING WIRE-CLOTH.

Specification forming part of Letters Patent No. **18,320**, dated October 6, 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 Wire-Cloth; 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; Fig. 2, a left hand end elevation; Fig. 3, a right-hand end elevation; Fig. 4, a plan; Fig. 5, a vertical section, and Figs. 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, and 18 are details.

Heretofore wire-cloth of the description herein contemplated has been woven on hand-looms, which require for weaving wide cloth the aid of two persons, one on either side of the loom, who alternately throw the shuttle across the web, and preparatory to throwing the shuttle they draw from the bobbin and straighten the wire required for the succeeding shot, while both co-operate to swing the ponderous lathe employed to beat up the cloth. Owing to the inflexibility of wire, the movements of the ordinary power-loom are not suited to weaving wire fabrics, the fly-shuttle being too uncertain in its action for perfect work, and not adapted to straighten the wire as it comes from the bobbin. To meet the exigencies of the case, therefore, I so organize my wire-cloth power-loom as to give to the shuttle a positive mechanical motion as it is being passed through the shed of the wire warps from side to side of the loom, and I also provide the shuttle with a wire-straightener, through which the filling-wire passes and is straightened as it is drawn from the shuttle-bobbin by the aforesaid positive movement of the shuttle; and to prevent the drag or pull required to straighten the filling-wire, as aforesaid, from drawing in the selvage-wires and contracting the cloth, I employ pointed bars, one on either side of the loom, which have a vibratory motion toward and from the selvages of the cloth; also, a vertical motion up and down, by which latter motion they are alternately thrust between the filling-wire of the shuttle and the selvages of the cloth, so that when the shuttle is passed through the wire warps the filling-wire draws around said pointed bars and pulls them, respectively, toward the selvages of the cloth until they are arrested by a stop, which prevents the pull or drag of said filling-wire from drawing in said selvage-wires. Then just before the shuttle has reached its greatest extent of outward motion said pointed bars are withdrawn from between the said filling-wire and said selvage-wires to allow the final motion of the shuttle to draw the said filling-wire snug up to the said selvage-wires, and produce a true and even selvage.

The first part of my invention therefore consists in the mode of constructing and operating the shuttle, and combining it with a selvage-forming apparatus, whereby the filling-wire is straightened, the certain action of the shuttle secured, and the width and selvages of the cloth preserved, whatever may be the inflexibility of the filling-wire or the pull or drag required thereon to straighten it. The aforesaid pointed bars for preserving the selvages of the wire-cloth are also employed to stop the loom when a filling-wire fails.

Another part of my invention therefore consists in the mode of arranging the parts which connect the aforesaid pointed bars for preserving the selvages of the cloth with the loom-shipper, whereby the loom is thrown out of gear when the filling-wire breaks or is exhausted on the bobbin.

Another part of my invention relates to the operation of the lathe, and consists in the mode of giving to the lathe a double action, whereby the first action, or that which sets the warp-wire, is given by the action of a spring causing the reed to strike the cloth with a sudden blow, like that of a hammer, and the second action, or that which completes the operation, is given by pressure-rollers.

If a warp-wire breaks and chances to lie across others when they are crossed to form a new shed, it will either cut them off or stretch them so as to make bad work. To prevent inconvenience arising from this source is the object of the last part of the invention, which consists in the mode of constructing and arranging the parts of the warp-wire stop-motion and combining it with the loom-shipper for stopping the loom when a warp-wire breaks.

These improvements will be better understood by reference to the accompanying drawings, in which—

a a represents the frame of the loom; b, the main shaft; c, the cam-shaft, and d the driving-shaft. The driving-shaft d turns the main shaft b by the pinion e, which engages with the cogged wheel f, and the main shaft b turns the cam-shaft e by the action of the cogged wheels g and h. The loom is driven by friction-cones and its momentum overcome by a friction-brake.

i represents the friction-cone, and j the belt-cone, which is pressed against the friction-cone i to drive the loom and withdrawn from it to stop the loom. The belt-cone j is acted upon to drive and stop the loom by the shipping-lever k, the rear end of which is supported by the stand l and vibrates on the stud m, while its forward end engages with the shipper n. The shipper n vibrates on the stud o, and at its upper end plies in the stand p and is drawn inward by the weaver to start the loom, and when released is thrown outward by the shipper-spring to stop the loom in the usual way.

q represents a brake-lever for arresting the loom, which is brought into action by the cam r acting on the roller s. When it is desirable to turn the loom without moving the shipper, the weaver may release the brake-lever q by stepping on the treadle t, which through the medium of the arm u and lever v forces the roller s from under the cam r. This mode of driving and stopping power-looms is more fully described in my patent entitled "improvements in looms," granted the 8th day of April, 1856, and numbered 14,590.

To enable the weaver to conveniently turn the loom forward and back to place it in position for mending the warp-wires, &c., I apply a double-acting slow motion to the end of the driving-shaft d, opposite from the main driving-cones, as follows: q' represents an upright shaft, the lower end of which is to be supported and receive motion from a main driver in any way best suited to the mill where the looms are to be run, while its upper end is supported by the shipper-lever r' and carries the bevel-pinion s', which is suitably formed to engage with either of the bevel-wheels t' and u' on the said driving-shaft d. The shipper-lever r' is supported by the shaft v', which vibrates in the stands w' and x'.

y' represents a spring, which extends forward from the shipper-lever r' and terminates in the form of a handle z'.

a'' represents a guide-stand, which is shaped as shown in Fig. 15, and b^2 a stud which is shaped to conform thereto. When the stud b^2 is at the bottom of the V, the beveled pinion s' runs clear of both of the bevel-wheels t' and u' to turn the loom. Therefore the weaver by acting on the handle z' throws said beveled pinion s' into one or the other of said beveled wheels t' and u', according to the direction of the motion required, and when said bevel-pinion is withdrawn the spring y' forces the stud b^2 back to the bottom of the V and holds the said pinion in a neutral position until the weaver shall again bring it into action.

w represents the warp-wire beam, which is formed with a series of recesses for the wire, as in hand-looms.

x represents the vibrating roller for regulating the delivery of the warp-wire, and y and z the take-up rollers for taking up the finished cloth.

The wire warps pass from the warp-wire beam w, around the vibrating roller x, through the harnesses a' a' and reed b' to the take-up rollers y and z. The take-up rollers are drawn together to hold the cloth by the springs c' c' acting on the rods d' d', and to insure the movement of the top roller y the two rollers are geared together by the gears e' and f'. The take-up rollers y and z are moved a given distance every thread of filling-wire introduced by the cam g', which acts on the lever h', and through the medium of the bar i', lever j', and pawl k' turns the ratchet-wheel l'. The ratchet-wheel l' turns on the end of the axis of the take-up roller z as on a stud, and through the action of the pinion m', intermediate wheel and pinion n', and wheel o' (which is fast to the axis of the roller z') turns the said take-up rollers.

The object of the intermediate wheel and pinion n' is to graduate by a change of size the movement of the take-up motion to the great variety of cloth required, which varies from four to eighty wires per inch.

p' represents a pawl to hold the ratchet-wheel l' from being drawn back by the pull of the wire warps.

The vibrating roller x for regulating the delivery of the warp-wire before mentioned is supported by the vibrating levers q' q', which are jointed at their upper end to the stands r' r', while their lower ends terminate in the form of a cogged segment and engage with the pinions s' s' on the shaft t'. The shaft t' rocks in the stands u' u' and carries the arms v' v', from which tension-weights are suspended to give tension to the warp-wire. The said tension-weights may be applied directly to the arms v' v', or they may be suspended below the floor of the weaving-room by the straps w' w'.

The object of the weights just described is to give tension to the warp-wire merely; but as the degree of tension best suited to shedding the warp-wires is not in most fabrics sufficient to resist the blow of the lathe in beating up the weft-wires brakes are employed to hold the vibrating roller x during that operation, which brakes are applied as follows: To either end of the shaft t' a friction-pulley o^2 is affixed.

p^2 p^2 represent friction-brakes, one on either side of the loom, (though in light fabrics one brake will be sufficient,) which vibrate on the studs q^2 q^2 at their upper ends, and are connected with their respective levers r^2 r^2 at their lower ends by the connecting-rods s^2 s^2.

The levers r^2 r^2 vibrate on their respective studs t^2 t^2, and are actuated by the cams u^2 u^2 on the main shaft b, which cams are so shaped as to bring the said brakes p^2 p^2 into action, when the lathe beats up and sets them free at other times.

On the warp-wire beam w the worm-wheel x' is affixed, which receives motion from the worm y' on the let-off-motion shaft z'. The let-off-motion shaft z' is supported by the stands a^2 a^2, and is actuated by the cam b^2 on the main shaft b. The cam b^2 acts on the roller c^2 and forces the lever d^2 forward to turn the let-off motion, while said lever d^2 falls back for renewed action by its own weight. Motion is communicated from said lever d^2 to the let-off-motion shaft z' through the medium of the connecting bar e^2, the three-armed vibrating lever f^2, crown-ratchet g^2, pawl h^2, pinion i^2, and cogged wheel j^2. The ratchet g^2 revolves on the stud k^2 and has the pinion i^2 affixed to its hub. One of the pawls h^2 h^2 is made shorter than the other by half the space between the ratchet-teeth, thus giving greater accuracy of action than if only one pawl was used.

The action of the let-off motion is regulated and adapted to the requirements of the loom as follows: The rear end of the connecting-bar e^2 is bent down and terminates in a sharp edge, as represented by l^2. m^2 represents a regulating-lever, which turns freely on the end of the shaft t', and is provided at its forward end with a series of notches n^2 n^2, rising one above the other, to receive the sharp edge l^2 of the bar e^2, while its rear end terminates in the form of a weight of sufficient size to constantly tend to throw up the opposite end just described. v^2 represents a stop, which is affixed to the brake-pulley o^2 to limit the upward movement of said regulating-lever m^2.

From the foregoing description of the parts which compose the let-off motion it will be understood that as the cam b^2 at each revolution forces the lever d^2 forward to a given point to turn the let-off motion, the extent to which said let-off motion will be moved by any one revolution of said cam b^2 will depend upon the extent which the said lever d^2 shall fall back for renewed action. Consequently when more warp-wire is being given out than is required for the cloth being woven, the vibrating roller x, under the action of tension-weights, falls back and raises the stop v^2, which allows the end of the regulating-lever m^2 on which it acts to rise and present such an one of the series of notches n^2 n^2 as will suitably diminish the backward movement of the lever d^2. Then as more warp-wire is required than is being given out, the said vibrating roller x is drawn forward, which forces down the regulating-lever m^2 and presents such an one of the notches n^2 n^2 as will give the required increase of motion to the lever d^2.

The harnesses a' a' are suspended from the roller v^2 by the chains w^2 w^2 and connected with the treadles z^2 z^2, the whole being operated by the cams a^3 a^3 in a similar manner to the harnesses in the ordinary power-loom.

The double action of the lathe will now be described.

The lathe is suspended from the shaft b^3, which rocks in the boxes c^3 c^3.

d^3 d^3 represent the swords of the lathe, e^3 the race-beam, f^3 the reed-binder, and g^3 the reed-cap.

h^3 represents a shaft, which rocks in the boxes i^3 i^3 and has the arms j^3 j^3 (one on either end thereof) extending upward from it, the upper ends of said arms being connected to their respective swords d^3 d^3 by the connecting-bars k^3 k^3.

l^3 represents a cam on the main shaft b, and m^3 m^3 springs, the forward ends of which are bolted to projections cast on the shaft b^3, while their rear ends are connected to a loom girth by their respective straps n^3 n^3.

o^3 o^3 represent balance-weights to counteract the weight of the lathe when forward of its center of gravity.

The lathe is drawn back by the cam l^3 acting on the roller p^3. Then as the said roller p^3 is set free by the said cam l^3 the springs m^3 m^3 force the reed against the fell of the cloth by a sudden blow of the lathe, which sets the warp-wires. Then the pressure-rollers q^3 q^3, one of which is carried by the arm r^3 and the other by the main gear f, come round and strike against similar rollers s^3 s^3 on the lower ends of the swords d^3 d^3 of the lathe and completes the operation.

The mode of constructing and operating the shuttle, straightening the filling-wire, and preserving the selvages will now be described.

The shuttle is formed, as represented, on a scale of one-half size in Figs. 10 and 11, in which Fig. 10 represents a front view and Fig. 11 a top view.

u^3 represents the body part of the shuttle, and v^3 v^3 the shuttle-handles, by which the shuttle is carried through the shed, as hereinafter to be described.

w^3 w^3 represent stands, which extend forward from the body part u^3 of the shuttle and support the filling-wire bobbin x^3, which revolves on the pin z^3.

a^4 represents a friction-lever, which is forced against the filling-wire on the bobbin x^3 by the spiral spring b^4 to prevent the too free movement of the said bobbin x^3. As the filling-wire is drawn from the bobbin x^3 in the process of weaving it passes through a wire-straightener out between the guide-rollers c^4 c^4, as indicated by the red line r^5 in Figs. 4 and 11. The wire-straightener is composed of a series of pins d^4 d^4, a part of which project upward from the arm e^4 and the remaining part project downward from the arm f^4. The arm e^4 is secured firmly to the body part u^3 of the shuttle, while the arm f^4 is made to swing on the stud-screw g^4 to facilitate passing the filling-wire between the said pins d^4 d^4, and is held in position by the spring h^4,

which may be adjusted so as to hold the said pins d^4 d^4 in greater or less proximity, according as more or less pull is required to straighten the wire. The ends of the pins d^4 d^4 and the guide-rollers c^4 c^4 are sunk into the parts which are connected with them, whereby they are shielded, so as to prevent the filling-wire from slipping over them. In weaving some fabrics, instead of the pins d^4 d^4, two conforming friction-surfaces may be employed to straighten the wire, said surfaces being pressed together by a spring and the wire drawn between them.

The shuttle is handed or carried through the shed of the warp-wire from one side of the loom to the other by the shuttle-arms i^4 i^4, one on either side of the loom, which have a simultaneous motion toward and from the center of the web and slide on their respective ways j^4 j^4. The inner ends of the shuttle arms i^4 i^4 are provided with sockets, which are suitably formed to receive the shuttle-handles v^3 v^3, and are made bell-shaped at their openings to facilitate the ingress of said handles. The shuttle engages with the shuttle-arms, as represented in Figs. 1 and 4, and is secured thereto when required by the latch-levers k^4 k^4, which vibrate on their respective studs l^4 l^4.

m^4 m^4 represent springs which have a constant tendency to throw the hooks n^4 n^4 on the latch-levers k^4 k^4 into action, so that when the shuttle-handles v^3 v^3 enter the sockets in their respective shuttle-arms i^4 i^4 the hooks n^4 n^4 glide over the points of the said shuttle-handles v^3 v^3 and lock into the openings o^4 o^4. The shuttle is alternately carried from the side of the web to the other, one arm carrying it toward the center of the web until it meets the other arm, which receives it and carries it to the opposite side of the web from whence it started. The hooks n^4 n^4 are alternately released to cause the shuttle to take the right direction after the two arms have come together in the center of the web, as aforesaid, by the levers p^4 p^4, which vibrate on their respective studs q^4 q^4.

r^4 r^4 represent projections which present a cam-like surface to similar surfaces s^4 s^4 on the latch-levers k^4 k^4, as represented in Figs. 3 and 4. The levers p^4 p^4 are alternately raised while the shuttle is being carried from the side of the web toward the center thereof, so that the cam-like surfaces s^4 s^4 come in contact with the projections r^4 r^4 just before the shuttle-arms reach their greatest extent of inward motion, and thus release the hooks n^4 n^4, the said hooks n^4 n^4 being released in alternate correspondence with the movement of the shuttle—that is to say, the hook on the side of the loom from which the shuttle is taken into the shed is released, while the one on the opposite side is left in action to draw the shuttle to the opposite side of the loom from whence it started.

The mode of communicating motion to the levers p^4 p^4 will be hereinafter described in connection with the filling-wire stop-motion.

The ways j^4 j^4, before mentioned, are screwed to the horizontal plate t^4, one end of which is supported by the stand u^4, while the other is bolted to the projection v^4 on the loom-frame.

w^4 represents a horizontal girth placed between the loom-frame and the upper end of the stand u^4 to give steadiness to the parts connected therewith. x^4 represents another horizontal girth which connects the lower end of said stand u^4 to the loom-frame and supports the counter-shafts y^4 y^4, which operate the shuttle. The end of the girth x^4 which is presented to the loom-frame is made in two parts to receive the bevel-gears z^4 z^4, as represented in Fig. 17. The counter-shafts y^4 y^4, through the said bevel-gears z^4 z^4, receive motion from the main shaft b and carry their respective double cams a^5 a^5. The said double cams a^5 a^5 act on their respective cam-rollers b^5 b^5, and, through the medium of the depending levers c^5 c^5, connecting-bars d^5 d^5, upright levers e^5 e^5, and bars f^5 f^5 move their respective shuttle-arms i^4 i^4 in a manner to carry the shuttle through the shed, as before described.

The apparatus for preserving the selvages of the cloth may be understood as follows: The pointed bars g^5 g^5, which prevent the drag on the filling-wire from drawing in the selvages, extend upward from the horizontal arms h^5 h^5, which are affixed to the upper ends of the vertical shafts i^5 i^5. The vertical shafts i^5 i^5—one on either side of the loom—are supported by suitable sockets formed in their respective rock-levers j^5 j^5 at their lower ends, while they are guided and supported at their upper ends by the stands k^5 k^5, in which they have both a vertical and rocking motion. The rock-levers j^5 j^5 are supported by their respective stands l^5 l^5, and their inward arms extend back and receive motion from the double cams m^5 m^5 on the cam-shaft c, while their outward arms extend forward and are bent to receive the lower ends of the vertical shafts i^5 i^5, as aforesaid, and as represented by the detached plan thereof in Fig. 7. The vertical shafts i^5 i^5 are prevented from rising out of their respective sockets by the lugs n^5 n^5, which so ply in grooves in said shafts as to secure them in their position without impeding their rocking motion.

o^5 o^5 represent arms which extend from the vertical shafts i^5 i^5 to act upon the filling-wire stop-motion, as hereinafter to be explained.

p^5 p^5 represent stops against which the arms o^5 o^5 strike to prevent the shafts i^5 i^5 from rocking too far toward or from the selvages of the cloth.

q^5 q^5 represent springs which have a constant tendency to draw the arms h^5 h^5 away from the selvages of the cloth.

Now suppose the loom to be in that stage of its operation at which it is represented in Figs. 4 and 5. The cam m^5 raises the shaft

i^5 (on the side of the loom where the shuttle is located) and brings the pointed bar g^5 up between the filling-wire r^5 and the selvage of the cloth. The shuttle then enters the web and draws the said filling-wire r^5 around the said pointed bar g^5, which at this stage of the operation serves to take up the slack of said filling-wire r^5, caused by the returning movement of the shuttle, and prevent it from kinking or twisting together; but as the shuttle further proceeds on its course across the web the said filling-wire r^5 draws the said pointed bar g^5 around toward the selvage to a line with the fill of the cloth, where it is arrested by the stop p^5, and prevents the drag on the filling-wire r^5 from drawing in the selvage-wire. Then just before the shuttle completes its movement the said cam m^5 withdraws the said pointed bar g^5, which allows the final movement of the shuttle to draw the said filling-wire snug up to the selvage-wire, thus forming a true selvage without drawing in the reed. When the pointed bar g^5 is withdrawn from the filling-wire r^5, as aforesaid, the spring q^5 draws it back to clear the lathe, and to the place where it is arrested by the stop p^5 for renewed action.

t^5 t^5 represent guide-stands so formed as to prevent the filling-wires from whipping over their respective pointed bars g^5 g^5. The pointed bars g^5 g^5 are brought into action alternately, corresponding with the movements of the shuttle, and the shaft i^5 i^5 carry their respective arms u^5 u^5, which engage with the levers p^4 p^4, before mentioned, so that when said shafts i^5 i^5 are raised and depressed to bring into action and withdraw the said pointed bars g^5 they at the same time bring into action and withdraw the said levers p^4 p^4, which act on the latch-levers k^4 k^4 to release the shuttle, as above specified. The hubs of the arms u^5 u^5 being loosely fitted to their respective shafts i^5 i^5 offer no obstruction to their rocking motion, but they are secured to and made to move vertically in unison with the said shafts i^5 i^5 by the hub of the arms h^5 h^5 and the collars v^5 v^5.

The mode of connecting the apparatus which is employed to preserve the selvages with the loom-shipper for stopping the loom when a filling-wire fails is as follows: x^5 represents a lever, which vibrates on the stud a^6, and has its upper end suitably formed to act on the shipper n and throw the loom out of gear when brought in action for that purpose. The lower end of said lever x^5 is not only connected with the apparatus now under consideration for stopping the loom when the filling-wire fails, but also with the apparatus for stopping the loom when a warp-wire breaks, which latter connection will hereinafter be described. It is connected with the former apparatus by means of the horizontal bar b^6, bent arm c^6, horizontal rock-shaft d^6, upright arms e^6 e^6, and cords f^6 f^6, which are attached to their respective arms o^5 o^5 before described. The rear end of the bar b^6 is jointed to the lower end of the vibrating lever g^6, which vibrates on stud h^6 and receives motion to throw the loom out of gear from the double cam i^6 on the main shaft b. The forward end of the said bar b^6 is provided with a hook j^6, which acts on the projection k^6 on the side of the lever x^5. The bent arm c^6 is provided with a fork at its extremity, in the bottom of which the bar b^6 rests, and as the stop l^6 prevents the shaft d^6 from turning too far the said arm c^6 sustains the bar b^6 in a suitable position to act on the projection k^6 when drawn back by the said double cam i^6. The said double cam i^6 gives one vibratory motion to the bar b^6 every movement of the shuttle, and if the said bar b^6 were allowed to remain in the position just described, and represented in Fig. 3, it is obvious that it would throw the loom out of gear every operation; but by tracing the connection of the parts of the apparatus before specified it will be seen that whenever the points or levers g^5 g^5, or either one of them, are drawn toward the selvage of the cloth by the filling-wire to preserve the selvage, as aforesaid, the cords f^6 f^6 will draw forward the arms e^6 e^6 and raise the bar b^6, so that when it is drawn back by the aforesaid cam i^6 the hook j^6 will pass clear of the projection k^6 and the loom continues in motion, whereas if the filling from any cause fails to act on said points or levers g^5 g^5, or one of them, as aforesaid, the said hook j^6 engages with the projection k^6 and throws the loom out of gear.

The mode of combining and arranging the apparatus for stopping the loom when a warp-wire breaks will now be described. The controlling part of this apparatus is placed under the warps at the back side of the loom, and is supported at either end by the stands m^6 m^6. n^6 represents a guide-frame, which resembles a long box divided by a partition o^6, but without a bottom, and contains as many weights p^6 p^6 as there are wires in the warp, one half of the said weights being put into one compartment of said guide-frame n^6, and suspended from one division or portion of the shed of the warp-wire, and the other half in the other compartment and suspended from the other division or portion of the shed of the warp-wire, each warp-wire having its respective weight. The said weights are made of a square form and of a thickness so nearly to fill their respective compartments of the said guide-frame n^6 as to require no other guide to steady them, but at the same time having sufficient play to move up and down freely.

q^6 represents a bed on which the weights p^6 p^6 drop when their respective warp-wires break, said bed being supported by the aforesaid stands m^6 m^6. The stands m^6 m^6 are provided with slots r^6 r^6, in which the stop-bar s^6 slides to and fro, said stop-bar s^6 being connected at both ends to the rock-shaft t^6 by their respective bars u^6 u^6 and upright arms v^6 v^6. The rock-shaft t^6 rocks in the stands w^6 w^6, and receives motion from the double

cam x^6 on the main shaft b, said motion being communicated through the medium of the vibrating lever y^6, connecting-rod z^6, and rock-lever a^7. The upper arm of the rock-lever a^7 is provided with a hub in which the rod b^7 slides, said rod b^7 being constantly forced against the cam c^7 on the aforesaid upright arm v^6 by the spring d^7, which plies in the groove e^7, as represented in a front elevation thereof in Fig. 12.

f^7 is another rock-lever on the rock-shaft t^6, the lower end of which is connected to the lever x^5 before specified by the rod g^7, the forward end of said rod g^7 being provided with a slot to allow the filling stop-motion to act on the said lever x^5, as before specified, without disturbing the parts of the warp-wire stop-motion. The stop h^7 and the spring i^7 serve to keep the levers x^5 and f^7 in position to be acted upon.

j^7 is a lever, which is connected with the lever f^7, as shown in Fig. 3, and vibrates on the stud k^7 to change the direction of the motion of the lever a^7, so that when either of the parts l^7 l^7 are acted upon by the said lever a^7 it will move the lever x^5 and throw the loom out of gear.

The mode in which the depressing of any one of the weights p^6 p^6 consequent upon the breaking of a warp-wire brings the lever a^7 into action to stop the loom is as follows: It should be borne in mind that the arms v^6 v^6 are permanently affixed to the rock-shaft t^6, while the hubs of the rock-levers a^7 and f^7 turn loosely on said rock-shaft t^6, the said rock-lever a^7 being connected with the arm v^6 to give motion to the stop-bar s^6 by the rod b^7 pressing against the recess m^7 of the cam c^7, as represented in Figs. 12 and 14. Now when all the warp-wires are in working order the weights p^6 p^6 are suspended so as to allow the stop-bar s^6 to vibrate freely, and the inner end of the rod f^7, being in the recess m^7 of the cam c^7, allows the outer end thereof to pass the parts l^7 l^7 without contact; but whenever a warp-wire breaks its respective weight p^6 falls onto the bed q^6, or is sufficiently depressed to arrest the stop-bar s^6, and as the rock-lever a^7 is continued in motion by the double cam x^6, which actuates it, the rod f^7 rises out of the recess m^7 and brings its outer end in contact with one or the other (according to the direction of its motion when the stop-bar s^6 is arrested) of the parts l^7 l^7 and stops the loom. The weights p^6 p^6 have a tendency to depress the warp-wires, to prevent which the roller n^7 is placed under them, which revolves in the stands o^7 o^7. For the same purpose, also, stands may be placed under the ends of the lease-rods p^7 p^7, and the middle portion of said rods may be supported by wires, as represented by the lines q^7 q^7 in Fig. 5.

I do not intend to confine myself to the precise form and construction of the parts as above specified, as it will be obvious to machinists that many parts of the loom may be varied without changing their essential character—as, for example, instead of operating the shuttle-arms by cams and levers, as above specified, they may be operated by a revolving screw placed with its axis parallel to the line of motion of said arms, and a suitable connection formed between them. I sometimes also operate the lathe by cams so formed as to give to it a double action, as represented in Fig. 6.

In weaving some wire fabrics the filling-wire is crimped by the process of weaving, and consequently requires a length of filling-wire to be introduced greater than the width of cloth being woven; otherwise the contraction of the said filling-wire produced by crimping it will cause undue action upon the warp-wires at the edges of the cloth and produce what is called "ruffle selvages"—that is, selvages longer than the body of the cloth. In weaving such fabrics I sometimes employ, in addition to the above-described apparatus for preserving the selvages, two or more pointed instruments w^5 w^5, which are in proper order of time and by appropriate mechanism thrust into the shed of the warp-wire forward of the filling-wire, so as to give it a sort of curve, and thus increase the length thereof taken into the shed, as represented in Fig. 16.

In order that the curve of the filling-wire may be equal on both sides of the web when the lathe strikes, I employ two levers, one on either side of the loom, the position of which is indicated at y^5 y^5, which levers, after the shuttle has passed and before the said pointed instruments w^5 w^5 are withdrawn, are alternately moved forward to bend the wire to the fill of the cloth, so that when the lathe beats up it will act alike on both edges. I sometimes also crimp the filling-wire before it is introduced into the shed by passing it through fluted rollers with flutes of a proportionate size to the meshes of the cloth to be woven, as represented in Fig. 18. When the filling-wire is crimped by fluted rollers, as aforesaid, the shuttle is dispensed with, and the said filling-wire may be introduced into the shed of the wire warps by means of pinchers or nippers mounted on the end of a sliding bar supported by suitable guides on one side of the loom, said sliding bar being so operated as to pass said pinchers or nippers through the warps to the opposite side of the web, where they seize the end of the filling-wire and, returning, draw it into the shed. The filling-wire may be cut into suitable lengths and placed at the side of the loom in a suitable manner for the said nippers or pinchers to successively seize them and draw them into the shed; or the crimping-rollers may be placed opposite (on the opposite side of the loom) to the said nippers or pinchers and move in unison with the returning motion of the said nippers or pinchers, thereby crimping the filling-wire and delivering it to the said nippers or pinchers at the same time. A cutter may be attached to the

sword of the lathe or otherwise operated, so as to cut off each succeeding shot of the filling-wire, and thus successively present a new end of the wire to the said nippers or pinchers. When larger wire is used—that is, wire sufficiently stiff for the purpose—the said nippers or pinchers may be placed on the same side of the loom as the filling-wire is placed and be employed to successively push the filling-wire into the shed, instead of drawing it in as above described. In some cases, also, the crimping-rollers may be employed so as to discharge the filling-wire into the shed of the wire warps at the same time they crimp it, in which case the nippers or pinchers may be dispensed with.

Having thus described my said invention and pointed out some of its modifications, what I claim as new therein, and desire to secure by Letters Patent, is—

1. The mode of constructing and operating the shuttle and combining it with the selvage-forming apparatus, whereby the filling-wire is straightened, the certain action of the shuttle secured, and the width and selvages of the wire-cloth preserved, substantially as specified.

2. The mode of arranging the parts which connect the selvage-forming apparatus with the loom-shipper, whereby the loom is thrown out of gear when the filling-wire fails, as above set forth.

3. The mode of giving a double action to the lathe, substantially in the manner and for the purpose specified.

4. The mode of constructing and arranging the parts of the warp-wire stop-motion and combining it with the loom-shipper for stopping the loom when a warp-wire breaks, substantially as specified.

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Witnesses:

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