

*E. B. Bigelow,*

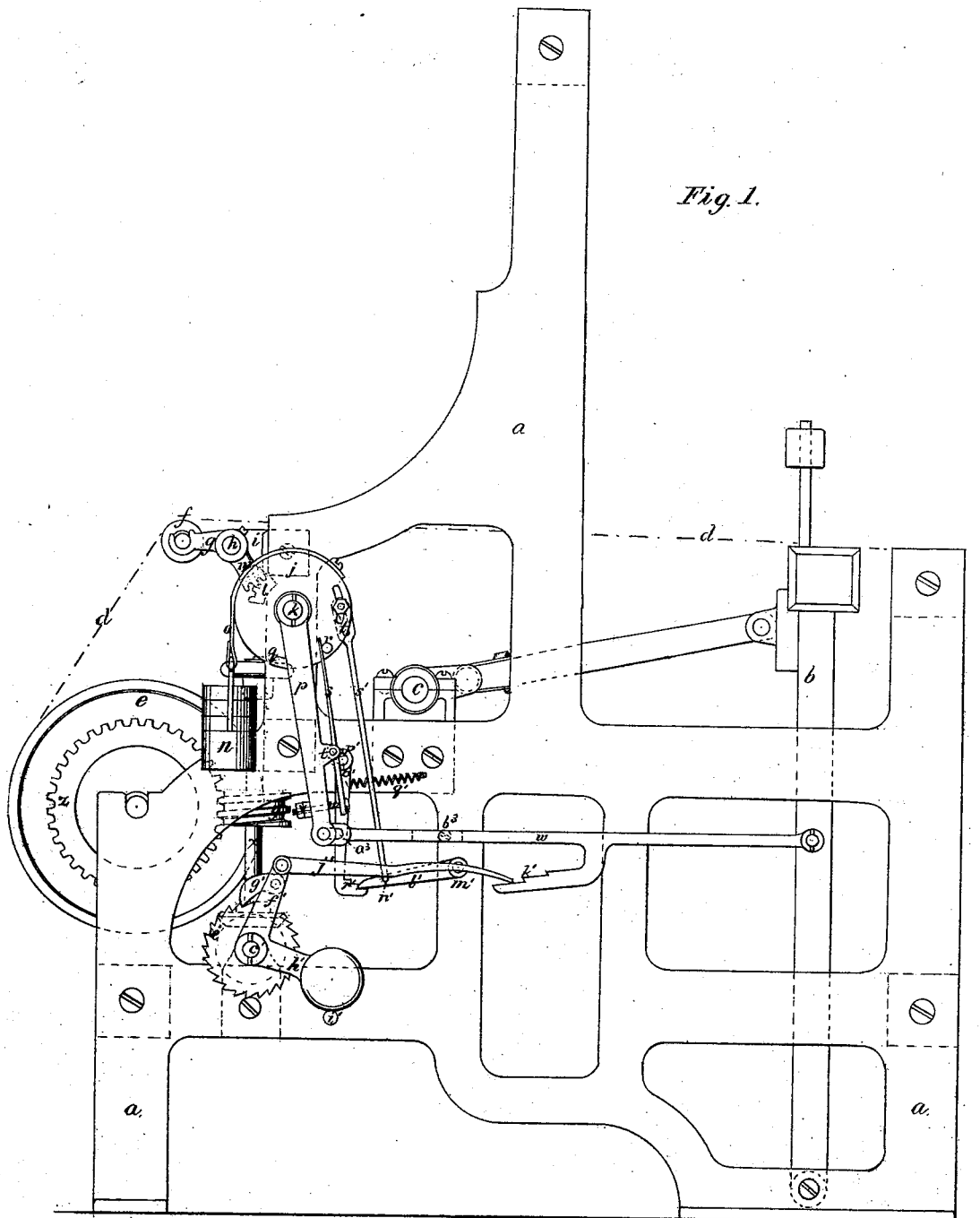
*6, Sheets, Sheet 1.*

*Let Off for Loom.*

*No. 110,000.*

*Patented Dec 13, 1870.*

*Fig. 1.*



*Witnesses*  
*Herbert F. Whitman.*  
*Wm. Sparrell*

*Erastus Brigham Bigelow.*

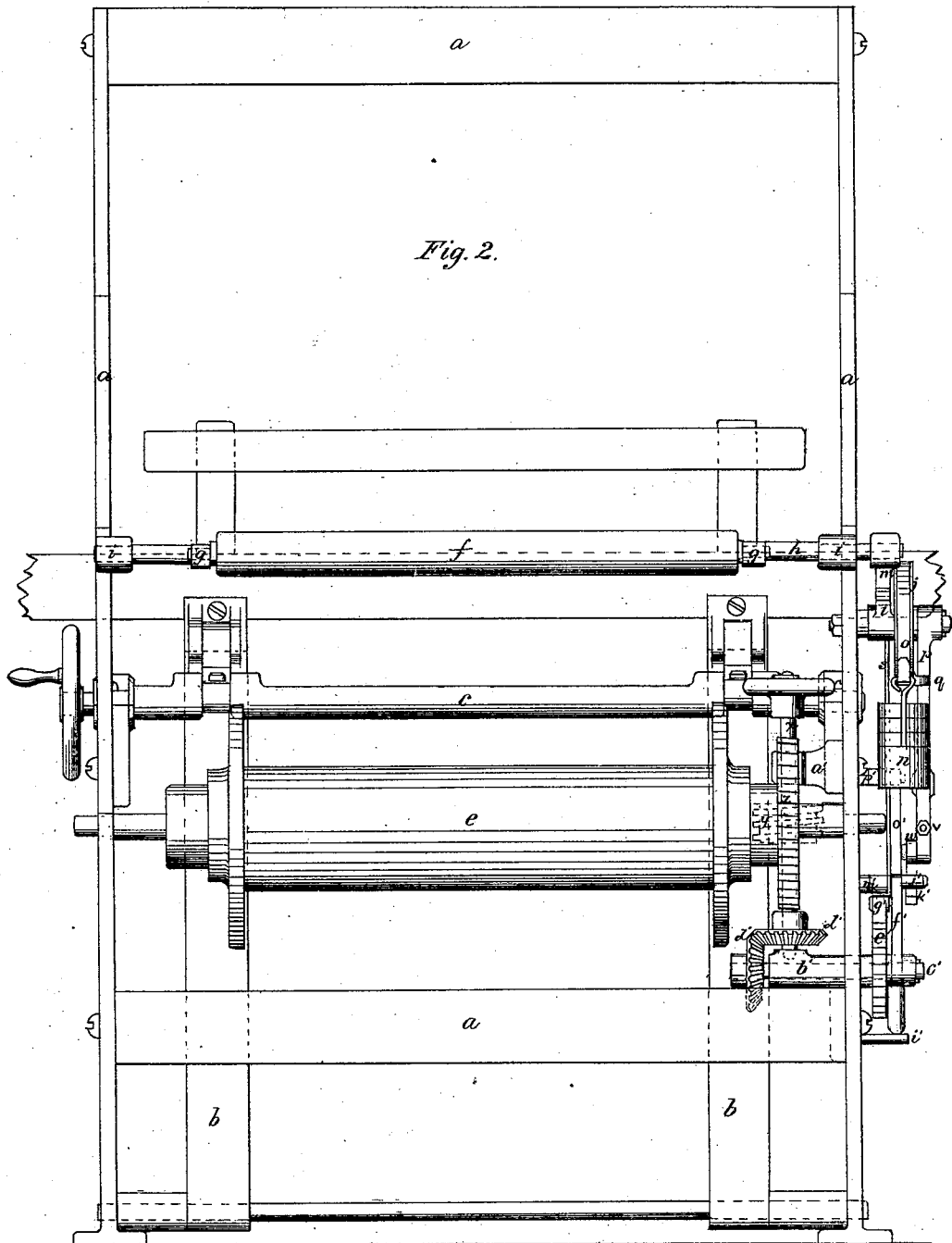
*O. Shatto, Street 2*

*E. B. Bigelow,*

*Let-Off for Loom.*

*No. 110,000.*

*Patented Dec. 13, 1870.*



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Herbert J. Whitman.  
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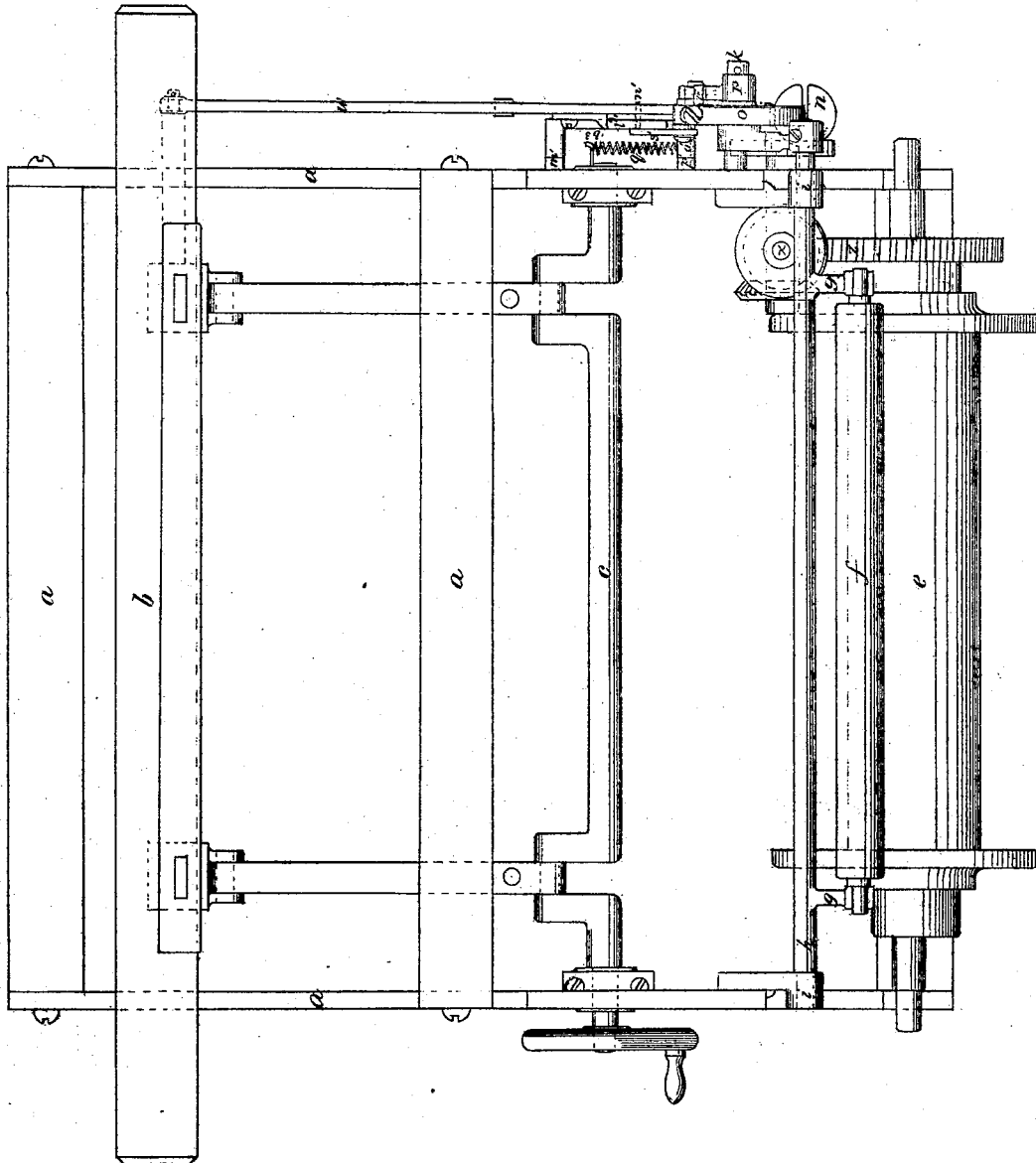
*E. B. Bigelow,*

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*Fig. 3*



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*Witnesses.  
Herbert J. Whitman.  
Wm. Spawcett.*

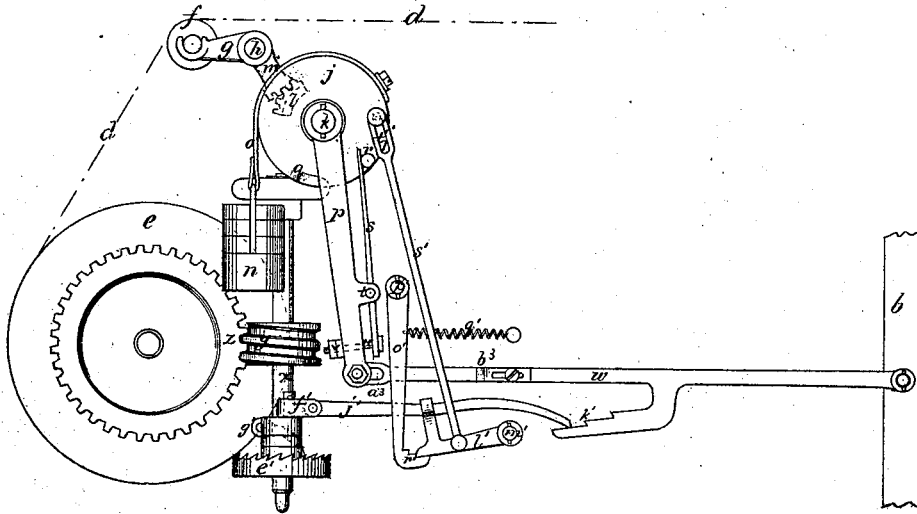
*E. B. Bigelow,* 6, Sheets, Sheet 4.

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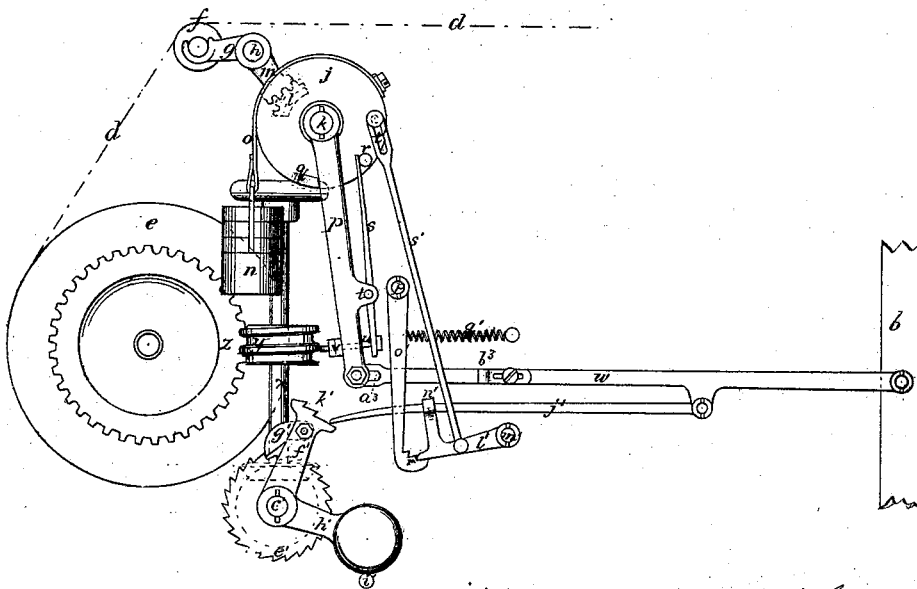
*No. 110,000.*

*Patented Dec. 13, 1870.*

*Fig. 4.*



*Fig. 5.*



*Witnesses*  
*Herbert S. Whitman.*  
*Wm. Sparrell*

*Eradus Brigham Bigelow*

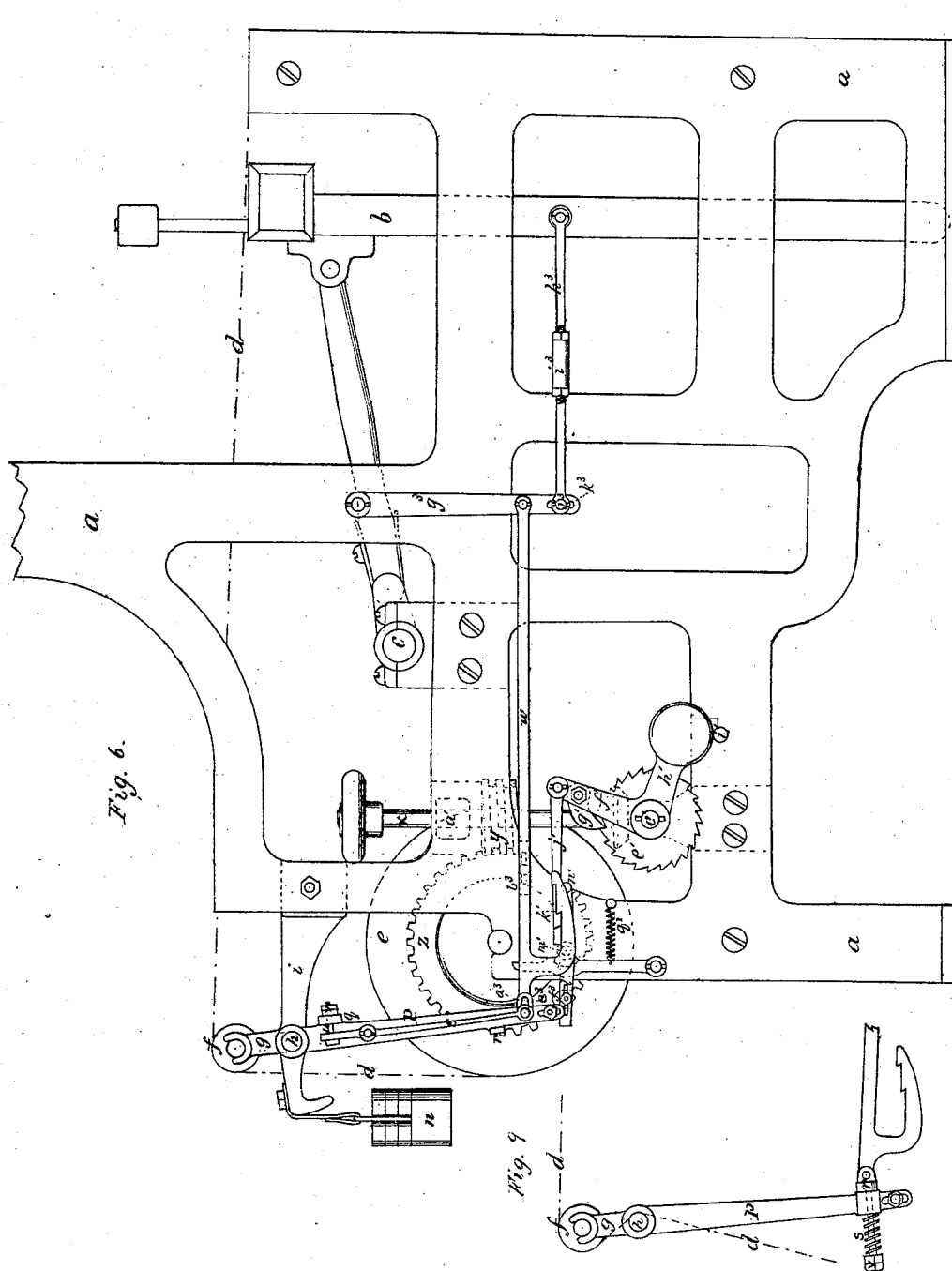
*E. B. Bigelow,*

*6, Sheets, Sheet 5.*

*Let Off for Loom.*

*No. 110,000.*

*Patented Dec. 13, 1870.*



*Fig. 6.*

*Fig. 9.*

*Witnessed.  
Herbert J. Whitman.  
Wm. Sparrell*

*E. B. Bigelow*

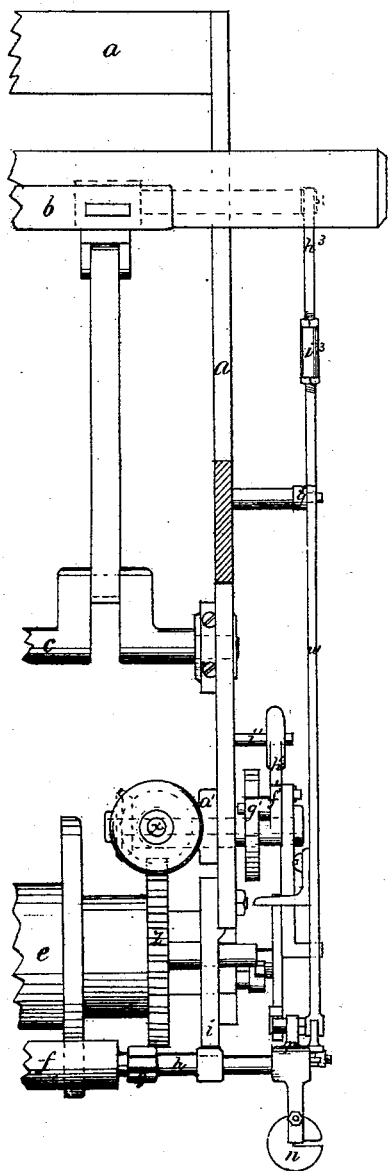
*E. B. Bigelow*

*Let-Off for Loom.*

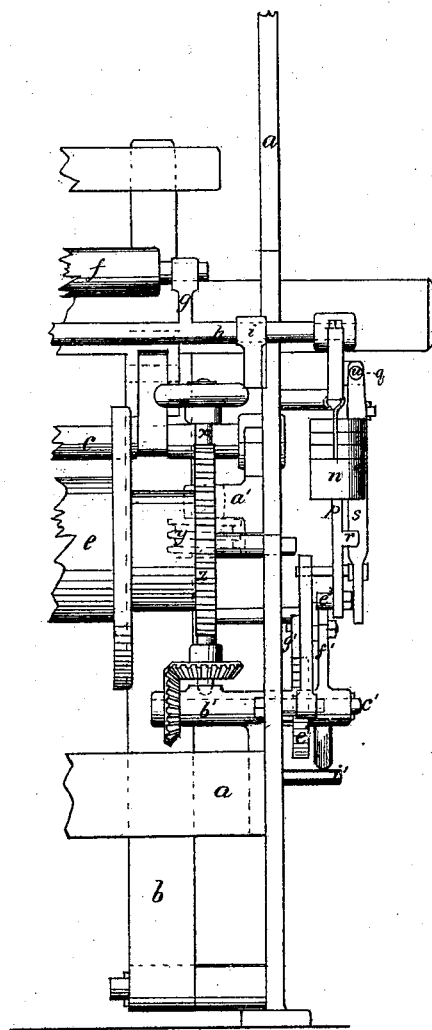
*No. 110,000.*

*Patented Dec. 13, 1870.*

*Fig. 8*



*Fig. 7.*



*Witnessed.  
Herbert S. Whitman.  
Wm. Sparrell*

*Ernest Brigham Bigelow.*

# UNITED STATES PATENT OFFICE

ERASTUS BRIGHAM BIGELOW, OF BOSTON, MASSACHUSETTS.

IMPROVEMENT IN LET-OFF AND TENSION MECHANISMS FOR POWER-LOOMS.

Specification forming part of Letters Patent No. 110,000, dated December 13, 1870.

*To all whom it may concern:*

Be it known that I, ERASTUS BRIGHAM BIGELOW, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain Improvements in Warp-Tension and Let-Off Mechanism for Power-Looms, of which the following is a specification.

In my patent of the 9th of February, 1869, No. 86,805, I have described and claimed, in combination with a vibrating roller which, by its varying position, governs the delivery of the warps, a spring arrangement whereby the tension of the warps is diminished while the shed is being formed, and increased to an extent to resist the beating up of the cloth while the shed is being closed, a single mechanism being employed to produce the required tension both in the open shed and in resisting the beat-up; and in my patent of the 24th of May, 1870, No. 103,415, I have described and claimed a method of accomplishing each of these objects by a separate device, one device being employed to produce the required tension of the warps when the shed is made, and the other to increase their tension to withstand the beating up of the cloth.

One part of my present invention relates to a mode of constructing the mechanism for increasing and diminishing the tension of the warps, and consists in combining with the lever-arm a spring capable of being adjusted so as to increase or diminish its force according to the resistance required, independently of the movement of said lever-arm, and in combining with the said parts the mechanism hereinafter described, which governs the action of the let-off mechanism; and another part relates to a mode of letting off the warps, and consists in combining with a vibrator and spring arrangement for increasing and diminishing the tension of the warps a let-off mechanism, the action of which is determined by said vibrator and spring arrangement at the time the lay beats up the cloth.

Figure 1 of the annexed drawings is an end elevation of my improvements with such parts of a loom as are necessary to illustrate their operation. Fig. 2 is a rear elevation of the same, and Fig. 3 is a plan.

The loom-frame is marked *a*, the lay *b*, and the lay-shaft *c*. The warps which are indicated by the line *d* pass from the warp-beam *e* over a vibrating roller, *f*, (for which a bar may be substituted,) to the cloth-forming line,

as is usual, the cloth being taken up by what is well known as the "positive take-up motion." The vibrator or vibrating roller *f* is supported by arms *g*, extending rearward from a shaft, *h*, which oscillates in bearings *i*. A pulley, *j*, oscillates on a stud, *k*, and has a segment of gear-teeth, *l*, formed on its inner side, which engage with another segment of a gear on the end of an arm, *m*, affixed to the shaft *h*, so that when the pulley *j* is oscillated it causes the roller *f* to vibrate correspondingly, and when moved in one direction it tightens the warps, and when moved in the opposite direction it slackens them. A weight, *n*, is suspended from the pulley *j* by a strap, *o*, the weight *n* being made in sections, so that its force may be easily adapted to the requirements of different descriptions of cloth, and in practice should be adjusted so as to give the required tension to the warps when the shed is open.

The mode of constructing the mechanism for increasing and diminishing the tension of the warps, which constitutes one part of my invention, will now be described. A lever-arm, *p*, is loosely fitted to the projecting end of the stud *k*, and is capable of vibrating between two stops, *q* and *r*, projecting from the outer side of the pulley *j*. A spring, *s*, is pin-jointed at *t* to the front edge of the lever-arm *p*, and has its upper end resting against the stops *r*, while its lower end is held in position by an adjusting-bolt, *u*, which passes through the spring and lever-arm, and is secured by nuts *v*, by which the force of the spring may be graduated.

By inspecting the drawings it will be seen that the spring, by resting against the stops *r*, presses the lever-arm against the stop *q*, so that the force of the spring may be increased or diminished irrespective of the movement of the lever-arm, according as the nuts *v* are adjusted. The lever-arm is connected with the lay *b*, before designated, by a connecting-rod, *w*, and vibrates with it. When the lay is moved forward to beat up the cloth, (the position in which it is represented in the drawings,) it draws the lever-arm forward and causes the spring, by pressing it against the stop *r*, to increase the tension of the warps at the time of the beat up, and allow the vibrator or vibrating roller at different beats to take positions varying according to the varying length of the warps between the warp-beam and the

take-up motion; then as the lay falls back the lever-arm goes back with it and slackens the warps for the formation of the shed.

For the convenience of adjusting the force of the spring to its proper relation to that of the weight, the connecting-rod is provided with a slot,  $a''$ , which allows it to free itself from the lever-arm at the extreme backward movement of the lay and leave only the force of the weight applied to the warps. The warps of different fabrics, when woven, require different degrees of tension when the shed is open, and also different degrees of increased tension at the time of the beat-up. It is important, therefore, that the devices by which these effects are produced should be easily graduated. The former, as before stated, is accomplished by putting on or taking off one or more sections of the weight  $n$ , and the latter by increasing or diminishing the force of the spring  $s$  between the stops  $q$  and  $r$ , by the nuts  $v$ , independently of the movement of the lever-arm  $p$ .

Though the weight  $n$  and the combined lever-arm and spring are described as co-operating to give the required tension on the warps, the combined lever-arm and spring may be used and I intend to use it separately; and the form and arrangement of the lever-arm and spring may be varied, while the advantages of adjusting the force of the spring independently of the movement of the lever-arm will be retained, as will be hereinafter explained.

The part of my invention which relates to the mode of letting off the warps will now be described. The warp-beam  $e$  is turned to deliver out the warps by a let-off shaft,  $x$ , worm  $y$ , and gear  $z$ , as is usual, the upper end of the shaft being supported by a stand,  $a'$ , and the lower end by a step on the upper side of a pipe-bearing,  $b'$ . Another shaft,  $c'$ , supported by the pipe-bearing  $b'$  just mentioned, is connected with the let-off shaft  $x$  by miter-gears  $d'$ , and has a ratchet-wheel,  $e'$ , affixed to it, the object of interposing this shaft being to bring the ratchet-wheel into a convenient position to be acted upon by the let-off mechanism. An elbow-lever oscillates on the outer end of the shaft  $c'$ , its upright arm  $f'$  carrying a pawl,  $g'$ , which engages with the ratchet-wheel  $e'$  and its horizontal arm  $h'$  a weight which draws the pawl back to renew its action, when left free to do so, its movement in that direction being limited by a stop,  $i'$ , projecting from the loom-frame. The upright arm  $f'$  has another pawl,  $j'$ , jointed to it, which engages with a series of steps,  $k'$ , on the upper side of an arm projecting from the connecting-rod  $w$ , before mentioned. The forward end of the pawl  $j'$  is supported by a lever-arm,  $l'$ , which oscillates on a stud,  $m'$ , and has a projection,  $n'$ , on which the pawl rests. The rear end of the lever-arm  $l'$  is supported by another lever-arm,  $o'$ , which oscillates on a stud,  $p'$ , and is drawn against the end of the lever-arm  $l'$  by a spring,  $q'$ , the lower end of the lever-arm  $o'$  being provided with a series of steps,  $r'$ , (corresponding in number with the

series of steps  $k'$ ,) on which the lever-arm  $l'$  rests. The lever-arm  $l'$  is connected with the pulley  $j$  by a connecting-rod,  $s'$ , provided with a slot,  $t'$ , which plays on a stud projecting from the pulley  $j$ , the use of the slot being to allow the pulley  $j$  to turn when the warps are slackened without pressing on the lever-arm  $l'$ . The loom is represented in all the figures in that stage of its operation in which the lay beats up the cloth, and in which the vibrator or vibrating roller determines the action of the let-off mechanism. The length of the warps between the warp-beam and the take-up motion is also supposed to be such as to prevent the spring  $s$  from turning the pulley far enough to raise the lever-arm  $l'$  above the lowest of the series of steps  $r'$ , thus leaving the pawl  $j'$  in a position to engage with the lowest of the series of steps  $k'$ , so that when moved backward by the lay it will turn the let-off mechanism to the fullest extent it is capable of doing. Now, suppose that as the weaving goes on more warps are given out than are taken up in the cloth, and the length of the warps between the warp-beam and the take-up motion thereby increased, the spring  $s$ , when the lay advances to beat up the cloth, will turn the pulley  $j$  so as to raise the lever-arm  $l'$  to a position to engage with the second or third of the series of steps  $r'$ , according as the length of the warps may be. If it be raised so as to engage with the second one, it will cause the pawl  $j'$  to engage with the second one of the series of steps  $k'$ , which will turn the let-off mechanism a less distance than the first one; and if it be raised so as to engage with the third, it will cause the pawl  $j'$  to wholly clear the step  $k'$ , and the lay will fall back without turning the let-off mechanism at all. At each backward movement of the lay an adjustable stand,  $b''$ , on the inner side of the connecting-rod  $w$ , pushes the lever-arm  $o'$  away from the lever-arm  $l'$  far enough to release it and allow it to descend and rest on the lowest of the series of steps  $r'$  until it is again raised in the manner just explained. The number of the steps in each of the series  $r'$  and  $k'$  may be varied according to the requirements of the cloth to be woven. In some cases only one step in each place is employed, but two or more are generally preferred.

The form and arrangement of the mechanism which embodies my invention may be varied without departing from its distinguishing principles—as, for example, Fig. 4 represents a modified arrangement in which the shaft  $c'$  is dispensed with, and the ratchet  $e'$  and lever  $f'$  are placed on the let-off shaft  $x$ . In this position the lever  $f'$  vibrates in a horizontal plane, and one end carries the pawl  $j'$ , which engages with the steps  $k'$ , and at the other the pawl  $g'$ , which acts on the ratchet  $e'$ .

Figure 5 represents another modified arrangement, in which the fulcrums of the pawl  $j'$  and steps  $k'$  are transposed—that is to say, the steps  $k'$ , instead of being applied to the connecting-rod  $w$ , are applied to the lever-arm



$f'$ , and the pawl  $j'$ , instead of being jointed to the lever-arm  $f'$ , is jointed to the connecting-rod  $w$ . In this arrangement the pawl moves the steps instead of being moved by them, though the result is the same in both cases.

Another modified arrangement is represented in Figs. 6, 7, and 8, Fig. 6 being an end elevation, Fig. 7 a rear elevation, and Fig. 8 a plan. The arms  $g$ , which support the vibrator or roller  $f$ , extend upward from the shafts  $h$ , so as to give it the required movement to tighten the warps at the time of the beat-up without the intervention of the pulley  $j$ , which is dispensed with, and the weight  $n$  suspended from an arm affixed to the shaft  $h$ . The lever-arm  $p$  is also affixed to the shaft  $h$ , and has the spring  $s$  jointed to it, which is capable of vibrating between the stops  $q$  and  $r$ , projecting from the lever-arm. The adjusting-bolt  $u$  passes through the spring and the stop  $q$ , the force of the spring being adjustable by the nuts  $v$ .

The connecting-rod  $w$ , instead of being jointed to the lever-arm, as before described, is jointed to the spring, the spring being represented as drawn forward by the lay away from the stop  $r$ , and the length of the warps being supposed to be such as to prevent the lever arm from moving forward as far as the spring has been moved. When the lay falls back, the spring will rest against the stop  $r$ , and in that position its force may be increased or diminished independently of the movement of the lever-arm. The direction of the pawl  $j'$  is reversed, so that the steps  $k'$  draw it forward to turn the ratchet instead of pushing it, as before described. Instead of the steps  $r'$  on the lever  $o'$ , friction-surfaces, as represented in the drawings, are employed to hold the lever  $l'$  in position. The connecting-rod  $s'$  is also dispensed with, and the lever-arm  $p$  employed in its stead to determine the action of the let-off mechanism, which is effected by a roller,  $e^3$ , at the lower end of the lower arm acting on a cam-surface,  $f^3$ , on the rear end of the lever  $l'$ ; and in order to vary the extent of the vibration given to the vibrator or vibrating-roller  $f$  by the lay, to meet the requirements of different fabrics, a lever,  $g^3$ , is interposed, to the lower end of which the connecting-rod  $w$  is jointed, the lever  $g^3$  being connected to the lay by another connecting-rod,  $h^3$ .

By a right-and-left handed nut,  $i^3$ , the length of the connecting-rod  $h^3$  may be varied at pleasure, and by raising or depressing the stud  $j^3$  in the slot  $k^3$  the extent of the movement imparted by the lay to the connecting-rod  $w$  may also be varied.

By adjusting the mechanism so that the lay will impart the required extent of vibration to the roller  $f$ , the weight  $n$  may be dispensed with, and the needed tension on the warps, both when the shed is made and when the beat-up takes place, be given by the combined lever-arm  $p'$  and springs  $s$ ; and I intend to use the combined lever-arm and spring separately as well as in combination with the weight.

When used separately, the slot  $a^3$  in the connecting-rod  $w$  is not required.

Fig. 9 represents the spring  $s$  applied to the lever-arm  $p$  in a spiral form and in a manner capable of being adjusted as to its force independently of the movement of the lever-arm  $p$ . The angle at which the warps pass from the warp-beams over the vibrator or roller  $f$  varies with the diameter of the warps on the beam, it being more obtuse when the beam is full than when it is nearly empty. To give the warps a uniform angle, and consequently a more uniform tension, I sometimes pass them around the shaft  $h$ , thence over the roller  $f$ , as indicated in Fig. 9.

The several parts of the mechanism herein described may be interchanged without changing the distinguishing features of my invention—as, for instance, the combined lever-arm and spring, as represented in Fig. 6, may be used in connection with the vibrator or vibrating roller, arranged and operated as represented in Fig. 1.

The lever and adjustable connecting-rod for varying the extent of the vibration given to the vibrator or vibrating roller by the lay (represented in Figs. 6, 7, and 8) may be used in connection with the arrangements of mechanism represented in any of the other figures; so also with the let-off mechanism herein described, which may be used, and I intend to use it in combination with a vibrator and spring arrangement for giving tension to the warps and regulating their delivery, whether said vibrator be operated wholly by one device or by one device for producing the tension on the warps when the shed is made, and another for increasing their tension to withstand the beating up of the cloth.

Having described my invention and pointed out some of the modifications of which it is susceptible without departing from its distinguishing principles, what I claim as new therein, and desire to secure by Letters Patent, is—

1. The combination, with a whip-roll and a lever-arm co-operating together, as described, to increase the tension on the warps at the beat-up of the lay and diminish their tension when the shed is formed, of an adjustable spring connected with the lever-arm, to increase or diminish the operative force of the arm independently of its movement.

2. The combination, with a vibrator and spring constructed and arranged as above described, whereby the tension on the warps is increased to withstand the beating up of the cloth and diminished when the shed is made, of a let-off mechanism, substantially as described, for delivering out the warps, the action of this let-off being determined by said vibrator and spring arrangement at the time the lay beats up the cloth.

ERASTUS B. BIGELOW.

Witnesses:

HERBERT T. WHITMAN,  
WM. SPARRELL.