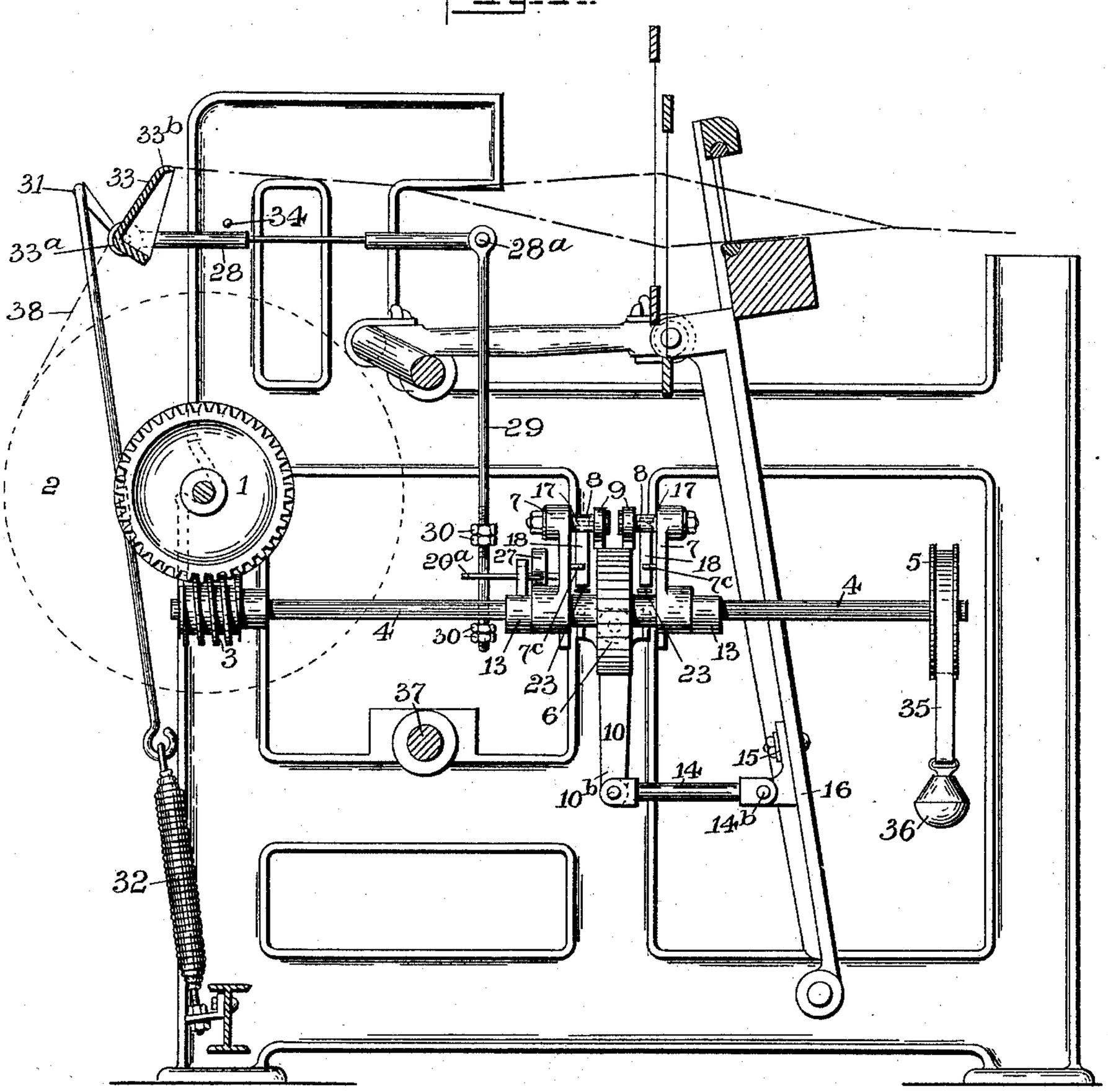
(No Model.) 3 Sheets—Sheet 1.

R. WILBY.

LET-OFF MOTION FOR LOOMS.

No. 495,766. Patented Apr. 18, 1893.

Fig. 1.



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3 Sheets—Sheet 2.

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Fig. 2.

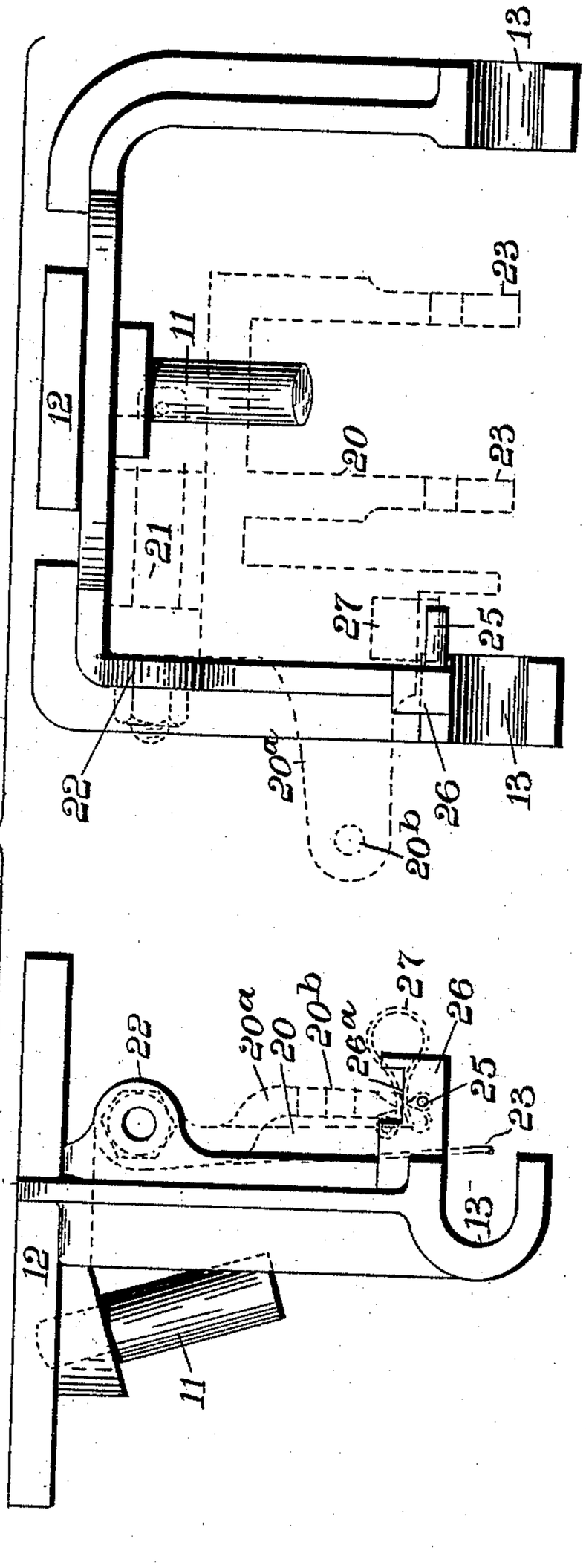
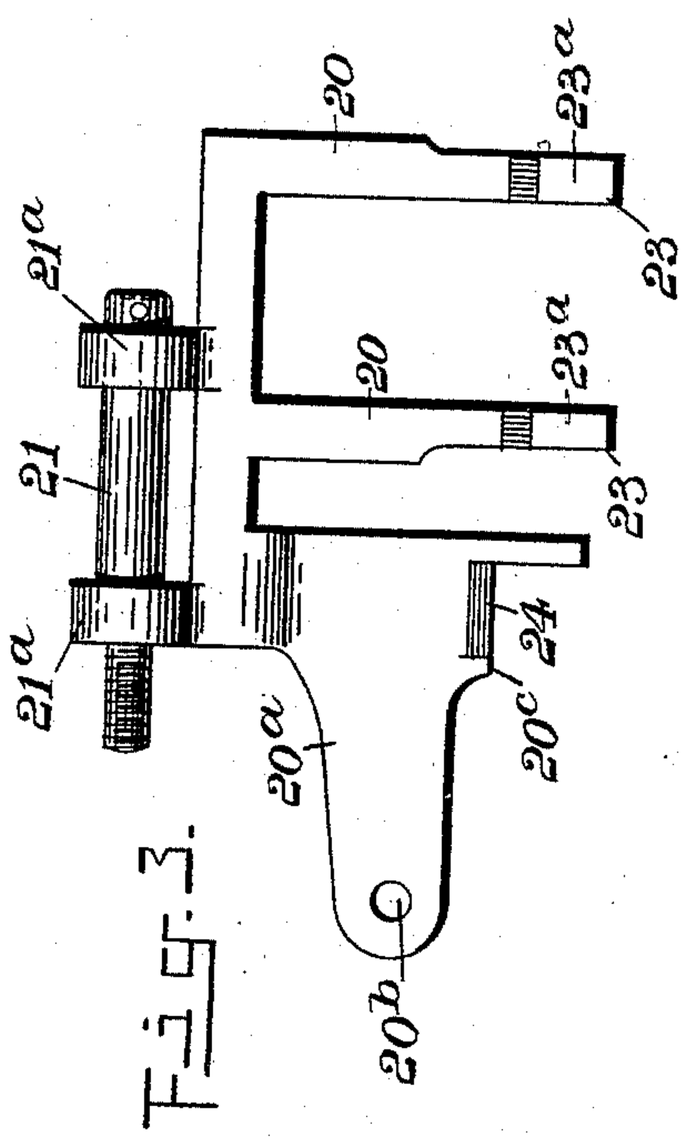


Fig. 3.



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(No Model.) 3 Sheets—Sheet 3.

R. WILBY.

LET-OFF MOTION FOR LOOMS.

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Fig. 4.

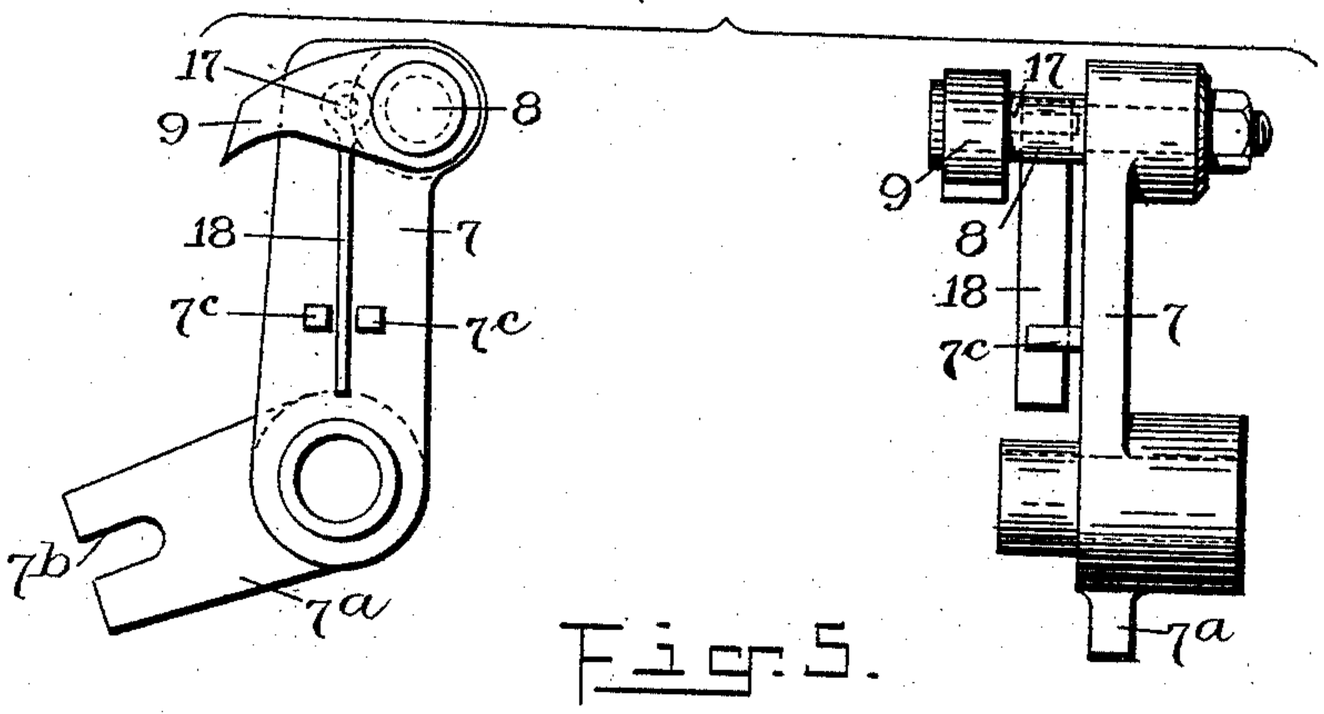


Fig. 5.

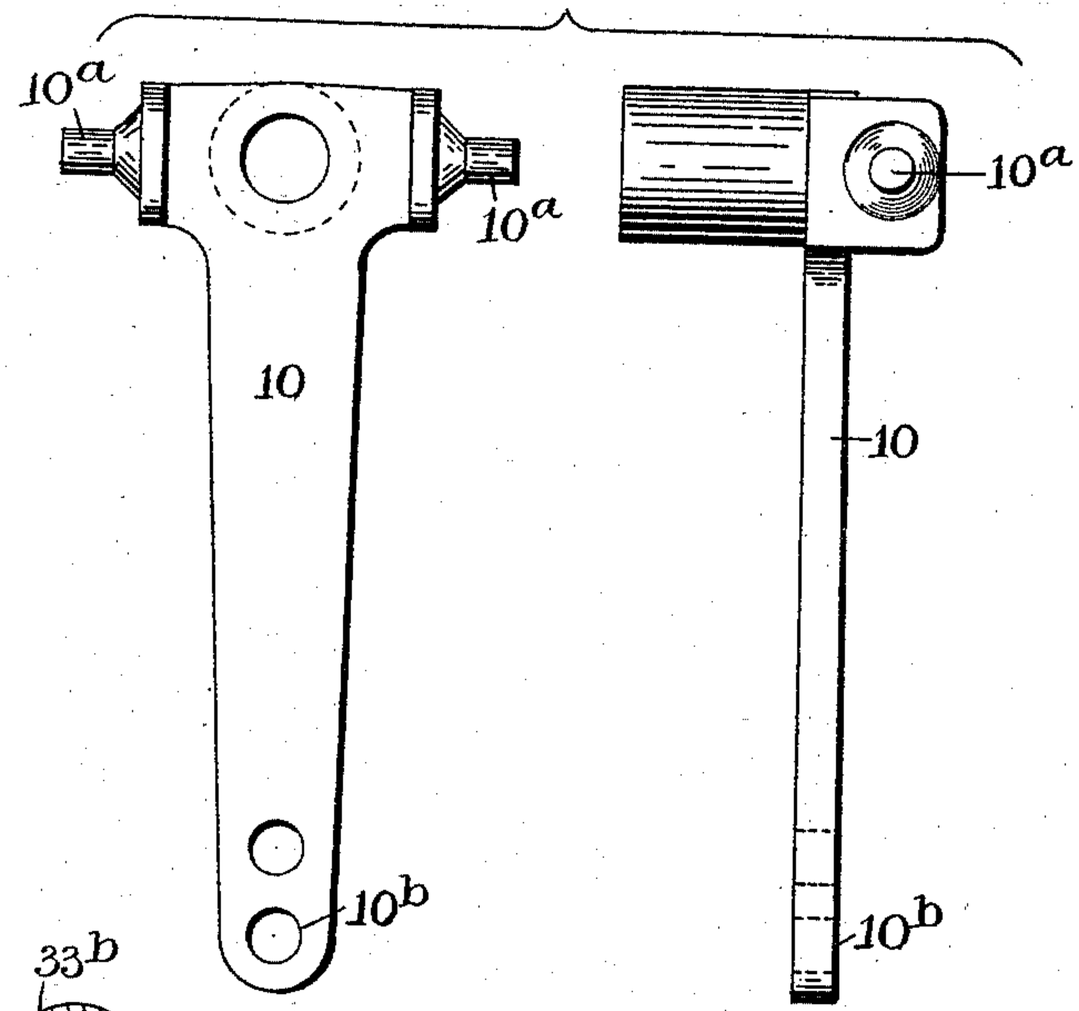


Fig. 6.

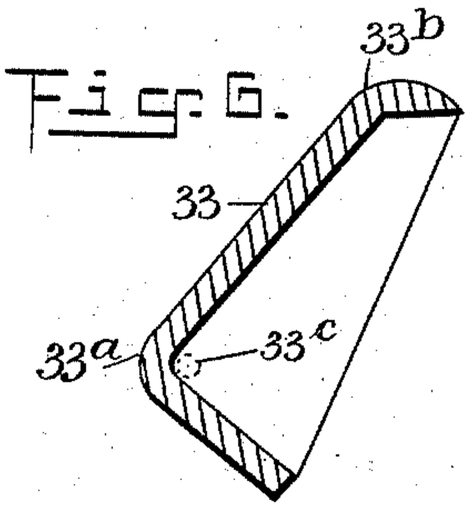
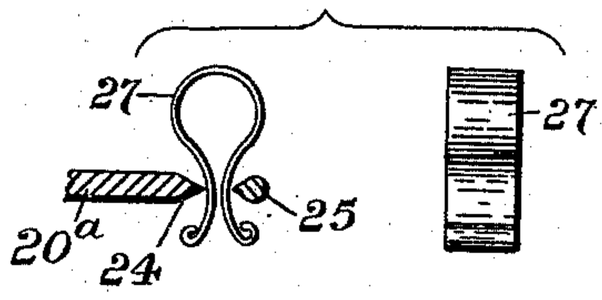


Fig. 7.



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UNITED STATES PATENT OFFICE.

RICHARD WILBY, OF HUDDERSFIELD, ENGLAND.

LET-OFF MOTION FOR LOOMS.

SPECIFICATION forming part of Letters Patent No. 495,766, dated April 18, 1893.

Application filed October 8, 1892. Serial No. 448,250. (No model.)

To all whom it may concern:

Be it known that I, RICHARD WILBY, a citizen of Great Britain, residing at Huddersfield, in the county of York, England, have invented certain new and useful Improvements in Let-Off Motions for Looms; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to a ratchet mechanism whose pawls are operated into and out of gear by a vibrating pivoted back bearer, and the objects of this invention are, first, to insure an even degree of tension on the warp threads during each pick cycle; secondly, to deliver the warp from the beam as the weaving proceeds, at one uniform degree of tension from full to empty beam.

The annexed drawings serve to illustrate my invention wherein

Figure 1 represents so much of a loom as is necessary to show how my mechanism is fixed and applied. Figs. 2, 3, 4, 5, 6 and 7 are detailed views of parts of the mechanism.

I will now describe my invention and explain that the oscillating motion to work the pawls 9 is obtained from the sley sword 16, and that the delivery of the warp is regulated and controlled by the slightly varying position of the arc of vibration of the pivoted back bearer 33, which bearer is made to place the pawls 9 into and out of gear with the teeth of their ratchet wheel 6 as the delivery of the warp requires, and the mechanism which thus puts the oscillating pawls 9, into communication with and under governable control of the oscillating pivoted back bearer 33, contains most of the new features of my invention.

Referring to Figs. 1, 2, 4, and 5, 1 is a worm wheel fixed on and near to one end of the warp beam 2, in the teeth of which worm wheel is geared a worm 3, which worm is fixed on the end of a shaft 4, said shaft being prolonged to the front of the loom and there provided with a hand wheel 5 for convenience to the weaver. 6 is a ratchet wheel keyed on said shaft and 7, 7, are bell crank levers of the shape shown in Fig. 4 which oscillate on said shaft, one on each side of the ratchet wheel 6. The upright arms of each of these bell crank levers are provided with a stud 8, 8, on which works a pawl 9. 9. capable of engaging with the teeth of the ratchet wheel 6.

7^a. 7^a. (Fig. 4) are the second arms of the bell crank levers, and each has a slot 7^b to receive the ends 10^a. 10^a. of a T shaped lever 10 (see Fig. 5). This lever 10 is suitably bored so as to fit and oscillate upon a stud 11 (see Fig. 2) which stud is firmly screwed into the bracket 12. secured to the side frame of the loom behind the ratchet wheel 6. Bearings 13 are made on this bracket to receive the shaft 4 and also serve to keep the bell crank levers 7. 7. in position on the shaft. Vibratory motion is given to the two bell crank levers 7, 7, through the medium of the connecting rod 14 (Fig. 1) which is attached by a knuckle joint to the hanging arm 10^b of the T shaped lever 10. This connecting rod 14 is attached at its other end by a similar joint 14^b to a bracket 15 which is bolted to the sley sword 16 and partakes of its motion when the loom is in action, thus giving through the medium of the connecting rod 14, T shaped lever 10, bell crank levers 7. 7. and pawls 9. 9. a nearly continuous motion to the ratchet wheel 6, shaft 4, and warp beam 2 when the pawls 9. 9. are in gear with said ratchet wheel. So far as described and illustrated, this meehanism would deliver the warp from the beam at every pick when the loom was in action, and other things being equal, the rate of such delivery at any one time would entirely depend upon the size of the roll of yarn upon the beam at that time.

I will now describe the mechanism which puts the oscillating pawls 9, 9, into working communication with the oscillating back bearer 33 (see Fig. 1), which mechanism causes the varying position of the arc of vibration of the said bearer to place the pawls 9. 9. into and out of gear with the teeth of the ratchet wheel 6, thereby causing the warp to be automatically delivered from the beam to the requirements of the weaving, and at a uniform degree of tension. The said mechanism between the pawls 9. 9. and the back bearer 33 for effecting this automatic delivery of the warp forms the new features in my invention.

Referring to Figs. 1, 3, and 4, 17. 17. are

pins fixed firmly in the sides of the pawls 9. 9. at about two thirds the pawls' length from their free ends.

18. 18. are hanging pins or pendants of the shape shown in Fig. 4, and hinged on the pins 17; such pendants pass down between guides 7^c. 7^c. cast or fixed on the levers 7. 7. to as near the center of oscillating motion as is possible on account of the diminished oscillating motion at those points.

20, 20, 20^a (Fig. 3) are arms which constitute a 3-armed lever and are cast so as to be in one piece near their axis 21^a, which axis is bored so as to be capable of working on the shed 21.

22 is a lug cast on bearing bracket 12, to which lug the stud 21 is firmly screwed.

23, 23, (see Figs. 1 and 4) are springs made of ribbon steel, which are riveted on the under side of the arms 20, 20, in a state of tension and pressing upward on the ends of the arms 20, 20, with a force just sufficient to promptly lift the pawls 9. 9. without deflecting. These springs project about three fourths of an inch beyond the lever ends of the arms 20, 20. The pawl pendants 18 18. (Figs. 1 and 4) rest on the top of the end portions of these springs 23, 23, (Fig. 1,) and are of such a length that when the pawls rest in the bottom of the teeth of the ratchet wheel 6 the ends of the pawl pendants are only just clear of the springs 23. 23.

The arm 20^a (Figs. 1 and 3) has a knife edge 24 filed on it and about one eighth of an inch from this is another knife-edge 25 made of a suitable piece of steel which is fixed in the lug 26 cast on bearing 13 (Fig. 2). Between these two knife edges is a double action spring 27 (see Fig. 7), a very good form or which is shown and made of ribbon steel. When the two knife edges as shown in Fig. 7 are in line with a radius of the triple armed lever 20^a the force of the double action spring on triple armed lever is neutral, but when the knife edge 24 is above or below the other knife edge 25, the action of the spring is to lift or depress the 3-armed lever 20, 20, 20^a. The use of this double action spring is to make the pawls change promptly and completely, and also for the purpose of insuring that the pawls 9. 9. shall always be either fully in gear or completely out of gear with the ratchet wheel 6. When the 3-armed lever 20, 20, 20^a (see Figs. 1 and 3) is lifted, it raises both the pawls 9. 9. clear of the teeth of the ratchet wheel 6 by means of the springs 23, 23, and pawl pendants 18, 18, and when the 3-armed lever is depressed, the pawls are again free to engage with the teeth of their ratchet wheel.

In order to give the necessary limit to the motion of the 3-armed lever, the part 20^c is made to work in a slot 26^a filed in lug 26 on bearing 13 (see Fig. 2) and the vertical depth of this slot determines how much the pawls 9. 9. shall rise clear of the teeth of the ratchet wheel 6 when said pawls are out of gear.

This 3-armed lever is put into communication with back bearer 33 by the horizontal arm 28 (Fig. 1) fixed on the back bearer and which partakes of its oscillating motion. This rod is reduced in thickness about midway of its length for the purpose of giving slight elasticity thereto. This arm 28 is coupled by knuckle joint 28^a to the vertical rod 29 passing through hole 20^b in arm 20^a. This rod 29 is provided with threaded parts as shown, on which are two nuts 30, 30, and two lock nuts. The distance between the inner surfaces of these two nuts is adjusted to be about a quarter of an inch greater than the amplitude of vibration of rod 29 plus the thickness of the metal 20^a which lies between said nuts.

To give the required tension to the warp I attach springs 32, 32, to arms 31, fixed to the back bearer 33 (see Fig. 1) and the angle between the said arms and the springs instead of being a right angle, as is usual, is arranged to be about forty or forty-five degrees of arc as shown, so that the leverage of the springs on the back bearer will increase as the back bearer moves backward. This angular arrangement of the springs is adapted for the purpose of compensating for the increased leverage of the warp threads on the back bearer as it moves backward, and also for the purpose of compensating for the slackening of the springs as the back bearer moves backward so as to insure the same degree of tension on the warp when the sheds are closed as when they are fully open. A stop piece 34 is provided for the back bearer 33 to take the force of the springs 32, whenever the warp has to be slackened, the stop being adjusted to be about one eighth of an inch beyond the backward limit of vibration of pivoted back bearer.

The number of teeth in ratchet wheel 6 and in worm wheel 1 is arranged to give warp sufficiently quick when the beam is nearly empty as will suffice when weaving the coarsest cloth usually woven in such looms and when each of the pawls is continuously in gear and each taking a single tooth per stroke.

The *modus operandi* is as follows:—Starting with the pawls 9. 9. in gear and the back bearer 33 vibrating so that neither of the nuts 30, 30, on the rod 29 come into contact with the arm 20^a (Fig. 1): Under these conditions (for the moment) the warp will be given off at a quicker rate than is required in the weaving, which extra length delivered is taken up by the back bearer 33 vibrating in an arc a little backward. Immediately the excess of delivery over consumption has reached a predetermined amount, say one twentieth part of an inch, the lower nut on rod 29 comes into contact with arm 20^a and lifts it, thereby raising both the pawls 9. 9. out of gear with the teeth of the ratchet wheel 6 and stopping the delivery of the warp until the excess of delivery is used up, at which stage the upper nut 30 comes into contact with arm 20^a and depresses the three-armed lever, permitting

both the pawls to fall into gear, and starting the delivery, again to be again stopped in the same manner, when the excess of delivery has again reached one twentieth part of an inch and again restarted when this excess of warp has been used up. It must be distinctly understood that this slightly varying position of the arc of vibration of back bearer 33 does not in the slightest degree alter the tension or tightness of the warp, and although the delivery is intermittent, yet the tension on the threads is kept perfectly uniform at all times. Very little force is required from the back bearer to effect the changes from delivery to non-delivery and vice versa which permits of the pawl mechanism being made extremely sensitive and the double action spring 27 always insures the changes being prompt and complete. The function of the steel ribbon springs 23, 23, (see Figs. 1 and 3,) is to allow of the three-armed lever 20^a being lifted when either of the pawls 9. 9. are locked in gear with the teeth of the ratchet wheel 6, the spring yielding at such times and its elasticity afterward lifting the pawl out of gear at the instant it is freed from its tooth. The reason why I employ a double ratchet mechanism instead of a single one is because only half the length of stroke of pawl arm is required, which permits me to get the oscillating motion for the pawls (even on fast running looms) from the sley sword instead of from the cam shaft 37. This again reduces the length of the stroke by one half on account of double speed of sley sword, so that the pawls need only turn the ratchet wheel one tooth each per stroke which reduces the momentum of the ratchet wheel shaft 4 which momentum is checked if necessary by a small brake strap 35, one end of which is fastened to the loom frame the other end having a small weight 36 hung on it, the strap passing in a groove over the hand wheel 5.

In order to prevent the varying angle of the warp threads 38 as they enter upon the back bearer 33 (due to the varying size of the roll of yarn on the beam) exerting a varying leverage on back bearer and so altering the tension of the warp as the weaving proceeds, I make said back bearer of the shape shown in section 33 (see Figs. 1 and 6). As the drawings show, the curved or rounded part over which the warp threads have to pass is divided along a line where the warp threads first touch the back bearer when the fullest warp beam is in the loom into two parts 33^a 33^b (Fig. 6) and these rounded parts are separated from each other by a distance of from two and a half to three and a half inches. I use this form of back bearer because it yields sufficiently to the requirements of the shedding when it is oscillating at an angle great enough to insure the warp threads entering upon said back bearer at the same distance from the center line of its oscillating motion 33^c when the fullest warp beam is in the loom as when the said warp beam is nearly empty, this condition being essential in order to obtain with a balanced back bearer one uniform tension on the warp with varied angles of the threads 38 as they enter upon said back bearer.

The variations in the position of the arc of vibration of pivoted back bearer (due to the letting-off being intermittent) and which are greatest at full beam, may be reduced to one half their usual amount if thought desirable by suspending one of the pawls 9 out of gear during the time of weaving the first half of each warp. This will not interfere with the working of the other pawl. The idle pawl must be set working again when about half the warp has been woven.

By the employment of my improved warp let-off mechanism, the warp can be automatically delivered from the beam as the weaving proceeds at one uniform degree of tension from full to empty beam, and yet an even degree of tension on the warp during each pick cycle is insured by employing a pivoted back bearer to govern the pawl mechanism of this let-off motion, which back bearer is perfectly free to vibrate to the requirements of the shedding.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination, with the vibratory sley sword, the T-shaped lever 10, and the rod 14 pivotally connecting the lower end of the said lever with the sley sword, of the horizontal shaft 4 and the ratchet wheel secured on it, the bell-crank levers journaled on the said shaft and having their lower ends operatively connected with the arms of the said lever 10, the pawls pivoted to the upper ends of the bell-crank levers and engaging with the said ratchet wheel, the warp beam shaft and toothed wheels connecting the said shaft 4 with the shaft of the warp beam, substantially as set forth.

2. The combination, with the shaft 4 for turning the warp beam, the warp beam, the connections between the said shaft and warp beam the ratchet wheel secured on the said shaft, the pawls and the bell-crank levers for turning the said ratchet wheel, and operating mechanism for oscillating the said levers; of the pivoted back bearer 33, the rod 28, and the rod 29 pivoted to the rod 28 and provided with the nuts 30; the pivoted three-armed lever provided with an arm 20^a adapted to be engaged by the said nuts and two arms 20 having spring ends 23 operating to raise the said pawls out of gear with the ratchet wheel when the 3-armed lever is raised, substantially as set forth.

3. In a let off motion, the combination, with the oscillatory bell-crank levers 7 provided with guides 7^c, of the pawls pivoted to the said levers and provided with the pins 17, the pendants 18 supported between the guides by the said pins, the pivoted 3-armed lever provided with arms 20 having spring ends 23 operating to raise the said pawls when the

3-armed lever is raised, and means for operating the 3-armed lever, substantially as and for the purpose set forth.

4. In a let off motion, the combination, with the oscillatory bell-crank levers, and the pawls pivoted to them, of the pivoted 3-armed lever provided with the arm 20^a, the arms 20 having spring ends operating to raise the said pawls, and the knife-edge 24; the stationary knife-edge 25, the double-acting spring 27 interposed between the two said knife-edges, and means for moving the said lever when the speed of the delivery of the warp is unduly increased or diminished, substantially as and for the purpose set forth.

In testimony whereof I affix my signature in presence of two witnesses.

RICHARD WILBY.

Witnesses:

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J. B. H. SHAW,

Solicitors' Clerks, Huddersfield.