No. 647,815. Patented Apr. 17, 1900.

W. F. DRAPER & C. F. ROPER.

LET-OFF MECHANISM FOR LOOMS.

(Application filed Sept. 30, 1899.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 2.

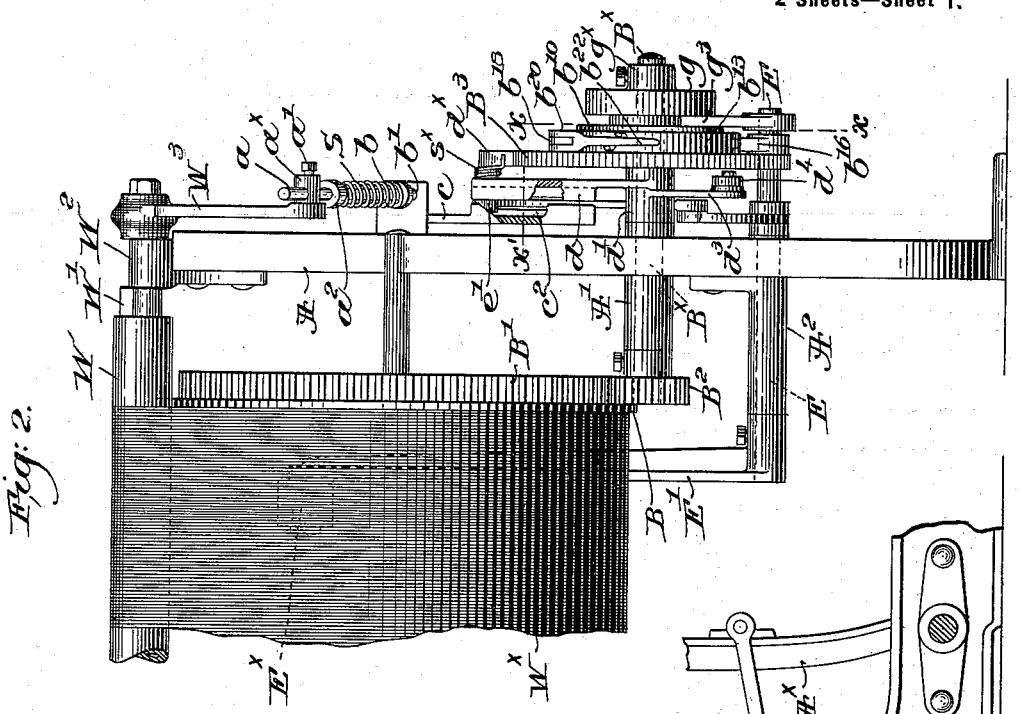

Fig. 1.

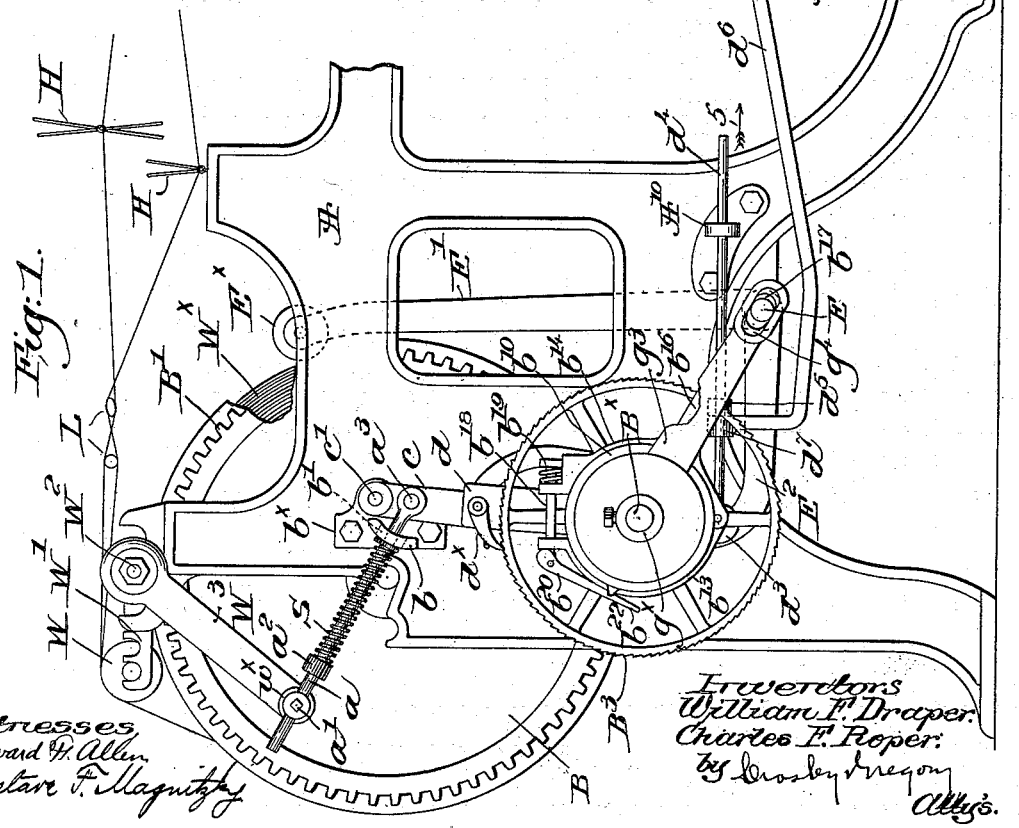

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Fig: 3.

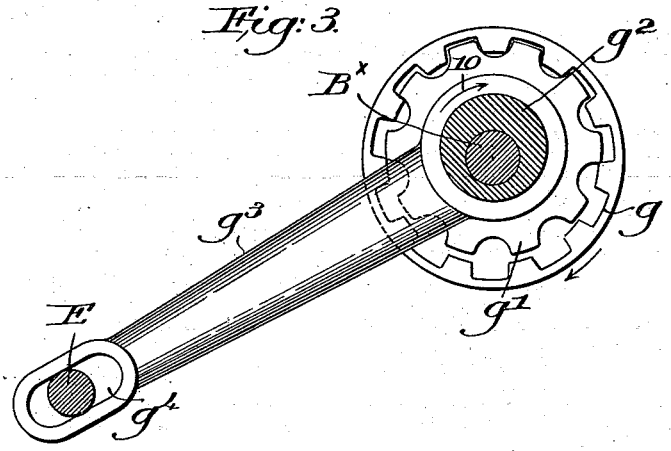


Fig: 5.

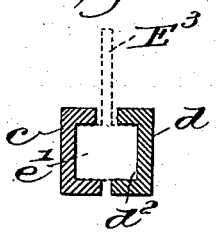
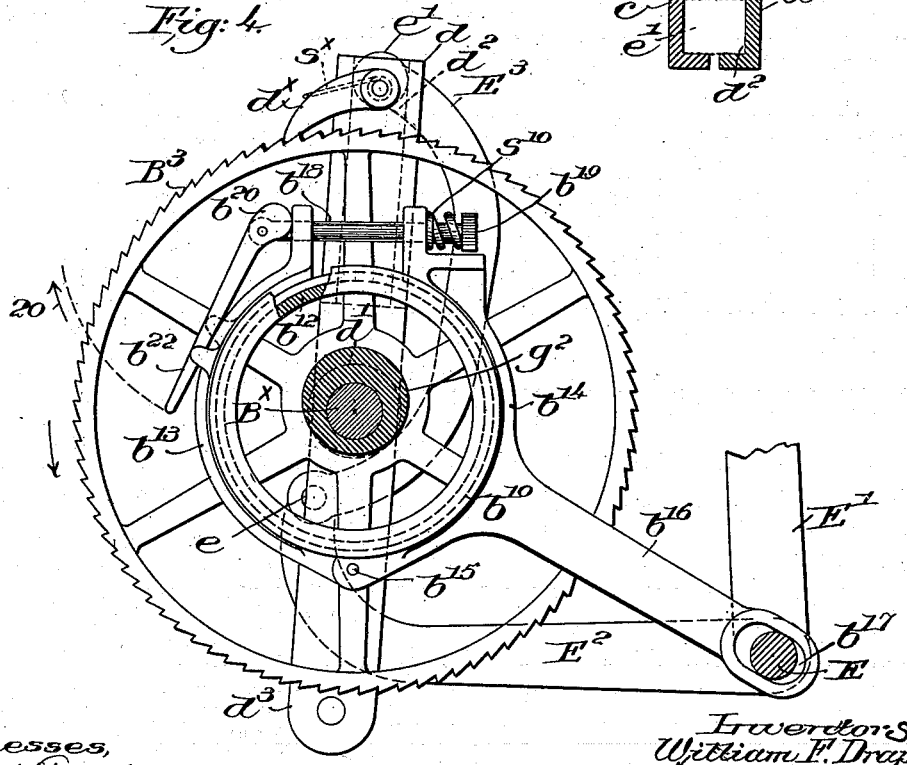


Fig: 4.



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UNITED STATES PATENT OFFICE.

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LET-OFF MECHANISM FOR LOOMS.

SPECIFICATION forming part of Letters Patent No. 647,815, dated April 17, 1900.

Application filed September 30, 1899. Serial No. 732,169. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM F. DRAPER and CHARLES F. ROPER, citizens of the United States, and residents of Hopedale, in the county of Worcester, State of Massachusetts, have invented an Improvement in Let-Off Mechanism for Looms, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

There are two types of let-off motions very largely used in this country, the one type depending upon or being governed automatically by the tension of the warp, the other depending upon friction applied to the warp-beam. Our present invention relates to the former type, and we have herein shown it as applied to the well-known "Bartlett" let-off motion, now substantially the standard, in which the whip-roll or warp-guide is either depressed or moved forward at each pick by the tension of the warp, a suitable connection setting a pawl coöperating with a ratchet in such manner that a greater or less number of teeth will be delivered when the pawl is moved forward to a fixed point. The greater the tension the larger the number of teeth which will be taken by the pawl when it is set, the movement of the pawl to a fixed point each time being accomplished by means of a rod or link connecting the pawl-carrier and some part of the lay. The ratchet is connected by gearing with the loom-beam, and the latter delivers the warp proportionately to the number of teeth included in the movement of the pawl. This let-off motion produces substantially even or uniform goods, so far as variations within a short length of cloth are concerned; but it is defective in one direction. As the warp mass on the beam decreases in diameter a greater number of teeth of the ratchet must be included in the stroke of the pawl in order to let off the same amount of yarn, so that the pawl has to be set by the tension of the warp to take substantially three times as many teeth when the beam is nearly empty as when it is full. In other words, the whip-roll must move three times as far at each pick when the beam is nearly empty as when the beam is full, and as the tension of the warp is governed by a spring the tension thereupon due to the spring grows continuously greater between the full and the nearly-empty beam. This increased tension results in narrower cloth, in thin places at the time of change of filling, and in greater warp breakage. In our present invention we have provided means whereby with the same or substantially the same movement of the whip-roll the actuating-pawl will be gradually set to take up an increasing number of teeth on the ratchet as the diameter of the warp mass on the beam decreases, so that the advantage as to tension between different picks in the same inch of cloth is retained and extended, giving substantially the same tension of cloth during each pick from the full to the empty beam.

Figure 1 is a left-hand side elevation of a portion of a loom with one embodiment of our invention applied thereto. Fig. 2 is a rear elevation, partly broken out, of the mechanism shown in Fig. 1. Fig. 3 is an enlarged sectional detail on the line $x\,x$, Fig. 2, looking toward the right. Fig. 4 is also an enlarged section on the line $x\,x$, but looking to the left, Fig. 2; and Fig. 5 is a transverse sectional detail on the line x', Fig. 2.

The loom-frame A, warp-beam B, having a large gear B′ attached thereto, the whip-roll W, mounted in arms W′, secured to a rock-shaft W^2, mounted on the frame, the rocker-arm W^3, fast on the said rock-shaft, the harnesses H, and lease-rods L may be and are substantially of well-known or usual construction.

A rocking stud $w^\times$ on the free end of the arm W^3 has extended through it a rod or link a, secured by a set-screw a', said rod having fast upon it a collar a^2, against which bears one end of the tension-spring S, shown as coiled around the rod and at its other end bearing against an ear b on a bracket $b^\times$, secured to the loom side, the rod passing loosely through a slot b' in the ear. The end of the rod a extended through the ear is pivotally connected at a^3 with one member c of a compound pawl-carrier, said member being shown as a depending arm fulcrumed at its upper end at c' on the bracket $b^\times$ and having a lon-

gitudinal guideway c^2 in its outer face, Figs. 2 and 5.

A hub A′ on the frame, Fig. 2, forms a bearing for a pinion-shaft $B^\times$, having fast thereon at its inner end a pinion B^2, in mesh with the beam-gear B′. The shaft is extended through and beyond the loom side and has loosely mounted upon it the let-off ratchet B^3, and between the latter and the loom side the hub d' of the other member d of the pawl-carrier is loosely mounted on the shaft, said member d being upturned alongside of the member c and having in its face adjacent thereto a longitudinal guideway d^2, Figs. 2 and 5. A let-off pawl $d^\times$ is mounted on the member d and pressed upon the teeth of the ratchet in any convenient manner, as by a spring $s^\times$, Fig. 2. A short arm d^3 depends from the hub d' and has pivotally connected with it a slide-bar d^4, supported in a bearing A^{10} on the loom side, said slide-bar having adjustably mounted upon it a collar d^5, Fig. 1. A link d^6, connected, preferably, to the lay-sword $A^\times$, is rearwardly extended and upturned to form an eye d^7, embracing the slide-bar d^4 back of the collar d^5, the forward beat of the lay bringing the eye d^7 against the collar and moving the slide-bar in the direction of arrow 5. Such movement of the bar swings the member d of the compound pawl-carrier $c\,d$ to the left, Fig. 1, and imparts the feed-stroke to the pawl $d^\times$, it being manifest that the termination of such stroke of the pawl will always be at the same point. The starting-point of the feed stroke of the pawl is variable and in our present invention is controlled by the tension of the warp and also by the diameter of the wound mass of yarn on the beam. The greater the tension of the warp the greater will be the depression of the whip-roll at each pick, and consequently the greater will be the arc through which the member c is swung by the rod a. Now if the members c and d of the pawl-carrier be connected between the fulcra of said members, the member d will be rocked by the member c, and if such point of connection be varied the throw of the pawl will be varied correspondingly, and we have devised means for varying the position of this connection according to the diameter of the yarn mass.

A sleeve-bearing A^2 on the inner side of the loom-frame (see Fig. 2) supports a rock-shaft E, extended beyond the loom side and having fast upon it at its inner end an upturned arm E′, provided at or near its upper end with a roll $E^\times$, which rests upon the periphery of the yarn mass $W^\times$ on the beam. Beyond the loom side said rock-shaft has fast upon it a second arm E^2, rearwardly extended and upturned at its inner end and pivotally connected at e, Fig. 4, with the lower end of an upturned radius-bar E^3, bent to clear the pinion-shaft $B^\times$. The upper end of the radius-bar extends between the members c and d of the pawl-carrier and is provided with a transverse stud e', the opposite ends of which enter the guideways c^2 d^2 of said members, respectively. The arms E′ E^2 form a bell-crank lever, and when the beam is full, as in Fig. 1, the arm E^2 will be raised and the stud e', which is the connection between the members c and d, will be at its highest point, and the stroke of the pawl $d^\times$ will be governed by the throw of the member c. As the yarn is wound off, however, the diameter of the mass $W^\times$ constantly decreases and the roll $E^\times$ will move toward the axis of the beam and the rear end of the arm E^2 will descend, so that the connection e' will move away from the fulcrum c' of the member c and toward the fulcrum of the member d—viz., the pinion-shaft $B^\times$. This results in increasing the throw of the member d, and consequently increases the stroke of the pawl, by setting its starting-point farther back along the ratchet, so that a greater number of teeth will be delivered, although the throw or swing of the member c remains substantially constant, varying slightly, of course, for variations in the warp tension. Thus while the movement of the whip-roll remains substantially the same the pawl will be set back a gradually-increasing distance as the yarn winds off to compensate for the constantly-decreasing diameter of the yarn mass.

It will be remembered that the ratchet is loose on the pinion-shaft $B^\times$, and as the movement of the beam at each pick must be very slight speed-reducing gearing is interposed between the ratchet-wheel and the pinion-shaft, one form of such gearing used in the Bartlett let-off motion including a worm-gear and worm-shaft; but herein we have represented a more compact form of reducing gearing. (Shown on an enlarged scale in Fig. 3.) The shaft $B^\times$ has fast upon it the hub $g^\times$ of an annular internal gear g, herein shown as having eleven teeth and meshing with a gear g' of ten teeth, the gear g' being loosely mounted on an eccentric hub g^2, fast on the ratchet B^3, an arm g^3, secured to the hub of gear g', having a longitudinal slot g^4 in its free end to embrace the rock-shaft E, permitting slight rocking and longitudinal movement of the arm. Rotation of the ratchet in the direction of arrow 10, Fig. 3, imparts a circular movement to the gear g', its rotation being prevented by the arm g^3, and the gear travels along the internal gear g, rotating the latter in the same direction; but owing to the difference in the number of teeth of the two gears the internal gear will fall back or rotate more slowly than the driving-gear g', and the pinion-shaft $B^\times$ will be slowly rotated, the speed of the beam being still further reduced by the pinion B^2, in mesh with the large gear B′ on the beam.

The gearing described is simple, very compact, and effective.

A suitable friction-clamp is herein shown coöperating with the ratchet B^3, the latter

having fast upon its outer face a peripherally-flanged hub b^{10}, having a band b^{12} of felt or other suitable material around it (see Fig. 4) to be embraced by a two-part clamp b^{13} b^{14}, as herein shown, pivotally connected at b^{15} and held from rotation by an arm b^{16} on one of the parts slotted at b^{17} to embrace the rock-shaft E. The separated ends of the clamp members are connected by a draw-bar b^{18}, headed at b^{19} and with a spring s^{10} between it and the adjacent part of the member b^{14}, Fig. 4, the other end of the clamp-bar passing loosely through the upturned part of the member b^{13} and having a locking-cam b^{20} mounted upon it to lock the clamp in operative position, as shown in Figs. 1 and 4. By lifting the handle b^{22} of the cam in the direction of arrow 20, Fig. 4, the clamp will be released, so that the ratchet can be readily rotated by hand when necessary.

Our invention is not restricted to the precise construction and arrangement herein shown and described, as we have shown one practical embodiment of our invention without attempting to illustrate the various modifications thereof which could be readily devised.

Any other suitable friction-clamp may be used instead of that herein shown, and other forms of reducing-gearing may be used, if desired, without departing from the spirit and scope of our invention.

The pawl-carrier hereinbefore described serves to set the pawl, and, as will be manifest, the operation of such setting means is controlled by the resultant effect of two separate factors at each pick—viz., the warp tension and the diameter of the yarn mass on the warp-beam.

The actuating means for rotating the warp-beam includes the ratchet and pawl and the connections between the pawl-carrier and the lay.

It may be stated that the spring S moves the whip-roll against the tension of the warp.

Having described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In let-off mechanism for looms, the warp-beam, means to rotate it, including a ratchet and pawl, an actuating device to move the pawl to a fixed point at each pick, and means controlled by the warp tension and the diameter of the yarn mass on the beam to determine the starting-point of each stroke of the pawl.

2. In let-off mechanism for looms, the warp-beam, means to rotate it positively, including a ratchet and a pawl, a compound pawl-carrier, a relatively-movable connection for the members thereof, means governed by the warp tension to move one of said members in setting the pawl, a controlling device dependent upon the diameter of the yarn mass on the beam to determine the position of the connection between the members of the pawl-carrier, and thereby to complete the setting of the pawl, and means to move the set-pawl forward to a fixed point at each pick.

3. In a loom, the warp-beam, a ratchet, a coöperating pawl having a variable stroke, connections between the ratchet and the beam, to positively rotate the latter and let off the yarn, and means governed by the diameter of the yarn mass on the beam to determine the length of the active stroke of the pawl.

4. In a loom, the warp-beam, means, including a ratchet to rotate it positively, a co-operating pawl, a pawl-carrier comprising two adjacent members fulcrumed at their opposite ends, a connection between said members and movable longitudinally thereof, means controlled by the warp tension to swing one of the members and thereby, through the connection, swing the other member on which the pawl is mounted, to set the pawl, and means to move said connection toward the fulcrum of the latter member as the yarn mass on the beam decreases, to increase the swing of said member and the length of the active stroke of the pawl.

5. In a loom, the warp-beam, a whip-roll, means including a ratchet and pawl, to rotate the beam, a two-part pawl-carrier, a relatively-movable connection between them, connections between one of said members and the whip-roll, to move said members proportionally to the warp tension when setting the pawl, means controlled by the diameter of the yarn mass on the beam to correspondingly vary the position of the connection between the members of the pawl-carrier, to thereby determine the final movement of the member on which the pawl is mounted, and an actuating device to move said member positively in the opposite direction and rotate the ratchet.

6. In a loom, the warp-beam having an attached gear, a pinion in mesh therewith, a pinion-shaft, a ratchet loose on the shaft, speed-reducing gearing intermediate the ratchet and the shaft, one member of said gearing being fast on the shaft and the other member mounted on and actuated by the ratchet, and means to actuate the ratchet in accordance with the warp tension and the diameter of the yarn mass at each pick.

7. In a loom, the warp-beam having an attached gear, a pinion in mesh therewith, a pinion-shaft, a ratchet loose on the shaft, speed-reducing means between the ratchet and shaft, comprising a non-rotatable gear mounted loosely and eccentrically on the ratchet, and an annular internal gear in mesh therewith and fast on the shaft, an actuating-pawl for the ratchet, and setting means for the pawl, operated by or through the warp tension and controlled by variation in the diameter of the yarn mass on the beam.

8. In let-off mechanism for looms, a ratchet having an eccentric and a concentric hub, a non-rotatable gear mounted loosely on the eccentric hub, a friction-clamp coöperating with

the concentric hub, a driving-shaft on which the ratchet is rotatably mounted, an internal gear fast on the shaft and in mesh with the non-rotatable gear, said internal gear having the greater number of teeth, whereby rotation of the ratchet effects rotation of the shaft at a reduced speed, and means to actuate the ratchet.

9. In let-off mechanism for looms, the warp-beam, a two-part pawl-carrier the adjacent members of which are fulcrumed at their opposite ends, a relatively-movable connection between them, a pawl mounted on one member, means connected with the other member to swing it according to the warp tension and thereby set the pawl, a controlling device for the connection, to move the latter toward the fulcrum of the pawl member as the diameter of the yarn mass on the beam decreases, a ratchet actuated by the pawl, and connections between the ratchet and the warp-beam.

10. In a loom, the lay, the warp-beam, means to rotate it positively, including a ratchet and a coöperating pawl, connections between the lay and pawl, to move the latter on its feed-stroke always to the same point, and means to vary the length of the feed-stroke proportionally to the warp tension and the amount of yarn on the beam at each pick.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

WILLIAM F. DRAPER.
CHARLES F. ROPER.

Witnesses:
GEO. OTIS DRAPER,
ERNEST W. WOOD.