No. 659,205. Patented Oct. 9, 1900.

J. C. BRYAN.

LET-OFF MOTION FOR LOOMS.

(Application filed Oct. 14, 1899.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

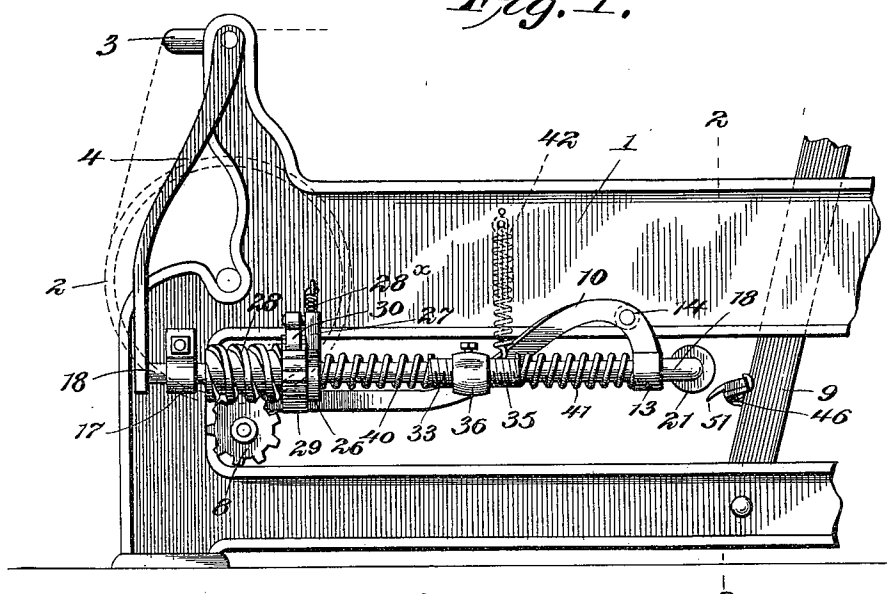
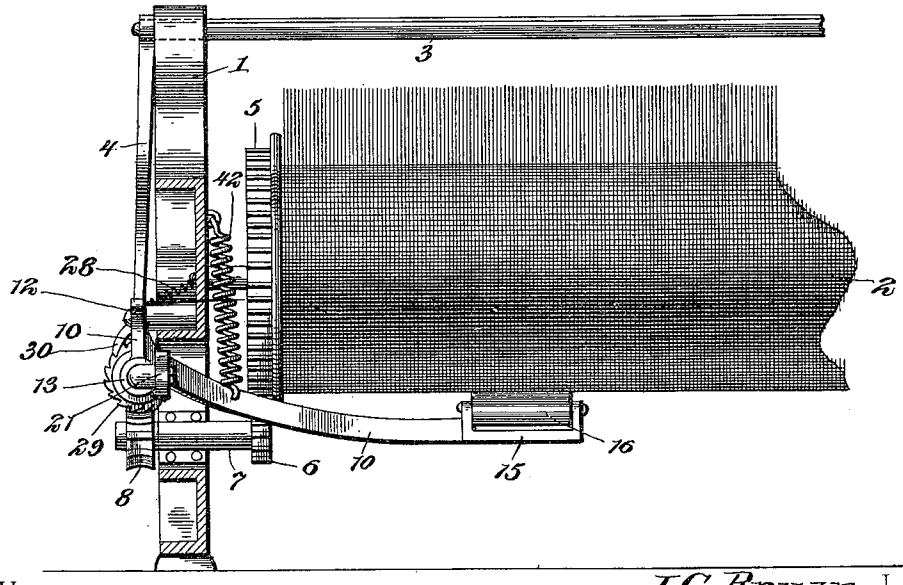



Fig. 2.




Witnesses

Howard D. Orr.

Chas. S. Hoyer.

J. C. Bryan, Inventor,

By his Attorneys,

C. A. Snow & Co.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 659,205. Patented Oct. 9, 1900.

J. C. BRYAN.

LET-OFF MOTION FOR LOOMS.

(Application filed Oct. 14, 1899.)

(No Model.) 2 Sheets—Sheet 2.

Fig. 8.

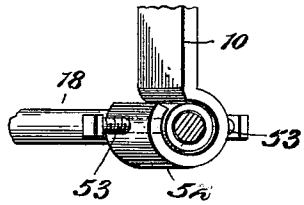



Fig. 3.




Fig. 4.

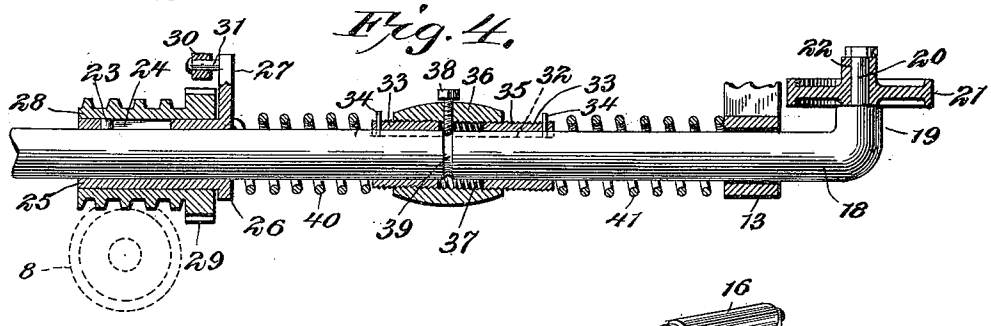



Fig. 5

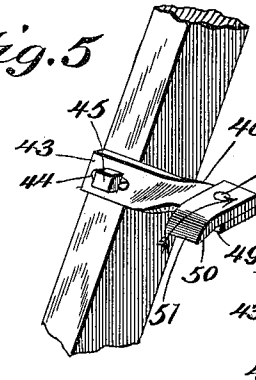



Fig. 7.

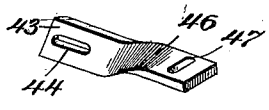
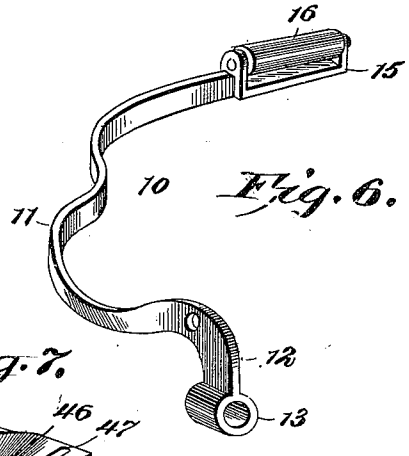



Fig. 6.




Witnesses

Howard D. Orr.

Chas. S. Hoyer.

J. C. Bryan, Inventor.

By his Attorneys,

C. A. Snow & Co.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

# UNITED STATES PATENT OFFICE.

JOHN C. BRYAN, OF AUGUSTA, GEORGIA.

## LET-OFF MOTION FOR LOOMS.

SPECIFICATION forming part of Letters Patent No. 659,205, dated October 9, 1900.

Application filed October 14, 1899. Serial No. 733,628. (No model.)

*To all whom it may concern:*

Be it known that I, JOHN C. BRYAN, a citizen of the United States, residing at Augusta, in the county of Richmond and State of Georgia, have invented a new and useful Let-Off Motion for Looms, of which the following is a specification.

This invention relates to let-off motions for looms, and contemplates the application of improved mechanism to a loom without disturbing or disorganizing its ordinary instrumentalities and to rely upon the regular movement of the lay-arms through one of the same to actuate a rotatable and longitudinally-shiftable device to move a ratchet or other analogous device intimately related to and operating the usual worm, which is in mesh with the worm-wheel for actuating a pinion, adapted to regularly turn the warp-beam, and whereby the warp-threads may be paid off from the beam at such a rate as shall be required by the weaving process, and which is dependent upon the rate of the picks, the sizes of the warp and weft thread, and the compactness with which it is beaten up by the lay.

The improved let-off motion is constructed in accordance with the well-known principle involving a regularity in the let-off which is secured by making the rate of surface motion of the warp-beam depend upon the tension of the warp-threads, and the rate of revolution of the beam to secure equal speed of let-off will become rapid as the bulk of the threads diminishes on the said beam. Therefore with this well-known principle in view the improved mechanism was devised, and is purely automatic in its operation after adjustment, to compensate for varying warp-thread tensions and properly and proportionately rotates the warp-beam by relating it to the lay-arms, and thereby insuring a positive and accurately-timed result.

The invention consists, essentially, of a cam or analogous projection on one of the lay-arms, which has a path of movement in the plane of and adapted to contact with a yielding member forming the operable part of a rotatable and longitudinally-shiftable device which actuates the feeding mechanism for the warp-beam and which is continually under the influence of a resilient counterbalancing attachment and elevated or lowered in an automatic manner in proportion to the bulk of warp on the warp-beam by a pivoted arm having a movable device bearing in the free end and continually held against the warp.

The invention further consists of other subcombinations and details of construction and arrangement, which will be more fully hereinafter described and claimed.

The preferred form of the improved let-off motion is illustrated in the accompanying drawings, but is subject to a wide range of modification, particularly to accommodate different applications of the principle therein involved, and for such purpose or purposes such changes will be made as fairly fall within the purview of the invention.

In the accompanying drawings, Figure 1 is a side elevation of the rear portion of a loom embodying a sufficient number of the instrumentalities of such a device to illustrate the mode of applying the improved let-off motion which is therein shown. Fig. 2 is a section on the line 2 2, Fig. 1, looking toward the warp-beam. Fig. 3 is a top plan view of the parts shown by Fig. 1. Fig. 4 is a horizontal section of a part of the improved mechanism and shown on an enlarged scale. Fig. 5 is a detail perspective view of a portion of the operating lay-arm, showing the controlling-cam adjustably carried thereby. Fig. 6 is a detail perspective view of the regulating-arm. Fig. 7 is a detail perspective view of the controlling-cam support. Fig. 8 is a detail perspective view showing a slight modification of a portion of the improved attachment.

Similar numerals of reference are employed to indicate corresponding parts in the several views.

The numeral 1 designates the rear portion of one side of a loom-frame having movably mounted in the rear portion thereof in any preferred or the usual manner a warp-beam 2 and above the latter a whip-roller 3, wh has a depending arm 4. The warp-beam has on one of its heads teeth 5, of suitable dimension and in mesh with a pinion 6, fastened on the inner end of a shaft 7, having bearing in a suitable part of the rear lower portion of the frame and supplied with a worm-wheel 8 on its outer end. In advance of the warp-

beam 2 the lay-arms are operatively positioned and have their usual motion and function. The one 9 shown is on the left side of the machine looking from the breast end, and the operation of the improved let-off motion is solely controlled by the said lay-arm.

A follower 10 forms an essential part of the improved let-off and consists of an arm 11, which has an outer depending member 12, with a terminal sleeve 13, the said arm being pivoted a short distance above the sleeve to the outer face of the side of the loom-frame, as at 14, and from its pivotal point the said arm is curved in such manner that it will pass under the edge of the adjacent portion of the frame and around the nearby head of the warp-beam and has at its inner terminal a seat 15, in which a roller 16 is journaled and adapted to continuously bear against the warp on the beam, said roller being disposed in a plane parallel with the beam by the bend of the arm 11, as clearly shown in Figs. 3 and 6. Within the sleeve 13 and a bearing 17 on the rear portion of the side of the loom-frame an operating rod or shaft 18 is movably mounted and has a crank 19 at its front extremity, which is inturned and terminates in a stud 20, on which is loosely journaled a roller 21, having an extended hub 22 to give it strength and resistance against breakage when operating in connection with the lay-arms 9, as will be presently described. The rear end of the rod or shaft 18 projects beyond the bearing 17, and therewith the lower extremity of the whip-roll arm 4 has contact. The sleeve 13 and the bearing 17 have openings therethrough which are large enough to permit slight vertical play of the rod or shaft 18, the movement in this direction, as will be presently explained, being greater at its forward portion or in the sleeve 13 than in the bearing 17. On the rod or shaft 18, near the bearing 17, is a pin or stud 23, extending upwardly into a slot 24, longitudinally disposed in a sleeve 25, which is flanged, as at 26, at its forward extremity and provided at this point also with an upstanding projection 27, connected by a spring 28× with the adjacent portion of the side 1 of the loom-frame. On the sleeve 25 a worm 28 is loosely mounted and has formed as a part thereof or otherwise fastened thereto a forward ratchet-wheel 29, which in practice will have fine teeth, and meshing with the said ratchet is a pawl 30, loosely carried by a pin 31, projecting rearwardly from the upper extremity of the spring-actuated projection 27. The worm 28 is held in continual mesh with the worm-wheel 8, the spiral rib of the said worm and the teeth of the worm-wheel being long enough to compensate for the movement of the rod or shaft 18 in a vertical plane to thereby maintain an operative engagement between the said parts under all conditions. The pin 23 on the rod or shaft 18 is free to slide in the slot 24, and the longitudinal adjustment of said rod or shaft can thus be effected without operating the pawl 30. As soon, however, as the rod or shaft is rotated the said pin 23 will immediately actuate and turn the sleeve 25 in the same direction and the pawl 30, carried by the projection 27, will be caused to operate in the ratchet device and rotate the worm 28. By this means the worm-wheel 8 will be turned proportionately, and the pinion 6, acting in conjunction with the teeth 5, will rotate the warp-beam in the direction to feed off the warp-threads carried thereby. At an intermediate point the rod or shaft 18 is formed with a longitudinal groove 32, and thereover are adjusting-sleeves 33, each having a pin 34 slidingly mounted in the said groove 32, both the sleeves 33 being exteriorly screw-threaded, as at 35, and have an adjusting-collar 36 fitted thereover, with internal screw-threads 37 running in the same direction from end to end. The collar 36 carries a set-screw 38, which has its inner end fitted in a circumferential groove 39, formed in the said rod or shaft, and it will be observed from the construction explained that the sleeves 33 and collar 36 move with the rod or shaft both in its rotative and sliding adjustment. By operating the collar 36 one sleeve 33 will be made to feed out therefrom and the other to move inwardly thereinto, a provision being made for this operation by a proper proportioning of the parts and initially arranging them so that there will be a space between the terminals of the said sleeves within the collar 36. Between the rear terminal of the rear sleeve 33 and the forward flange end 26 of the sleeve 25 a coiled spring 40 surrounds the rod or shaft 18, and in like manner between the front terminal of the opposite sleeve 33 and the sleeve 13 of the arm 11 another spring 41 surrounds the said rod or shaft. By turning the collar 36 in a direction to project the sleeve 33 therefrom in a rearward direction the spring 40 is compressed and its tension increased, and at the same time the outer sleeve 33 is fed into the collar 36 and the tension of the spring 41 slackened or relaxed. Conversely, by turning the collar 36 in the opposite direction the outer or forward sleeve 33 is projected or moved toward the sleeve 13 of the arm 11 to compress and increase the tension of the spring 41, and simultaneously the rear sleeve 33 is drawn into the said collar and the tension of the spring 40 relaxed. The spring 40 has its tension increased to compensate for heavy warp tension, and the rearward movement of the rod or shaft 18 will meet with greater resistance and be less than when the spring 41 is adjusted to increase its tension and which will permit a greater movement of the said rod or shaft and give the improved attachment a proper adjustment relatively to a slack warp. Under a very high tension of warp, however, the rod or shaft 18 will not be moved longitudinally in either direction in view of the fact that the operating power applied through the roller 21 may be only suf-

ficient to equalize the resistance transmitted by the arm 4 and brought to bear on the rear terminal of the said rod or shaft, and in this latter condition the rod or shaft will only rotate without being longitudinally shifted. The shifting movement of the rod or shaft 18 when permitted to so operate is comparatively limited or of slight extent, and when both springs are equally adjusted, if such adjustment is ever effected, they counterbalance each other. Hence when the spring 40 is compressed to increase its tension it acts, it might be said, independently of the spring 41, except that the latter tends to assist the applied power to shift the rod or shaft 18 rearwardly. When the spring 41 is compressed by the adjustment of the sleeve 33, controlling the same, it serves in a more active capacity to assist in quickly shifting the rod or shaft 18 rearwardly by reason of its increased tension; but this movement will be counterbalanced by the then buffer operation of the spring 40, though the latter will not materially resist the said rearward shift of the said rod or shaft, but prevents a too sudden or abrupt movement. The rod or shaft 18 is intended to have a normal relation to the sleeve 13 of the arm 11 and the bearing 17, so that the roller 21 will at all times be at the same distance from the front end of the said sleeve 13, and in normal position the rod or shaft 18 when arranged for operation with a full warp-beam will be disposed as clearly shown in Fig. 1. It will never rise above a horizontal plane, but will be slightly depressed below such plane, as the bulk of the warp on the warp-beam gradually lessens, owing to its use, and by reason of the fact that the roller 16, carried at the inner terminal of the arm 11, forming an essential part of said follower, gradually elevates and is continually forced up against the bulk by a spring 42, secured to said arm 11 and the inner upper portion of the side 1 of the loom-frame. Therefore it will be seen that as the inner end of the arm 11 elevates the sleeve 13 at the outer end will gradually depress; but this depression will be very slight in view of the proximity of the sleeve to the fulcrum of the arm. This movement of the rod or shaft 18 downwardly with the sleeve 13 will not in the least detract from the positive operation of the pawl 30 and ratchet 29 nor of the worm 28 and worm-wheel 8, as the length of the said rod or shaft 18 is sufficient to make the downward movement thereof at the point where the parts just mentioned are located so slight as to be hardly appreciable. The slight downward movement of the sleeve 13 brings the roller 21 nearer the applied or operating power, and a greater range of movement, particularly in a rotative plane, will be accorded the rod or shaft 13, and consequently the pawl 30 will have a greater throw over the ratchet 29, the worm 28 will be rotated for a longer period, and the worm-wheel 8 will be given an increased movement, and more warp will be fed off from the beam at a time when such increased feed is necessary, and this increase in the feed of the warp will be proportionately governed by the nearness of the roller 21 to the operating power therefor.

On the lay-arm 9 is an outstanding cam-support 43, which consists of a comparatively-narrow plate, having a slot 44 in its inner extremity for the passage therethrough of a bolt 45 to permit adjustment of these supports and accommodate a difference of location in various looms. The outer part of the said plate is formed with an approximate quarter-twist 46 to give the same a forward and upward inclination, and the outer extremity has a slot 47 therein in a plane at right angles to the slot 44 for the reception of a clamping-bolt 48, extending therethrough and through a cam 49, which is firmly seated on said outer twisted portion of the plate and has its rear extremity extending beyond the rear edge of said portion of the plate. The rear extremity of the cam 49 is slightly dipped, as at 50, and the upper surface is formed with a curved bevel 51. When all the parts of the attachment have been adjusted for operation, the rear dipped extremity of the cam 49 will be in alinement and in advance of the adjacent face of the roller 21, so that when the said cam first contacts with the roller it will squarely strike the latter, and the start of the operation will be with both the cam and roller in firm engagement.

It will be observed that by arranging the cam on the adjacent lay-arm the improved attachment will be operated at each rear stroke of said arm, and consequently the pay-off of the warp-threads will be in proportion and properly timed relatively to the movement of the said lay-arm and the mechanism carried thereby and intimately related thereto. When the cam 49 contacts with the roller 21, the latter rides upwardly over the curved beveled surface 51 of the rear extremity of said cam, and the parts are so positioned that the lay-arm will continue to move rearwardly for a considerable time or at least sufficiently long to obtain the desired operation of the rod or shaft 18. A continuation of the rearward movement of the lay-arm 9 when the cam 49 is in contact with the roller 21 causes the latter to turn on its outer edge and move over the cam in an outwardly-diagonal direction, which is caused by the resistance first offered and the release obtained by the rod or shaft turning outwardly, the latter motion being due to the attachment of the roller 21 to the inwardly-directed end of the said rod or shaft. If, as before stated, the tension of the warp-threads is such that the resistance offered by the arm 4 against the rear end of the rod or shaft 18 equalizes or counterbalances the power or force applied to the roller 21 by the cam 49, said rod or shaft will be rotated solely, and after release from the cam by the forward movement of the lay-arm the spring 28 will return it to its normal

position. If the resistance at the rear terminal of the rod or shaft 18 is less than the applied force of the cam 49 against the roller 21, then the rod or shaft will be both longitudinally shifted in a rearward direction and also rotated, and the arm 4 will be thrown rearwardly and the whip-roller 3 elevated from a horizontal position, as shown. As the warp-bulk reduces on the beam and, as previously indicated, the forward extremity of the rod or shaft 18 and the roller are lowered gradually and brought in such depressed position that when the cam 49 contacts with the roller the motion of the said latter shaft will extend through a longer period and the pawl 30 will have a greater sweep over the ratchet below and pay off more of the warp-threads through the medium of the springs 40 and 41, as previously indicated, the counterbalancing tension of the rod or shaft 18 can be adjusted to a nicety and made to accurately correspond to the tension of the warp-threads and different kinds of weaving. This adjustment can be quickly controlled by an operative turning the collar 36 and without disturbing the movement of the loom.

In some instances the movement of the forward extremity of the rod or shaft 18 may be better governed and produce a more satisfactory result by the use of the device shown by Fig. 8, wherein is an open sleeve 52, somewhat similar to the sleeve 13 and carried by the outer extremity of the arm 11. Extending through said sleeve 52 from diametrically-opposite points and in horizontal planes are trunnion-screws 53, which have their inner ends bearing against and holding a journal-bearing 54, preferably of cylindrical form and movably positioned within the said sleeve 52. The trunnion-screws 53 provide a fulcrum for the bearing 54, and through the latter the rod or shaft 18 loosely extends and is permitted to have its longitudinal sliding adjustment or movement and is also free to be automatically depressed by the downward movement of the outer extremity 12 of the arm 11.

In addition to the operation of the springs 40 and 41 it is to be understood that in their simplest function they serve to control the movement of the rod or shaft 18 in its shifting movement in opposite longitudinal directions, the spring 40 tending to force said rod or shaft outwardly or forwardly in normal position at the rearward movement, and the spring 41 operates to move the shaft or rod in the opposite direction, and the activity or force of both springs is regulated, as before indicated, by the adjustment of the collar 36 and sleeves 33, as explained.

The salient feature of the present improvement is the automatic operation of a rotatable and longitudinally-shiftable device under control of an element partially in contact with the warp on the beam, affecting the warp tension by automatically moving proportionately to the decrease of the warp on the beam, and thereby controlling and operating the said rotatable and longitudinally-shiftable device and moving the latter nearer to and for intermittent contact with the operating force, which in this instance are the lay-arms, one of the latter having a portion thereof adapted to directly engage with the said device and by said close position of the device to the operating force increase the movement or time of operation of the same to have the warp-threads pay off from the beam in proportion to the demands of the weaving process, and thereby obtain a uniformity in the weave of the fabric constructed.

Having thus described the invention, what is claimed as new, is—

1. In a let-off motion for looms, the combination with a warp-beam and a lay-arm, of a follower operatively held in constant contact with the bulk of warp on the beam, a rotatable and longitudinally-movable device connected to said follower and by its movement controlling the feed of the warp-beam, and a contacting projection on the lay-arm to intermittently and directly engage a portion of the said rotatable and longitudinally-movable device.

2. In a let-off motion for looms, the combination with a warp-beam and a lay-arm, of an automatically-adjustable rotatable and longitudinally-movable device for controlling the feed of the warp-beam, and a projection on the lay-arm to intermittently and directly contact with an extremity of said rotatable and longitudinally-shiftable device.

3. In a let-off motion for looms, a warp-beam, a lay-arm having a projection, and a horizontally-disposed rotatable and longitudinally-movable device with which a projection on the lay-arm intermittently contacts to control the pay-off of the warp-threads from the beam.

4. A let-off motion for looms having a rotatable and longitudinally-shiftable device controlling the feed of the warp from the warp-beam, a follower having one extremity in contact with the bulk of the warp on the beam and the opposite extremity loosely and adjustably supporting the said rotatable and shiftable device, and a lay-arm having a projection adapted to contact with a portion of the said rotatable and shiftable device.

5. A let-off motion for looms having a rotatable and longitudinally-shiftable device adapted to operate the feeding mechanism of the warp-beam and having bearing against the arm of the whip-roll, a lay-arm having a projection adapted to contact with a portion of said rotatable and shiftable device, and means for engaging the said rotatable and shiftable device and controlling its depression below a horizontal plane automatically and proportionately to the gradual diminution of the bulk of warp-threads on the beam.

6. A let-off motion for looms, comprising a rotatable and longitudinally-shiftable device

for controlling the feed of the warp-beam proportionate to the tension on the warp-threads, a lay-arm for directly operating the said rotatable and shiftable device, yielding means on opposite portions of the said rotatable and longitudinal shiftable device adapted to be adjusted to control the longitudinal movement of the latter, and means for supporting the said rotatable and shiftable device and regulating its vertical position proportionately to the feed of the warp-threads from the beam and to bring a portion thereof within a greater distance of the path of movement of the lay-arm.

7. A let-off motion for looms comprising a rotatable and longitudinally-shiftable device in operative relation to the feeding-gears of a warp-beam and suspended in bearings to permit of movement below a horizontal plane, of a means for automatically increasing the feeding operation of said device to gradually compensate for the regular diminution of the bulk of the warp on the beam, and a lay-arm directly operating to actuate the said device.

8. In a let-off motion for looms, the combination with a warp-beam and feeding-gearing therefor, and a lay-arm having a projection, of a horizontally-disposed and longitudinally-movable rotatable device for actuating the said gearing and adapted to be longitudinally shifted through a portion of the same without affecting its operation, the said rotatable and shiftable device being actuated by having a portion thereof brought into contact with the projection on the lay-arm.

9. In a let-off motion for looms, the combination with a warp-beam and feeding-gearing therefor, and a lay-arm having a projection, of a horizontally-disposed rotatable device for actuating the said gearing and adapted to be longitudinally shifted through a portion of the same without affecting its operation, the said rotatable and shiftable device being actuated by having a portion thereof engaged by the projection on the lay-arm, means controlled by the diminution of the bulk of warp on the warp-beam for loosely supporting a portion of the said rotatable and shiftable device and regulating its vertical elevation without interfering with the gearing, and means for regulating the movement of said rotatable and shiftable device.

10. In a let-off motion for looms, the combination with a warp-beam, gearing for operating the same and a lay-arm, of mechanism, including a horizontally-disposed device capable of rotary and longitudinal movement, and interposed between a portion of the path of movement of the said lay-arm and the gearing and adapted to be intermittently contacted by the lay-arm and automatically adjustable to regularly compensate for the diminution of the bulk of warp on the warp-beam and the tension of the warp-threads.

11. In a let-off motion for looms, the combination with a warp-beam, gearing for operating the same and the lay-arm, of horizontally-disposed mechanism interposed between the path of movement of the said lay-arm and the gearing, means for regulating the tension of the said mechanism, and means for automatically controlling the depression of the same below a horizontal plane proportionately to the diminution of the bulk of warp-threads on the beam.

12. In a let-off motion for looms, the combination with a warp-beam, gearing for operating the same, and a lay-arm having a projection, of a rotatable and longitudinally-shiftable rod or shaft operatively connected to the said gearing and having an angular extremity with a movable element thereon for engagement by the projection on the lay-arm, and means for adjusting the said rod or shaft.

13. In a let-off motion for looms, the combination with a warp-beam, gearing for operating the same, and a lay-arm having a projection, of a rotatable and longitudinally-shiftable rod or shaft in intimate relation to the said gearing and having an angular extremity with a movable element thereon for engagement by the projection on the lay-arm, and an automatically-movable follower having loose engagement with the said rod or shaft at one extremity and the opposite extremity supplied with an antifrictional device adapted to bear against the bulk of warp on the beam.

14. In a let-off motion for looms, the combination with a warp-beam, gearing for operating the same, and a lay-arm having a projection, of a rotatable and longitudinally-shiftable rod or shaft having the extremity adjacent the lay-arm provided with an angular projection and supplied with a movable element adapted to be engaged by the projection of the lay-arm, means for adjustably supporting the said rod or shaft, springs surrounding opposite portions of the same, adjustable sleeves between the said springs, and a collar for controlling the movement of the said sleeves.

15. In a let-off motion for looms, the combination with a warp-beam, gearing for operating the same, and a lay-arm, of a rotatable and shiftable rod or shaft to actuate the said gearing and having a crank at its front extremity with a roller thereon, a support adjustably secured to the lay-arm and a cam adjustably mounted on the said support and adapted to engage the said roller.

16. In a let-off motion for looms, the combination with a warp-beam, gearing for operating the same, and a lay-arm, of a device in connection with the gearing and capable of having both a rotary and longitudinal movement, individual yielding mechanism on different portions of said device, means for adjusting said yielding mechanism, and means for loosely and adjustably supporting one extremity of the said device.

17. In a let-off motion for looms, the combination with a warp-beam, gearing for operating the same, and a lay-arm, of a rotatable

and longitudinally-movable device operatively connected to said gearing and actuated by the lay-arm, opposed yielding mechanism on different portions of the said device, and means for automatically controlling the depression of the said device proportionately to the diminution of the bulk of the warp-threads on the beam.

18. In a let-off motion for looms, the combination with a warp-beam, gearing for operating the same, and a lay-arm, of a rotatable and longitudinally-movable device operable by contact with the said lay-arm, and means for lowering one extremity of the device below a horizontal plane and proportionately to the diminution of the bulk of warp-threads on the beam.

19. In a let-off motion for looms, the combination with a warp-beam, gearing for operating the same and a lay-arm, of a rotatable and longitudinally-movable device operable by contact with a part of the lay-arm, means for automatically controlling the depression of the said device below a horizontal plane proportionately to the diminution of the bulk of warp-threads on the beam, and opposed yielding mechanism on the said device for regulating its movement in a longitudinal direction.

20. In a let-off motion for looms, the combination with a warp-beam, gearing for operating the same, a whip-roll having an arm, and a lay-arm, of a rotatable and longitudinally-shiftable device operatively connected to the said gearing and having one extremity engaged by the arm of the whip-roll, the said device being operable by the intermittent contact therewith of a projection on the lay-arm, and means for adjusting the said device to proportionately compensate for the diminution of the bulk of warp-threads on the beam.

21. In a let-off motion for looms, a warp-beam, gearing for operating the same, and a lay-arm, combined with mechanism for operating the gearing, and bearings for loosely supporting said mechanism to permit it to be automatically moved below a horizontal plane proportionately to the diminution of the bulk of warp-threads on the beam, the said mechanism being intermittently contacting by a portion of the lay-arm and the length of operation depending on the depression of the mechanism.

22. A let-off motion for looms, comprising the usual beam-operating instrumentalities, and a lay-arm, and a horizontally-disposed rotatable and longitudinally-movable device adapted to be directly and intermittently engaged by a portion of the lay-arm to actuate the beam.

23. In a let-off motion for looms, the combination with a warp-beam, gearing for operating the same, and a lay-arm, of a rotatable and longitudinally-shiftable device operatively connected to and movable through a part of said gearing, the said device being also adjustable below a horizontal plane proportionately to the diminution of the bulk of warp-threads on the beam and actuated by direct and intermittent contact with a portion of said lay-arm.

24. In a let-off motion for looms, the combination with a warp-beam, gearing for operating the same, and a lay-arm, of a cam projection on the lay-arm, and a rotatable and longitudinally-movable device between the gearing and the lay-arm, the said device being capable of the two movements independently and through the medium of an intermittent contact with the cam projection on the lay-arm.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

JOHN C. BRYAN.

Witnesses:
W. PERRY HAHN,
CHAS. S. HYER.