W. F. DRAPER & E. S. WOOD.

LET-OFF MECHANISM FOR LOOMS.

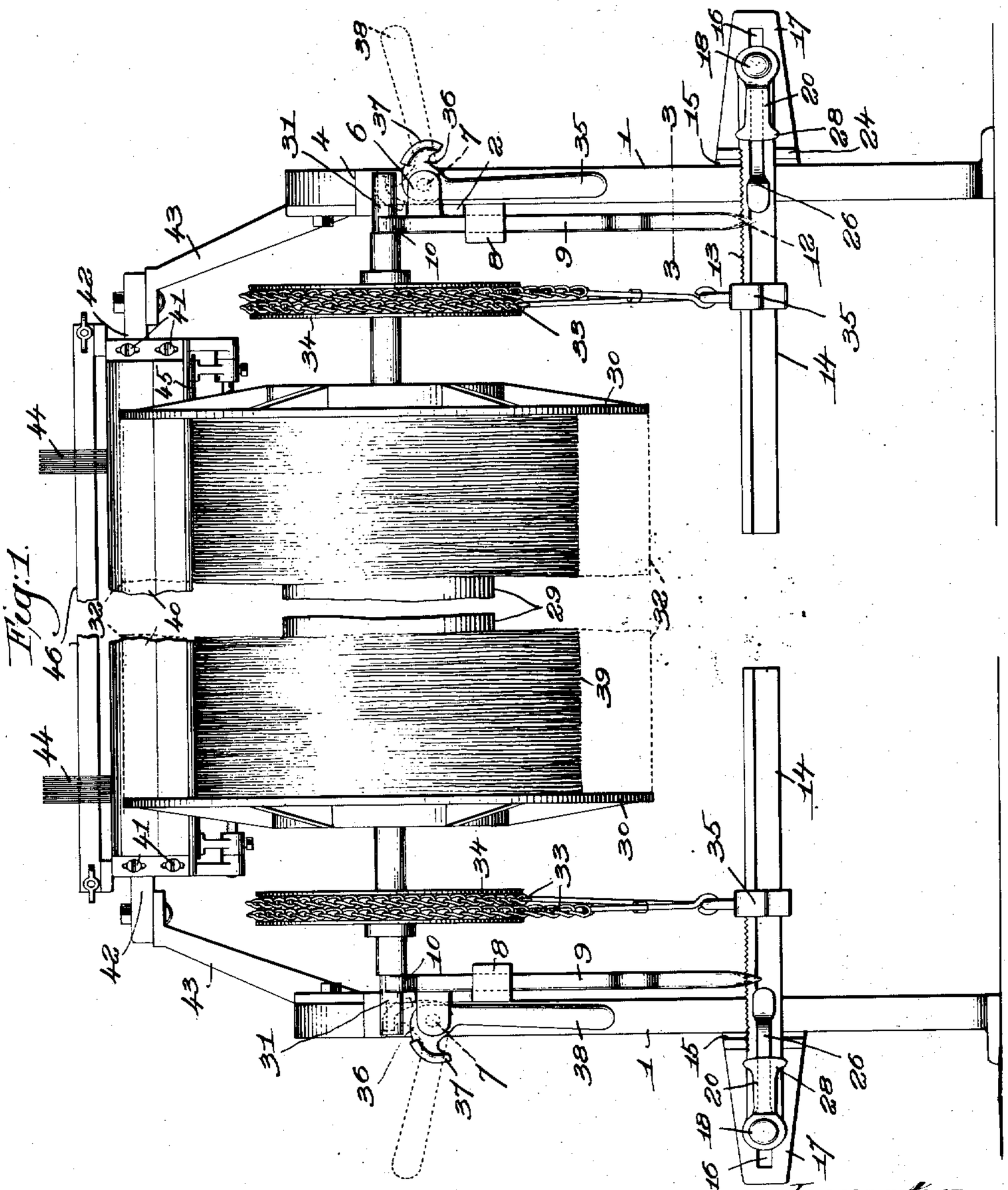
APPLICATION FILED JAN. 6, 1908.

912,942.

Patented Feb. 16, 1909.

2 SHEETS—SHEET 1.

Fig. 1.



Witnesses,
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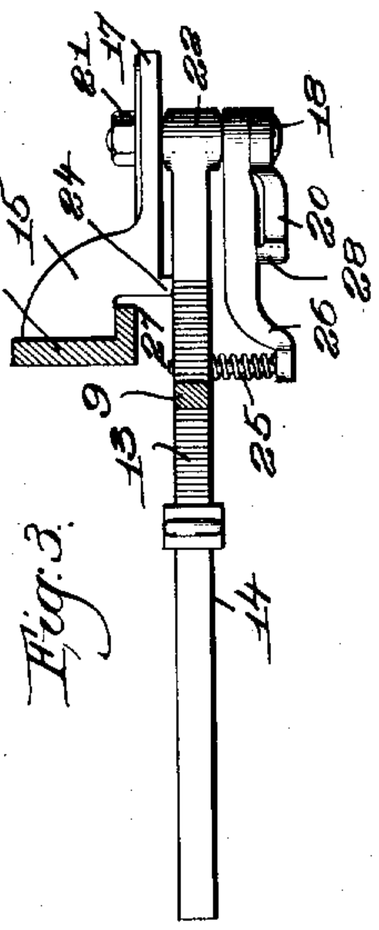

Fig. 3.

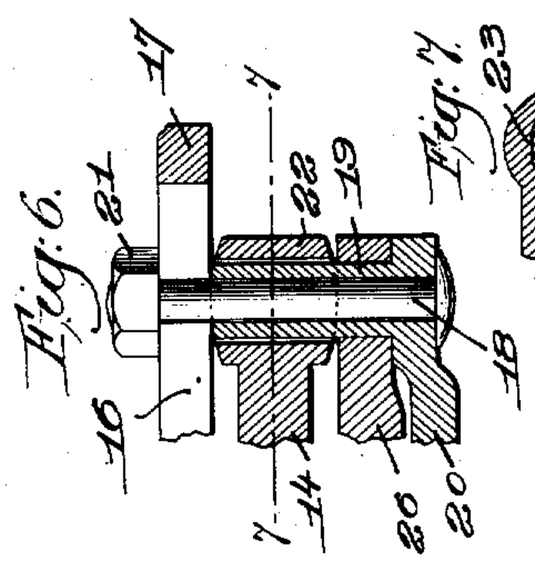

Fig. 6.

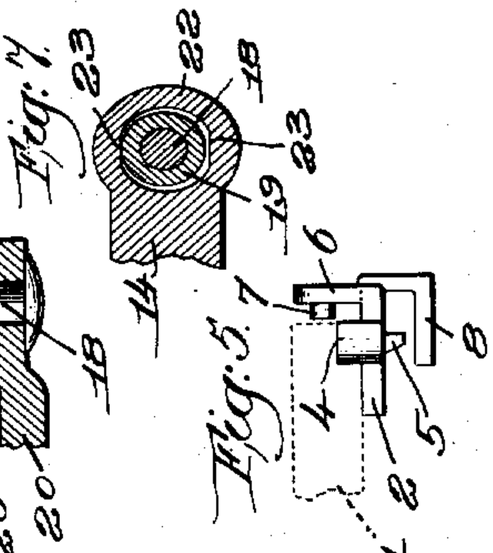

Fig. 7.

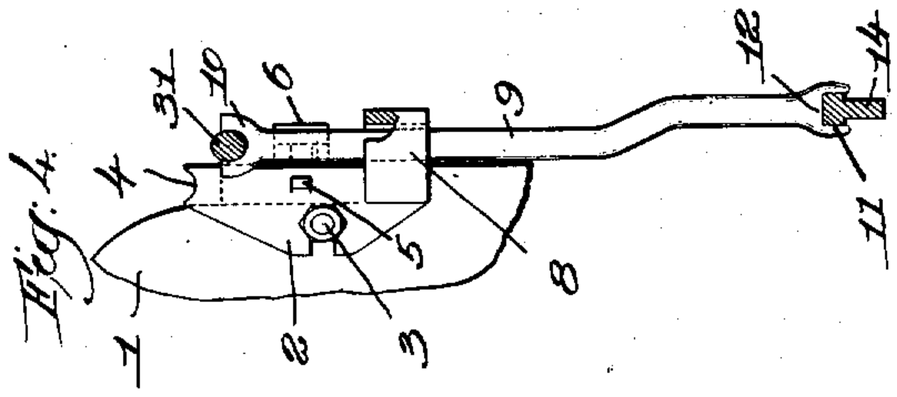

Fig. 4.

Fig. 5.

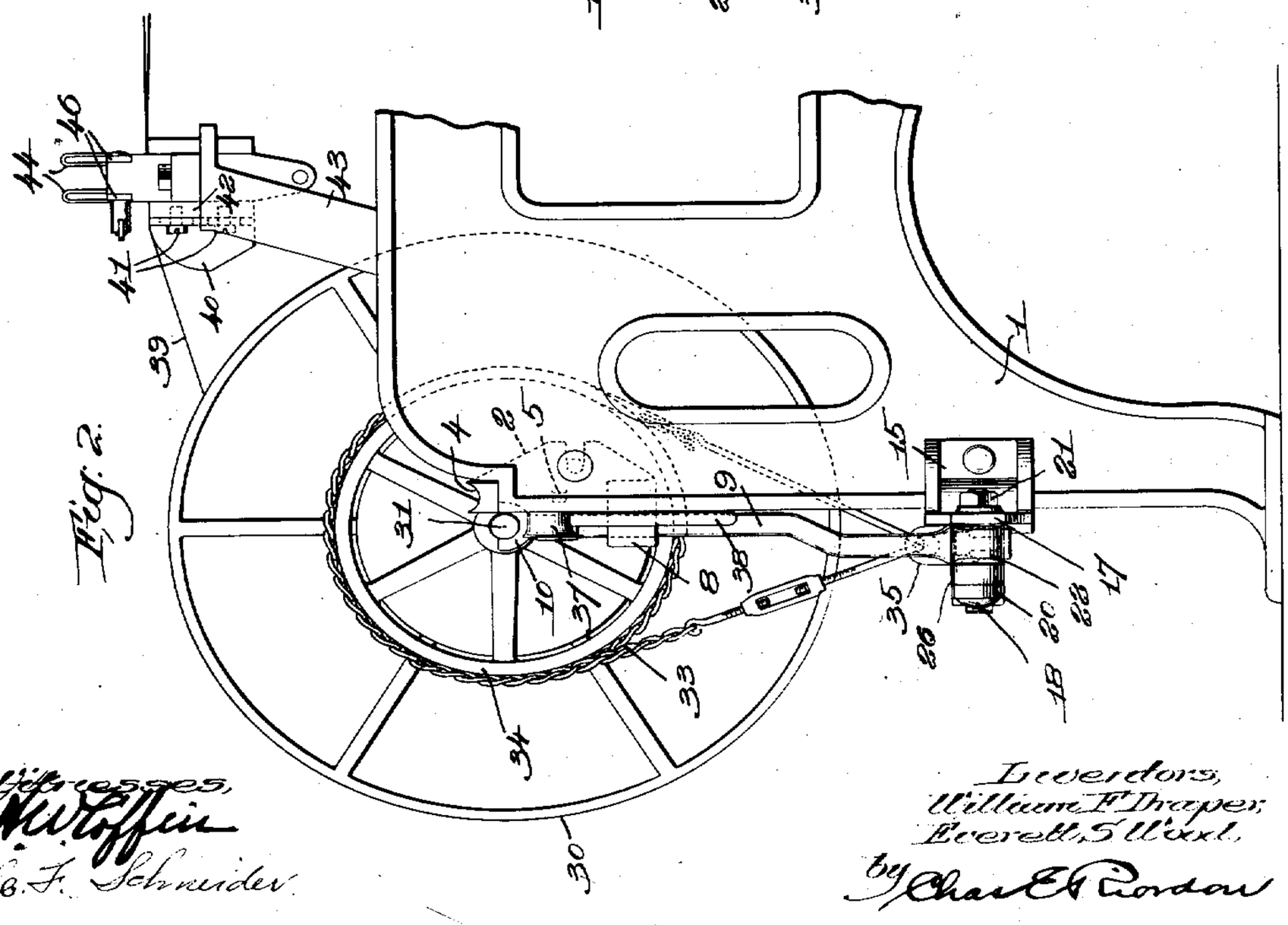

Fig. 2.

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UNITED STATES PATENT OFFICE.

WILLIAM F. DRAPER AND EVERETT S. WOOD, OF HOPEDALE, MASSACHUSETTS; SAID WOOD ASSIGNOR TO SAID DRAPER.

LET-OFF MECHANISM FOR LOOMS.

No. 912,942. Specification of Letters Patent. Patented Feb. 16, 1909.

Application filed January 6, 1908. Serial No. 409,459.

To all whom it may concern:

Be it known that we, WILLIAM F. DRAPER and EVERETT S. WOOD, citizens of the United States, and residents of Hopedale, county of Worcester, State of Massachusetts, have invented certain new and useful Improvements in Let-Off Mechanism for Looms, of which the following is a full, clear, and exact specification.

It is generally conceded by those skilled in the art of weaving that the so-called friction let-off, wherein a rope or chain is carried around a sheave on the shaft of the warp-beam and attached to a weighted lever, to regulate the amount of tension, makes the most evenly laid filling and so far has produced the best cloth. Such let-off mechanism is in widely-extended use for the coarsest and finest fabrics, and largely for the intermediate ones, but it is open to one serious objection, viz: that the control or regulation of the warp tension is left to the weaver, who is obliged to move the weight on the lever as the beam unwinds, such shifting of the weight being necessary on account of the changing leverage through which the warp acts in turning the beam. That is, the leverage is at the maximum with the full beam and gradually decreases as the diameter of the yarn mass decreases, the leverage ratio between full and nearly empty beam being more than three to one. With no change of weight on the lever to which the friction member is attached the result would be that the warp tension would be fully three times as great for the nearly empty beam as it would be for the full beam, while the weight of a full beam is about 2½ times that of an empty one.

In our present invention we have devised a friction let-off mechanism wherein the adjustment of the tension on the warp is effected automatically by a combination of the results due to the decreasing weight and diameter of the yarn mass as the beam unwinds.

In our studies leading up to the invention we have discovered that the change of weight of the beam, properly controlled, could be made to offset the change of leverage through which the warp acts, so that by enlarging the diameter of the beam barrel without materially changing its weight, and properly proportioning the diameter of the full beam, we have made the ratio between the weight of the full beam and the empty beam substantially the same as the leverage ratio between the full and the nearly empty beam, and we have so hung or mounted the beam that the change in weight practically balances the change in leverage. As a result a substantially uniform tension is maintained throughout the entire process of winding off the yarn. We are enabled to do this because the enlargement of the beam barrel reduces the leverage ratio much more than it does the weight of the yarn, and the result is most favorable in weaving. Much more uniform warp tension is insured without any attention from the weaver or loom-fixer, than is now attained even when the necessary attention is given, as it is impracticable to shift the weights on all the looms of a group just when, and to the extent, required. As beams are now made the diameter of the barrel is quite small, in order to get more yarn on the beam, and manifestly this increases the leverage ratio, while the amount of yarn gained by the small barrel is easily compensated for by a much smaller increase in the diameter of the yarn mass on the full beam by our invention. That is, by enlarging somewhat the diameter of the beam heads, and increasing the diameter of the barrel in much larger proportion, we are enabled to make the difference in warp leverages between full and empty beam correspond to the difference in weights, and at the same time get as much, and probably more, yarn on the beam.

We have, in the present embodiment of our invention, mounted the beam on levers fulcrumed on the loom-frame, and have connected with said levers the flexible friction members which are passed around the sheaves fixedly connected with the beam, the parts being so constructed and arranged that as the weight of the beam decreases the friction is diminished, substantially co-equally with the decrease in the leverage of the warp pull as the diameter of the yarn mass diminishes. We have also applied springs to the supporting levers in such manner that the strain of any sudden pull on the yarn is eased, obviating a yieldingly mounted whip-roll and also preventing the formation of thin places in the cloth being woven. In our experiments we have found that by the use of the springs there is less tendency to break the yarn.

The various novel features of our inven-

tion will be fully described in the subjoined specification and particularly pointed out in the following claims.

Figure 1 is a rear elevation, centrally broken out, of a sufficient portion of a loom with let-off mechanism embodying one practical form of our present invention; Fig. 2 is a right-hand side elevation of the mechanism illustrated in Fig. 1; Fig. 3 is a top plan view of one of the beam supporting levers, below the line 3—3, Fig. 1; Fig. 4 is an inner side elevation of one of the beam bearing members and the fixed guide for the upper end thereof; Fig. 5 is a top plan view of the guide; Fig. 6 is an enlarged detail, partly in section, of the fulcrum and adjacent parts of one of the beam-supporting levers; Fig. 7 is a cross-section thereof on the line 7—7, Fig. 6.

Referring to the drawings the loom-sides 1 at the back of the loom have fixedly attached brackets 2, held in place by bolts 3 and provided at their upper ends with concaved seats 4 to receive the journals of the warp-beam when the latter is first placed in the loom. Each bracket has on its inner face a lateral stop lug 5, best shown in Figs. 4 and 5, and an outwardly turned ear 6 which projects across the adjacent part of the loom-side, each ear having a fulcrum-stud 7 for a purpose to be described. At the lower end each bracket is shaped to present an open guide 8, the ear 6 being so located with relation thereto as to prevent interference with the depending, elongated leg 9 of a vertically movable, open bearing 10 which normally supports one of the beam-journals during the unwinding of the beam. The legs 9 are vertically movable in the guides 8 and are thereby held from lateral movement, and the upper ends of the legs may move forward as far as the stop lugs 5, the latter preventing escape of the bearing legs from the guides when the beam is not in position in the bearings. At its lower end each leg is notched at 11, and preferably brought to a transverse edge 12, see dotted lines Fig. 1, between the sides of the notch, to engage the toothed part 13 of a lever 14, shown as substantially T-shaped in cross-section. Two of the levers are shown, fulcrumed at their outer ends as will be explained and extended inwards toward each other, as clearly shown in Fig. 1, the lower ends of the bearing legs being shown as rearwardly offset, Fig. 4, to properly coöperate with the levers.

A stand 15 having a horizontal slot 16 in its vertical, laterally extended web 17 is rigidly bolted to each loom-side near its lower portion, and a fulcrum bolt 18, Fig. 6, is extended through each slot 16, a sleeve-like hub 19 on a short arm 20 embracing the bolt and being clamped rigidly to the web by the bolt and its nut 21. Each lever 14 has its hub 22 rounded off at its ends, as shown in Figs. 3 and 6, and loosely embracing the sleeve 19, the axial recess of the hub being materially larger than the external diameter of the sleeve, as best shown in Fig. 7, and slightly flattened at top and bottom, at 23. This construction enables the lever to rock vertically about the sleeve as a fulcrum, and it can also swing laterally to a limited extent, the front side of each lever being normally held against a rib 24 on the web 17, see Fig. 3, by a spring 25 interposed between the lever and an arm 26 rocking on the sleeve 19 between the hub 22 and the fixed arm 20. The arm 26 swings up and down with the lever 14, owing to a guide-pin 27 for the spring, which pin is fixed to the arm and passes loosely through a hole in the lever, the fixed arm 20 having its free end enlarged at 28 to form a firm support for the arm 26 as it swings. If the lever is swung laterally toward the arm 26 the spring will be compressed, yieldingly controlling such movement of the lever, the movement being useful at the time of beat-up, as will be referred to hereinafter. By loosening the nut 21 the fulcrum of each lever can be moved toward or away from the loom-side, and the distance varied between the fulcrum and the point on the lever at which the leg 9 rests.

The warp-beam is in its general structure of usual construction, in so far as it comprises a barrel 29, attached circular heads 30, and a central shaft presenting journals 31 which rest in the bearings 10 during unwinding of the beam, but so far as concerns the relation between the barrel and the heads our beam is materially different from beams heretofore made. Ordinarily the barrel is so small that when the beam is full, the warp leverage, *i. e.*, the distance from the axis of the beam to the point on the circumference of the yarn mass at which the warp leaves it, is more than three times as great as when the beam is empty.

Inasmuch as the letting off of the warp in our present invention is controlled by the weight of the beam between full and empty conditions, as will be explained, such weight being about in the ratio of $2\frac{1}{2}$ to 1, it will be manifest that in order to make the variation in weight balance the variation in warp leverage the beam must be so constructed that the two ratios will be substantially the same, so that a substantially uniform tension upon the warp can be obtained throughout the unwinding of the beam. To this end we have materially increased the diameter of the barrel 29, and in order to beam the same amount of yarn we have slightly increased the diameter of the beam-heads, but the diameter of the latter is practically $2\frac{1}{2}$ times that of the barrel. The full beam is indicated by the dotted lines 32, Fig. 1,

and when the unwinding of a full beam begins the warp leverage will be the distance from one of said lines 32 to the axis of the beam, such leverage gradually decreasing to the radius of the barrel 29 when the beam is empty, the latter leverage being practically two-fifths of the former leverage, at full beam. We thus have the leverage ratio of 2½ to 1 between full and empty beam, which is substantially the same as the weight ratio between full and empty beam. It will now be manifest that as the weight of the beam decreases the warp leverage decreases with it, so that if the letting off of the yarn is governed by the weight of the beam the warp leverage variation will act in accord therewith to effect uniform tension on the warp.

As the beam-journals rest upon the movable bearings 10 it will be seen that the weight of the beam is transmitted through the bearing legs 9 to the supporting levers 14, and the latter are thereby pushed downward. This downward push is resisted by flexible friction members of a beam retarding device, said members being shown as chains 33 wound around friction sheaves or pulleys 34 rotatable with the beam, the ends of each flexible member being connected with a stirrup 35 slidably mounted on the free end of each lever 14. When the fulcra of the beam supporting levers are adjusted out or in the stirrups are slid along the levers to position beneath the friction sheaves 34, the legs 9 engaging the levers between their fulcra and the stirrups, as shown. The greater the weight of the beam the stronger will be the downward force exerted upon the levers, and the greater the retarding effect of the friction retarding means upon the beam, but as the beam lightens in the process of unwinding the retardation of rotation diminishes in exact accord, so that the action upon the warp in letting off is substantially uniform from full to empty beam. As the warp leverage decreases in the same proportion, for reasons set forth, there is nothing to interfere with the uniform tensioning of the warp, as will be obvious.

The beam journals 31 extend across the upright rear faces of the seats 4, and the pull of the warp holds the journals forward during weaving, but we have found that by the use of the springs 25 we obviate what may to a certain extent be termed a dead pull on the warp during unwinding, and when beat-up occurs. That is, the yarn acting at the top of the beam tends to throw rearward the lower ends of the legs 9, and this in turn tends to swing the levers 14 laterally, or rearward away from the webs 17, such movement being yieldingly controlled by the springs, so that there is a slight "give" or yield in the direction of warp travel. When beat-up takes place the warp is tightened and subjected to strain, and the springs tend to relieve such strain, the beam in practice having a slight oscillatory movement about its axis, due to this construction and arrangement. We have found that there is less tendency to yarn breakage with than without the springs, and the latter also tend to eliminate the formation of thin or uneven places in the cloth. The fixed guides 8 permit the requisite play of the bearing legs, back and forth, as shown in Fig. 4, wherein the guide is partly broken out, while properly guiding the relatively slight up and down movement of said legs. In order to thoroughly explain the above described action let it be assumed, momentarily, that the chains 33, stirrups 35, the connections between the chains and stirrups, and the levers 14 are all rigid, and rigidly connected to one another and to the beam. It will also be assumed that said levers 14 are not restrained from moving except by the springs 25. If, now, the beam be rotated slightly, as by a pull on the warp, such as occurs when the lay beats in the filling, the assumed rigidly connected and rigid parts will also swing or rotate about the beam journals 31 as centers, the levers 14 moving bodily rearward against the resistance of the springs 25. Let the stirrups 35 be now considered as loosely, instead of rigidly, attached to the levers 14, and the outer ends of the latter be considered as actually constructed (see Fig. 3) said levers would be rocked on their fulcrums by reason of the warp pull, and the springs would be compressed as before, but to a somewhat lesser extent. This is identically what occurs in the actual operation of the loom in practice, for we find that when the weight of the beam and yarn mass is on the chains they act as if they were rigid parts of the beam, so far as their effect upon the levers 14, at the time of beat up, is concerned.

Whatever the condition of the beam, between full and empty, it will be seen that the weight acts with greater or less force upon the friction retarding or letting off device, so long as the beam journals are sustained in the bearings 10, and in order to readily turn the beam forward or back when necessary we have provided manually operated means to temporarily support the beam and take its weight off the movable bearings, thereby relieving the beam from the friction retarding device. To this end we mount on each of the fulcrum studs 7, which latter are shown at right angles to and below the beam journals 31, a temporary support comprising a cam head 36 having a concave seat 37, and an elongated, normally depending handle 38. Ordinarily the tem-

porary supports are positioned as shown in full lines Figs. 1 and 2, the cam heads 36 being turned outward and entirely out of engagement with the beam journals. When the handles 38 are swung outward and up into dotted line position, Fig. 1, the cam shape of the heads brings the curved and concaved seats 37 under and gradually lifts the journals 31 of the beam, so that they will be entirely disengaged from the bearings 10, the final operative position of the heads being shown in dotted lines Fig. 1. At such time the heads are thrown over slightly past dead center, the inner end of each seat abutting against the top of the ear 6 where it joins the bracket 2. When the beam is held in the temporary supports it can be readily turned forward or back, as will be obvious, and return of the handles 38 to normal position reseats the beam journals in the movable bearings 10.

We have shown the warp 39, Fig. 2, as leading from the beam over a fixed whip-bar 40, vertically adjustable by means of set screws 41 on a stand 42 supported by brackets 43 on the loom-sides, said brackets also sustaining a warp-stop-motion comprising drop-detectors 44 and a normally vibrating feeler 45, the connection between the feeler and the stopping instrumentality of the loom forming no part of our present invention.

Inasmuch as the yielding movement of the warp-beam, previously described, obviates any dead pull on the warp we are enabled to dispense with a yieldingly controlled and normally movable whip-bar, the vertical adjustment being provided to vary the height of the sheet of warp as may be necessary.

Fixed guide-bars 46 coöperate with the detectors, to guide them in their vertical movement and to support a dropped detector, the detectors being shown in Fig. 2 as arranged in two banks or series, and they can be utilized also to divide or lease the warp if desired.

While our invention will give a substantially uniform tension on the warp-from full to empty beam it is well known that different kinds of goods require different tension. This we provide for by the adjustable fulcra of the levers 14, so as to impart greater or less, but uniform tension, throughout the unwinding of the beam; that is, any tension desired will be substantially uniform from full to empty beam. Our invention is not restricted, however, to the particular arrangement of the whip-bar nor to the particular warp-stop-motion shown, as the same is illustrative, and various changes may be made by those skilled in the art in details of construction and arrangement without departing from the spirit and scope of our invention as set forth in the appended claims.

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

1. In friction let-off mechanism for looms, a warp-beam having a barrel of large diameter relatively to its heads, the beam being rotated by the pull of the warp, combined with vertically movable bearing members for the beam, pivoted levers on which said members are supported, and friction retarding means for the beam connected with said levers, the weight of the beam acting through the levers to reduce the action of said retarding means in proportion to the diminution in weight as the beam unwinds, the warp leverage and the decrease in weight varying in substantially the same ratio from full to empty beam and imparting uniform tension to the warp.

2. In friction let-off mechanism for looms, a warp-beam having attached friction sheaves, vertically movable bearing members for the beam, levers on which the bearing members are supported, means permitting adjustment of the fulcra for the levers with relation to the movable bearings, and flexible friction members passed around the sheaves and attached to the levers, whereby the retarding action of the friction devices is directly governed by and in accordance with the weight of the beam, adjustment of the lever fulcra permitting regulation of the tension on the warp.

3. In friction let-off mechanism, a warp-beam, friction-retarding means therefor, and an instrumentality to sustain the beam and automatically govern the action of the retarding means according to the weight of the beam, said instrumentality including means to permit yieldingly-controlled retative movement of the beam when the beat-up occurs.

4. In friction let-off mechanism for looms, a warp-beam having attached friction sheaves, movable bearing members for the beam, fixed guides in which the upper ends of said members are vertically movable, and movable fore and aft to a limited extent, levers on which the lower ends of the bearing members rest, fulcra for the outer ends of the levers, the latter having slight lateral movement on their fulcra, springs to govern the lateral movement, and flexible friction members embracing the sheaves on the beam and attached to the levers.

5. In friction let-off mechanism for looms, a warp-beam, movable bearing therefor, pivoted levers on which the bearings are supported, friction retarding means for the beam, including flexible members attached to the levers, and manually movable means to lift the weight of the beam from said bearings to relieve the action of the friction means and temporarily sustain the beam.

6. In friction let-off mechanism for

looms, a warp-beam, friction retarding means therefor governed automatically and directly by the weight of the beam, and manually operated means to remove the beam from the control of said retarding means and temporarily support said beam.

7. In friction let-off mechanism for looms, a warp-beam, vertically movable bearing members therefor, retarding means for and acting directly upon the beam and governed automatically by the variation in weight from full to empty beam, positive connecting means between the bearing members and said retarding means, and means to vary the warp leverage in substantial accord with the weight variation.

8. In let-off mechanism for looms, a warp-beam having friction sheaves attached thereto, movable bearings for the beam journals, each bearing having a depending leg terminating in a notched end, supporting levers fulcrumed at their outer ends and extended inward, a stirrup longitudinally adjustable on the inner end of each lever, flexible friction members attached at their ends to the stirrups and wound around the sheaves, the notched ends of the legs embracing the levers between their fulcra and the stirrups, fixed guides for the bearing legs, and means to laterally adjust the lever fulcra.

9. In let-off mechanism for looms, a warp-beam, vertically movable bearings therefor, fixed guides for said bearings, mounted on the loom-sides, levers upon which the bearings are supported, friction retarding members connected with the levers and coöperating with the beam, and manually movable temporary supports for the beam, fulcrumed on the loom-sides and having cam-heads to engage and lift the beam journals from the movable bearings.

10. In let-off mechanism for looms, a warp-beam, combined supporting and friction retarding means for the beam, to automatically govern the letting off of the warp by or through the weight of the beam, said means including devices to permit yieldingly-controlled rotative movement of the beam at the time of beat-up, and a whip-bar over which the warp passes from the beam.

11. In let-off mechanism for looms; a friction let-off, a beam upon which the warp is wound, bearings to normally support the same vertically, and manually operated means to relieve the friction let-off and temporarily engage and support the beam independently of said bearings, said means being normally disconnected from and out of coöperation with the beam.

12. In let-off mechanism for looms, a beam upon which the warp is wound, mechanism to control the rotation thereof, and manually operated means to temporarily support and remove the beam from the control of said mechanism, said means being normally disconnected from and out of coöperation with the beam.

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

WILLIAM F. DRAPER.
EVERETT S. WOOD.

Witnesses:
FRED E. WOOD,
SHELLEY V. VINCENT.

Correction in Letters Patent No. 912,942.

It is hereby certified that in Letters Patent No. 912,942, granted February 16, 1909, upon the application of Willlam F. Draper and Everett S. Wood, of Hopedale, Massachusetts, for an improvement in "Let-Off Mechanism for Looms," an error appears in the printed specification requiring correction, as follows: In line 121, page 4, the word "bearing" should read *bearings;* and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 2nd day of March, A. D., 1909.

[SEAL.]

C. C. BILLINGS,
Acting Commissioner of Patents.

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