This invention relates to looms, and more particularly to mechanism employed in connection with weaving from beam to "let off" the yarn at a rate commensurate with the requirements of the weaving operations.

In existing looms there are two types of let-off motions extensively employed. One type includes mechanism which is governed automatically by the tension of the warp, and the other depending upon friction applied to the warp beam. This invention is to be employed in connection with the former type, in which a pawl and ratchet mechanism is utilized to intermittently turn the warp beam to pay out the warp. The amplitude of turning movement of the ratchet upon each stroke of the pawl is regulated by the degree of tension exerted on the warp. The warp beam has a large gear that meshes with a pinion which is turned at a reduced speed by the pawl and ratchet through conventional interposed speed-reducing mechanism, and the warp beam is rotatably mounted upon the loom frame near its rear end and adjacent to the pawl and ratchet mechanism. Warp yarns from the warp beam engage a whip roll, and the whip roll is mounted for yielding swinging movement responsive to the tension of the warp yarns. The whip roll is operably connected with the pawl and ratchet mechanism, and also with the operating component of the loom to vary the starting point of the pawl in its drive movement relative to the ratchet to thereby drive the warp beam to turn it sufficiently at each pick of the loom to pay out the requisite length of warp yarn to maintain the warp yarn at the proper tension.

Let-off mechanisms of this type are expensive to install and maintain, especially the elements which are operably interposed between the whip roll and the ratchet mechanism, and the operating components of the loom. Such let-off mechanism also requires frequent adjustment.

Accordingly, it is an object of this invention to simplify and otherwise improve the let-off mechanism employed in modern looms, and particularly the elements which are operably interposed between the whip roll and ratchet mechanism and the operating components of the loom.

A specific object of the invention is to provide, for use in looms, an improved let-off mechanism which imparts a positive drive to the warp beam to pay out the requisite length of warp yarn at each pick of the loom.

A more specific object of this invention is to provide, for use in looms, an improved let-off mechanism which cooperably connects the whip roll and ratchet mechanism directly with an operating component of the loom through greatly simplified instrumentality, and to also provide a device which may be readily installed on existing looms and which requires only a minimum of adjustment in its operation.

It is also an object of this invention to provide, for use in looms, a let-off mechanism of generally improved construction whereby the device will be simple, durable and inexpensive in construction, as well as convenient, practical, serviceable and efficient in its use.

With the foregoing and other objects in view, which will appear as the description proceeds, the invention resides in the combination and arrangement of parts, and in details of construction hereinafter described and illustrated, it being understood that various changes in form, proportion, and minor details of construction may be made within the scope of the claims; without departing from the spirit or sacrificing any advantages of the invention.

For a complete disclosure of the invention, a detailed description of it will now be given in connection with the accompanying drawings forming a part of the specification, wherein:

Figure 1 is a fragmental side elevation depicting parts of the loom with which the invention is operably associated, and particularly illustrating the improved let-off mechanism embodying this invention;

Figure 2 is a fragmental horizontal sectional view taken on the line 2--2 of Figure 1;

Figure 3 is a similar enlarged view taken through the composite bracket;

Figure 4 is a side elevation of the bearing component of the composite bracket; and

Figure 5 is a front view of the bearing component.

Referring to the drawings, in which similar reference characters designate corresponding parts, there is depicted a conventional loom frame having loom sides 10 which operably support the components of the loom. A yarn beam 11 is carried by a yarn beam shaft 12, which is rotatably mounted in bearings 13 formed in brackets of the loom sides 10, thereby rotatably supporting the yarn beam. A large gear 15 is carried by one of the warp beam heads 16 provided at one terminal of the yarn beam, and this gear meshes with a let-off pinion 17 secured to a let-off shaft 18 which is rotatably supported in bearings formed in the machine frame and a let-off bracket 20 which is secured to a loom side by bolts 21 or other suitable securing devices.
off shaft 18 has a worm wheel or gear 22 secured thereto, and this gear meshes with a worm 23 carried by a worm shaft 25, rotatably mounted in the let-off bracket 20. A let-off hand wheel 26 is keyed or otherwise secured at the upper terminal of the worm shaft, in order that the worm shaft may be manually turned in conformity with the accompanying practice, and a conventional let-off friction clamping mechanism 27 engages the worm shaft adjacent the hand wheel to place the shaft under predetermined tension or frictional resistance. The worm shaft 25 has a ratchet wheel 28 keyed or otherwise secured thereto adjacent the hand wheel 26, and this ratchet wheel is operably engaged by a ratchet or pawl 30 pivotally supported on a ratchet lever 31 which is provided with a bearing portion or eye 32 which engages and oscillates about the worm shaft 25. A speed-reducing mechanism is usually interposed between the let-off pinion 17 and the worm wheel 22, but inasmuch as this mechanism forms no part of the present invention it has not been depicted in the drawings of this application.

Whip roll brackets 33 are suitably secured to the machine frame, and these brackets have bearing recesses 35 formed therein to rotatably receive a whip roll shaft 26. Spaced whip roll arms 37 are rigidly secured to and extend radially from the whip roll shaft, and these arms are provided with bearing recesses 38 which rotatably receive a shaft on trunnions 40 extending axially from a whip roll 41, thereby rotatably supporting the whip roll. A whip roll lever 42 is secured to and extends radially from a terminal of the whip roll shaft 26, and the outer terminal of the whip roll lever is provided with a projecting pin or stud 43. The machine components hereinbefore disclosed are well known in the art and are extensively employed in existing looms. This invention contemplates the provision of simplified mechanism for operably connecting the whip roll and warp beam with operating components of the machine, whereby the requisite length of yarn may be let off during each pick of the loom.

The improved let-off mechanism includes a tension link or rod 45 which is slidable mounted in a bearing recess 46 formed in a bearing component 47 of a composite bracket. The bearing component 47 is secured to a supporting component 48 of the composite bracket, and the supporting component is, in turn, secured to a loom side 10. The bearing component 47 is provided with a body portion 50 having an elongated slot 51 formed therein. A bearing head 52 forms a part of the bearing component 47 and extends at an angle therefrom, and this head has the bearing recess 46 formed therein to slidably receive and support the tension link 45, as will be more fully disclosed hereinafter. The supporting component 48 is provided with a foot 53 having spaced apertures 55 formed therein for the reception of bolts or screws 56 which rigidly secure the bracket component 48 to the loom side. A leg 57 extends perpendicularly from the foot 53, and the leg is provided with spaced threaded apertures 58 for the reception of the threaded shanks of screws 60 which extend through the slot 51 formed in the bearing component body 50, thereby rigidly securing the bearing component 47 to the supporting component 48 in position to operably support the tension link 45.

One terminal of the tension link 45 is provided with threads 61 which are received in a threaded recess 62 formed in a head or cam follower 63, and a jamb nut 65 engages the threads 61 and the head 63 to thereby securely lock the tension link 45 to the head 63. The outer terminal of the head is bifurcated to receive a cam roller 66, and each fork 67 of the head carries an anti-friction bearing unit 68, thereby rotatably receiving the trunnions or shaft 70 of the cam roller 66, thereby rotatably supporting the cam roller in the cam follower head 63. The opposed terminal of the tension link is provided with a bearing adjuster which includes a head 71 bolted or otherwise rigidly secured to the tension link 45, and this head has a finger 72 extending therefrom, and this finger is provided with a slot 73 which receives therein the stud 43 that extends from the outer terminal of the whip roll lever 42. The head 71 is provided with a cylindrical recess 75 in which an adjusting screw 76 is rotatably received. The adjusting screw 76 is held against axial movement relative to the head 71 by a collar 77, that is rigidly secured to the screw and engages one terminal of the head, and by an adjusting screw hand wheel 78 which has its hub portion rigidly secured to the screw and abutting the opposed terminal of the head 71. A traveller 80 is slidable supported on the tension link 45 and it is also threadedly secured to the adjusting screw 76, whereby rotary movement of the screw 76, by manipulating the hand wheel 78, causes the traveller 80 to move axially along the tension link 45 or from the bearing bracket component 47. The tension link 45 supports a helical extension spring 81 which surrounds the link and is interposed between the bearing bracket component 47 and the traveller 80, so that movement of the traveller along the tension link 45 will adjust the degree of tension exerted by the link against the whip roll lever 42.

A cam 82 is secured to the outer terminal of a cam shaft 83, which forms a conventional component of existing looms and drives certain of the weaving instrumentalities in conformity with the practice well known to the skilled in the art. The cam 82 is of elliptical configuration having diametrically opposed high portions 84 and diametrically opposed low portions 86, which are operably interposed between the high portions in perpendicularly related thereto, so that upon rotation of the shaft 83, the cam 82 will impart reciprocatory movement to the tension link 45 against the bias of the tension spring 81, as will be more fully explained hereinafter.

A connecting rod or link 87 has one terminal pivotally secured to the ratchet lever 31 by a cap screw 88, or other suitable securing device, and its opposed terminal is pivotally secured to the cam follower head 63, as indicated at 89, so that a reciprocatory movement of the tension link 45 and cam follower head 63 will impart oscillatory movement to the ratchet lever 31, thus causing the ratchet 30 to engage and rotate the ratchet wheel 28, thereby imparting the let-off motion to the yarn beam through the interposed instrumentalities.

In operation, at each pick of the loom the conventional harnesses separate alternate warp yarns to permit the filling yarn to be inserted therewith, and when the warp yarns are thus separated, this separating movement imparts tension to the warp yarns, thus causing the whip roll 41 to move downwardly about the whip roll shaft 26. The downward movement of the whip roll 41 causes the tension link 45 to move inwardly
toward the cam 82, and this inward movement is resisted by the bias of the tension spring 81. Accordingly, by manipulating the hand wheel 18, the requisite degree of tension may be imparted to the warp yarns through the instrumentality of the whip roll, the whip roll supporting members and the tension link 45. At each pick of the weaving instrumentality, a high portion 65 of the cam is presented to the cam roller 66 of the follower head 63, thus forcing the tension link 45 outwardly and the whip roll 41 upwardly to a predetermined position. When the warp yarns are separately received to the filling yarns, the whip roll 45 moves downwardly, and the amplitude of this downward movement is determined by the degree of bias exerted by the tension spring 81 and the diameter of the yarn mass on the warp beam. As the diameter of the yarn mass on the warp beam is decreased, the tension of the warp yarns is commensurately increased, so that during each pick of the loom the whip roll is forced through a greater amplitude of downward movement, thus imparting a let-off motion of greater amplitude to the warp beam to compensate for the decreased diameter of the yarn mass. Thus it is seen that the starting of the operative movement of the ratchet relative to the ratchet wheel is determined by the diameter of the yarn mass on the warp beam and the adjustment of the tension spring 81. The terminal of the upward movement of the whip roll, however, is predetermined by the high points of the cam, thus causing the amplitude of let-off motion imparted to the warp beam to be commensurate with the degree of tension exerted on the warp yarns during the operation of the weaving instrumentality.

Having thus described our invention, what we claim as new and useful is:

1. In a loom provided with a frame operably supporting weaving instrumentality including a drive shaft rotatable in timed relation with components of the said weaving instrumentality, a warp beam, a whip roll over which warp yarns from the warp beam are guided, a rockable whip roll shaft, whip roll arms secured to the whip roll shaft and rotatably supporting the whip roll when the whip roll is mounted for swinging movement about the whip roll shaft, and a whip roller secured to the whip roll shaft, the combination of a movable tension link operably connected with the whip roller lever and operably interposed between it and the drive shaft, a spring for biasing the tension link for movement towards the whip roll lever to thereby force the whip roll against the warp yarns, means for adjusting the degree of bias exerted by the tension link, a follower head rigidly secured to the inner terminal of the tension link, a cam roller operably supported by the follower head, a cam rigidly secured to the drive shaft to operably engage the cam roller to positively move the whip roll against the warp yarn tension resistance to a predetermined position during each pick of the loom, the extent of movement of the tension link towards the cam during each pick of the loom being determined by the degree of spring tension adjustment and the consequent warp yarn tension exerted against the whip roll, let-off mechanism operably connected with the warp beam, and means for operably connecting the tension link with an operating component of the let-off mechanism whereby movement of given amplitude of the tension link imparts movement of commensurate amplitude to the let-off mechanism to let off the requisite length of warp yarn at each pick of the loom.

2. In a loom provided with weaving instrumentality including a drive shaft rotatable in timed relation with components of the said weaving instrumentality, a warp beam, a whip roll over which warp yarns from the warp beam are guided, a rockable whip roll shaft, whip roll arms secured to the whip roll and rotatably supporting the whip roll whereby the whip roll is mounted for swinging movement about the whip roll shaft, and a whip roller secured to the whip roll shaft, the combination of a movable tension link operably connected with the whip roller lever and operably interposed between it and the drive shaft, a spring for biasing the tension link for movement towards the whip roll lever to thereby force the whip roll against the warp yarns, means for adjusting the degree of bias exerted by the tension link, a follower head rigidly secured to the inner terminal of the tension link, a cam roller operably supported by the follower head, a cam rigidly secured to the drive shaft to operably engage the cam roller to positively move the whip roll against the warp yarn tension resistance to a predetermined position during each pick of the loom, the extent of movement of the tension link towards the cam during each pick of the loom being determined by the degree of spring tension adjustment and the consequent warp yarn tension exerted against the warp beam, and means for operably connecting the follower head of the tension link with an operating component of the let-off mechanism whereby movement of given amplitude of the tension link imparts movement of commensurate amplitude to the let-off mechanism to let off the requisite length of warp yarn at each pick of the loom.

3. In a loom provided with weaving instrumentality including a drive shaft rotatable in timed relation with components of the said weaving instrumentality, a warp beam, a whip roll over which warp yarns from the warp beam are guided, a rockable whip roll shaft, whip roll arms secured to the whip roll shaft and rotatably supporting the whip roll whereby the whip roll is mounted for swinging movement about the whip roll shaft, and a whip roller secured to the whip roll shaft, the combination of a movable tension link operably connected with the whip roller lever and operably interposed between it and the drive shaft, a spring for biasing the tension link for movement towards the whip roll lever to thereby force the whip roll against the warp yarns, means for adjusting the degree of bias exerted by the tension link, a follower head rigidly secured to the inner terminal of the tension link, a cam roller operably supported by the follower head, a cam rigidly secured to the drive shaft to operably engage the cam roller to positively move the whip roll against the warp yarn tension resistance to a predetermined position during each pick of the loom, the extent of movement of the tension link towards the cam during each pick of the loom being determined by the degree of spring tension adjustment and the consequent warp yarn tension exerted against the warp beam, and means for operably connecting the follower head of the tension link with an operating component of the let-off mechanism whereby movement of given amplitude of the tension link imparts movement of commensurate amplitude to the let-off mechanism to let off the requisite length of warp yarn at each pick of the loom.
whip roll, let-off mechanism operably connected with the warp beam, and a connecting rod for operably connecting the follower head of the tension link with an operating component of the let-off mechanism whereby movement of given amplitude of the tension link imparts movement of commensurate amplitude to the let-off mechanism to let off the requisite length of warp yarn at each pick of the loom.

4. In a loom provided with weaving instrumentality including a drive shaft rotatable in timed relation with components of the said weaving instrumentality, a warp beam, a whip roll over which warp yarns from the warp beam are guided, a rockable whip roll shaft, whip roll arms secured to the whip roll shaft and rotatably supporting the whip roll whereby the whip roll is mounted for swinging movement about the whip roll shaft, and a whip roll lever secured to the whip roll shaft, the combination of a movable tension link operably connected with the whip roll lever and operably interposed between it and the drive shaft, a spring for biasing the tension link for movement towards the whip roll lever to thereby force the whip roll against the warp yarns, means for adjusting the degree of bias exerted by the spring against the tension link, a follower head rigidly secured to the inner terminal of the tension link, a cam roller operably supported by the follower head, a cam rigidly secured to the drive shaft to operably engage the cam roller to positively move the whip roll against the warp yarn tension resistance to a predetermined position during each pick of the loom, the extent of movement of the tension link toward the cam during each pick of the loom being determined by the degree of spring tension adjustment and the consequent warp yarn tension exerted against the whip roll, a rotatable worm shaft operably connected with the warp beam through interposed instrumentality whereby rotation of the worm shaft imparts rotary movement to the warp beam, a ratchet wheel secured to and rotatable with the worm shaft, a ratchet lever mounted for oscillatory movement about the worm shaft, a ratchet pivotally secured to the ratchet lever and operably engaging the ratchet wheel to impart rotary movement in one direction to the worm shaft of amplitude commensurate with the amplitude of oscillatory movement of the ratchet lever, and a connecting rod having one terminal pivotally connected with the follower head of the tension link and its opposed terminal pivotally connected with the ratchet lever whereby movement of given amplitude of the tension link imparts movement of commensurate amplitude to the warp shaft and warp beam to let off the requisite length of warp yarn at each pick of the loom.

JESSE ODELL FOSTER.
GEORGE ROME CLAWSON.

REFERENCES CITED

The following references are on record in the file of this patent:

UNITED STATES PATENTS

<table>
<thead>
<tr>
<th>Number</th>
<th>Name</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>647,815</td>
<td>Draper</td>
<td>Apr. 17, 1900</td>
</tr>
<tr>
<td>954,648</td>
<td>Rhoades</td>
<td>Apr. 12, 1910</td>
</tr>
<tr>
<td>1,116,460</td>
<td>Farnsworth</td>
<td>Nov. 10, 1914</td>
</tr>
<tr>
<td>1,688,982</td>
<td>Epps</td>
<td>June 1, 1926</td>
</tr>
<tr>
<td>1,749,120</td>
<td>Baker</td>
<td>Mar. 4, 1930</td>
</tr>
</tbody>
</table>