Sept. 2, 1952 C. R. BEALL 2,609,007

POSITIVE LETOFF MECHANISM FOR LOOMS

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Fig. 1

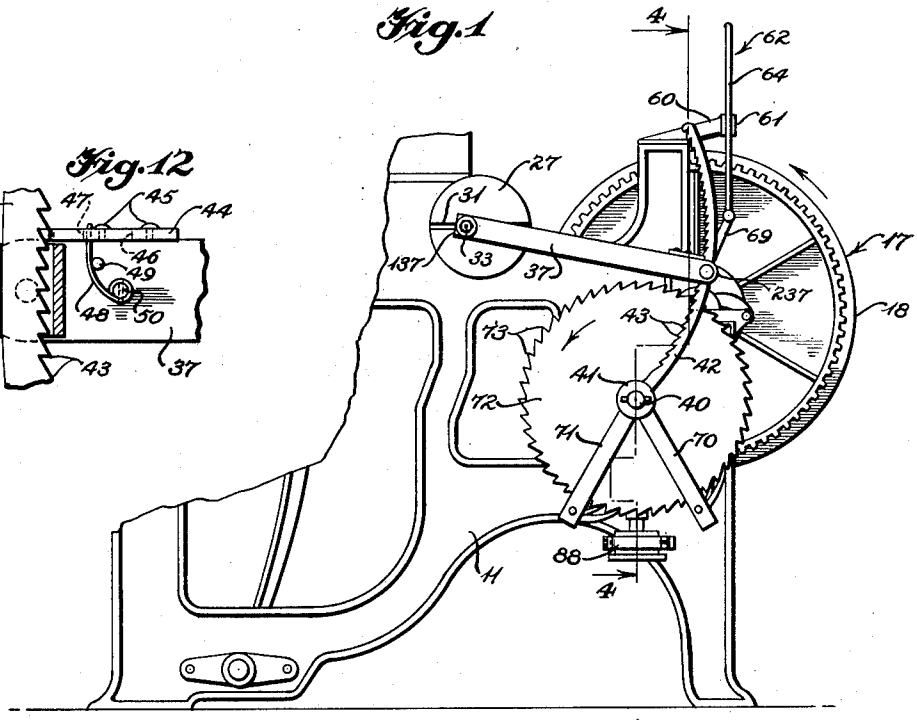
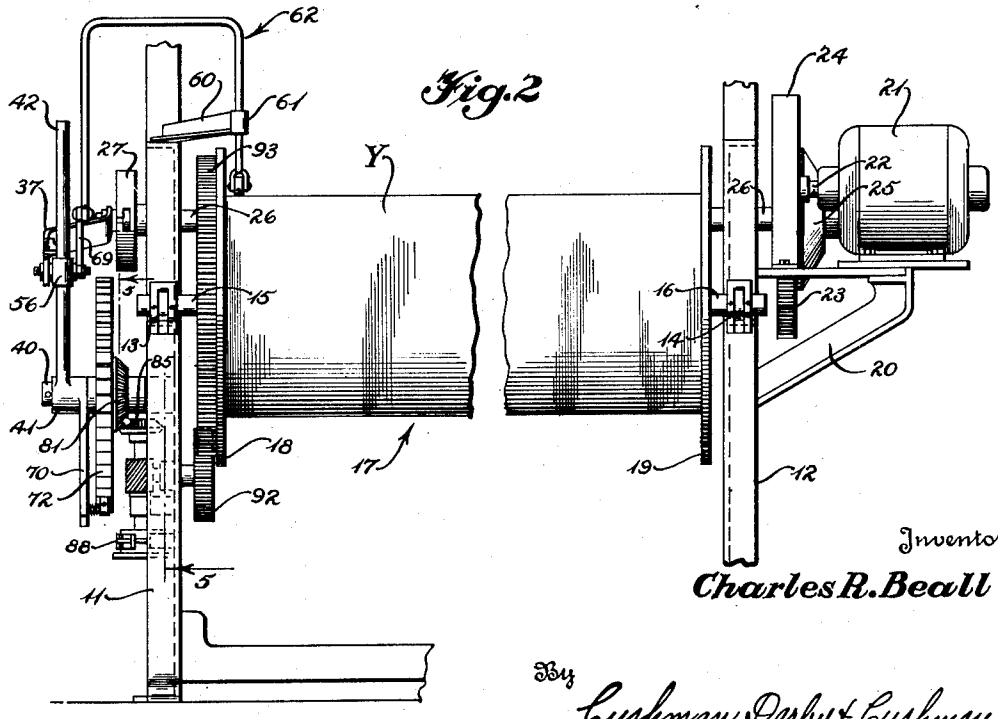



Fig. 12




Fig. 2




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Fig.4

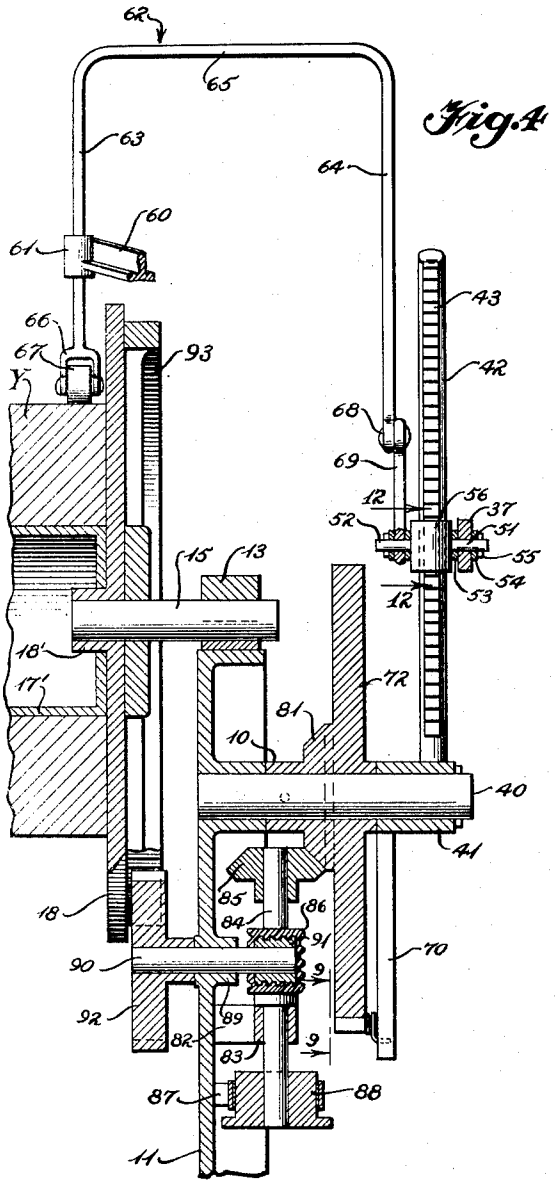



Fig.7

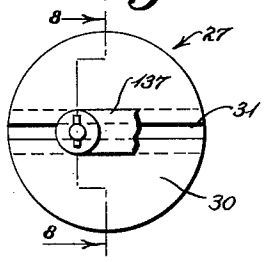



Fig.8

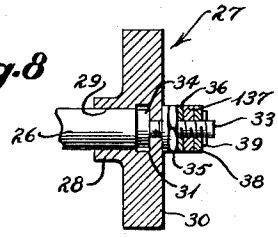



Fig.9

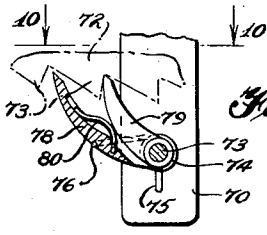



Fig.10

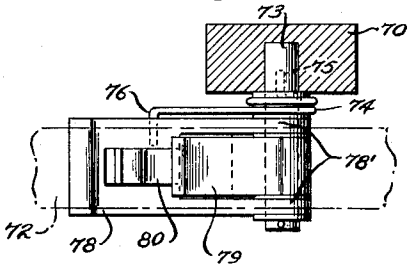
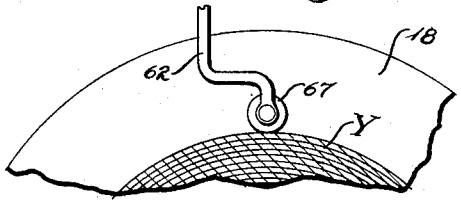



Fig.11




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Fig. 3

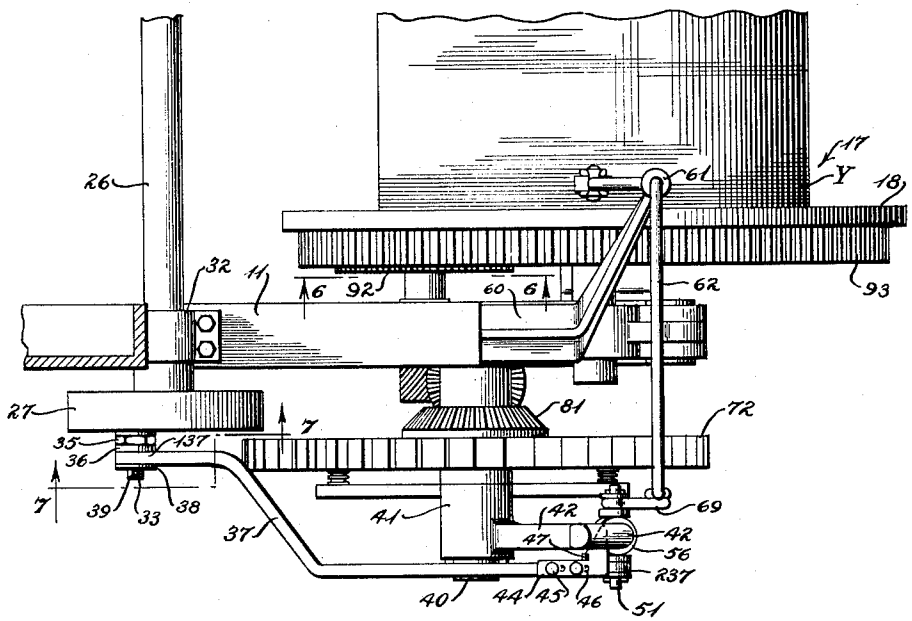
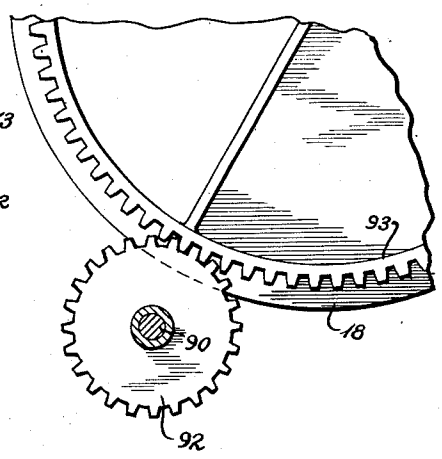



Fig. 6



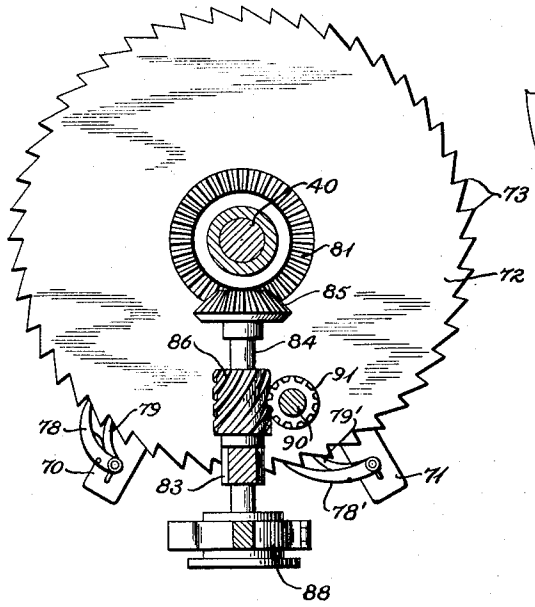




Fig. 5

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# UNITED STATES PATENT OFFICE

2,609,007

## POSITIVE LETOFF MECHANISM FOR LOOMS

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Application May 19, 1949, Serial No. 94,175

9 Claims. (Cl. 139—108)

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This invention relates to textiles looms, and more particularly, to an improved let-off mechanism for positively driving the warp beam so as to regulate the delivery of warp yarn from the beam.

A primary object of this invention is to provide a loom having a rotatable warp beam from which the warp yarn is let off and delivered at a substantially constant let-off speed irrespective of the amount of yarn remaining wound on the beam.

A further object of the invention is to provide a let-off mechanism for positively driving the warp beam at an increasing angular velocity as the diameter of the cylindrical spool of warp yarn wound on the beam decreases during let-off.

Another object of the invention is to provide an improved positive let-off drive having a let-speed controlled by the position of a follower which contacts the cylindrical surface of the warp yarn wound on the beam.

A further object of the invention is to provide a let-off mechanism comprising an oscillating lever drivingly connected to the warp beam whereby the beam will be rotated at an angular velocity directly proportional to the angular velocity of the oscillating lever and a drive means for oscillating said lever at an angular velocity determined by the position of a follower which maintains contact with the surface of the wound yarn.

Another object of the invention is to provide a novel drive connection between said oscillating lever and the warp beam whereby relative lost motion may be reduced to a minimum.

Further objects and advantages of the present invention will be apparent from the detailed description and drawings in which there is illustrated and describe one particular embodiment of the invention.

In the drawings:

Figure 1 is a side elevational partial view of a loom embodying the present invention, the conventional part of the loom not being shown;

Figure 2 is an end elevational view as seen from the right of Figure 1;

Figure 3 is a partial plan view;

Figure 4 is a vertical sectional view taken on the line 4—4 of Figure 1;

Figure 5 is a vertical sectional view taken on the line 5—5 of Figure 2;

Figure 6 is a vertical sectional view taken on the line 6—6 of Figure 3;

Figure 7 is an elevational view of the rotary

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drive crank as seen from the line 7—7 of Figure 3;

Figure 8 is a sectional view taken on the line 8—8 of Figure 7;

Figure 9 is a detail view of the pawl mechanism as seen from the line 9—9 of Figure 4;

Figure 10 is a sectional view taken on the line 10—10 of Figure 9;

Figure 11 shows the follower in contact with the cylindrical surface of the wound warp yarn; and

Figure 12 is a sectional view taken on the line 12—12 of Figure 4.

Referring to the drawings and particularly to Figures 1 and 2, 11 and 12 indicate the two spaced upright parallel side frames of the loom. A bearing 13 is mounted on the side frame 11 and oppositely disposed is a bearing 14 mounted on the side frame 12. A conventional warp 17 has shafts 15 and 16 and extending from the opposite ends thereof and journalled respectively within bearings 13 and 14 so as to provide a rotatable mounting for the warp beam 17. As shown in Figure 4, the beam 17 comprises a hollow cylinder 17' having a pair of flanges 18 and 19 fixedly secured at opposite ends of the cylinder 17'. The flanges 18, 19 have annular projections as shown at 18' and the shafts 15, 16 are fixedly secured within these projections of the flanges 18, 19.

As best seen in Figure 2, a bracket 20 is secured to the side frame 12 and supports an electric motor 21. The output shaft 22 of the motor 21 has a gear (not shown) in engagement with the gear 23 which rotates within the gear casing 24. A clutch 25 transmits the power from the gear 23 to a horizontal shaft 26 which extends parallel to the axis of the warp beam 17.

As seen in Figure 3, the end of the shaft 26 is journalled within a bearing 32 mounted on the side frame 11. Referring further to Figures 7 and 8, a rotary drive crank plate 27 is fixed to the end of the shaft 26 by means of an annular flange 28 having an opening 29 for receiving the end of the shaft 26 with a press fit.

Communicating with the face 30 of the crank plate 27 and extending diametrically thereacross is a T-shaped slot 31. A crank pin 33 is integrally formed with an enlarged head portion 34 which is slidably mounted within the enlarged portion of the T-shaped slot 31. The crank pin 33 extends from the head portion 34 through the smaller portion of the T-shaped slot 31 and projects from the face 30 of the crank plate 27. The crank pin 33 is threaded and a lock nut 35 is screwed thereon for locking the crank pin 33 in any se-

lected position along the length of the diametrical T-shaped slot 31. It will thus be seen that the degree of eccentricity of the crank pin 33 with respect to the axis of the shaft 26 may be adjusted so as to obtain a desired crank throw. A washer 36 is mounted on the crank pin 33 adjacent the lock nut 35 and one end 137 of a connecting rod 37 is rotatably mounted on the crank pin 33 adjacent the washer 36. A washer 38 and locking pin 39 are mounted on the exterior end of the crank pin 33 for preventing lateral displacement of the connecting rod 37 along the axis of the crank pin 33.

As best shown in Figure 4, the side frame 11 has an annular flange 10 integral therewith and within which is rigidly secured a pin 40. A cylindrical hub member 41 is rotatably mounted on the end of pin 40. Rigidly secured to the hub 41 and extending upwardly therefrom in a plane perpendicular to the axis of pin 40 is a lever 42. It will be seen in Figure 1 that the lever 42 is preferably of arcuate shape in the form of a segment of a circle having its center coincident with the axis of the shaft 26. A series of teeth 43 are formed on the lever 42 on the side facing the shaft 26 and crank plate 27.

As best shown in Figures 3, 4 and 12, the other end 237 of the connecting rod 37 engages the lever 42 in a manner now to be described. A tubular collar 56 surrounds the lever 42 and is freely slidable thereon. Rigidly secured to the collar 56 and extending from opposite sides thereof are pins 51 and 52. The end 237 of connecting rod 37 is rotatably mounted on the pin 51 and held in assembled relation thereon by means of the washers 53, 54 and the locking pin 55.

A spring pressed detent 44 is slidably mounted on the upper edge of the connecting rod 37 adjacent the end 237 by means of pins 45 secured to the connecting rod 37 and extending within longitudinal slots 46 formed in the detent 44. A spring 48 is anchored to the connecting rod 37 by means of pin 50 and extends around the pin 49 and into a notch 47 formed in the detent 44. It will thus be seen that the spring 48 biases the detent 44 into engagement with the teeth 43 formed on the lever 42. As shown in Figure 12, the teeth 43 depend downwardly so as to allow the detent 44 to ratchet freely over the teeth 43 when the end 237 of the connecting rod 37 is moved downwardly along the length of the lever 42 toward the axis of the pin 40.

Rigidly secured to an upper portion of the side frame 11 is a bracket 60 having a bearing sleeve 61 for slidably mounting a follower 62. As shown in Figure 4, the follower 62 is substantially U-shaped and comprises vertical parallel members 63, 64 integrally formed with a horizontal member 65. The member 63 is slidable within the bearing sleeve 61 and has at the lower end thereof a yoke 66 within which is rotatably mounted a roller 67. The lower end of the member 64 is pivotally connected to the upper end of a link 69 by means of pin 68. The lower end of the link 69 is rotatably mounted on the pin 52 and held in assembled relation thereon by means of washers and a locking pin in the same manner as heretofore described with respect to the connecting rod 37 and the pin 51.

Rigidly secured to the hub 41 and radially extending therefrom in a downward direction are two pawl supporting members 70 and 71. A ratchet wheel 72 is rotatably mounted on the fixed pin 40 in abutting relation to the end of the hub 41. Formed around the periphery of the ratchet wheel 72 is a plurality of ratchet teeth 73. The lower ends of the members 70, 71 carry a plurality of pawls for engagement with the ratchet teeth 73. In the particular embodiment of the invention illustrated herein, each of the members 70, 71 has two pawls but it will be obvious that any number may be employed. As shown in Figures 9 and 10, two pawls 78 and 79 are pivotally mounted on a pin 73 fixed to the lower end of the member 70. A spring 74 is anchored to the member 70 at 75 and extends around the pin 73 and has a transverse portion 76 in abutment with the lower surface of the pawl 78 so as to bias the pawl 78 in a clockwise direction as viewed in Figure 9. A spring 80 has one end rigidly secured to the upper side of the pawl 78 and has an arcuate portion which abuts against the lower side of the pawl 79 so as to bias the pawl 79 in a clockwise direction. As shown in Figure 10, the lower portion of the pawl 78, which portion is pivoted to the pin 73, comprises two parallel spaced legs 78' which form a yoke within which the lower portion of the pawl 79 extends. As shown in Figure 5, pawls 78' and 79' are similarly mounted on the lower end of the pawl supporting member 71.

Each of the pawls 78, 79, 78', 79' engages one of the ratchet teeth 73. It should be noted that the pawls are so positioned that only one of the pawls will be in engagement with its respective ratchet tooth 73 for any particular driving angular relationship of the hub 41 with respect to the ratchet wheel 72. For instance, it will be seen in Figure 5 that as the members 70, 71 rotate clockwise to drive the ratchet wheel 72, the pawl 79 is the only pawl in driving engagement with a ratchet tooth 73 and the other pawls 78, 78' and 79' are out of driving engagement with their respective ratchet teeth 73. Each of the pawls is positioned out of phase with respect to the other pawls. That is, assuming that there are sixty ratchet teeth on the wheel 72, the angular pitch of the teeth 73 will be six degrees. It will be obvious that if only one pawl were employed there would be a lost angular motion of the hub 41 with respect to the ratchet wheel 72 of six degrees. In other words, the hub 41 might rotate six degrees in the driving direction (clockwise as viewed in Figure 5) before the single pawl would drivingly engage a ratchet tooth so as to impart the rotary motion of the hub 41 to the ratchet wheel 72. However, by employing the four pawls 78, 79, 78' and 79', each out of phase with respect to the others, the lost angular motion is reduced to one-fourth, or one and one-half degrees. It will be obvious that the lost angular motion may be further reduced by providing additional phase-spaced pawls.

A bevel gear 81 is integrally formed with or otherwise rigidly secured to the ratchet wheel 72. As best seen in Figure 4, a bracket 82 is secured to the side frame 11 and supports a bearing 83 within which is rotatably journalled a shaft 84. Non-rotatably secured to the upper end of the shaft 84 is a bevel gear 85 in engagement with the bevel gear 81. A worm gear 86 is non-rotatably secured to an intermediate portion of the shaft 84. The lower end of the shaft 84 is engaged by a conventional friction clamp which latter is secured to the side frame 11 by means of the bracket 87. Integrally formed with the side frame 11 is a bearing 89 within which is journalled a shaft 90 having a worm gear 91 secured at one end for engagement with the worm gear 86 on the shaft 84. Non-rotatably secured to the end of the shaft 90 is a spur gear 92. A large spur

gear 93 is non-rotatably secured to flange 18 and shaft 15 and engages the spur gear 92.

*Operation*

A beamer machine (not shown) is first employed for winding the warp yarn Y onto the beam 17. The wound warp yarn is then in the form of a cylindrical spool composed of long lengths of many threads arranged in parallel order. As shown in this particular embodiment of the invention, the follower 62 is slidably mounted for reciprocal movement in a vertical direction and hence gravity will tend to bias the follower 62 downwardly whereby the roller 67 will continue to maintain contact with the cylindrical outer surface of the wound warp yarn Y as said surface recedes toward the axis of the beam 17 during let off of the warp yarn Y. However, it will be obvious that means other than gravity may be used to bias the follower 62 to maintain contact with the yarn surface.

The electric motor 21 drives the shaft 26 at a constant speed through the gear 23 and the clutch 25 and thereby causes the crank plate 27 to rotate at a constant angular velocity. The crank pin 33 may be fixed in a selected position within the diametrical slot 31 so as to obtain the desired crank throw.

The end 237 of the connecting rod 37 is supported by the link 69 and follower 62 at a particular position with respect to the lever 42. The spring 48 will bias the detent 44 inwardly to engage the teeth 43 of the lever 42. As the crank plate 27 rotates, an oscillatory motion will be imparted to the lever 42, the hub 41 and the pawl supporting members 70, 71 by the connecting rod 37. The pawls constitute a one-way clutch mechanism and will ratchet over the teeth 73 on the ratchet wheel 72 as the members 41, 42, 70 and 71 rotate in a clockwise direction as viewed in Figure 1 and will drivingly engage the ratchet wheel 72 during the counterclockwise portion of the oscillatory cycle of said members, thereby converting the oscillatory motion of the lever 42 to rotary motion of the ratchet wheel 72. The bevel gear 81 will then drive the bevel gear 85, the shaft 84 and the worm gear 86. The rotary motion of the worm gear 86 will drive the worm gear 91, the shaft 90 and the spur gear 92 which latter in turn drivingly engages the spur gear 93 so as to cause the warp beam 17 to rotate and let off the warp yarn Y.

As the cylindrical surface of the wound warp yarn Y recedes toward the axis of the beam during let-off, the peripheral speed of the cylindrical spool of warp yarn would decrease if the angular velocity of the warp beam were maintained constant. Hence it is necessary to provide that the angular velocity of the warp beam 17 be increased as the yarn is being let off so as to provide a substantially constant average let-off speed of the warp yarn irrespective of the amount of yarn remaining wound on the beam 17.

As the outer cylindrical surface of the wound yarn recedes toward the axis of the beam 17, the follower 62 will move downwardly. This movement of the follower 62 allows the end 237 of the connecting rod 37 to move downwardly along the length of the lever 42 and toward the axis of the shaft 40. It will be obvious that as the distance of the position of engagement of the connecting rod 37 and the lever 42 from the axis of pin 40 decreases, the oscillatory amplitude and the angular velocity of the lever 42 will increase for a given rotary crank speed. That is, the angular velocity of the oscillating lever 42 will be inversely proportional to the distance between the position on the lever 42 engaged by the connecting rod 37 and the axis of pin 40. It will also be obvious that the downward movement of the follower 62, and hence also the downward movement of the lever-engaging end 237 of the connecting rod 37 will be directly proportional to the receding movement of the surface of the wound warp yarn toward the axis of the beam. Furthermore, the angular velocity of the rotating ratchet wheel 72, and hence the angular velocity of the rotating warp beam 17 will be directly proportional to the angular velocity of the oscillating lever 42. Therefore, the angular velocity of the rotating warp beam 17 will be inversely proportional to the distance of the surface of wound yarn remaining on the beam 17 from the axis of the latter, and the beam 17 will be accelerated as the surface of the wound yarn recedes toward the axis of the beam 17 during let-off of the yarn. That is, the average peripheral speed of the cylindrical spool of yarn wound on the beam 17, and hence the let-off speed, will remain constant irrespective of the diameter of said spool.

It should be understood that the term "constant let-off speed" as used in the specification and claims refers to the average speed and is not intended to mean that the warp yarn leaves the beam 17 at an instantaneous speed which remains the same at every instant of loom operation, since obviously the oscillation of the lever 42 will impart intermittent driving impulses to the beam 17 and the latter will accelerate and decelerate during each cycle of rotation. However, the amount of warp yarn let off during each cycle of rotation of the crank plate 27 will be substantially equal to the amount of yarn let off during any other cycle of crank plate rotation irrespective of the amount of yarn remaining wound on the beam 17, and furthermore, since the crank plate 27 rotates at a constant speed it will be seen that although the instantaneous let-off speed may vary during each cycle of rotation of the crank plate 27, the average let-off speed remains constant irrespective of the amount of warp yarn remaining wound on the beam 17.

The particular embodiment of the invention disclosed in this specification and the drawings is merely illustrative whereas the scope of the invention is delineated in the appended claims.

I claim:

1. A loom comprising a rotatably-mounted warp beam, a beam follower movably-mounted to maintain contact with the surface of warp yarn wound on the beam as said surface recedes toward the axis of the beam during let-off of the yarn, a lever mounted for pivotal oscillatory movement, means drivingly connecting the lever and the beam for converting the oscillatory movement of the lever to rotary motion of the beam whereby the angular velocity of the beam is directly proportional to the angular velocity of the oscillating lever, a constant-speed drive means, means for connecting said drive means to said lever at various positions of engagement along the length of the lever so as to oscillate said lever at an angular velocity inversely proportional to the distance of the engagement position from the center of oscillation, and means controlled by the position of the follower for varying said distance in substantially direct proportion to the distance of the follower and yarn surface from the axis of the beam.

2. A loom comprising a rotatably-mounted

warp beam, a beam follower movably-mounted to maintain contact with the surface of warp yarn wound on the beam as said surface recedes toward the axis of the beam during let-off of the yarn, a lever mounted for pivotal oscillatory movement, means drivingly connecting the lever and the beam for converting the oscillatory movement of the lever to rotary motion of the beam whereby the angular velocity of the beam is directly proportional to the angular velocity of the oscillating lever, a rotary drive crank, a connecting rod having one end connected to said crank, means for connecting the other end of the connecting rod to the lever at various positions of engagement along the length of the lever so as to cause oscillation of the lever at an angular velocity inversely proportional to the distance of the engagement position from the center of oscillation, and means controlled by the position of the follower for varying said distance in substantially direct proportion to the distance of the follower and yarn surface from the axis of the beam.

3. A loom comprising a rotatably mounted ratchet wheel, one-way-clutch pawl means warp beam, a beam follower movably-mounted to maintain contact with the surface of warp yarn wound on the beam as said surface recedes toward the axis of the beam during let-off of the yarn, a rotatably-mounted ratchet wheel, means drivingly connecting the ratchet wheel and the beam, a hub rotatably mounted for oscillatory movement about the same axis of rotation as the ratchet wheel, one-way clutch pawl means mounted on the hub for drivingly connecting the ratchet wheel and hub during one direction of rotation of the hub and allowing for ratcheting during the opposite direction of hub rotation, a lever secured to the hub, a drive means, means for connecting said drive means to said lever at various positions of engagement along the length of the lever so as to oscillate said lever and hub at an angular velocity inversely proportional to the distance of the engagement position from the center of oscillation, and means controlled by the position of the follower for adjusting said distance whereby the rotary speed of the beam may be controlled by the distance of the surface of the wound warp yarn from the axis of the beam.

4. A loom comprising a rotatably-mounted warp beam, a beam follower movably-mounted to maintain contact with the surface of warp yarn wound on the beam as said surface recedes toward the axis of the beam during let-off of the yarn, a rotatably mounted ratchet wheel, means drivingly connecting the ratchet wheel and the beam, a hub rotatably mounted for oscillatory movement about the same axis of rotation as the ratchet wheel, one-way-clutch pawl means mounted on the hub for drivingly connecting the ratchet wheel and hub during one direction of rotation of the hub and allowing for ratcheting during the opposite direction of hub rotation, a lever secured to the hub, a constant speed rotary drive crank, a connecting rod having one end connected to said crank, means for connecting the other end of the connecting rod to the lever at various positions of engagement along the length of the lever so as to cause oscillation of the lever and hub at an angular velocity inversely proportional to the distance of the engagement position from the center of oscillation, and means controlled by the position of the follower for adjusting said distance whereby the rotary speed of the beam may be controlled by the distance of the surface of the wound warp yarn from the axis of the beam.

5. A loom comprising a rotatably mounted warp beam, a beam follower movably mounted to maintain contact with the surface of warp yarn wound on the beam as said surface recedes toward the axis of the beam during let-off of the yarn, a lever mounted for pivotal oscillatory movement, means drivingly connecting the lever and the beam for converting the oscillatory movement of the lever to rotary motion of the beam whereby the angular velocity of the beam is directly proportional to the angular velocity of the oscillating lever, a constant speed rotary drive crank, a connecting rod, means connecting one end of said rod to said crank at a point eccentric to the axis of rotation of the latter, the other end of the connecting rod being connected to said follower, and means mounted at said other end of the rod for engaging said lever so as to enable the connecting rod to oscillate the lever, whereby movement of the follower will control the position on the lever of the engagement of said other end of the connecting rod and thereof adjust the angular velocities of the lever and the beam in accordance with the amount of warp yarn remaining wound on the beam.

6. The combination set forth in claim 5 wherein the lever is arcuate-shaped approximately in the form of a segment of a circle having its center approximately coincident with the axis of rotation of the crank.

7. The combination set forth in claim 5 wherein the lever has a series of teeth and said means for engaging the lever comprises a spring-pressed detent engageable with said teeth and adapted to ratchet freely thereover in a direction toward the axis of oscillation of the lever when said other end of the connecting rod is moved by the follower toward said axis of oscillation.

8. The combination set forth in claim 5 wherein said means for engaging the lever is freely movable with respect thereto in a direction along the lever toward the axis of oscillation of the lever whereby said other end of the connecting rod may be moved by the follower toward said axis of oscillation.

9. The combination set forth in claim 5 wherein said means for connecting said one end of the connecting rod to the crank comprises a crank pin rotatably secured to said one end of the rod, said crank having a slot extending radially from the axis of crank rotation, and adjustable means for securing an end of said crank pin in any selected position within said slot, whereby the throw of the crank may be adjusted to select a desired oscillatory amplitude and angular velocity of the lever.

CHARLES ROSS BEALL.

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