Dec. 3, 1929. J. LUCAS 1,737,600

MECHANISM FOR CONTROLLING THE WARP YARN SUPPLY ON WEAVING MACHINES

Filed Jan. 8, 1927 3 Sheets-Sheet 1

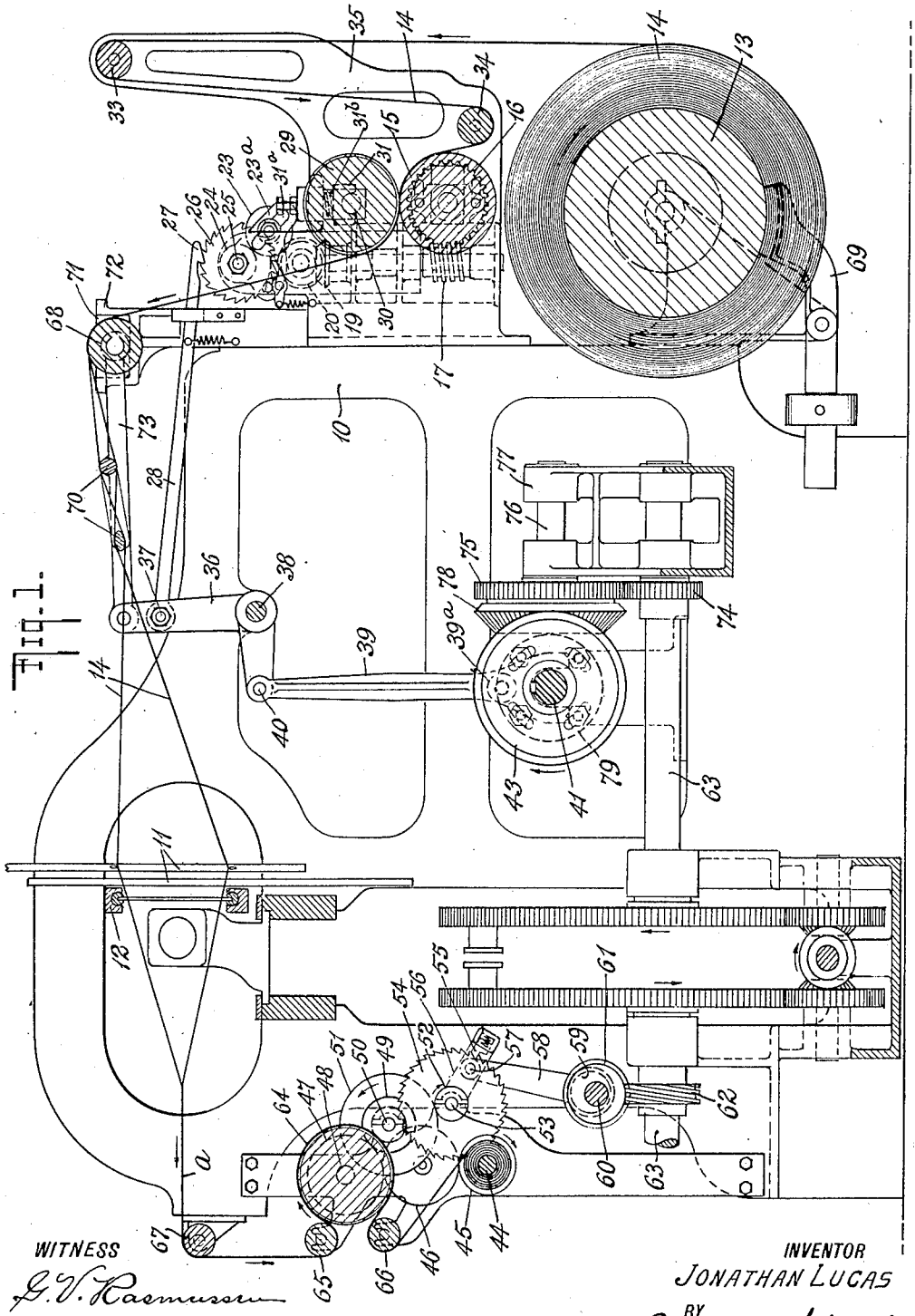


Fig. 1.

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Fig. 3.

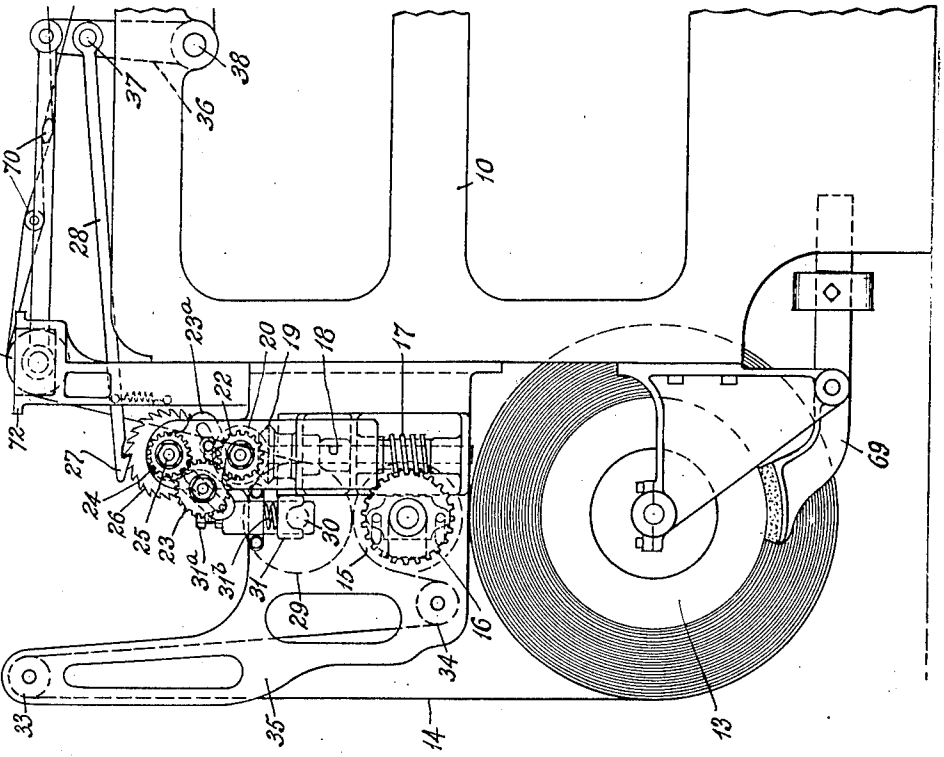
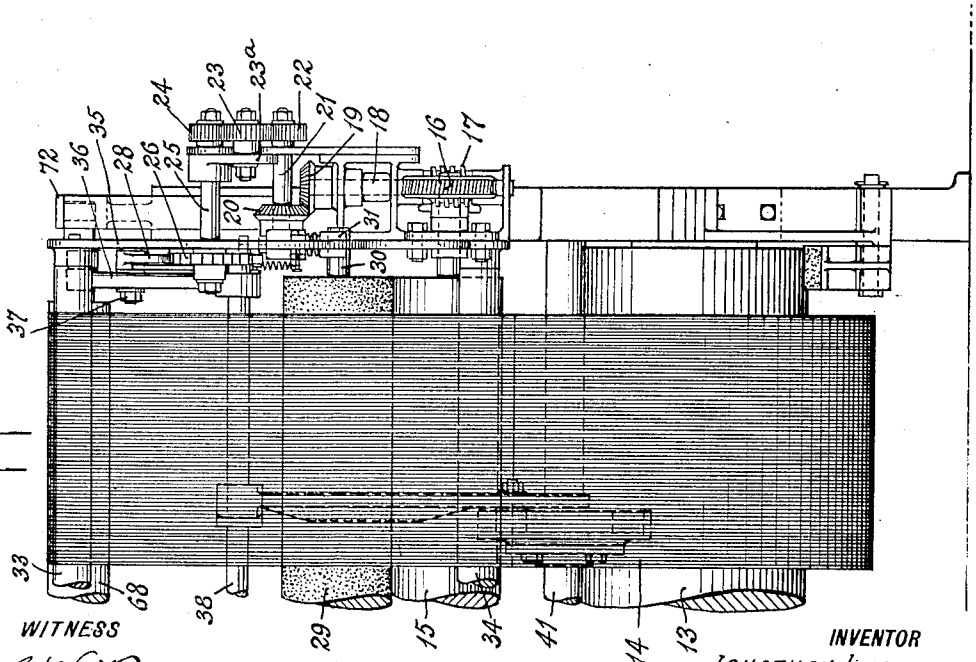


Fig. 2.



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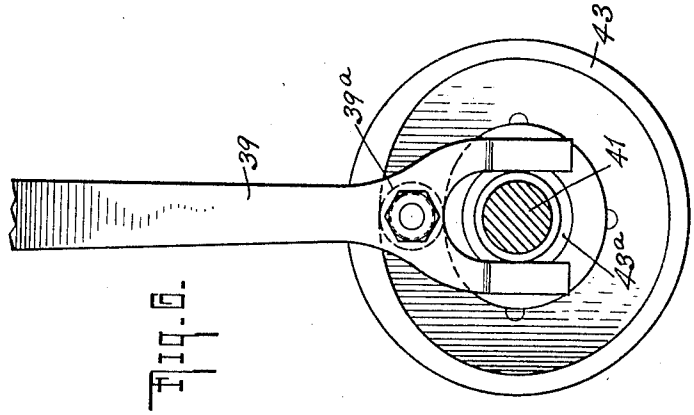


Fig. 6.

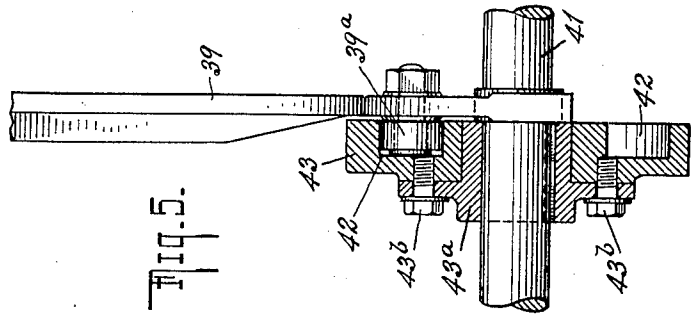


Fig. 5.

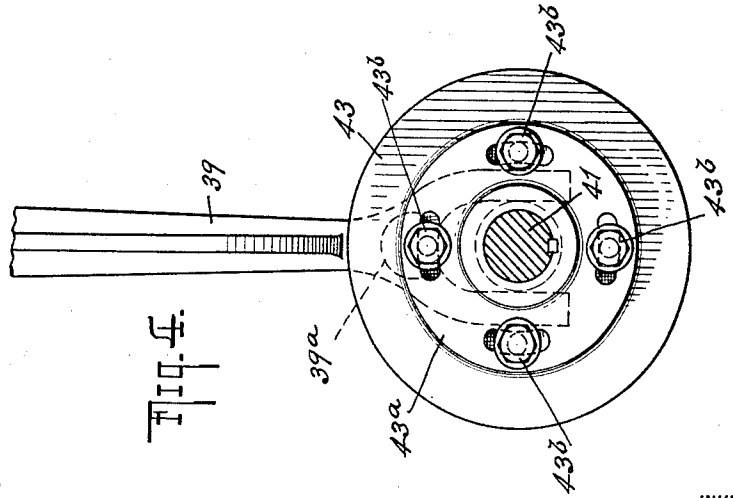


Fig. 4.

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Patented Dec. 3, 1929 1,737,600

UNITED STATES PATENT OFFICE

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MECHANISM FOR CONTROLLING THE WARP-YARN SUPPLY ON WEAVING MACHINES

Application filed January 8, 1927. Serial No. 159,759.

My invention relates to machines for weaving fabrics, of the class commonly referred to as looms, and more particularly to the mechanism thereof which controls the supply of warp yarns to the shed and fell line. Heretofore it has been the custom to let off the yarns from the warp beam in successive steps by the action of the picking ratchet of or on the sand roll associated with the cloth roll as the latter is operated to wind up the woven fabric. Under such conditions the warp beam is rotated by the pull of the yarns, resisted by the action of a brake upon said warp beam, so that the feed of the warp yarns is an impositive one and ofttimes is at variance with the pick of the fabric being woven. The warp yarns are accordingly supplied in varying degrees to the shed which results in uneven and otherwise defective weaving. The object of my invention is to overcome the inaccuracies and defects of such arrangements by providing a take-off motion in combination with a take-up motion, in contradistinction to a let-off motion, of simple and efficient design whereby the supply of warp yarns to the shed is positively controlled in uniform and accurate harmony with the picks of the fabric being woven. The movements of the "take-off" (warp beam) and the "take-up" (cloth roll) are separate and independent of each other, each member operating at its own correct speed which is dependent upon the character of the particular fabric being woven. The invention contemplates further the provision of a novel mechanism constructed and arranged to maintain the warp yarns in the shed under an even tension during the reversal of the yarns in the shed. Other more specific objects will appear from the description hereinafter and the features of novelty will be pointed out in the claims.

Reference is to be had to the accompanying drawings which illustrate an example of the invention without defining its limits and in which Fig. 1 is a diagrammatic sectional elevation of a loom with the invention incorporated therein; Fig. 2 is a fragmentary rear end view; Fig. 3 is a fragmentary side elevation; and Figs. 4, 5, and 6 are detail views of an operating cam forming part of the construction.

As shown in the drawings, the loom comprises a frame 10 of suitable dimensions and customary construction provided with the conventional harness frames 11 which are reciprocated in vertical directions in inverse relation to each other to reverse the yarns in the shed in the well known way. The customary beater mechanism, including the usual reed 12 for laying the weft threads, also forms part of the loom; the latter, in addition to the parts to be hereinafter described in detail, may include any and all features commonly found in weaving mechanisms of the type in question. The mechanism for controlling the supply of warp yarns to the shed comprises a warp beam 13 which is rotatably mounted in a suitable manner upon the frame 10 and contains a supply of warp yarns 14 in the well known way. The controlling mechanism further includes a take-off roll 15 journaled in suitable bearings upon the frame 10 and provided with a friction surface; that is to say, the outer surface of the roll may be sanded or provided with any other suitable friction material such as cork or the like whereby a grip is developed upon the warp yarns 14 as will be described more fully hereinafter. The take-off roll 15 is driven in the required manner, that is to say, in successive steps corresponding accurately with the picks of the woven fabric in any suitable manner; for instance, as shown in the drawing, a worm gearing comprising a worm wheel 16 fixed upon the shaft of the take-off roll 15 and meshing with a worm gear 17 located upon an upright shaft 18 may be provided for this purpose. The shaft 18 is mounted in suitable bearings upon the frame 10 and carries a bevel pinion 19 in mesh with a cooperating bevel pinion 20 mounted upon a counter-shaft 21 also journaled in bearings upon the frame 10. The shaft 21 in addition carries a pinion 22 arranged in mesh with an idler pinion 23, the latter in turn being in mesh with a pinion 24 carried by a shaft 25 also rotatably mounted upon the frame 10. The shaft 25 constitutes the driving shaft and is intermittently operated in successive steps by means

of a ratchet wheel 26 fixed upon the shaft 25 and a pawl 27 carried by or forming part of a lever 28 reciprocated in the manner which will be more fully set forth hereinafter. An idler roll 29 is carried by a shaft 30, journaled in blocks 31 vertically adjustable upon the frame 10 and pressed resiliently downwardly, for instance by means of bolts 31^a mounted on the frame 10 and acting to compress springs 31^b; the surface of the roll 29 is covered with felt or similar cushioning material and is pressed against the take-off roll 15 to grip the yarns 14 by means of said bolts 31^a and springs 31^b bearing on the blocks 31 as clearly shown in Fig. 1. To eliminate any inequalities in the tension of the warp yarns 14 on the warp beam 13 and in order to bring all of the yarns in question to the take-up roll 15 at a uniform tension, rolls 33 and 34 are mounted upon suitable brackets 35 carried by the frame, for instance as indicated in Fig. 1. As shown in Fig. 1, the roll 33 is located at a considerable distance above the take-off roll 15 while the roll 34 is placed in close proximity to said take-off roll 15. As previously stated herein, any suitable mechanism may be provided for reciprocating the lever 28 in a manner to bring about the step by step operation of the ratchet 26 and the corresponding intermittent rotation of the take-off roll 15 through the medium of the worm gearing 16—17 and associated elements. In the illustrated example the means referred to comprises a bell-crank lever 36 to which the one end of the lever 28 is pivoted at 37. The bell-crank lever 36 is fixed upon a shaft 38 suitably journaled upon the frame 10 and rocked by means of a link 39 pivotally connected at 40 with the bell-crank lever and having its lower end forked to straddle a power-shaft 41 as shown in Fig. 1. The link 39 carries a roller 39^a located in the cam groove 42 of a cam 43 fixed upon the shaft 41. Power is applied to rotate the latter in any suitable manner, it being understood that the groove 42 of the cam 43 is so constituted as to bring about a rocking of the bell-crank lever 36 and its shaft 38 and a consequent horizontal reciprocation of the lever 28 and its pawl 27.

The controlling mechanism further includes a cloth roll 44 suitably journaled upon the frame 10 at the front end thereof, upon which the woven fabric is wound. This cloth roll 44 is driven in intermittent steps in harmony with the picks of the fabric to wind the fabric thereon by any suitable mechanism. In the illustrated example the driving mechanism in question comprises a friction wheel or gear 45 fixed upon the shaft of the roll 44 and engaging an idler friction wheel or gear 46 journaled upon the frame 10 and in turn engaging a similar friction gear 47 mounted upon a shaft 48 which is rotatably mounted on the frame 10. The gear 47 in turn is operated by a pinion 49 located upon a shaft 50 journaled upon a frame 10 and carrying a friction gear 51 which meshes with a pinion 52. The latter is fixed upon a shaft 53 suitably mounted upon a frame 10 and provided with a ratchet wheel 54. In the drawings this ratchet 54 is actuated by means of a pawl 55 carried by an arm 56 pivotally mounted upon the shaft 53 and pivotally connected at 57 with one end of an arm 58, the other end of which is connected with an eccentric 59. The latter is fixed upon a shaft 60 which also carries a worm gear 61 meshing with a cooperating worm gear 62 fixed upon a counter shaft 63 of the loom. A sand roll or other friction roll 64, is mounted upon the shaft 48 in close proximity to idler rolls 65 and 66 journaled upon the frame 10 at points above and below the shaft 48, as shown in Fig. 1, an additional roll 67 being journaled upon the frame 10 at a distance above the roll 65. A whip roll 68 is located upon the frame 10 in proper relation to the controlling mechanism, as shown in Fig. 1.

As the loom is operated to carry on the weaving operation the link 28 will be reciprocated by the action of the cam 43 and its associated elements to cause the ratchet 26 to be rotated in intermittent successive steps to thereby correspondingly operate the gears 24, 23 and 22 and the bevel pinions 20 and 19 which results in a rotation of the shaft 18. This brings about a corresponding operation of the worm gear 17—16 and accordingly rotates the take-off roll 15 in intermittent successive steps each of which corresponds accurately with a pick of the fabric being woven. Because of the frictional engagement between the warp yarns 14 and the take-off roll 15 and because of the action of the felt covered roll 29 to press the warp yarns into surface engagement with said take-off roll 15, this step by step rotation of the take-off roll will cause the yarns 14 to be withdrawn in corresponding successive steps from the warp beam 13. In order to prevent overrun of the warp beam a brake 69 may be provided, said brake being of a small load just sufficient to prevent such overrun. The yarns 14 before they reach the take-off roll 15 pass over the rolls 33 and 34 as illustrated in Fig. 1. The yarns 14 are passed over the rolls 33 and 34 for the purpose of eliminating any inequalities in tension of the warp yarns on the beam so that said yarns will reach the take-off roll all at the same tension. The yarns 14 after passing between the rolls 15 and 29 pass over the whip roll 68 and over and under the customary leese rods 70 to the harness frames 11. The latter are reciprocated vertically in inverse relation to each other to reverse the yarns in the shed in the well known way and in proper sequence with the operation of the customary shuttle, and the reed 12 is synchronously operated to lay the filler threads in the conventional manner. The woven fab-

ric *a* after passing successively over the rollers 67 and 65 passes over the sand roll 64 and the roll 66 to the frictionally driven cloth roll 44. The latter being driven in intermittent successive steps by the ratchet 54 and pawl 55 and associated mechanism operates to wind up the finished fabric as the weaving proceeds, the friction connection between the ratchet drive and the cloth roll absorbing the increased take-up as the roll increases in diameter. With the arrangement described the yarns are positively taken off from the warp beam in contradistinction to being let off therefrom as in the old forms and are positively fed into the shed in exact accordance with the picks of the fabric being woven. The control of the take-off of the yarns from the warp beam is therefore positive and the feed of the said yarns into the shed and to the fell line accordingly takes place in positive steps in uniform and accurate harmony with the picks of the fabric being woven. As a result of this, the weave of the fabric is uniform and reliable and defects therein are reduced to a minimum or avoided entirely. By substituting pinions 22 of different predetermined dimensions the feed of the yarns 14 into the shed may be adjusted in accordance with any pick which may be desired. In machines heretofore employed no account was taken of the fact that the warp yarns are coiled about the filler threads in the woven fabric, going over one thread and under the next alternately. It results from this coiling of the warp that the total length of warp yarn fed to the shed is actually longer than the length of cloth woven. It has been the common practice to feed the warp yarn at the same speed as the circumferential speed of the cloth roller. This practice, in view of the fact that the woven cloth was shorter than the warp yarn fed to the shed, created tension in the cloth and warp yarn which caused slipping of friction rollers or breaking of the yarn which unfavorably affected the yield and quality of cloth obtained from the machine.

By means of the removable and interchangeable gear 22 above described, applicant is enabled to increase the speed of the warp yarn over the circumferential speed of the cloth roller 44 and also to vary such increase of speed. The magnitude of this additional increment of speed of the warp threads over the woven cloth will depend not only upon the number of picks, but also upon the thickness of the warp and filler threads. In the illustrated example the pinion 22 is removed and replaced by another for this purpose, the pinion 23 being adjustably mounted in a slotted arm 23^a in order to permit said pinion 23 to be adjusted to different positions to properly mesh with the different pinions 22; to still further facilitate this adjustment of the pinion 23 the arm 23^a may be loosely mounted upon the shaft 25 so as to be capable of pivotally swinging thereon. To still further reduce the possibility of defects in the weaving, I have provided a mechanism constructed and arranged to maintain the warp yarns in the shed under an even tension during the reversal of the yarns in said shed.

In existing arrangements, the distance between the harness frames, and the whip roll being fixed, the warp yarns in the shed slacken up or are under a varying tension as the reversal of the yarns in the shed takes place. To overcome this objection and to maintain the yarn in the shed under an even tension at all times, the whip roll 68 instead of being rotatable upon a fixed axis as in existing looms, is journaled in bearing blocks 71, which are capable of horizontal sliding movements in bearings 72, forming part of or secured to the frame 10. To bring about a shifting of the whip roll toward and away from the harness frames to an extent necessary to maintain the warp yarns under an even tension at all times, a link 73 is pivotally connected at one end with the shaft of the whip roll 68 and at its other end with the bell-crank lever 36 which is extended upwardly for this purpose, and a corresponding link 73 is connected with the other end of the shaft of the whip roll 68 and with another bell-crank lever 36 fixed upon the farther end of rock shaft 38 as viewed in Fig. 1. In the preferred arrangement, the previously mentioned cam 43 is adjustably fixed upon the shaft 41 for instance by being adjustably mounted on a hub 43^a which is fixed upon the shaft 41, as shown in Figs. 4 and 5. The cam 43 is adjustable relatively to the hub 43^a and to the shaft 41, in order to bring about a proper timing of the compensating movement of the whip roll 68 in accordance with the harness motion of the particular loom in question, and is fixed in its adjusted positions in any suitable manner as by means of a bolt or the like 43^b. With this arrangement, as the previously described operations of the loom take place, the cam 43 actuated by the rotation of the shaft 41, will through the medium of the roller 42 and link 39, rock the bell-crank lever 36 in a manner to reciprocate the lever 28 in the manner and for the purposes hereinbefore set forth. At the same time the actuation of the bell-crank lever 36 will rock the shaft 38 and accordingly will bring about a corresponding actuation of the other bell-crank lever 36 which is not shown in the drawings. As a result of this the links 73 will be reciprocated horizontally and will correspondingly reciprocate the whip roll 68 in horizontal directions. The adjustment of the cam 43 and the dimensions and the relation of the parts are so proportioned that the reciprocation of the whip roll 68 is such that the warp yarns 14 in the shed will at all times be maintained under an even tension. That

is to say, as the vertical dimensions of the shed are reduced due to the changing position of the harness frames 11, the whip roll 68 will be moved in a direction away from said harness frames to the slight extent necessary to take up the slack in the yarns 14, which otherwise would occur; similarly, as the shed opens up, the whip roll will be adjusted toward the harness frames 11, to compensate for the decrease in the length of the warp yarns which takes place because of this adjustment.

The mechanism illustrated and described whereby the whip roll is adjusted automatically to compensate for the reversal of the yarns, in the shed and to maintain said yarns under a uniformly even tension is of the simplest character and operates it in a most efficient manner. As a result, breakage or other injury to the yarns in the shed is reduced to a minimum or is eliminated entirely. It will, of course, be understood that the devices herein shown and described, are constructed and arranged to operate in proper synchronism with the harness movement and with the remaining mechanism of the loom which may be of any conventional type.

In order to transmit motion from the shaft 41 to the shaft 63 the latter may carry a pinion 74 arranged in mesh with a gear 75 fixed upon a jack shaft 76 journaled in suitable bearings 77. The shaft 76 also carries a bevel gear 78 in mesh with a corresponding bevel gear 79 fixed on the shaft 41 whereby the two shafts 41 and 76 are operatively connected.

Various changes in the specific form shown and described may be made within the scope of the claims without departing from the spirit of my invention.

I claim:

1. In a weaving machine, the combination of a warp beam, a take-off roll, operating mechanism for positively and intermittently rotating said take-off roll in successive steps predetermined by the picks of the fabric being woven to feed the warp yarns from the warp beam to the shed and fell line, a cloth roll, actuating mechanism for actuating said cloth roll in successive steps corresponding to the movement of said take-off roll, said take-off roll operating mechanism including an adjustable element adapted to control the magnitude of the intermittent angular displacements of said take-off roll, whereby the extent of movement of said take-off roll may be varied independently of said cloth roll.

2. In a weaving machine, the combination of a warp beam, a take-off roll, operating mechanism for positively and intermittently rotating said take-off roll in successive steps predetermined by the picks of the fabric being woven to feed the warp yarns from the warp beam to the shed and fell line, a cloth roll, actuating mechanism for rotating said cloth roll in successive steps corresponding to the movement of said take-off roll, and means for varying the extent of movement of said take-off roll independently of said cloth roll, said means forming part of the operating mechanism for said take-off roll and including a driving gear, an arm pivoted coaxially therewith, an idler gear mounted on said arm, and a removably mounted driven gear arranged to drive said take-off roll, said idler gear being adjustable to mesh with said driving and driven gears.

3. In a weaving machine, the combination of a warp beam, a take-off roll adapted to draw the warp yarns from said beam and feed the same to the shed and fell line, operating mechanism connected to said take-off roll for positively and intermittently rotating the same in successive steps predetermined by the picks of the fabric being woven, said mechanism being adjustable to vary the magnitude of the intermittent angular displacements of said take-off roll in accordance with the character of the fabric being woven.

4. In a weaving machine, the combination of a warp beam, a take-off roll adapted to draw the warp yarns from said beam, gearing operatively connected with said take-off roll, pawl and ratchet mechanism for intermittently operating said gearing in successive steps predetermined by the picks of the fabric being woven, whereby said take-off roll is actuated to feed the warp yarns positively from the warp beam to the shed of the loom, a cloth roll, and independent pawl and ratchet mechanism for actuating said cloth roll in successive steps corresponding to the feed of said take-off roll.

5. In a weaving machine, the combination of a warp beam, harness frames movable vertically in inverse relation to reverse the warp yarns in the shed, a whip roll, mechanism for driving said beam intermittently including a ratchet wheel, a shaft, a bell-crank, a connection between said shaft and said bell-crank to oscillate the latter, a pawl actuated by said bell-crank and engaging said ratchet wheel, and a connection between said whip roll and said crank whereby said roll is oscillated toward and away from said harness frames to maintain said yarns under a uniform tension during reversal thereof in the shed.

In testimony whereof I have hereunto set my hand.

JONATHAN LUCAS.