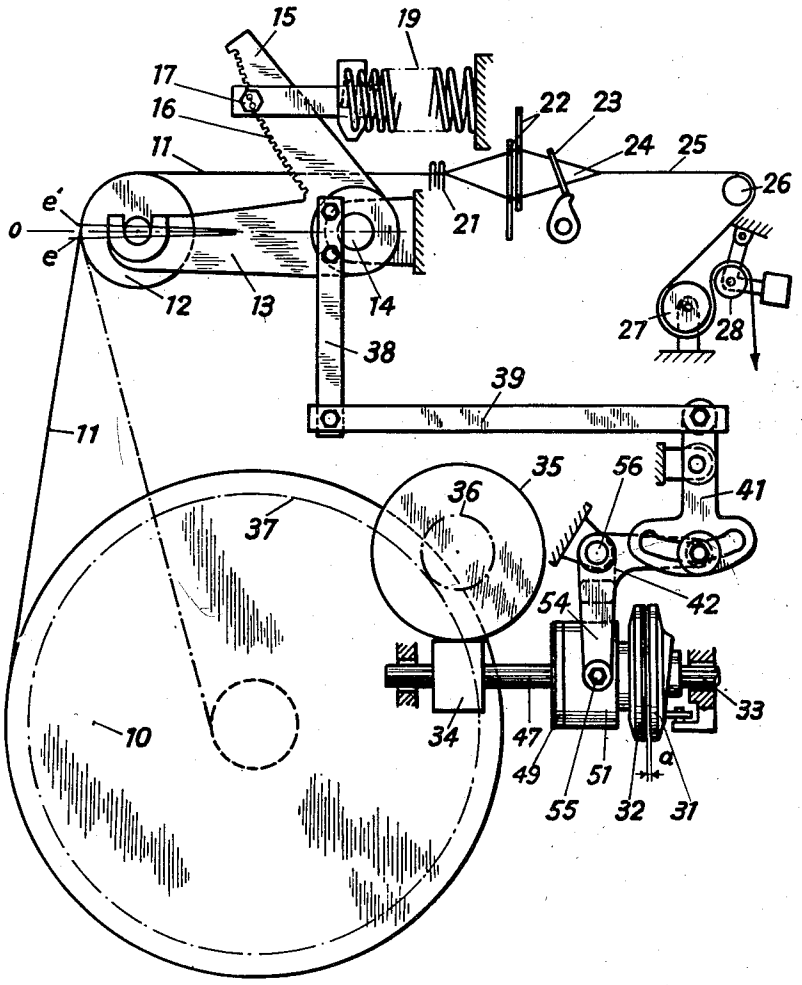
Jan. 14, 1958 E. PFARRWALLER 2,819,734

APPARATUS FOR CONTROLLING THE WARP IN A LOOM FOR WEAVING

Filed Jan. 26, 1954 4 Sheets-Sheet 1

Fig. 1



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APPARATUS FOR CONTROLLING THE WARP IN A LOOM FOR WEAVING

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Fig. 2

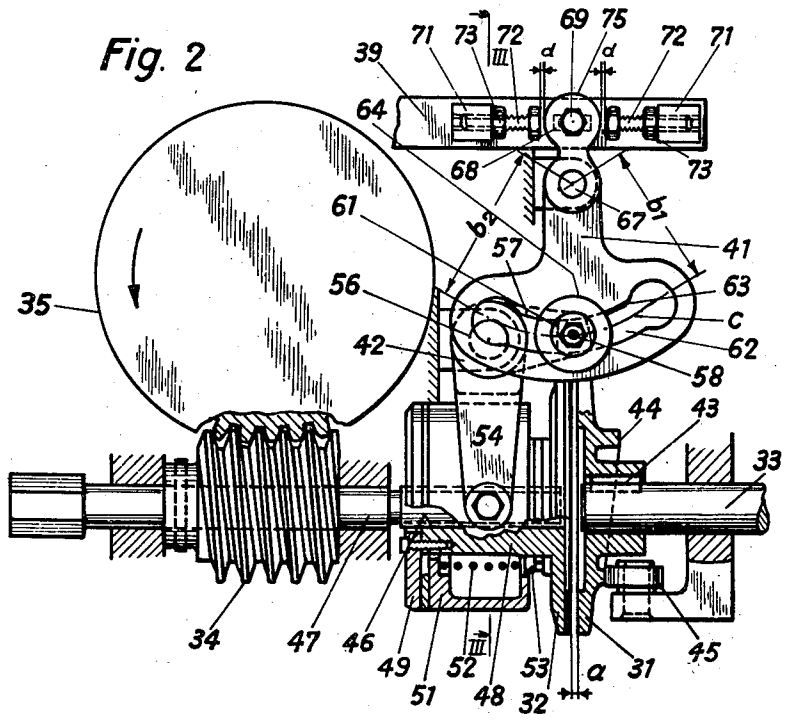
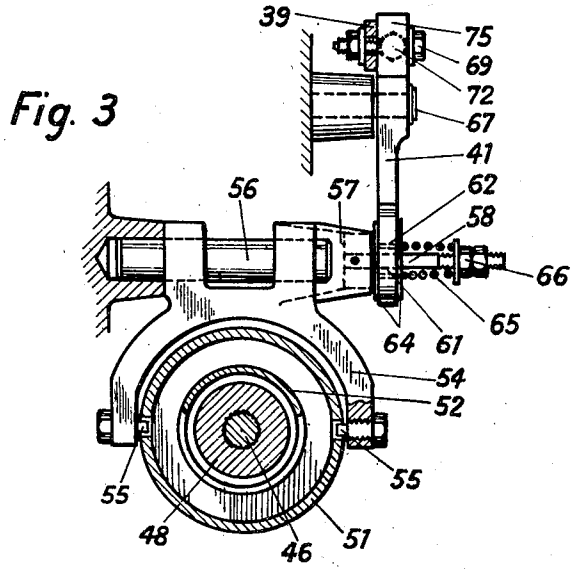


Fig. 3



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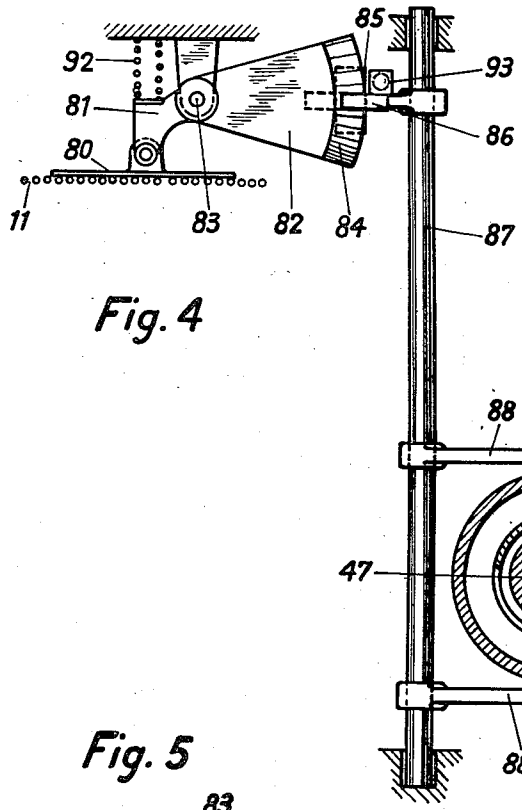
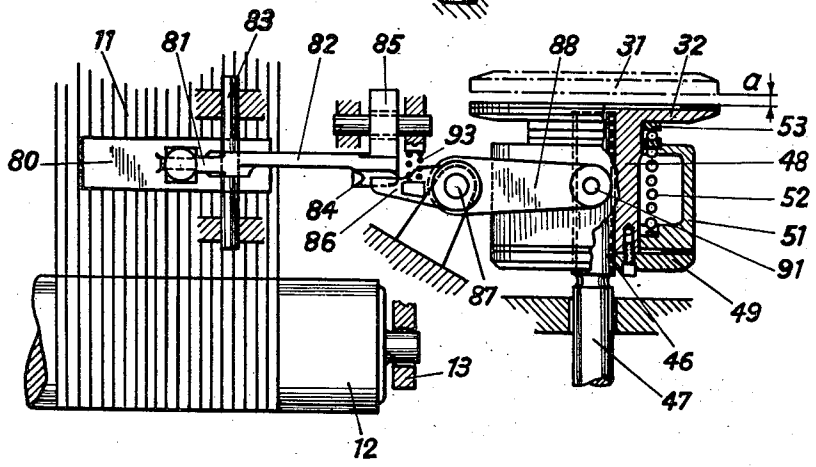


Fig. 4

Fig. 5



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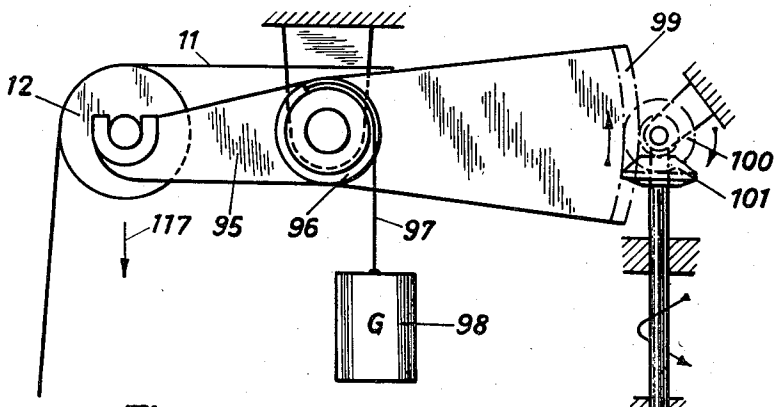
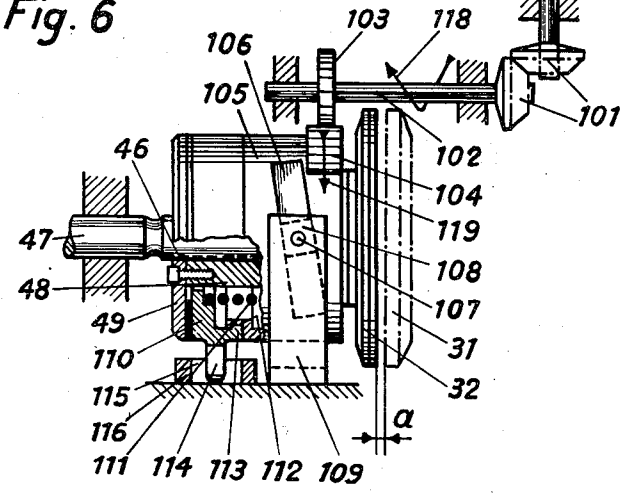


Fig. 6



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APPARATUS FOR CONTROLLING THE WARP IN A LOOM FOR WEAVING

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Application January 26, 1954, Serial No. 406,116

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12 Claims. (Cl. 139—110)

The present invention relates to an apparatus for controlling the warp in a loom for weaving whereby the warp is periodically advanced, by means of a clutch having a driving part operated by the loom drive.

It is known to effect the advance of the warp by means of a clutch driven by the loom drive, the clutch including a spring which also temporarily affects the warp tension. Since the same spring affects the warp tension and produces the clutch pressure, the mechanism for controlling the warp tension must be locked while the clutch is engaged so that the clutch pressure cannot affect the warp tension.

An object of the invention is the provision of an apparatus for controlling the warp in a loom without interruption, since it is undesired in certain cases to stop the mechanism for controlling the warp tension.

According to the invention not only the duration of the warp advance is controlled by axially moving a clutch part according to the position of an element serving for supervising the change of the length of the warp threads between the warp beam and the fabric, the element being connected with the clutch by a mechanical linkage, but also a self-locking mechanism is interposed in the linkage which mechanism prevents transmission of a force to the supervising element, which force is produced during the warp advance in the clutch actuated by the supervising element.

The novel features which are considered characteristic of the invention are set forth with particularity in the appended claims. The invention itself however and additional objects and advantages thereof will best be understood from the following description of embodiments thereof when read in connection with the accompanying drawing in which:

Fig. 1 is a schematic illustration of a warp tension control system, according to the invention,

Fig. 2 is a part sectional large scale side view of a clutch and self-locking device forming part of the system, shown in Fig. 1;

Fig. 3 is a sectional view along line III—III in Fig. 2;

Fig. 4 is a part sectional front view of a modified system, according to the invention in which the self-locking device is combined with the warp tension supervising element;

Fig. 5 is a part sectional top view of the system, according to Fig. 4;

Fig. 6 is a part sectional side view of a further modification of the system, according to the invention, in which the self-locking device is combined with the driven part of the clutch.

The same numerals designate the same parts in all figures.

Fig. 1 is a diagrammatic illustration of a loom having a warp beam 10 from which a warp 11 is unwound, the warp being laid over a warp tensioning beam 12 whose ends are supported by levers 13 individually swingable on pins 14 which are mounted on the frame

of the loom. The levers 13, which supervise the length of the warp between the warp beam and the fabric, individually have an arm 15 provided with indentations 16 for receiving a bolt 17 connected with a tension spring 19. The latter has one end connected with the frame of the loom and tends to tension the warp 11 by actuating the lever 13. The warp 11 travels from the tensioning beam 12 through the warp feelers 21, through the heddles 22, and through the reed 23. After insertion of the weft threads 24, the fabric 25 is formed which travels around a beam 26, a fabric movement control beam 27, and a yieldingly supported roller 28 which presses the fabric against the beam 27. Thereupon the fabric is wound on a cloth beam, not shown.

A warp control mechanism is provided for rotating the warp beam 10. This mechanism includes a clutch 31, 32 which is driven by a shaft 33 connected with the loom drive and which periodically or interruptedly drives a tooth wheel 37 of the warp beam 10 by means of a worm 34 and tooth wheels 35 and 36. An arm 38 is connected with the lever 13 for actuating a lever 41 by means of a link 39, lever 41 actuating an elbow lever 42 which determintes the position of the clutch part 32.

Fig. 2 shows that the clutch disc 31 is axially movable on the shaft 33, but cannot rotate relatively to the shaft because of a key 43. The clutch disc 31 is provided with a cam 44 cooperating with a cam follower roller 45 mounted on the loom frame. The clutch disc 32 is axially movable on a splined shaft 47 carrying the worm 34 and is not rotatable on the shaft 47 because of splines 46.

The clutch disc 32 is provided with a sleeve 48 surrounding the shaft 47. A brake disc 49 is bolted to the left end of the sleeve 48. The disc 49 rests against a casing 51 containing a spring 52 pressing with its left end against the interior end wall of the casing and with its right end against an axial bearing 53 which surrounds the sleeve 48 and rests against the clutch disc 32. The spring casing 51 is held between the prongs 54 of one arm of the elbow lever 42 by means of pins 55 screwed into the prongs and extending into apertures in the spring casing. The pins 55 move on an arc, if the lever 42 rotates about its fulcrum 56 which is fast on the loom frame. For this reason, either the apertures in the casing 51 are vertically elongated, or the bore in the left end wall of the spring casing receiving the sleeve 48 and the bore in the right end receiving the axial bearing 53 are made so large that the spring casing can move up and down.

A bolt 58 is fixed to the end of a horizontal arm 57 of the lever 42. The bolt carries a slide member 61 which is movable in a slot 62 of the lower portion 63 of the lever or guide member 41. A washer 64 is provided on the bolt 58 on each side of the portion 63, the washers being pressed against the portion 63 by means of a spring 65 whose tension is adjustable by manipulation of nuts 66. The lever 41 swings about a stationary fulcrum 67, the link 39 being slidably connected with the lever 41 by means of a bolt 69 which is fast on the lever 41 and extends through a horizontal slot 68 in the link 39. Adjusting screws 72 and 72′ are individually screwed into bosses 71 and 71′ of the link 39 and held in position by means of nuts 73, 73′, respectively.

The device operates as follows:

The roller or beam 27 is continuously rotated by the loom drive to produce the desired density of the fabric when the weft threads 24 are beaten up. The warp 11 is correspondingly advanced. This advance is effected by intermittent rotation of the warp beam 10 by the loom drive through the clutch 31, 32. If there is a difference between the length of the wound up fabric 25 and the advance of the warp 11, the position of the warp ten-

sioning beam 12 changes. If the advance is too small, the beam 12 is lowered and if the advance is too great, the beam 12 is raised.

The time between two actuations of the warp beam may be different if the beam is not regularly actuated but only according to the advance requirements of the warp, i. e. at each predetermined deviation *e* or *e'* of the warp tensioning beam 12 from its center position *o*. The warp beam may also be actuated periodically, for example in synchronism with the shuttle picks. If the shaft 33 rotates at the same speed as the main shaft of the loom, the duration of the periodic rotations of the warp beam 10, i. e. of the engagement of the clutch 31, 32, corresponds to an angle whose size is regulated and whose occurrence is chosen according to other loom operations, for example the picking of the shuttles.

If the speed of rotation of the clutch 31, 32 is greater than that of the main loom shaft or if the actuation of the warp beam is irregular, the clutch 31, 32 may make one or more revolutions between its engagement and its disengagement.

Since the cam 44 has an ascending and a descending portion and lies against the roller 45, which is rotatable on a stationary pin mounted on the loom frame, the clutch disc 31 is moved to the left from the position shown in Fig. 1 by the ascending portion of the cam during one revolution of the shaft 33 so that it comes to rest against the disc 32 after travelling through the clearance *a*, pushing disc 32 to the left upon farther movement of the disc 31 to the left. This causes disengagement of the brake disc 49 from the spring casing 51. The spring 52, which is pretensioned, produces the required clutch pressure so that the shaft 47 is rotated and the worm 34 is rotated until the clutch disc 31 is removed from the disc 32 when the disc 31 moves to the right because of the descending portion of the cam 44. The brake disc 49 rests again against the spring casing 51 braking the shaft 47 and the worm 34. The latter has rotated through an angle whose size depends on the angle through which the disc 31 has rotated as long as the clutch 31, 32 was engaged. Provided that the shaft 33 rotates at the same speed as the main shaft of the loom, the last mentioned angle is in most cases considerably smaller than 360°, even at greatest duration of the periods of engagement of the clutch. However, the angle may be temporarily as great as 360°. The ascending and the descending portions of the cam 44 may extend through equal angles. In order to effect a smooth engagement of the clutch and a rapid disengagement of the clutch and a quick braking of the warp beam 10, the ascending portion may be considerably larger, for example extending through an angle of 270° and the descending portion may extend through an angle of 90°. The pretension of spring 52 is preferably so great that the disc 32 is taken along by the disc 31 without slipping, even at greatest load.

The warp beam 10 is somewhat rotated at each revolution of the shaft 47 and a length of the warp 11 is unwound from the warp beam. The tension of the warp 11 is maintained by the tension spring 19. If the length of the warp 11, which is unwound from the warp beam 10, corresponds to the length of the cloth pulled off by the beam 27, the position of the warp tensioning beam 12 and the tension of the warp 11 remain unchanged.

If the position of the spring casing 51, i. e. if the clearance *a* between the clutch discs 31 and 32 in the right end position of disc 31 is not changed, the angle of rotation of the warp beam 10 remains unchanged at each revolution of the shaft 33; the warp unwound from the largest diameter of the warp beam 10, however, is greater than the length of the warp 11 which is unwound at the same angle of rotation, if the warp beam 10 is almost empty.

Notwithstanding other influences, the shortening of the unwound warp 11 would cause a lowering of the tensioning beam 12, because of the constant operation of the beam 27. Upon lowering of the tensioning beam 12, lever 13 swings counterclockwise, moving the lever 38 so that the link 39 is moved to the right. If there is no clearance between the adjusting screw 72 and the head 75 of the lever 41, the latter is taken along by the link 39.

The lever 41 rotates clockwise and the slide 61 moves closer to the rotation axis 67, because the distance b_1 between the right end of the arc *c* in the center of the slot 62 and the rotation axis 67 is smaller than the distance b_2 at the left end. Therefore, the arm 57 is raised and the lever 42 is turned counterclockwise, pushing the fork 54 of the spring housing 51 and also the disc 32 to the right so that the clearance *a* is reduced.

The condition set forth above has the effect that the clutch disc 31 contacts the disc 32 sooner and the discs remain in contact during a greater angle of rotation of the shaft 33. Therefore, the shaft 47 and the warp beam 10 are also rotated through a greater angle. Due to the greater length of the warp 11 unwound from the beam 10 the tensioning beam 12 is raised a little and, if the length of the warp, which was unwound before the aforedescribed adjustment, was too short, the tensioning beam 12 will remain in the new position and the reduced clearance *a* will remain unchanged. The spring 19 or the position of the bolt 17 and the position of the arm 15 can be so arranged that the tension of the warp will remain almost the same in spite of the slight movement of the beam 12 about the axis 14.

If a temporary substantial change of the warp tension is effected at each weft insertion upon heating up of the weft thread 24 by the reed 23, the tensioning beam 12 is temporarily lowered. In order to avoid an undesired effect on the warp advance by these periodic changes of the warp tension, a certain clearance *d* is adjusted between the adjusting screws 72, 72' and the head 75 of the lever 41. If the tensioning beam 12 is lowered or lifted to a greater extent than corresponds to the clearance *d*, either the adjusting screw 72 or the screw 72' effects a displacement of the head 75 and consequently a rotation of the lever 41 and a displacement of the spring housing 51 and of the clutch disc 32. In spite of the clearance *d*, the lever 41 is held in the adjusted position against the effect of vibrations by the pressure of the spring 65 against the washers 64.

The spring 52, which produces the required clutch pressure of the discs 31 and 32, acts on the fork 54 during rotation of the warp beam 10. Since the lever 42 can transfer the effect of the spring 52 only to the slide 61 and since the slight eccentricity of the arc *c* cannot produce rotation of the lever or guide member 41 by the slide 61, the clutch pressure, which is effective during the advance of the warp 11, cannot change the warp tension, whereas the change of the position of the tensioning beam 12 beyond the positions *e* or *e'* can immediately effect a change of the length of the warp to be pulled from the warp beam. The arrangement of the slide member 61 and the configuration of the slot 62 are such as to produce a self-locking effect preventing a reaction of the movements of the driven clutch part on the warp supervising means. The surface of the slot 62 which serves as a guide for the slide member 61 is inclined with respect to an imaginary plane which is perpendicular to the up and down movement of the slide member, the inclination being such that the guide member can produce an up or down movement of the slide member whereas the latter cannot move the guide member.

In the modification, shown in Figs. 4 and 5, a warp feeler 80 is provided as a warp supervising means, which feeler rests on the warp threads 11 and is pivoted to a lever 81. The latter is mounted on a shaft 83 and includes a segment 82 which is provided with a cam surface 84 which is inclined with respect to the plane of the segment 82, the distance between the plane of the segment and the cam surface increasing from the top to

the bottom in Fig. 4. The segment 82 rests against a support roller 85, which is rotatable on a pin mounted on the loom frame.

The cam surface 84, which is inclined with respect to the plane in which the member 81, 82 is movable, cooperates with a finger 86 which is fast on a shaft 87 and which can move transversely to the plane in which the member 81, 82 is movable. Arms 88 are fixed to the lower part of the shaft 87, the arms being provided with pins 91 extending into apertures 89 in the spring casing 51 of the clutch 31, 32.

The device according to Figures 4 and 5 operates as follows:

If the warp 11 is elongated, the horizontal part of the warp between the tensioning beam and the warp feelers 21 moves upwards, if the tensioning beam 12 is arranged and is actuated for producing the warp tension in the manner shown in Fig. 1. The feeler 80 is raised and the segment 82 is lowered from its illustrated middle position. The weights of the feeler 80 and of the segment 82 are preferably approximately the same. The feeler 80 rests on the warp 11 due to its slight excess weight and/or is kept in contact with the warp by a weak spring 92.

If the clutch disc 31, as shown in Fig. 2, is moved to the left due to rotation of the cam 44 and if the clutch 31, 32 is engaged, the finger 86 is laid on the segment 82 against the action of a weak compression spring 93, the segment 82 being supported by the roller 85. This arrangement defines the position of the spring casing 51 and of the clutch disc 32 and also the time during which the clutch is engaged, i. e. the angle of rotation of the clutch during which it is engaged.

If the segment 82 is lowered from its middle or zero position, the casing 51 and the clutch disc move from the illustrated middle or zero position to the left, because the finger 86 rotates through a greater angle until it comes to rest at a new, upper portion of the segment 82. Because of the movement of the clutch disc 32 to the left, the duration of the rotation of the warp beam and also the length of the unwound warp 11 is reduced so that the elongation of the warp is absorbed.

The pressure of the spring 52 against the casing 51 affects only the lever 88, the shaft 87 and the finger 86, pressing the segment 82 against the roller 85. The inclination of the cam surface 84 is so small that a self-locking effect is produced and the aforesaid pressure cannot move the segment and cannot effect the warp feeler 80. Since the finger 86 does not rest on the segment 82 because of the action of the spring 93, if the clutch 31, 32 is disengaged, the feeler 80 can adjust the position of the segment 82 according to the position of the warp 11 without any resistance.

In the modification shown in Fig. 6 a disc 96 is rigidly connected with a lever 95 which carries the tensioning beam 12, a rope 97 being laid over the disc 96 and a tensioning weight 98 hanging on the rope. This makes the tension of the warp independent of the position of the tensioning beam 12, and the latter can be used for indicating and supervising the change of the length of the warp between the beam 12 and the fabric 25. The lever 95 includes a tooth segment 99 which meshes with a pinion 100. The latter drives a shaft 102 through bevel gears 101. The shaft 102 carries a tooth wheel 103 meshing with a spur gear 104 on a casing portion 105 surrounding a clutch spring 111. This arrangement affords rotation of the casing portion 105 according to the position of the lever 95.

A groove 106, which is inclined with respect to a plane which is perpendicular to the rotation axis of the clutch, is provided on each side of the casing portion 105. A slide 108 is inserted in each groove, the slides being individually mounted on pins 107 which are connected with a support 109 partly surrounding the casing portion 105 and rigidly connected with the loom frame. The right side of a spring retainer 110 forming a second casing portion for the spring 111 abuts against the left end of the clutch spring 111 and is provided with a flange 113 rotatable in an annular groove 112 of the casing portion 105 so that the retainer 110 is moved axially together with the casing portion 105. A pin 114 is provided at the bottom of the spring retainer 110, the pin extending into an axial slot 115 of a guide 116 which is mounted on the loom frame. The left side of the retainer 110 is adapted to abut against the brake disc 49.

If the warp tensioning beam 12 moves in the direction of the arrow 117, the spur gear wheel 103 rotates as indicated by an arrow 118, turning the spur gear segment 104 and the casing portion 105 in the direction of the arrow 119. The guide grooves 106 in the casing portion 105 slide along the slides 108 which are connected with the support 109 by means of pins 107. If the portion of the groove 106 which portion is visible in Fig. 6 moves upwards, the casing portion 105 together with the spring retainer moves to the left. This increases the clearance a between the clutch discs 31 and 32. The duration of the periods during which the warp beam is rotated is increased or decreased according to the position of the tensioning beam 12.

If the clutch disc 31 moves to the left and abuts against the disc 32 and the brake disc 49 is removed from the retainer 110, the pressure of the spring 111, i. e. the clutch pressure acts through the casing portion 105, the grooves 106, the slides 108, and the pins 107 only on the support 109 which is fast on the loom frame. Because of the slight inclination of the guide grooves 106 a self-locking effect is produced and the casing portion 105 and the tooth wheel 103 are not revolved so that neither the position of the tensioning beam 12 nor the tension of the warp 11 are affected by the clutch pressure.

Upon disengagement of the clutch, the brake disc 49 contacts the spring retainer disc 110, braking the rotation of the shaft 47. The brake moment acting on the disc 110 is absorbed by the pin 114 and the guide 116 and cannot cause rotation of the casing 105 and axial movement thereof which would change the duration of rotation of the warp beam.

The afore-described examples do not cover all possible mechanisms for controlling the length of the warp threads between the warp beam and the fabric. The illustrated locking devices for preventing a reaction of the clutch pressure on the tension control or supervising devices or on the warp tension may be used in combination with different arrangements.

The embodiment of the invention shown in Figs. 4 and 5 has the advantage that the abutments 72 and 73 of the modification, shown in Figs. 2 and 3, are not needed whereby the mechanism is simplified. The embodiment according to Fig. 6 has the advantage that the movement transmitting linkage can be very light since no member thereof is exposed to the clutch pressure, which is transmitted from the casing 105 directly to the frame.

What is claimed is:

1. A device for operating the warp beam in a loom for weaving, comprising a clutch having a driving and an axially movable driven part, supervising means responsive to changes of the length of the warp between the warp beam and the fabric, a mechanism interconnecting said supervising means and said driven clutch part for changing the axial position of the latter according to the length of the warp between the warp beam and the fabric, and self-locking means interposed in said mechanism and affording transmission of motion in one direction and preventing transmission of motion in the opposite direction for preventing a reaction of the movements of said driven clutch part on said supervising means.

2. A device as defined in claim 1, in which said self-locking means include a guide member having a guide surface, a slide member slidable on said surface, said guide surface being inclined with respect to an imaginary

plane which is perpendicular to the direction of movement of said slide member, the inclination of said guide surface being such as to move said slide member upon movement of said guide member and to prevent movement of the latter by said slide member.

3. A device as defined in claim 1, in which said self-locking means comprise a member connected with said supervising means and adapted to be moved in a plane by the latter, said member having a surface which is inclined to the plane in which said member is movable, a finger slidable on said surface and movable transversely to said plane, and a support roller rotatable on a stationary axis and abutted by said member for counteracting the pressure exerted by said finger on said member.

4. A device according to claim 1, comprising a brake disc connected with said driven part of said clutch, and said mechanism comprising an axially movable housing member cooperative with said brake disc.

5. A device according to claim 1, said clutch including a spring for axially moving said driven clutch part towards said driving clutch part, said mechanism comprising a housing for said spring cooperative with said driven clutch part, said housing being axially movable and rotatable on the rotation axis of said clutch; said self-locking means including grooves on said housing which grooves are inclined with respect to a plane which is perpendicular to the rotation axis of the clutch, slide members individually slidable in said grooves, and a stationary support for said slide members.

6. A device according to claim 1, comprising a brake disc connected with said driven part of said clutch, said clutch including a spring for axially pressing said driven clutch part against said driving clutch part, said mechanism comprising a casing for said spring, said casing being axially movable and having a first portion rotatable on the rotation axis of said clutch and having a second portion abutting against said brake disc, means for preventing rotation of said second portion; said locking means including grooves on said first portion which grooves are inclined with respect to a plane which is perpendicular to the rotation axis of the clutch, slide members individually slidable in said grooves, and a stationary support for said slide members.

7. A device according to claim 1, comprising a roller rotatable on a stationary axis, the driving part of said clutch being axially movable and including a cam surface engageable with said roller for axially moving said driving part.

8. A device according to claim 7, said cam surface having a first portion effecting axial movement of said driving clutch part towards said driven part and a second portion effecting movement of said driving part away from said driven part, said first portion being substantially longer than said second portion.

9. A device according to claim 1, said mechanism comprising lost motion means affording a predetermined movement of said supervisory means without actuating said driven clutch part, said self-locking means comprising brake means for preventing vibrational movement of said mechanism within the range otherwise afforded by said lost motion means.

10. A device according to claim 1, said mechanism comprising lost motion means affording a predetermined movement of said supervisory means without actuating said driven clutch part, said self-locking means being interposed in said mechanism between said lost motion means and said driven clutch part and comprising brake means for preventing vibrational movement of said mechanism within the range otherwise afforded by said lost motion means.

11. A device as defined in claim 1, comprising a warp tensioning beam, said supervising means being connected with, actuated by, and responsive to the position of said warp tensioning beam.

12. A device as defined in claim 1, said supervising means including a feeler adjacent to the warp threads.

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