This invention relates to irregular warp feed mechanisms.

An object of the invention is to provide control mechanism in the nature of an attachment for existing or new looms, and having for its principal purpose the coordinating, stopping and starting of the warp beam let-off and cloth take-up roll so that the loom is rendered much more flexible in operation and can weave regular cloth of various novelty cloths, terry cloth and the like.

Another object of the invention is to provide a control attachment for looms which may be operated by the looms dobby head in some instances or by foot pedal means on the loom, the invention being adapted for use on either a dobby equipped or can loom. When the invention is used in conjunction with a loom having a dobby head, the loom let-off and cloth take-up motions may be caused to start and stop simultaneously in accordance with any desired pattern of operation so as to produce a variety of novelty weaves or a regular weave. When the invention is under control of a foot pedal means at the front of the loom, the weaver may operate the loom one pick at a time and stop the let-off and take-up motions, thereby preventing feeding of the warp yarn. This latter arrangement is advantageously used for the removal of broken picks or filling which has been placed in the incorrect shed and for matching picks, etc.

Another object of the invention is to provide a control attachment for looms which may be installed on new or existing looms with economy and without the necessity for altering the basic loom structure and with only a minimal addition of mechanism to the conventional let-off motion.

Another object is to provide loom control mechanism which is highly simplified in construction and operation, very efficient, sturdy and durable, and easy to install and maintain.

The invention is particularly applicable to looms having a positive type let-off for feeding the warp yarns from a beam under constant tension and constant linear velocity, such as the let-off disclosed in United States Patent 2,786,491, issued March 26, 1957, to J. O. Hunt. The disclosure of the Hunt patent is incorporated fully herein by reference hereto and therefore forms a part of the disclosure in this application.

This application also contains subject matter in common with prior copending application Serial Number 111,415, filed May 29, 1961, for Control Attachment for Loom Let-Off Mechanism, Edward J. Williams, inventor.

Other objects and advantages of the invention will be apparent during the course of the following detailed description.

In the accompanying drawings forming a part of this application and in which like numerals are employed to designate like parts throughout the same,

FIGURE 1a is a side elevation of a loom equipped with the control mechanism and let-off motion according to the invention, the figure showing the back portion of the loom adjacent the warp beam and let-off motion.

FIGURE 1b is a fragmentary side elevation of the front portion of the loom adjacent the cloth take-up means and showing parts of the invention control mechanism connected therewith.

FIGURE 2 is a fragmentary plan view of the invention as seen in FIGURE 1b.

FIGURE 3 is an enlarged fragmentary vertical section taken approximately on line 3-3 of FIGURE 1a.

FIGURE 4 is a fragmentary plan view of the mechanism shown in FIGURE 3.

FIGURE 5 is a vertical section taken on line 5-5 of FIGURE 4.

FIGURE 6 is a vertical section taken on line 6-6 of FIGURE 3.

FIGURE 7 is an enlarged fragmentary vertical section taken on line 7-7 of FIGURE 1a, and

FIGURE 8 is a fragmentary side elevation of the loom and the invention mechanism in accordance with a modification having foot pedal means for operating the invention mechanism manually, and

FIGURE 9 is a diagrammatic side elevation of a loom dobby head used for actuating the control mechanism of the invention according to one embodiment thereof.

In the drawings, wherein for the purpose of illustration are shown preferred embodiments of the invention, attention being directed first to FIGURES 1a to 7 and FIGURE 9 of the drawings, the numeral 10 designates one loom side, at the rear of which the loom beam 11 is supported between the side 10 and the opposite loom side, not shown. The arbor 12 of beam 11 is journaled on brackets 13 attached to the loom sides in a conventional manner.

The warp let-off motion in accordance with the mentioned Hunt patent includes a vertical plate 14 which has ribs 14a along its vertical edges, and an opening for receiving the cylindrical end section of a projection 15a. FIGURE 7, forming part of a bracket 15 which is bolted to the loom side 10. The plate 14 is secured in the desired angular relation to the bracket by screws 14b extending through a flange on the plate and bearing against the bottom of projection 15a. The plate 14 is provided near its upper end with ears 16 and 17 containing bearings for a let-off input shaft 18 having a hand wheel 19 rigidly secured thereto at one end.

At its other end, a worm gear 20 according to a feature of the invention is mounted rotatably on the shaft 18 and has a hub 21 provided with V-shaped clutch teeth 21a, adapted to mesh with corresponding internal teeth 22a of a let-back clutch element 22, keyed at 22b to the shaft 18 and shiftable axially thereof in a manner to be described. This construction is best shown in FIGURES 4-6.

A let-back nut 23 having a screw-threaded bore 24 has adjustable screw-threaded engagement with a screw-threaded extension 25 of input shaft 18 of the let-off motion, and the nut has an integral cup extension 26 engageable loosely over the outer hub end 27 of clutch element 22, FIGURE 6. The hub extension 27 has a recess 28 facing and communicating with the interior of cup 26, and a compressible coil spring 29 surrounds the input shaft 18 and has its ends bearing against clutch element 22 and adjusting nut 23, as shown in FIGURE 6. The position of the spring 29 may be varied through a considerable range by turning the nut 23. The spring 29 tends to maintain the clutch element 22 in coupled or driven relationship with the worm gear 20 so that rotation of the loosely mounted worm gear is transmitted to the input shaft 18 at desired times during the operation of the loom. As will be described, means are provided to uncouple the clutch element 22 from worm gear 20 at certain desired times so that the continuously driven gear 20 will be disconnected from the input shaft 18 and will not turn the same during loom operation. A spacer ring 30 on the shaft 18 is disposed between the gear 20 and
the ear 16, FIGURE 6, to prevent axial movement of the gear 20 away from clutch element 22.

The gear 20 is in continuous mesh with and continuously driven by a worm 31 carried by a shaft 32 held in a bearing link 33, which is connected by a plate 14 exactly in accordance with the description in the Hunt patent. The shaft 32 carries a sprocket gear 34, connected with and driven by a chain 35, engaging a sprocket gear 36 carried by the cam shaft 37 of the loom, FIGURE 1a.

A pair of coned discs 38 and 39, FIGURE 1a, are mounted on shaft 18, with the disc 38 secured fast to the shaft 18 and the disc 39 having splined engagement with the shaft, so as to be shiftable toward and away from the disc 38 while rotating with the shaft 18. A ball thrust bearing 40 surrounds the shaft 18 and abuts the hub of coned disc 39. A lever 41 pivoted at 42 to plate 14 has a yoke 43 at its upper end straddling shaft 18 and engaging one side of thrust bearing 40 to shift the same and the coned disc 39 toward the companion disc 36. The bearing 40 has a guide pin means 44 in accordance with the teachings of the mentioned Hunt patent to prevent rotation of the bearing 40 with the input shaft 18.

The let-off motion has a lower output shaft 43 journaled within bearings 46 and 47 on plate 14 adjacent the lower end of shaft 18. The output shaft 48 and 49, the disc 48 being fast on shaft 45 while the disc 49 is splined thereto so as to be shiftable toward and away from the disc 48 while rotating with the output shaft 45. A ball thrust bearing 50 on shaft 45 engages the hub of coned disc 49 and this bearing is engaged by a shifter yoke 51, adjustably mounted by a lever 52, pivoted to the plate 14 at 53 in accordance with the teachings of the Hunt patent.

The top of lever 52 is pivotally connected with an adjustable length link 54 having one end thereof engaging the lower end of lever 41 opposite the yoke 43 as fully described in the Hunt patent. The discs 38 and 39 constitute an adjustable driving pulley connected by a transmission belt 55 with the adjustable driving pulley formed by the discs 48 and 49, FIGURE 1a, all shown and described in the Hunt patent.

Output shaft 45 carries a worm gear 56, FIGURE 1a, meshing with a worm wheel 57 loosely mounted on a let-off shaft 58, mounted in bearings 59 of the bracket 15. Let-off shaft 58 also carries a pinion gear 60 meshing with and driving a large gear 61 secured to the flange 62 of warp yarns Y, FIGURE 1a. The gear 57, FIGURE 7, is secured to the let-off shaft 58 and has a hub provided with teeth 63 adapted to mesh with teeth on a sleeve 64 splined to the shaft 58 and moveable axially thereon under influence of a hand wheel 65, as shown in the Hunt patent. A spring 66 between the sleeve 64 and the hub of gear 57 tends to urge the gear against a spacer 67 on let-off shaft 58 between the gear and the end of projection 15a. The gear hub with teeth 63 and the sleeve 64 with its mating teeth form a clutch by which the gear 57 may be connected to and disconnected from let-off shaft 58 in accordance with the teachings of the Hunt patent.

A sheet of warp yarns Y leaving the beam 11 pass upwardly and over a whip roll 68 mounted in arms 69 on a cross shaft 70 having an arm 71 rigidly secured thereto. The free end of this arm is connected with a tension link 72 mounted in the end of a scale beam 74, pivoted to the plate 14 as at 75. At its outer end, the beam 74 has counterweight means 76 mounted thereon. A link 77 is connected to the scale beam 74 by being mounted on the pivot 73 and the free end of link 77 is connected to arms 69, as shown in the mentioned Hunt patent, FIGURE 1a.

The mode of operation of the described let-off motion for the beam 11 is fully described in the Hunt patent and need not be fully repeated herein. Suffice it to say that the let-off operates in response to variations in tension on the beam of yarn Y transmitted by tension link 72 to the movable pivot 73 on counterbalanced scale beam 74. This mechanism through the mechanical linkage including levers 41 and 52 and their associated yokes constantly adjusts the differential coned pulleys to keep the let-off shaft 58 operating in the proper relationship to the loom, so as to maintain substantially constant tension and linear velocity during the normal weaving operation of the loom.

With reference to FIGURE 1b showing the front portion of the loom and the adjacent cloth take-up roll operating means, the construction is as follows. A connector link 79 has one end thereof connected at 80 to an arm 81 of parallel shoe 82, carried by the loom rocker shaft. The lay swords of the loom, not shown, are mounted upon the rocker shaft and oscillate therewith in the direction of the arrows, FIGURE 16, and this oscillating movement is transmitted through the link 79 to the lower end 83 of take-up pawl 84, pivoted to the loom at 85 and engaging the stepped teeth of take-up ratchet wheel 86 as indicated at 87. Each oscillation of the take-up pawl 84 therefore advances the cloth take-up roll circumferentially a distance equal to the spacing between two adjacent teeth of ratchet wheel 86. A hold-back pawl 89 pivotedally mounted upon the loom side 10 at 89 rides over the teeth of ratchet wheel 86 and prevents retrograde movement thereof after each stepped advancement of the ratchet wheel. A control lead rod 90 extends from the ratchet wheel 91 and is connected to a set screw 93, FIGURE 1a, to prevent longitudinal movement of said control lead rod 90 in the event the ratchet wheel 91 is not engaged. A control lever 92, FIGURE 16, is pivotally secured to the control lead rod 90. A coil spring 94 extends between the control lever 92 and the ratchet wheel 91 and serves to maintain the ratchet wheel 91 in mesh with the control lead rod 90 under tension to prevent accidental disengagement of the ratchet wheel 91 from the control lead rod 90. A control lever 92, FIGURE 16, is pivotally secured to the control lead rod 90. A coil spring 94 extends between the control lever 92 and the ratchet wheel 91 and serves to maintain the ratchet wheel 91 in mesh with the control lead rod 90 under tension to prevent accidental disengagement of the ratchet wheel 91 from the control lead rod 90. A control lever 92, FIGURE 16, is pivotally secured to the control lead rod 90. A coil spring 94 extends between the control lever 92 and the ratchet wheel 91 and serves to maintain the ratchet wheel 91 in mesh with the control lead rod 90 under tension to prevent accidental disengagement of the ratchet wheel 91 from the control lead rod 90. A control lever 92, FIGURE 16, is pivotally secured to the control lead rod 90. A coil spring 94 extends between the control lever 92 and the ratchet wheel 91 and serves to maintain the ratchet wheel 91 in mesh with the control lead rod 90 under tension to prevent accidental disengagement of the ratchet wheel 91 from the control lead rod 90.
The take-up and let-off motions by hand, in position to the take-up and let-off motions at the beat up for the proper matching of picks. The invention is advantageous for the removal of broken picks of filling or filling placed in the incorrect shed.

FIGURE 8 at the left hand portion thereof shows a fragment of the identical let-off motion previously described and shown in the mentioned Hunt patent and the parts need not again be described in detail. The same warp gear 20, let-back clutch 22, clutch operating ring 106 and associated elements are present and operate exactly as herein described. Likewise, in FIGURE 8, the cloth take-up means is essentially the same and embodies the take-up ratchet wheel 86 for operating conventional cloth take-up roll. A foot pedal 120 is pivoted on the front of the loom near the bottom thereof in such a manner that stepping on the pedal will pull down a control rod 121, having its top end connected at 122 through a suitable linkage 123 with a rock shaft 124 upon which an arm 125 is secured. A control cable 126 has one end connected at 127 to the arm 125 and when the pedal 120 is depressed by the operator, the control cable 126 is pulled to the right, FIGURE 8, by the arm 125 and the hold-back pawl 128 will simultaneously be elevated to disengage ratchet wheel 86. The take-up pawl 84 omitted in FIGURE 8 for simplicity merely continues to oscillate in response to movement of the loom rocker shaft and the let-off motion is rendered inactive and does not advance or wind-up the cloth. Simultaneously with the raising of the hold-back pawl 128, control cable 126 pulls and pivots the ring 108 in the proper direction to disengage the let-back clutch 23 from the continuously turning gear 20 of the let-off motion, thereby simultaneously rendering inactive the let-off and interrupting the feeding of the warps as in the prior form of the invention. As is now obvious, depression of the foot pedal 120 renders the left-off motion and take-up motion inoperative at the will of the operator and the warp yarn will not be fed even though the loom otherwise continues to operate. As mentioned, this arrangement allows the removal of broken picks or filling and also the matching of picks without advancing the warp yarn and thereby causing undesirable spaces between the filling as it is placed in the warp. The invention in this form is useful in preventing the commonly named cloth defects known as broken picks, unmatched picks, and set marks.

It is to be understood that the forms of the invention herewith shown and described are to be taken as preferred examples of the same, and that various changes in the shape, size and arrangement of parts may be resorted to, without departing from the spirit of the invention or scope of the subjoined claims.

Having thus described our invention, we claim: 1. In a loom, a positive type let-off motion for regulating the feeding of warp yarns into the loom and having an input rotary shaft and a let-off rotary shaft and variable transmission means interconnecting said shafts and operable to feed the warp yarns under substantially constant tension and constant linear velocity regardless of the diameter of the beam, the said input shaft of the let-off motion, gearing continuously driven by the loom cam shaft and continuously turning said gear during the operation of the loom, said gear having clutch teeth on one side thereof, a shiftable clutch element having teeth on said input shaft, resilient means engaging said clutch element and urging it toward coupling engagement with said gear during normal weaving by the loom, a clutch element shifter pivotally mounted on the let-off motion and swingable toward the clutch element to engage the latter and disengage the former, said shifter being actuated by means whereby the input shaft may be de-activated during continuous loom operation to arrest the feeding of warp yarns into the loom, a cloth take-up motion on said loom operated by the loom rocker shaft during loom operation to accumulate cloth woven in the loom and including a pivoted
take-up pawl and a ratchet wheel to be engaged by said pawl, a loom doby head having a jack, and control means interconnecting said jack, shifter and take-up pawl and operable in response to movements of the jack to move the shifter and pawl simultaneously in directions for simultaneously de-activating the let-off and take-up motions during continuous loom operation to facilitate the weaving of novelty cloth.

2. The invention as defined by claim 1, and wherein said control means is a pair of cables each connected with said shifter and take-up pawl, guide means for said cables allowing end portions thereof to extend in spaced parallel relation, a rock shaft on the loom, arms secured to the rock shaft and connected one each with said end portions of the cables, another arm on said rock shaft, another cable connected with the last-named arm, and a doby jack on said loom connected with the last-named cable and operable to pull such cable for turning the rock shaft.

3. In a loom, a let-off motion having an input rotary shaft and a let-off rotary shaft, a gear loosely mounted on said input shaft and having a clutch part, gearing connected with said gear to turn the same continuously during normal loom operation, a shiftable clutch element on said input shaft adapted for coupling engagement with said clutch part of said gear, resilient means normally maintaining said coupling engagement of said clutch element and clutch part, a clutch element shifter on said let-off motion operable to uncouple the clutch element and clutch part of the gear, whereby rotation of said input shaft may be interrupted, a cloth take-up motion on the loom including a take-up pawl and a ratchet wheel engaged by the pawl, a loom doby head having a jack, and control means interconnecting said jack, shifter and take-up pawl and operable in response to movements of the jack to move the shifter and pawl simultaneously for simultaneously de-activating said let-off and take-up motions.

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