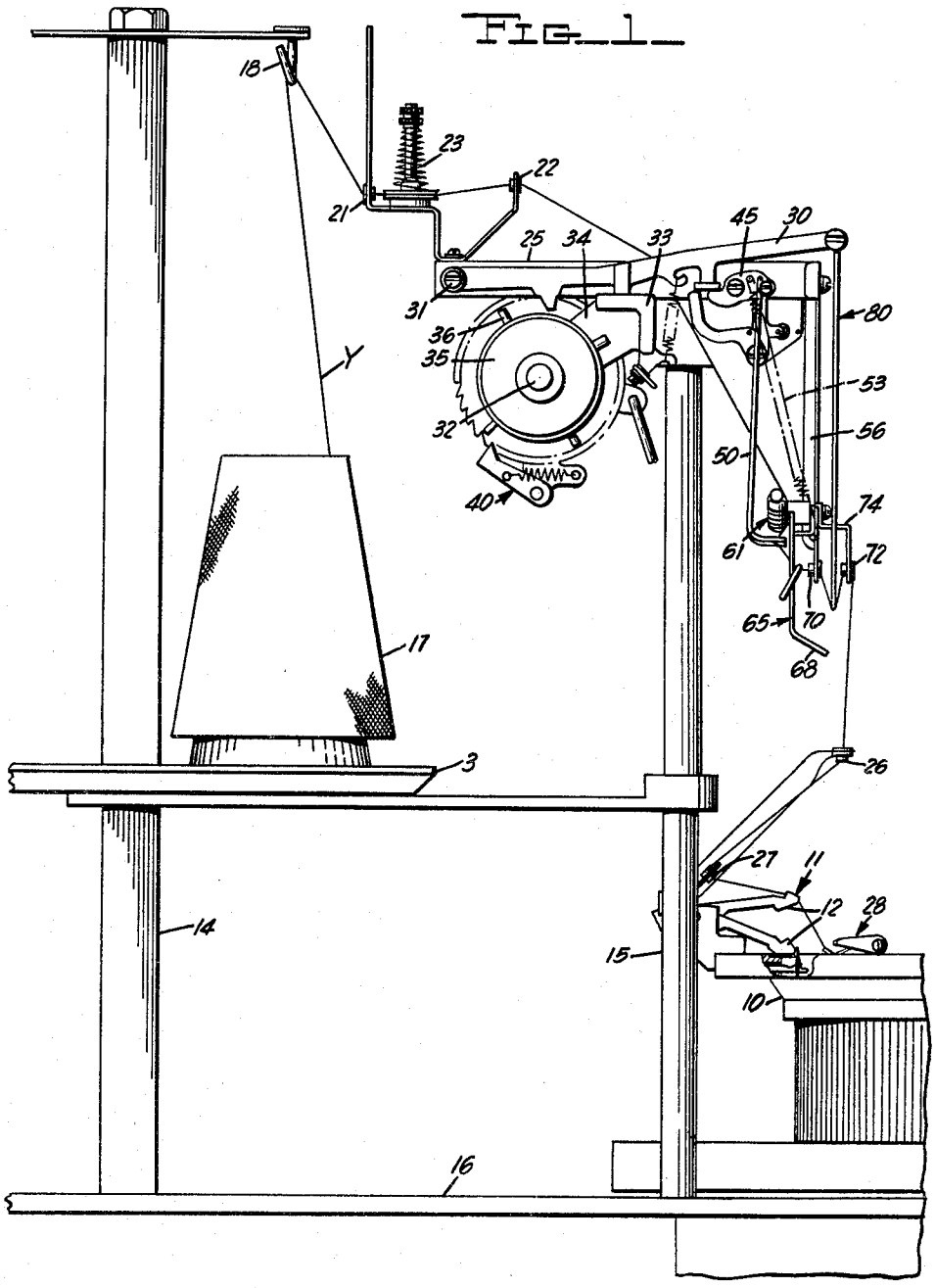
Sept. 8, 1964 E. R. ZIEMBA 3,147,604

YARN TAKE-UP MEANS FOR KNITTING MACHINES

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FIG. 1



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FIG. 5

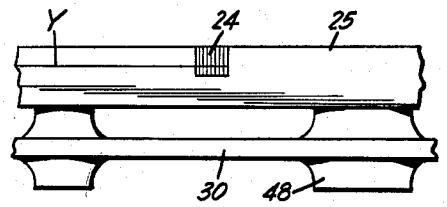
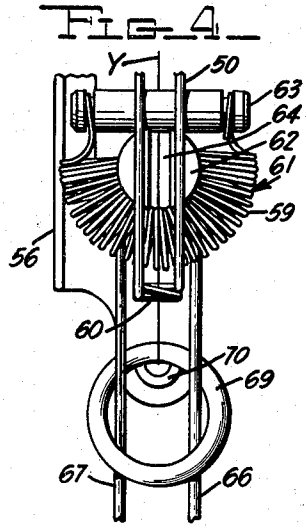


FIG. 2

FIG. 4



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YARN TAKE-UP MEANS FOR KNITTING MACHINES

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FIG. 3

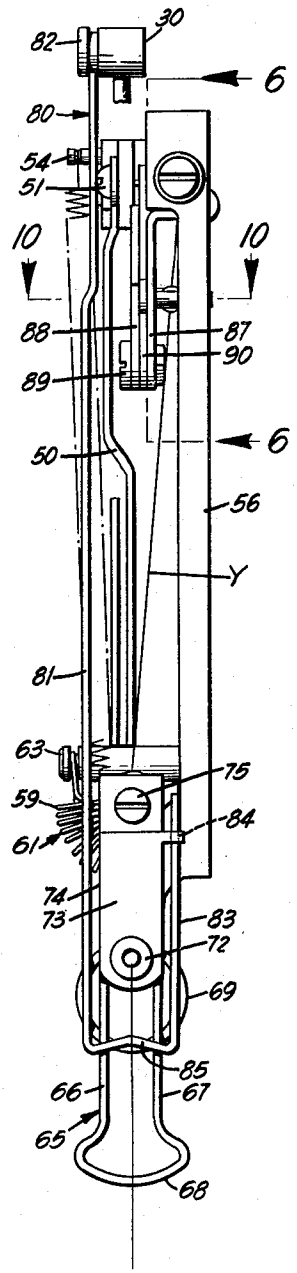


FIG. 6

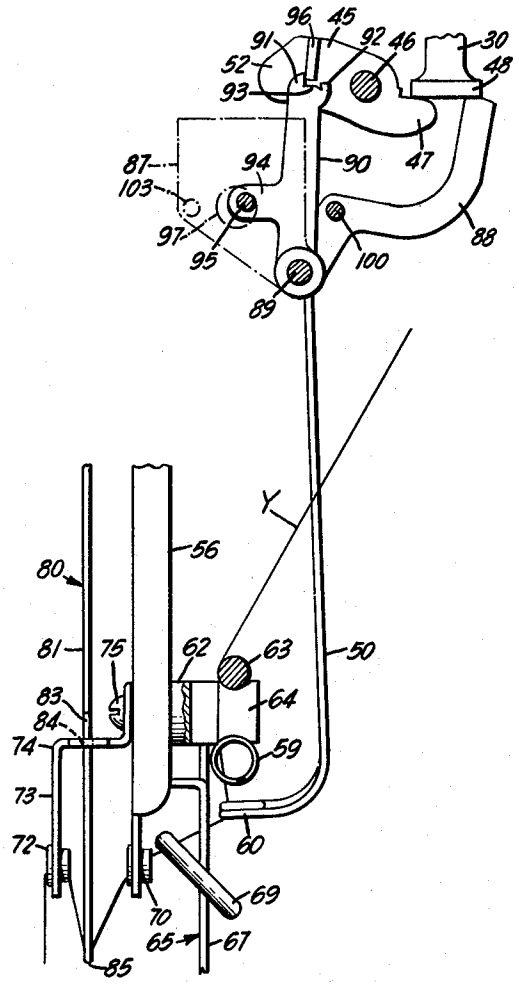
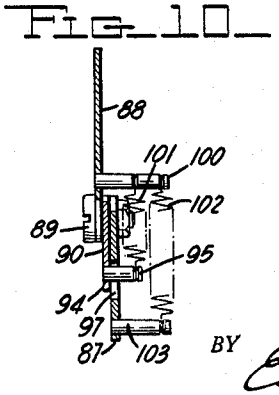


FIG. 10



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YARN TAKE-UP MEANS FOR KNITTING MACHINES

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FIG. 7

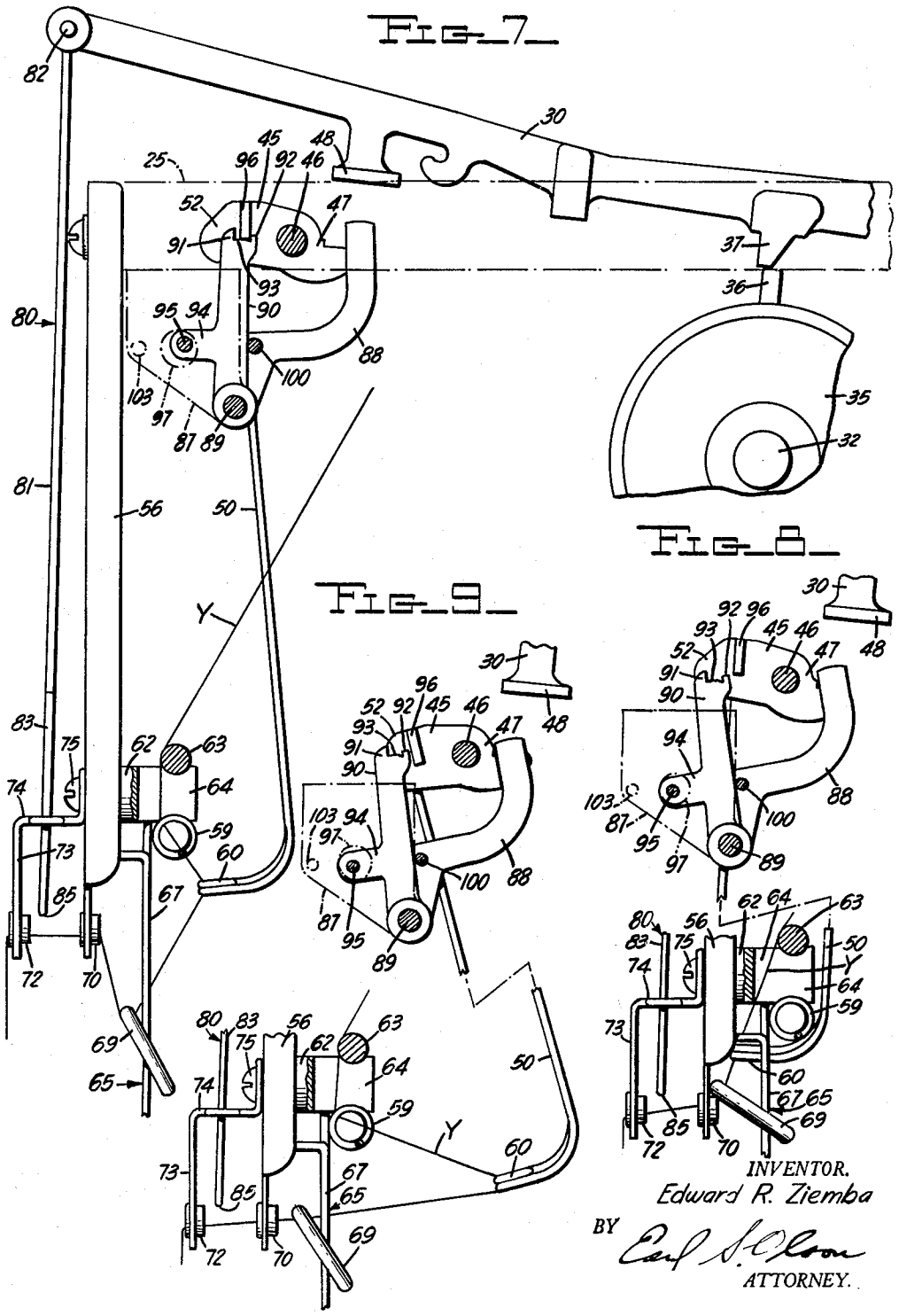


FIG. 9

FIG. 8

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United States Patent Office 3,147,604 Patented Sept. 8, 1964

3,147,604
YARN TAKE-UP MEANS FOR KNITTING MACHINES

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Filed June 9, 1961, Ser. No. 116,173
9 Claims. (Cl. 66—125)

The instant invention relates to circular knitting machines and more particularly to improvements in the yarn take-ups employed therein.

In the usual yarn feeding systems of circular knitting machines the yarn is supplied from a cone or pirn and fed through a suitable tension device such as a disk tension, through a take-up device and thence to a yarn feeding finger which supplies the yarn to the knitting instrumentalities of the machine, guide eyes being placed at strategic points along the path of travel of the yarn. The take-up device, employed to take up the slack in the yarn which occurs from time to time during the knitting action, particularly during reciprocatory knitting, is movable under pattern control between its active position, it being in such position when the yarn finger is feeding yarn, and an inactive position when the feed finger is moved to non-feeding position the yarn being held at this time against further withdrawal from the pirn. Conventionally when the feed finger becomes inactive the yarn formerly fed thereby is cut and the free end clamped, the inactivation of the take-up being also necessary at such time to insure against the end of the yarn being pulled from the clamp.

It has been found that in the operation of the yarn feeding systems employing yarn take-ups as heretofore constructed the release of the take-up, occurring substantially simultaneously with the moving of the feed finger into yarn feeding position, has at times exerted a sufficient pull on the yarn as to cause it to be withdrawn from the clamp and through the needle circle before the loop forming operation of the knitting instrumentalities had proceeded to the point where the yarn end was tied into the fabric. The principal object of the instant invention is the provision of an improved yarn feeding system which will overcome the above noted and other disadvantages of existing systems. More specifically an object of the invention is the provision of a yarn feeding system embodying means to supply an excess of yarn between the take-up device in its inactive position and the yarn feed finger to permit the yarn feed finger to be moved into yarn feeding position and initial loops formed to the point where the yarn will be tied into the fabric before the yarn take-up is released from action.

A further object of the invention is the provision of a yarn feeding system as defined above including means whereby the tension in the yarn, as the excess yarn is used up in the knitting operation, releases the take-up device for resumption of its active status.

Another object of the invention is the provision of mechanism attaining the foregoing objects including latch means for retaining the take-up arm in its inactive position, said means being of a character to release its latching action by movement of the take-up arm caused by the tension of the yarn.

The invention will be more fully understood and further objects and advantages thereof will become apparent when reference is made to the more detailed description thereof which is to follow and to the accompanying drawings in which:

FIG. 1 is an elevational view of a knitting machine incorporating my invention, the machine cylinder and associated parts being shown diagrammatically;

FIG. 2 is a view similar to FIG. 1 illustrating a portion of the apparatus of FIG. 1 on an enlarged scale;

FIG. 3 is an end elevational view on an enlarged scale of the apparatus illustrated in FIG. 2;

FIG. 4 is a detail elevational view on an enlarged scale looking in the direction of the arrow 4 in FIG. 2;

FIG. 5 is a detail plan view of a portion of the apparatus looking in the direction of the arrow 5 in FIG. 2;

FIG. 6 is a sectional view with certain parts broken away and other parts omitted for clearness of illustration taken on the line 6—6 of FIG. 3 and showing the device at one stage of its operation;

FIGS. 7, 8 and 9 are views similar to FIG. 6 showing the device at other stages of its operation; and

FIG. 10 is a sectional view on the line 10—10 of FIG. 3.

Referring now to the drawings my invention is shown as embodied in a circular knitting machine which may be of any known or conventional type, the multifeed machine shown in the formerly co-pending application of Benjamin Franklin Coile, Serial No. 329,801, filed January 6, 1953, now Patent No. 3,136,145, issued July 9, 1964 hereinafter referred to as the "Coile Disclosure," being an example. The knitting head of the machine, indicated diagrammatically at 10, contains the usual knitting instrumentalities such as needles, sinkers and their operating mechanisms, shown only diagrammatically herein. The machine may have one or a plurality of yarn feeding and knitting stations, one such station being shown at 11 and comprising suitably a plurality of pivoted yarn feed fingers 12 each adapted for movement under pattern control, which may be of any suitable type such as that of the Coile disclosure, between a lowered active yarn feeding position and a raised inactive position (see FIG. 1).

The knitting machine includes a yarn feeding system of any generally conventional construction and reference may be made to said Coile disclosure for further details of a preferred type, the specific features hereinafter described being, with the exception of the inventive features, selected only for purposes of illustration. The system includes a yarn rack 3 supported by frame members 14 and 15 from a bed plate 16. A spool or pirn 17 of yarn Y is mounted on the rack for each feed finger 12 to be employed in the knitting of the fabric. The yarn Y of each finger 12 is led in a path from the pirn through a guide eye 18, through spaced eyelets 21 and 22, and between the disks of a conventional disk tension device 23 positioned between said eyelets, thence through a guide slot 24 in a frame member 25 (see FIGS. 2 and 5) and through yarn holding, tensioning and take-up devices hereinafter to be described, and through eyelets 26 and 27 to its yarn finger 12 from whence, when the finger is active, the yarn is fed to the knitting instrumentalities and formed into fabric. When the yarn feed finger is inactive the yarn is cut between the finger and the fabric and the loose end extending from the finger 12 is retained in a yarn clamp of a yarn clamping and severing device illustrated diagrammatically at 28.

Referring now specifically to FIGS. 2 to 10 the known features of the yarn take-up device and associated structure includes a lever arm 30 pivoted as at 31 to the frame member 25 the latter being supported by a bracket 33 which in turn is supported by one or more of the frame members 15. Bracket 33 has arms 34 rotatably supporting a shaft 32 having a pattern drum 35 secured thereto and the shaft is adapted to be rotated at intervals to move one or the other of a circular row of pattern lugs 36, carried by the drum, beneath a follower portion 37 projecting downwardly from arm 30. A pawl and ratchet mechanism 40 (see FIG. 1) is provided for driving shaft 32 this mechanism being operated at suitable intervals under pattern control as explained, for example, in said Coile disclosure. As will be understood, when the shaft and

drum are rotated to bring a pattern lug 36 beneath follower 37 lever arm 30 will be rotated on its pivot 31 from the position illustrated in FIG. 2 to the position shown in FIG. 7. Lever arm 30 is provided with a hook 40 to which is attached one end of a tension spring 41 the other end of which is connected to a hook 42 carried by bracket 33 the spring serving to yieldably urge follower 37 toward drum 35, or against a lug 36 thereon when the latter is positioned beneath the follower.

A lever 45 is mounted on a pivot pin 46 adjacent the outer or right hand end of frame member 25, one arm 47 of the lever underlying a projection 48 on arm 30. A take-up or sweep arm 50 has an upper end fixedly secured as by stud 51 to a second arm 52 of lever 45. A tension spring 53 has one end secured to lever 45 as by pin 54 at a point intermediate pin 46 and stud 51, the other end of the spring being secured as at 55 adjacent the lower end of a bracket 56 projecting downwardly from the outer or right hand end (FIG. 2) of frame member 25. Sweep 50 terminates in an eye 60 formed in a lower outwardly bent portion of the sweep arm.

Associated with sweep arm 50 is a yarn holding device 61 (see particularly FIGS. 2 and 4). This device is in the form of a coil spring 59 bent into a semicircle around a pin 62 carried by bracket 56. The end coils of the spring are supported on the ends of a transversely extending pin 63 bridging a vertically extending slot 64 in pin 62.

Bracket 56 also supports a ring tension device 65, the device comprising a wire bent to define legs 66 and 67 spaced sufficiently to permit the passage of the eye 60 therebetween and a lower flattened loop 68 extending at an angle to and joining legs 66 and 67. Surrounding legs 66 and 67 is a tension ring 69 of a diameter to slide readily therealong but less than the outer diameter of loop 68 whereby it is retained on the legs. Adjacent to but outwardly of the ring tension device is a thread guide eye 70 carried by an extending end of bracket 56. A second guide eye 72 in substantial horizontal alignment with guide eye 70 is mounted in a vertical arm 73 of a plate 74 secured to bracket 56 as by stud 75, the second guide eye being for a purpose hereinafter described. Stud 75 penetrates bracket 56 and a loop formed in the end of leg 66 of the ring tension device and is threaded into the end of pin 62 whereby the stud serves to secure the device 61 and the ring tension device 65 as well as plate 74 to bracket 56.

In the substantially conventional mechanism above described and with the take-up in its inactive position as illustrated in FIGS. 2 and 6 with no pattern lug 36 beneath follower 37 lever arm 30 is held in its lowest position by the action of spring 41, arm 47 of lever 45 being depressed by projection 48 and the take-up sweep held in a substantially vertical position. At this time yarn Y after passing through the ring tension 23 and the several guide eyes and guide slot 24 passes around pin 63 through slot 64 in pin 62, through eye 60 of sweep arm 50, thence through ring 69 of ring tension 65 and through guide eye 70 to yarn feed finger 12. It will be noted that in this position of the parts the run of yarn between pin 63 and eye 60 is between the coils of the spring 59 whereby it is pinched therebetween and further withdrawal of the yarn from the pirn is prevented.

In such known yarn feeding systems when the yarn feed finger 12 is moved to feeding position the take-up device is activated by the movement of the pattern device to shift a lug 36 beneath follower 37. It is at this point that the problem previously referred to, and the solution of which is the primary object of the invention, is presented. It has been found that the pull on the yarn by sweep arm 50 as the latter is thus released for operation, this occurring before the loop forming operation has proceeded to the point where the yarn is tied into the fabric, tends to withdraw the yarn end from the clamp 28 and through the needle circle. The improvement in the mechanism and its operation whereby this problem is overcome will presently be described but for the purposes of completing the description of the operation of the known constructions it will be assumed that the problem has not occcured in this particular instance.

Sweep 50 will first take up any slack in the yarn between spring 59 and the feeding point and then be rotated in a counterclockwise direction, as viewed in FIG. 2, by the tension in the yarn as the loop drawing action starts, this rotating movement continuing until eye 60 is in the position substantially that illustrated in FIG. 8 whereby the run of yarn between pin 63 and eye 60 is free of the coil spring, the yarn thereafter being drawn from the pirn.

During this active period of feed finger 12 and with the machine in rotary operation sweep 50 is normally maintained by the tension in the yarn in advance of spring 59 whereby the yarn is free of the coils thereof and continues to freely feed to the knitting point. When the machine is shifted to reciprocatory operation the change of direction of feeding in each stroke creates alternating slack and tension in the yarn, the slack being taken up by the sweep arm 50 as it rotates in a clockwise direction (FIG. 2) under the pull of spring 53. In this movement of the sweep arm the yarn is immediately drawn and pinched between coils of spring 59 preventing further yarn from being drawn from the pirn until the slack is used up. When feed finger 12 is again moved into non-yarn feeding position the pattern device causes lug 36 to ride out from under follower 37 and the parts then again assume the full line positions of FIG. 2. It will be understood that the force exerted by spring 41 is sufficient to overcome the resistance of spring 53 as well as other elements resisting the clockwise movement of lever arm 30.

The modification of the known mechanism in accordance with the instant invention will now be described. Lever arm 30 at the free end thereof and outwardly of bracket 56 supports a yarn drawing member 80 consisting preferably of a wire bent into substantial U shape to include an extending leg 81 having one end pivotally connected to lever arm 30 as by pin 82, and a second relatively short leg 83 having a free end projecting upwardly through a perforation 84 formed in plate 74 whereby the lower end of the member is constrained to move substantially vertically as lever arm 30 is rocked between its lowered and raised positions. In the lowered position of arm 30 the base 85 of the U, bent into a shallow inverted V, is substantially below aligned guide eyes 70 and 72 whereby a bight of yarn is drawn between said guide eyes.

Referring now particularly to FIGS. 2 and 6 to 10 inclusive, a plate bracket 87 is secured to frame member 25 adjacent the outer end thereof the bracket extending downwardly from the frame member. A curved lever 88 has one end pivotally mounted on bracket 87, as by pivot pin 89, and its other end underlying projection 48. Also pivotally mounted on pivot 89 and between lever 88 and bracket 87 is a latch lever 90 having an upwardly extending arm terminating in a bifurcated end defining an extended shoulder 91 and a relatively low shoulder 92 the shoulders defining a notch 93 therebetween (see FIGS. 6 to 9, inclusive). Latch lever 90 additionally includes a transversely extending arm 94 carrying a pin 95 projecting through an enlarged opening 97 in bracket 87. Lever 45, hereinabove referred to, has a lug 96 projecting from its inner face (the face adjacent frame member 25) at a point intermediate pivot 46 and pin 51, a lower edge of lug 96 being adapted at certain times, as will be hereinafter described, to be received within notch 93.

Projecting from the inner face of lever 88 at a point intermediate its ends is a pin 100. A tension spring 101 (FIG. 10) has one end connected to pin 100 and the other to the pin 95 on arm 94 of latch lever 90. A second tension spring 102 also has one end connected to pin 100 and the other end to a pin 103 fixedly mounted on plate bracket 87. The proportioning and posi-

tioning of the parts are such that when latch lever **90** is in position to receive lug **96** within notch **93** (see FIGS. 6 and 7) a right hand edge of latch lever **90** opposite pin **100** projects beyond the right hand edge of plate bracket **87**. The extent and purpose of this projection is hereinafter explained.

The operation of the modified apparatus will now be described starting with the inactive condition of the take-up illustrated in FIGS. 1 through 6 with the known parts in the positions previously described. At this stage the yarn leading from eye **60** of the take-up sweep arm **50** passing through the ring **69** of ring tension device **65** is held in a bight between guide eyes **70** and **72** by the lower end **85** of yarn drawing member **80**. Referring particularly to FIGS. 2 and 6, projection **48** of lever arm **30** has rotated levers **88** and **45** to the positions of FIG. 6. Latch lever **90** has also been rotated by the tension of spring **101** to position notch **93** beneath lug **96**, further rotation of the latch lever being prevented by the contact of its extended shoulder **91** with lug **96**. As a result pin **100** is spaced from the edge of the latch lever and the adjacent edge of bracket **87**. The parts remain in these positions until yarn Y is again to be fed to the needles of the machine by yarn finger **12**.

The activation of the yarn feed finger and the movement of a pattern lug beneath follower **37** of lever **30** occur at substantially the same time as previously explained. Upon the occurrence of these events lever arm **30** is rocked in a counterclockwise direction as viewed in FIG. 2 to the position of FIG. 7 causing, at the same time, the lifting of the lower end of member **80** above the level of guide eyes **70** and **72**, tension ring **69** simultaneously pulling the yarn, formerly forming the bight between guide eyes **70** and **72**, into a tensioned bight between eyes **60** and **70**. Also as lever arm **30** rotates upwardly carrying projection **48** therewith both lever **45** and lever **88** rotate in a clockwise direction as viewed in FIG. 2, or in a counterclockwise direction as viewed in FIGS. 6 to 9 inclusive, under the tension of springs **53** and **102**, respectively. Referring specifically to FIGS. 6 and 7, inasmuch as pin **100** at the stage illustrated in FIG. 6 is spaced from the edge of latch lever **90**, as previouly mentioned, the simultaneous rotation of levers **88** and **45** upon upward movement of projection **48** allows lug **96** to enter notch **93** in the latch lever **90** before pin **100** contacts the edge of the latch lever whereby latch lever **90** latches lever **45** against further rotary movement. After pin **100** carried by lever **88** contacts the edge of latch lever **90** the latch lever is moved by the pin **100** under the influence of spring **102** to engage the low shoulder **92** with the lug **96**. At this stage, illustrated in FIG. 7, sweep arm **50** has been rotated in a counterclockwise direction but only slightly from the position illustrated in FIG. 6 and remains in inactive position. Hence, although the pattern mechanism of the machine has released the take-up as in the known devices, it is prevented from exerting a pull on the yarn leading from the feed finger.

The formation of the initial loop or loops from the yarn fed by the feed finger **12** draws yarn from the excess provided by the bight of yarn now between eyes **60** and **70** and under the relatively light tension exerted by ring **65**. As the excess of yarn is used up in the knitting action, sufficient excess being provided that the loops are formed to the point that the yarn is tied into the fabric before depletion occurs, the continued drawing of the yarn by the needles causes sweep arm **50** to rotate in a counterclockwise direction as viewed in FIG. 2, or in a clockwise direction as viewed in FIGS. 6 to 9, rotating lever **45** and lifting lug **96** out of notch **93** and above the shoulder **92**. When this occurs the tensioning action of spring **102** causes lever **88** and latch lever **90** to rotate in a clockwise direction as viewed in FIG. 2, or a counterclockwise direction as viewed in FIGS. 6 to 9, until pin **100** strikes the edge of bracket **87** as indicated in FIG. 8. The positioning and proportioning of parts is such that at the time pin **100** strikes the edge of bracket **87** latch lever **90** is entirely removed from beneath lug **96** thereby releasing lever **45** and the sweep arm **50** for yarn take-up operation, as indicated in FIG. 9, in the manner previously described for the known mechanisms.

At the time the yarn finger moves out of yarn feeding position and lever arm **30** is permitted to rotate in a clockwise direction, as viewed in FIG. 2, to its lowered position, yarn drawing member **80** draws the bight of yarn between guide eyes **70** and **72**. This action is timed to take place before the yarn is severed from the fabric and the loose end thereof extending from the finger **12** is clamped by the device **28**. As projection **48** descends to its lowered position it depresses lever **88** and arm **47** of lever **45** to reset the apparatus to the condition illustrated in FIG. 6, the parts remaining in such positions until the yarn feed is again placed in yarn feeding position.

As will be understood from the foregoing description of the construction and operation of a yarn take-up system embodying the instant invention the take-up action of sweep **50** is withheld until the newly fed yarn is sufficiently formed into loops to be connected into the fabric, the yarn for this purpose being supplied by the excess of yarn drawn into a bight by yarn drawing member **80**. The take-up is not released by the latch lever until this excess is used up, the tension of the yarn itself performing the releasing function.

Having described the invention in rather full detail it will be understood that these details need not be strictly adhered to and that various changes and modifications may be made all falling within the scope of the invention as defined by the following claims.

I claim:

1. In a knitting machine including yarn feeding means movable between yarn feeding and inactive positions, a yarn supply, means defining a path for yarn between said yarn supply and said yarn feeding means including a take-up device movable between active and inactive positions, and means for moving said take-up device from its active to its inactive position upon movement of said yarn feeding means to inactive position, the improvement comprising means operable by said moving means for said take-up device to draw an extra length of yarn from said supply to provide an excess of yarn between said take-up device and yarn feeding means when said take-up device is moved to its inactive position.

2. In a knitting machine including a yarn feeding means movable between yarn feeding and inactive positions, means for forming yarn fed by said feeding means into fabric loops, a yarn supply, means defining a path of travel of the yarn from said supply to said yarn feeding means including a take-up device movable between active and inactive positions, control means for moving said take-up device to an inactive position upon movement of said yarn feeding means to an inactive position, the improvement comprising means to draw an excess of yarn from said yarn supply between said take-up device and said yarn feeding means upon movement of said take-up device to inactive position, means to lock said take-up device in said inactive position, and means to release said locking means, after said yarn feeding means is moved to active position, by the pull of the yarn fed thereby following the forming of the excess yarn into fabric loops.

3. In a knitting machine as defined in claim 2 wherein said means for moving said take-up device to an inactive position comprises a swingable arm, and said means for drawing an excess of yarn comprises means carried by said arm.

4. In a knitting machine as defined in claim 3 having spaced yarn guide means positioned between said take-up device and said yarn feeding means, and said means

carried by said arm comprises a yarn contact element movable between said spaced guide means to draw a bight of the yarn extending therebetween.

5. In a knitting machine including a yarn feeding means movable between yarn feeding and inactive positions, means for forming yarn fed by said feeding means into fabric loops, a yarn supply, means defining a path of travel of the yarn from said supply to said yarn feeding means including a take-up device movable between active and inactive positions, and pattern controlled means to move said take-up device to its inactive position and to temporarily hold it in such position, the improvement comprising means to latch said take-up device in said inactive position upon release of the holding action of said pattern controlled means, and means to release said latch means, said last mentioned means being operable by the tension of the yarn in said path leading to said yarn feeding means.

6. In a knitting machine as defined in claim 5, means for drawing an excess of yarn from said supply upon movement of said take-up device to inactive position, and means to release said excess of yarn to said loop forming means upon release of the holding action of said pattern controlled means.

7. In a knitting machine as defined in claim 6 wherein said pattern controlled means comprises a swingable arm and said means for drawing an excess of yarn comprises thread guides in said path of travel of the yarn and means carried by said swingable arm to define a bight of yarn between said thread guides.

8. In a knitting machine including a yarn feeding means movable between yarn feeding and inactive positions, means for forming yarn fed by said feeding means into fabric loops, a yarn supply, means defining a path of travel of the yarn from said supply to said yarn feeding means, a take-up sweep arm in said path, a support member, means mounting said sweep arm on said support member for rocking between active and inactive positions, a lever arm, means pivotally mounting said lever arm for rocking movement between first and second positions, cooperating means on said mounting means for said lever arm and said lever arm for rocking said sweep arm to its inactive position upon rocking of said lever to its first position, the improvement comprising a latch means adapted to hold said sweep in its inactive position upon the rocking of said lever arm to its second position and means operable by the tension of the yarn in said path to release said latch means.

9. In a knitting machine as defined in claim 8 the further improvement comprising a member carried by said lever arm, cooperating means including said member to draw an excess of yarn from said yarn supply between said sweep arm and said yarn feeding means when said lever arm is rocked into said first position and to release said excess for feeding to said loop forming means when said lever arm is rocked to said second position.

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