United States Patent [19]

Kühn

[11] 3,834,190

[45] Sept. 10, 1974

[54] LATCH OPENER APPARATUS FOR KNITTING MACHINES AND PARTICULARLY CIRCULAR KNITTING MACHINES

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[52] **U.S. Cl.** **66/111,** 66/157

[51] **Int. Cl.** **D04b 15/08,** D04b 35/10

[58] **Field of Search** 66/157, 111, 165

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Primary Examiner—W. C. Reynolds

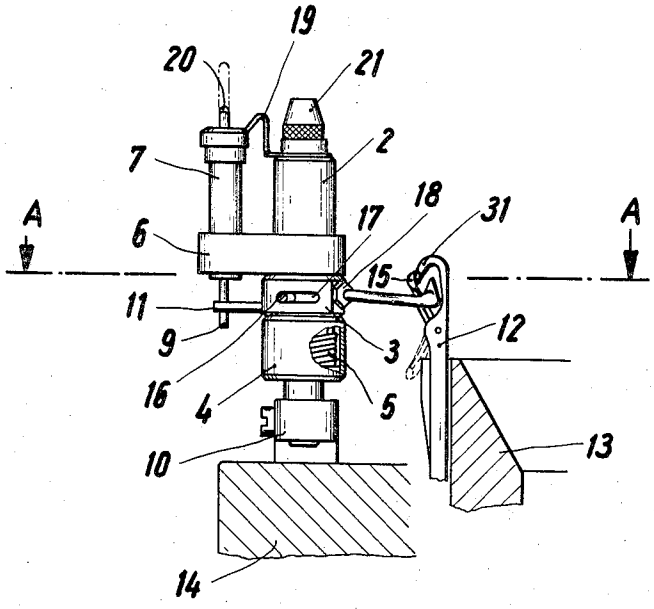
Assistant Examiner—A. M. Falik

Attorney, Agent, or Firm—Flynn & Frishauf

[57] **ABSTRACT**

A tubular housing retains a spirally wound torsion spring, which is locked in one position and bears against a rotatable carrier which carries the latch opener itself in the form of a hook having a first bend, the inside corner of which may be formed as a cutting edge; and a second bend at an obtuse angle engaging the latches of the needle. If a needle latch should not open, or the needle be bent, the latch opener swings against the force of the torsion spring, thus tripping a shut-off switch to stop the machine, and simultaneously giving an indication by an indicator lamp which latch opener has tripped.

7 Claims, 8 Drawing Figures



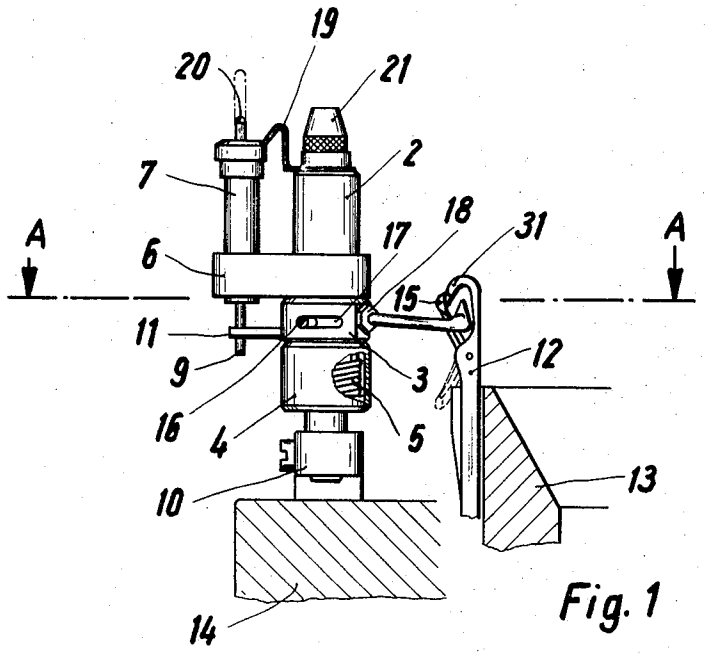


Fig. 1

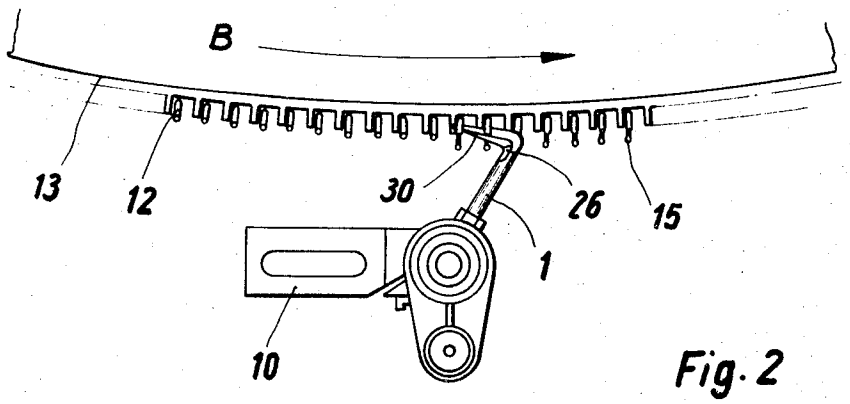


Fig. 2

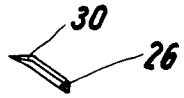


Fig. 4

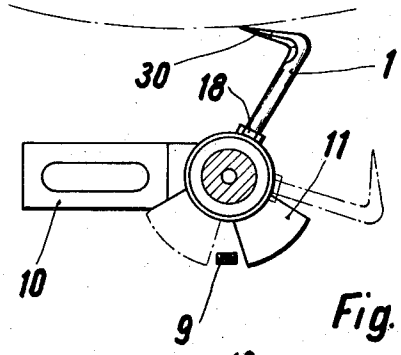


Fig. 5

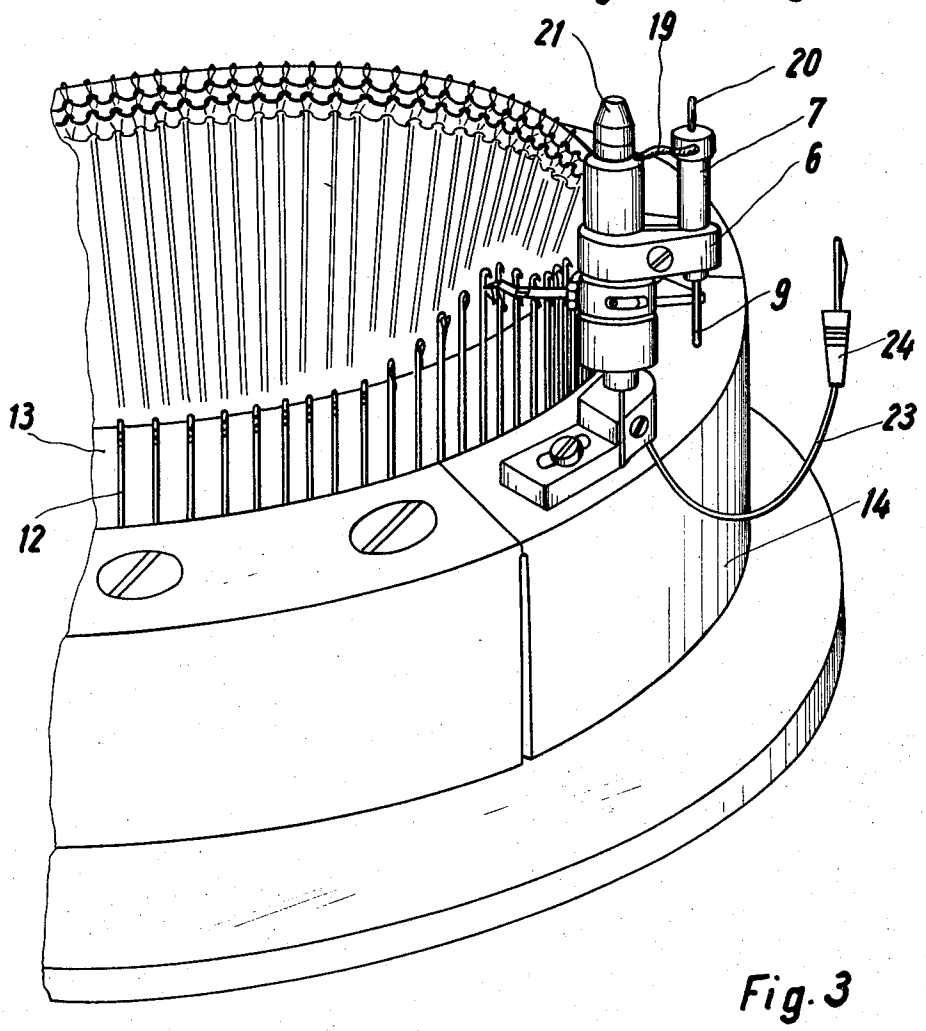


Fig. 3

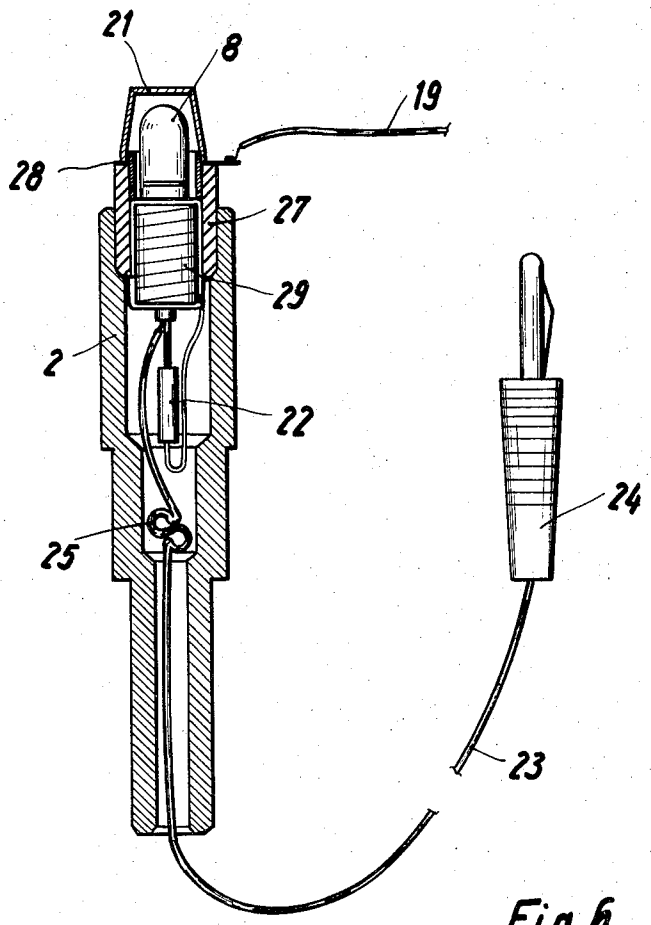


Fig. 6

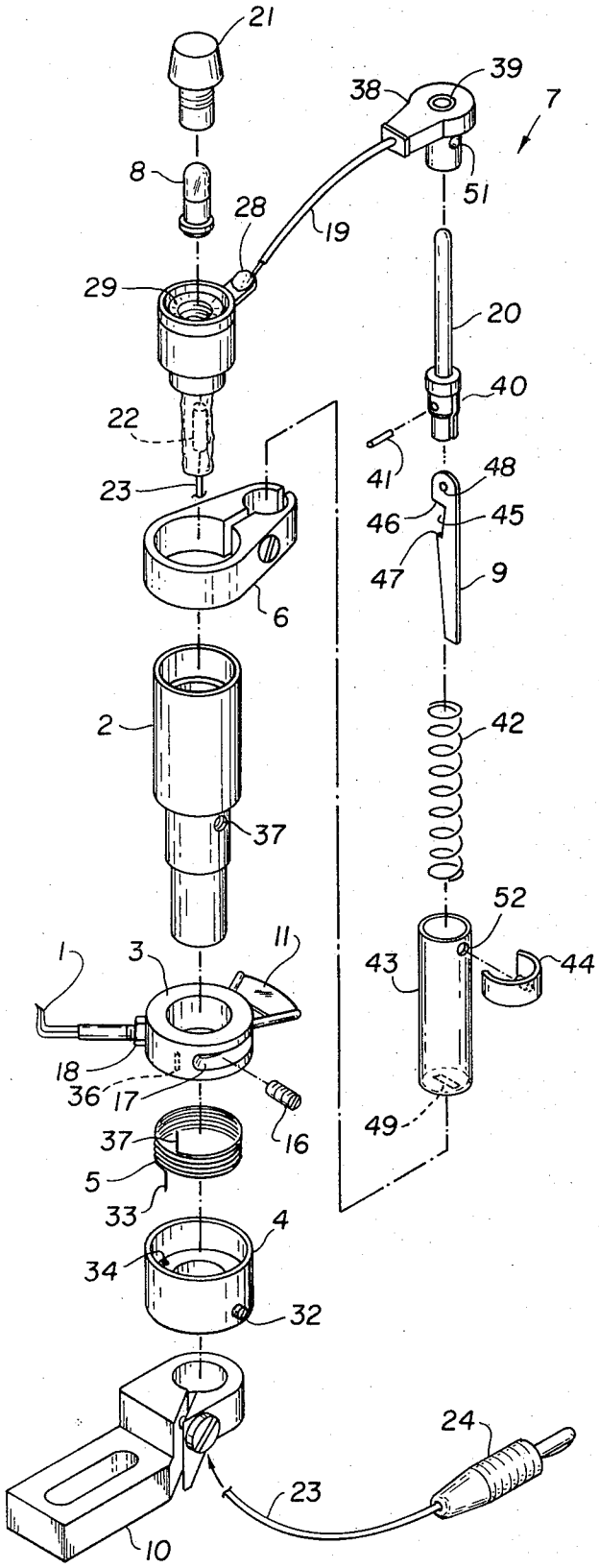

21
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38
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8
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6
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17
16
49
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5
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4
34
32
24
23
10

Fig. 7

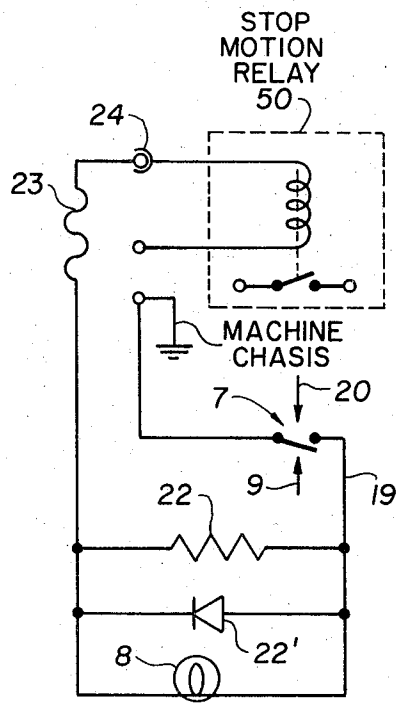

STOP
MOTION
RELAY
50
24
23
MACHINE
CHASIS
7
20
9
19
22
22'
8

Fig. 8

LATCH OPENER APPARATUS FOR KNITTING MACHINES AND PARTICULARLY CIRCULAR KNITTING MACHINES

The present invention relates to latch openers, and more particularly to latch openers for circular knitting machines.

Transfer feeds on knitting machines frequently require latch openers (see U.S. Pat. Nos. 3,397,556 and 3,631,690). Such latch openers are arranged to provide for stopping of the machine for knitting machine needle latches which are not and properly positioned.

The arrangements of the prior art have the disadvantage that the operating sequence of the latch opener must be preprogrammed, that is, it would stop the machine at any time that the tongue is being operated by being opened, even during knitting of a pattern which requires no opening. The program, however, determines the time during which the machine should be stopped if a tongue, or latch of a needle is sensed to be in a wrong position. For example, if an edge, or certain pattern is to be knitted, some latches remain in closed position which may, however, cause tripping of the latch opener. In prior art constructions the opening hook of the latch opener is comparatively far away from a pivot point about which it can swing, so that the latch opener as described can be used with machines having a very fine cut, only with difficulty. Play in the bearing, and looseness of the opening hook cannot be tolerated, since any play is multiplied in effect by the long lever arm resulting from the construction of the hook itself i.e., the distance of the hook from the pivot point.

The adjustment of the latch opener with respect to the needles themselves has to be precise. This requires a construction for a latch openener which will retain its precision position with respect to the needles, and which can be adjusted accurately in a predetermined position. The latch opener should, additionally, so operate that it will not damage the needles and be so constructed that it will not hook into the knitted fabric, due to erroneous positioning, vibration or the like, even though the knitted fabric itself may, due to some other defects, pile up at the needles. Multifeed, and particularly high-feed transfer machines utilize a large number of dial and cylinder needles, and thus require a large number of latch openers. If all these latch openers act on a common turn-off switch, it is difficult to check which latch opener actually was tripped.

It is an object of the present invention to provide a latch opener construction which provides for accurate positioning, is reliable in operation, and gives an indication which opener has been tripped.

Subject matter of the present invention: Briefly, a tubular housing is provided which retains a spring, for example a spiral torsion spring, against the force of which a latch opener hook can be rotated, the hook itself having, preferably, a double bend so that the lever effect of a long hook is largely minimized. The hook is carried on a ring-type hook carrier which is biassed by the spring. A shut-off switch is provided, which is tripped if the needle latch opener is swung against the force of the spring, for example upon sensing a defective needle for example having a defective latch or being deformed, the switch on the one hand controlling stopping of the machine and on the other connecting an indicator lamp placed directly on the latch opener housing to show which latch opener has tripped.

In accordance with a feature of the invention, the entire assembly is essentially tubular and can be clamped accurately, both in radial as well as in longitudinal position (with respect to the needles of the knitting machine) and maintained in this position in spite of machine vibration.

The tip of the latch opening hook, in accordance with another feature of the invention, is so made that a straight point thereof is followed by an angled portion, offset by an obtuse angle; this arrangement provides for complete opening of the latch of the needle and sufficient clearance for the latch with respect to a subsequent thread guide such thread guides are customary, particularly in circular knitting machines. The angled-off portion is then followed by a second angled portion, bent about an angle which is much sharper and may be less than 90°, for example 75°, although this angle, itself, is not critical at all.

The invention will be described by way of example with reference to the accompanying drawings, wherein:

FIG. 1 is a schematic side view of the latch opener applied to a circular knitting machine, and showing its engagement with cylinder needles;

FIG. 2 is a top view of FIG. 1;

FIG. 3 is a perspective view of a circular knitting machine illustrating the latch opener and its placement on the machine;

FIG. 4 is a detail view of the tip of the latch opener hook, to an enlarged scale;

FIG. 5 is a transverse sectional view along line A—A of FIG. 1;

FIG. 6 illustrates the top element, showing the electrical connections, in vertical section;

FIG. 7 is an exploded, perspective view of the latch opener and switch; and

FIG. 8 is a schematic circuit.

A tubular support **2**, preferably a circular tube, rotatably retains thereon a ring-shaped latch opening hook carrier **3**, which has one or more threaded holes therein, into which a latch opening hook **1** is threaded and secured by means of a nut **18**. A pin **16**, secured to the support **2** is movable in an elongated slot **17** formed in carrier ring **3**, to limit the excursion of the latch opening hook **1**.

A housing **4** is secured to the support **2** at the bottom thereof, the housing **4** being rotatable with respect thereto and arranged to be held in predetermined rotary position. A spiral torsion spring **5** is located in the housing, secured at its lower end to the housing **4** and at its upper end to the carrier ring **3**, so that, upon rotating the housing **4**, and securing it in a predetermined rotary position, the spring **5** therein can be pre-stressed to hold the latch opening hook **1** in the full line position of FIG. **5** with a predetermined force, which is continuously adjustable. The setting force of the latch opening hook **1** can thus be matched to the type of needles which is being used.

A clamp **6** is secured to the support **2** above the ring **3**, the clamp **6** retaining a shut-off switch assembly **7**, which is adjustably mounted on support **2** to be both radially and axially movable. The ring **3** has a fan-shaped flag **11** (FIG. **5**) secured thereto which bears against a feeler **9** in form of a pin extending downwardly from the switch assembly **7**. Feeler **9** is so arranged that it can be pressed downwardly in the switch assembly to be engaged by the projecting flag **11**; this

is the normal, or base position of feeler **9.** Feeler **9** is so arranged that it will lock in the normal or base position, as shown in FIGS. **1** and **3,** but that, upon engagement by the projecting flag **11,** it will trip and move upwardly, and remain upwardly, regardless of subsequent movement of flag **11,** until manually re-set. The combination of feeler **9** and manual feeler-reset element or pin **20** forms the operating parts of the shut-off switch **7.**

The entire latch opening apparatus is adjustably secured to the knitting machine so that both its height, as well as its radial and longitudinal position with respect to the knitting needles can be adjusted. A clamp **10** (FIG. **1**) clamps a support stem secured to support **2,** or forming part thereof, the clamp **10** ending in an elongated bracket having an elongated clamping slot for securing to the knitting machine by means of a screw (see FIGS. **2** and **3**).

A signal lamp **8** (FIG. **6**) is located within a transparent housing **21** (FIG. **1**) at the head of the latch opening apparatus, the signal lamp **8** being connected over line **19** to the shut-off switch assembly **7** (FIG. **3**). Upon deviation and tripping of the feeler **9,** lamp **8** is connected to light, simultaneously providing a signal indication over a cable **23** and a connection plug (FIG. **6**) to the stop mechanism of the machine. The position of the feeler **9** can readily be seen by checking not only which one of the lamps **8** is lit, but also by checking the position of the feeler reset pin **20.**

The latch opening hook **1** is formed with an obtuse angle adjacent its tip (FIG. **4**) which, as illustrated, is about 150°, although this angle is not critical at all. The obtuse angle then continues to a sharply bent angle, for example in the range of between 70° and 80°, for example about 75°, although again this angle is not critical at all and may also be an obtuse angle. The relative proportion of the angular relationship will determine the closeness by which the latch opener apparatus can be mounted with respect to the needles, and the effectiveness of opening thereof. To permit cutting of thread, the two sharply angled bends of the opener **1** are sharpened at their inner corner, as seen at **26** (FIGS. **2, 4**) to form a cutting edge.

FIG. **5** illustrates the two limiting positions of the opener hook **1,** the full line position being the normal opening position and the chain-dotted line the opened position into which the opener hook may swing upon being struck by a deformed needle or by a needle in which the latch is defective so it will not readily open. The corresponding positions of the projecting flag **11** are likewise shown in full and chain-dotted lines. The direction of motion of the machine is indicated by arrow B in FIG. **2,** the hook engaging the needles **12** of needle bed **13** between the needle hook **31** and the latch **15** (FIG. **1**). A closed latch **15** is opened due to interaction of the yarn and movement of the needles **12** within the machine apparatus.

FIG. **6** schematically indicates the wiring; one side of the circuit is grounded, or connected to chassis of the switch element **7.** When the feeler **9** has been tripped, current is conducted over line **19,** solder terminal **28** to lamp socket **29** for the lamp **8.** Connector **23** and plug **24** provide for signal connections to the machine stop apparatus. To prevent damage from current surges, a resistor **22** (which, in case of a-c signal operation may be a diode) can be connected in parallel to the lamp socket **29,** and hence the lamp **8.**

The latch opening apparatus can be made to be very small so that it can readily be accomodated even in limited space available on multifeed circular knitting machines. The close spacing between the latch opening apparatus and the needles themselves permits accurate operation, with limited play, suitable choice of angles of the latch opening hook providing for minimum spacing and thus short lever arms. If the hook should encounter a bent needle or a needle in which the latch is stuck or will not open readily, it will deflect and cause the machine to stop; immediately after deflection, however, the hook will snap back to its initial position and cause opening of the subsequent needle latches to be again effective for its intended primary operation. Lamp **8** will clearly indicate in which knitting feed the trouble arose.

In some knitting operations it may not be desired to utilize the latch opening hook. The feeler **9** for the shut off switch assembly **7** can be so arranged that it will trip the switch within the assembly **7** only when moved in one direction, for example (referring to FIG. **5**) the switch will operate only when feeler **9** is deflected towards the left. Upon complete, for example manual deflection of the hook to its limiting position illustrated in chain-dotted lines, and then, after resetting feeler **9** by depression of feeler reset pin **20** permitting the hook to return under spring pressure, the flag **11** will bear against feeler **9** to tend to move trip lever **9** towards the right. If the switch in assembly **7** is so arranged that it is operated by deflection in one direction only, depression of the manually operable feeler reset pin **20** after the hook **1** has been manually placed in the chain-dotted position will securely hold hook **1** in place, and out of operation, for example when the particular feed is not used for transfer. The spring **5,** in this case, will resiliently press the leading edge of flag **11** against the feeler **9,** thus securely retaining the hook **1** in the chain-dotted position (FIG. **5**) in spite of machine vibration. The latch opening apparatus and the feeler **9** thus cooperate to conjointly prevent undesired operation. To again use the latch opener, it is only necessary to trip the feeler **9,** or to manually lift the feeler reset pin **20,** and permit the latch opener to return under spring pressure, to the full-line position of FIG. **5.** Pin **20** is then again depressed and the latch opener is ready for operation. If necessary, the feeler **9** may be formed with a slight notch into which a matching edge of flag **11** can engage.

Referring now specifically to FIG. **7**: The set screw **34** in housing sleeve **4** is used to adjust tension or torsion spring **5.** Leg **33** on spring **5** fits into hole **34** in spring housing **4.** Leg **37** on spring **5** is anchored in hole **36** on the lower face of ring **3.** Rotating housing **4** and securing it against element **2,** by tightening the set screw, then winds up, or releases the tension or torsion spring **5.**

Screw **16** passes through opening **17** and is threaded in hole **37** in support **2.** Feeler switch **7** is topped by a plastic connector **38** which has a metal sleeve **39** at its center, electrically connected to line **19.** When the plastic pin **20** is in the upward position, metal surface **40** contacts sleeve **39** to complete the circuit. This circuit will be: **24, 23, 29, 8, 19, 39, 40, 43, 6, 2** to **10,** forming the machine chassis. Pivot pin **41** allows feeler **9** to swing about pivot hole **48.** A notch **45** in feeler **9** has an upper surface **46** and lower surface **47.** The upper turn of spring **42** rests against the upper surface

46 causing counter-clockwise (as seen in FIG. 7) rotation of feeler 9. When feeler 9 passes through the rectangular hole 49 in the bottom of housing 43, surface 47 snaps into locking position. Any force on feeler 9 will result in disengagement of the notch 47 from the surface of hole 49.

Pin collar 44 engages the hole 52 in housing 43 and hole 51 in connector 38 to retain the feeler switch in the assembly. The feeler switch assembly 7 is suitably secured in clamp 6 to provide interference between the feeler 9 and the flag 11 (FIG. 1).

In the circuit, FIG. 8, diode 22 in parallel with resistor 22 is shown. The switch is only schematically indicated, feeler 9, when operated, providing an upward force against switch 7 to short the stop motion relay 50, provided on all machines, to machine chassis, thus closing the circuit and operating the stop motion relay 50, if the feeler switch 9 is deflected to permit upward motion, and engagement of collar 40 with metal sleeve 39, thus completing the contact.

Various changes and modifications may be made within the inventive concept.

I claim:

1. A latch opener for combination with a knitting machine utilizing latch needles to engage the needle latches to open any closed latches comprising

a central support (2);

a tubular spring housing (4) surrounding the support (2) and having a planar end defining a single plane of rotation;

a torsion spring (5) within the housing (4) and secured at one end thereto;

a latch opening hook (1);

a rotatable, ring-shaped carrier (3) supporting said hook (1), said carrier (3) being located coaxially to rotate about the support as a center and supported on said planar end of the tubular spring housing on said support, the other end of said spring (5) engaging said carrier and biassing the carrier (3) and hence the hook (1) into latch engaging position and permitting rotary movement of the carrier (3) and the hook (1) thereon into a clearance position of the hook upon engagement of the hook with a bent needle or a closed latch and thereafter to return under spring bias to a hook opening position, the latch opening and clearance positions which define the limits of rotation of the carrier (3) and the hook (1) thereon, and the path of rotation of said carrier all being confined to said single plane of rotation;

enclosed unilaterally operable spring-loaded latchable knitting machine control switch means (7) having a manually operable trip reset element (20), the switch means being secured to the support (2) and located laterally alongside the support and having a feeler pin (9) movable axially with respect to said housing to control ON-OFF switching of the switch means and to latch in axially extended position; and

a switch operating projection (11) secured to said reset element, the latter and extending radially from the carrier (3) and movable in said plane, upon rotary movement of the carrier, in a path interfering with the position of the feeler pin (9) of the switch means (7) when the feeler pin (9) is in axially extended position, to engage the feeler pin (9) at one side to trip and unlatch the feeler pin to remove the feeler pin from interference position with said projection, tripping of the feeler pin causing stop motion operation to stop the machine;

and wherein the unilaterally operable control switch means is disabled from tripping when engaged by the projection from the other side thereof, to provide, upon movement of the operating projection (11) beyond said interfering position, and manual operation of said trip reset element (20) into interfering position, for engagement of said operating element with the other side of the feeler pin which will then not be tripped and unlatched and permit continued operation of the machine, with the operating projection rotated beyond said interfering position, carrying along said carrier (3) and rotating said latch opening hook out of the path of the needles, engagement of the feeler pin (9) and said operating projection (11) being maintained by the force of the spring (5) acting on said carrier (3) upon deflected movement of said carrier (3).

2. Latch opener according to claim 1, wherein the latch opening hook (1) has a pointed free end (30) and a shank forming an obtuse angled bend adjacent the free end thereof.

3. Latch opener according to claim 2, wherein the shank of the latch opening hook (1) has a second bend inclined at an angle which is sharp with respect to the obtuse angle;

and a cutting surface (26) is formed in the crook

4. Latch opener according to claim 3, wherein the sharp angle is between 70 and 80 .

5. Latch opener according to claim 1, wherein said housing (4) is rotatable with respect to said support (2) and settable with respect thereto for continuous adjustment of the tension of said spring (5) biassing the carrier and hence the hook.

6. Latch opener according to claim 1, including electrical signalling means (8) directly located on said latch opener and electrically connected to indicate operation of said switch means (7, 9) upon deflection of the hook and movement into clearance position and tripping of the feeler pin (9) to indicate deflection of the hook upon malfunction of a latch-opening sequence during operation of the knitting machine.

7. Latch opener according to claim 1, wherein the switch operating projection comprises an essentially flat, radially extending segment forming an operating flag (11).

* * * * *