Aug. 20, 1968 G. WOOD 3,397,556

LATCH NEEDLE KNITTING MACHINES

Filed Dec. 22, 1965 3 Sheets-Sheet 1

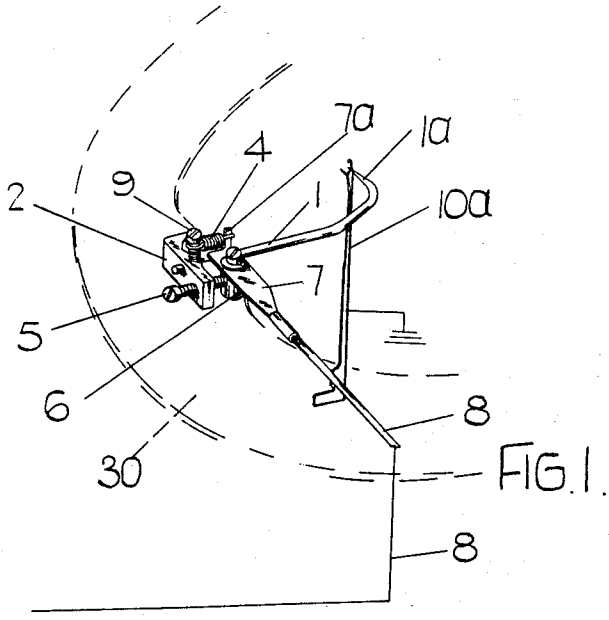


FIG. 1.

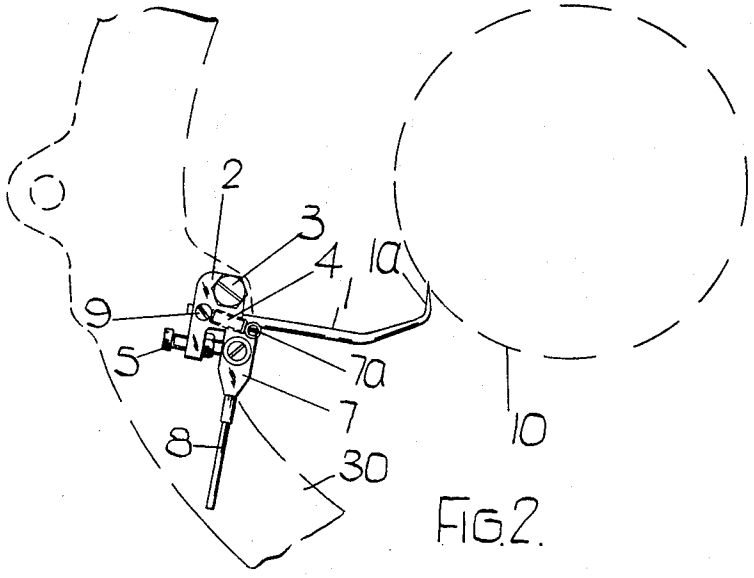


FIG. 2.

INVENTOR
GILLIES WOOD
BY
Kenyon Kenyon
ATTORNEYS

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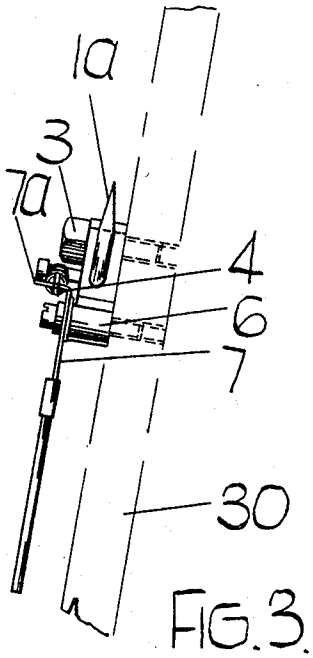


FIG. 3.

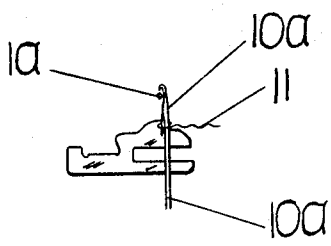


FIG. 4.

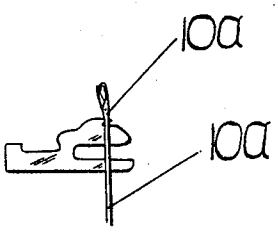


FIG. 5.

INVENTOR
GILLIES WOOD
BY
Kenyon & Kenyon
ATTORNEYS

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LATCH NEEDLE KNITTING MACHINES

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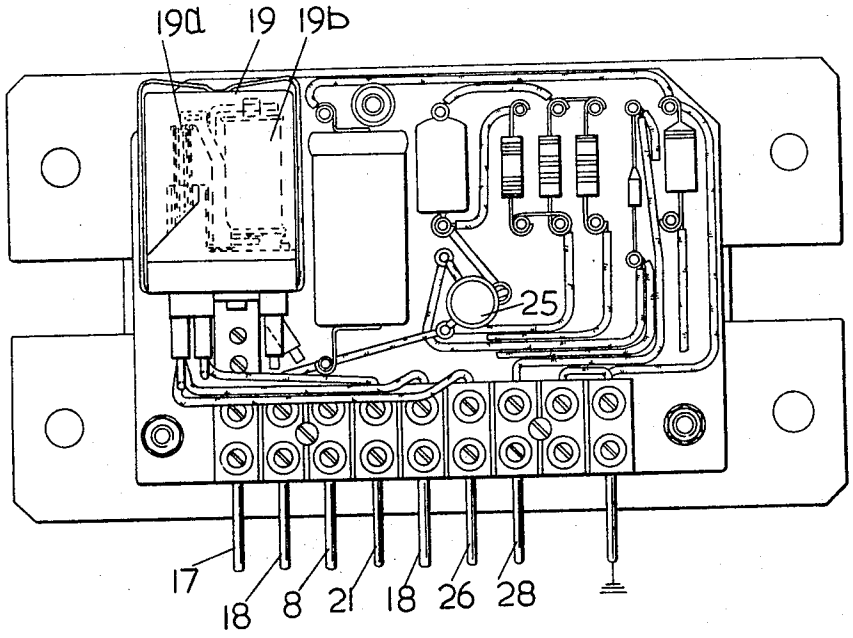


FIG. 7.

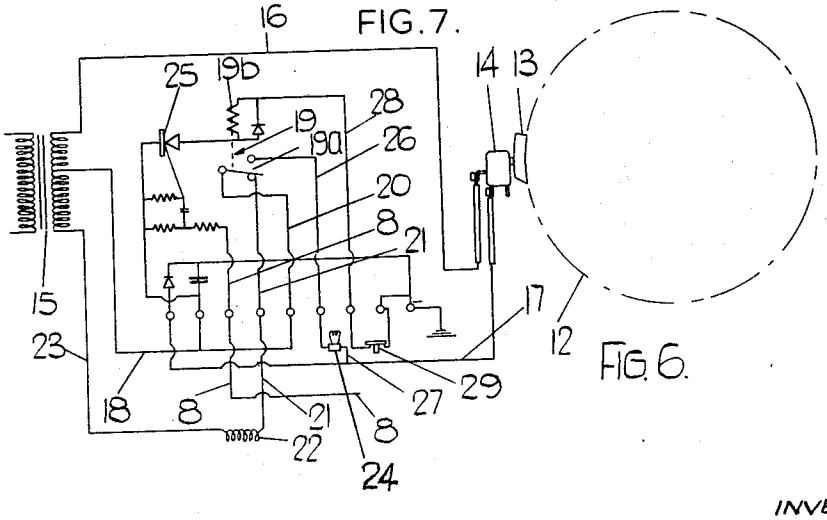


FIG. 6.

INVENTOR
GILLIES WOOD
BY
Kenyon & Kenyon
ATTORNEYS

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LATCH NEEDLE KNITTING MACHINES

Gillies Wood, Evington, Leicester, England, assignor to The Bentley Engineering Company Limited, Leicester, England

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Claims priority, application Great Britain, Dec. 29, 1964, 52,653/64
7 Claims. (Cl. 66—111)

ABSTRACT OF THE DISCLOSURE

Stop motion apparatus of a latch needle knitting machine including a combination comprising an electrically conducting combined latch opener and detecting device having an insulating mounting, means associated with the said device to produce electrically a machine stop signal when a needle latch is misplaced and means inhibiting the production of such a signal at times when the said device is required to operate as a latch opener without causing stoppage of the machine.

This invention concerns latch needle knitting machines, primarily circular knitting machines, and relates to a combined latch opener and stop motion apparatus. Such machines require to be quickly brought to a standstill in the event of a knitting fault, or in the event of the yarn supply running out (which latter results in the fabric being pressed off the needles). In some circumstances the fabric is deliberately pressed off the needles, as for example in the manufacture of stockings, socks or the like, in which case it is usual to press off the stocking or the like as soon as its knitting is completed and then to restart the machine on empty needles. After a press-off it is necessary to ensure that the latches of the empty needles are open preparatory to producing a setting-up course for the next stocking or the like. It is therefore known to provide a latch needle knitting machine with a latch opener and, separate and distinct therefrom, with a stop motion apparatus which incorporates a detector for detecting a fault. These separate devices require space for their accommodation and in the case of circular knitting machines having a plurality of knitting and feeding positions the provision of the necessary space has become increasingly difficult.

The present invention therefore provides, in a latch needle knitting machine having a stop motion apparatus serving automatically to stop the machine upon receipt of a signal indicative of a fault, the combination of a latch opener for performing the two functions of (a) opening the latches and (b) detecting a fault consisting of a misplaced latch and sending the signal and a control for preventing the transmission (which expression includes the effective transmission) of the signal during a required period of the operation of the machine. This control is necessary because of the dual function of the latch opener. Specifically the control is arranged to prevent the latch opener from sending the signal during a period when it performs its latch opening function but permitting it to send a signal when it acts as a fault detector to detect a misplaced latch occurring during knitting.

Thus, in a knitting machine having a programming means for programming it to perform a cycle of operations resulting in the production of a length of fabric (such for example, as a stocking, sock, or the like), this programming means may also prevent said signal transmission during a portion of the cycle of operations. The cycle of operations may include knitting a setting up course on initially bare needles, thereafter knitting a predetermined number of courses to produce the length of

fabric, and finally pressing that length off the needles. In these circumstances it is necessary for the latch opener to function to open the latches preparatory to the commencement of the setting up course, but while it is doing so, it must be inoperative to send a signal as it makes contact with a closed or partially closed latch.

It will be appreciated that the programming means may be of any suitable kind, such for example as the essentially mechanical kind commonly employed and consisting of one or more cam drums, pattern drums, or pattern chains, or a jacquard system or punched card system.

Having regard to the speed at which present day power-driven knitting machines operate and the relative frailty of needle latches, practical considerations dictate that the signal shall be electrical. However since arcing between the latch opener and the needle latches cannot be tolerated the electrical current used must be an extremely weak one, and means provided for amplifying it.

In addition to bringing the stop motion apparatus into operation, the signal may also serve to cause a warning light to be illuminated.

In order that the invention may be better understood reference will now be made to the accompanying drawings, in which:

FIGURE 1 is a perspective view showing the dual-function latch opener in a circular knitting machine;

FIGURE 2 is a plan view thereof;

FIGURE 3 is an elevation from the right of FIGURE 2;

FIGURE 4 shows a needle with fabric on it;

FIGURE 5 shows a needle without fabric and at a phase when contact is being made with the latch opener;

FIGURE 6 shows a wiring diagram (in an electrical control unit) and part of the programming apparatus of the machine; and

FIGURE 7 is a view of the electrical control unit.

In FIGURE 1 one of the latch needles is shown at **10***a* and in FIGURE 2 the circle in which these latch needles are arranged is indicated at **10**. They are operated to perform their knitting function in known manner, and the machine has any desired number of yarn feeding and knitting positions. In advance of each such position there is a metal latch opener **1** which is mounted in insulating block **2** pivoted on screw **3** for movement about an axis parallel to that of the needle circle. The latch opener **1** has a pointed extremity **1***a* which is directed obliquely towards the needle circle at a level such that, when the needles approach it in the anti-clockwise direction (FIGURE 2) and slightly below clearing height, it will enter the hooks of the needles and open their latches if closed or nearly closed. It thus prises the latches open. It is also arranged, by its fleeting physical contact with a closed or nearly closed latch, to transmit an electrical signal in the manner hereinafter described.

FIGURE 4 illustrates a needle **10***a* with fabric **11** on its latch being held open by a knitted loop so that no contact is made between the tip **1***a* of the latch opener and the needle latch. In FIGURE 5 it is assumed that there has beeen a cessation in the yarn supply (e.g. due to the yarn supply having been exhausted) so that the fabric has been pressed off the needles with the further result that a needle latch has arrived at the latch opener in a raised (latch closed) position and has made contact with the opener to send a signal.

The operating position of the latch opener is determined by an adjustment screw **5** in the block **2** which engages a stop **6** of insulating material fixed to a stationary supporting plate **30**. The latch opener is urged to this position by a light tension spring **4** extending between a screw **9** in block **2**, which screw makes electrical contact with the latch opener, and an abutment **7***a* standing up from the end of a terminal **7** mounted on stop **6**. This terminal **7** is

connected by a lead 8 to the circuit shown in FIGURE 6.

Thus the latch opener 1 is in electrical connection with the lead 8 by way of spring 4, but is insulated from the machine. There is an earth connection from the needles as illustrated in FIGURE 1. Thus the fleeting physical contact between the latch opener and a misplaced latch results in the circuit shown in FIGURE 6 being connected to earth and receiving a fleeting signal pulse. It may be mentioned that in this fleeting physical contact the latch opener may swing momentarily to an inoperative position against the action of spring 4 so as to avoid damage either to the latch of the needle or to itself.

Turning now to FIGURE 6, 12 indicates the usual cam drum of the machine which forms part of the programming means. It carries, among others, a cam 13 which serves to operate a micro-switch 14. This switch 14 is held closed during knitting so an effective signal will be transmitted in the event of a misplaced latch being detected, but is open during the time that the needles are bare so as to prevent the effective transmission of a signal when the latch opener is functioning to open latches. The function of the control unit illustrated in FIGURES 6 and 7 is to amplify this electric signal and to maintain the amplified signal for a long enough period of time for it to operate the stop motion of the machine. The importance of this will be realised when it is understood that the time of contact between a needle latch and the latch opener 1 is only a few milli-seconds while the current flowing between the two is desirably only in the order of a few milli-amps (so that there will be no arcing between the latch opener and a latch as they separate).

The control unit illustrated employs a thyristor (a thyratron transistor) as the basic amplifying device, but any other suitable amplifying devices including transistors, thermionic valves, and thermionic discharge valves such as thyratrons or cold cathode tubes, or alternatively suitable magnetic amplifying means, may be used.

The electrical supply to the unit is preferably of a relatively low voltage and 24 volts A.C. is safe and adequate for the purpose. It is derived from the mains supply by way of a transformer 15 having a split secondary from which lead 16 goes to the switch 14 and thence a lead 17 goes to the amplifying circuit. The other lead 18 goes directly to the unit from the transformer 15 and an additional circuit (conveniently 42 volts A.C.) is used for the machine starter.

The control unit contains a relay 19 the changeover contacts 19*a* of which in the de-energised condition of the relay coil 19*b* allow current to flow from the supply via leads 18, 20, 21 and 23 through the contact coil 22 incorporated in the stop motion apparatus. This coil 22, when energised, permits the machine to run and when de-energised results in the machine being automatically brought to a standstill in any suitable manner. While coil 22 is energised a circuit through a warning light 24 is interrupted.

Upon contact being made betwen a misplaced latch and the latch opener a signal is sent along lead 8 to the thyristor 25. This serves to amplify the current to the coil 19*b* of relay 19 so as to reverse the contacts 19*a*. This interrupts the circuit to coil 22 so that the machine is brought to standstill and at the same time establishes a supply circuit to the warning light 24 through leads 26, 27 so that the warning light is illuminated.

The thyristor has the property of maintaining this condition even after the cessation of the extremely brief signal from the latch opener, the maintaining current flows through lead 28 and normally closed press-button switch 29 to earth.

When the operator wishes to re-start the machine he first presses the button switch 29 to open it. This breaks the circuit through the coil 19*b* of the relay 19 and re-establishes the conditions shown in FIGURE 6 so that the circuit through the warning light is interrupted and the latter is extinguished and the coil 22 is energised. It is then possible to re-start the machine in the normal manner.

It will be appreciated that during such time as the switch 14 may be held open by the control cam 13 in the programming means (i.e. during the time when the latch-opener 1 is required to function solely as a latch opener) the circuit to the thyristor 25 and relay coil 19*b* is interrupted, so that (a) the effective transmission of a signal from the latch opener is prevented and (b) the coil 22 is maintained in its energised condition and the stop motion apparatus is rendered inoperative to stop the machine.

The stop motion apparatus itself may have any suitable form. It may be arranged to receive and act on signals, from a fault detector or detectors additional to the latch-opener 1, indicative of a fault or faults other than a misplaced latch, such as a needle wrongly remaining in an elevated position (as may occur due to a broken butt).

Following the foregoing description of the application of the invention to a circular knitting machine, its application to other latch needle machines will present no difficulty to the knitting machine builder.

What I claim is:

1. In stop motion apparatus of a latch needle knitting machine, the combination comprising an electrically conducting latch opener, means for mounting said latch opener on and electrically insulating it from a machine for co-operation with needle latches thereof for opening any that are closed, electrical signal sending means connected to the latch opener to produce a machine stop signal when the latch opener engages a closed or partly closed latch, and control means for preventing production of such a signal when latch opening without machine stoppage is required.

2. A combination according to claim 1, having the said control means organized to prevent the signal sending means from operating when the latch opener is required to perform a latch opening function at one stage of knitting and to permit the signal sending means to operate when the latch opener is required to detect a misplaced latch during another stage of knitting.

3. A combination according to claim 1 provided in conjunction with programming means of a knitting machine, which programming means serves to control the machine for a performance of a cycle of operations, and having means actuated by said programming means to prevent the signal sending means from operating during a portion of the cycle of operations.

4. A combination according to claim 3 having the programming means organised to control a cycle of operations including knitting a setting up course on initially bare needles, thereafter knitting a length of fabric and afterwards pressing off the fabric from the needles, and having the means actuated by the programming means arranged to render the signal sending means inoperative during a period preparatory to the commencement of the setting up course, whereby the latch opener will open any closed or partly closed latches without stopping the machine.

5. A combination according to claim 3 provided with programming means of a mechanically operating type.

6. A combination according to claim 1 comprising low current electrical signal sending means actuated by the latch opener and means for amplifying the signal given by said signal sending means to provide an output appropriate for operating the stop motion.

7. A combination according to claim 6 comprising a warning light and means whereby said light is illuminated on the sending of a signal by the signal sending means.

References Cited

UNITED STATES PATENTS

2,161,209	6/1939	Vossen	66—157
2,165,975	7/1939	Lawson et al.	66—157

(Other references on following page)

5

UNITED STATES PATENTS

2,531,681	11/1950	Hill	66—157
2,257,037	9/1941	Crawford	66—157
2,588,689	3/1952	Antonevich	66—157
2,661,615	12/1953	Crawford et al.	66—157
2,755,648	7/1956	Vossen	66—157
2,760,363	8/1956	Van Alen et al.	66—157
2,869,343	1/1959	Toone	66—157
2,933,909	4/1960	Hanzl et al.	66—157

6

FOREIGN PATENTS

626,961	7/1949	Great Britain.
870,690	6/1961	Great Britain.
552,237	11/1956	Italy.
133,546	4/1961	Russia.

MERVIN STEIN, *Primary Examiner.*

R. FELDBAUM, *Assistant Examiner.*