Nov. 28, 1950

R. HILL

2,531,681

ELECTRIC STOP MOTION FOR DOUBLE FEED MECHANISM ON KNITTING MACHINES

Filed July 14, 1949

2 Sheets-Sheet 1

FIG. 1.

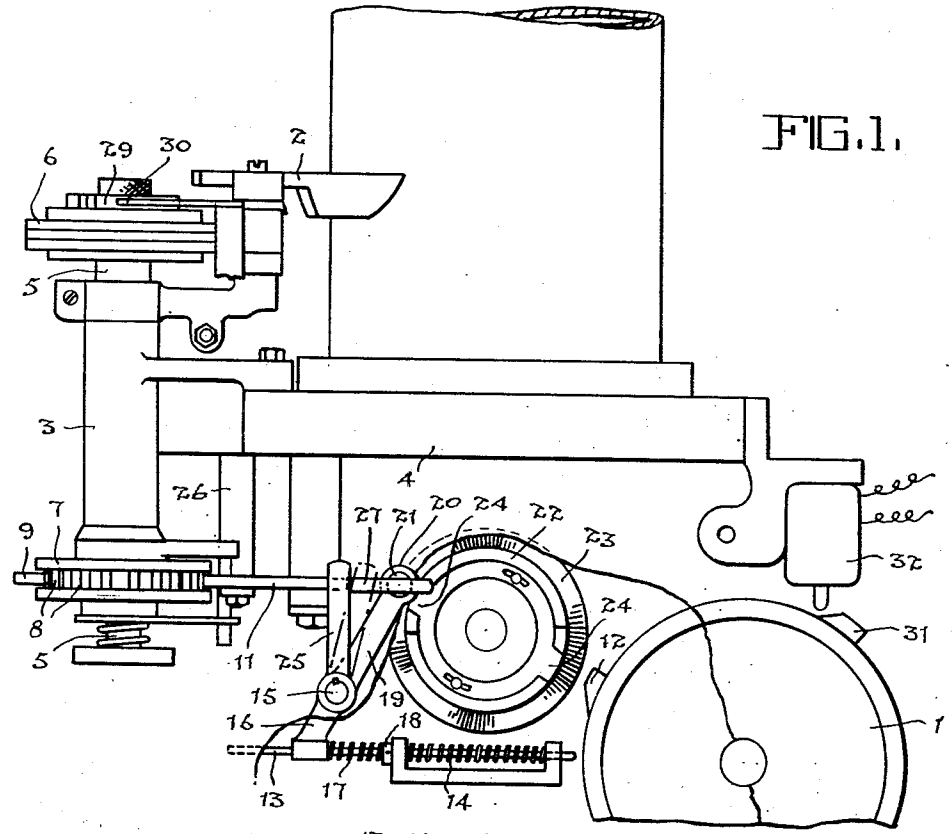
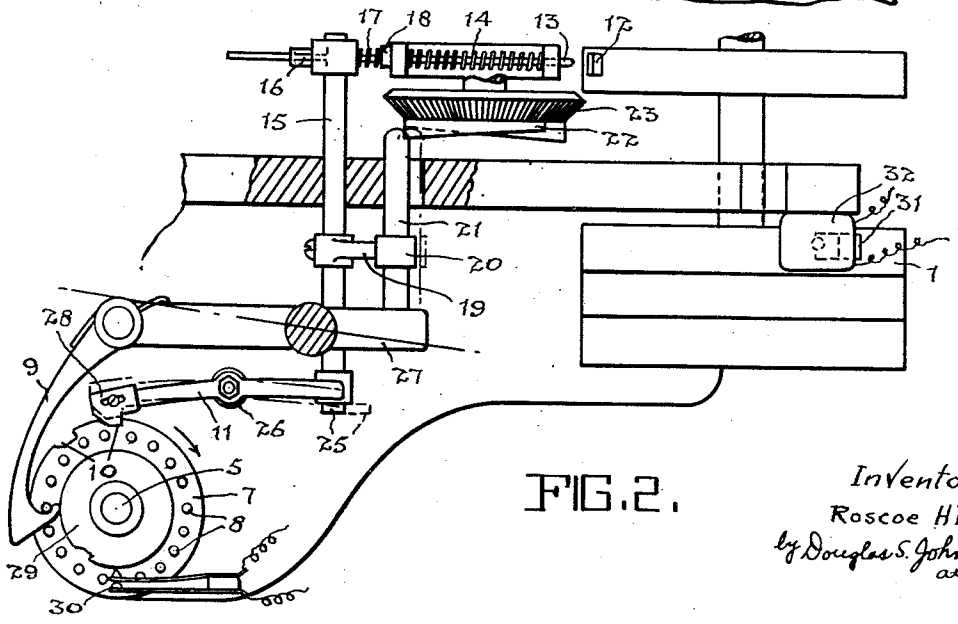


FIG. 2.



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2 Sheets-Sheet 2

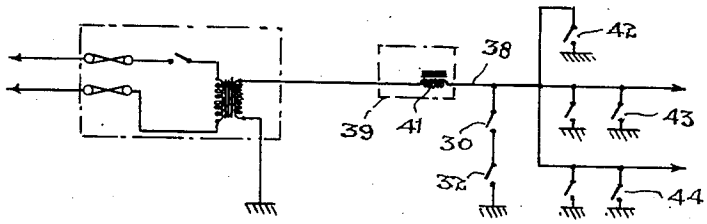


FIG. 3

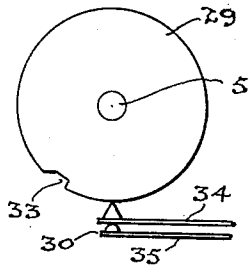


FIG. 4.

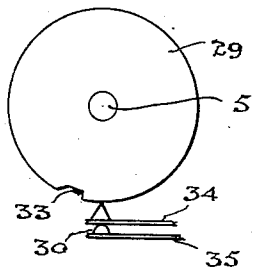


FIG. 5.

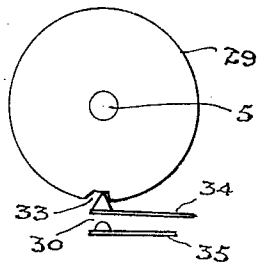


FIG. 6.

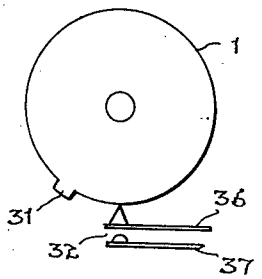


FIG. 7.

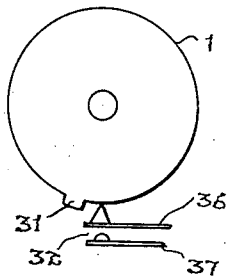


FIG. 8.

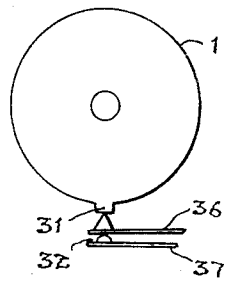


FIG. 9.

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UNITED STATES PATENT OFFICE

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ELECTRIC STOP MOTION FOR DOUBLE FEED MECHANISM ON KNITTING MACHINES

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Application July 14, 1949, Serial No. 104,793

7 Claims. (Cl. 66—157)

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This invention relates to improvements in knitting machines and more particularly to improvements in the control of the double-feed attachment commonly used on knitting machines of the superposed cylinder type. The present knitting machines are generally provided with a double-feed attachment so that two courses of fabric can be knitted each revolution of the machine in place of the single course knit by a machine without double feed.

The double feed is accomplished by introducing a second yarn at a second feed point at the rear of the machine, and the machine may be made to knit two courses of similar or different coloured yarns throughout the whole of the sock or stocking being knitted with the exception of the heel and toe where knitting at the second feed point must be suspended.

Camming at the second feed is designed to manipulate needles only where the needle cylinders rotate, but during the knitting of the heel and toe the cylinders reciprocate and unless provision is made for suspending knitting at the second feed point damage to the machine will occur, resulting in both the expensive repairing of the damage and the consequent loss of production until the damage is repaired.

Accordingly on existing machines, means for suspending knitting at the second feed point are included in the double feed attachment and are controlled from cams on the main or control drum of the machine.

From experience it has been found that the double feed control mechanism is liable to become out of time or synchronism with the remainder of the machine and upon such occurrence knitting at the second feed point is not suspended and commenced at the proper time, with the result that feeding at the second point during knitting of the heel or toe where the needle cylinders are reciprocating may occur and damage to the machine and loss of production as explained above is apt to result.

It is the object of this invention to provide a stop motion associated with the double feed attachment to accurately determine whether or not the double feed mechanism and the machine are in synchronism and to stop the machine upon the double feed mechanism becoming out of time with the knitting action to overcome the previously encountered difficulty.

Another important object is to provide a stop motion device including an electrical control circuit which can be readily incorporated into an existing electric stop motion for stopping the machine upon breakage of a yarn or other knitting failures.

A still further important object consists in providing a stop motion control which can be easily, quickly and economically mounted on

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present machines equipped with conventional electric stop motions without modifying or altering or interfering with the present machine actions.

The principal feature of the invention consists in providing a cam device shown in the form of a notched disc mounted on the vertical shaft of the racking mechanism of the double feed attachment along with the control cam for the knitting cams, yarn feeders and trappers of the extra feed, arranging a switch connected in the machine stop motion control circuit to be operated by the notched disc upon the racking mechanism completing its normal racking, providing a cam on the main drum related to the double feed and associating therewith a second switch also connected in the machine stop motion control circuit and in series with the aforesaid switch whereby with the double feed control mechanism and machine in synchronism the second switch is operated by the main drum coincidental with the operation of the first switch by the notched disc upon completion of the movement of the double feed racking mechanism to maintain said stop motion control circuit de-energized to prevent stopping of the machine.

With reference to the accompanying drawings,

Figure 1 is an elevational view of a double feed attachment mounted on a knitting machine and provided with an electric stop motion in accordance with my invention.

Figure 2 is a fragmentary plan sectional view illustrating the manner in which the double feed mechanism is racked as controlled by the main control drum of the machine.

Figure 3 is a circuit diagram of the normal electric stop motion control circuit of a knitting machine in which my double feed attachment stop motion has been incorporated.

Figures 4, 5 and 6 are diagrammatic illustrations showing successive movements of the notched disc on the spindle of the double feed attachment as the double feed is put through a normal racking.

Figures 7, 8 and 9 are diagrammatic illustrations showing the successive positions of the main control drum corresponding to the positions of the double feed notched disc with the control drum and double feed attachment in time or synchronism.

In reference to the drawings, only those parts of the knitting machine which are essential to the understanding of this invention are included, it being understood that the functioning of the machine is controlled through cam mechanisms arranged on the main or front control drum 1, as is well understood in the art.

The double feed attachment generally designated as 2 comprises a vertical bracket 3 mounted on the frame 4 of the machine. Extending

through this bracket 3 is a vertical shaft 5 on the upper end of which are secured the double feed operating cams 6 which operate respectively the draw thread trapper, the double feed trapper, the double feed feeder, the plain and rib feed bolts and the draw thread feeder mechanisms, details of which are not shown.

Secured to the lower end of the vertical shaft 5 is the horizontally disposed rack wheel 7 carrying the peripheral pins 8 with which the racking pawl 9 co-operates and provided with the peripheral notches 10 with which the prop lever 11 co-operates to control the racking of the rack wheel, as hereinafter explained.

Mounted on the front control drum 1 are cams 12 (only one being shown) which are arranged to operate the double feed attachment at the points in the article to be knitted where it is necessary to bring the double feed into operation or to suspend the double feed action.

When the front drum is racked through the normal operation of the machine to the point where the double feed mechanism is to be actuated, e. g., going into the knitting of the heel or toe of the sock, cam 12 engages the spring-loaded push rod 13 to move same horizontally against the restraining action of the spring 14. This push rod in turn rocks the shaft 15 through the lever 16 and the spring 17 which is compressed between the lever 16 and the abutment 18 on the push rod 13 as the push rod is forced rearwardly.

Mounted on the shaft 15 is an arm 19 carrying at its upper end a journal boss 20 in which slidably operates a racking push rod 21 which is swung upon rocking of the shaft 15 into co-operative relation with the racking cams 22 mounted on the bevel gear 23 of the machine.

The racking cam 22 (being actually two diametrically opposed cams) is formed with its cam surface on its forward peripheral face. The racking push rod 21 enters the path of this cam surface through one of the openings 24 so that the timing between the movements of the racking push rod 21 and the machine will be synchronized.

The spring 17, which has been compressed during the movement of the racking cam 22 to permit entry of the racking push rod, serves to force the push rod into position as an opening 24 comes opposite thereto.

Also mounted on the shaft 15 is an arm 25 which is normally forward of the rearward end of the prop lever 11 but which, when swung rearwardly as the shaft 15 is rocked to move the racking push rod 21 into the path of a racking cam, clears the prop lever 11 to permit the latter when swung on its support 26 to block the return movement of the arm 25 and shaft 15 to withdraw the racking push rod 21 from the racking cam 22.

With the racking push rod in position to be engaged by a racking cam it will be forced outwardly in its boss 20 to engage the end of the racking pawl lever 27 which operates the racking pawl engaging the pins 8 of the racking wheel to advance the wheel in steps to rotate the vertical shaft 5.

Normally when the racking wheel 7 is at rest the end of the prop lever 11 which carries the foot 28 engages in one of the peripheral notches 10 of the rack wheel, but upon the wheel being racked its foot rides out onto the periphery of the rack wheel to swing its opposite end into the path of the arm 25 which has been cleared therefrom upon rocking of the shaft 15 to position the racking push rod 21 in the path of a cam 22.

Thus the racking push rod 21 will be held from withdrawal from the racking cam 22 until the prop lever 11 clears the arm 25 and therefore racking will continue to rotate the rack wheel and vertical shaft 5 until the next notch 10 appears to permit the foot 28 of the prop lever to move inwardly off the periphery of the rack wheel.

Thus it will be seen that racking is initiated by the main or front control drum 1 but once initiated racking continues as controlled by the prop lever 11 and spacing of the peripheral notches 10 on the rack wheel.

Once racking has been initiated a proper racking operation must be relied upon to maintain the double feed attachment in time or synchronism with the machine. It has been found in practice however that due to improper lubrication or improper action in any phase of the mechanical movement effecting racking of the rack wheel 7 the double feed mechanism may become out of time with the remainder of the machine and the cams 6 will not operate to introduce or withdraw the knitting cams at the second feed point at the correct instant, resulting in the damage described above. This fact is particularly true where the extra feed is taken out of action at the heel or the toe at which points the movement of the rack wheel 7 is very rapid and due to the speed of racking the wheel may overthrow and move beyond its normal position, preventing in some cases the prop lever 11 from falling into the notch 10 prepared therefor.

My control device to actuate the stop motion of the machine upon such loss of timing between the double feed attachment and the machine comprises the cam device in the form of a notched disc 29 located on the vertical shaft 5 of the double feed attachment and arranged to operate the switch 30, and a cam 31 mounted on the front control drum 1 and arranged to operate the switch 32, the switches being included in the stop motion control circuit of the machine shown in Figure 3.

The notched disc 29 on the shaft 5 normally holds the switch 30 in the closed position, as shown in diagrammatic form in Figure 4, which illustrates the relationship of the disc and the switch at the instant racking is initiated to withdraw the extra feed and take it out of action at either the heel or the toe.

Formed in the periphery of the disc 29 is a notch 33 which, when brought opposite the spring contact arm 34 of the switch 30, allows the arm 34 to move away from its co-operating contact 35 to open the switch 30 upon moving into the notch.

In taking the extra feed out of action at the heel for instance two very sharp rapid racks occur. Figure 5 shows the relationship of the notched disc 29 and the switch 30 following one rack. It will be seen that the switch 30 is still maintained in the closed position. Upon the second rack the disc 29 will be further rotated corresponding to the movement of the rack wheel 7 and vertical shaft 5 operated thereby, and the spring contact arm 34 registers with and moves into the notch 33 to open the switch 30.

On the other hand, it will be seen from Figure 7 that the switch 32 is normally open, Figure 7 illustrating the relationship between the cam 31 on the control drum 1 and the switch 32 at the instant racking is being initiated corresponding to the illustration of Figure 4.

Upon the initial rack, Figure 8, which corresponds to Figure 5, shows the second switch 32 so related to the front control drum cam 31 that

its contacts 36 and 37 are still maintained in the open position. Upon the second rack it will be seen that the cam 32 has moved to close the contacts 36 and 37, and as the timing sequence of Figure 9 corresponds to the timing sequence of Figure 6 it will be seen that this switch 32 is closed an instant after the switch 30 is opened, with the machine control drum 1 and double feed attachment 2 in synchronism.

Should the rack wheel 7 over-throw or should it not be racked far enough through sticking of one of the racking pawl operators described above, it will be seen that the notch 33 of the disc 29 will not register with the end of the spring contact arm 34 at the completion of the racking operation and the switch 30 will be maintained closed at the time that the contacts 36 and 37 of the second switch 32 are closed by the cam 31.

With reference to Figure 3, it will be seen that the switches 30 and 32 are connected in series between the live conductor 38 of the electric stop motion control circuit of the machine generally designated as 39 and ground. This connection places the switches in series in a normally open circuit with an electro-magnetic operator 41 which when energized by the closing of switches 30 and 32 operates a device (not shown) which mechanically stops the knitting machine.

Also included in series with this unit in the stop motion machine circuit are the usual top tension dropper switch 42, dropper switches 43 and needle detector switches 44, all of which form circuits paralleling the series switches 30 and 32.

It will be seen that as long as at least one of the switches 30 and 32 remains open there will be no current flow through the circuit branch including the switches to energize the coil of 41 to stop the machine. These switches 30 and 32 will always maintain the stop motion control circuit 39 de-energized with one of the switches' contacts being open at all times with the double feed attachment and the machine in synchronism, as clearly shown in Figures 4 to 9. However, should the double feed mechanism lose step with the machine, either through failure to rack or through the racks overthrowing, the switch 30 will be closed when the cam 31 on the main control drum 1 affects the closing of the switch 32. With the concurrent closing of these two switches the coil operator 41 will be energized and the mechanism operated to stop the machine.

It will be seen that the inclusion of these two switches 30 and 32 into the electric stop motion control circuit 39 of the machine will not interfere in any way with the operation of this circuit through the action of the top tension dropper switch 42, dropper switches 43 or needle detector switches 44, which operate in the usual manner, as well known in the art, to stop the machine.

While the diagrammatic illustrations of Figures 4 to 9 show the disc 29 provided with the single notch 33 and the front control drum 1 provided with the single cam projection 31, it will be appreciated that several notches may be included in the surface of the disc 29 and several cam projections on the drum 1 to control the synchronism of the machine at the various points where it is desired or required to introduce or withdraw the double feed attachment, Figures 4 to 9 being by way of illustration only.

The modification of present machines equipped with conventional electric stop motions to include my safety control feature is extremely simple. The notched disc 29 is simply mounted on the vertical shaft 5 and the cam 31 mounted on a convenient segment of the control drum 1 and adjusted relative to their respective switches 30 and 32 to gain their relationships illustrated in Figures 4 to 9. Once these cams and switches have been relatively located they are securely locked in position and the switches included in the stop motion control circuit of the machine. The provision of the notched disc, cams and switches will stop the machine upon any improper racking operation.

While my device is extremely simple and is further enhanced in that it can be conveniently and easily incorporated in present machines, its importance will nevertheless be fully appreciated particularly by the hosiery manufacturer in the substantial saving of material and time in the elimination of damage and loss of production presently occurring upon improper operation of the double feed attachment.

While I have particularly described my control device as including the cam 31 in its preferred position on the main control drum, it will be appreciated that it may be mounted in any manner to be moved or driven in synchronism with the knitting action of the machine without departing from the scope of my invention. The only stipulation which must essentially be fulfilled is that it must function to close its normally open switch 32 an instant after the normally closed switch 30 is opened upon a normal racking of the double feed mechanism.

While my device has been described as being applied to a knitting machine presently equipped with an electric stop motion, it should be understood that, various electric stop motions are commercially available for use on machines not so equipped and upon application of one of these, my device could be installed to function as described. It should also be understood that by combining my device with a suitable transformer and an electro magnet to trip the machine stop mechanism, it would operate independently of any other stop motion.

What I claim as my invention is:

1. In a knitting machine equipped for double feed, the combination with the main control drum, the double feed mechanism including racking wheel and cam operating vertical shaft operated thereby, and mechanism for effecting the racking of said double feed mechanism into and out of feeding relation upon actuation of said control drum, of a notched disc mounted on said cam operating shaft, a stop motion electrical control circuit, a switch included in said control circuit and arranged adjacent said notched disc to be operated thereby upon completion of normal racking of said double feed mechanism, a cam located on said main drum and a second switch included in said stop motion electrical control circuit and arranged adjacent said cam to be actuated thereby coincident with the completion of the normal racking of said double feed mechanism, said switches being connected in series to maintain said stop motion electrical control circuit de-energized while said racking mechanism and control drum remain in synchronism and to energize said electrical control circuit upon said racking mechanism and control drum moving out of synchronism during racking to stop said machine.

2. In a knitting machine equipped for double feed, the combination with the main control drum, the double feed mechanism including a racking wheel and a cam operating shaft secured thereto

for effecting the introduction and withdrawal of a second yarn for commencing and ending double feed, mechanism actuated by said control drum for operating said double feed mechanism, and a stop motion electrical control circuit to stop said machine upon energization, of cam means mounted on said shaft to be racked with said racking wheel, a switch included in said control circuit and arranged adjacent said shaft to be operated by said cam means at the end of a normal rack of said racking wheel to actuate said double feed mechanism, a second cam mounted on said main drum, a second switch mounted adjacent said main drum to be actuated by said second cam means upon the movement of said main drum to a position corresponding to the position which said rack wheel has been moved at the end of its rack when in correct synchronized relationship with said main drum, said switches being connected in series with one switch normally open and the other normally closed to maintain said control circuit de-energized and coincidentally closing and opening respectively with said main drum and racking wheel moved in correct synchronized relation but adapted to both assume a closed position upon said drum and racking wheel losing synchronism.

3. A device as claimed in claim 2 in which said switch operated by said cam means mounted on the shaft of said double feed mechanism is normally closed and said second switch operated by the cam means on said main drum is normally open.

4. In a knitting machine equipped for double feed, the combination with the main control drum, the double feed mechanism having a racking wheel to effect upon being racked the introduction and withdrawal of yarn at the second feed point for commencing and ending double feed, a mechanism controlled by the main drum for racking said double feed mechanism in synchronism with said main drum to suspend double feed at the heel and toe, of means for stopping the machine upon said main drum and double feed racking wheel losing synchronism during the racking of said racking wheel to suspend knitting at the heel and toe, said means comprising a notched disc driven by said racking wheel, a normally closed switch arranged adjacent said notched disc to be opened thereby upon said racking wheel completing a normal racking movement to withdraw said double feed mechanism, a cam driven by said main drum, a second normally open switch arranged to be closed by said cam an instant after opening of the first switch with said racking wheel and main drum in synchronism, and a stop motion control circuit having said switches in series included therein to be energized thereby upon said racking wheel and main drum losing synchronism to effect the closure of said switches at the same time.

5. In a knitting machine equipped for double feed, the combination with the main control drum, the double feed mechanism having a racking wheel to effect upon being racked the introduction and withdrawal of yarn at the second feed point for commencing and ending double feed, a mechanism controlled by the main drum for racking said double feed racking wheel in synchronism with said main drum to suspend double feed at the heel and toe, of means for stopping the machine upon said main drum and racking wheel losing synchronism during racking of said racking wheel, said means comprising a normally de-energized control circuit to stop the machine upon energization, a normally closed switch and a normally open switch connected in series in said control circuit and arranged to energize same upon being closed, a notched disc driven by said racking wheel to open said normally closed switch upon completion of normal movement of said racking wheel, and a cam driven by said main drum to close said normally open switch an instant after said normally closed switch is open with said racking wheel and main drum in synchronism to maintain said control circuit de-energized.

6. In a knitting machine equipped for double feed, the combination with the main control drum, the double feed mechanism having a racking wheel to effect upon being racked the introduction and withdrawal of yarn at the second feed point for commencing and ending double feed, a mechanism controlled by the main drum for racking said double feed racking wheel in synchronism with said main drum to suspend double feed at the heel and toe, of means for stopping the machine upon said main drum and racking wheel losing synchronism during racking of said racking wheel, said means comprising a normally de-energized control circuit to stop the machine upon energization, a normally closed switch and a normally open switch connected in series in said control circuit and arranged to energize same upon both being closed, means actuated by said double feed mechanism to open said normally closed switch upon completion of a normal rack and arranged to maintain said normally closed switch closed upon improper racking of said double feed mechanism, and means actuated by the machine to close said normally open switch an instant after said normally closed switch is opened upon normal racking of said double feed mechanism.

7. In a knitting machine equipped for double feed, the combination with the main control drum, the double feed mechanism having a racking wheel to effect upon being racked the introduction and withdrawal of yarn at the second feed point for commencing and ending double feed, a mechanism controlled by the main drum for racking said double feed racking wheel in synchronism with said main drum to suspend double feed at the heel and toe, of means for stopping the machine upon said main drum and racking wheel losing synchonism during racking of said racking wheel, said means comprising a normally de-energized control circuit to stop the machine upon energization, a normally closed switch and a normally open switch connected in series in said control circuit and arranged to energize same upon both being closed, cam means driven by said racking wheel to open said normally closed switch upon completion of normal movement of said racking wheel, and cam means driven in synchronism with the knitting action of said machine to close said normally open switch an instant after said normally closed switch is opened with said racking wheel completing a normal racking movement.

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