Dec. 13, 1960 J. M. HOOTS 2,963,890

ELECTRICAL STOP MOTION FOR KNITTING MACHINES

Filed Sept. 3, 1957 3 Sheets-Sheet 1

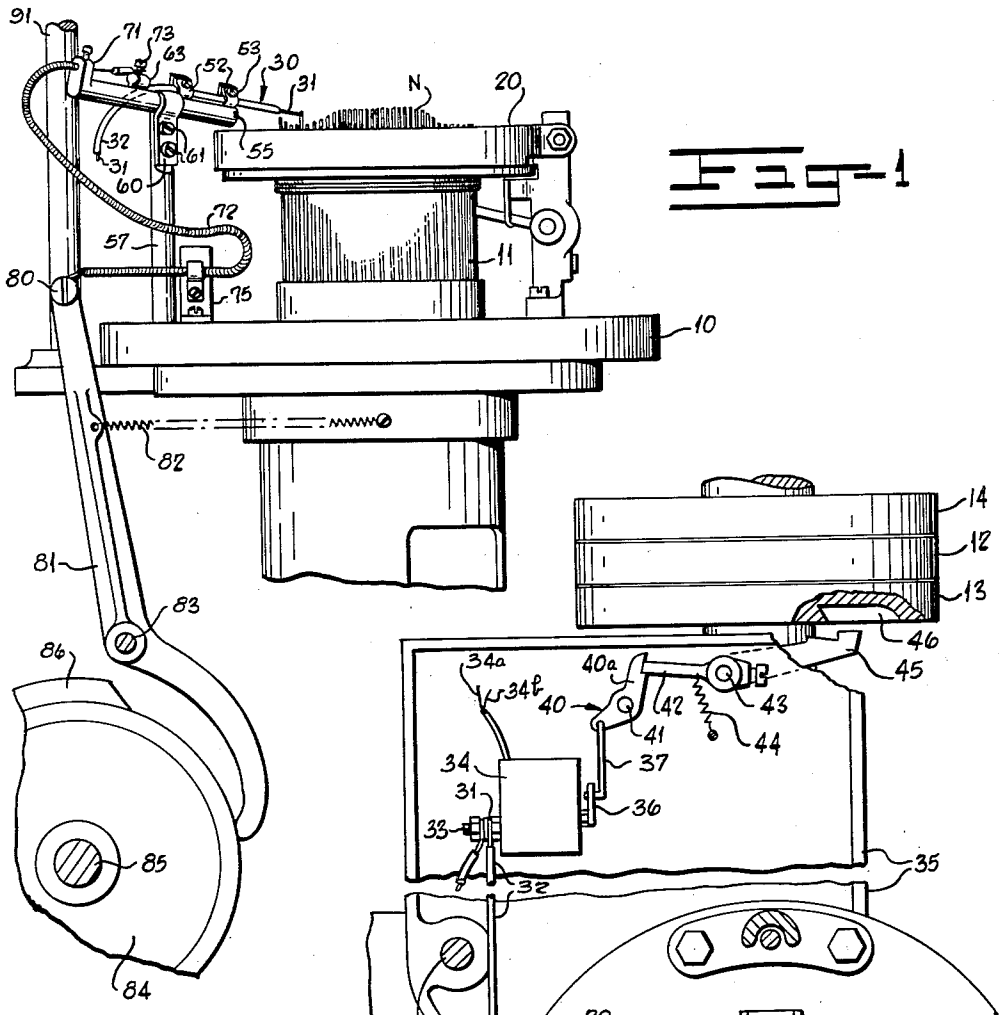


FIG. 1

FIG. 2

Dec. 13, 1960 J. M. HOOTS 2,963,890

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Filed Sept. 3, 1957 3 Sheets-Sheet 2

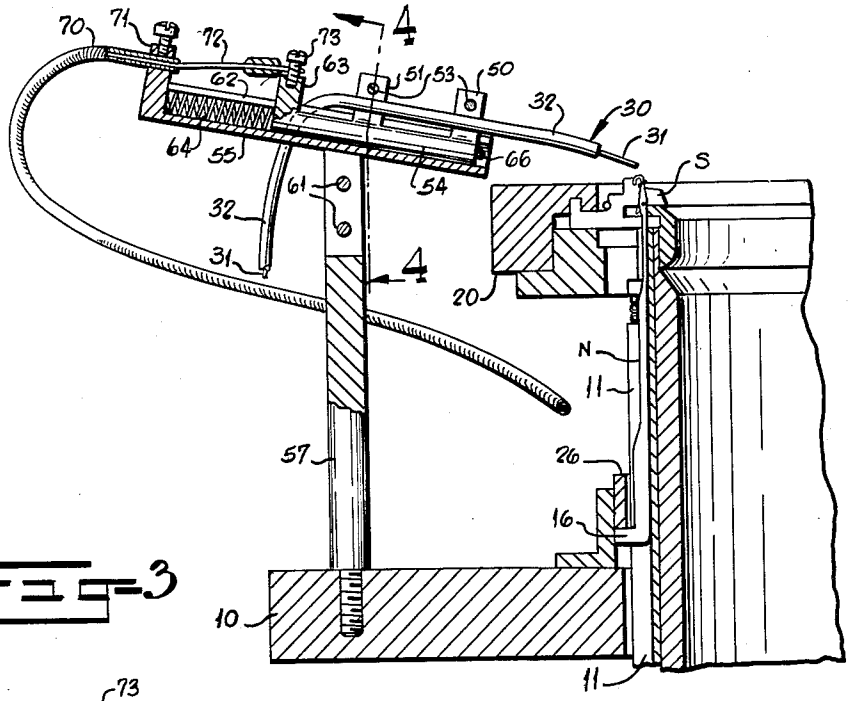


Fig-3

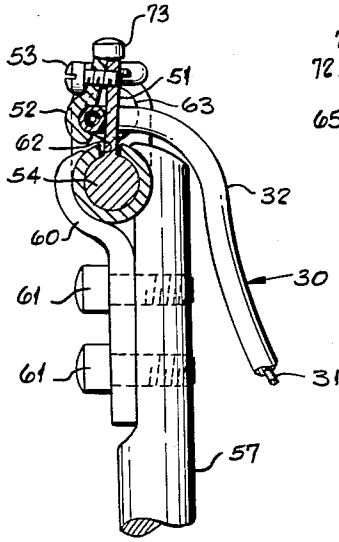


Fig-4

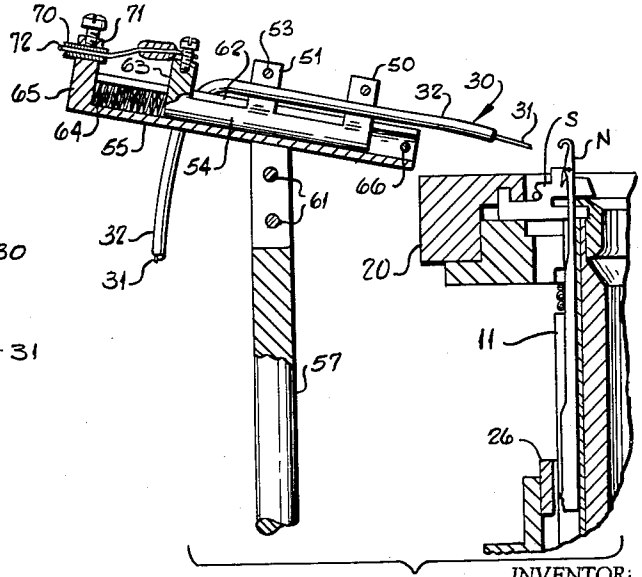


Fig-5

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Dec. 13, 1960 J. M. HOOTS 2,963,890

ELECTRICAL STOP MOTION FOR KNITTING MACHINES

Filed Sept. 3, 1957 3 Sheets-Sheet 3

Fig. 6

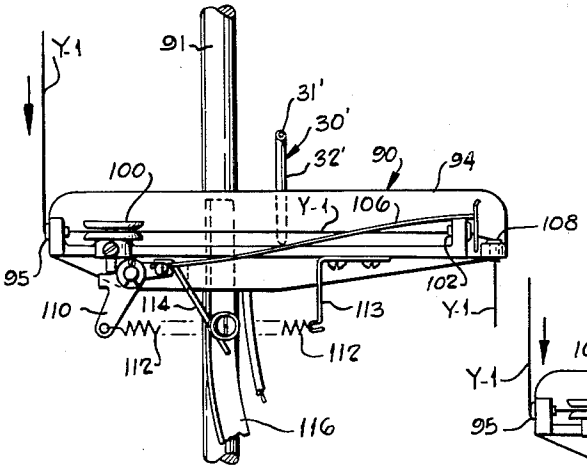
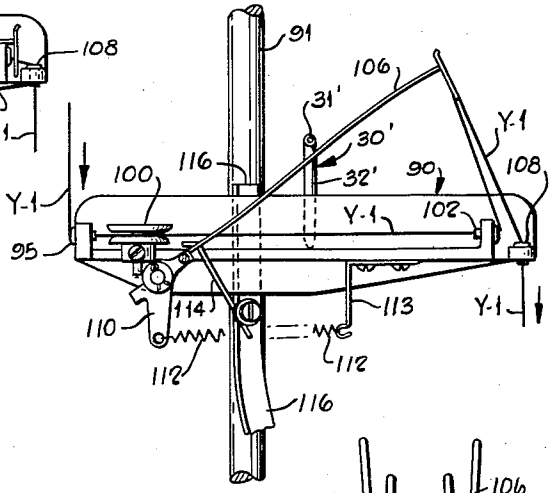


Fig. 7



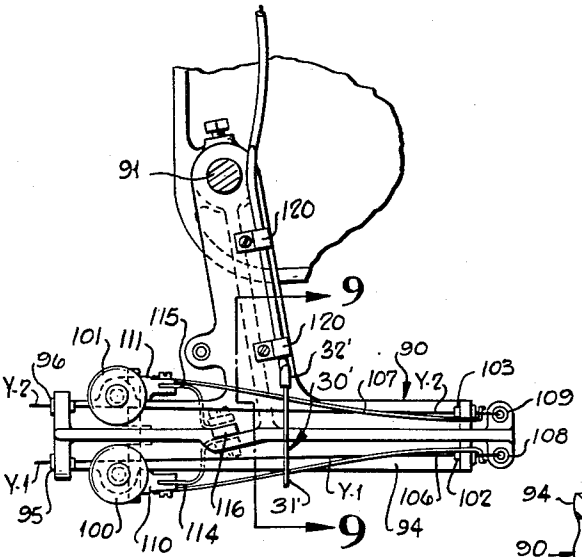


Fig. 8

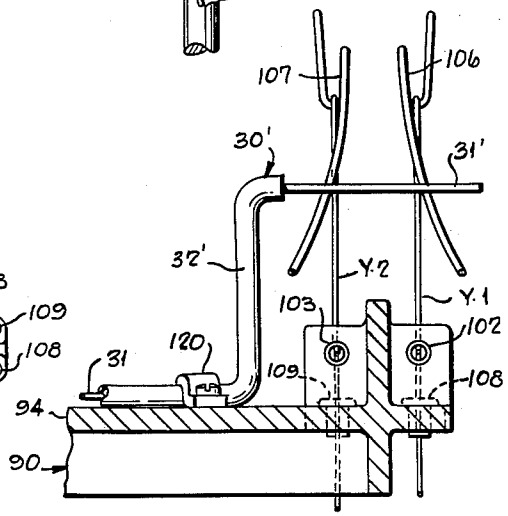


Fig. 9

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United States Patent Office 2,963,890 Patented Dec. 13, 1960

2,963,890

ELECTRICAL STOP MOTION FOR KNITTING MACHINES

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Filed Sept. 3, 1957, Ser. No. 681,651

1 Claim. (Cl. 66—157)

This invention relates generally to an electrical stop motion mechanism for circular knitting machines and more particularly to an electrical stop motion having a detector which forms a part of the electrical circuit of the stop motion and which detector is positioned to be engaged upon improper operation of the knitting machine to immediately stop the knitting machine.

Heretofore, various other types of electrical stop motions have been employed on knitting machines and most of which have included a detector operatively connected to an electrical switch or the like, to actuate the stop motion device to stop the machine upon improper operation of a part of the knitting machine. With this type of device, there is necessarily some delay in stopping the machine due to the delay in transmitting the motion through the detector and to the switch. Also, there is a problem of adjustment of the detector relative to the electrical switch and adjustment of the electrical switch itself.

It is the primary object of this invention to provide an electrical stop motion device having a detector which forms an integral part of the electrical circuit of the stop motion and will immediately actuate the stop motion when engaged by an improperly operating part of the knitting machine.

It is another object of this invention to provide a detector for a stop motion device which is of uncomplicated construction and readily adaptable to be positioned at various locations on the knitting machine so that when the detector is engaged by an improperly functioning part of the knitting machine the machine will be immediately stopped.

It is a more specific object of this invention to provide an electrical stop motion for stopping the knitting machine upon a butt on any needle being broken and also upon a yarn being broken. The stop motion is provided with a first detector comprising an electrical conductor positioned adjacent the normal path of travel of the needles and adapted to be contacted by any broken butt needle not traveling the normal path of travel to immediately stop the knitting machine. The stop motion is also provided with a second detector comprising another electrical conductor positioned adjacent the yarn take-up which guides the yarn to the knitting machine and adapted to be contacted by the yarn take-up when the yarn is broken to immediately stop the knitting machine.

Some of the objects of the invention having been stated, other objects will appear as the description proceeds when taken in connection with the accompanying drawings, in which—

Figure 1 is a simplified side elevation of a portion of a circular knitting machine illustrating a first application of the electrical stop motion;

Figure 2 is a simplified plan view of the knitting machine shown in Figure 1;

Figure 3 is an enlarged fragmentary vertical sectional view taken substantially along the line 3—3 in Figure 2;

Figure 4 is an enlarged vertical sectional view taken substantially along the line 4—4 in Figure 3;

Figure 5 is a view similar to the upper portion of Figure 3 with some of the parts in different positions;

Figure 6 is a side elevation of the conventional yarn take-up device normally positioned above the portion of the knitting machine shown in Figure 1 and illustrating another application of the detecting apparatus applied thereto;

Figure 7 is a view similar to Figure 6 and showing the yarn take-up device in a different position;

Figure 8 is a plan view of the yarn take-up device shown in Figure 6;

Figure 9 is an enlarged fragmentary vertical sectional view through the yarn take-up device taken substantially along the line 9—9 in Figure 8.

Referring to the drawings and in particular to Figures 1 through 5, a first application of the present invention is shown wherein the electrical stop motion is used to detect broken butt needles and is adapted to co-operate with the conventional stop motion mechanism of the knitting machine. The knitting machine is provided with a main bed plate 10 in which the lower end of a grooved needle cylinder 11 is mounted for rotation. The needle cylinder 11 is adapted to at times be rotated and at other times reciprocated through conventional driving gears, not shown, mounted in the bed plate 10 and driven through conventional gears connecting the needle cylinder 11 to driving pulleys 12, 13 and 14. The pulleys are selectively driven by a belt, not shown, shiftable to any one of the pulleys and driven by an electric motor or line shaft.

The knitting machine also includes a plurality of needles N mounted for vertical movement in the needle cylinder 11 and each of which has an operating butt 16 at the lower end thereof (Figures 3 and 5). The butts 16 are engaged by conventional cams surrounding the lower portion of the needle cylinder 11 to cause the hooks or upper portions of the needles N to travel the desired path when knitting. Suitable conventional sinkers S (Figures 3 and 5) are mounted for radial movement in a sinker cap 20 adjacent the upper end of the needle cylinder 11 and the sinkers S cooperate with the needles N in forming the fabric as the yarn is fed to the needles.

During ordinary rotary knitting, the needle cylinder rotates in a counter-clockwise direction, in Figure 2, and the needles N are raised by conventional stitch cams to take yarn from conventional yarn feeding fingers, not shown, at approximately the location indicated by the arrow 25 in Figure 2 and are thereafter lowered by their butts 16 engaging a stitch cam 26 (Figure 3) to lower the same below the position shown in Figure 3 to form stitch loops with the yarn taken at the position indicated at 25 in Figure 2. Often times, the butts 16 on the needles N are broken away, as illustrated in Figure 5, since the butts 16 are used to raise and lower the needles in the cylinder 11 by various cams surrounding the needle cylinder 11. The butts 16 may be broken if a butt engages a flat portion of one of the needle cams and, of course, any needle N with a broken butt will not be lowered to stitch drawing position by the stitch cam 26. Thus, broken butt needles N will pass the stitch cam 26 at a higher elevation than needles having butts 16, or substantially at the elevation shown in Figure 5.

In order to detect broken butt needles in the needle cylinder 11, a detector, broadly indicated at 30, is provided which comprises an electrical conductor wire 31, the free end of which is positioned above the normal path of travel of the upper ends of the needles N (Figures 2 and 3) and in vertical alinement above the position where the needles are ordinarily drawn downwardly by the stitch cam 26. The conductor wire 31 is pro-

vided with an insulating cover or casing 32 enclosing the medial portion of the wire 31. The end of the conductor wire 31 opposite the free end is suitably connected to a terminal 33 of a stop motion actuator 34 fixed on and electrically grounded to the frame 35 of the knitting machine.

The stop motion actuator 34 may be one of several conventional types commercially available, one type of which is shown in U.S. Patent No. 2,490,936. The actuator 34 may be any other suitable type which will be operated when the detector 30 is engaged and which when operated will move an arm 36 on the actuator 34. The arm 36 is connected to the knitting machine stop motion, broadly indicated at 40 and which comprises a link 37 connected at one end to the arm 36. The other end of the link 37 is connected to one leg of a bell crank 40*a*. The bell crank 40*a* is oscillatably mounted intermediate its ends as at 41 on the machine frame 35 and holds a pawl 42 in the position shown in Figure 2. The pawl 42 is fixed on the upper end of a pivot post 43 oscillatably mounted in the machine frame 35 and is held against the bell crank 40*a* by a tension spring 44. The lower end of the post 43 has the inner end of a stop arm 45 fixed thereto and the free end of which is adapted to at times engage suitable notches 46 in the inner face of the pulley 13.

Thus, during normal rotary knitting, the needles N will be drawn downwardly by the stitch cam 26 to the level shown in Figure 3 so that their upper ends pass below the level of the free inner end of the conductor wire 31 and the bell crank 40 holds the pawl 42 in the position shown in Figure 2 so that the knitting machine will continue to operate. Upon one of the butts 16 of the needles N being broken, the corresponding needle N will not be lowered by the stitch cam 26 and its upper end will engage the free end of the conductor wire 31 to complete an electrical circuit through the needles N, needle cylinder 11, bed plate 10, frame 35 and to the stop motion actuator 34. Immediately, the stop motion actuator 34 will move the arm 36 and through the link 37 will oscillate the bell crank 40*a* to release the pawl 42 so that the spring 44 will pull the free end of the arm 45 into a notch 46 in the pulley 13 and stop operation of the machine. The actuator 34 is supplied electrical current, preferably of low voltage on the order of 6 volts, through wires 34*a* and 34*b* (Figure 2) connected to the operating solenoid, not shown, in the actuator 34. While the machine is stopped, the operator may exchange the broken butt needle for a needle which has a butt 16 thereon and the machine may then again be started by resetting the stop motion actuator 34.

In order to move the detector 30 out of operative position during reciprocatory knitting of the heel and toe pockets, the insulating cover 32 and conductor wire 31 are fixed to a pair of upstanding members 50 and 51 (Figure 3) by clips 52 (Figure 4) suitably secured thereto as by screws 53 to clamp the detector 30 to the members 50 and 51. The lower ends of the upstanding members 50 and 51 are formed integral with a sliding body member 54. The body member 54 is slidably mounted inside of a sleeve or housing 55 which is adjustably secured on the upper end of a support post 57 as by a clamp 60 suitably secured to the post 57 and in clamping engagement with the housing 55 as by screws 61. The upper surface of the housing 55 has a longitudinally extending slot 62 cut therein to accommodate the upstanding members 50 and 51 and an upstanding member 63 integral with the rear portion of the slide 54.

The slide 54 is normally urged to the position shown in Figure 3 by a compression spring 64, one end of which bears against the rear or outer end of the slide 54 and the opposite end of which bears against a closed end 65 of the housing 55. The front or inner end of the slide member 54 is adapted to normally engage a stop pin 66 extending transversely of the housing 55 and opposite ends of which are suitably embedded in the side walls of the housing 55.

One end of a Bowden wire housing 70 is suitably secured in an upstanding portion 71 of the end 65 of the housing 55 and houses a control wire 72 for sliding movement therein. One end of the control wire 72 is fixed to the upstanding member 63 as by a screw 73 and the opposite end of the wire 72 is suitably secured as at 80 to the upper end of a control arm 81. The Bowden wire housing 70 is fixed above the bed plate 10 on the upper end of a bracket 75, the lower end of which is fixed to the upper surface of the bed plate 10.

The control arm 81 is normally urged in a clockwise direction in Figure 1 by a tension spring 82, one end of which is fixed on the control arm 81 and the opposite end of which is suitably secured to a fixed part of the knitting machine. The control arm 81 is oscillatably mounted on a shaft 83 and its lower end is adapted to at times engage the outer periphery of a conventional main pattern drum 84 mounted for rotation on a shaft 85. At other times, the lower end of the control rod 81 is adapted to engage suitable cams 86 on the periphery of the main pattern drum 84 and which cams 86 are in alinement with the lower end of the control arm 81. When the lower end of the control arm 81 engages a cam 86, the upper end of the control rod 81 is moved to the left in Figure 1 to pull the wire 72 and sliding member 54 from the position shown in Figure 3 to the position shown in Figure 5 and thus move the detector 30 from the operative to inoperative position.

Upon the lower end of the control arm 81 moving off of the cam 86, the spring 82 will again move the control rod 81 in a clockwise direction so that the compression spring 64 will move the sliding member 54 forwardly or from left to right in Figures 3 and 4 and move the detector 30 from the inoperative position shown in Figure 5 to the operative position shown in Figure 3.

It is thus seen that in this adaptation of the invention, the detector 30 will be directly contacted by the upper end of any broken butt needle N to immediately complete an electrical circuit to the stop motion actuator 34, without any delay whatsoever. Of course, the stop motion actuator 34 may be connected directly to a driving motor or to a different type of stop motion than the stop motion 40, if desired.

In the adaptation of the invention shown in Figures 6 through 9, a detector, broadly indicated at 30', is shown cooperating with a yarn take-up broadly indicated at 90 and supported above the needle cylinder 11 on a post 91, the lower end of which is suitably mounted in the frame 35. The yarn take-up 90 includes a bracket 94 fixed on the post 91 and having a pair of yarn guide eyes 95 and 96 mounted therein to guide respective yarns Y–1 and Y–2 through respective tension disks 100 and 101. The yarns Y–1 and Y–2 extend from the tension disks 100 and 101 through yarn guide eyes 102 and 103, through the free ends of respective yarn tension wands 106 and 107 and downwardly through respective yarn guiding eyes 108 and 109 to suitable yarn feeding fingers, not shown, disposed above the sinker cap 20 and each of which are movable into and out of yarn feeding position relative to the needles N in the needle cylinder 11.

The yarn tension wands 106 and 107 are each fixed on respective brackets 110 and 111 normally urged upwardly to the position shown in Figure 7 by tension springs 112, only one of which is shown. One end of each of the springs 112 is suitably secured to the brackets 110 and 111 and the opposite ends thereof are suitably secured on the lower end of a spring perch 113, fixed on the bracket 94.

When the yarns Y–1 and Y–2 are not being fed, the wands 106 and 107 are moved downwardly to the position shown in Figure 6 by wires 114 and 115 which engage and lower the respective brackets 110 and 111. The wires 114 and 115 are suitably secured to opposite

sides of the upper end of a control thrust rod **116**, the lower end of which is adapted to at times engage the periphery of the main pattern drum **84** and at other times to be raised by suitable cams, not shown. When the thrust rod **116** is raised, the wands **106** and **107** will be released to maintain the yarns Y–1 and Y–2 under tension as they are fed to the knitting machine. During rotary knitting the wands **106** and **107** are held downwardly in substantially the position shown in Figure 6 by the yarns passing over the free ends of the wands **106** and **107**. During reciprocatory knitting, the needle cylinder is caused to reciprocate so that the yarn is intermittently fed and as the needle cylinder stops moving in one direction and starts moving in the opposite direction, the excess yarn which has been fed to the needles must be removed and tension maintained on the yarn by the wands **106** and **107**. Thus, the wands **106** and **107** will move down when yarn is fed to the machine and the wands **106** and **107** will raise when the needle cylinder reverses its direction of movement to take up the extra yarn and maintain tension on the yarn at all times. Should one of the yarns Y–1 or Y–2 be broken while it is being fed to the knitting machine, the corresponding wand **106** or **107** will immediately be pulled upwardly beyond the position shown in Figure 7 by the tension spring **110** to engage the detector **30'** and stop the knitting machine.

In order to be sure that the wands **106** and **107** will engage the detector **30'** upon a knitting yarn being broken, the horizontally disposed free end portion of an electrical conductor wire **31'** is positioned above normal operating level of the wands **106** and **107**. The wire **31'** has an insulating cover **32'** enclosing the medial portion and is bent downwardly and outwardly (Figures 8 and 9) to be supported on the bracket **94** by suitable clamp members **120**. The end of the wire **31'**, opposite the free end, extends to and is suitably connected to the terminal **33** of the stop motion actuator **34** (Figure 2).

Thus, upon one of the yarns Y–1 or Y–2 being broken, the corresponding yarn tension wand **106** or **107** will be immediately pulled upwardly by one of the tension springs **112** to engage the conductor wire **31'** and immediately activate the stop motion actuator **34** to stop the knitting machine in the manner previously described. Of course, the free end portion of the conductor wire **31'** could be extended to overlie more than two take-up wands, if desired.

Although the detector **30** is shown in position to detect broken butt needles (Figures 1 through 5) and the detector **30'** is shown in position to detect a broken knitting yarn, it is to be understood that the detecting devices **30** and **30'** may be employed at other locations on a knitting machine to detect malfunctioning parts of the knitting machine and immediately stop operation of the knitting machine upon detecting a malfunctioning part.

It is thus seen that an electrical stop motion mechanism has been provided which utilizes a detector forming an integral part of an electrical circuit to a stop motion actuator for stopping the machine upon engagement of the detector by a part of the knitting machine which is operating improperly.

In the drawings and specification there has been set forth a preferred embodiment of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention being defined in the claim.

I claim:

In a knitting machine having driving means, electrically operable stop motion means connected to said driving means for stopping said knitting machine, a circle of vertically movable independent needles normally traveling in a given path of travel during operation of said knitting machine; the combination therewith of a normally open electrical circuit operatively connected to said stop motion means, an electrical conductor wire forming an integral part of said electrical circuit, a free end on said wire, support means connected adjacent the free end of said wire, said support means comprising a slide member connected adjacent the free end of said wire, a substantially horizontal disposed tubular housing extending radially from said circle of needles and slidably supporting said slide member therein, spring means positioned in said housing and engaging said slide member to urge said slide member and said wire radially toward said circle of needles to position the free end of said wire above said given path of travel of said needles whereby the free end of said wire will be engaged by any of said needles traveling a path of travel higher than said given path of travel and complete said electrical circuit to immediately actuate the stop motion means and stop the knitting machine.

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