

[54] STOP MOTION APPARATUS FOR KNITTING MACHINES

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[51] Int. Cl.D04b 35/12

[58] Field of Search.....66/158, 160, 161, 66/163, 157, 146; 200/61.13, 61.18, 61.34; 242/36, 131

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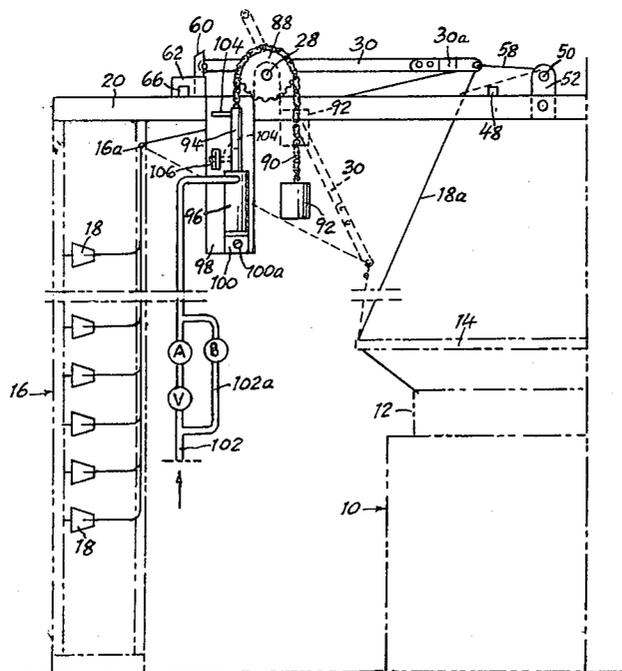
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Primary Examiner—Ronald Feldbaum

[57] ABSTRACT

An automatically resettable yarn actuated stop motion apparatus for use with multi-feed circular knitting machines comprising a pivotally mounted yarn arm for the yarn of each feed of the machine, each arm is latched in normal position so long as there is no excess tension in each of the running yarns being used by the machine, each of the yarn arms being unlatched and turned to down position by its yarn when there is excess tension therein, thereby to stop the machine, and air operated means to yieldingly return the yarn arms to normal latched position thereby to automatically reset the apparatus and to re-start the machine. The yarn arms are each journaled on a shaft to individually turn from the normal to the down position, and the yarn arms in down position are returned to normal position by turning movement of the shaft.

10 Claims, 10 Drawing Figures



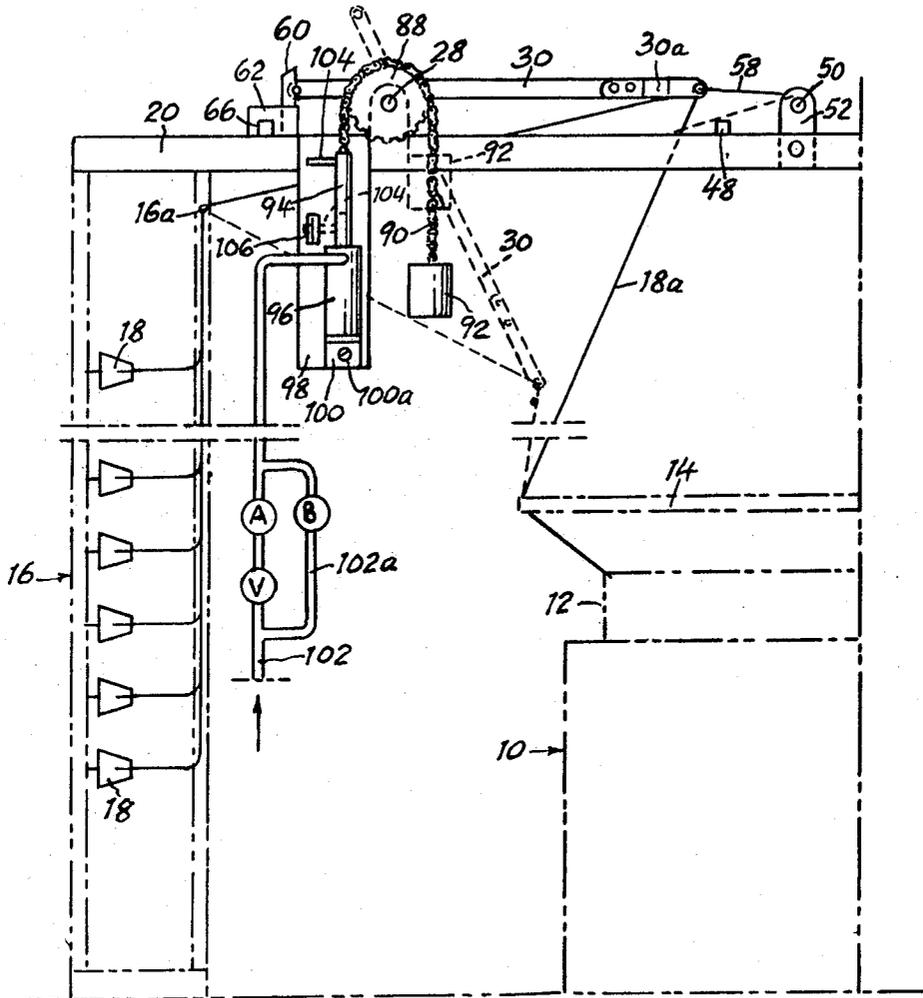


Fig. 1.

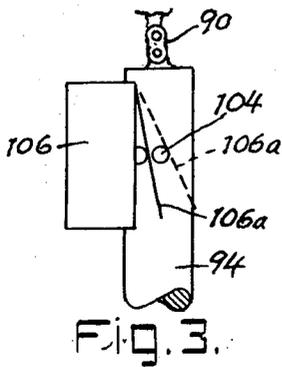


Fig. 3.

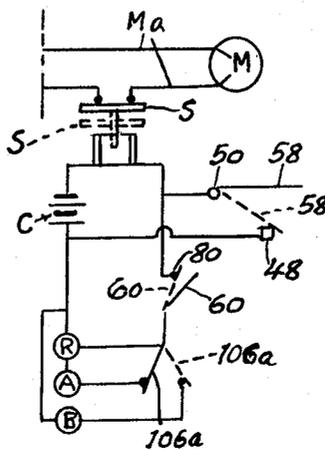


Fig. 10.

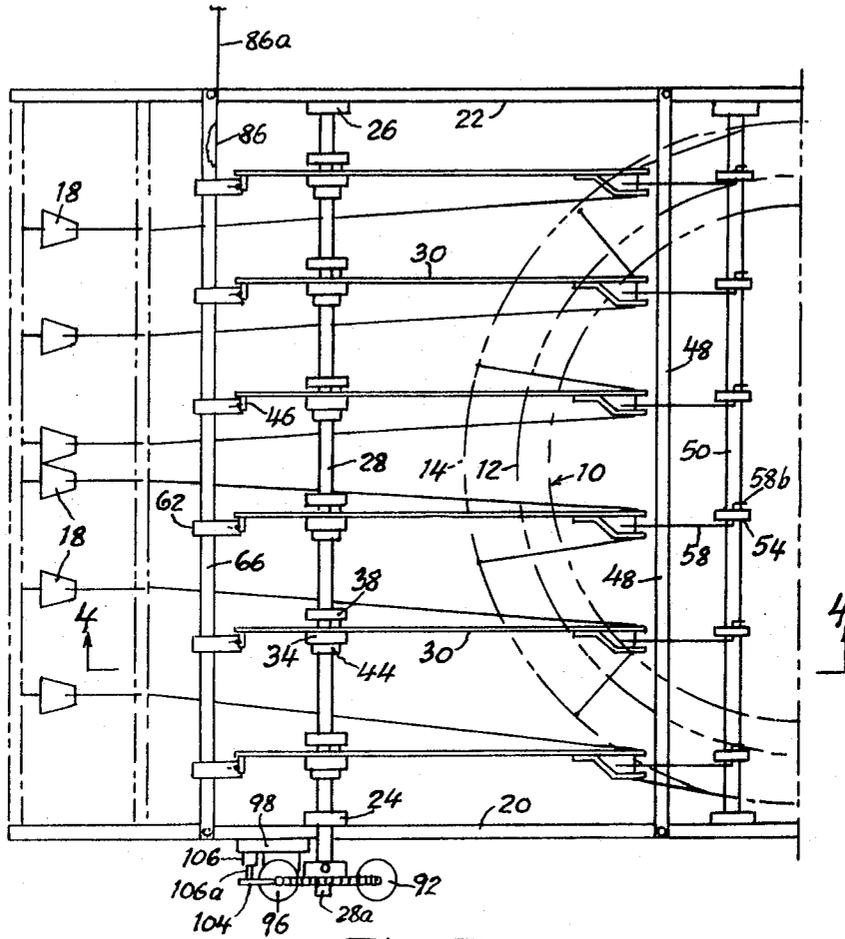


Fig. 2.

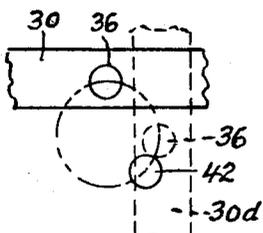


Fig. 7.

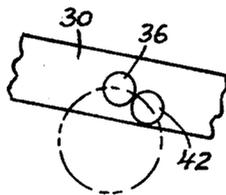


Fig. 8.

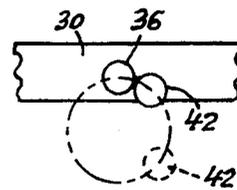


Fig. 9.

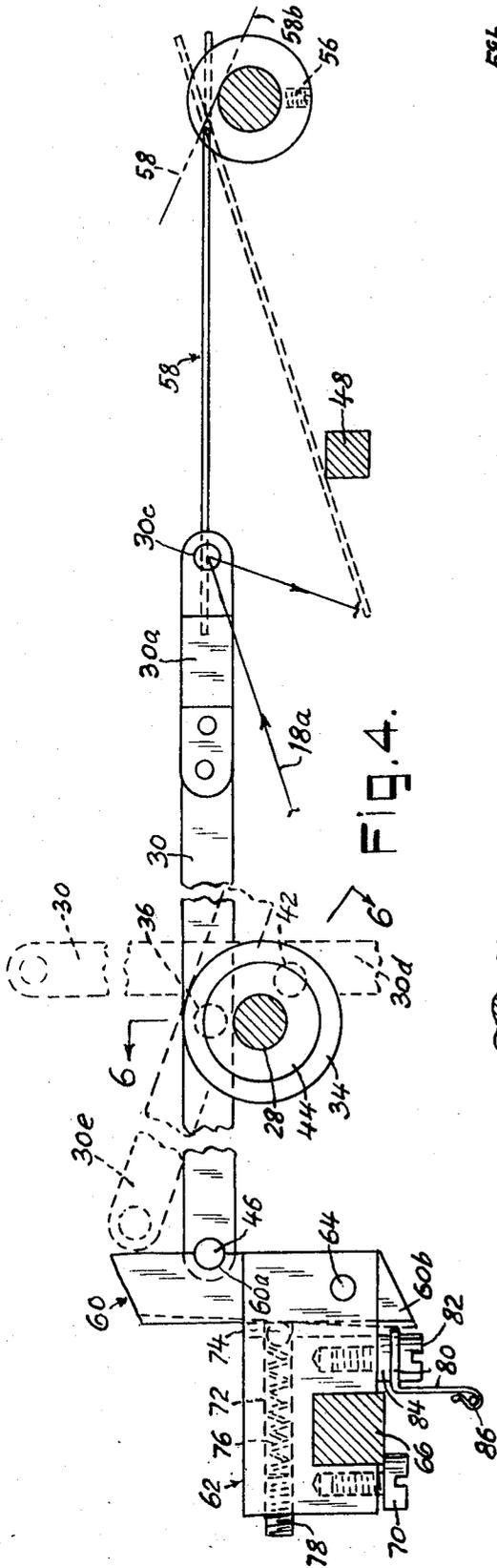


Fig. 4.

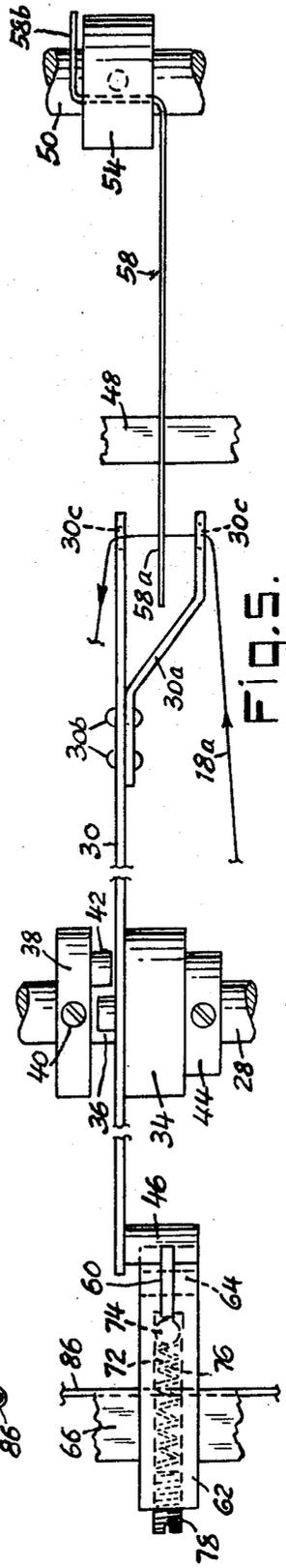


Fig. 5.

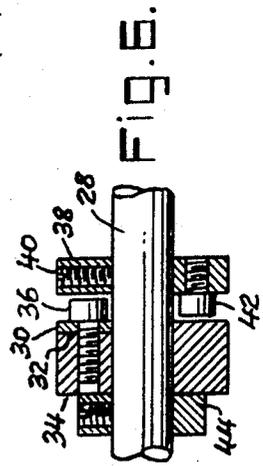


Fig. 6.

STOP MOTION APPARATUS FOR KNITTING MACHINES

The present invention relates generally to the art of knitting and particularly to yarn actuated stop motions, the present invention being directed to automatically resettable yarn actuated stop motion apparatus for knitting machines which first acts to stop the machine when there is excess tension in the yarn and which then acts to reset itself and to re-start the machine.

In the yarn actuated stop motion apparatus of the prior art presently in general use which acts to stop the machine when there is excess tension in the yarn, it is necessary to manually rethread the apparatus and to manually re-start the machine.

Accordingly, it is the principal object of the present invention to provide yarn actuated stop motion apparatus for knitting machines which first acts to stop the machine when there is excess tension in the yarn and which then acts to rest itself and to re-start the machine.

It is also an object of the present invention to use the present automatically resettable yarn actuated stop motion apparatus in combination with a yarn creel which is associated with the knitting machine to support the cones of yarn for the feeding of the yarns thereof to the machine.

With the above and other objects and advantages in view which will become apparent from the following detailed description of a preferred embodiment of the invention as shown in the accompanying drawings, the present invention resides in the elements of construction and arrangement of parts of the automatically resettable yarn actuated stop motion for knitting machines illustrated, and as pointed out in the claims.

In the drawings:

FIG. 1 is a side elevational view of the automatically resettable stop motion apparatus of the present invention as applied to a standing yarn creel and to a multi-feed circular knitting machine, the yarn extending from the creel and through the present stop motion apparatus to the feeds of the machine,

FIG. 2 is a plan view of the machine, the creel and the stop motion apparatus shown in FIG. 1,

FIG. 3 is an enlarged detail view of a portion of the air cylinder piston and switch used to reset the stop motion apparatus,

FIG. 4 is a side elevational view, partly broken away and on an enlarged scale, of one of the pivotally mounted yarn arms of the present invention, the latch holding the yarn arm in normal latched position, and the drop wire associated with the yarn passing through the yarn arm, as taken on line 4—4 of FIG. 2,

FIG. 5 is a plan view of the apparatus shown in FIG. 4,

FIG. 6 is a sectional view, as taken on line 6—6 of FIG. 4, showing the mechanical means used to turn the yarn arms from their down unlatched to their normal latched position,

FIGS. 7, 8 and 9 are schematic views showing steps in the return of the yarn arms from their down unlatched to their normal latched position, and

FIG. 10 is a schematic wiring diagram of the electrical portions of the apparatus of the present invention and its insertion into the electrical motor drive circuit of the machine.

In FIGS. 1 and 2 of the drawings, a representative multi-feed circular knitting machine is indicated at 10, in dot dash lines, in which the needle cylinder is indicated at 12 and the tape and roller yarn feeder is indicated at 14. It will be noted that one half only of the machine is shown with the apparatus of the present invention applied thereto and it will be understood that the present apparatus may be similarly applied to the other half of the machine so that it is not necessary to show the same in order to understand the present invention. While the machine shown is provided with 12 feeds (six in each half thereof), it will be understood that the number of feeds is representative only and that the present invention may be applied at each feed of multi-feed machines having a much larger number of feeds.

A conventional yarn creel 16, also shown in dot dash lines, is shown in association with the machine 10 to conveniently hold a number of yarn cones 18 of which the yarns are fed to the individual feeds of the machine through the present stop motion apparatus. A similar creel, not shown, is similarly associated with the unshown half of the machine. A pair of spaced parallel side rails 20, 22 extend between and are disposed at the sides of the two creels at the top thereof. Disposed crosswise above the side rails and rotatably supported in uprights 24, 26 is a shaft 28. The uprights 24, 26 are secured to the rails 20, 22, respectively.

Rotatably supported upon shaft 28, between side rails 20, 22, is a plurality of flat yarn arms 30, one for each feed of the machine. Each arm 30 is disposed in a cut out 32 formed in one side face of a circular collar 34 and is secured to the collar by a horizontally disposed cylindrically headed screw 36 extending through an aperture in arm 30 and into threaded engagement with the collar 34, the head of screw 36 extending laterally from said side face of the collar. The collar 34 is centrally apertured to be freely rotatable on shaft 28. Also positioned on shaft 28 is a collar 38, for each arm 30, which is secured to the shaft in adjusted angular and lengthwise position by means of a radially extending set screw 40 and which is provided with a horizontally disposed cylindrically headed screw 42, similar to screw 36, in threaded engagement with and extending laterally from a side face of collar 38. The screws 36 and 42 are equally radially spaced from the axis of shaft 28 and have their heads extending from the near sides of collars 34 and 38 so that upon relative rotation of the collars there will be contact between the screw heads. An additional positioning collar 44, for each arm 30, is set screwed fast on shaft 28 to maintain collars 34 and 38 in such spaced relation as will permit relative rotation thereof with resultant contact between the heads of screws 36 and 42.

Normally, with the machine running, each arm 30 is in its full line horizontal position of FIGS. 1 and 3 and is held in this position by a latch operating on one end of the arm. The latch means will be described later. In the normal position of arm 30, the collars 34 and 38 are so disposed that the heads of screws 36 and 42 are spaced from each other, as in FIGS. 4 and 7. The arm 30 extends unequally from both sides of collar 34 with the shorter end having a latch pin 46 extending laterally from the side of the arm opposite to the side from which the head of screw 36 extends. The longer end of

the arm is bifurcated by the addition thereto of a relatively short angled piece **30a** which is riveted to the arm **30** at **30b**, thereby to provide spaced end portions of **30** and **30a** through each of which aligned apertures **30c** are formed for the passage of a yarn **18** therethrough. A span of yarn **18a** extends across and between the spaced yarn apertures **30c**.

The yarns from cones **18** extend from the creel **16** at level **16a** and each individual yarn **18a** is threaded through the yarn apertures **30c** of a yarn arm and is then directed to the tape **14** at each of the feeds of the machine. The tape **14** draws the yarns from the cones at a pre-determined rate and feeds the yarns to the machine at each of its knitting stations. Should there be an increase in tension in the running yarn above a pre-determined minimum amount (which may be adjustably determined by the latching means to be described) for any reason, such as the yarn being temporarily or permanently caught on its cone or as may result from the change over from one cone to another, the so-tensioned yarn will unlatch and pull down its arm **30** from its full line to its dotted line position about the shaft **28**, FIG. 1. When an arm **30** is so pulled down, an electrical stop motion circuit, to be described, will be energized to stop the machine. However, as the machine is coming to a stop, a certain amount of slack yarn will be required for use by the machine until it comes to rest. This slack yarn is provided by the present arrangement of the arms **30** in full and dotted line positions in relation to the level **16a** of the creel and the level of tape **14**. The difference in distance between **16a**, the yarn holes **30c** and tape **14** when the arm **30** is in normal full line and when in down dotted line positions is a measure of the amount of slack yarn available to the machine as it comes to a stop after the stop motion of the machine has been actuated. Obviously, this may be increased or decreased by appropriate positioning of the levels of and the distance between **16a** and **30c** (in the normal position of arm **30**) in relation to the level of tape **14**. The down arms **30** are returned to their normal latched position by air actuated means to be described.

Secured to and extending crosswise above and between side rails **20**, **22** is a drop wire contact bar **48** which is so secured to the side rails as to be electrically insulated therefrom. The bar **48** is located so that the bifurcated end of arm **30** is close thereto as the arm moves past the bar. Also extending crosswise of and above side rails **20**, **22**, in spaced parallel relation to the bar **48**, is a rod **50** which is non-rotatably supported in uprights **52**, **52** secured to the side rails so that the rod **50** is at a higher level than that of bar **48**. Disposed upon rod **50**, one for each arm **30**, is a collar **54** which may be adjustably secured angularly and lengthwise of rod **50** by its set screw **56** so that a drop wire **58**, rotatably extending through a suitable aperture in the collar **54**, has its end **58a** disposed midway of the bifurcated ends of each arm **30**. The wire **58** has a first right angle bend which extends through collar **54** and has a second right angle bend to provide a tail **58b** for the wire. Tail end **58b** in contact with rod **50**, as in dotted line in FIG. 4, will prevent undesirable turning of the wire. End **58a** of wire **58** engages the span of yarn between the bifurcated ends of arm **30** when the arm is in its normal position and the wire **58** is thereby nor-

mally supported in its full line position of FIG. 4. Should there be no span of yarn present in a normally positioned arm **30**, for any reason, the wire **58** will drop down into electrical contact with bar **48**, as shown in dotted line, to stop the machine in an electrical circuit to be described. It will be noted that when the arm **30** is pulled down due to excessive yarn tension, the wire **58** is no longer supported by the yarn and the wire **58** will drop to contact bar **48**. The wire **58** will be raised from the bar **48** by the span of yarn across the bifurcated ends of arm **30** when the latter is reset in its normal position.

A vertically arranged latch **60** is provided to retain each arm **30** in normal operating position, the latch being disposed in a vertical slot formed in the forward end of a block **62** and being pivotable about a pin **64** extending through the slotted portion of the block and the latch **60**. Each block **62** is mounted for lengthwise adjustment upon a square bar **66** extending crosswise above and secured to the side rails **20**, **22** in spaced parallel relation to shaft **28**. Each block **62** is provided with a square bottomed cut out or keyway **68** which slidably fits on the bar **66**. The bottom surface of bar **66** is slightly below the corresponding bottom surface of block **62** and the head of a clamping screw **70**, in threaded engagement with block **62** adjacent keyway **68**, will engage bar **66** and clamp blocks **62** thereto at any desired position along the bar. Block **62** is provided with a lengthwise extending horizontal hole **72** which connects with the latch slot and in which is placed a ball bearing in contact with latch **60**, a compression spring **76** in contact with the ball bearing, and a spring tension adjusting screw **78** in threaded engagement with the hole **72**. The latch **60** is provided with a semi-circular cut out **60a** within which the pin **46** of arm **30** is seated when the arm **30** is in normal latched position with the spring **76** urging the latch against the pin.

The amount of pressure on latch **60** by spring **76** will be preset by the position of screw **78** and by the power of the spring used so that should there be tension in excess of the normal amount of tension in the running yarn, such excess tension in the yarn will cause it to pull down and to unlatch the arm **30**. Should arm **30** become unlatched, spring **76** will pivotally urge latch **60** to its dotted line position, FIG. 4, wherein its lower end **60b** will electrically contact a metal washer or bent clip **80**. A plastic screw **82** extends through clip **80** and through a plastic washer **84** into threaded engagement with block **62** thereby to support and to electrically insulate clip **80** from blocks **62** and from the rest of the apparatus and the machine. An electrically conductive wire **86** is seated in and extends between each of the clips **80** of each of the blocks **62**, the wire **86a** extending beyond the side wall **22**, FIG. 2, to be joined into the electrical circuit of the apparatus. Contact between a latch **60** and associated clip **80** will serve to actuate the stop motion of the machine to stop the same and will also serve to operate the present apparatus to reset the stop motion and re-start the machine. It will be noted, FIG. 4, that when arm **30** is in latched position, end **60b** of latch **60** in full line position is spaced from and not in electrical contact with clip **80**.

The shaft **28** extends beyond rail **20**, FIG. 2, at **28a** where a sprocket **88** is fixed thereon. A chain **90**, trained over the sprocket, has one end thereof attached

to a return weight 92 and has the other end attached to the end of a piston rod 94. The piston rod extends through and from one end of an air cylinder 96 which is mounted upon a plate 98 secured to and depending from side rail 20. A suitable bracket 100 is attached to the lower end of cylinder 96 and is secured to plate 98 by a screw 100a. Air under pressure is admitted to the upper end of cylinder 96 by suitable tubing 102, 102a, the air moving in the direction of the arrow. A pin 104 extends laterally from the end of piston rod 94 and is adapted to engage arm 106a of a plate mounted micro-switch 106, as the piston rod moves, FIG. 3, to operate the switch by moving arm 106a from its dotted line to its full line position. When air is admitted into cylinder 96, piston rod 94 is drawn into cylinder 96 and chain 90 turns sprocket 88 and shaft 28 so that weight 92 and pin 104 will assume their dotted line positions, FIG. 1. When the air is turned off, the parts will return to their original positions.

Air is admitted to the cylinder in two stages. In FIG. 1, A represents a first conventional solenoid controlled air valve in main tube line 102 and B represents a second conventional solenoid controlled air valve in shunt tube line 102a. V represents a reducing valve by means of which the main line air pressure may be reduced as desired. Accordingly, in the first stage, with valve A open, valve B closed and, with the air at a properly reduced pressure, the air enters cylinder 96 to withdraw cylinder rod 94 and rotate sprocket 88 and shaft 28. In the second stage, while piston rod 94 is still moving and shaft 28 has not as yet received its full movement, pin 104 reaches and operates micro-switch 106, to move its arm 106a from dotted line to full line position of FIG. 3, and the electrical wiring arrangement is such that upon such operation of switch 106 the valve A is closed and valve B is opened whereby full line pressure then enters the air cylinder through tube 102a for the final movement of the piston rod and of shaft 28, to fully latch up the arms 30 into normal position. The valves A and B have air vents which are open when the valves themselves are closed and vice versa. The preferred arrangement is such that the air vent of valve B is closed off entirely and the air vent of valve A is partially closed off so that the air cylinder is vented at a relatively slow rate when both the valves are closed. It will be understood that valve B is closed, with valve A remaining closed, after shaft 28 has been fully turned.

The turning of shaft 28 causes arm 30 to be reset as it is turned from its down position to its normal latched horizontal position. While the down position of arm 30 in FIG. 1 does not show it to be fully vertical, it may move to at least the vertical position (with proper angular positioning of the head of screw 42) as shown at 30d in FIGS. 4 and 7 as the slack yarn is used by the machine. When arm 30 moves to its full vertical position, the head of screw 36 will have moved ninety degrees as arm 30 and collar 34 turn about shaft 28. As shown in dotted lines, the head of screw 36 comes into position limiting contact with the head of screw 42. The angular position of which is fixed on shaft 28. When arm 30 becomes unlatched and starts to move to its down position, regardless of the extend of such movement, the arrangement is such that air is then admitted to cylinder 96 to cause sprocket 88 and shaft 28 to be turned, in counterclockwise direction of FIG. 1. Such

rotation of shaft 28 will cause the head of screw 42 to move with it whereby it will contact the head of screw 36 in its displaced position, and turn the head of screw 36, collar 34 and arm 30 back toward the normal position of arm 30. Movement of arm 30 by the reduced air pressure of the first stage movement thereof positions the arm just short of latching position, as in FIG. 8 and as at 30e in FIG. 4. Further movement of arm 30 to normal latched position, as in FIG. 6, then takes place by the full line air pressure of the second stage movement thereof. The additional force of the full line air pressure insures that the latching of individual arms 30 will take place and overcomes any resistance which may be created by the already latched up arms 30. Under the influence of weight 92, after the air pressure is turned off, shaft 28 and its collars 38 and screws 42 are moved in clockwise direction to their original full line positions of FIG. 1, ready to be again actuated.

The electrical circuit joining the several switches of the present apparatus to each other and to the circuit of the machine is shown in FIG. 10, wherein Ma represents the normal line circuit to and from motor M which is used to rotate the knitting machine. A solenoid switch S is placed in one line of the motor circuit. The solenoid switch is also in the circuit of the present apparatus and can be energized by a current from battery C to open the motor line circuit to stop the machine. Should drop wire 58 make contact with bar 48, a circuit would be closed to energize solenoid S to open the motor line circuit and stop the motor M thereby to stop the machine. Upon removing drop wire from bar 48, the circuit is opened whereby solenoid S acts to close the motor line circuit and motor M starts to turn the machine. Should latch 60 make contact with clip 80, a circuit containing a two second time delay relay R is closed whereupon the motor line circuit is opened by switch S and the motor M is stopped to stop the machine. After a two second delay by relay R, to allow the machine to come to a stop, valve A is opened (with valve B remaining closed) and the first stage air operation takes place to turn arm 30 to its nearly latched up position of FIG. 8 at which time pin 104 actuates micro-switch 106 to open valve B and close valve A and the second stage air operation takes place to fully turn arm 30 to its latched normal position of FIGS. 1 and 9. The latching of arm 30 opens the switch between latch 60 and clip 80 and this permits solenoid S to close the motor line circuit and motor M turns to start the machine once more. At the same time, with the opening of the stop motion circuit, valve B closes (valve A is already closed) and air vents from the air cylinder through valve A thereby permitting shaft 28 to return to its original position ready for the next turning thereof.

The air actuated movement of arm 30 toward its normal position will turn the latter to yieldingly press against the yarn thereby acting to free the yarn from any temporary condition which caused the excess tension in the yarn. Should the yarn condition be such that it cannot be made free by the yielding pressure of arm 30, then the position of arm 30 will remain in its partially turned location and further operation of the present apparatus will cease. Obviously, the air pressure, at least in its first stage, is such as not to break the yarn.

It will be understood that the resetting of arm 30 is independent of the protective action of the drop wire 58. The series of yarn arms associated with the unshown creel and the unshown half of the knitting machine are similarly operated and are preferably included in the circuit of FIG. 10. The two shafts upon which the yarn arms of both halves of the machine are mounted are preferably interconnected so as to be commonly turned by the air pressure.

We claim:

1. In a knitting machine having a plurality of knitting stations, having a plurality of yarns fed to said machine at said knitting stations when said machine is in operation, and having mechanism to automatically stop the operation of said machine, said yarns being drawn off and running from individual cones thereof to such knitting stations during said machine operation, said yarns during surh running movement thereof generally being subjected to normal tension while individual ones of said yarns at times may be subjected to abnormal tension, the combination therewith of apparatus having a plurality of arms operatively related to said stop mechanism and to said plurality of yarns, said arms having yarn receiving apertures associated therewith and said yarns being permanently threaded through said apertures, said arms being individually movable between a first and a second position and being movable from said first toward said second position to operate said stop mechanism to automatically stop said machine operation, said apparatus having means to maintain said plurality of arms in their said first position in such manner that individual ones of said arms are moved from said first toward said second position by their related yarns when such yarns are subjected to a certain amount of said abnormal tension, such movement of such individual ones of said arms serving to automatically stop said machine operation, and said apparatus having additional means commonly related to said plurality of arms and operable upon any of said individual ones of said arms which have been so moved from their said first position to automatically return the same to their said first position.

2. The combination of claim 1 wherein said additional means is automatically operable, and wherein said plurality of arms is operatively related to said additional means in such manner that any of said arms which are so moved from their said first position toward their said second position are operative to cause said additional means to automatically return said any of said arms to their said first position.

3. The combination of claim 2 wherein said machine has mechanism to automatically start the operation of said machine, and wherein said start mechanism is operatively related to said plurality of arms and to said additional means in such manner as to automatically re-start said machine operation upon the return to their said first position by said additional means of all of those of said arms which had previously been moved

from their said first position.

4. The combination of claim 1 wherein said first mentioned means includes a plurality of latches having latched and unlatched positions, said latches being operatively related to said plurality of arms in such manner that said latches in their said latched position maintain said arms in their said first position, said latches in their said latched position exerting a yieldable force upon said arms thereby to yieldingly maintain the latter in their said first position, those of said arms which are moved from their said first to their said second position by their related yarns are caused to overcome said yieldable force during such movement whereby their related latches assume their said unlatched position, and wherein said additional means acts upon those of said arms which have been so moved to return the same to their said first position thereby to cause their related latches to assume their said latched position.

5. The combination of claim 4 wherein said apparatus includes a lengthwise extending shaft, wherein said plurality of arms are rotatably mounted upon and extend crosswise of said shaft, wherein said plurality of latches are lengthwise aligned in spaced parallel relation to said shaft, wherein said arms are rockable about said shaft between their said first and second positions, wherein said latches are movable between their said latched and unlatched positions, and wherein said arms in their said first position yieldingly maintain said latches in their said latched position.

6. The combination of claim 5 wherein said shaft is angularly movable between two positions thereof, wherein said shaft is operatively related to said plurality of arms, and wherein angular movement of said shaft to one of its said positions is adapted to move said arms to their said first position.

7. The combination of claim 6 wherein pressurized air is operatively related to said shaft to angularly move the same to at least one of its said positions.

8. The combination of claim 1 wherein said additional means uses a yieldable force to return said any of said arms to their said first position, and wherein the amount of said yieldable force so used is sufficient to subject the yarns associated with any of said arms to an amount of tension in excess of said certain amount of said abnormal tension.

9. The combination of claim 3 wherein a yarn creel is associated with said knitting machine, wherein said yarn cones are disposed on said creel, and wherein said apparatus is also disposed on said creel.

10. The combination of claim 3 wherein said apparatus includes an electrical circuit, wherein said latches are operatively related to said circuit, wherein said electrical circuit is in opened non-operative condition when said latches are in their said latched position, and wherein said electrical circuit is in closed operative condition when any of said latches are in their said unlatched position.

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