

[54] STOP MOTION APPARATUS FOR KNITTING MACHINES

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[51] Int. Cl. D04b 35/12

[58] Field of Search 66/157, 160, 161, 163, 158

[56] References Cited

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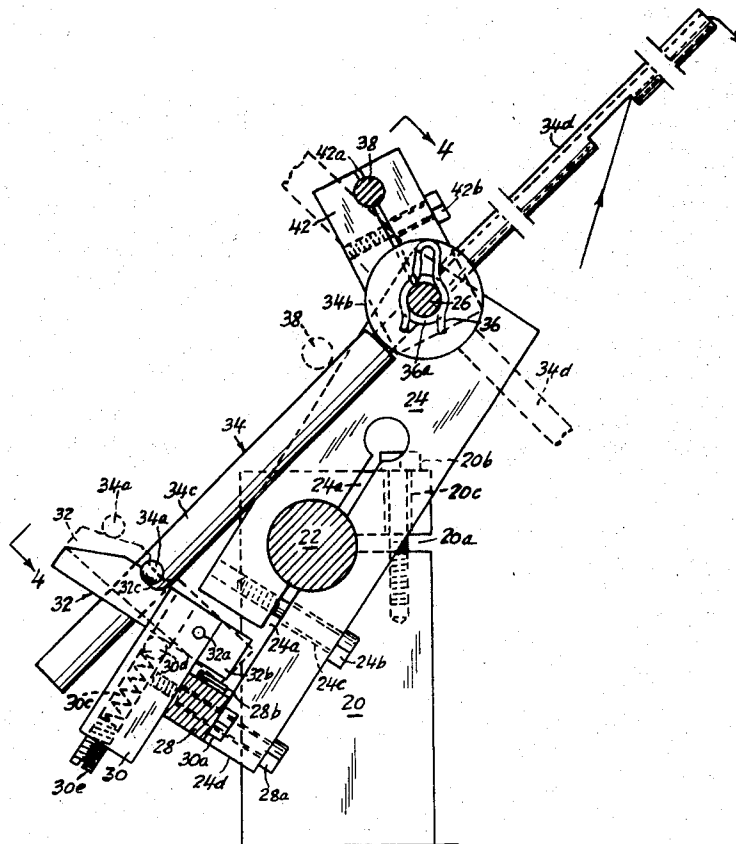
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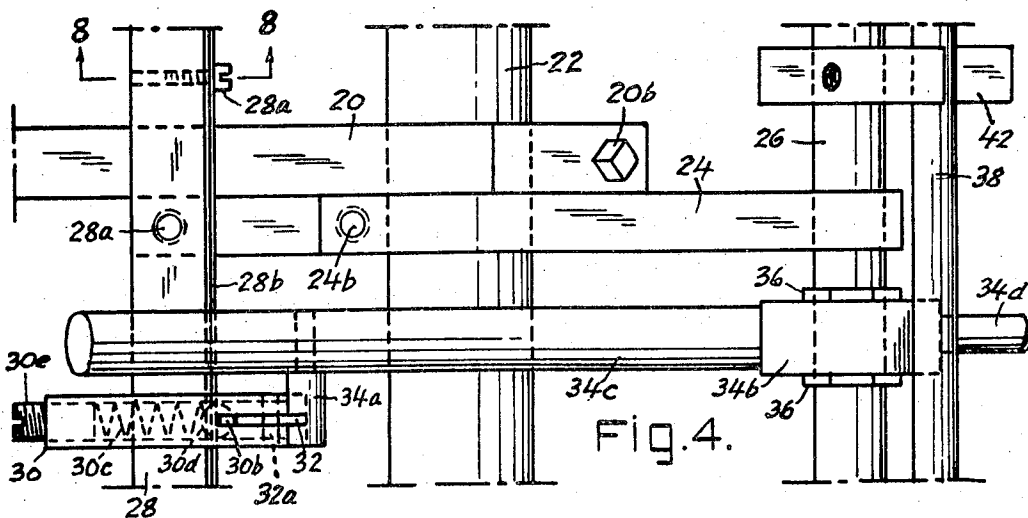
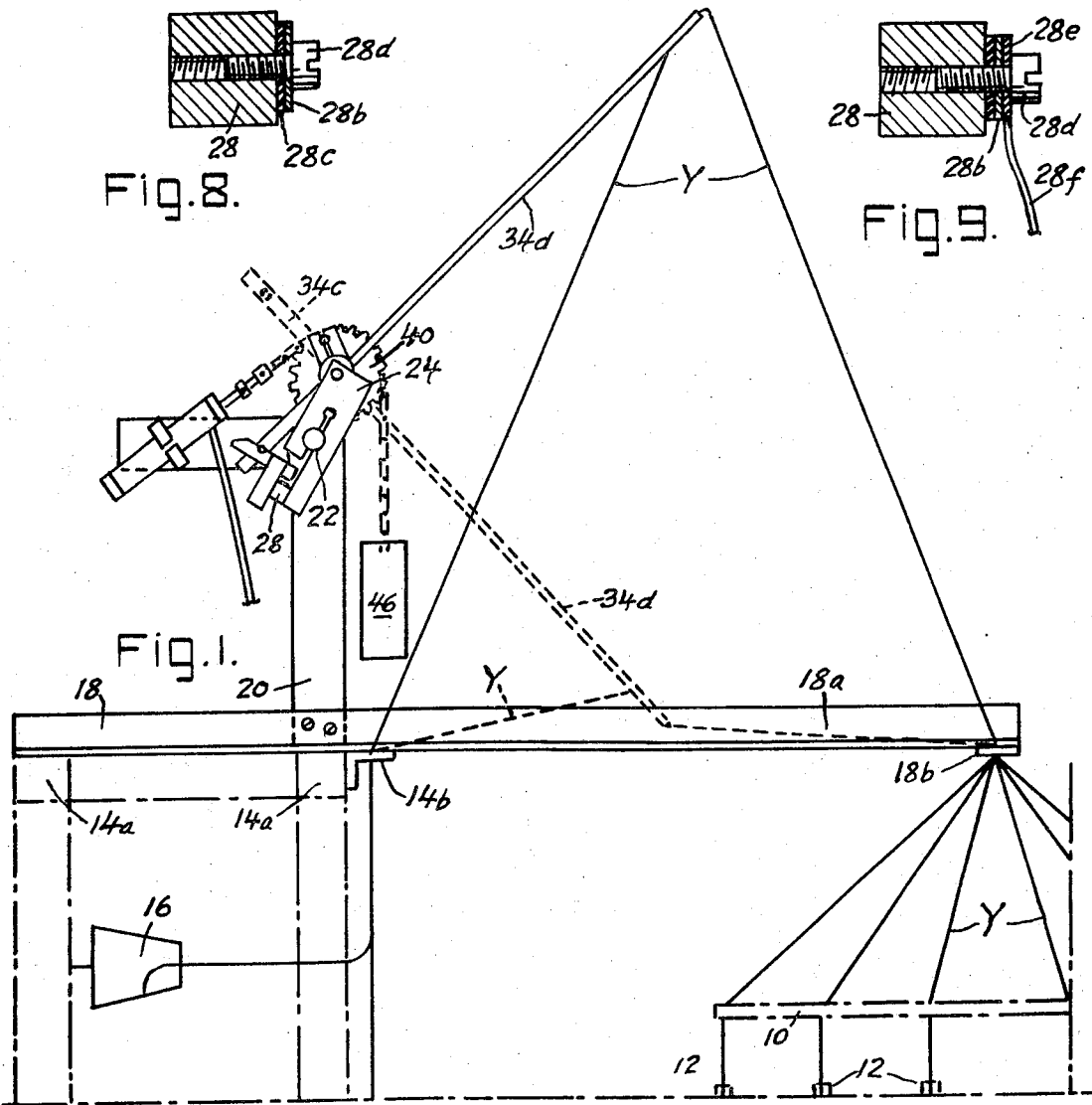
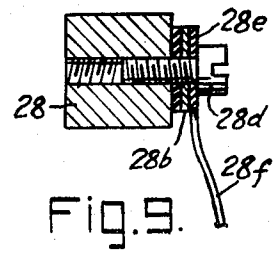
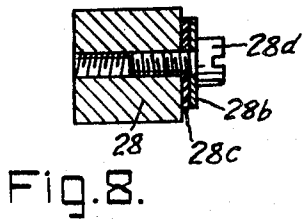
Primary Examiner—Ronald Feldbaum

[57] ABSTRACT

Stop motion apparatus for use with knitting machines and having a fixed rigid shaft, a plurality of spaced brackets secured to shaft, a rotatable shaft journaled in the brackets and movable to a pair of positions, a rectangular bar secured to the brackets, the two shafts and the bar being in spaced parallel relation and being co-extensive, a plurality of spaced yarn arms rotatably supported on the rotatable shaft and movable to normal and to down positions, a like plurality of pivotally movable latches supported on the bar in individual operative relation to the yarn arms to maintain the latter in their normal positions, a plurality of spaced rocker arms secured to the rotatable shaft and movable therewith, a re-setting shaft secured in the rocker arms and movable therewith to a first and to a second position when the movable shaft is moved to its pair of positions, the re-setting shaft in its first position acting as a limit stop for the yarn arms in their down position and the re-setting shaft as it moves to its second position engaging and moving the yarn arms to their normal position, and air operated means secured to the fixed shaft for moving the rotatable shaft.

10 Claims, 11 Drawing Figures





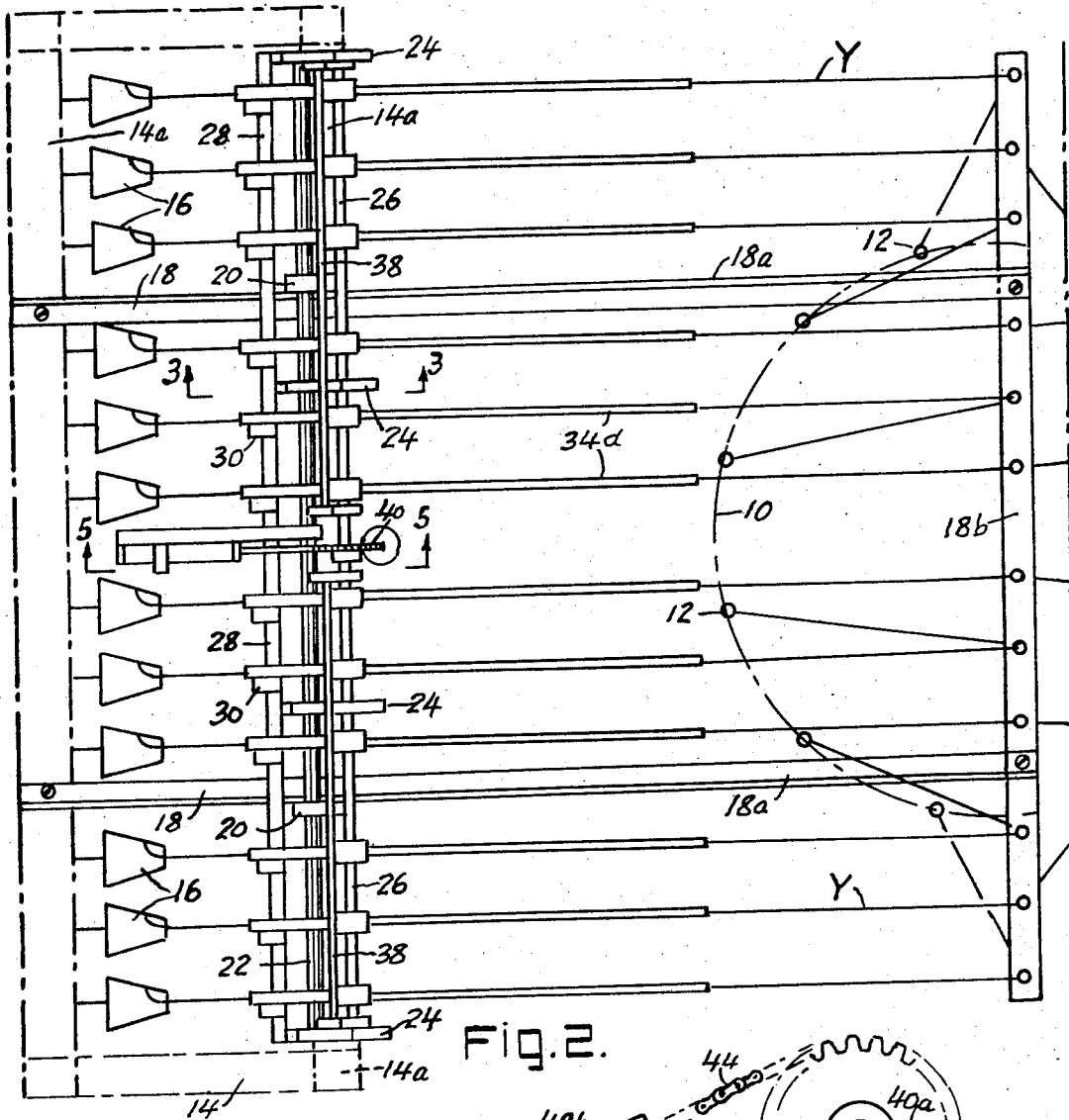


Fig. 2.

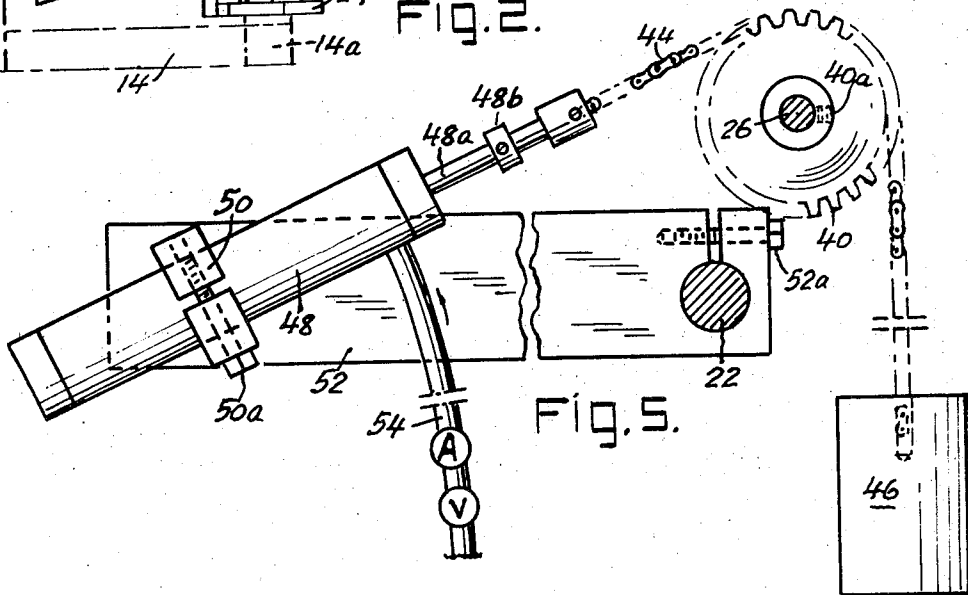


Fig. 5.

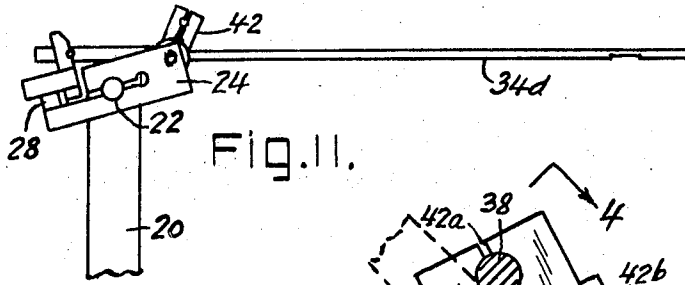


Fig. 11.

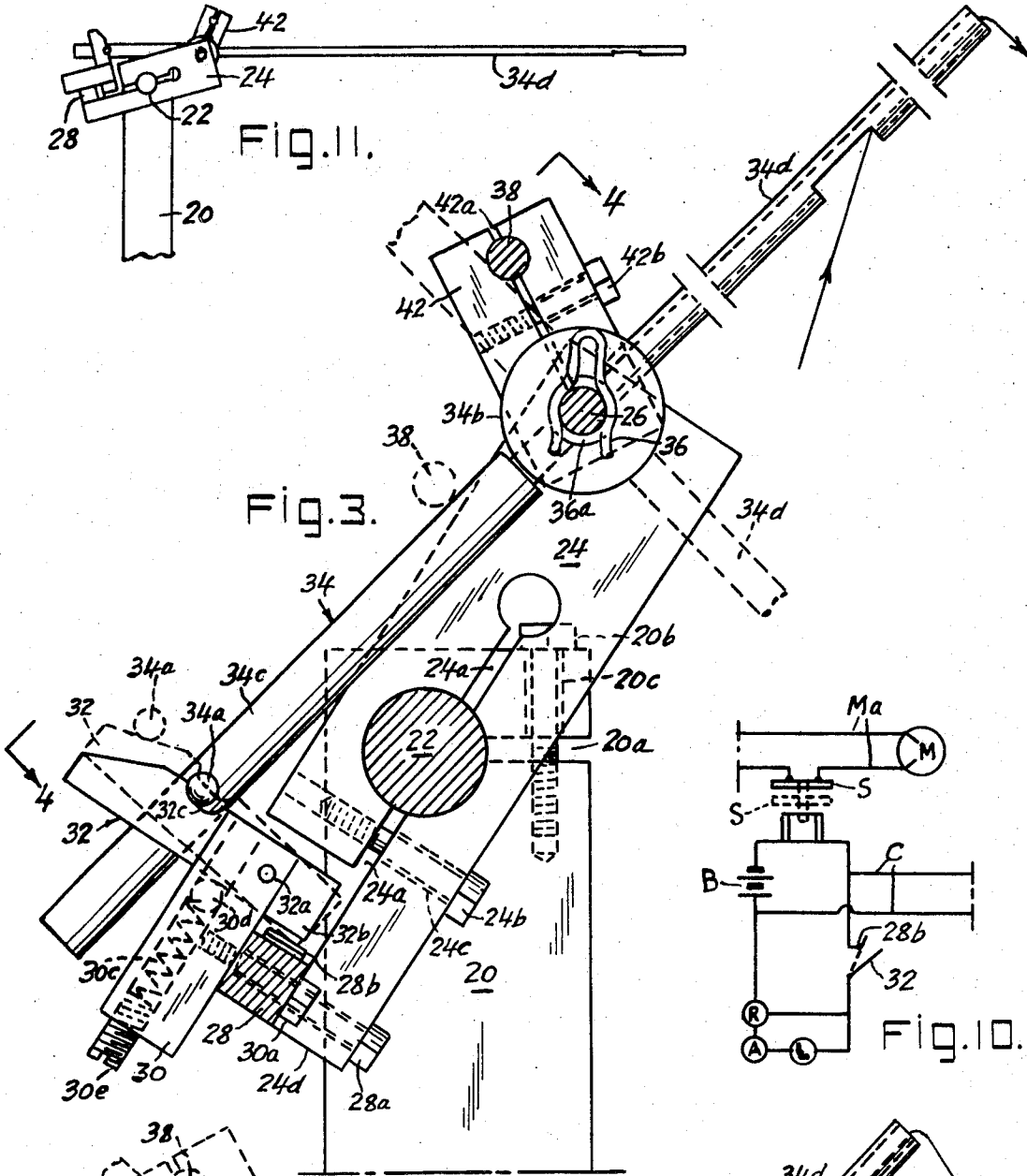


Fig. 3.

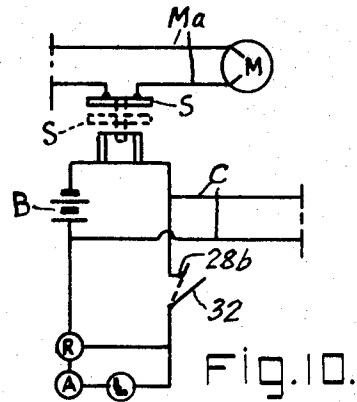


Fig. 10.

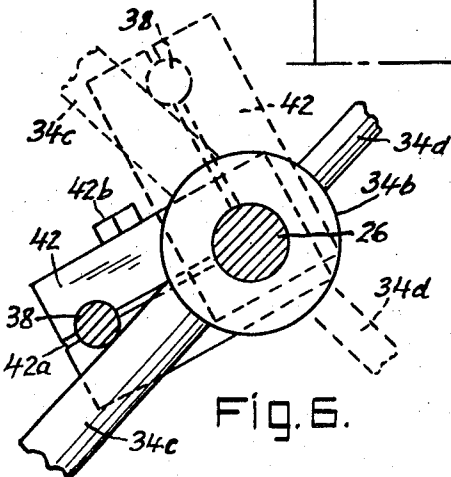


Fig. 6.

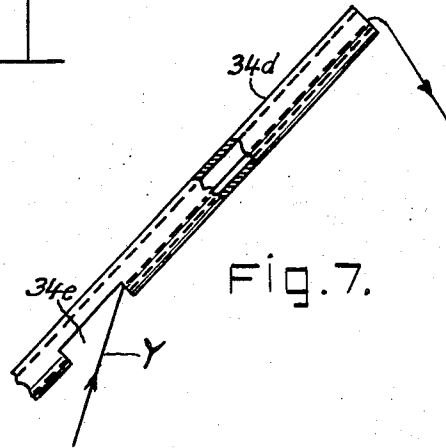


Fig. 7.

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 operated 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.

The present application is for an improvement over the subject matter of patent application Ser. No. 112,687, filed Feb. 4, 1971, by Nathan Levin, the present applicant, and by Thomas Anderson Oliver, Jr.

It is the principal object of the present invention to provide improved stop motion apparatus embodying the principle of the invention set forth in the above patent application.

In such improved apparatus, a grid or base is provided as an integral part of the apparatus and upon which the individual parts of the apparatus are mounted whereby the apparatus is self-contained and may be handled as a unit. Additionally, a new type of non-tangling yarn arm is provided and the apparatus is made adjustable to avry the amount of slack yarn provided thereby.

With the above and other objects and advantages in view as 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 operable 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 and machine re-starter of the present invention as applied to a standing yarn creel and to a multi-feed circular knitting machine with the knitting yarns extending from the creel and through the present apparatus to the feeds of the machine,

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

FIG. 3 is an enlarged cross-sectional view taken on line 3—3 of FIG. 2,

FIG. 4 is a plan view of FIG. 3 as taken on line 4—4 of FIG. 3,

FIG. 5 is an enlarged cross-sectional view taken on line 5—5 of FIG. 2 showing the air operated means to reset the stop motion,

FIG. 6 is a view showing a detail of the stop motion re-setting means,

FIG. 7 is a view showing a detail of the yarn feeding arm,

FIG. 8 is a cross-sectional view as taken on line 8—8 of FIG. 4 showing the electrical contact strip,

FIG. 9 is a view similar to FIG. 8 showing the wire extending from the electrical contact strip,

FIG. 10 is a schematic wiring diagram of the electrical circuit of the present apparatus and its insertion into the electrical motor drive and stop motion circuits of the knitting machine, and

FIG. 11 is a schematic view on a reduced scale showing how the present apparatus may be adjusted to place the yarn arms thereof in different angular positions.

In FIGS. 1 and 2 of the drawings, the tape of a conventional tape and roller yarn feeder of a multi-feed circular knitting machine is schematically indicated in dot dash lines at 10. The tape is adapted to feed a plurality of individual yarns, indicated at Y, to the knitting stations, indicated at 12, of the machine. While the presently indicated machine is provided with 12 knitting stations or feeds, of which only six thereof are indicated at 12, it will be understood that the number of feeds is representative only and that the present invention may be applied to the yarn for each feed of multi-feed machines having a much larger number of feeds.

The upper portion of a conventional box shaped yarn creel indicated at 14, in dot dash lines, is shown in association with the knitting machine to conveniently hold a number of yarn cones 16 from which the yarns Y are fed through the present apparatus to the feeds 12 of the machine. The top of the creel is provided with a spaced pair of longitudinally extending horizontally disposed parallel side rails 14a. Extending crosswise of said rails 14a and suitably secured thereto is a spaced pair of horizontally disposed angularly shaped parallel base members 18, the end portions of which may extend from the creel, as at 18a, to a position above the center of the knitting machine. Extending vertically from said pair of base members 18 and suitably secured thereto at the front of the creel is a spaced pair of upright parallel support members 20. The upper ends of said upright members 20 are each suitably apertured to supportingly receive therethrough a longitudinally extending fixed support shaft 22. The length of said shaft 22 will vary in direct proportion to the number of feeds of the machine. The uprights 20 are each slotted, as at 20a, to intersect the shaft receiving apertures whereby the shaft 22 may be clampingly secured in fixed position in uprights 20 by the tightening action of screws 20b extending through suitable apertures 20c, at one side of slot 20a, and into threaded engagement with the uprights 20 at the other side of slots 20a. Shaft 22 is angularly adjustable in uprights 20.

The shaft 22 provides a support for a series of spaced brackets 24, here shown as being four in number, which are equally positioned along the shaft. The number of brackets 24 will depend upon the length of shaft 22 and their spacing will generally be such as to equalize the load upon the shaft. Each bracket 24 is provided with a suitable aperture to receive shaft 22 therein, the bracket also being slotted at 24a to intersect opposite sides of the shaft receiving aperture whereby the bracket may be clamped in place upon shaft 22 by the tightening action of a screw 24b extending through a suitable aperture 24c formed in bracket 24 at one side of slot 24a and into threaded engagement with the bracket at the opposite side of slot 24a. The brackets 24 are thus supported perpendicular to shaft 22 and are so adjusted as to have the same angular relation to the shaft. Brackets 24, at one end thereof, are suitably apertured to rotatably support a horizontally disposed shaft 26 therein, the rotatable shaft 26 extending parallel to fixed shaft 22 and being generally co-extensive therewith. Brackets 24, at the opposite end thereof, are cut away at one side of slots 24a to provide tail ends 24d of reduced extent which serve as supports for a longitudinally extending fixed support

bar 28. The bar 28 is generally co-extensive with the shafts 22 and 26.

Support bar 28, which may be of rectangular cross section, is supported upon and secured to the upper sides of the tail ends 24d of the spaced brackets 24 by screws 28a extending through suitable apertures in tail ends 24d and into threaded engagement with bar 28. The bar 28 itself provides a support for a series of spaced upright control boxes 30, each of which is secured to the bar by means of a screw 30a extending upwardly through a suitable aperture in the bar and into threaded engagement with the underside of the control box. The number of control boxes is equal to the number of feeds of the machine. The bar 28, on the side thereof facing shaft 22, is provided with a strip 28b of electrically conductive material for substantially its entire length, the strip 28b being spaced from bar 28 itself by an interposed strip 28c of non-electrically conductive material, the two strips being secured to the bar by means of screws 28d spaced at suitable intervals along the bar, the screws being formed of any suitable non-electrically conductive material. As shown in FIG. 9, an electrically conductive washer 28e having an electrically conductive wire 28f connected to and extending therefrom may be placed on screw 28d for contact with strip 28e whereby the latter strip, via wire 28f, may be placed in the stop motion circuit of the machine. It will be understood that the bar 28 will be electrically grounded.

Each box 30, of generally rectangular shape, is set transversely of bar 28 and is provided at its forward end with a centrally disposed slot 30b extending vertically therethrough. A vertically extending latch 32 is disposed in slot 30b, the latch being pivotally supported upon pivot pin 32a extending through the slotted portion of the box and through latch 32 itself. Lower portion 32b of the latch extends below box 30 and is disposed opposite strip 28b on bar 28. When latch 32 is held in its full line position of FIG. 3 portion 32b thereof is spaced from strip 28b, whereas when latch 32 is permitted to be in its dotted line position of FIG. 3 portion 32b thereof is in contact with strip 28b. When latch 32 is in dotted line position, portion 32b thereof is urged into contact with strip 28b by compression spring 30c disposed in a suitable lengthwise extending aperture in box 30, this aperture intersects and extends at least partway through slot 30b. A small ball 30d is interposed between spring 30c and latch 32, contact between the ball and latch being above pin 32a. A screw 30e is threadedly engaged in the end of the spring receiving aperture in box 30 to adjustably tension the spring. Each latch 32 is retained in full line latched position, against the action of spring 30c, by a laterally extending pin 34a of a pivotally movable yarn arm 34. Latch pin 34a is caught in and retained by the undercut notch 32c formed in the front edge of the latch thereby to hold the latter in its latched position.

There is an arm 34 for each box 30 and for each yarn Y, the number thereof being equal to the number of feeds of the machine. Each arm 34 has an apertured collar 34b by means of which the arms are rotatably supported on the rotatable shaft 26. Collar 34b is provided with an aperture extending diametrically therethrough and wherein a reduced end portion of a relatively short handle 34c is suitably secured in one

end of said aperture and one end of a tube 34d is suitably secured in the opposite end of said aperture. The handle 34c and tube 34d may be force fitted into collar 34b. Handle 34c, which may be made of steel, is designed to balance tube 34d, which may be made of aluminum, on shaft 26. Handle 34c, latch pin 34a extending from the handle, collar 34b and tube 34d make up the yarn arm 34. As shown in FIG. 7, the tube 34d is notched or undercut at 34e to intersect the interior of the tube whereby yarn Y enters the tube via the notch and leaves the tube at the free end thereof. Suitable porcelain yarn guides, not shown, may be placed in the tube and at the end thereof to guide the yarn. The notch 34e is spaced from the free end of the tube a sufficient distance so that yarn Y will not become entangled around the free end of the tube when the yarn arm is in lowered position, one such lowered position being shown in dotted lines in FIG. 1. A distance of from one to three inches between notch 34e and the free end of the tube will suffice for this purpose, however, it is understood that this portion of the invention is not to be limited by the distances set forth.

The normal operating position of the yarn arms is shown in full lines in FIG. 1 wherein the arms, via latch pin 34a, maintains the portion 32b of latches 32 in spaced relation from strip 28b, and, at the same time, the latches maintain the yarn arms in normal operating position. Each yarn arm is maintained on shaft 26 in spaced relation to adjacent yarn arms by a pair of spring clips 36 positioned in a pair of suitably spaced grooves 36a formed in the shaft 26, the grooves of each pair thereof being on opposite sides of collar 34b. Each yarn extends from a cone 16 in creel 14 through a suitable aperture in a longitudinally extending yarn guide bar 14b secured to the front upper side of the creel, then upwardly through notch 34e in the tube 34d and then out the free end thereof, then downwardly and through a suitable aperture in a second longitudinally extending guide bar 18b secured transversely of the ends 18a of members 18, then to tape 10 and finally to the feeds of the knitting machine. The yarns Y are virtually tension free as they leave the yarn arms, and, if desired, the yarns may pass through conventional tension discs to have some tension applied thereto.

Should there be any excess tension on yarn Y as may result from an improperly wound yarn cone or from cone changeover or from any other reason, it will tend to turn the yarn arm in clockwise direction, FIG. 1, and, if such tension is sufficient to overcome the force exerted by spring 30c on the yarn arm, via latch 32 and pin 34a, the yarn arm will be released from latch 32 and will be turned in clockwise direction. The arm may dip to its dotted line position of FIG. 1 or to any position therebetween. Latch 32 will be moved by spring 30c to dotted line position and electrical contact will be made between latch end 32b and strip 28b to stop the machine, as will be set forth in connection with FIG. 10. As the machine comes to a stop a certain amount of slack yarn is required by the machine until its motion is finally arrested. This slack yarn is provided by the dipping of the yarn arm from its full to its dotted line positions in FIG. 1. The excess of length between the length of the yarn shown in full line and shown in dotted line is the measure of the length of slack yarn available. The amount of slack yarn is adjustable by

changing the angle of the yarn arm in its full and dotted line positions, by changing the length of tube 34d, by changing the length of supports 20, by changing the downward limit stop of the yarn arm and/or by changing the elevation of and the distance between yarn guide bars 14b and 18b. The angle of the yarn arms in normal position may be changed by angular adjustment of shaft 22 in uprights 20, one such adjustment being shown in FIG. 11 wherein the yarn arms are generally horizontal in their normal position.

The limit stop for the dotted line or dipped position is provided by the same means used to reset the yarn arms to their normal position. To this end there is a secondary shaft 38 which, in its full line position of FIG. 3 and its dotted line position of FIG. 6, acts to stop the further rotation of handle 34c of the yarn arms. The same shaft 38, as it is being moved to its dotted line position of FIG. 3 and to its full line position of FIG. 6, acts to return the yarn arms to their normal latched operating position. The shaft 38 comprises two separate similar sections thereof, one section being disposed on each side of a sprocket 40 on shaft 26. Each shaft 38 is clampingly engaged in suitable apertures formed in a pair of spaced rocker arms 42 at one end thereof, the rocker arms 42, at their other ends, having suitable apertures to clampingly engage shaft 26 whereby angular movement of shaft 26 is transmitted to shafts 38. Each rocker arm 42 is longitudinally slotted at 42a to intersect the apertures therein and is provided with a screw 42b extending through an aperture formed in one side of the slotted portion of the rocker arm and into threaded engagement with the other side of the slotted portion. As screw 42b is tightened, rocker arm 42 clampingly engages shafts 26 and 38. While a spaced pair of rocker arms is provided for each section of shaft 38, it will be understood that more rocker arms may be used. The reason for the two sections of shaft 38 is the interference of sprocket with the use of a single length of shafting. As shaft 38 moves to its dotted line position of FIG. 3, it engages with and causes handle 34c of the yarn arm to move to its full line position during which latch pin 34a, in dotted line position, engages the face of latch 32 to move the latter to its full line position wherein it is maintained by the presence of latch pin 34a in notch 32c of the latch.

The sprocket 40 on and fixed to shaft 26 by set screw 40a, FIG. 5, is adapted to be turned back and forth to accordingly move shaft 26, rocker arms 42 and shafts 38. To this end a flexible sprocket chain 44 is trained over the teeth of sprocket 40 with one end thereof suitably secured to a return weight 46 and the other end suitably secured to the end of piston rod 48a of an air operated piston within an air cylinder 48. The cylinder 48 is clampingly secured in a split block 50, by screw 50a, the block being suitably secured to one end of a base 52, the other end of the base is clampingly secured to fixed shaft 22 by screw 52a. Air under pressure entering the forward end of cylinder 48 through an air line tube 54 acts to pull in the piston rod 48a thereby turning sprocket 40, shaft 26, rocker arms 42 and shafts 38 counterclockwise until latch pin 34a enters notch 32c in latch 32. The angular position of sprocket 40 on shaft 26, the position of chain 44 on sprocket 40 and/or the axial position of cylinder 48 in block 50 may be adjusted as desired to secure the

desired movement of the yarn arms. In air line 54 there is an electrically controlled solenoid air valve A to permit or to stop the passage of air therethrough into cylinder 48. Also in air line 54 is a valve V to regulate the air pressure passing therethrough. When movement of air into cylinder 48 is stopped and the air therein is vented, the sprocket 40, under influence of weight 46, will return to its pre-moved position thereby returning shaft 26, rocker arms 42 and shafts 38 to their normal operating position, FIG. 3. A stop member 48b axially adjustable on piston rod 48a may be provided to limit the stroke of the piston.

As indicated schematically in FIG. 10, the motor used for operating the knitting machine is shown at M and part of the motor circuit at Ma, the latter including a solenoid controlled starting switch S which, in its full line position, causes the motor to operate the machine. Connected to the switch S is the usual stop motion circuit of the machine of which a portion thereof is shown at C and contains its own power source B. The closing of the circuit lines of C by any of the usual stop motion devices of the machine will energize the solenoid of switch S to move the latter to its dotted line position and to stop the machine. Connected into and across the stop motion circuit of the machine is the circuit of the present apparatus which includes the electrical contact between the latches 32 and strip 28b. The circuit is normally open since latch 32 is normally spaced from strip 28b. Also in the circuit is the solenoid operated air valve A and a time delay relay R connected thereto. Assuming the machine to be running with switch S in closed position and latch 32 spaced from strip 28b, when a yarn arm is lowered by excessive yarn tension thereby causing contact to be made between one of the latches 32 and strip 28b, switch S is energized and opened to stop the machine. At the same time the time delay relay R is energized and after a few seconds the solenoid of valve A opens the same to permit air to enter cylinder 52 and draw piston rod 48a therein. Such movement of the piston rod will, through the parts above described, cause the yarn arm to be reset in normal position wherein latch 32 is moved away from strip 28b to once again open the circuit. As the circuit is opened, the switch S is permitted to return to its closed position to re-start the motor M to run the machine. At this time solenoid A will close and allow the air to vent from the cylinder 48 thereby permitting the weight to pull the piston rod from the cylinder, to turn the sprocket 40, to turn shaft 26, to turn rocker arms 42 and to return shafts 38 to their initial positions as stops for the yarn arms. Movement of shaft 26 within collars 34b of the yarn arms does not disturb the latter.

It will be noted that the mechanical portion of the present apparatus of the present invention is wholly supported upon uprights 20 and base members 18. Accordingly, the apparatus may be fully assembled and then placed, as a unit, upon the creel and secured thereto. While the apparatus has been shown as having been placed upon a creel, it is not so limited and may be otherwise supported, such as being placed atop the machine itself with the yarns moving in reversed direction through the yarn arms.

In the operation of the present apparatus, the amount of air pressure used to reset the yarn arms may be sufficient to exert considerable tension in the yarn

itself to free it from its entanglement, such tension being much greater than can be used or is even desirable in the running yarn when the machine is in operation. It will be noted that the re-setting shafts 38 will operate upon any one or more of the yarn arms which may require re-setting at the same time. It may also be noted that fixed shaft 22, which is relatively rigid and of larger diameter than shaft 26, serves as a foundation for the operative parts of the stop motion.

As shown in FIG. 10, a normally closed relay L (relay R being normally open) may be placed in the circuit to be energized once relay R is closed and air passes through valve A. The relay L is of the on and off type with 4 seconds duration in each of its positions (while relay R has, for example, a two second time delay). Consequently, if the air operating on the yarn arm is unable to return the same to its normal upper position in four seconds, then relay L will be opened to open the circuit and shut off the air thereby to release pressure on the yarn and on the yarn arm. Then, after a further four seconds, the relay L will close and, with latch 32 still in contact with strip 28b, the cycle will be repeated. Such repetition or repetitions of the cycle of operations may thus serve to free the yarn from its obstruction and return the yarn arm to its upper position, and, if it does not do so, an operator will free the yarn. If desired, an additional time delay relay may be placed in the circuit so that solenoid S will act to start the motor M a few seconds after the latching up of arm 34 wherein latch 32 is moved away from contact with the strip 28b.

I claim:

1. Stop motion apparatus for use with knitting machines having a longitudinally extending foundation member, a plurality of spaced brackets supportedly secured to said foundation member and extending perpendicular thereto, a shaft supported by said brackets in spaced parallel relation to said foundation member, a longitudinally extending bar supportedly secured upon said brackets in spaced relation to said foundation member and to said shaft, a plurality of spaced yarn arms rotatably supported upon said shaft and extending perpendicular thereto, and a plurality of spaced latches supported upon said bar in operative relation to said yarn arms, said yarn arms being movable between a first and a second position thereof and said latches maintaining said yarn arms in one of its said positions, said foundation member providing a support for said brackets, said shaft, said bar, said yarn arms and said latches.

2. Apparatus as in claim 1 wherein said foundation member is a relatively rigid fixed shaft and wherein said fixed shaft, said rotatable shaft and said bar are

generally co-extensive.

3. Apparatus as in claim 2 wherein said fixed shaft is supportedly secured in a plurality of vertically extending spaced base members, said base members extending perpendicularly to said fixed shaft and providing a support therefor and for the parts supported thereby.

4. Apparatus as in claim 3 wherein said fixed shaft is angularly adjustable relative to said base members.

5. Apparatus as in claim 1 wherein each of said arms comprises a collar rotatably disposed on said rotatable shaft, first and second arms of unequal lengths extending diametrically from opposite sides of said collar, and a latch pin extending laterally from the shorter of said arms.

6. Apparatus as in claim 5 wherein the longer of said arms is a tube, wherein said tube is provided with a notch intersecting the interior thereof whereby yarn may pass through said notch and through the portion of said tube between said notch and the free end thereof and through said free end, said notch being spaced from the free end of said tube a sufficient distance to prevent entanglement of said yarn therewith.

7. Apparatus as in claim 6 wherein said notch is spaced within a range of from one to three inches from the free end of said tube.

8. Apparatus as in claim 1 wherein said shaft is rotatable, wherein a plurality of spaced rocker arms are supportedly secured to said rotatable shaft to rotate therewith, and wherein a longitudinally extending re-setting shaft is supportedly secured in and is movable with said rocker arms, said re-setting shaft being disposed in spaced parallel relation to said rotatable shaft, said rotatable shaft being movable to a pair of positions thereby moving said re-setting shaft to a corresponding pair of positions in one of which it serves as a limit stop for said arms in one of their said positions thereof, said re-setting shaft as it is moved to the other of its positions is adapted to engage said yarn arms to move the latter to the said one of their positions in which they are maintained by said latches.

9. Apparatus as in claim 2 wherein air means is operable to move said rotatable shaft and wherein said air means is supportedly secured to said fixed shaft.

10. Apparatus as in claim 1 wherein said latches are movable to a pair of positions in one of which they maintain said yarn arms in the said one of their positions, an electrically conductive strip of material extending lengthwise of and electrically insulated from said bar, said latches in said one of their positions being spaced from said strip of material and in the other of their positions being in contact with said strip of material.

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