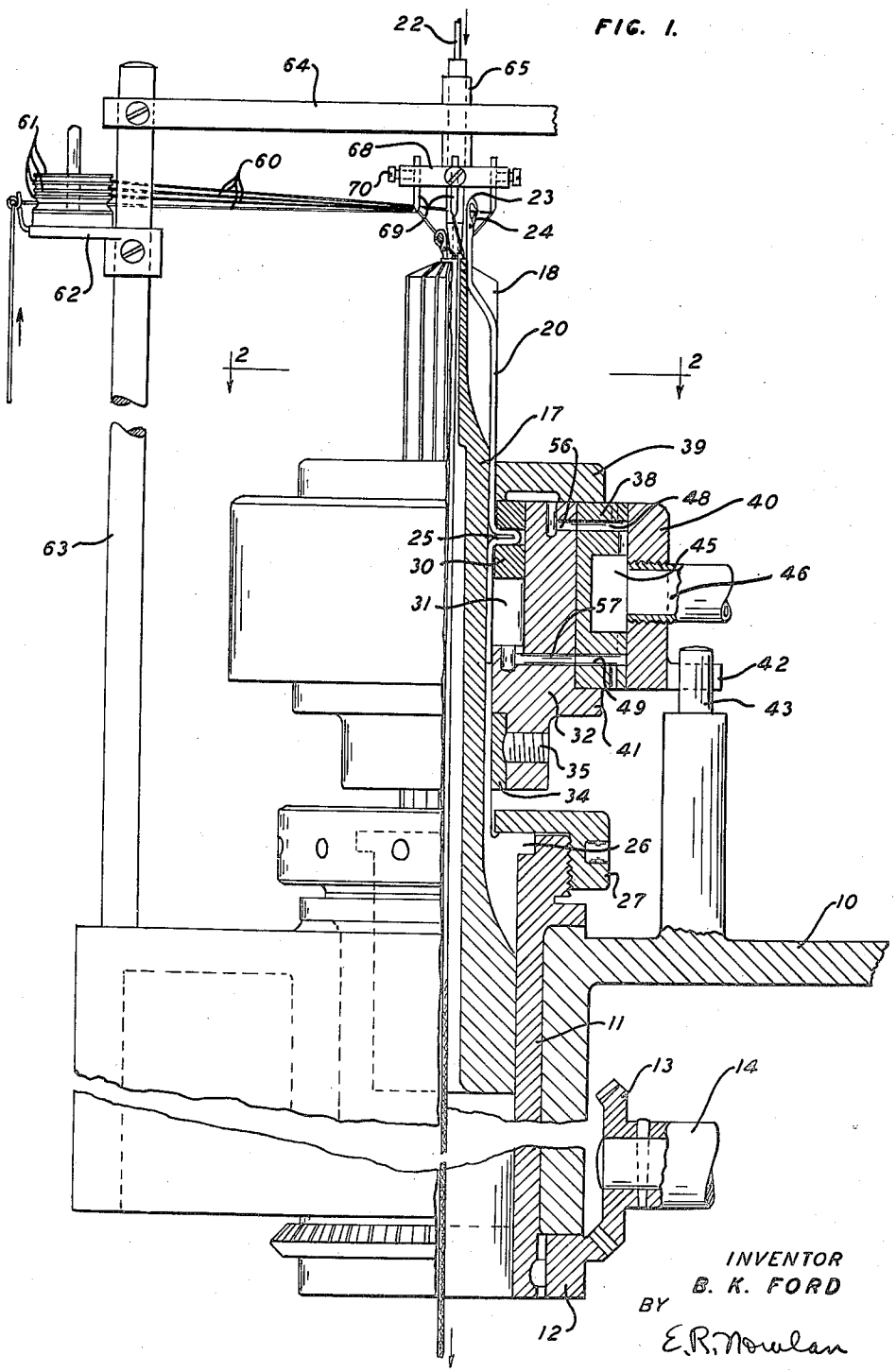
Nov. 19, 1940. B. K. FORD 2,222,286

APPARATUS FOR HANDLING STRANDS

Filed May 3, 1938 2 Sheets-Sheet 1

FIG. 1.



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FIG. 2.

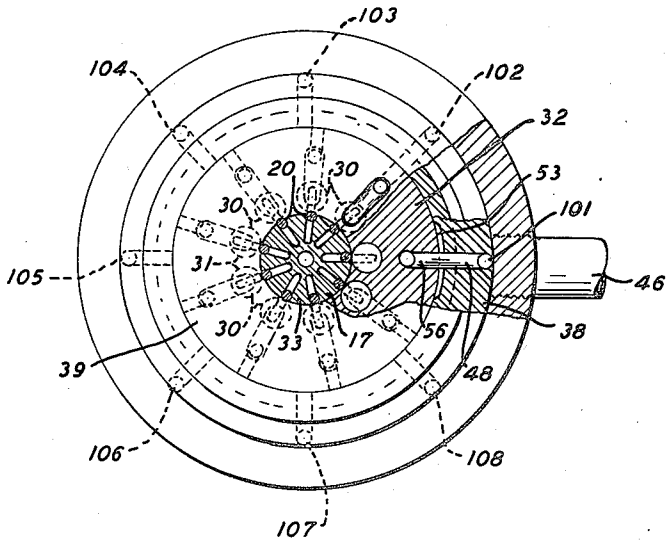


FIG. 3.

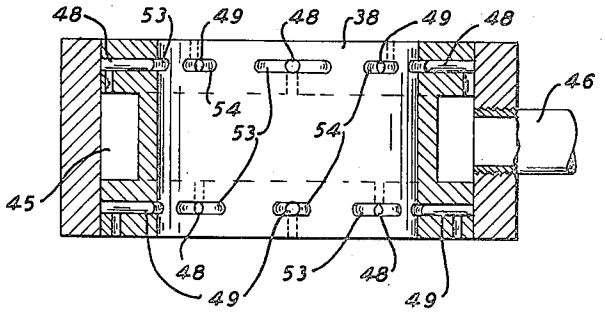
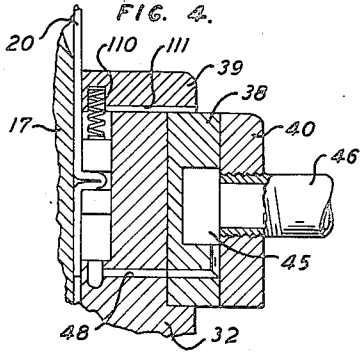


FIG. 4.



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APPARATUS FOR HANDLING STRANDS

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Application May 3, 1938, Serial No. 205,683

19 Claims. (Cl. 66—9)

This invention relates to apparatus for handling strands and more particularly to apparatus for knitting a cover or sheath of textile strands on an electrical conductor strand.

In the manufacture of certain types of insulated electrical conductors, e. g. the conductor cords used in connection with telephone instruments, switchboards and the like, it is highly desirable to have the cords as flexible and durable under repeated flexure and torsion as possible.

An object of the present invention is to provide an efficient, practical and expeditious fluid actuated knitting apparatus.

One embodiment of the invention contemplates a knitting machine having a hollow rotatable carrier supporting a plurality of needles or thread engaging elements in a predetermined spaced relation about a core passing therethrough, stationary strand supply and guide means to feed strands to be knitted about the core to the needles, and fluid actuated means to actuate the needles in predetermined sequence.

Other objects and advantages will be apparent from the following detailed description taken in conjunction with the accompanying drawings, wherein:

Fig. 1 is a fragmentary elevational view of a portion of a knitting machine illustrating the invention, portions thereof being shown in section;

Fig. 2 is a horizontal sectional view taken along the line 2—2 of Fig. 1, portions thereof being broken away;

Fig. 3 is a vertical sectional view of a portion of the fluid controlling means; and

Fig. 4 is a fragmentary sectional view of another form of the invention.

The embodiment herein disclosed comprises a circular knitting machine of generally conventional construction of which only sufficient is shown in the drawings to enable a clear understanding of the novelty embodying the invention. There is shown a stationary base 10 apertured to rotatably receive a hollow shaft 11, the shaft having fixed to its lower end a bevelled gear 12 intermeshing a bevelled gear 13 of a power shaft 14 driven by any suitable power means (not shown). Within the hollow shaft 11 is disposed a rotatable carrier 17 which in the present embodiment of the invention may be termed a needle carrier, as it has suitable longitudinally extending slots 18 equally spaced about its periphery to receive and guide thread engaging elements or needles 20. The present form of the invention was designed to knit a textile cover upon a relatively small core, which necessitates positioning the thread engaging ends of the needles in close relationship to the axis of the carrier through which the strand core, indicated at 22, passes during the knitting operation. The needles 20 are of the conventional type having a hooked head or tip 23 at the top with a pivoted latch 24 and having a laterally projecting portion or lug 25 formed in its lower portion. In order to position the heads of the needles more closely to the center or axis of the carrier 17 the needles are bent as illustrated in Fig. 1 and the grooves or slots 18 are cut more deeply at the upper portion of the carrier to allow free reciprocatory movement of the needles in their respective slots. The carrier 17 has an annular flange 26 receivable in an offset portion in the upper end of the hollow shaft 11, where it is securely held against movement relative to the shaft by a cap 27 removably secured to the shaft through a threaded connection.

Removably secured to the projection 25 of each needle is a piston 30 cylindrical in general contour and slidably disposed in a cylinder 31 of a fluid controlling unit 32. The carrier 17 and the unit 32 may be considered as one element, as they are fixed to each other as described hereinafter. The number of needles may vary depending upon the size of the core to be covered and upon the type of knitted sheath to be applied to the core but in the present embodiment there are shown nine needles. Therefore, in this embodiment nine cylinders 31 are disposed in circular formation as illustrated in Fig. 2, with their circumferences adjacent to a central aperture 33 for receiving the carrier 17. The lower portion of the fluid controlling unit 32 is cut away to receive a split ring 34 which when forced inwardly by the aid of a set screw 35 rigidly secures the unit to the carrier. This also provides means for adjusting the relative positions of the needle actuating means and the carrier.

The outer periphery of the unit 32 is circular in contour and upon this portion of the unit is concentrically disposed a fluid controlling member 38 resting upon an annular flange 41 of the unit and held against vertical displacement by a cover ring 39, the latter being fixed by means of screws or the like (not shown) to the unit so as to rotate therewith during rotation of the carrier. A stationary annular sleeve member 40 is fixed to the fluid controlling member 38 by any suitable means (not shown) and has projections 42, only one of which is shown in the drawings, positioned to straddle a stationary pin 43 mounted

upon the base 10 to hold the members 38 and 40 against rotation.

The fluid controlling member 38 has an annular groove 45 cut quite deeply in its outer surface and cooperating with the inner wall of the member 40 to form a fluid passageway communicating with a fluid line 46. Any desired number of intake ports and exhaust ports may be formed in the member 38, in the present instance there being eight exhaust ports and eight intake ports, four of each being alternately disposed in circular arrangement above passageway 45 and the same number in a similar arrangement below the passageway 45.

The term "fluid", for purpose of the specification and claims, includes various fluids, for example, air which may be used under pressure or atmospheric pressure controlled by vacuum. In Fig. 2 the portion shown in section illustrates an intake port 48 in the upper portion of the member 38 and an exhaust port 49 in the lower portion thereof. The intake port 48 includes the vertical passageway communicating with the passageway 45 and the exhaust port includes the vertical passageway open to the atmosphere.

By viewing Figs. 2 and 3 it will be observed that the intake ports 48 are equally spaced about the member 38, and in alignment with each upper intake port and each lower intake port is respectively positioned a lower and upper exhaust port 49. Relatively long grooves 53 are formed in the inner surface of the member 38 and extend predetermined distances upon each side of the intake ports, whereas similar grooves 54 are provided for the exhaust ports, but these grooves are shorter in length than groove 53 to provide controlling means for the pistons, as will hereinafter be described. Fluid passageways 56 and 57 communicating with the upper and lower ends, respectively, of the cylinder 31 are positioned to be moved into registration with the upper and lower intake and exhaust ports, respectively. It will be observed by viewing Fig. 1 that the passageway 56 includes a horizontal and vertical connecting aperture in the unit 32 associated with a groove in the cover ring 39.

By viewing Fig. 2 it will be observed that of the eight sets of intake and exhaust ports in the fluid controlling member 38 four of the sets provide four positions where each piston and needle carried thereby will be moved upwardly and the other four sets afford four intermediate positions for moving each piston and its needle downwardly. However, there are nine pistons equally disposed in circular arrangement with radially projecting passageways, thus resulting in the actuation of the pistons singly so that a uniform pressure may be applied to each piston and so that the needles will be brought into engagement with only one strand at a time.

In view of the fact that there are four active positions to move the needles upwardly in this embodiment of the invention, four strands 60 of suitable material such as textile are supplied from any desired source (not shown) and directed around sheaves 61 rotatably mounted upon single or separate pins of a bracket 62 supported by a rod 63 extending upwardly from a base 10. The rod 63 with a similar rod (not shown) supports a horizontally extending cross member 64, the center portion of which is apertured to rigidly hold a guide sleeve 65 through which the core 22 passes. Adjustably mounted upon the sleeve 65 beneath the bar 64 is fixed a bracket 68 grooved to receive strand guides 69 held in place by set screws 70 and apertured at their lower ends for the passage of the strands 60 therethrough. The strand guides 69 are positioned so as to enable the needles to engage the strands during the actuation of the needles.

In operating the apparatus the driving means is set in motion to rotate the shaft 11 through the gears 12 and 13 to rotate the carrier 17 at a predetermined speed. A suitable fluid, such as air under pressure, is supplied to the passageway 45, thus supplying the fluid under pressure constantly to the intake ports 48. As the carrier is rotated the unit 32 is likewise rotated, moving the passageways 56 and 57 into communication with the intake and exhaust ports in a predetermined sequence. For the purpose of illustration let it be assumed that the unit 32 and the member 38 are in the relative positions shown in Fig. 2. The sets of intake and exhaust ports may be referred to as operating positions 101, 102, 103, 104, 105, 106, 107 and 108. At position 101 the passageway 56 of the cylinder 31 at the extreme right is in communication with the intake port and the passageway 57 of this cylinder is in communication with the exhaust port 49 directly beneath the intake port shown. As a matter of fact, the passageway 56 referred to is at approximately the center of its movement in communication with the adjacent intake port, the latter also including its groove 53. With the parts, i. e. the unit 32 and the member 38, so positioned air under pressure is forced through the intake port, the passageway 56, to the adjacent cylinder 31, forcing the piston therein downwardly together with its needle 20, during which movement the needle engages the strand adjacent thereto. During the downward movement of the piston the air therebeneath is forced from the cylinder through the passageway 57, and the exhaust port 49 communicating therewith.

The grooves 53 and 54 for the intake and exhaust ports, respectively, being of different lengths effect relative slow starting and stopping of the pistons to avoid jerking and thus breaking the strands. The intake ports are open to supply air to the pistons before the exhaust ports are open, thus moving the pistons relatively slowly at the beginning of their strokes until the heads of the needles engage the strands, the pistons compressing the air at the opposite sides thereof, and when the pressures on both sides of the pistons are substantially balanced the exhaust ports are opened to allow continuation of the piston movement. Furthermore, cushioning means for the pistons are formed near the ends of their strokes, as there are direct outlets for the air at the exhaust ends of the pistons until the pistons approach the ends of their stroke, at which times the exhaust passageways are closed, preventing complete exhausting of the air and allowing the remaining quantities of air to serve as cushions for the pistons.

When the rotating elements have advanced counter-clockwise to move cylinder 31 from position 101, where the piston therein is moved downwardly, to position 102 the same piston will at this position be moved upwardly due to its cylinder communicating with the intake port 38, which at position 102 is at the bottom, to force air under pressure into the cylinder beneath the piston and force the latter upwardly. In following the same piston from one position to the other it will be understood that the needle carried thereby is raised at position 102, lowered at position 103, raised again at position 104, etc.

throughout the cycle, completing four upward movements and four downward movements of each needle and at the four definite positions during each cycle of operation. While the piston at 101 is completing its downward movement, the second piston, counter-clockwise, is beginning its upward movement at 102, the third piston is approaching position 103, and so on, as illustrated in Fig. 2.

By operating the thread engaging elements or needles by fluid under pressure the apparatus may be operated at an exceedingly rapid speed. The clearance between the various elements where there is relative movement, for example, the carrier 17 and needles, the pistons and the fluid controlling unit 32, and the unit and the fluid controlling member 38, is such that a small quantity of the air under pressure will seep between these parts, resulting in a means to float the moving parts and providing a film of air which serves as a lubricant, obviating the necessity of other lubricants between these parts. Furthermore, although it has been possible to operate the moving parts at a more rapid rate of speed than is ordinarily possible with other types of machines, the parts are kept cool due to the cooling effect of the air under pressure combined with the lubricating effect of the same fluid. Therefore, this combined result, i. e., the cooling and lubricating effect of the cooling fluid, prevents seizing of the parts.

The apparatus may be readily conditioned to be operated by a vacuum merely by adjusting the bracket 68 to properly position the strands being fed to the needles. When the apparatus is operated by a vacuum it is still controlled or actuated by a fluid which in this instance is the atmosphere. However, the pistons will be operated in just the reverse order as that previously described, for example, they will be moved toward the intake ports instead of being forced away therefrom when the control means at the intake ports is a vacuum instead of a fluid under pressure. However, the result accomplished will be the same in that the pistons will be operated in the same sequence. Furthermore, the grooves 53 and 54 at the ports will cause a relatively slow starting and stopping of the pistons caused by controlling the air back of the pistons. If desired suitable sealing rings may be employed if the apparatus is operated by vacuum.

It may also be desirable to move the needles through the aid of their pistons in one direction by fluid actuating means and to move the same in an opposite direction by mechanical means such as a spring 110 (Fig. 4). For example, the springs 110 may be positioned above and in alignment with each piston so that each piston will engage its respective spring upon an upward movement brought about by fluid actuating means and the spring, aided by gravity, could return the piston to its lower position. In this form the upper end of each cylinder is open to the atmosphere through a groove 111 in the cover ring 39. Other than the removal of the upper ports and the addition of the springs 110 and the grooves 111, the various parts shown in this figure and bearing the same reference numerals as those appearing in the other figures are the same.

It is to be understood that the apparatus is operable in any position, as, for example, either vertically or horizontally or at an angle if so desired. The apparatus may also be operated in a reverse direction and may be conditioned for such operation merely by adjusting a strand feeding means. Furthermore, the ports 56 and 57 in the unit 32 each function alternately as intake and exhaust ports during their rotary travel.

The embodiments of the invention herein disclosed are illustrative only and can be modified and departed from in many ways without departing from the spirit and scope of the invention as pointed out in and limited only by the appended claims.

What is claimed is:

1. In a knitting apparatus, a plurality of movable strand engaging elements, a movable carrier therefor, and fluid operated means controlled through the movement of the carrier to move the elements.

2. In a knitting apparatus, a plurality of movable strand engaging elements, a carrier therefor, and a fluid control member, the member and carrier rotatable one relative to the other to control a fluid to cause actuation of the elements.

3. In a knitting apparatus, movable strand engaging elements, a carrier therefor, a fluid supply member, the member and the carrier rotatable one relative to the other, pistons operatively associated with the elements, cylinders for the pistons, and means rendered effective during the relative movement of the carrier and member to supply a fluid to the pistons to actuate the elements in predetermined sequence.

4. In a knitting apparatus, reciprocable strand engaging elements, a rotatable carrier therefor, means to supply a plurality of strands to the elements, means to supply strands to the elements, and fluid controlled means to actuate the elements to take the strands singly and in predetermined sequence.

5. In a knitting apparatus, movable strand engaging elements, a carrier therefor having fluid receiving cylinders therein, means to supply strands to the elements, pistons for the elements disposed in the cylinders, a fluid control member, the member and carrier being rotatable one relative to the other, and means cooperating to direct a fluid to the cylinders to cause movement of the pistons and their elements in one direction at one position and in a reverse direction at another position during the relative rotation of the member and carrier.

6. In a knitting apparatus, movable strand engaging elements, a carrier therefor having fluid receiving cylinders therein, means to supply the strands to the elements, pistons for the elements disposed in the cylinders, a fluid control member, the member and carrier being rotatable one relative to the other, and means cooperating to direct a fluid to the cylinders to cause movement of the pistons and their elements in one direction at certain positions and in a reverse direction at other positions during the relative rotation of the member and carrier.

7. In a knitting apparatus, strand engaging elements, a piston for each element, and a pair of relatively rotatable members, one having cylinders for the pistons and the other having fluid passageways to supply a fluid to the pistons in predetermined sequence during the relative rotation of the members to actuate the element.

8. In an apparatus for tubular knitting, a plurality of reciprocable strand engaging elements, a rotatable carrier therefor, stationary means to supply a plurality of strands to the elements, a piston for each element, a unit rotatable with the carrier and element and having cylinders for the pistons and fluid ports for the cylinders, and

means registerable with the ports in predetermined sequence during the rotation of the unit to supply fluid to the pistons to actuate the elements.

9. In a knitting apparatus, strand engaging elements, a piston for each element, a unit having cylinders for each piston and ports communicating with the top and bottom of each cylinder, and fluid supply member having fluid passageways positioned to communicate with the ports in the unit, the unit and the member being movable one relative to the other to cause registration of the ports and passageways in predetermined sequence, each port acting alternately as an intake and an exhaust port.

10. In a knitting apparatus, a plurality of strand engaging elements, a carrier therefor having adjacently positioned cylinders therein, a piston connected to each element and movably disposed in the cylinder adjacent thereto, a fluid controlling member conditioned to supply a fluid to the cylinders to cause reciprocatory movements of the pistons and elements during relative movement of the carrier and member, and means to cause relative movement of the carrier and member.

11. In a knitting apparatus, a plurality of strand engaging elements, a carrier therefor having adjacently positioned cylinders therein with fluid passageways communicating with each end thereof, a piston connected to each element and movably disposed in the cylinder adjacent thereto, a fluid controlling member having fluid actuating positions including sets of fluid supply and exhaust ports positioned to communicate with the passageways to cause reciprocatory movements of the pistons and elements at the actuating positions during relative movement of the carrier and member, and means to cause relative movement of the carrier and member.

12. In a knitting apparatus, a plurality of strand engaging elements, a carrier therefor having adjacently positioned cylinders therein, a piston connected to each element and movably disposed in the cylinder adjacent thereto, a fluid controlling member conditioned to supply a fluid to the cylinders to cause reciprocatory movements of the pistons and elements during relative movement of the carrier and member and to retard the pistons at the ends of their movements, and means to cause relative movement of the carrier and member.

13. In a knitting apparatus, a plurality of strand engaging elements, a carrier therefor having adjacently positioned cylinders therein, a piston connected to each element and movably disposed in the cylinder adjacent thereto, a fluid controlling member conditioned to supply a fluid to the cylinders to cause reciprocatory movements of the pistons and elements during relative movement of the carrier and member and to retard the pistons at the beginning of their movements, and means to cause relative movement of the carrier and member.

14. In a knitting apparatus, a movable strand engaging element, a rotatable carrier therefor, and fluid operated means controlled by the rotation of the carrier to move the element.

15. In a knitting apparatus, a movable strand engaging element, a rotatable carrier therefor, and fluid operated means controlled by the rotation of the carrier to move the element at predetermined positions during rotation of the carrier.

16. In a knitting apparatus, a movable strand engaging element, a piston therefor movable in a cylinder to move the element, and a fluid controlling means including inlet and exhaust passageways and conditioned to cause communication of the passageways with the cylinder at different intervals to cause retarded movement of the piston.

17. In a knitting apparatus, a movable strand engaging element, a piston therefor movable in a cylinder to move the element, and a fluid controlling means including inlet and exhaust passageways and conditioned to cause the exhaust passageway to communicate with the cylinder subsequent to the communication of the inlet passageway therewith to retard movement of the piston at the beginning of its stroke.

18. In a knitting apparatus, a movable strand engaging element, a piston therefor movable in a cylinder to move the element, and a fluid controlling means including inlet and exhaust passageways and conditioned to cause the exhaust passageway to discontinue communication with the cylinder during communication of the inlet passageway with the cylinder to retard movement of the piston at the end of its stroke.

19. In a knitting apparatus, a movable strand engaging element, a piston therefor movable in a cylinder to move the element, and a fluid controlling means including inlet and exhaust passageways and conditioned to cause communication of the passageways with the cylinder at different intervals to cause retarded movement of the piston at the beginning and end of each stroke.

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