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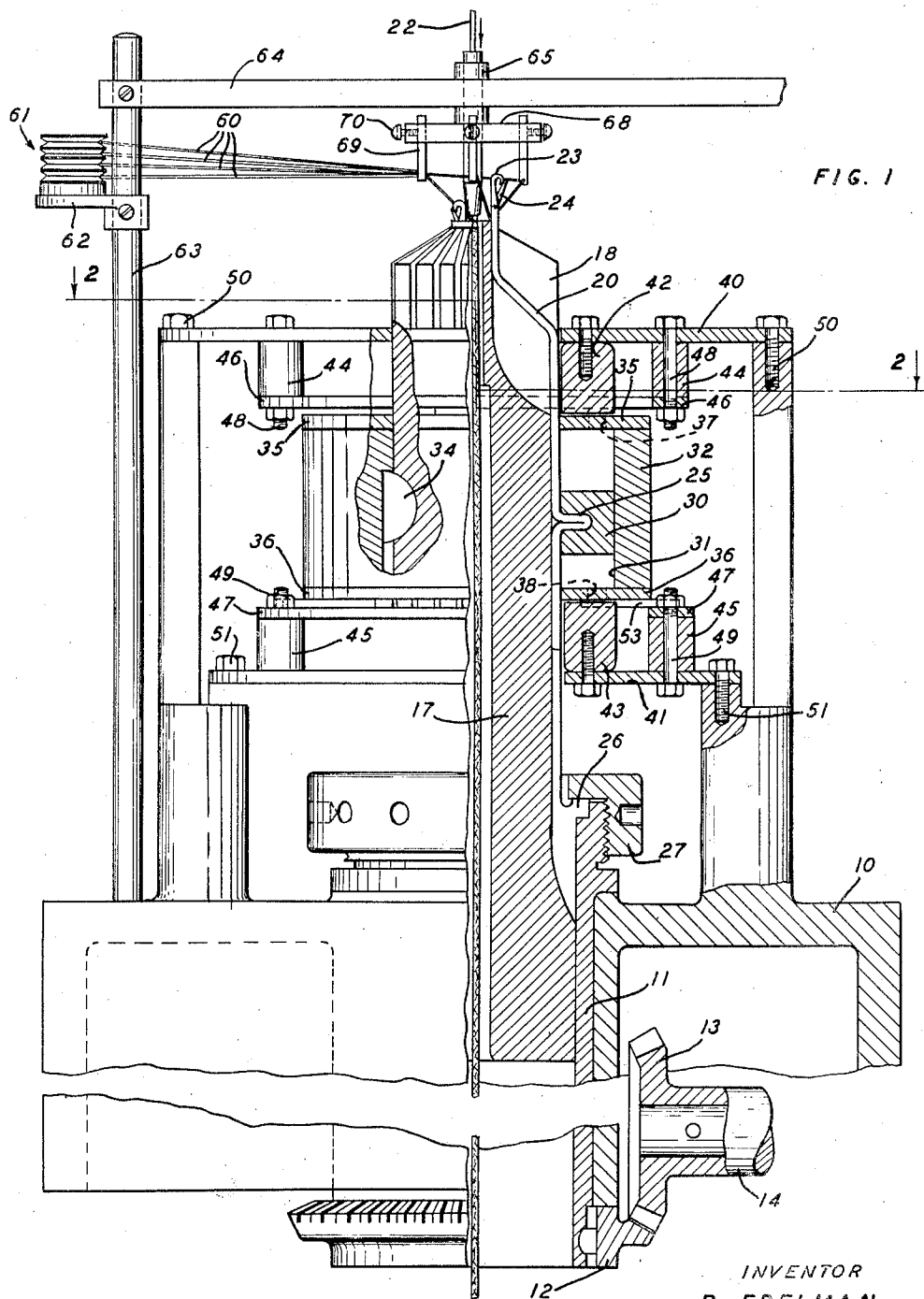
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2,261,349

APPARATUS FOR HANDLING STRANDS

Filed Jan. 13, 1940

3 Sheets-Sheet 1



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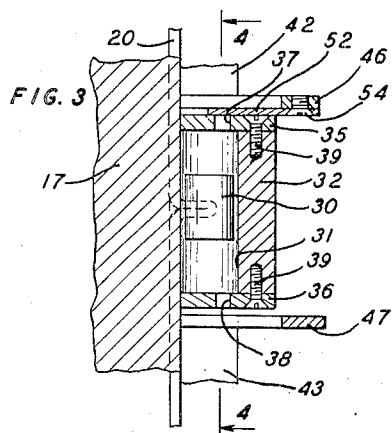
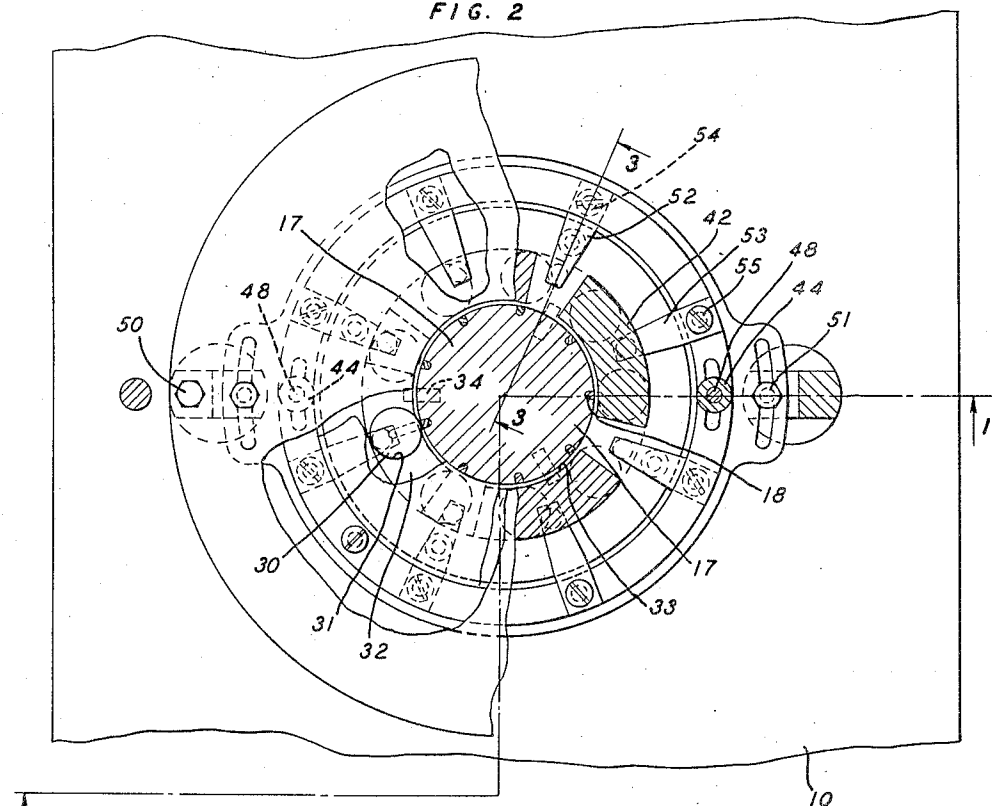
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APPARATUS FOR HANDLING STRANDS

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3 Sheets-Sheet 2

FIG. 2



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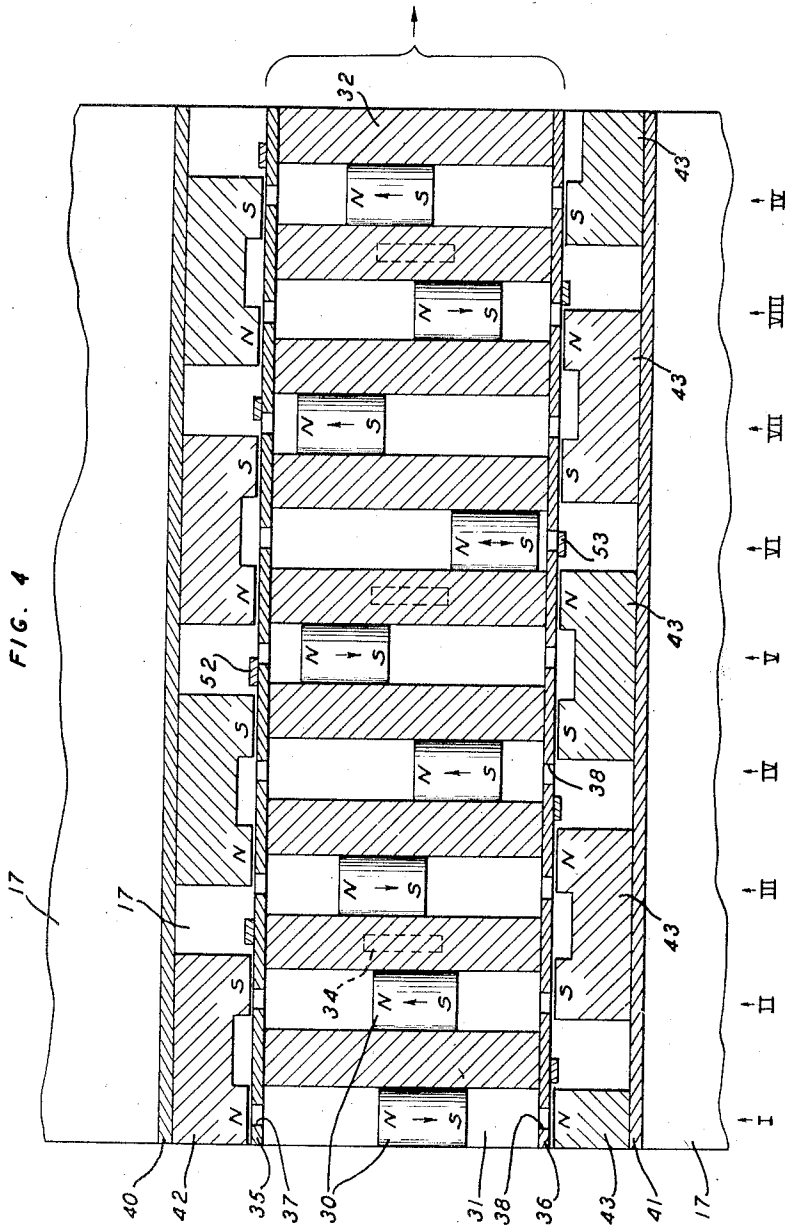
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APPARATUS FOR HANDLING STRANDS

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3 Sheets-Sheet 3



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APPARATUS FOR HANDLING STRANDS

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16 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 magnetically 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 magnetically 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 magnetic controlling means; and

Fig. 4 is a developed, radially panoramic view toward the axis on the line 4—4 of Fig. 3, with the needles and needle slots omitted, the vertical dimension being exaggerated.

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 combination magnetic armature and piston 30 cylindrical in general contour and slidably disposed in a guide bore or cylinder 31 of a 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 bores or 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 unit is locked to and supported on the carrier by one or more keys 34. Each end of the unit is covered by a flat annulus or ring 35 or 36 respectively. Each ring is formed with a plurality of small apertures or ports 37 or 38 communicating with the bores 31. Screws 39 secure the rings to the unit.

Annular supports 40 and 41 are attached to suitable extensions of the base 10 by screws 50 and 51 passing through arcuate slots in the supports, so that these are rotatably adjustable on the base about the principal axis. These annular supports are, respectively, above and below the units 32 and carry pluralities of arcuate magnet members 42 and 43, encircling the carrier 17 and having their faces nearest the rings 35 and 36 spaced a little therefrom. Each of the

magnets 42 and 43 is centrally recessed on the face next to the rings 35 and 36, as shown in Fig. 4, to provide pole ends.

Pairs of pillars 44 and 45, respectively, secured on the supports 40 and 41 outside of the magnets 42 and 43, carry flat annuli or rings 46 and 47 secured thereto by bolts 48 and 49 passing through arcuate slots in the rings, so that the rings are rotatably adjustable on the pillars.

In the particular apparatus disclosed, there are four of the magnets 42 and four of the magnets 43. In each set, the magnets are spaced apart at their ends. The ring 46 carries four, radially inwardly extending, flat, tapered valve arms 52, secured thereto by screws 54, and positioned, respectively, in alternation with the magnets with their inner ends resting and slidable on the outer face of the ring 35 to open and close the apertures 37. Similarly valve arms 53 are secured to the ring 47 by screws 55 to open and close the apertures 38.

The members 30, 42 and 43 are made of magnetic material of high retentivity, for example of an alloy comprising about 12% aluminum, 20% nickel, 5% cobalt and the balance iron, and have been permanently magnetized to have magnetic poles as shown in Fig. 4. The carrier 17 and unit 32 are made of a suitable aluminum alloy; and the rings 35 and 36, screws 39, supports 40 and 41, pillars 44 and 45, rings 46 and 47, bolts 48 and 49, screws 50 and 51, valves 52 and 53, and screws 54 and 55 are made of suitable brass, bronze or the like alloys.

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 the 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 operation, the shaft 14 and gear 13 are thought of as being driven in counterclockwise rotation as seen from the right in Fig. 1. The gear 12 then drives the carrier 17 counterclockwise as seen in Fig. 2; and, the carrier 17 having the unit 32 keyed thereto, the unit 32 and its closure rings 35 and 36 as well as the armature-pistons 30 housed therein, are all revolved in synchronism with the carrier.

In Fig. 4, therefore, elements 35, 32 and 36, numbered at the right side of the figure, move to the right as indicated by the bracket and arrow; while all the other parts shown in this figure are stationary. In the particular machine disclosed herein as an illustrative embodiment of the invention, there are nine needles in the carrier 17 and four knitting positions. Hence there are nine armature-pistons, one for each needle, in the unit 32, and four pairs of opposed driving magnets 42, 43. Fig. 4 shows the instantaneous relative positions of the nine magnetic pistons, when the machine is in the instantaneous phase

of its operation selected for all the figures. The piston at VI has just completed a downward stroke and is momentarily stationary, so far as vertical motion is concerned, its downward inertial energy having been absorbed by compressing air below it in the cylinder, the port 38 having been closed a little by the valve arm 53. Magnetically the piston is substantially balanced between the attraction of the N pole of the magnet 43 which it is just leaving, and the repulsion of the S pole of the magnet 42 which it is just approaching. A moment later, the piston has left the attractive field of the N pole and entered the repulsive field of the next S pole and starts up. This start is aided by the compressed air until the port 38 is carried away from the arm 53; and the weakening drive of the repelling S pole as the distance from it to the piston increases is compensated by the increasing drive of the attracting S pole vertically opposite. At VII, the next piston is shown nearing the top of its upward stroke. Thus the nine pistons shown from I to IX illustrate not only the relative positions of the nine pistons at a given instant, but also illustrate nine consecutive positions of any one piston at nine equally spaced moments of one revolution of the unit 32.

In Fig. 4, the cooperating poles of the opposed driving magnets are shown in vertical alignment, the ports of the cylinders are shown in central alignment with the cylinders, and the valve arms are shown in a specific location between the driving magnets. This specific arrangement of these parts corresponds to one particular speed of rotation of the carrier, and will require modification if the carrier is to be driven either faster or slower than that speed. Hence the two rings 40 and 41 are angularly adjustable about the axis of the machine, each independently of any other element, to shift the driving magnets 42 or 43 or both, as may be necessary. The rings 46 and 47 are similarly independently adjustable to shift the valve arms angularly also. Furthermore, the screws 39 which hold the cylinder closure rings 35 and 36 on the unit 32 may pass through arcuate slots in the rings, if necessary, so that the ports of the cylinders may be shifted adjustably with respect to the cylinders.

For simplicity of disclosure and drawing, the illustrative embodiment shows the piston-armature and driving magnets as permanent magnets of high retentivity magnetic alloy. For some purposes, particularly where it may be desired to have the magnetic driving forces adjustable, it may be preferred to use electromagnetic instead of permanent magnets for these elements. It is thought that the details of such a modification are too obvious to need explicit detailed illustration and description. However, in the appended claims the words "magnet" and "magnetic" are not intended to be limited to permanent magnets but to include any suitable element having an appropriate magnetic field for its purpose and operation, whether permanent magnet, electromagnet or solenoid. The embodiment disclosed and described is illustrative and may be modified and departed from in various 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 movable strand engaging element, a magnetic armature for the element, and pneumatic means to retard the armature at the end of a stroke.

2. In a knitting apparatus, a movable strand engaging element, a magnetic armature for the element, and pneumatic means to accelerate the armature at the beginning of a stroke.

3. In a knitting apparatus, a movable strand engaging element, magnetic means to move the element, and pneumatic means to assist the magnetic means to reverse the motion of the element.

4. In a knitting apparatus, a plurality of movable strand engaging elements, a movable carrier therefor, and magnetic means controlled by the movement of the carrier to move the elements.

5. In a knitting apparatus, a rotatable carrier, a plurality of strand engaging elements movable therewith and reciprocable therein, a magnetic armature in the carrier for each element, and magnetic means to actuate the armatures in turn to reciprocate the elements upon rotation of the carrier.

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

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

8. In a knitting apparatus, a movable strand engaging element, a combined piston-armature therefor, a member having a cylinder for the piston-armature, magnetic means to reciprocate the piston-armature in the cylinder, and valve means to pneumatically retard and accelerate the motion of the piston-armature during reversals thereof.

9. In a knitting apparatus, a plurality of movable strand engaging elements, a combined piston-armature for each element, a member having a cylinder for each piston-armature, magnetic means to reciprocate the piston-armature in sequence, and valve means to pneumatically retard and accelerate the motion of each piston-armature during reversals thereof.

10. In a knitting apparatus, a rotatable generally cylindrical carrier, a plurality of needles rotatable with and reciprocable in the carrier, a piston-armature connected to each needle to reciprocate the same, an annular member rotatable with the carrier and having a cylinder for each piston-armature, and stationary magnets at the ends of the cylinders to reciprocate the piston-armatures in the cylinders and thereby reciprocate the needles.

11. In a knitting apparatus, a rotatable generally cylindrical carrier, a plurality of needles rotatable with and reciprocable in the carrier, a piston-armature connected to each needle to reciprocate the same, an annular member rotatable with the carrier and having a cylinder for each piston-armature, stationary magnets at the ends of the cylinders to reciprocate the piston-armatures in the cylinders and thereby reciprocate the needles, and valve means to pneumatically retard

and accelerate the motion of each piston-armature during reversals thereof.

12. In a knitting apparatus, a rotatable generally cylindrical carrier, a plurality of needles rotatable with and reciprocable in the carrier, a piston-armature connected to each needle to reciprocate the same, an annular member rotatable with the carrier and having a cylinder for each piston-armature, and adjustably stationary magnets at the ends of the cylinders to reciprocate the piston-armatures in the cylinders and thereby reciprocate the needles, the magnets being angularly adjustable about the axis of the annular member.

13. In a knitting apparatus, a rotatable generally cylindrical carrier, a plurality of needles rotatable with and reciprocable in the carrier, a piston-armature connected to each needle to reciprocate the same, an annular member rotatable with the carrier and having a cylinder for each piston-armature, adjustably stationary magnets at the ends of the cylinders to reciprocate the piston-armatures in the cylinders and thereby reciprocate the needles, the magnets being angularly adjustable about the axis of the annular member, and valve means to pneumatically retard and accelerate the motion of each piston-armature during reversals thereof.

14. In a knitting apparatus, a rotatable generally cylindrical carrier, a plurality of needles rotatable with and reciprocable in the carrier, a piston-armature connected to each needle to reciprocate the same, an annular member rotatable with the carrier and having a cylinder for each piston-armature, stationary magnets at the ends of the cylinders to reciprocate the piston-armatures in the cylinders and thereby reciprocate the needles, and adjustably stationary valve means to pneumatically retard and accelerate the motion of each piston-armature during reversals thereof, the valve means being angularly adjustable about the axis of the annular member.

15. In a knitting apparatus, a rotatable generally cylindrical carrier, a plurality of needles rotatable with and reciprocable in the carrier, a piston-armature connected to each needle to reciprocate the same, an annular member rotatable with the carrier and having a cylinder for each piston-armature, adjustably stationary magnets at the ends of the cylinders to reciprocate the piston-armatures in the cylinders and thereby reciprocate the needles, the magnets being angularly adjustable about the axis of the annular member, and adjustably stationary valve means to pneumatically retard and accelerate the motion of each piston-armature during reversals thereof, the valve means being angularly adjustable about the axis of the annular member.

16. In a knitting apparatus, a movable strand engaging element, a magnetic armature for the element, and fluid actuated means to retard the armature at the end of a stroke.

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