

May 16, 1944.

DE HART G. SCRANTOM

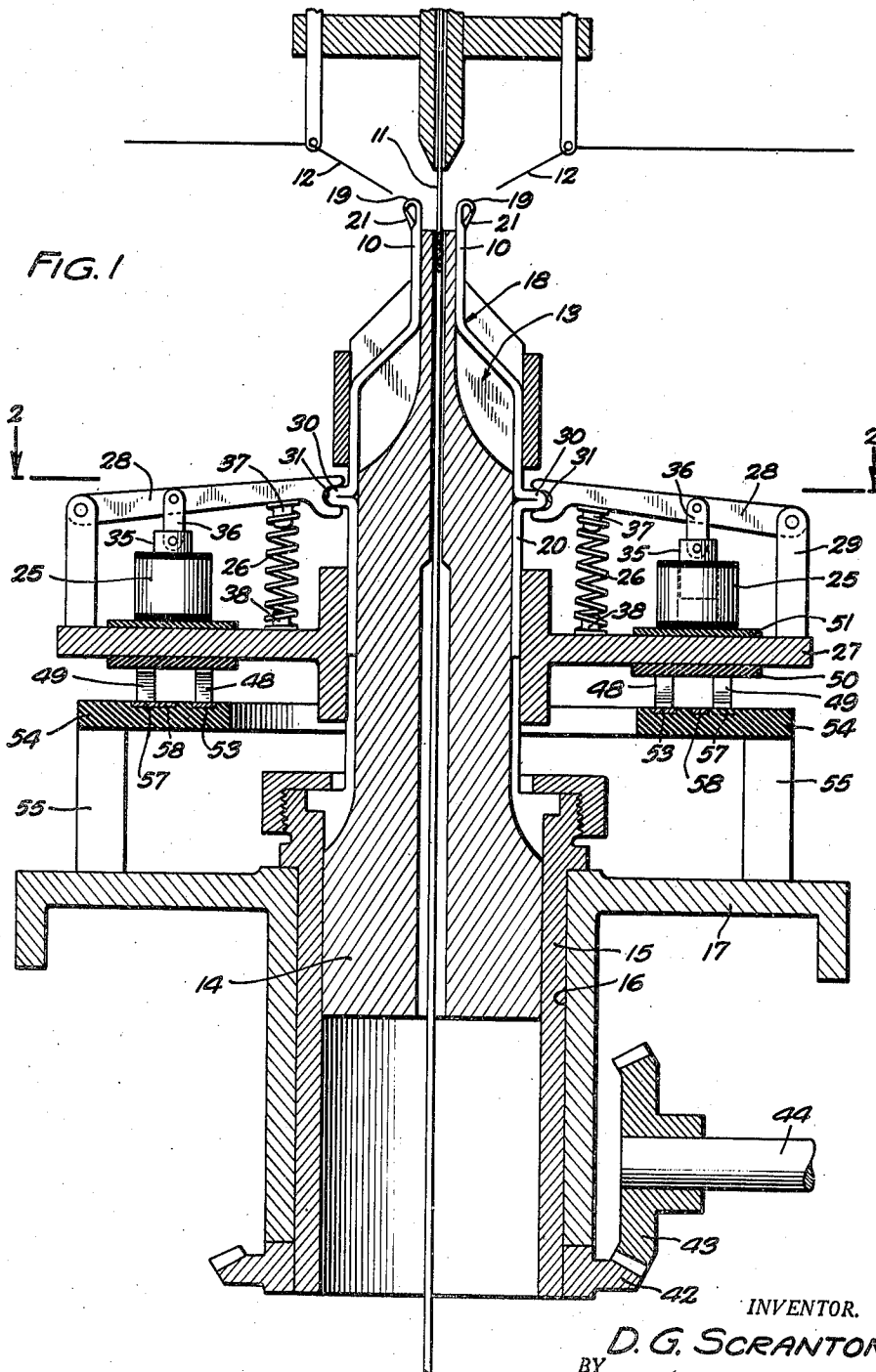
2,348,932

KNITTING MACHINE

Filed March 17, 1943

3 Sheets-Sheet 1

FIG. 1



INVENTOR.

D. G. SCRANTOM

BY

Harry L. Smith

ATTORNEY

May 16, 1944.

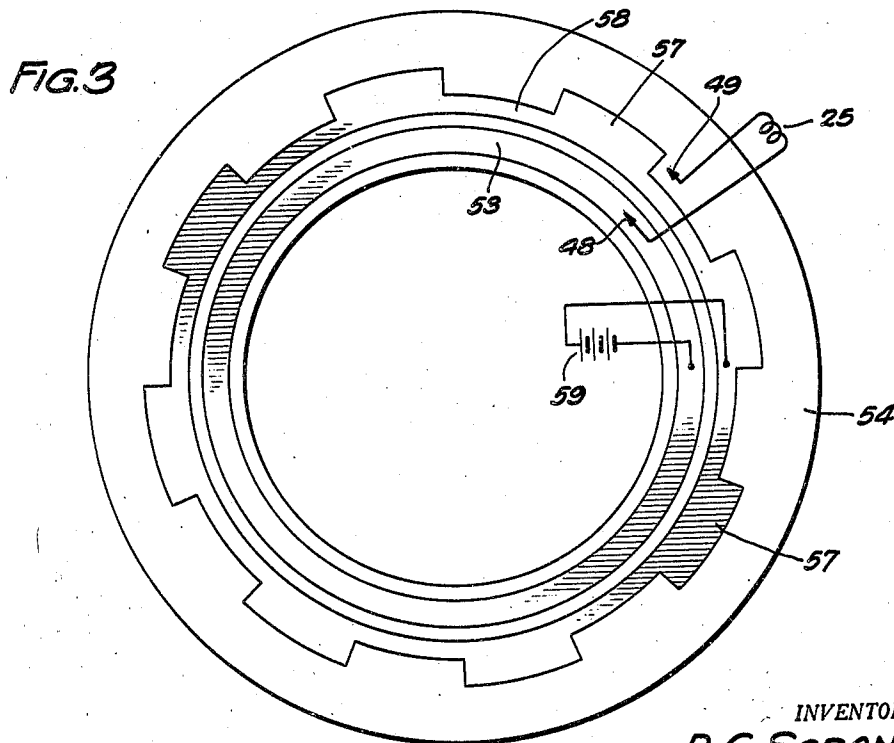
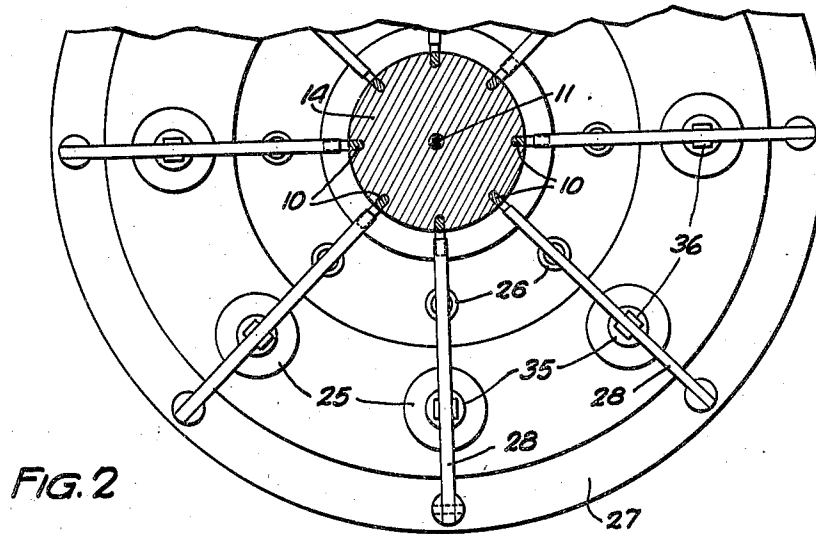
DE HART G. SCRANTOM

2,348,932

KNITTING MACHINE

Filed March 17, 1943

3 Sheets-Sheet 2



INVENTOR.
D. G. SCRANTOM
BY *Harry L. Sault*
ATTORNEY

May 16, 1944.

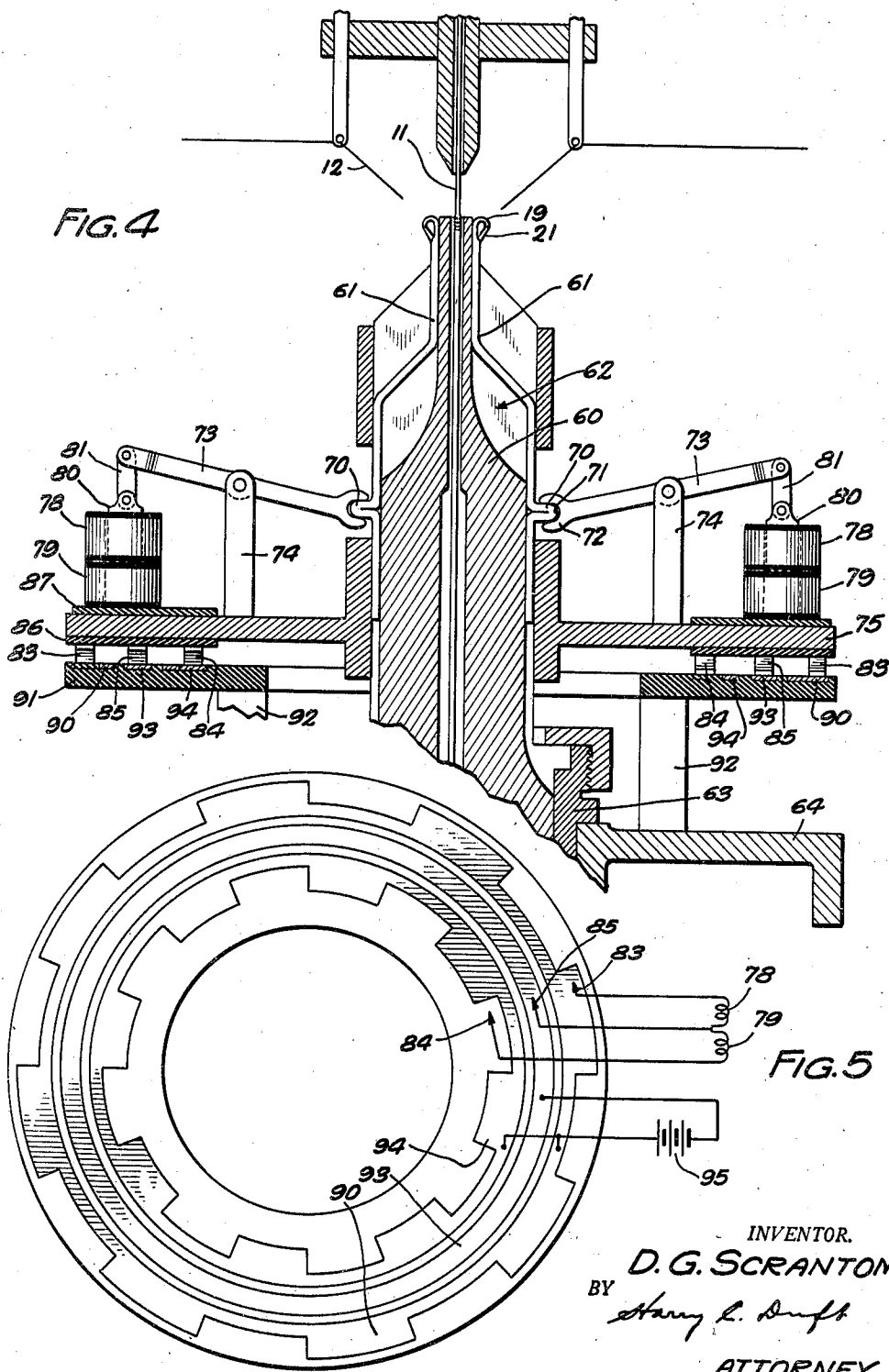
DE HART G. SCRANTOM

2,348,932

KNITTING MACHINE

Filed March 17, 1943

3 Sheets-Sheet 3



INVENTOR.
D. G. SCRANTOM
BY *Harry L. Duff*
ATTORNEY

UNITED STATES PATENT OFFICE

2,348,932

KNITTING MACHINE

De Hart G. Scrantom, Maplewood, N. J., assignor
to Western Electric Company, Incorporated,
New York, N. Y., a corporation of New York

Application March 17, 1943, Serial No. 479,442

14 Claims. (Cl. 66—9)

This invention relates to knitting machines and more particularly to knitting machines for applying a knitted covering over a core such as an electrical conductor.

In the manufacture of certain types of insulated electrical conductors and particularly the electrical conductors used in some types of telephone apparatus, it is sometimes the practice to apply a knitted covering to the conductors in order to obtain the greatest flexibility and durability under repeated flexure and torsion.

An object of the present invention is to provide an efficient and effective knitting apparatus.

In accordance with one embodiment of this invention, a knitting machine may be provided in which a plurality of reciprocable knitting needles are mounted in a rotatable housing and solenoids associated with each needle and carried by the rotatable housing, actuate the needles in predetermined sequence, while springs also associated with each needle return the needles to starting position.

In accordance with a second embodiment of the present invention, a similar knitting machine may be provided in which the return of the needles is accomplished by a second set of solenoids.

Other objects and advantages of the present invention will be apparent from the following detailed description taken in conjunction with the drawings, wherein

Fig. 1 is a vertical sectional view of a knitting machine constructed in accordance with one embodiment of this invention;

Fig. 2 is a fragmentary sectional view along the line 2—2 of Fig. 1;

Fig. 3 is a diagrammatic view of the circuit used with the embodiment of this invention, shown in Figs. 1 and 2;

Fig. 4 is a fragmentary vertical sectional view of a second embodiment of this invention, and

Fig. 5 is a diagrammatic view of a circuit used with the embodiment of this invention shown in Fig. 4.

The speed of operation of some types of knitting machines is limited by reason of the increasing rate of needle breakage with increasing speeds, this needle breakage rate being greatly affected by the slope of the cam lobes by which needles are reciprocated. By avoiding the use of cams and by substituting solenoids as the actuating mechanism, needle breakage is reduced while increased operating speeds are made feasible.

Referring now to the drawings and particularly to Fig. 1, a knitting apparatus constructed in accordance with one embodiment of this invention is shown in which a plurality of knitting needles 10 (in the present embodiment of this invention, eight needles are shown) are ro-

tated about a strand 11, and actuated in predetermined relation to a number of threads 12, served to the needles, to form a closely knitted textile covering over the strand 11 as it is drawn along the axis of rotation of the needles. The needles are positioned in longitudinally extending slotted recesses 13 formed in a substantially cylindrical needle carrier 14. The base of this needle carrier 14 extends into a hollow supporting shaft 15 which is rotatably mounted in an aperture 16 formed in a fixed housing 17 of the apparatus.

It will be noted that the needles are not straight but, rather, that an upper portion 18 of each needle is bent to position a hook-shaped head or tip 19, integrally formed with the upper end of each needle, as close to the strand to be covered as feasible, while spacing lower portions 20 of the needles further apart than the upper portions to prevent crowding of the needle actuating mechanisms. The slotted recesses 13 are thus made deeper in carrier 14 at the upper end than at the lower, as shown in Fig. 1, to receive the bent needles.

In the operation of this knitting apparatus, a knitting needle, while rotating about the strand, is raised to engage a thread and then lowered. The needle is then raised again, permitting the engaged thread to slide downward past a latch 21 associated with each needle and the needle engages a second thread. As the needle is again lowered, carrying with it the second engaged thread, the latch 21 pivots upward, thus preventing the previously engaged thread from entering the hook-shaped tip 19, and instead causing the thread to slip over the tip, thus completing one cycle of the knitting operation.

In the first embodiment of this invention, reciprocation of each needle is accomplished by a solenoid 25 and return spring 26. A circular platform 27, mounted on the needle carrier 14 and positioned about the mid-portion thereof, serves as a support for the needle reciprocating mechanism, including the return spring 26 and a solenoid 25. In order to move the needles, a lever arm 28, pivotally supported at its outer end on a bracket 29 mounted at the edge of the platform 27, is associated with each needle and engages a lug 30 integrally formed in the lower portion 20 of each needle, the lug engaging end of each lever arm 28 being enlarged and recessed to form a bell shaped depression 31 into which the lug 30 extends. Pivoting of the lever arm and consequent moving of the associated needle is accomplished by a solenoid core 35 which is positioned in the center portion of each solenoid 25 and connected to the lever arm by a link 36, which is preferably pivotally attached to both the core and the lever arm. When energized, the solenoid 25 causes the core 35 to move down-

ward into the solenoid against the pressure of the needle return spring 26, which is mounted on the platform 27, as aforesaid, and presses against the underside of the lever arm, and then, when the solenoid is deenergized, the core is moved upward by the spring 26. A lug 37, fixed to the underside of each lever arm, extends into the upper portion of each spring 26 to prevent the spring slipping off the arm, while a second lug 38, mounted on the platform 27, holds the spring in position on the platform.

In the operation of this knitting apparatus, the needle carrier 14 is rotated about the strand 11 by a bevel gear 42, which is mounted on the lower end of the hollow shaft 15 which supports the needle carrier. This gear is engaged by a second bevel gear 43 which is keyed to the end of a power shaft 44. In order to move each needle into engagement with a thread at the required moment, a pair of current collecting shoes 48 and 49 are connected to either end of the winding of each of the solenoids 25 and are mounted on the underside of the circular platform 27, being insulated therefrom and from each other by a strip 50 of non-conductive material. A similar strip 51 insulates each solenoid from the upper side of the platform 27. As the needle carrier rotates, the platform 27, on which is mounted the needle actuating mechanism, and which is supported by the needle carrier, also rotates carrying with it the current collecting shoes 48 and 49.

While rotating with the platform 27, the inner shoe 48 is in constant contact with a continuous, annular terminal strip 53 which is positioned beneath the shoe 48 and mounted on a stationary, annularly shaped platform 54. This platform, which is preferably made of insulating material, is supported on the apparatus housing 17 by a circular member 55 fixed to the underside of the platform and attached to the housing 17. The outer current collecting shoe 49, on the other hand, intermittently contacts a number of circumferentially positioned terminals 57 comprising the projecting segments of a segmental terminal ring 58 mounted on the stationary platform 54. Since the strip 53 is connected to one side of a current supply 59 and the terminals 57 are connected to the other side, when the outer shoe 49 contacts a terminal 57, a circuit is completed to the current supply 59 and the associated solenoid 25 is energized. The solenoid core 35 is thereby pulled downward into the solenoid and the associated needle also moved downward.

The frequency of reciprocation of the needles is determined by the speed of rotation of the needle carrier and the number of spaced current supply terminals contacted by the current collecting shoes associated with each solenoid. It will be understood, of course, that by attaching the solenoid core to the outer end of the lever arm 28 and by pivotally supporting the lever arm 28 at a point between its ends, the operation could be reversed and the solenoid used to move the needle upward while a spring returns the needle.

In some cases, it may be desirable to control both the upward and the downward movement of the knitting needles with more positiveness than is afforded by the single solenoid 25 and the return spring 26, hereinbefore described. In such cases, in accordance with a second embodiment of this invention, two alternately operating solenoids may be employed with each knitting needle, one solenoid raising the needle,

while the other lowers it. This embodiment of the present invention is illustrated in Figs. 4 and 5.

It will be seen from Fig. 4 that, with the exception of the needle reciprocating mechanism, a knitting apparatus in all other respects essentially the same as that shown in Figs. 1 and 2, may be employed with this second embodiment. A cylindrically shaped needle carrier 60 supports a plurality of knitting needles 61 which are slidably positioned in suitably formed, longitudinally extending, slotted recesses 62 in the needle carrier. The lower portion of the needle carrier 60 extends into and is supported by a hollow shaft 63 which is rotatably mounted in a stationary apparatus housing 64.

Each of the needles 61 is provided with an integrally formed lug 70 in the mid-portion thereof which extends into a bell shaped recess 71, formed in an enlarged end 72 of a lever arm 73. This arm is pivotally mounted at a point near its mid-portion on a bracket 74, which is mounted on a circular platform 75 fixed to the needle carrier 60 and rotatable therewith.

The needles 61 are reciprocated by a pair of solenoids 78 and 79 associated with each needle and mounted one above the other, a single solenoid core 80 being attached to the outer end of the lever arm 73 by a link 81 and extending into the center of the solenoids. Alternate energizing of these solenoids to alternately raise and lower the associated knitting needles is effected through a pair of current collecting shoes 83 and 84 connected to the upper and lower solenoids, respectively, and a common current collecting shoe 85, which is connected to both solenoids. These shoes are mounted on the underside of the circular platform 75, being insulated therefrom and from each other by a strip 86 of non-conductive material. A similar strip 87 of non-conductive material insulates the solenoids 78 and 79 from the platform 75.

The outer shoe 83, which is connected to the upper solenoid 78, contacts circumferentially positioned, spaced terminals 88 comprising the projecting segments of an annular terminal ring 89, which is mounted on an annularly shaped, stationary platform 91. This platform is made of a suitable insulating material and is supported on the apparatus housing 64 by a wall member 92. The common current collecting shoe 85 is in constant contact with a continuous terminal ring 93, also mounted on the stationary platform 91.

The inner current collecting shoe 84, which is connected to the lower solenoid 79, contacts circumferentially positioned spaced terminals 94 comprising the projecting segments of an annular terminal strip 95 which is positioned within the strip 93 and mounted on the platform 91. The terminals 94 are so spaced that when a shoe 84 contacts one of them, the associated shoe 83, connected to the upper solenoid, is not in contact with a terminal 90 and the terminals 90 are so positioned with respect to the terminals 94 that when a shoe 83 is in contact with one of them, the associated inner shoe 84 is not in contact with a terminal 94. Thus, either the upper solenoid or the lower solenoid is energized but never are both energized simultaneously.

The spaced terminals 90 are connected to one side of a suitable current supply 95, while the terminal ring 93 is connected to the other, the terminals 94 being connected to the same side of the current supply as the terminals 90. When the upper solenoid 78 is energized, the needle is,

lowered, and then, when the lower solenoid 79 is energized, the upper solenoid being then deenergized, the needle is raised, the relative time during which either solenoid is energized being controlled by the relative lengths of the terminals.

While this invention has been shown and described in connection with a knitting machine having eight needles, it will be understood that any desired number of needles may be employed, that while solenoids are illustrated as constituting part of the means for operating the needles, electromagnets or other suitable electrically operated means may be employed, and that any desired number of thread supplies may be used, all without departing from the spirit or scope of the present invention.

What is claimed is:

1. In an apparatus for knitting a covering on a strand, a knitting needle, a carrier for said needle, and electromagnetically actuated means supported on said carrier for reciprocating said needle.

2. In an apparatus for knitting a covering on a strand, a thread supply, a knitting needle, a carrier for said needle, electromagnetically actuated means supported on said carrier for reciprocating said needle, a current supply, and means associated with said electromagnetically actuated means for intermittently connecting said electromagnetically actuated means to said current supply to reciprocate said needle.

3. In an apparatus for knitting a covering on a strand, a thread supply, a knitting needle, a carrier for said needle, a solenoid supported on said carrier for moving said needle in one direction, and resilient means for moving it in the opposite direction.

4. In an apparatus for knitting a covering on a strand, a thread supply, a knitting needle, a carrier for said needle, said thread supply and said needle carrier being relatively rotatable about said strand, a solenoid supported on said carrier for moving said needle in one direction, and resilient means for moving it in the opposite direction.

5. In an apparatus for knitting a covering on a strand, a thread supply, a knitting needle, a carrier for said needle, said thread supply and said needle carrier being relatively rotatable about said strand, an electromagnetically actuated means for reciprocating said needle, a current supply, current collecting means associated with said solenoid, and a terminal contactable by said collecting means for actuating said solenoid.

6. In an apparatus for knitting a covering on a strand, a thread supply, a knitting needle, a carrier for said needle, said thread supply and said needle carrier being relatively rotatable about said strand, electromagnetically actuated means for reciprocating said needle, a current supply, current collecting means associated with said solenoid, and a terminal, said terminal and said collecting means being relatively rotatable to intermittently engage said collecting means and said terminal.

7. In an apparatus for knitting a covering about a strand, a knitting needle, a rotatable carrier for said needle, electromagnetically actuated means mounted on said carrier and rotatable therewith for moving said needle axially with respect to said strand, and means for supplying

current to said electromagnetically actuated means to energize the same.

8. In an apparatus for knitting a covering on a strand, a thread supply, a knitting needle, a carrier for said needle, a solenoid supported on said carrier, and a lever arm supported on said carrier and movable by said solenoid to reciprocate said needle.

9. In an apparatus for knitting a covering on a strand, a thread supply, a knitting needle, a carrier for said needle, a solenoid supported on said carrier, means for energizing said solenoid, a lever arm supported on said carrier and operable by said solenoid when energized to move said needle in one direction, and resilient means for moving said arm in the opposite direction when said solenoid is deenergized.

10. In an apparatus for knitting a covering on a strand, a knitting needle, a rotatable carrier for said needle, electromagnetically actuated means supported on said carrier for reciprocating said needle, means for rotating said carrier, a current supply, terminal members connected to said supply, and means associated with said electromagnetic means for contacting said terminals to energize said electromagnetic means.

11. In an apparatus for knitting a covering on a strand, a knitting needle, a rotatable carrier for said needle, electromagnetically actuated means supported on said carrier for reciprocating said needle, means for rotating said carrier, a current supply, terminal members connected to said supply, and means associated with said electromagnetic means for contacting said terminals to energize said electromagnetic means at intervals as said carrier rotates.

12. In an apparatus for knitting a covering on a strand, a knitting needle, a rotatable carrier for said needle, a solenoid supported on said carrier for reciprocating said needle, means for rotating said carrier, a current supply, circumferentially positioned terminals connected to said supply, and means associated with said solenoid for contacting said terminals to energize said solenoid as said carrier rotates.

13. In an apparatus for knitting a covering on a strand, a knitting needle, a rotatable carrier for said needle, a solenoid for reciprocating said needle mounted on and rotatable with said carrier, means for rotating said carrier, a current supply, circumferentially positioned terminals connected to said supply, means associated with said solenoid for contacting said terminals to energize said solenoid as said carrier rotates, and resilient means for returning said needle when said solenoid is deenergized.

14. In an apparatus for knitting a covering on a strand, a knitting needle, a rotatable carrier for said needle, a pair of solenoids mounted one above the other for raising and lowering said needle and supported on said carrier, means for rotating said carrier, a current supply, a circular terminal strip connected to one side of said current supply, a plurality of spaced, alternately circumferentially positioned terminal members on either side of said terminal strip, said terminal members being connected to the other side of said current supply, said terminal members being alternately spaced, and individual current collecting means connected to each of said solenoids for alternately energizing said solenoids as said carrier rotates.

DE HART G. SCRANTOM.