July 27, 1965 S. MARLEY 3,196,638

REVERSIBLE ROTARY HOSIERY MENDING APPARATUS

Filed Aug. 8, 1961 2 Sheets-Sheet 1

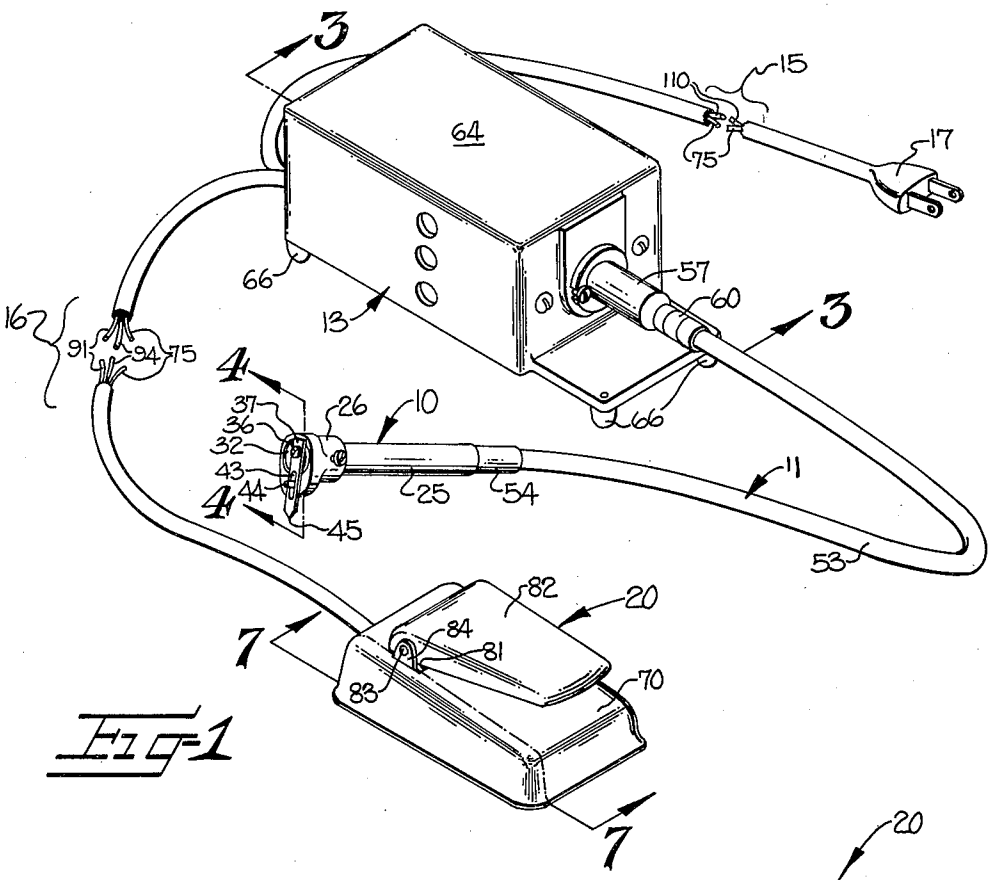


Fig-1

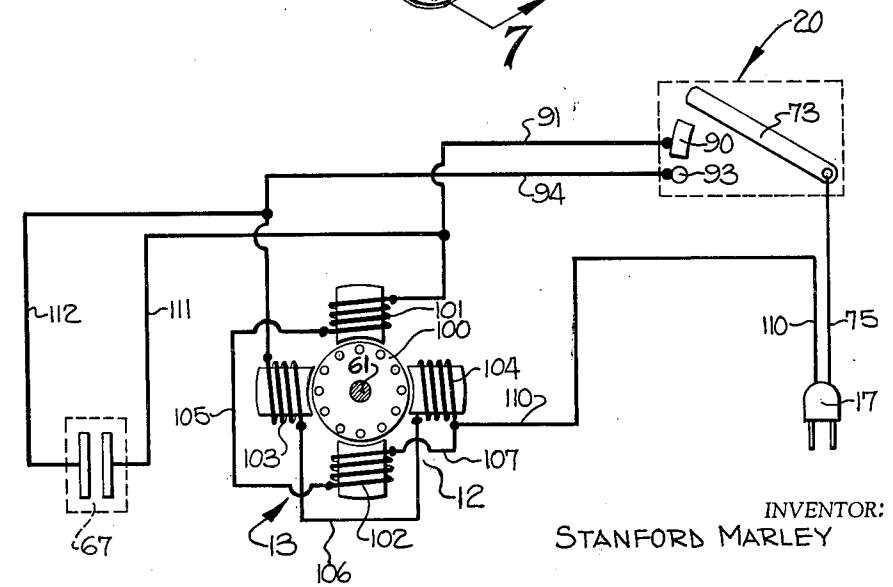


Fig-2

INVENTOR:
STANFORD MARLEY

BY Eaton, Bell, Hunt & Dellger

ATTORNEYS

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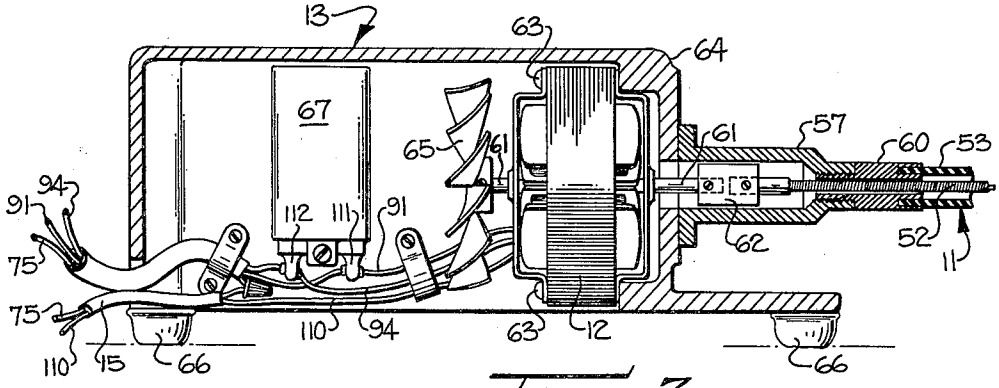


Fig-3

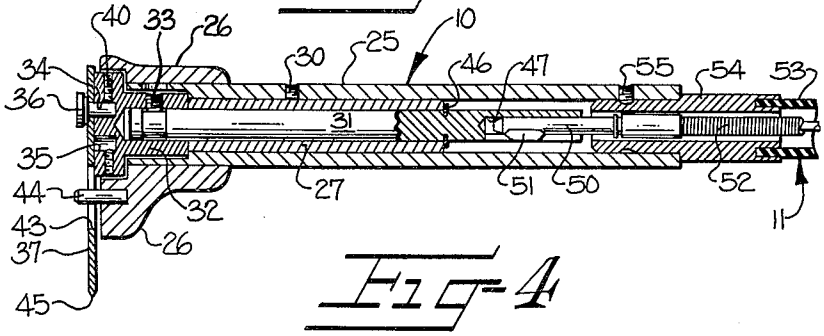


Fig-4

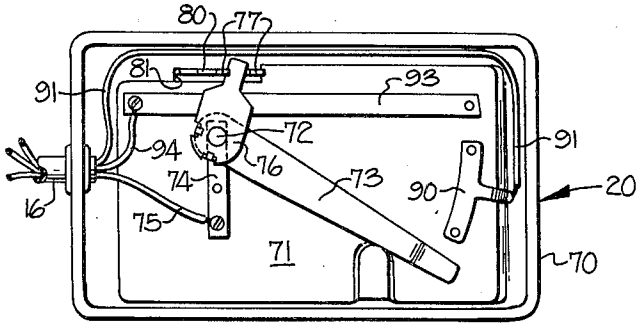


Fig-6

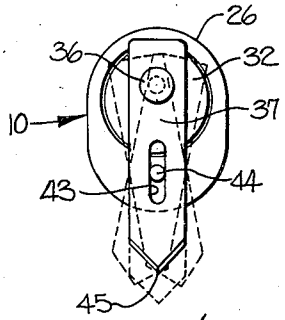


Fig-5

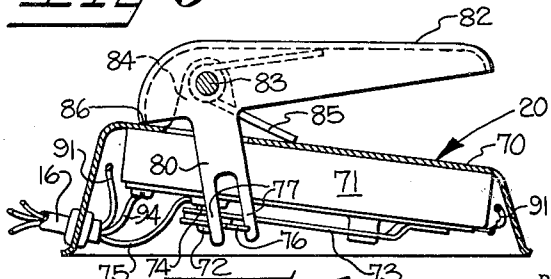


Fig-7

INVENTOR:
STANFORD MARLEY

BY Eaton, Bell, Hunt & Seltzer

ATTORNEYS

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REVERSIBLE ROTARY HOSIERY MENDING APPARATUS

Stanford Marley, 37—28 80th St., Jackson Heights, N.Y.

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1 Claim. (Cl. 66—1)

This invention relates to hosiery mending apparatus and, more especially, to improvements in apparatus for restoring to original condition areas of knitted fabric whose loops have accidentally become abnormally enlarged.

Various types of hosiery mending apparatuses have been provided heretofore for restoring to original condition enlarged loops in knitted fabrics. One type of prior art apparatus includes a mending wheel having work engaging elements thereon in the form of circularly arranged radial projections which are rotated against the damaged portion of the knitted fabric while such portion is under tension. In another type of hosiery mending apparatus, a work engaging element in the form of an oscillating substantially V-shaped blade, movable in an elliptical path, is held against the taut damaged portion of the knitted fabric for restoring the enlarged loops to normal size. Apparatuses of these types are disclosed in various patents such as U.S. Patent No. 2,570,637, granted October 9, 1951, to Marvey Specialty Company, Inc., upon application of Merle M. Brown; U.S. Patent No. 2,713,783, granted to E. E. Zane et al. on July 26, 1955; and U.S. Patent No. 2,819,598, granted to H. G. Mayer on January 14, 1958.

In order to effect efficient restoration of pulled threads to their proper positions with respect to adjacent loops of the knitted fabric, it is desirable, and generally necessary, to relocate the work, as in Brown, or to reverse the direction of rotation of the work engaging elements as in Zane. Although the mending device of Mayer is said to be reversible, it appears from Mayer's disclosure that the reversing feature is provided merely to accommodate both left-handed and right-handed operators rather than to eliminate the need for turning the work during the mending operation.

The hand-operated switch of Zane requires the operator to vary her grip on the device with the consequent danger of misalinement of the work and the mending device. Similarly, in Brown and in Mayer, the mending device must be realined with the work after rotation of the work or mending cup.

Such movements of the operator's hands have not only retarded production, but, more importantly, the resulting displacement of the work engaging elements from their correct operating positions with respect to the knitted fabrics would frequently result in aggravating the condition of the pulled threads and would even produce additional undesirable enlarged loops or holes in the fabric, thus defeating the purpose for which the hosiery mending apparatus was intended.

It is therefore an object of this invention to provide an improved hosiery mending apparatus having a rotatable hub with a work engaging element thereon in the form of an elongate V-shaped blade, which hub is operatively connected to a reversible electric motor. A pressure responsive or foot-operated switch having an upwardly biased pedal will complete a circuit to the motor such as to cause the hub to rotate in one direction when the pedal is partially depressed by the operator and, upon applying additional pressure to the pedal, the switch will complete another circuit to the motor to reverse the direction of rotation of the hub whereby the movement of the

blade may be reversed at the will of the operator and the operator need not divert her attention from the hose or the blade of the mending apparatus, thus obviating the defects inherent in the prior art hosiery mending apparatuses of the character heretofore described.

It is a more specific object of this invention to provide an improved apparatus for restoring pulled threads in knitted fabric comprising a shaft, a hub on said shaft, supporting means in which said shaft is journaled, a pin eccentrically mounted on the hub, a second pin carried by said supporting means adjacent the hub, an elongate work engaging element pivoted on one of the pins and having a longitudinal slot loosely penetrated by the other of the pins with a reversible electric motor operatively connected to the shaft. A foot-operated switch is provided including an armature, a pedal operatively connected to the armature and being movable from one position to another position by the operator. First and second spaced contact means or brushes are provided which are successively engageable by the armature during the course of movement of the pedal from one position to another position and the first and second contact means are electrically connected to said motor in parallel relationship and in series with the armature so that, upon the pedal being partially depressed by the operator, the pedal effects rotation of the hub in one direction and, upon the pedal being further depressed, the direction of rotation of the hub is reversed. Thus, the operator can cause the hub to rotate in one direction and then the other in alternation by simply depressing and relaxing the pressure applied to the foot pedal.

Some of the objects of the invention having been stated, other objects will appear as the description proceeds, when taken in connection with the accompanying drawings, in which

FIGURE 1 is a perspective view of the improved hosiery mending apparatus;

FIGURE 2 is a schematic electrical diagram showing the electrical connections between the reversible motor and the novel foot-operated switch;

FIGURE 3 is an enlarged longitudinal vertical sectional view through the motor housing taken substantially along line 3—3 in FIGURE 1;

FIGURE 4 is an enlarged longitudinal vertical sectional view through the hosiery mending instrument of the apparatus taken substantially along line 4—4 in FIGURE 1;

FIGURE 5 is an end elevation of the hosiery mending instrument looking at the left-hand side of FIGURE 4 and showing the work engaging element in various positions in broken lines;

FIGURE 6 is an enlarged inverted plan view of the foot-operated switch shown in the lower central portion of FIGURE 1;

FIGURE 7 is an enlarged longitudinal vertical sectional view through the foot-operated switch taken substantially along line 7—7 in FIGURE 1.

Referring more specifically to the drawings, and to FIGURE 1 in particular, the improved hosiery mending apparatus generally comprises a hosiery mending implement or instrument 10 connected by a flexible cable 11 to a reversible electric motor 12 of a driving unit broadly designated at 13. Driving unit 13 has a pair of flexible electrical conduits 15, 16 leading therefrom. Cable 15 has a plug 17 on its free end which is adapted to be connected to a suitable source of alternating electrical energy, not shown, and the end of cable 16 opposite from driving unit 13 is connected to an improved foot-operated switch broadly designated at 20.

The hosiery mending instrument

As best shown in FIGURE 4, the hosiery mending instrument 10 comprises a tubular handle, housing or body 25 having an enlarged head member 26 suitably secured to or formed integral with its free end portion. The body 25 and head member 26 preferably are made from a light material such as wood, plastic or the like. An elongate tubular bushing or bearing 27 is fixed in a medial portion of body 25, as by a set screw 30, and a shaft 31 is journaled or rotatably mounted in tubular bearing 27.

The outer or free left-hand end of shaft 31 in FIGURE 4 has the reduced inner portion of a hub or rotor 32 fixed thereon, as by a set screw 33. Hub 32 is provided with a pair of eccentric cavities 34, 35 in the outer face thereof, in either one of which a headed or shouldered pivot pin 36 may be positioned. Cavity 35 is spaced in further offset relationship to the axis of hub 32 than cavity 34 so that, when the pin 36 is positioned in cavity 35, the blade or work engaging element 37 pivotally mounted thereon will move in a larger elliptical path than it will when the pin 36 is mounted in the cavity 34. In either instance, the pin 36 is held in the corresponding cavity by a set screw 40 which is shown engaging the pin 36 while the pin 36 is positioned in cavity 34.

The work engaging element 37 is shown in the form of an elongate relatively thin and narrow blade and has an elongate slot 43 in a medial portion thereof which is loosely penetrated by a relatively small rigid guide element or pin 44 carried by and projecting outwardly from the enlarged head member 26 of body 25 and in parallel relationship to the axis of shaft 31. The operating end of the work engaging element 37 is pointed or substantially V-shaped, as indicated at 45, and projects radially outwardly beyond the head member 26. Opposed edges of the V-shaped portion 45 of the work engaging element 37 are preferably uniformly beveled to provide relatively sharp edges on the V-shaped operating end 45 of the work engaging element 37 (FIGURE 5).

Referring again to FIGURE 4, it will be observed that the reduced inner portion of the hub 32 bears against the corresponding end of bushing 27 and the shaft 31 is retained in bushing 27 by a snap ring 46 which engages the inner end of bushing 27. The end of shaft 31 opposite from hub 32 has a bore or cavity 47 therein for receiving a rigid shaft member 50 which is keyed, as at 51, in the bore 47 of shaft 31. The stem or shaft member 50 is connected to a flexible shaft, Bowden wire or pliable element 52 which extends loosely through a pliable tube 53. The pliable element 52 and tube 53 are parts of the flexible cable 11. The tube 53 is connected to the right-hand end of the body 25 of the hosiery mending instrument 10 by means of a rigid sleeve 54, which rigid sleeve is secured within the rear portion of tubular body 25 by any suitable means, such as a set screw 55.

The end of tube 53 opposite from the hosiery mending instrument 10 is coupled to a tubular adaptor 57, as at 60, and the end of pliable element 52 opposite from hosiery mending instrument 10 is connected to the shaft 61 of electric motor 12 by a coupling 62. The electric motor 12 is suitably secured, as by screws 63, to one wall of a housing 64 of the driving unit 13. In order to prevent motor 12 from becoming overheated, a suitable fan 65 may be mounted on the end of motor shaft 61 opposite from coupling 62.

The housing 64 of driving unit 13 is preferably substantially rectangular in plan and is open-bottomed and has suitable, preferably yieldable, feet 66 thereon which may rest upon the floor while the apparatus is in use. One wall of housing 64 also has a capacitor 67 suitably secured thereto, and which is connected in electrical circuits to motor 12 in a manner to be later described.

The foot-operated switch

Referring to FIGURES 6 and 7, it will be observed that the improved foot-operated switch 20 comprises an inverted hollow cup-like housing 70 to the lower surface of the upper wall of which a relatively large insulation block or base 71 is suitably secured. The insulation block 71 has a relatively small pivot shaft 72 suitably journaled therein and projecting downwardly therefrom and on which one end of a metallic switch arm or armature 73 is fixedly mounted.

The shaft 72 also extends through and engages a fixed strip conductor 74 suitably secured to the lower surface of insulation block 71 and having a lead conductor 75 connected thereto.

Also mounted on shaft 72 and suitably secured to armature 73 is an insulation crank arm 76 which extends outwardly and whose reduced portion is straddled by bifurcations 77 (FIGURE 7) formed integral with an acuating arm 80. Actuating arm 80 extends upwardly in FIGURE 7 and loosely penetrates an opening 81 provided in the upper wall of housing 70. Actuating arm 80 is formed integral with or suitably secured to a substantially channel-shaped foot pedal, treadle or manually operable actuator 82 whose flanged opposed side portions are journaled on a shaft 83 carried by boss portions 84 projecting upwardly from the upper wall of housing 70.

The free end of pedal 82 is normally biased upwardly to inoperative or "off" position by a torsion spring 85, one end of which engages the lower surface of a medial portion of pedal 82 and the other end of which engages the upper surface of housing 70. The coils of torsion spring 85 encircle shaft 83. It will be noted that the free end of pedal 82 is limited as to upward movement by engagement of the rear edge portion 86 of the pedal 82 with the upper surface of housing 70.

It will be observed in FIGURES 2 and 6 that, when pedal 82 occupies raised or inoperative position, the free end of armature 73 is spaced to one side of a first contact member or brush 90, which brush has one end of a conductor 91 connected thereto. It is apparent that, upon applying downward pressure to pedal 82 to thereby depress the same, the wiper element or armature 73 moves into engagement with brush 90 and remains in engagement therewith throughout a substantial portion of the arc of movement of armature 73 effected by the downward movement of pedal 82. However, as pedal 82 approaches the limit of its downward movement, as determined by the position of pedal 82 with respect to the upper wall of housing 70, armature 73 moves out of engagement with brush 90 and moves into engagement with a second contact or brush 93. Both of the brushes 90, 93 are suitably secured to insulation block 71.

Brush 93 has one end of a conductor 94 suitably connected thereto. It will be observed in FIGURES 6 and 7 that the flexible conduit 16 penetrates one wall of the housing 70 of foot-operated switch 20, and the conductors 75, 91 and 94 extend from the respective contacts 74, 90, 93 into the conduit 16, and thence, into the housing 64 of driving unit 13, from whence the conductors 91, 94 extend to the capactor 67 and electric motor 12 as will now be described.

The driving unit

Referring to FIGURE 2, it will be observed that electric motor 12 includes a rotor 100, to which motor shaft 61 is suitably secured, and also includes four stator coils or windings 101–104. The diametrically opposed coils 101, 102 are interconnected by a conductor 105 and the diametrically opposed coils 103, 104 are interconnected by a conductor 106. Corresponding ends of coils 102, 104 are interconnected by a conductor 107, to a medial portion of which a lead conductor 110 is connected.

The lead conductors 75, 110 extend through conduit 15 to plug or connector 17. The end of stator coil 103

opposite from conductor 106 is connected to the end of conductor 94 opposite from brush 93 and the end of stator coil 101 opposite from conductor 105 is connected to the end of conductor 91 opposite from brush 90. Conductors 91, 94 are connected to opposed plates of capacitor 67 by respective conductors 111, 112 which are shown in the form of terminals in FIGURE 3.

The capacitor 67 is connected to the conductors 91, 94 in the manner last described so as to produce a leading flux through the corresponding pair of coils which may be connected in series therewith, depending upon the position of switch armature 73, and with respect to the other two coils which may then be directly connected to the source of current whereby the timed relationship between the lagging flux of the main phase coils and the leading flux of the auxiliary phase coils determines the direction of rotation of rotor 100, it being understood that coils 101, 102 are the main phase coils when armature 73 is in engagement with brush 90 while, conversely, coils 103, 104 are the main phase coils when armature 73 is in engagement with brush 93.

Method of operation

In operation, the connector 17 is connected to a source of alternating current and the operator places one of her feet against and applies downward pressure to the pedal 82 as she hold the handle 25 of the hosiery mending instrument 10 in one hand with the blade 37 above a portion of a stocking which has been stretched over a so-called mending cup and is held by the other hand of the operator, as is usual. Now, as the operator initially moves downwardly the pedal 82, it is apparent that the free end of switch armature 73 moves into engagement with brush 90 of foot-operated switch 20 to thus impart what shall be termed as clockwise rotation to the rotor 100 of motor 12 and thus to the hub 32 of the instrument 10.

Clockwise rotation is imparted to the rotor 100 of motor 12 when armature 73 of switch 20 is in engagement with brush 90, because current flows from lead conductor 75, through armature 73 and brush 90, through conductor 91 and directly through the coils 101, 102, and thus returns to connector 17 through lead conductor 110. Thus, in this instance, coils 101, 102 are the main phase coils and respond only to inductive reactance so that the current lags the voltage in time and sets up a lagging flux through rotor 100.

At the same time, current flows from conductor 91 through conductor 111, capacitor 67, conductors 112, 94, through the coils 103, 104, and to lead conductor 110. Thus, the coils 103, 104 are then auxiliary phase coils and the portion of current which flows through the capactior and through auxiliary phase coils 103, 104 tends to lead the voltage in time, this being caused by the negative capactive reactance. This sets up a leading flux through the rotor 100 with respect to the lagging flux produced through the rotor by the then main phase coils 101, 102, thus causing the rotor 100 to rotate in the clockwise direction.

The operator then moves the hosiery mending device to cause the free or operating end 45 of the blade or work engaging element 37 to move in an elliptical path in which the working stroke thereof passes through an arc of movement of relatively large radius, in the course of which its strikes and then momentarily slides against the row of stitches of the portion of a hose having a relatively large loop therein adjacent which abnormally small loops are present. Thus, the work engaging element 37 rapidly delivers a series of light blows and subsequently slides against the shortened reaches of each of the reduced loops adjacent an abnormally long loop to thereby cause some material to be withdrawn from an adjacent long loop and added to the reduced loop thus contacted.

In order to complete the restoration of the enlarged loop or pulled thread to its proper condition with respect

to the adjacent threads or loops, the operator then reverses the direction of rotation of hub 32, and thus the direction of movement of the operating end of the blade 37 with respect to the fabric, simply by applying additional pressure to the pedal 82 of foot-operated switch 20 sufficiently to move armature 73 out of engagement with brush 90 and into engagement with brush 93.

Current then flows from lead conductor 75 through armature 73 and brush 93 and, through coils 103, 104 and thus to the lead conductor 110 so that coils 103, 104 then become the main phase coils, and coils 101, 102 become the auxiliary phase coils. In this instance, current also flows through the auxiliary phase coils 101, 102, since current flows from conductor 94, through conductor 112, capacitor 67, conductor 111 and conductor 91 to the auxiliary phase coils 101, 102 and thus to the lead conductor 110. It is thus seen that the coils 101, 102 then set up a leading flux through the rotor 100 with respect to the lagging flux set up through rotor 100 by the then main phase coils 103, 104. Thus, the rotor 100 rotates in the opposite or counterclockwise direction.

It is apparent that, any time the operator wishes to cause the motor to resume clockwise rotation, she merely relaxes the pressure applied to the foot pedal 82 of switch 20 sufficiently to permit armature 73 to move out of engagement with brush 93 and into engagement with brush 90 and, of course, whenever the operator wishes to stop rotation of the hub 32 of hosiery mending instrument 10, she merely raises her foot out of engagement with the pedal 82 of switch 20 and spring 85 will return the same to the inoperative or "off" position. Thus, the operator's hands are free at all times to manipulate the mending instrument 10 and the fabric while starting, stopping and reversing the direction of rotation of hub or rotor 32 at will. It is apparent that, since the direction of rotation, the starting and the stopping of hub 32 are controlled by the foot pedal 82, the eyes of the operator may remain focused on the fabric throughout the restoration of each pulled thread.

The pressure responsive switch 20 is specifically defined herein as a foot-operated switch, because it is particularly devised for foot operation. However, it is apparent that a suitable reversing switch, separated from but controlling the direction of rotation of the rotor of the hosiery mending instrument, may be so fastened to a table leg or other support as to be operated by the calf, knee or thigh of either leg of the operator without departing from the spirit of the invention.

In the drawings and specification there has been set forth a preferred embodiment of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention being defined in the claim.

I claim:

Apparatus for restoring pulled threads in knitted fabric comprising, in combination with a shaft, a hub on said shaft, supporting means in which said shaft is journaled, a work-engaging element carried by said hub, and a reversible electric motor operatively connected to said shaft; a foot-operated switch including an armature, a foot-pedal operatively connected to said armature and being progressively movable unidirectionally from one position to another position, first and second contact means successively and independently engageable by said armature with movement of said foot-pedal from said one position to said other position, said first and second contact means being electrically connected to opposite sides of said motor in parallel relationship and being in series with said armature, a source of electric power for said motor, and circuit means electrically connecting said armature in series with said power source, whereby said armature effects rotation of said motor and of said hub in one direction when said foot-pedal is partially moved from said one position to said other position and effects

rotation of said motor and of said hub in the opposite direction upon further movement of said foot-pedal towards said other position.

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RUSSELL C. MADER, *Primary Examiner.*

ORIS L. RADER, DONALD W. PARKER, *Examiners.*