United States Patent [19]

Maddox, Jr.

[11] **3,818,849**

[45] **June 25, 1974**

[54] **INDEXING ATTACHMENT**

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[73] Assignee: **American Needle Positioners Inc.,** Augusta, Ga.

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[52] **U.S. Cl.** ..... **112/219 A**

[51] **Int. Cl.** **D05b 69/22**

[58] **Field of Search** ..... 112/219 A, 219 R, 220, 112/221

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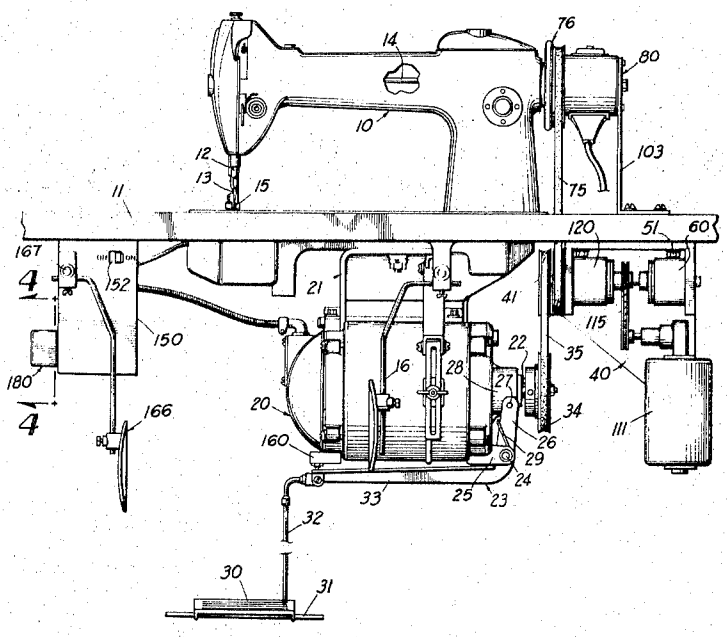
Primary Examiner—H. Hampton Hunter

Attorney, Agent, or Firm—Richards, Shefte & Pinckney

[57] **ABSTRACT**

An attachment assembly operable on a sewing machine for automatically controlling cyclic movement of the machine sewing needle in a stitching operation. The attachment assembly includes transmission means having an input drive means and an output drive means. The sewing machine main motor drive means is operatively connected to the transmission input drive means and the transmission output drive means is connected to the machine sewing needle drive means. The power transmission drive means includes electromagnetic clutch means for operatively connecting the input drive means to the output drive means whereby the main motor drive means can transfer power to the sewing needle drive means for effecting continuous cycles of operation of the sewing needle in a stitching operation. The power transmission means includes a second or alternate motor drive means having a drive member operatively associated with the power transmission output drive means, and wherein electromagnetic clutch means is operatively associated with said alternate motor drive means and the transmission output drive means. Control means is operatively associated with the main drive motor, the needle drive means and the alternate motor drive means for automatically controlling predetermined cyclic movement of the sewing needle. The control means includes interchangeable modular program means whereby the cyclic movement of the sewing needle can be altered by interchanging selected ones of a combination of modular program elements. Certain ones of the interchangeable modular program elements include means for effecting a control drive movement from the alternate drive motor to the needle drive means for driving the needle to either an up or down position in response to deactivation of the main drive motor. An additional interchangeable modular program element includes means for effecting driving movement from the alternate drive motor to the needle drive means for driving the needle drive means through a predetermined number of cycles of operation in response to deactivation of the main drive motor.

2 Claims, 11 Drawing Figures



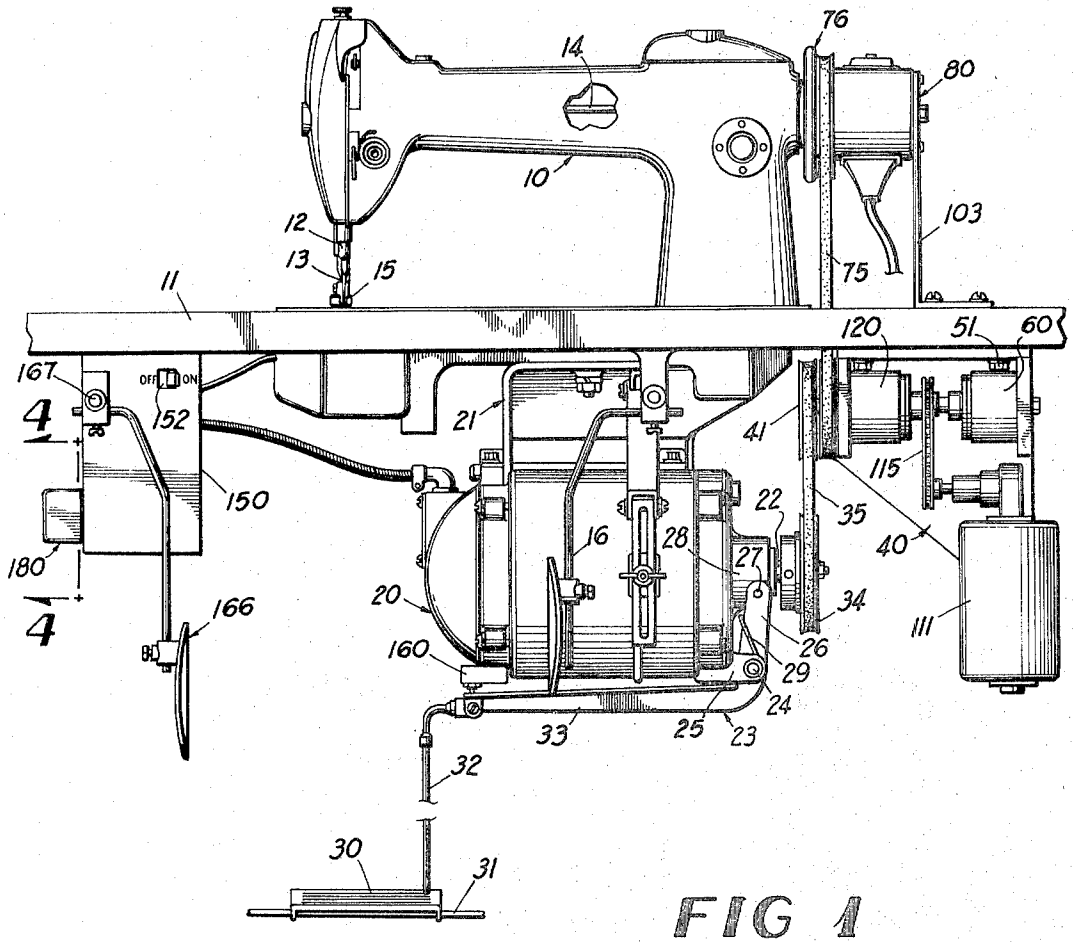

76
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80
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12
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75
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11
120
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FIG 1

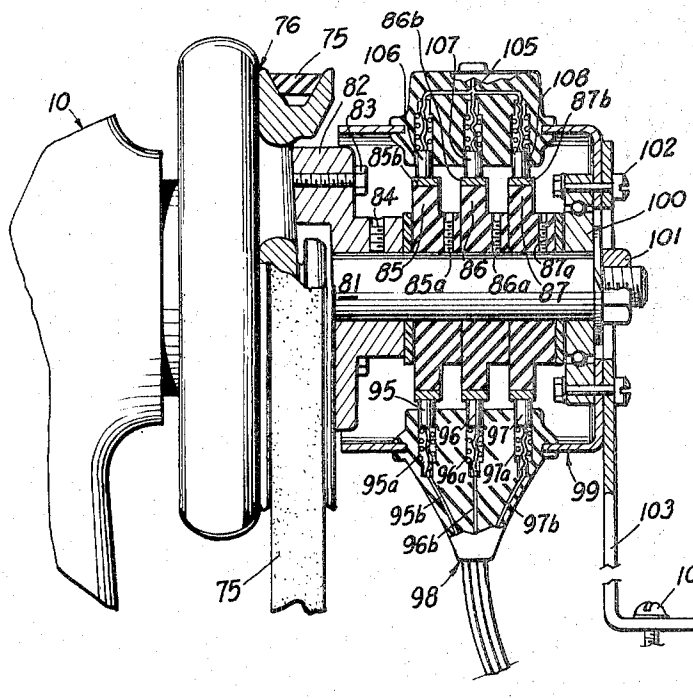

76
75
86b
106
107
105
108
82
83
87b
10
85b
102
84
100
101
81
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85a
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86a
87a
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96a
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103
95b
97b
96b
98
104
104
75

FIG 2

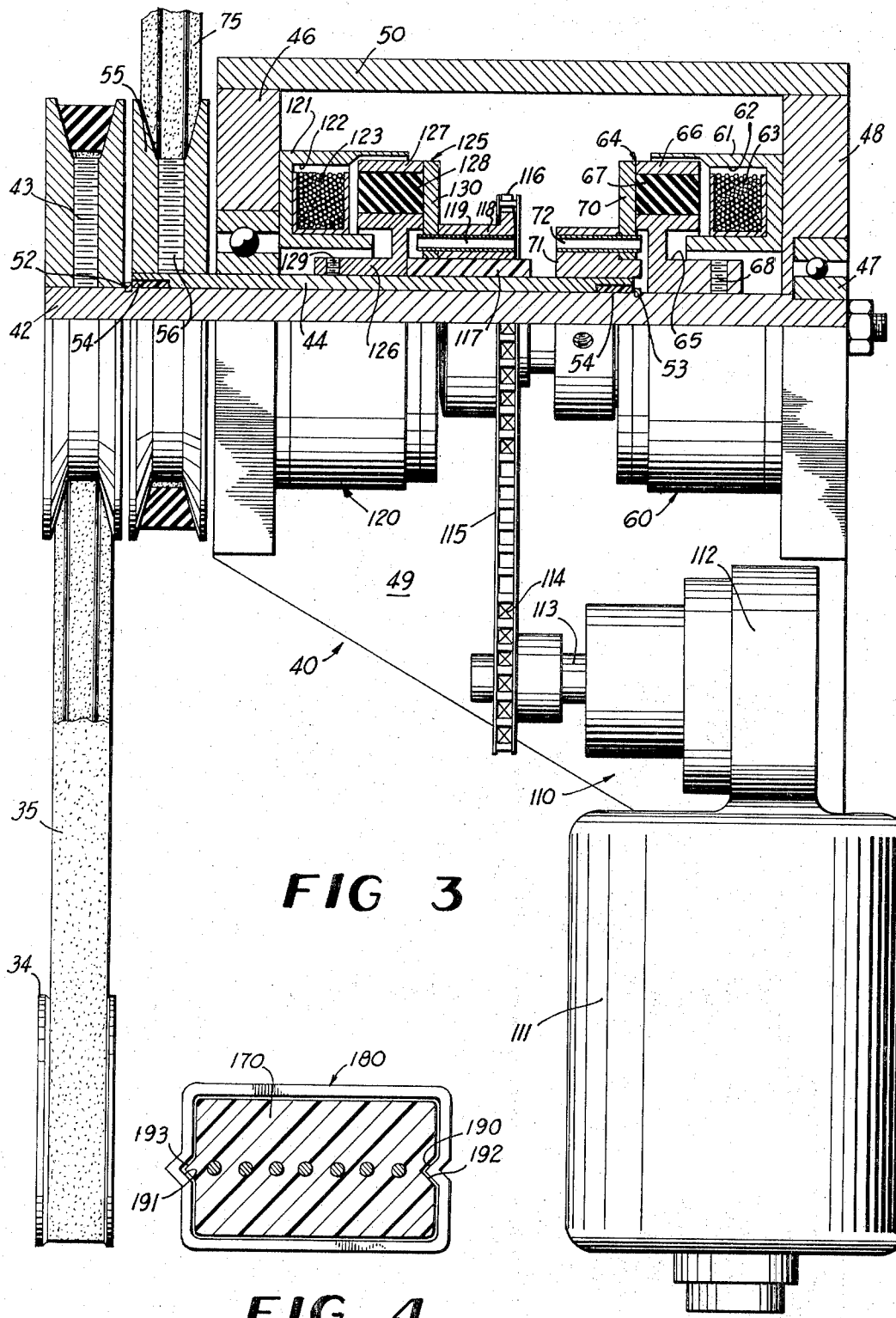

75
46
50
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121
122
123
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125
128
130
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42
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56
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120
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FIG 3

170
180
193
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191

FIG 4

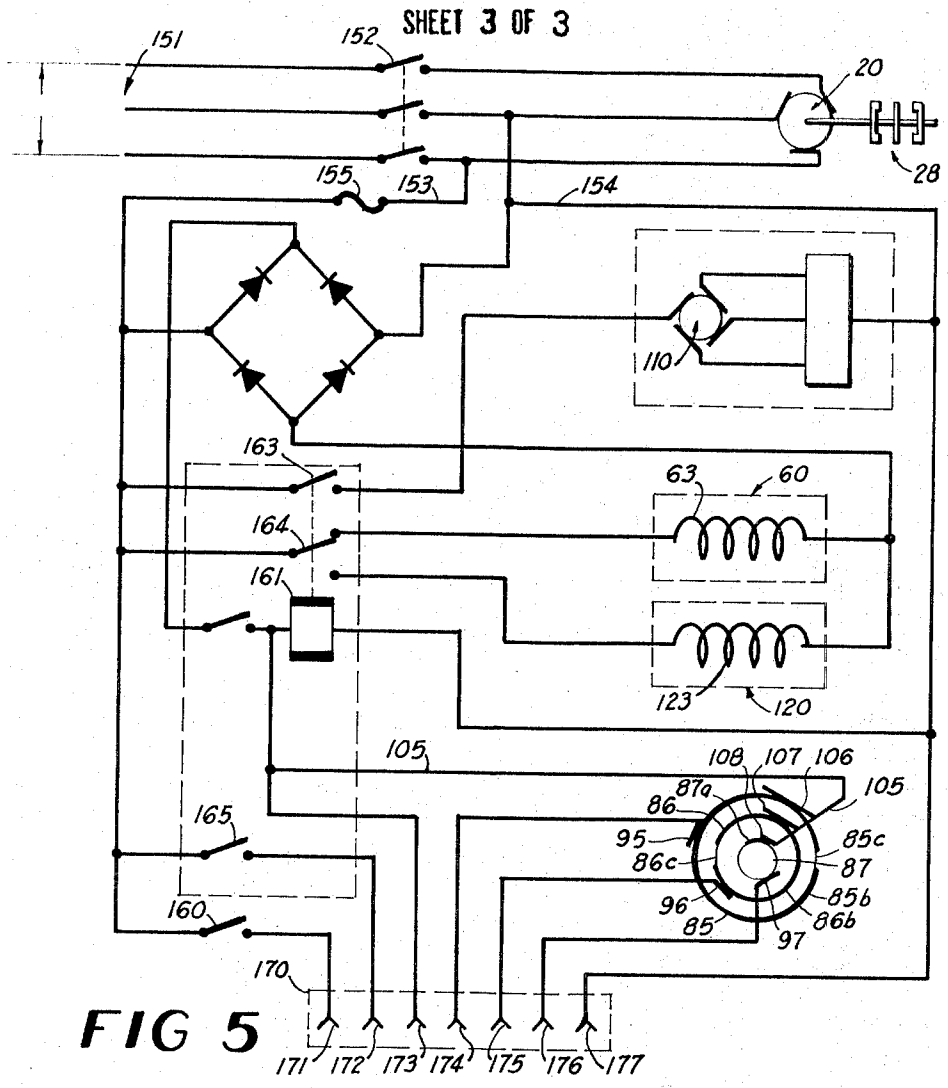


FIG 5

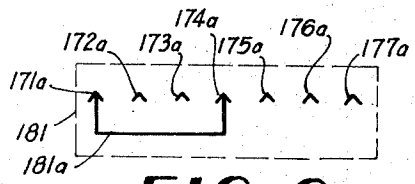


FIG 6

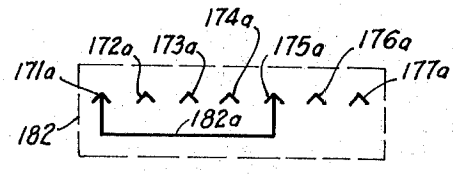


FIG 7

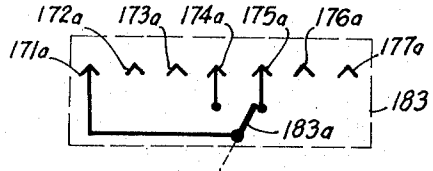


FIG 8

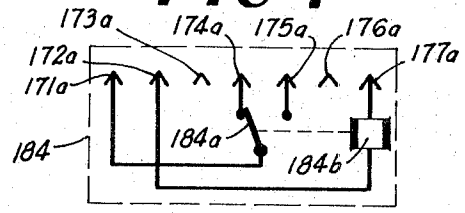


FIG 9

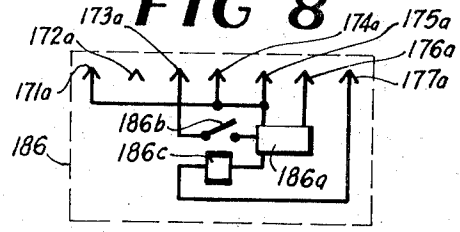


FIG 11

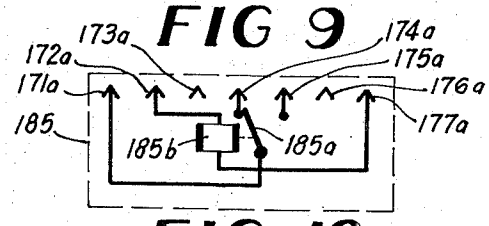


FIG 10

INDEXING ATTACHMENT

BACKGROUND OF THE INVENTION

This invention relates to a needle stop mechanism for power driven sewing machines and, more particularly, to apparatus for controlling the position and/or the number of cycles of operation of a stitching needle in response to deactivation of the sewing machine main drive means.

In a wide variety of sewing machines, it is advantageous to make positive provisions for orientation of the movable needle of the stitching mechanism relative to the work at the end of a stitching period or interval. For example, in a sewing machine of the blind stitch type, it is important to position the movable needle in a retracted or clearance position relative to the work to facilitate the unloading and reloading of the machine. It is desirable to have a sewing machine stop with the needle in its up position when threading the needle, changing the bobbin thread on a box stitch sewing machine or changing the position of the needle in the fabric. It is desirable to leave the needle in its down position during sewing when it is necessary to turn the fabric without moving the needle from the fabric as in the case of turning a line of stitching.

It has been time consuming and bothersome to bring the ordinary reciprocating needle of the sewing machine to stop and place it in a specific up or down position for any of these purposes. Generally the position is achieved by turning the balance wheel by hand after the machine has stopped. Hand operation of the balance wheel to achieve desired needle position is very time consuming and can represent an appreciable faction of the labor costs involved in producing a garment. It is therefore a great benefit to the garment industry, and ultimately to the consumer, that the labor costs be reduced in production of stitched articles by eliminating the time wastage associated with manual positioning of the sewing machine needle.

In still other types of garment stitching operations, it is often desirable to drive the stitching needle through a predetermined number of cycles of operation, such as making a predetermined number of connecting stitches in one direction and a predetermined number of stitches in an opposite direction for securing adjacent edges of fabric material.

There are a number of prior art needle positioning units which may be built into the sewing machine or attached thereto for orienting the needle in relation to the work. However, such units are comparatively complicated in construction and therefore relatively expensive, both with respect to the initial cost and expense dependent on installation and servicing. Further, due to the complicated construction used in these prior art mechanisms the automatic controlling of the needle positioning devices are unreliable in operation.

SUMMARY OF THE INVENTION

The above disadvantages of the prior art have been overcome by the present invention which basically includes a needle positioner and control assembly which can be attached to presently used sewing machines and which includes interchangeable modular program elements for effecting automatic control of a machine sewing needle in a stitching operation. The needle positioner assembly includes a transmission means having an input drive shaft which is operatively connected to the main drive motor and which includes an output drive shaft which is operatively connected to the needle drive means. The transmission assembly includes electromagnetic clutch means which is operable for connecting the input drive shaft to the output drive shaft in response to operation of a manual control actuator means. The positioner assembly includes an alternate motor drive means which includes a drive member operatively associated with the transmission output drive shaft and includes additional clutch means which is operable for connecting the alternate drive means to the transmission output drive shaft in response to deactivation of the main motor clutch means. A synchronizer control means is operatively associated with the needle drive means and includes means for controlling operation of the alternate drive means for effecting a predetermined cyclic movement of the transmission output drive shaft to thereby advance the needle to a predetermined adjusted position.

One important feature of the present invention includes the control means operatively associated with the needle drive means and the alternate drive means, wherein the control means includes interchangeable modular program elements which can be selectively connected to the control means for altering the cyclic movement of the needle drive means.

Another important feature of the present invention includes the construction of the drive transmission attachment wherein a pair of concentrically mounted drive shafts are supported in a housing and include a number of selectively operable clutch means associated therewith and detailed such that input drive can be transmitted to one drive shaft and an output drive can be transmitted to a second drive shaft.

It is therefore a primary object of this invention to provide a needle positioning and control mechanism which can be attached to a sewing machine for automatically controlling the position of a machine sewing needle in a stitching operation.

Another object of this invention is to provide a needle positioning attachment which is simple in construction and operation, economical to manufacture and reliable in performance.

A still further object of this invention is to provide a needle positioning attachment which includes interchangeable modular program means for altering the control operation of the needle positioning attachment.

A further object of this invention is to provide a drive transmission means having juxtaposed coaxially operable input drive means and output drive means.

Yet another object of this invention is to provide an indexing drive means which would have utility in the drive mechanisms associated with punch presses, textile looms and similar related equipment.

Still other objects and advantages of the details of construction will become apparent upon reading the following description of the illustrative embodiment embodying the principles of the present invention with reference to the attached drawings wherein like reference numerals have been used to refer to like parts throughout the several figures, and wherein:

BRIEF DESCRIPTION OF THE FIGURES OF DRAWING

FIG. 1 is a fragmentary elevational view showing an indexing attachment embodying the principles of the

present invention operatively associated with a sewing machine, with certain parts omitted for purpose of clarity;

FIG. 2 is an enlarged fragmentary vertical sectional view taken through the indexing attachment synchronizer mechanism;

FIG. 3 is an enlarged one-quarter sectional view of the indexing attachment transmission control means;

FIG. 4 is an enlarged sectional view taken along line 4—4 in FIG. 1;

FIG. 5 is an electrical schematic view of the indexing attachment control means; and,

FIGS. 6–11 are electrical schematic views showing a number of modular program elements utilized in the present invention.

DESCRIPTION OF THE ILLUSTRATIVE EMBODIMENT

Referring now to the drawings, the indexing attachment embodying the principles of the present invention will be described with reference to a conventional industrial type sewing machine generally represented by the reference numeral **10** having a clutch operated motor drive means **20.** Motor drive means **20** is operatively connected to the transmission assembly **40** which is electrically controlled by synchronizer means **80** adjusting motor **110** and electrical control assembly **150.**

As shown in FIG. **1,** the sewing machine may be of any well known type such as the machine shown in the Kaier U.S. Pat. No. 2,206,285, dated July 2, 1940 which has been modified in the manner to be described. The machine **10** is supported on a conventional table support means **11** and is provided with a reciprocating needle bar **12** carrying a needle **13.** Needle **13** is driven by an actuating shaft **14** in a conventional manner. The sewing machine includes a presser foot **15** which can be lifted from its work engaging position upon the application of pressure to an operating lever **16** of a knee-shift device similar to that disclosed in the Kaier patent. Reference is made to the Kaier patent for details of construction of the sewing machine and pressure foot lifting mechanism.

As shown in FIG. **1,** drive means for effecting operation of the sewing machine **10** is provided by a conventional electrical motor means **20.** Motor **20** is supported beneath the table **11** by means of a conventional motor bracket assembly **21.** Motor includes a power output shaft **22** which is controlled in a conventional manner between a clutch engaging driving operation and a clutch disengaged braking operation by means of a lever means **23.** Lever **23** is pivotally supported at **24** on a motor bracket mechanism **25.** Lever **23** is substantially L-shaped and includes a first arm portion **26** which is pivotally connected at **27** to a reciprocating motor clutch and brake assembly **28.** Motor clutch and brake assembly **28** is coaxially mounted relative to power output drive shaft **22.** Reference is made to prior U.S. patent to Larys et al. U.S. Pat. No. 2,942,564, dated June 28, 1960 for details of construction of the reciprocally operable clutch and brake assembly **28.** Movement of lever **23** to an operable clutch engaging position is effected by means of a treadle **30.** Treadle **30** is pivotally supported by a support shaft **31.** Treadle **30** is operatively connected by a link **32** to a second arm portion **33** of the L-shaped lever **23.** The clutch operating lever **23** is normally urged in a clockwise direction by the torsion spring **29** to a clutch disengaged braking position. Movement of the lever **23** in a counterclockwise direction will effect movement of the clutch and braking assembly **28** to a clutch engaging position. Lever **23** is moved in the counterclockwise direction by depressing the treadle **30.**

As shown in FIG. **1,** power from the motor drive shaft **22** is delivered to the power transmission assembly **40** by means of a pulley **34** and belt drive means **35.** Pulley **34** is fixed to the motor drive shaft **22.** The drive belt **35** is supported in driving engagement with an input pulley **41.** As shown in FIG. **3,** the input pulley **41** is fixed to an input drive shaft **42** by a conventional set screw means **43.** Input drive shaft **42** is rotatably supported within an output drive shaft **44.** The two drive shafts **42, 44** are supported by conventional bearing means **45** in a first end plate support member **46.** An opposite end of input drive shaft **42** is supported by conventional bearing means **47** in a second horizontally spaced end plate member **48.** End plate members **46, 48** are supported in a horizontally spaced vertically oriented position by means of a transmission housing frame member **49.** A top plate support member **50** is secured across the upper edges of the end plate members **46, 48** and the frame member **49.** The top plate member **50** is secured to the underside of table **11** by conventional bolt connecting means **51.**

As shown in FIG. **3,** the output drive shaft **44** is secured in an axially set position relative to input drive shaft **42** by means of a pair of axially spaced retaining clips **52, 53.** The output drive shaft **44** includes oppositely directed, axially formed recess notch portions provided with self lubricating bearing elements **54** which provide suitable means for supporting the output drive shaft **44** for rotary movement relative to the input drive shaft **42.** The output drive shaft **44** is secured in an axially set position to include a projecting end portion which extends laterally outward of end plate member **46** a sufficient distance to provide a support portion for a drive pulley **55.** The drive pulley **55** is secured in an angular set position on the output drive shaft **44** by means of a conventional set screw means **56.**

As shown in FIG. **3,** the output drive shaft **44** is normally rotatable relative to the input drive shaft **42** and is adapted to be connected in driving relationship therewith by means of an electromagnetic clutch assembly **60.** The electromagnetic clutch assembly **60** includes an annular housing member **61** which is supported on end wall **48** in concentric relationship relative to drive shaft **42.** Annular housing **61** includes a recessed groove **62** which supports an annular electrical coil **63.** The electrical coil **63** is adapted to be connected to conventional electrical supply means having selective control means for effecting operation of the electromagnetic clutch, as will be described in more detail hereinbelow. The clutch assembly **60** includes a rotor member **64.** Rotor member **64** includes an inner member **65** and an outer member **66** secured in concentric relationship relative to each other by means of suitable non-conductive non-magnetic plastic material **67.** The inner rotor member **65** is secured in an angular set position on the input drive shaft **42** by means of a conventional set screw means **68.** Thus, it is apparent that rotary input to drive shaft **42** will effect corresponding rotary movement of the rotor member **64.**

A drive from rotor **64** is transferred to the output drive shaft **44** by means of a selectively engageable

clutch plate **70**. The clutch plate **70** is supported on the output drive shaft **44** by means of a collar member **71**. Collar **71** is secured to the output drive shaft **44** by conventional set screw means (not shown). Clutch plate **70** is secured in an angular set axially slidable position on collar **71** by a plurality of roll pins **72** (only one of which is shown in FIG. **3**, however it is to be understood that a plurality of equal angularly spaced roll pins will be provided for supporting the clutch plate member **70** for limited axial sliding movement). A drive is transferred from the input drive shaft **42** to the output drive shaft **44** by energization of the electrical coil **63**.

Energization of the electrical coil **63** will develop a magnetic field outward through the outer rotor member **66** through the clutch plate member **70** and back through the inner rotor member **65**. The magnetic field will effect an axial displacement of the clutch plate member **70** on roll pins **72**, thereby bringing the clutch plate **70** into frictional engagement with the rotor **64**. Rotary movement of the rotor **64** will thereby effect a corresponding rotary movement of the clutch plate **70** and the output drive shaft **44**. A drive from output drive shaft **44** will effect rotation of pulley **55**. Drive from pulley **55** is delivered by a conventional belt **75** to the machine hand wheel pulley **76**. The hand wheel pulley **76** is secured to the needle actuator shaft **14**.

Thus, it can be seen that a drive from motor **20** can be transferred to the input drive shaft **42**, through the clutch assembly **60**, out through the output drive shaft **44**, and delivered by the belt and pulley drive means **75, 76** for effecting reciprocating cycles of actuation of the needle **13**. In a normal stitching operation, the clutch assembly **60** is energized for effecting continuous operation of the needle **13**, by depressing the treadle **30**, in a manner as will be described in more detail hereinbelow in the description of the operation of the present invention.

As shown in FIGS. **1–4**, the indexing attachment of the present invention includes a needle positioner assembly which includes a synchronizer **80** and a second drive motor adjusting means **110**. The synchronizer **80** includes a rotary shaft element **81** which is fixed in coaxial relationship to the machine drive shaft **14**. The synchronizer shaft **81** is secured to the hand wheel means **76** by means of an attachment assembly **82**. The attachment assembly **82** is secured to the hand wheel **76** by a plurality of connecting bolt means **83** and includes an opening which receives shaft **81** which is fixed relative thereto by means of conventional set screw means **84**.

As shown in FIG. **2**, the synchronizer **80** includes a plurality of disk members **85, 86, 87**. The disks **85, 86, 87** are secured to the synchronizer shaft **81** by means of conventional set screw means **85***a*, **86***a*, and **87***a*. The disk members **85–87** are constructed of plastic or other suitable non-conducting material, with each being provided with a conducting ring portion **85***b*, **86***b*, **87***b*. The conducting ring portions **85***b*, **86***b* include small cutout portions **85***c*, **86***c*, as shown in FIG. **5**, which are nonconducting. The disk elements **85** and **86** are secured in angular set positions relative to shaft **81** whereby the cutout portions **85***c* and **86***c* are angularly displaced substantially 180° relative to each other.

The cutout **85***c* is representative of a needle up position, the cutout **86***c* is representative of a needle down position, with the angular conducting ring **87***b* operable for developing cyclic pulses through a counter mechanism, all of which will be described in more detail hereinbelow. Electrical current is conducted to and through the ring portions **85***b* –**87***b* by means of brushes **95, 96** and **97**, respectively. Each of the brushes **95–95** are slidably supported by a conventional electrical connection bracket **98**. The electrical connection bracket **98** is secured in a cylindrical housing **99**. Housing **99** is supported in coaxial relationship relative to the disk elements **85–87** by means of a conventional bearing element **100**. The inter race of bearing **100** is secured to the synchronizer shaft **81** by a conventional bolt connected means **101** and the bearing outer race is secured to the housing **99**. Housing **99** is supported in an axially fixed position relative to shaft **81** by means of a support bracket **103**. The support bracket **103** is secured to the table top **11** by conventional threaded bolt connecting means **104**.

As shown in FIG. **2**, the brush elements **95–97** are spring urged into contact with their respective ring elements by compression springs **95***a*, **96***a* and **97***a*, with each brush being electrically connected to a respective lead line **95***b*, **96***b* or **97***b*. As shown in FIG. **2**, the conducting ring elements **85***b*, **86***b* and **87***b* are electrically connected to an output line **105** by three similar spring operated brush elements **106, 107** and **108** which are operatively supported in a mounting bracket **109**. The electrical controls produced by the synchronizer **80** will be described in more detail hereinbelow.

As shown in FIG. **3**, the indexing attachment includes a needle adjusting drive assembly **110**. The adjusting drive assembly **110** includes a conventional electrical motor **111**. Motor **111** is provided with a gear reduction housing **112** having an output drive shaft **113**. A conventional sprocket **114** is secured to drive shaft **113**. Drive from sprocket **114** is transferred by means of a conventional chain **115** to a sprocket **116**. Sprocket **116** is rotatably supported on a coaxial self lubricating sleeve element **117**. The sleeve **117** is concentrically supported on the output drive shaft **44**. Sprocket **116** includes a collar portion **118** having a plurality of axially extending roll pins **119**. A drive from the sprocket **116** is delivered to the output drive shaft **44** by means of an electromagnetic clutch means **120**. The electromagnetic clutch means **120** is identical to the electromagnetic clutch means **60** and includes an annular support housing **121** having a recessed groove portion **122** which is provided with an electromagnetic coil means **123**.

As shown in FIG. **3**, the clutch assembly **120** includes a rotor **125**. Rotor **125** includes an inner hub portion **126** and an outer ring portion **127** secured in concentric relationship by means of conventional non-conducting, non-magnetic plastic or other similar material **128**. The rotor inner hub portion **126** is secured to the output drive shaft **44** by conventional set screw means **127**. A clutch disk **120** is supported on the roll pins **119** for axial displacement relative to the sprocket **116**. A drive operation is transferred from the sprocket **116** to the output drive shaft **44** by energizing the electromagnetic coil **123**. Energization of the electromagnetic coil **123** will develop a magnetic field out through the rotor outer ring element **127**, through the clutch disk **130** and back through the rotor inner hub member **126**. Since the clutch plate **130** is magnetically attracted to the rotor **125**, a rotary movement of the

clutch plate **130** by sprocket **116** will effect a corresponding movement of the output drive shaft **44**.

The synchronizer **80**, adjusting motor drive means **110** and electromagnetic clutch means **120** is operable for effecting predetermined cyclic movement of the needle **13** between an up and down position and between a number of predetermined cycles of operation by an electrical control assembly generally represented by the reference numeral **150**. The electrical control assembly is contained within a housing supported beneath the sewing machine top **11**. The electrical control assembly is schematically shown in FIG. **5** and includes a power input line means **151** which is electrically connected to the sewing machine main drive motor **20** by means of a manual control switch **152**. The manual control switch **152** is also operable for developing current flow in a pair of lead lines **153, 154**. Lead line **153** is provided with a conventional fuse means **155**.

In a continuous stitching operation by the needle **13**, the power is delivered from motor **20** by effecting operation of the clutch assembly **28**. The clutch assembly **28** is operated by depressing the treadle **30**. Operation of clutch **28** will connect the output drive shaft **22** to the motor **20** for rotating pulley **34** and belt **35**. Rotation of belt **35** will effect corresponding rotation of input pulley **41** and input drive shaft **42**. A control switch **160** is supported beneath motor housing **20** and in position to be contacted by the lever arm **33**. When the lever arm **33** is in an operable clutch disengaging position, the lever arm will effect a closing of switch **160**. When lever arm **33** is moved to an operable clutch engaging position, switch **160** is opened. Switch **160** is operatively connected through one of the modular program elements and the synchronizer to a relay member **161**. Relay **161** is connected to a pair of switches **163, 164**. Switch **163** is electrically connected to the adjusting motor drive means **110** and switch **164** is electrically connected for conducting power through either the electromagnetic coil **63** or the electromagnetic coil **123**. As shown in FIG. **5**, a current converter is electrically connected between the lead lines **153** and **154** and the clutch coils **63, 123**. With the relay **161** deenergized, switch **164** is biased to a position for conducting electrical current through coil **63**. Clutch coil **63** will operate to energize the electromagnetic clutch means **60** thereby connecting the input drive shaft **42** with the output drive shaft **44**, whereby drive can be delivered from motor **20** to the sewing machine pulley **76** for effecting cyclic operation of the needle actuating shaft **14**.

Since the control switch **164** is automatically biased to conduct current to clutch coil **63** when treadle **30** is actuated to effect operation of the clutch assembly **28**, there will be an uninterrupted drive flow from motor **20** to the hand wheel pulley **76** for effecting the continuous operation of the stitching needle **13**. When the treadle **30** is released, the torsion spring **29** will automatically return the clutch assembly **28** to a disengaged braked position stopping rotation of pulley **34**, belt **35** and input drive shaft **42**. Also, when the lever **33** is returned to a clutch disengaged position, the switch **160** will be closed, thereby conducting current to the synchronizer **80** through a selected modular program element, as will be described hereinbelow.

Switch **160** is electrically connected through a terminal connector element to modular programmed means **180** including a plurality of modular program elements **181, 182, 183, 184, 185, 186**. The terminal connector element **170** is provided with seven female connector contacts **171, 172, 173, 174, 175, 176** and **177**. The connector contact **171** is electrically connected to switch **160**. Connector contact **172** is electrically connected to a manual control switch **165**. Control switch **165** is operated by a knee action lever means **166**, as shown in FIG. **1**. The knee action lever **166** is adjustably connected to a pivot support shaft **167**. The knee action lever **166** is urged in a clockwise direction to effect corresponding clockwise movement of shaft **167** to close switch **165**. The switch **165** and lever **166** is urged to a counterclockwise limit by conventional spring means (not shown).

Connector contact **173** is connected directly to relay means **161** whereby current conducted through the conducting contact **173** will effect operation of relay **161**. Connector contact **174** is electrically connected to brush element **95** and the needle-up position control ring **85**. The connector contact **175** is electrically connected to brush **96** and needle-down position control ring **86**. The connector contact **176** is electrically connected to brush **97** and pulse developing ring **87**. Connector contact **177** is electrically connected to the lead line **154**.

As shown in FIGS. **6–11**, each of the modular program elements **181–186** includes seven male connector contact elements **171***a*, **172***a*, **173***a*, **174***a*, **175***a* **176***a* and **177***a*. Electrical current is conducted from the closed switch **160** and connector contact **171** to selected ones of the synchronized control switches by making an electrical connection between the connector contact **171***a* and the desired output connector.

As shown in the module **181** of FIG. **6**, the lead line **181***a* is electrically connected between connector contact **171***a* and contact **174***a*. Current conducted through the modular program **181** will be transferred through the connector contact **174** to the brush element **95**. When the ring member **85** is in any position other than a needle-up position, the brush **95** will contact the current conducting ring portion **85***b*. Current transferred to ring **85***b* will be transferred through brush **106** to lead line **105** which will effect operation of relay **161**. When relay **161** is energized, switch means **163** will be moved to an on position allowing current to flow to the adjusting motor drive means **110** for effecting movement to the sprocket **116**. Simultaneously with the closing of switch **163** by the relay **161**, the switch **164** will be moved to an alternate position for conducting electrical current through clutch coil means **123**. When current is conducted to clutch coil **123**, the clutch disc **130** will be axially displaced into frictional driving engagement with rotor **125**. Rotary movement of sprocket **116** and clutch disc **130** will effect corresponding rotary movement of rotor **125** and the output drive shaft **144**. The rotary movement of output drive shaft **144** will continue until shaft **81** effects an annular displacement of disc **85** to bring the cut out portion **85***c* into alignment with brush **95**. When brush **95** is aligned with cut out portion **85***c*, the current flowing to relay **161** will be stopped thereby effecting an opening of switches **163** and **164**. As soon as switch **163** is opened the drive from motor **110** will be stopped and switch **164** will be moved to a position for energizing clutch coil **63**. When clutch coil **63** is energized the output drive shaft **44** will be effectively

stopped in a stationary position by input drive shaft **42** and the braking mechanism associated with the main motor drive means **20.** Thus it can be seen that by plugging the modular program means **181** into the terminal connection means **170,** the current conducted by switch **160** when the treadle **30** is moved to an inoperable position will allow the current to flow through the modular program means **181,** synchronizer means **80** to the relay element **161** for effecting adjustment of the needle to the up position.

As shown in the modular program element **182** of FIG. **7,** contact **171***a* is electrically connected by a lead line **182***a* to contact **175***a*. When the modular program element **182** is inserted or connected to the terminal connection **170,** the current flowing through switch **160** will be transferred through the connected contact **175** to brush element **96.** Current flowing through brush element **96** will be transferred through the annular ring **86***b*, through brush **107** and output line **105** to the relay **161** for effecting operation of the adjusting motor drive means **110** and electromagnetic means **120** as described hereinabove, for adjusting the needle to an automatic down position.

Referring now to the modular program element **183** of FIG. **8,** the connector contact **171***a* is connected to a manually shiftable switch element **183***a*. The manually shiftable switch element **183***a* is selectively operable for conducting electrical current to either contact **175***a* or contact **174***a*. Thus it can be seen that by connecting the modular program element **183** with the terminal connection means **170,** current flowing through switch **160** can be transferred to either the up control disc element **85** or the down control disc element **86,** whereby the needle can be adjusted to the selected position. The program control element **183** can be altered by manually moving the switch **183***a* to an alternate position.

As shown in FIG. **9,** still another modular program means **184** is provided wherein contact **171***a* is electrically connected to a switch element **184***a*. Switch **184***a* is operatively associated with contacts **174***a* and **175***a* for selectively conducting current to either of these contacts. Switch **184***a* is normally biased to a position for conducting current to switch **174***a* for effecting movement of the needle to the up position, as described hereinabove. Movement of switch **184***a* into contact with connector contact **175***a* is effected by means of a relay means **184***b*. Relay **184***b* is energized by operation of the knee action control switch **165** which will effect a transfer of current through connector contact **172,** connector contact **172***a* into the relay **184***b*. Relay **184***b* is connected to the ground connector contact **177***a*. In operation, the modular program element **184** is connected with the terminal connection means **170,** wherein the current flowing through switch **160** will be transferred in a first mode of operation out through the connector contact **174***a* for adjusting the stitching needle to an up position. After the needle has been stopped in an up position, if it is desired to move the needle to a down position, the operator will merely effect a clockwise rotation of the knee action lever **166** which will in turn close switch **165.** When switch **165** is closed, current will flow through the connector contact **172** and **172***a* for energizing relay **184***b*. When relay **184***b* is energized, the switch **184***a* will be moved to an adjusting position for conducting current through the contact **175***a* and contact **175** for effecting operation of the adjusting motor **110** to bring the needle to a down position.

As shown in FIG. **10,** a further modular program element **185** is provided for effecting still another automatic operation of the needle adjusting mechanism. The modular program element **185** is similar in construction to the modular program element **184,** except that the switch means **185***a* is normally biased into position with contact **175***a* and is moved into position with the connector contact **174***a* by means of operation of the relay **185***b*. The modular program means **185** is a reverse of that provided by modular program means **184,** in that the current conducted through contacts **171, 171***a* will be transferred first through the contacts **175***a*, **175** for effecting adjustment of the needle to the down position, and if it is desired to move the needle to the up position, the operator would then effect counterclockwise movement of the knee action lever **166.**

Referring now in particular to FIG. **11,** a still further modular program element **186** is provided for effecting predetermined numbers of cyclic movement of the stitching needle **13.** In the modular program element **186,** the connector contact **171***a* is electrically connected to the connector contact **174***a* for automatically adjusting the needle to the up position. The purpose of providing current through contact **171***a* and contact **174***a* is to provide means for conducting current to either of the electrical brush elements **106, 107** and to the brush element **108.** Current conducted into brush **108** will develop an electrical pulse with each cycle of rotation of the conducting ring **87***b*. When the conducting ring **87***b* passes the electrical brush means **97,** the pulse will be transferred through the contact **176,** contact **176***a* into a conventional electrical pulse operated counter mechanism **186***a*. The pulse flowing through counter mechanism **186***a* is transferred through conventional indexing counter mechanism (not shown) and out through the ground connector contact **177***a*. The conventional electrical pulse counter **186***a* is operable for counting predetermined number of pulses transmitted thereto. A continuous supply of current is conducted to the counter mechanism **186***a* from the connector contact **171***a*. The continuous supply of current conducted to counter **186***a* will flow out through a normally closed switch **186***b* into the connector contact **172***a*. Current flowing through connector contact **172***a* will flow through the connector contact **173***a*, connector contact **173** into the relay means **161***a* for effecting a continuous operation of the adjusting motor **110** until the switch **186***b* is moved to an opened position. Switch **186***b* is moved to an open position upon de-energization of relay **186***c*. Relay **186***c* is normally maintained in an energized position for closing switch **186***b* and is de-energized after the counter **186***a* has effected a counting of a predetermined number of pulses, at which time relay **186***c* is de-energized to open switch **186***b*. When switch **186***b* is open, the current will stop flowing through the connector contacts, **173, 173***a*. However, the motor means **110** will continue to rotate the needle **13** until the needle is moved to the up position under control of synchronized disc **85.** Thus it is apparent that the modular program control means **186** is operable for effecting a continuous adjustment of the needle **13** by the adjusting motor **110** for a predetermined number of cycles, after which the needle is stopped in the up position. It

is obvious that a similar modular program element could be provided similar to the one shown in FIG. 11 for stopping the needle in the down position after a predetermined number of cycles of movement of the stitching needle 13.

Referring now to FIG. 4, the modular program elements 181–186 are provided with alignment projections and recesses 190, 191, respectively, which are adapted to be connected in an aligned engagement with a complementary recess 192 and projection 193, respectively, formed on the connection terminal 170.

As shown in FIG. 2 the synchronizer 80 is constructed of a plurality of axially spaced disc elements 85–87 which are supported on shaft 81. It is obvious that the capabilities of the synchronizer 80 can be increased by adding additional disc elements to the shaft element 81 and operatively connecting the disc elements with additional terminal connection elements provided on the connection terminal 170 and modular program elements 181–186.

It now becomes apparent that the above described illustrative embodiment of the indexing attachment embodying the principles of the present invention is capable of obtaining the above stated objects and advantages. It is obvious that those skilled in the art may make modifications in the details of construction without departing from the spirit of the invention which is to be limited only by the scope of the appended claims.

What is claimed is:

1. An attachment assembly operable in a sewing machine for automatically controlling the position of the machine sewing needle comprising, in combination:

a. drive means for said sewing needle including a needle drive shaft,

b. a main motor for selectively driving said needle drive means,

c. an auxiliary motor for said needle drive means to alternatively position said sewing needle at preselected positions thereof,

d. power transmission means including

i. a drive shaft having a drive pulley mounted thereon, said drive pulley being in driving connection with said main motor,

ii. a driven shaft telescopically mounted for relative rotation with respect to said drive shaft, said driven shaft having a first pulley mounted thereon in driving connection with said needle drive means and having a second pulley rotatably mounted thereon in driving connection with said auxiliary motor,

iii. a first electromagnetic clutch associated with said drive shaft and said driven shaft for selectively connecting said drive shaft in driving connection with said driven shaft upon energization of said first electromagnetic clutch,

iv. a second electromagnetic clutch associated with said driven shaft and said second pulley for selectively connecting said driven shaft in driving connection with said second pulley upon energization of said second electromagnetic clutch, and

e. control means including

i. a first ring formed principally of electrically conducting material and including a relatively small non-conducting portion, said first ring being mounted for rotation with said needle drive shaft,

ii. a second ring formed principally of electrically conducting material and including a relatively small non-conducting portion, said second ring being mounted for rotation with said needle drive shaft,

iii. a first electrical circuit including two contacts engaging said first ring for selectively energizing said first electromagnetic clutch when both contacts engage conductive portions of said first ring and for selectively deenergizing said second electromagnetic clutch when one of said contacts engages only the non-conductive portion of said first ring at the up position of said sewing needle,

iv. a second electrical circuit including two contacts engaging said second ring for selectively energizing said second electromagnetic clutch when both contacts engage conductive portions of said first ring and for selectively deenergizing said second magnetic clutch when one of said contacts engages only the non-conductive portion of said second ring at the down position of said sewing needle,

v. switching means for alternately and selectively closing said first and second electrical circuits whereby said second electromagnetic clutch may be energized by either of said first and second electrical circuits.

2. An attachment assembly as defined in claim 1 and further characterized in that:

said telescopically mounted driven shaft has an extending length that is less than the length of said drive shaft;

said first electromagnetic clutch includes a first rotatable member secured to said drive shaft at a point adjacent one end of said driven shaft, and a second rotatable member carried on said one end of said driven shaft, said first and second rotatable member being magnetically connected to one another when said first magnetic clutch is energized; and

said second electromagnetic clutch includes a first rotatable member secured to said driven shaft, and a second rotatable member carried by said second pulley adjacent said first rotatable member, said first and second rotatable members being magnetically connected upon energization of said second magnetic clutch.

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