July 22, 1952 M. C. RICH 2,604,062

BUTTONHOLE SEWING MACHINE

Original Filed Jan. 8, 1949 3 Sheets-Sheet 1

Fig. 1

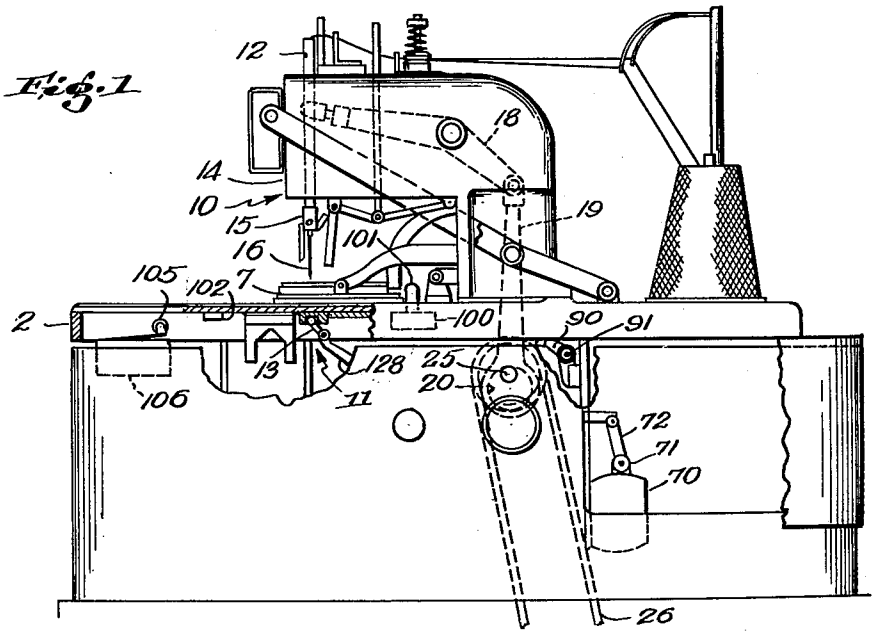


Fig. 2

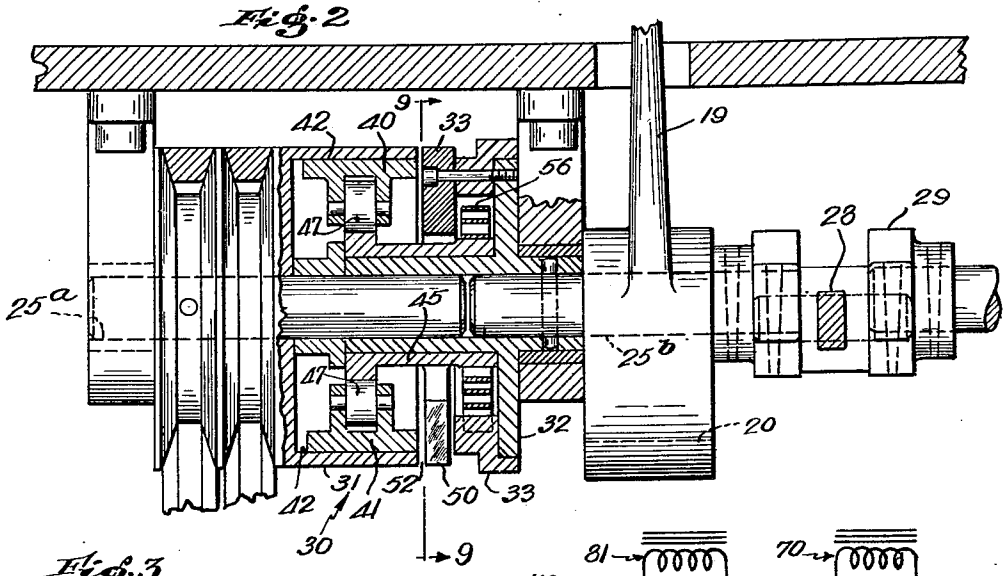
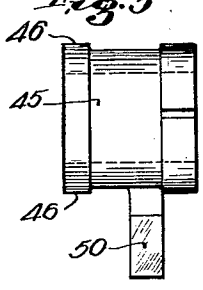


Fig. 3



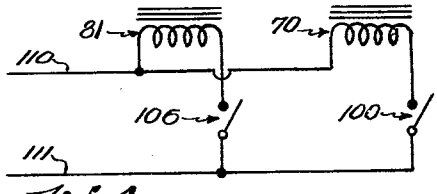


Fig. 4

Inventor
Marion C. Rich
By Dike, Calver & Porter
Attys.

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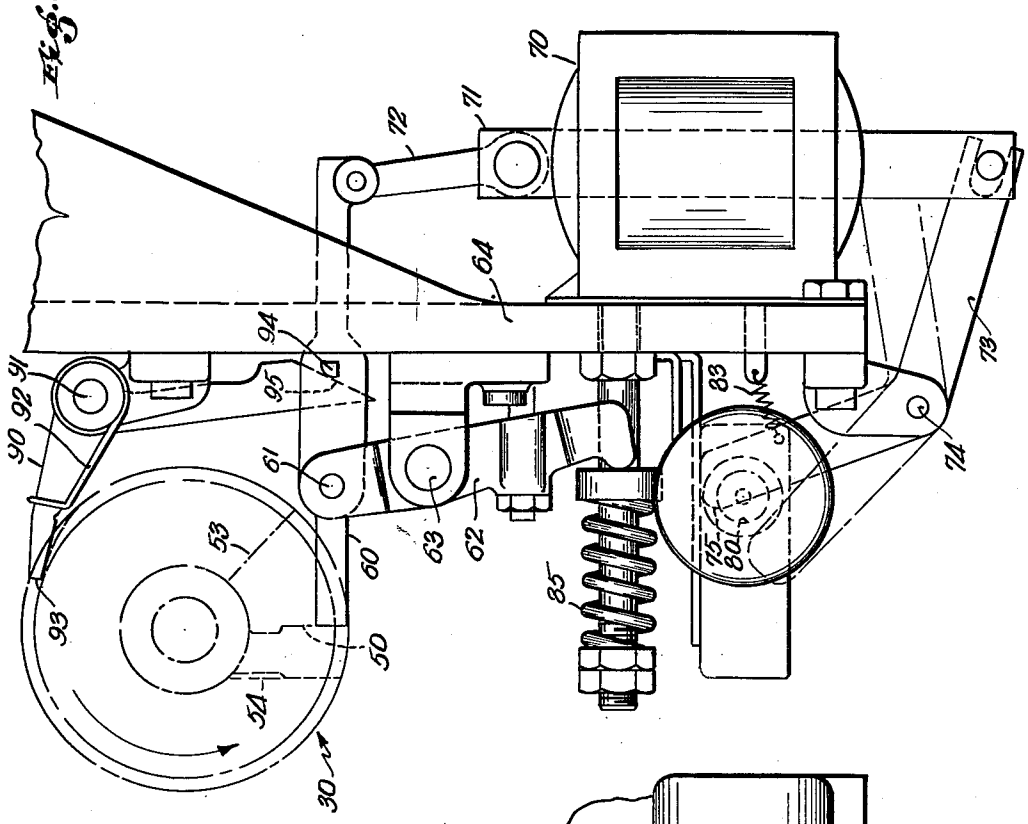
Fig. 5



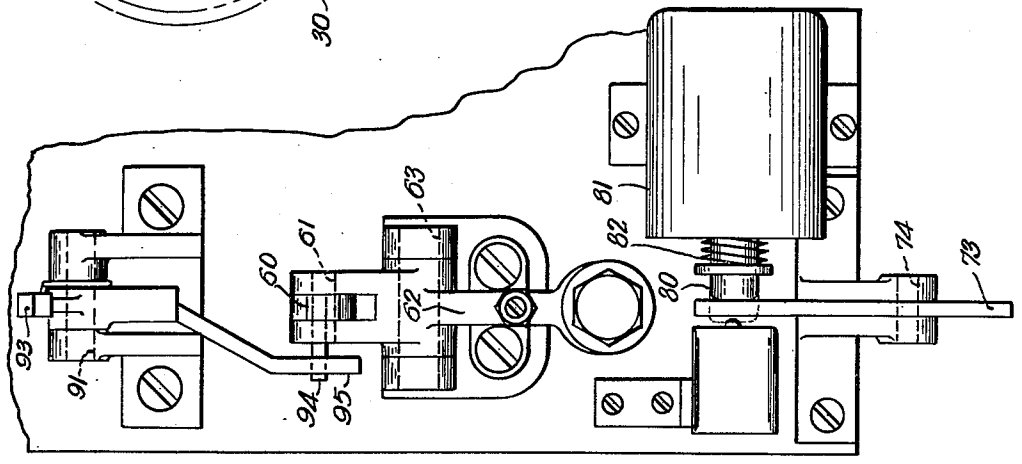


Fig. 6

Inventor
Marion C. Rich
By Wicks, Culver & Porter
Attys.

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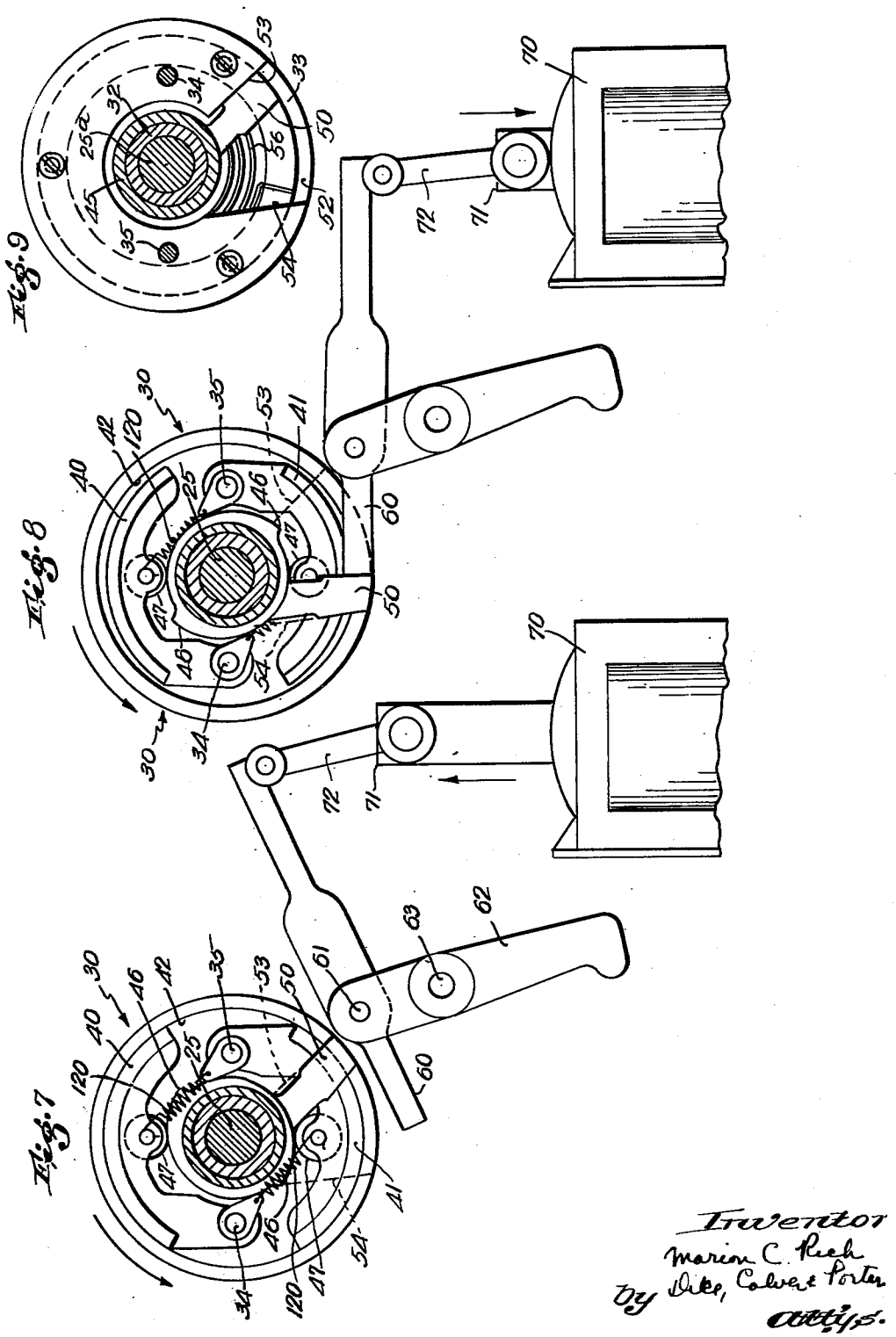

Inventor
Marion C. Rich
By Dike, Calver & Porter
Attys.

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UNITED STATES PATENT OFFICE

2,604,062

BUTTONHOLE SEWING MACHINE

Marion C. Rich, Denver, Colo., assignor to The Reece Corporation, Boston, Mass., a corporation of Massachusetts

Original application January 8, 1949, Serial No. 69,858. Divided and this application February 23, 1949, Serial No. 77,958

3 Claims. (Cl. 112—67)

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This is a division of my copending application Serial No. 69,858, filed January 8, 1949, now Patent No. 2,573,359, dated October 30, 1951, for Button Hole Sewing Machine and fully describing and illustrating but not claiming the subject matter claimed herein.

This invention relates to sewing machines and more particularly to start and stop mechanism for the stitching mechanism.

Recent inventions in the sewing machine art have provided improved machines, particularly machines for forming button holes, which are hydraulically operated by fluid under pressure as shown and described in my said copending application Serial No. 69,858 of January 8, 1949, and in the application of Franklin A. Reece, Serial No. 67,671, filed December 28, 1948, now Patent No. 2,555,095, dated May 29, 1951. In the improved art, as illustrated by these applications, it has been found that a much higher speed, more compact, lighter, more economical and smoother running machine for forming button holes can be provided by operating the mechanisms in automatic sequence by fluid under pressure according to the respective inventions. It has also been found expedient to operate by direct mechanical linkage with power operating means, some of the reciprocating needle and looper carrying parts of the stitching mechanisms. In such cases the power operating means are usually also employed for generating the fluid pressure for the operation of all the other motions in the machines.

In the machines described and illustrated in both of the above mentioned copending applications, the needle bar reciprocation and the oscillation of the loopers in the lower stitching mechanisms are accomplished by mechanical linkages in each case driving through a stitching mechanism drive clutch which is engaged during sewing to operate the said parts of the stitching mechanisms and is otherwise disengaged before and after sewing during the remainder of the fully automatic operative cycle of the machine. In order to control the operation of the said machines automatically electric operating and control mechanism is provided in an electric control circuit including control switches for the various fluid pressure operated motors, the switches being operative automatically at various predetermined points in the operative cycle of the said machines. In such a machine, most of the parts of which are operated by fluid under pressure, but in which also some of the reciprocating parts of the stitching mechanisms are mechanically driven from the main power operating means, it is desirable to

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provide starting and stopping mechanism for the sewing drive clutch, operation of which is controlled electrically in cooperation with the automatic electric control system and mechanism of the machine.

Accordingly I have accomplished these objects by the provision of electrically operated start and positive stop mechanism for the sewing drive clutch operating in predetermined adjustable time with the operative cycle of the sewing machine.

At the much higher speeds of operation of the machine illustrated herein and similar machines, it is desirable and necessary to have light, quick acting and simple control mechanisms which can be timed precisely to operate in cooperation with other mechanisms in the machine. It will also be understood that the control mechanism described, while meeting these requirements, must also be able to withstand the terrific shocks of sudden starts and stops of the parts operating at very high speeds. I have provided a clutch control mechanism which has adequate stamina for this requirement and which at the same time is sensitively and immediately responsive to control signals imparted by a finely adjusted electric control system.

The mechanism of the present invention is shown and described in my said copending application and in the following description and the accompanying drawings of its embodiment in a hydraulically operated machine for forming piped buttonholes and which, however, are intended to illustrate one form of the invention and not to limit its scope beyond the requirements of the prior art.

In the drawings:

Fig. 1 is a general side elevation view partly broken away and in section of a machine for forming piped buttonholes incorporating the mechanism of my invention;

Fig. 2 is a front elevation view partly in section showing a sewing drive clutch and part of the linkage for reciprocating the needle bar and the loopers of the stitching mechanism;

Fig. 3 is a view of a part of the clutch illustrated in Fig. 2;

Fig. 4 is a wiring diagram;

Fig. 5 is a side elevation view of the mechanism of the invention showing its relationship to the clutch of Fig. 2;

Fig. 6 is a front elevation view of part of the mechanism of Fig. 5;

Fig. 7 is a partial side elevation view partly in section of the mechanism and clutch showing

the clutch engaged and the start and stop mechanism of the invention in running position.

Fig. 8 is a view similar to Fig. 7 showing the clutch disengaged and the mechanism in stop position;

Fig. 9 is a view taken on the lines 9—9 of Fig. 2.

Fig. 1 shows a machine for forming piped button holes as fully described in my said copending application. Such a machine includes upper stitching mechanism indicated at 10 and lower stitching mechanism indicated at 11. In this machine the upper stitching mechanism 10 is supported in a housing 14 which is fixed relative to the machine in a fore and aft direction and to a bed plate 2, the latter supporting the lower stitching mechanism 11 also fixed in a fore and aft direction relative to the machine. The work (not shown) is supported in mechanism including a work clamp 7 and moves or feeds relative to the stitching mechanisms 10 and 11 for forming a row of stitches therein, the work clamp 7 being slidable on the bed plate 2 to the left and right relative to the stitching mechanisms 10 and 11 as viewed in Fig. 1. The upper stitching mechanism 10 includes a vertically reciprocating needle bar 12, and attached to its lower end a needle clamp 15 and a pair of needles 16 (only one being visible) adapted to penetrate the work and form stitches in cooperation with a pair of loopers (not shown) in the lower stitching mechanism 11 which are oscillated by the reciprocation of mechanism including the arm 13. The mechanism for reciprocating the needle bar 12 includes the pivotal member 18 mounted in the housing 14 and a connecting rod 19 reciprocated by an eccentric 20 fixed on the driven part 25*b* of a sewing drive shaft 25 of which the concentric part 25*a* is the driving part rotated by belting 26 from power operated means (not shown) such as an electric motor. The oscillating member 13 of the lower stitching mechanism 11 is also connected to the driven part 25*b* of the shaft 25 by a connecting rod 28 and a crank 29.

The driving part 25*a* of the shaft 25 and the belting 26 run constantly in this machine throughout its operative cycle.

A sewing drive clutch generally indicated at 30 and connecting the shaft parts 25*a* and 25*b* is engaged at the commencement of sewing to drive the driven part 25*b* and the upper and lower stitching mechanisms 10 and 11 and disengaged at the end of sewing to bring them to a positive stop. A flange shaped driving member 31 is fixed to the driving shaft part 25*a*, and a driven clutch member 32 is fixed to the driven shaft part 25*b*, and part of its mechanism is enclosed and engaged by the driving member 31, and it floats freely on the end of the driving shaft part 25*a*. Fixed to the driven member 32 is a clutch shoe supporting member 33 and pivotally attached thereto at 34 and 35, Figs. 7, 8 and 9, are a pair of internally expanding clutch engaging shoes 40 and 41 adapted in their expanded position, Fig. 7, to engage the internal surface 42 of the driving member 31, thereby connecting the driving and the driven members 31 and 32 and in their contracted position, Fig. 8, to disengage the driven member 32 from the driving member 31. Floating rotatably externally of the hub part of the driven member 32 is a shoe expansion cam 45, Figs. 2 and 3, having a pair of cam surfaces 46 engaging rollers 47 attached to the cam shoes 40 and 41 thereby expanding the shoes when turned in a counterclockwise direction, as viewed in Fig. 7, and allowing the shoes to contract under the tension of springs 120 when rotated in a clockwise direction as viewed in Fig. 8 relative to the clutch driven member 32.

A stop dog 50 integral with the cam member 45 projects externally through a slot 52 in the driven member part 33, the advanced end of the slot 52 being indicated by the lines 53, Figs. 7, 8 and 9, and the retarded end thereof being indicated by the line 54. A coil spring 56 between the driven member part 33 and the cam member 45 urges the cam 45 rotatively relative to the driven member 32 so that the stop dog 50 is normally positioned in the advanced end 53 of the slot 52 or in a counterclockwise direction relative to the driven member 32, thus normally engaging the driving member 31 to the driven member 32 for operating the stitching mechanisms 10 and 11. As long as the stop dog 50 is allowed to rotate uninterrupted with the parts 30, the stitching mechanisms 10 and 11 are drivingly connected to the driving shaft part 25*a*, but when the rotation of the stop dog 50 is interrupted, it is retarded in the slot 52 relative to the rotation of the driven member 32, the clutch shoes 40 and 41 are allowed to contract as viewed in Fig. 8, the driven member 32 is disengaged from the driving member 31, and when the stop dog 50 reaches the retarded end 54 of the slot 52, the driven member 32 is then brought to a positive predetermined stop. The mechanism of the clutch 30 so far described is commonly known mechanism in a normally engaged self-engaging clutch, interruption of the rotation of part of which not only disengages the clutch but brings its driven side to a positive stop.

To stop and start the stitching mechanism according to the invention herein, I provide a clutch interrupting finger 60 pivoted at 61 on an arm 62 which, in turn, is pivoted at 63 to part of the machine frame 64. When the finger 60 is in the up position and engaging the stop dog 50, Figs. 5 and 8, the clutch 30 is disengaged and stopped and the stitching mechanisms 10 and 11 are in rest position. When the finger 60 is in down position, Fig. 7, the clutch 30 is engaged and the stitching mechanisms 10 and 11 are operating.

To lower the finger 60 out of the way of the stop dog 50, I provide a clutch start solenoid 70, the arm 71 of which is attached to the finger 60 by a link 72. Attached to the lower end of the plunger 71 is a rock arm 73 pivoted at 74 to the frame 64 and whose other end 75 is in a clutch stop position to the right, Fig. 5, when the solenoid plunger 71 is down and the finger 60 is holding the clutch 30 in stop position. When in this position, the arm 75 abuts the end of another solenoid plunger 80 in a clutch stop solenoid 81 holding the plunger 80 to the right against the force of a spring 82 as shown in Fig. 6.

The finger 60 is held normally in its up position to hold the clutch 30 disengaged by the weight of the clutch start solenoid plunger 71 partly aided by the tension of a spring 83 between the frame 64 and the arm 75. When the solenoid 70 is energized, the solenoid plunger 71 rises and the finger 60 disengages the stop dog 50 allowing the clutch 30 to engage and start the stitching mechanisms 10 and 11. At the same time the arm 75 moves to the left as viewed in Fig. 5 and allows the clutch stop solenoid plunger 80 to move to the left and on past the arm 75 to its extended dotted line position seen in Fig. 6. Since the clutch start solenoid 70 is only momentarily energized to allow the clutch 30 to engage, movement of the clutch stop solenoid plunger 80

past the arm 75 and to a position preventing its return to the right maintains the finger 60 out of engagement with the stop dog 50. At the end of sewing, the clutch stop solenoid 81 is momentarily energized, moving its plunger 80 back to the right as viewed in Fig. 6, long enough to allow the stop plunger 71 to drop and the arm 75 to move back to the right, as viewed in Fig. 5, again causing the interrupting finger 60 to engage the stop dog 50 and stop the clutch 30. The plunger 80 thus comprises a lock mechanism which locks out the finger 60 automatically and releases it at a predetermined point. The clutch 30 is maintained disengaged until the clutch start solenoid 70 is again energized.

When the interrupting finger 60 engages the stop dog 50, the latter moving at extremely high speed tends to move the arm 62 in a clockwise direction as seen in Fig. 5 when the dog 50 has been moved to the retarded end 54 of its slot 52 and, therefore, has the inertia of the driven parts behind it, and the shock of sudden stopping of the clutch is absorbed by a heavy spring 85 engaged by the lower end of the arm 62.

An anti-back lash finger 90 pivoted on the frame 64 at 91 is normally urged by a spring 92 to engage a notch 93 in the driven member part 33 of the clutch 30 after the interrupting finger 60 engages the stop dog 50, and moves it to its retarded position in order to prevent the clutch from back lashing and re-engaging itself under the force of the spring 56. When the solenoid 70 is energized to disengage the interrupting finger 60, a boss or projection 94 on the finger 60 rises against a sloping cam surface 95 on a lower arm of the finger 90 and lifts the finger 90 out of the notch 93 until the next time the clutch is disengaged. The sewing operation is the first operation in the cycle of the machine illustrated after the work has been positioned, and it is started by the closing of a manually operated switch 100 having a push button 101, Figs. 1 and 4, which energizes the solenoid 70 and the stitching mechanisms 10 and 11 commence operating as described. At the same time by mechanisms described in my said copending application, the work clamp 7 feeds to the left as viewed in Fig. 1. An adjustably positioned switch cam 102 attached to the moving work clamp 7 engages the arm 105 of a normally open switch 106 to close it at the end of sewing. The closing of the switch 106 energizes the solenoid 81 as described and stops sewing. The switch cam 102 is adjustable in position so that sewing will be stopped at the end of a row of stitching of predetermined length.

The solenoids 70 and 81 may be connected across the lines 110 and 111 of an electric power source through the switches 100 and 106 as shown in the simplified wiring diagram of Fig. 4 and they may be adopted to cooperate with the electric control mechanism along with the fluid pressure operations of the machine as fully shown and described in my said copending application.

I claim:

1. In a sewing machine, said machine having stitching mechanism and a work clamp movable relatively to each other, power operating means, a clutch connecting said stitching mechanism and power means, said clutch including a normally engaged driven part and a rotating stop dog which, when the latter is interrupted disengages said clutch and brings said driven part to a positive stop, and start and stop mechanism for said clutch including an interrupting finger engaging said stop dog to disengage and stop said clutch at the end of sewing and disengaging said stop dog to engage said clutch at the commencement of sewing; electric operating means for said interrupting finger, said means including a circuit, a solenoid in the circuit connected to actuate said finger and a control switch for said solenoid, said switch being actuated at a predetermined point in the cycle of operation of said machine.

2. In a sewing machine, said machine having stitching mechanism and a work clamp movable relatively to each other, power operating means, a clutch connecting said stitching mechanism, and said power means, said clutch including a normally engaged driven part and a rotating stop dog which, when the latter is interrupted disengages said clutch and brings said driven part to a positive stop, and start and stop mechanism for said clutch including an interrupting finger engaging said stop dog to disengage and stop said clutch at the end of sewing and disengaging said stop dog to engage said clutch at the commencement of sewing; electric operating means for said interrupting finger including a circuit, a pair of solenoids in said circuit, said solenoids being connected respectively to engage and disengage said finger, and switches for said solenoids, at least one of said switches being actuated at a predetermined point in the cycle of operation of said machine.

3. In a sewing machine having stitching mechanism and a work clamp movable relatively to each other, power operating means, a clutch connecting said stitching mechanism and power means, said clutch including a normally engaged driven part and a rotating stop dog which, when the latter is interrupted disengages said clutch and brings said driven part to a positive stop, and start and stop mechanism for said clutch including an interrupting finger engaging said stop dog to disengage and stop said clutch at the end of sewing and disengaging said stop dog to engage said clutch at the commencement of sewing; operating means for said interrupting finger including a circuit, a start solenoid in said circuit connected to disengage said finger, lock mechanism to hold said finger disengaged, a stop solenoid in said circuit connected to release said lock mechanism thereby allowing said finger to reengage, and switches for said solenoids, said switches being actuated at predetermined points in the cycle of operation of said machine.

MARION C. RICH.

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