Dec. 16, 1952 F. CHATFIELD ET AL 2,621,620

NEEDLE DIPPER MECHANISM

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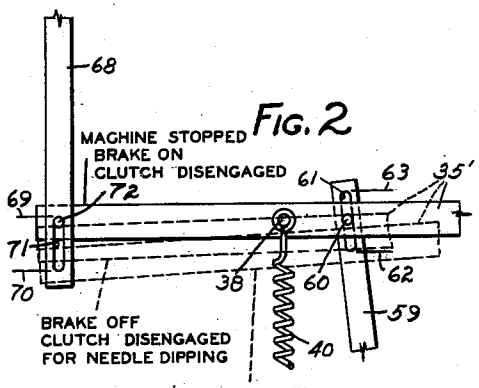


FIG. 2

FIG. 1

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Dec. 16, 1952 F. CHATFIELD ET AL 2,621,620

NEEDLE DIPPER MECHANISM

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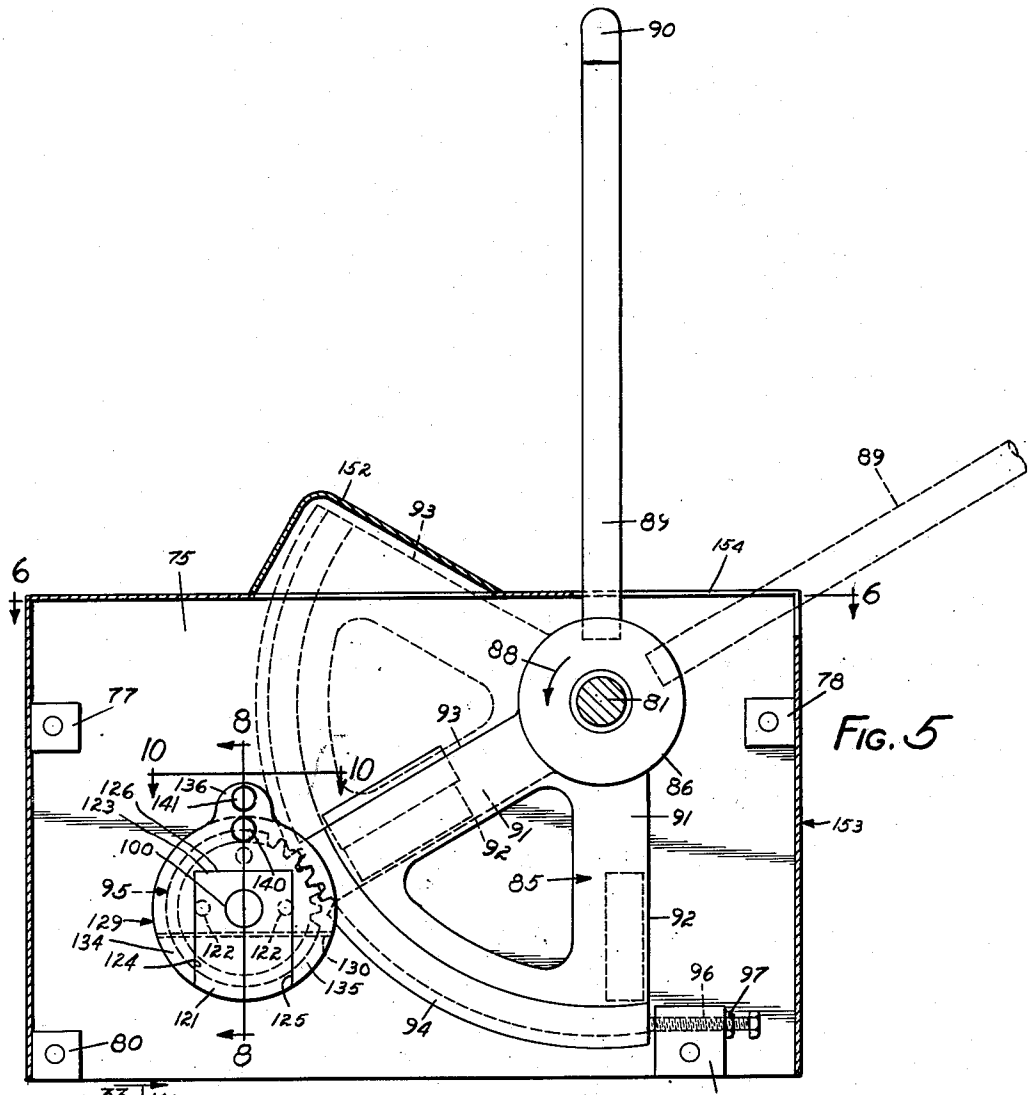


FIG. 5

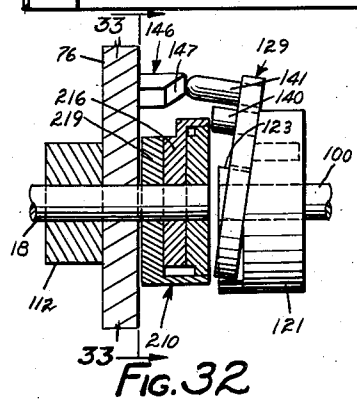


FIG. 32

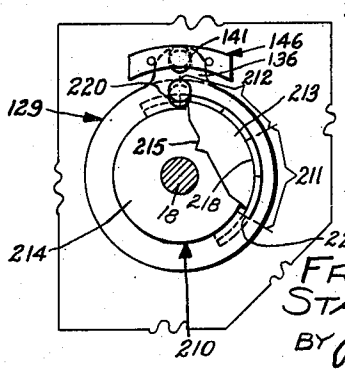


FIG. 33

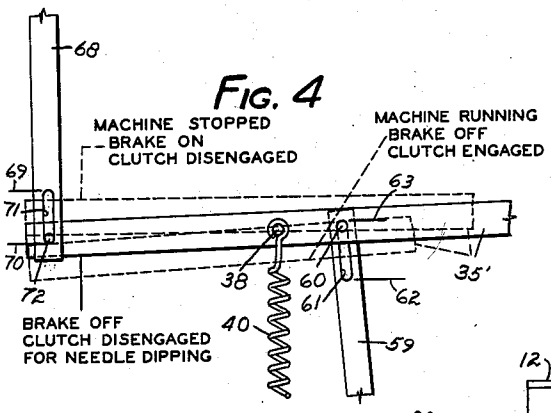
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NEEDLE DIPPER MECHANISM

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FIG. 4



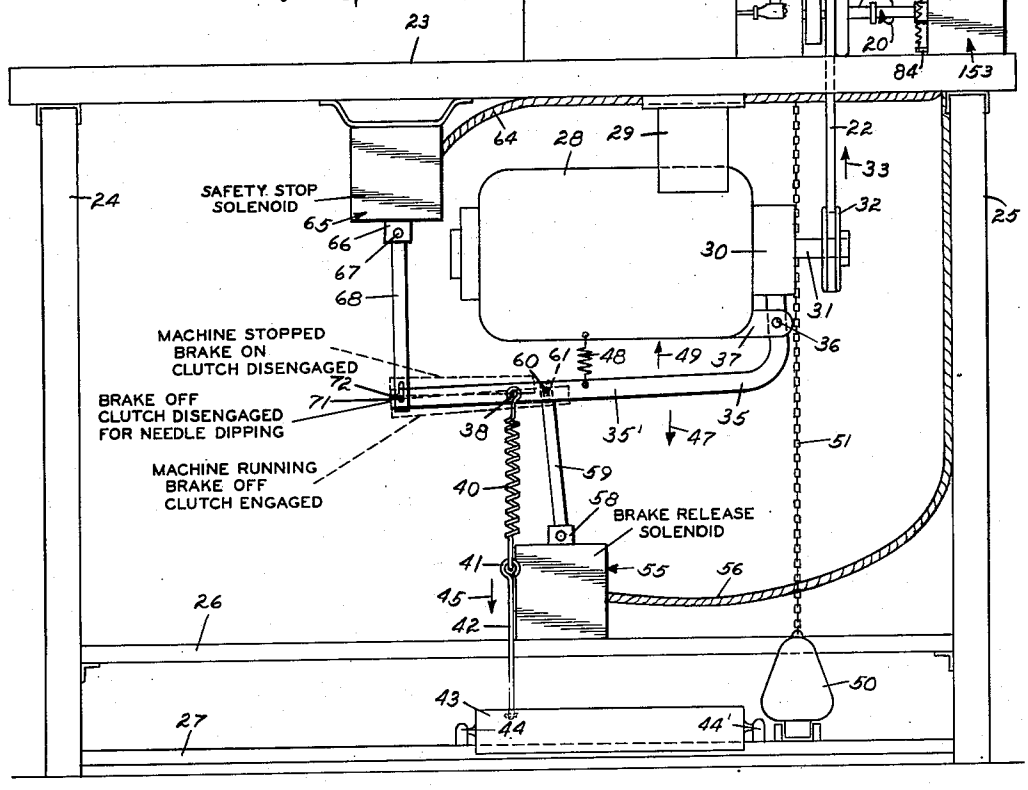


FIG. 3

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NEEDLE DIPPER MECHANISM

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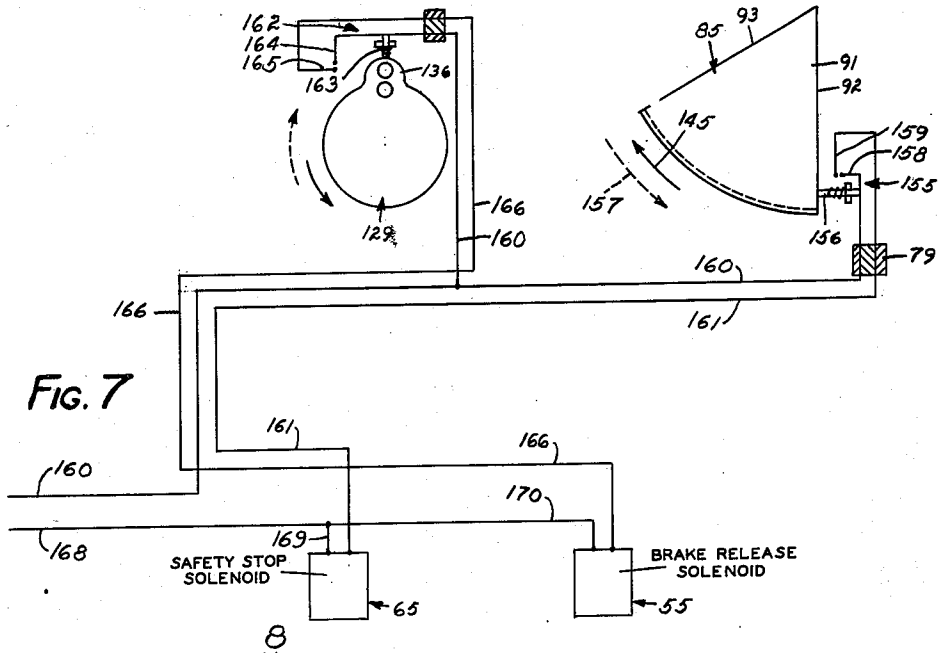


FIG. 7

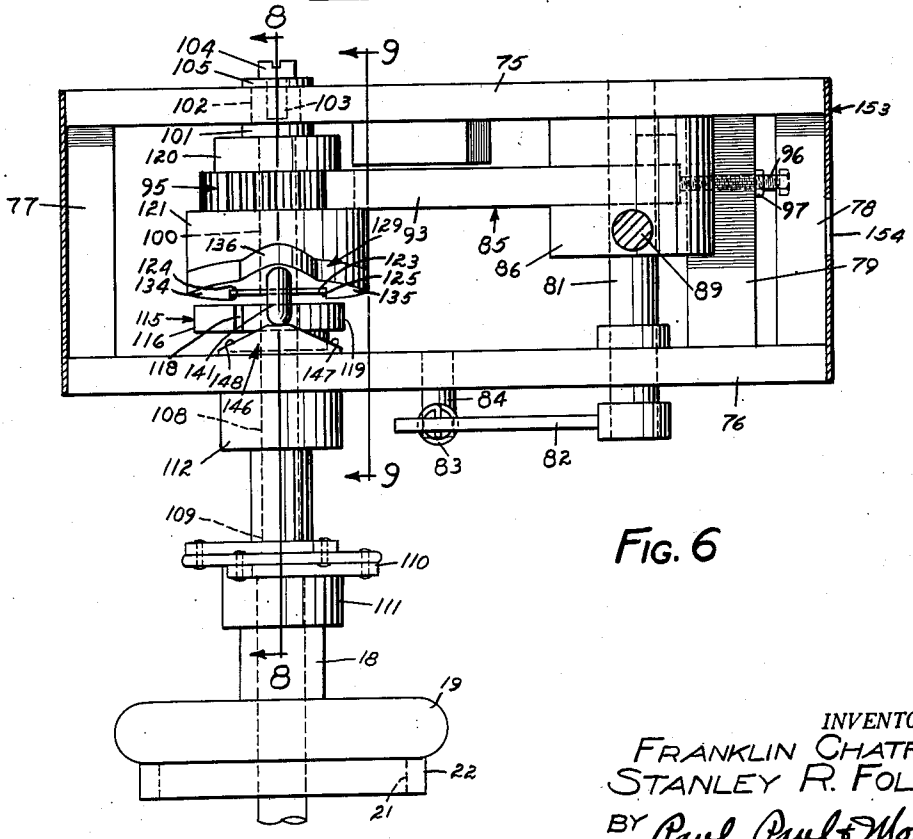


FIG. 6

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NEEDLE DIPPER MECHANISM

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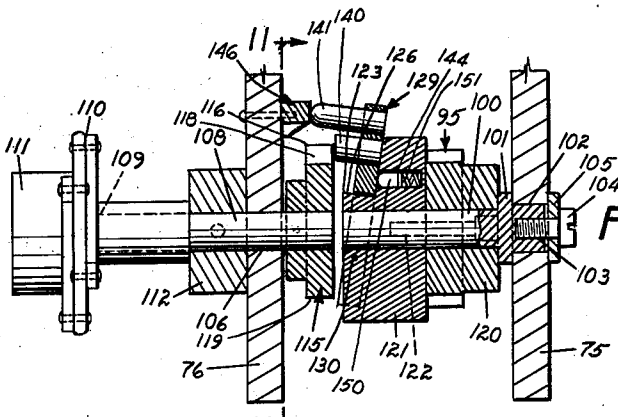


FIG. 8

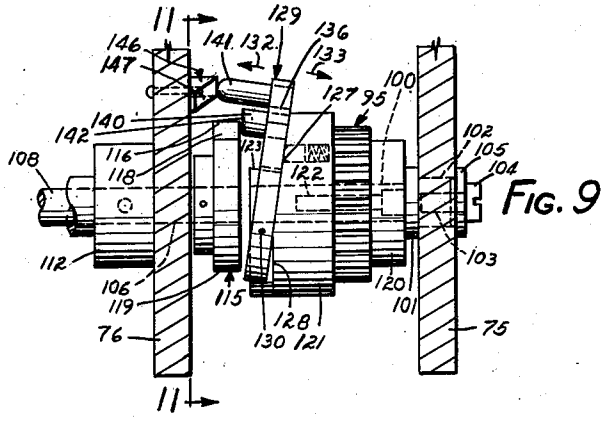


FIG. 9

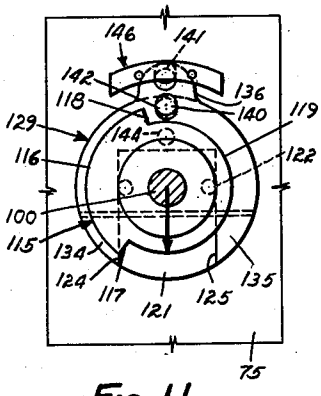


FIG. 11

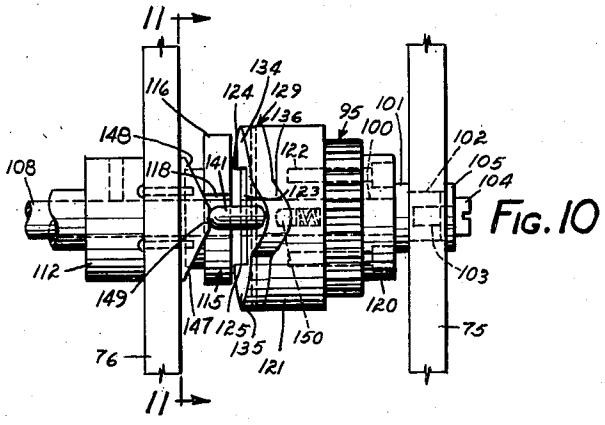


FIG. 10

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NEEDLE DIPPER MECHANISM

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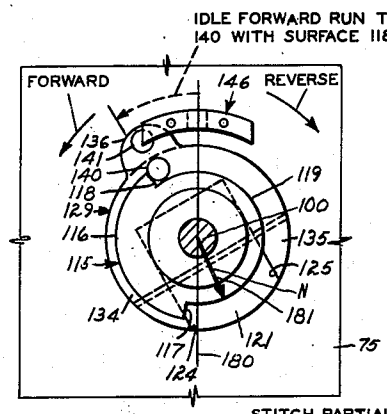


FIG. 13

STITCH PARTIALLY COMPLETED AND BEYOND UNLOCKING POSITION

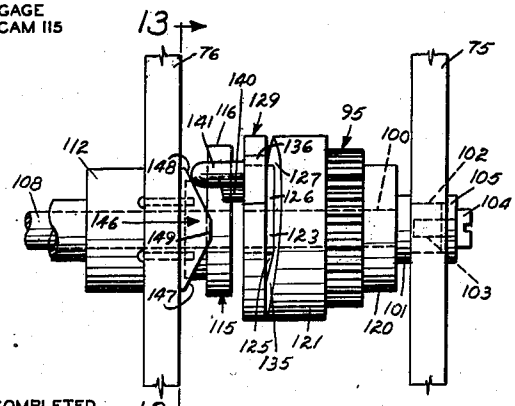


FIG. 12

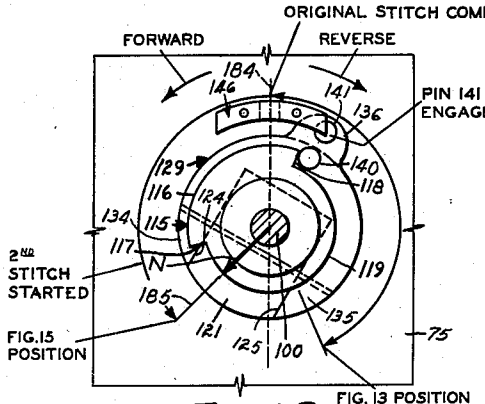


FIG. 15

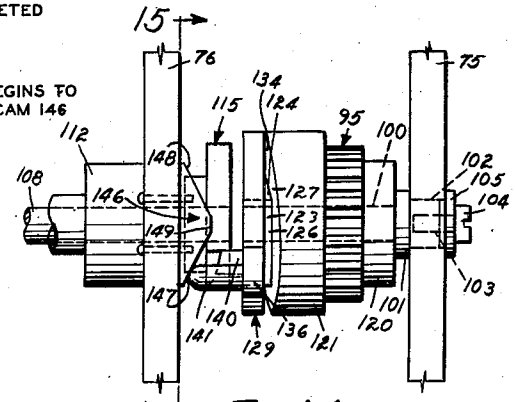


FIG. 14

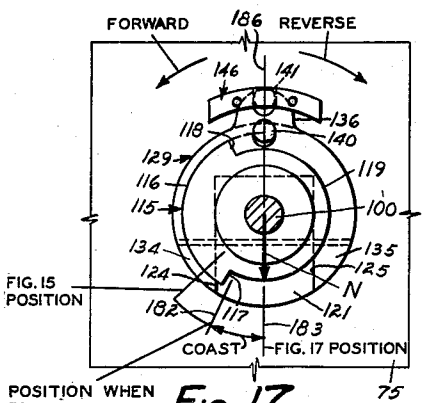


FIG. 17

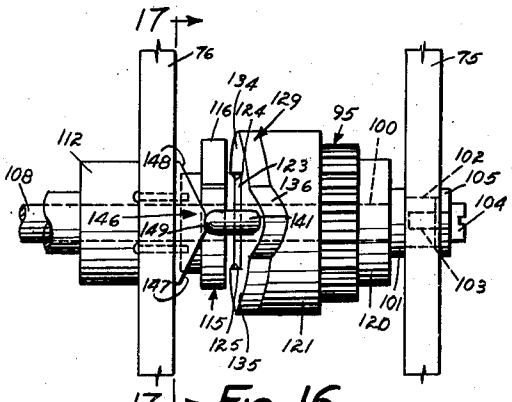


FIG. 16

2ND STITCH CARRIED FORWARD BUT IS STOPPED SHORT OF UNLOCKING CONDITION

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NEEDLE DIPPER MECHANISM

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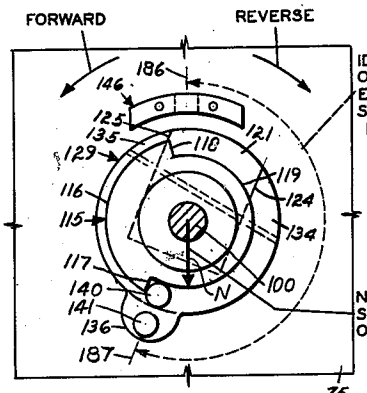


FIG. 19

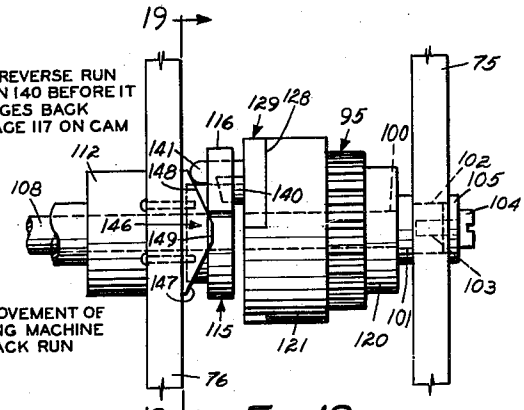


FIG. 18

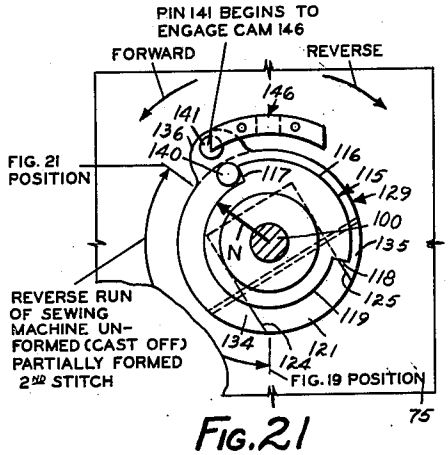


FIG. 21

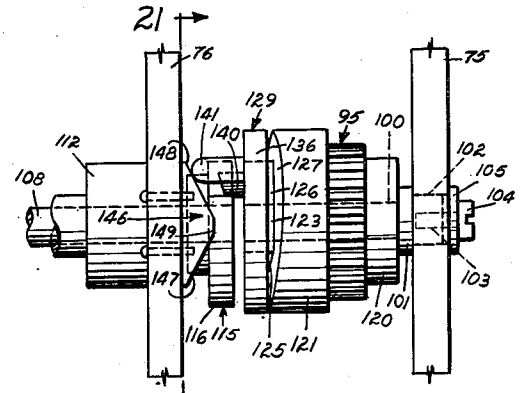


FIG. 20

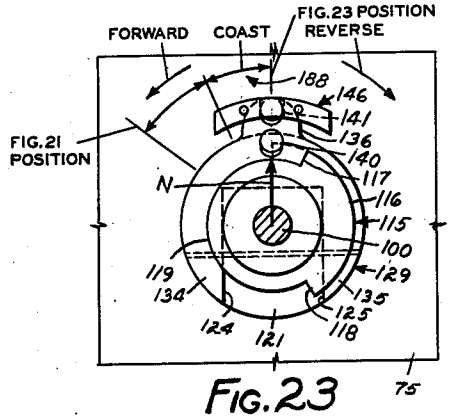


FIG. 23

2ND STITCH COMPLETELY CAST OFF AND NEEDLE BAR RAISED TO FULL UP POSITION

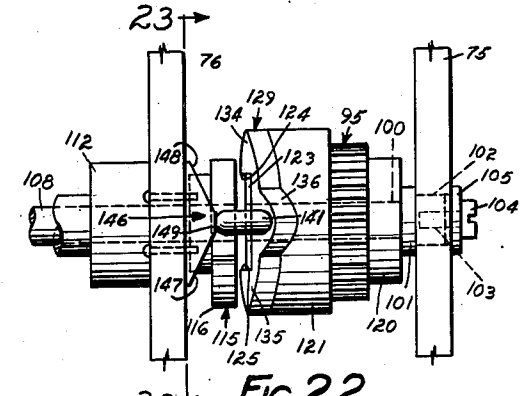


FIG. 22

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NEEDLE DIPPER MECHANISM

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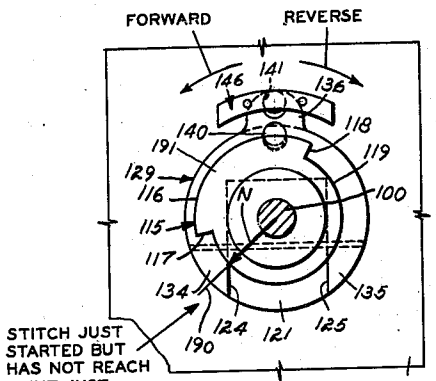


FIG. 25

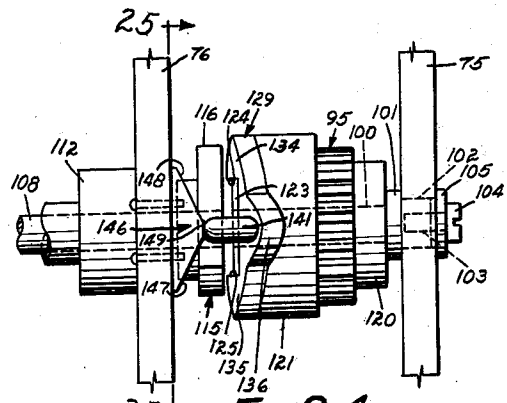


FIG. 24

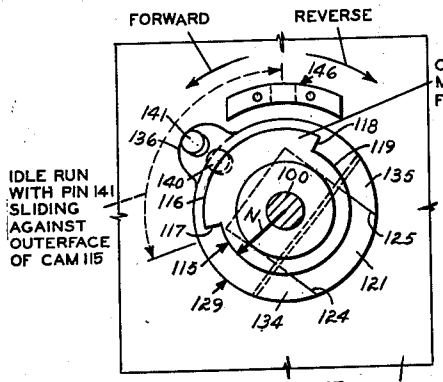


FIG. 27

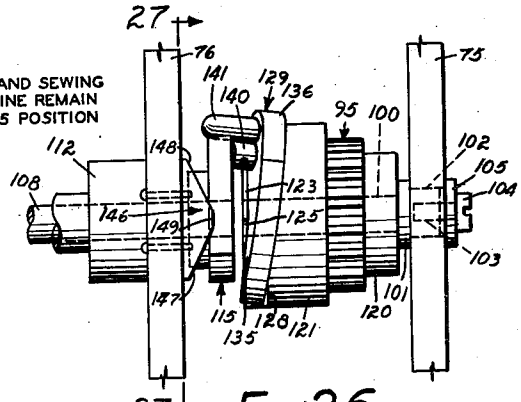


FIG. 26

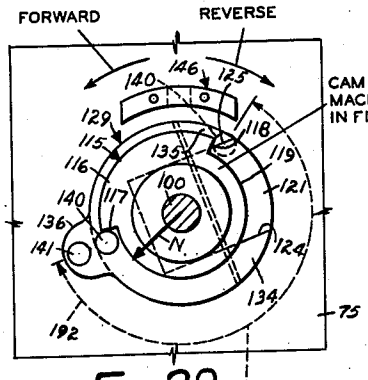


FIG. 29

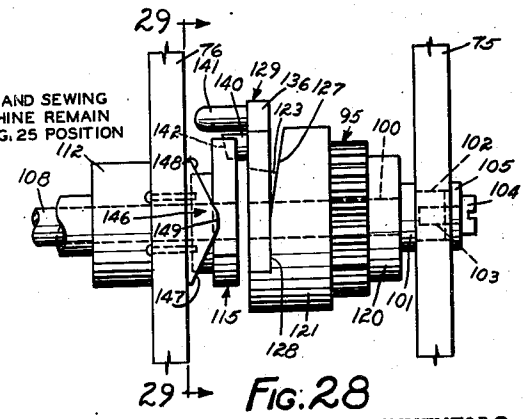


FIG. 28

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NEEDLE DIPPER MECHANISM

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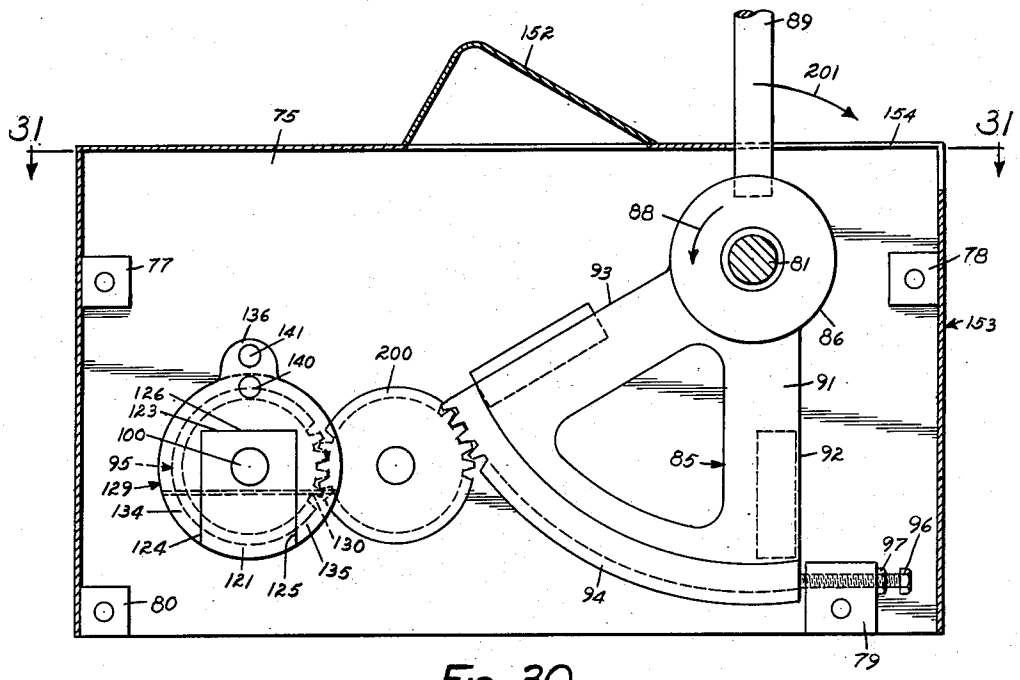


FIG. 30

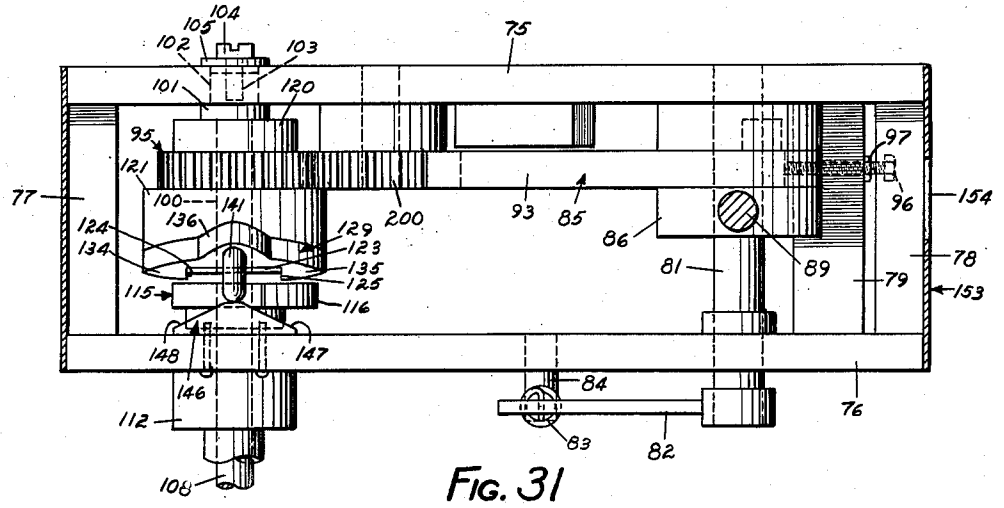


FIG. 31

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Patented Dec. 16, 1952 2,621,620

UNITED STATES PATENT OFFICE

2,621,620

NEEDLE DIPPER MECHANISM

Franklin Chatfield and Stanley Roberts Folsom, Minneapolis, Minn., assignors to Munsingwear, Inc., Minneapolis, Minn., a corporation of Delaware

Application May 9, 1949, Serial No. 92,182

11 Claims. (Cl. 112—219)

1

This invention relates to devices for use in conjunction with sewing machines and more particularly for use with power driven production sewing machines. In the operation of such sewing machines, of which there are many varieties, stitch formation is accomplished by the interaction of the needle thread (or multiple needle threads) with another stitch forming device which may or may not carry another thread or threads. The device which cooperates with the needle to form the stitch may be a shuttle, but in most machines is a looper bar mechanism or multiple looper bar mechanism.

The instant invention is for use with sewing machines of such types. In general, it may be stated that the instant invention is used in conjunction with chain or lock stitch sewing machines, such as one, two, three or higher multiple needle machines having single, double or triple interlock; flat lock machines; multiple needle machines using lower or upper and lower looper mechanism; one, two or three needle triple interlock machines and the like. It is to be understood that this is by no means a complete list of types of sewing machines to which the invention is applicable.

During the operation of such sewing machines as, for example, at the end of a stitched seam, the operator of the machine may desire to withdraw the work and this necessitates drawing off the threads from the needle or needles and also in many machines requires the simultaneous withdrawal of thread from the shuttle or looper mechanisms, so as to allow cutting the threads beyond the termination of stitching. This provides suitable length of threads extending from the machine preparatory to insertion of more work and allows the thread or threads to extend beyond the line of stitches just formed. To permit such withdrawal of the thread or threads, which in every case must run smoothly and simultaneously through the eye of the needle (or needles) and where the shuttle or looper mechanisms carry thread also through the eye or eyes of the shuttle or looper mechanisms, it is necessary to have completed the last stitch and to have the needle (needle bar) retracted from the work (up position) and in a prescribed position so that the thread tension mechanisms will release all threads and permit them to be drawn out smoothly. In the simplest sewing machines, namely those of the household type a considerable range of angular movement of the sewing machine drive shaft and corresponding considerable range of movement of the needle before and after reaching retracted (up) position, is possible and the operator can usually obtain a condition of "release of the threads" by bringing the needle toward and past the "up" position and then "feel for the release position" by rotating the hand

2

wheel forwardly and reversely while applying slight tension to the work until the threads release and run free. However, in many precision machines, particularly the more complex production machines, a prescribed sequence of operations must be followed to obtain such "release" of the threads. This sequence of operation is known in the textile arts as "needle dipping" and is as follows:

When the line of stitching is to be completed, the operator brings the sewing machine controls to the stopping position and the sewing machine therefore stops, but the position of the needle bar and needles carried thereby may be at any place throughout the range of movements of these devices during stitch formation, and thus may be completely down with the needles completely penetrating the work or entirely retracted (up) with the needles completely withdrawn from the work, or at any place between these extremes on either the downstroke or the upstroke of the needle bar. The stopping position is a random occurrence and the operator has no way of predetermining the stopping position. Accordingly, the sewing machine may come to rest with the stitch in any degree of formation. It should be borne in mind that throughout the sequence of occurrences in stitch formation, the same things do not happen on the upstroke of the needle as happen on the downstroke of the needle. Furthermore, stitch formation is not a reversible process, i. e. the thread cannot be "unstitched" by reversing direction of running of the sewing machine, except that during the formation of the stitch and up to a certain point in stitch formation, which is before the threads lock, reversing direction of the sewing machine will permit the partly formed stitch to be "cast off."

In the sequence of "needle dipping" the operator takes ahold of the sewing machine hand wheel after it has come to rest and then propels it slowly by hand in the stitch-forming direction until the stitch which is in the process of being made is completed and the process of formation of the next stitch is begun and carried to a point just short of locking the stitch. Then the direction of rotation of the hand wheel is reversed and it is "backed" until the needles (needle bar) are at the retracted (up) position. When this is done the threads of any machine will be released and (provided the presser foot is raised) the material can be withdrawn and the thread or threads, of which the line of stitches were formed, will be withdrawn easily (and if several threads are involved, simultaneously) through the eyes of the needle (or needles) and the eyes of the bobbin or looper bar or bars or other stitch-forming mechanisms, in the event these carry threads.

It may be noted parenthetically that, depend-

ing upon the design of the machine, the direction of rotation of the hand wheel may be in either direction when the machine is running in the stitch-forming direction. Thus, in some machines the top of the hand wheel moves towards the operator while forming the stitches, whereas in others the top of the hand wheel moves away from the operator when the machine is running in stitch-forming direction. Throughout this specification movement of the machine mechanism in stitch-forming direction will be designated the "forward direction," regardless of whether the top of the hand wheel runs towards or away from the operator, whereas movement opposite to the stitch-forming direction will be called "reverse direction."

Using this nomenclature, the process of needle dipping is (1) to stop the machine, (2) to propel the machine by hand in the forward direction until the partially formed stitch is completed and the next stitch is partly completed, to a condition short of that point in the stitch formation where the threads lock, i. e. can be cast off and the partially formed stitch "un-formed" and (3) to then propel the machine by hand in a reverse direction until the needle bar is completely retracted (up) which has the effect of unforming the last partially formed stitch. When this is done, and regardless of the particular style of stitch, the threads will be released and (provided the presser foot is raised) the work can be pulled out and thread or threads running through the stitch-forming mechanism will run freely and can be extended indefinitely (drawn out) to any desired length.

The process of "needle dipping," while seemingly very simple, is actually difficult to achieve in production machines because of the fact that production machines are motor driven and stopped by brakes. As a result of this it takes weeks and even months for an operator to learn to put this "needle dipping" technique into practice, and some operators never learn the technique. The reason is that the modern production sewing machine is a high speed precision instrument, and requires precise control and is driven and stopped by a treadle mechanism which controls the running of the machine through a clutch on a high speed constantly running motor and controls the stopping by means of clutch release and brake. Thus, usually, the drive consists of a powerful high-speed, constantly-running motor (or line shaft) connected through a combined clutch-brake mechanism to the sewing machine drive wheel, the clutch-brake mechanism being connected to a foot treadle so that when the treadle is pushed forwardly (toe down, heel up) the brake goes off and the clutch is engaged to run the machine; when the treadle is centered (placed neutral, i. e. equal pressure on toe or heel) the brake goes off and the clutch is released and when the treadle is moved backwardly (heel down, toe up), the clutch is disengaged and the brake is applied.

These three positions of the treadle (i. e. "run," "neutral" and "stop") are set close and the "neutral" position (clutch disengaged, brake off) is hence closely prescribed. If the treadle is pushed forwardly (toe down) from "neutral," the machine will begin to run and if the treadle is pushed heel down from "neutral" the brake is set and the machine cannot be turned even by hand. While it would be possible to adjust the treadle so as to give a broad "neutral" range, this is undesirable because the machine should always be under precise control (i. e. should either run or stop and should not coast) and also because for best production the treadle controls should be set "sensitive" and responsive to slight movements of the operator's foot.

These facts concerning the power drive and controls have their effect upon the "needle dipping" sequence for the needle dipping is carried out by propelling the machine by hand; hence, it can only be done when the machine controls are in neutral, i. e. clutch disengaged and brake off. Therefore, to carry out the "needle dipping sequence" on power driven machines the operator must first learn to position the controls in "neutral" and then carry out the "needle dipping" sequence. This is difficult to do.

It is an object of the present invention to provide a needle dipper mechanism and more particularly to provide a mechanism for carrying out the needle dipping function automatically.

It is also an object of the invention to provide a mechanism for carrying out the needle dipping sequence on power driven sewing machines.

It is a further object of the invention to provide an operator controlled mechanism for power driven sewing machines having a single operator control for automatically placing the machine in neutral and then carrying out the needle dipping sequence, and to provide such a mechanism in which provision is made for guarding against power drive of the sewing machine during the needle dipping sequence.

It is another object of the invention to provide an operator controlled mechanism for accomplishing needle dipping with power and also to provide an operator controlled mechanism for carrying out the sequence of needle dipping on any sewing machine.

Other objects of the invention are those inherent in the apparatus herein illustrated, described and claimed.

The invention is illustrated with reference to the drawings in which corresponding numerals refer to the same parts and in which

Figure 1 is a front elevational view of the usual form of production type power-driven sewing machine with which the apparatus of the invention is incorporated;

Figure 2 is an enlarged fragmentary front elevational view of a portion of the control mechanism of the instant invention;

Figure 3 is a front elevational view of the sewing machine illustrated in Figure 1, to which the invention is applied, showing the operating parts in another position;

Figure 4 is an enlarged front elevational view of a portion of the apparatus of Figure 3;

Figure 5 is a transverse sectional view taken in the direction of arrows 5—5 of Figure 1 showing a portion of the needle dipping mechanism;

Figure 6 is a plan view of the apparatus shown in Figure 5 and is taken along the lines 6—6 of Figure 5;

Figure 7 is a wiring diagram of certain of the electrical components of the invention, together with certain of the mechanical components thereof;

Figure 8 is a vertical sectional view of a portion of the mechanism shown in Figures 5 and 6, taken in the direction of arrows and along the line 8—8 of Figures 5 and 6;

Figure 9 corresponds to the apparatus shown in Figure 8, except that it is a fragmentary vertical elevational view in the direction of and along the line 9—9 of Figure 6;

Figure 10 is a plan view of the portion of the apparatus shown in Figures 8 and 9 and is taken along the line and in the direction of arrows 10—10 of Figure 5;

Figure 11 is a side elevational view partly in section taken along the line and in the direction of arrows 11—11 of Figures 8, 9 and 10.

The series of views Figures 12–29 are shown in corresponding pairs. Thus, Figures 12 and 13 correspond; Figures 14 and 15 correspond and so forth through this series. Throughout this series the even-numbered views, viz. Figures 12, 14, 16 etc. to Figure 28 correspond to Figure 10, being a fragmentary top plan view taken along the line and in the direction of arrows 10—10 of Figure 5, whereas the odd-numbered Figures 13, 15, 17 etc. through Figure 23 correspond to Figure 11. This series of views, Figures 12–13, Figures 14–15, Figures 16–17 and so on through Figures 22–23 illustrate certain of the working parts of the needle dipper throughout the series of positions through which the parts move during the needle dipping operation for various positions in which the sewing machine has stopped prior to the needle dipping operation. As further explanation, it is noted that Figure 13 is a sectional view in elevation, taken along the line 13—13 of Figure 12. Figure 15 is a sectional view in elevation taken along the line 15—15 of Figure 14. Figure 17 is an elevational view partly in section taken along the line and in the direction of arrows 17—17 of Figure 16. Figure 19 is an elevational view partly in section taken along the line and in the direction of arrows 19—19 of Figure 18. Figure 21 is a sectional view partly in elevation taken along the line and in the direction of arrows 21—21 of Figure 20. Figure 23 is a sectional view partly in elevation taken along the line and in the direction of arrows 23—23 of Figure 22. Figure 25 is a sectional view partly in elevation taken along the line and in the direction of arrows 25—25 of Figure 24. Figure 27 is a sectional view in elevation taken along the line and in the direction of arrows 27—27 of Figure 26. Figure 29 is a sectional view in elevation taken along the line and in the direction of arrows 29—29 of Figure 28.

Figure 30 is a side sectional view corresponding to Figure 5, except that it is for a sewing machine which is driven in the opposite direction of rotation for stitch formation than that in Figure 5. Figure 30 is taken along the same section line as shown at line 5—5 of Figure 1. Figure 31 is a plan view with the cover removed, of the apparatus shown in Figure 30, and is taken along the line and in the direction of arrows 31—31 of Figure 30.

Figures 32 and 33 show a somewhat modified form of adjustable cam for the needle dipping mechanism, Figure 32 being an elevational view partly in section and Figure 33 being a fragmentary side view taken along the line and in the direction of arrows 33—33 of Figure 32.

Referring to the drawings and particularly to Figures 1–9 the apparatus is illustrated as applied to a conventional power-driven production type sewing machine generally designated 10 which includes a frame 11, work plate 12, needle bar 13, a needle operating mechanism 15, various thread guides and thread tension mechanisms 16, 17 and the like and a main sewing machine drive shaft 18, which is provided with a hand wheel 19. This particular sewing machine, which it must be understood is illustrative of many types to which the invention is applicable, is of the type which

rotates in the direction of arrow 20 when moving in the stitch forming direction, that is to say the top of the hand wheel 19 moves away from the front of the machine (operator station) when the machine is moving in the stitch-forming direction. The hand wheel 19 is provided with a V-pulley at 21 in which a V-belt 22 or other suitable drive belt runs. The entire sewing machine (sewing head) is mounted upon the board 23 which is supported by legs 24, 25 that are in turn tied together by the bottom cross braces 26 and 27.

Beneath the sewing head 10 and fastened to the under side of the board 23 there is a constantly running motor 28 which in some machines is replaced by a line shaft. The support for the motor is by means of pedestal 29 reaching up to and fastened to the board 23. The motor 28 is of the constantly rotating type and is provided at one end with a combined clutch-brake mechanism 30, by means of which the rotation of the motor may be communicated to the drive shaft 31 and to the drive pulley 32 over which the V-belt 22 also travels so that when the pulley 32 is driven by the motor, the belt 22 will travel in the direction of the arrow 33 and drive the hand wheel 19 and shaft 18 of the sewing machine in the stitch-forming direction.

The clutch-brake mechanism 30, which per se forms no part of the instant invention, is arranged to be actuated by means of a lever 35 pivotally mounted at pin 36 on bracket 37, which is a part of the motor. The lever 35 has a bend in it and extends across below the motor at the portion 35' and near its outer end is provided with a pin 38 to which the upper end of a tension spring 40 is attached, the lower end of the spring 40 being connected to the eye 41 in the upper end of a pull rod 42 that extends down to and is pivotally attached to the rear part of a treadle 43, the latter being pivotally mounted at 44 and 44' upon the bottom cross brace 27. The treadle 43 when moved to the forward position (toe down, heel up) causes the rod 42 to be pulled downwardly in the direction of arrow 45 and consequently the lever 35 is pulled downwardly in the direction of arrow 47 and pivots about the pin 36 and in this position causes the brake to be disengaged and the clutch to be engaged, thus allowing the motor 28 to drive the shaft 31 and pulley 32 in a clockwise direction as viewed from the right end, or stated another way, in the direction to move the front side of the belt 22 upwardly in the direction of arrows 33. The sewing machine 10 is accordingly driven in the stitch-forming direction.

When the operator releases the toe down, heel up pressure on the treadle 43, the downward pull on the rod 42 is released and the lever 35 is moved upwardly by means of a spring 48 connected between the lever 35 and the motor 28. The spring 48 causes the lever 35 to move upwardly in the direction of arrow 49 and therefore moves the lever about the pivot pin 36 through the neutral position where the clutch is disengaged and the brake not yet engaged, and into the braking position where the clutch is disengaged and the brake is engaged. When this occurs, a braking force is applied to the shaft 31 and hence to the pulley 32, and this braking force is communicated through the belt 22 to the drive shaft 18 of the sewing machine, causing the latter quickly to come to a stop and to be held immovably. This is the customary type of production sewing machine control. It may also be

noted that upon the bottom cross brace 27 there is also mounted a supplemental treadle 50 which is connected through the chain 51 to the free end of the lever 52 that serves to raise or lower the presser foot of the sewing machine. These latter elements are illustrated and herein mentioned merely as showing the customary type of sewing machine auxiliary mechanisms.

In accordance with the instant invention the lever 35 is provided with supplementary solenoid actuated mechanism by which the lever can be positively moved to the neutral (clutch disengaged-brake not engaged) position, but held against movement beyond the neutral position to the running position where the clutch would be engaged. These supplemental mechanisms take the form of a pair of solenoids which are best illustrated in Figures 1–4. One of these solenoids, namely the brake release solenoid 55, is provided with a winding served by a pair of conductors 56 and has an armature 58 which is pulled upwardly by lever 35 due to the action of spring 48. When pin 60 on lever 35 reaches end 63 of slot 61, the link 59 and armature 58 are lifted. The armature 58 is pulled downwardly by the magnetic action of the solenoid. The armature 58 is coupled by means of a link 59 to a pin 60 set crosswise in the motor control lever 35. The member 59 has a slot 61 in it which has a length extending from the line 62 to the line 63, Figure 2. The length of the slot 61 is such that when the solenoid 55 is energized the upper end of the slot at the line 63 will engage upon the pin 60 set in the lever 35 and will pull the pin, and hence the lever, to the neutral position shown in full lines in Figure 4. However, the length of the slot 61 is such that when the solenoid 55 is de-energized and the link 59 hence is moved to the position shown in Figures 1 and 2, the operator can, by moving the treadle 43, cause the lever 35 to move beyond the neutral position and into the running position (denoted "Machine Running Brake Off Clutch Engaged") in Figures 1 and 3 and shown by the lower dotted lines in these figures. Thus, the action of brake release solenoid 55 is such that when energized it will, through the link 59 and slot 61 and pin 60, cause the lever 35 to be drawn down to the neutral position. The movement of the solenoid 55 is a very rapid, snap action movement and accordingly when the armature 58 thus moves rapidly downwardly when the solenoid is energized, it produces a quick downward pull on the link 59 and this causes the lever 35 likewise to be pulled down rapidly. The fact that slot 61 extends downwardly far below the pin 60 when in the full line position shown in Figure 4 would permit the lever 35 when pulled by armature 58 to move downwardly and then by inertia to move beyond the neutral position, and hence into the position where the brake is off and the clutch is engaged (shown by the lower dotted line position in Figure 2) and hence the machine would tend to start and run a little bit which is undesirable. In order to prevent this from happening there is provided a safety solenoid generally designated 65 which is energized through a pair of conductors 64.

The safety solenoid armature 66 of the solenoid 65 normally moves downwardly under its own weight and is lifted upwardly when the solenoid 65 is energized. The armature 66 is connected pivotally at 67 to the link 68 which, at its lower end, is slotted from the position 69 to the position 70, the slot being designated 71. The slot 71 serves as a connection to a pin 72 set crosswise through the end of the lever 35 of the motor control mechanism. It is the purpose of the safety solenoid 65 and the link connection 68 through slot 71 to the pin 72 to provide a stop against which the pin 72 may move and thus prevent the lever 35 from moving beyond the neutral position and into the running position. This stop which is actually the end of slot 71 in the link 68 is effective only during those portions of the use of the apparatus when the needle dipping function is about to be performed. The length of the slot 71 and its position along link 68 is such that when the solenoid 65 is energized the link 68 is moved upwardly to the position shown in Figure 4 and in this position the lower termination 70 of the slot 71 serves as an abutment against which the pin 72 can move, it being noted that when the link is up, the position of slot 71 is such that when the pin 72 is in the lower end of slot 71, viz. against end 70 the lever 35 is in the neutral position shown in full lines in Figure 4. Thus, by first energizing the solenoid 65 a stop is provided such that when the brake release solenoid 55 is subsequently energized, it will not pull the lever 35 downwardly beyond the neutral position. Yet the length of the slot 71 is such that when the solenoid 65 is de-energized and the link 68 is permitted to move downwardly to the position shown in Figure 2, enough length and position of slot is provided so that the pin 72 may move under control of the operator from the machine stop (brake on, clutch disengaged) position shown in full lines in Figure 2 all the way down through the neutral position (brake off, clutch disengaged) and to the machine running position (brake off, clutch engaged).

The energization of the solenoids 65 and 55 in the sequence just described is carried out by the mechanical action of the needle dipping mechanism now to be described.

Referring particularly to Figures 5 through 11, the mechanical needle dipping mechanism shown in Figures 5 and 6 includes a frame composed of side plates 75 and 76 which are fastened together by a plurality of cross frame members 77, 78, 79 and 80. Through the plates 75 and 76 there extends a pivot shaft 81 which is provided at its outer end with a firmly attached lever 82 to which a spring 83 is firmly attached at its outer end, the spring being anchored at its lower end on a pin 84 set into the side plate 76. The action of the spring 83 causes the outer end of the lever 82 to be pulled downwardly and this causes the shaft 81 to be rotated in the direction of arrow 88, as shown in Figure 5. Upon the shaft 81 there is provided a segmental gear generally designated 85 which has a hub portion 86 pinned or otherwise firmly attached to the shaft 81 so as to be rotatable therewith. Into the hub 86 there is set a hand lever rod 89 which is bent at its upper end 90 so as to provide a hand grip portion by means of which the operator may grasp the lever and pull it towards her during the needle dipping function. The hub 86 has a segmental gear portion 91—94 extending through the angularity defined by the boundaries 92 and 93 of the gear. The gear has a segmental portion 94 provided with teeth which engage with a pinion gear 95 presently to be described. The action of spring 92 and lever 82 is to cause the segmental gear 85 to be moved in the direction 88 to a stop position which is provided by means of an adjustment screw 96 set in the cross frame member 79, the screw being positioned so that the edge 92 of

the segmental gear moves against it when pulled in the direction of arrow 88 by the spring 83 and lever 82. The screw 96 can be adjusted and held in any adjusted position by means of the locking nut 97.

The gear 95, with which the teeth 94 on the segmental gear 85 engage, is mounted upon a stationary pivot shaft 100, as shown in Figures 8–10. The stationary shaft 100 has a flange at 101 and a reduced section 102 that fits neatly into a hole bored in the frame member 75. The reduced portion 102 is threaded at 103 to receive a cap screw 104 which passes through a washer 105. Thus, when the cap screw 104 is drawn up it pulls the reduced portion 102 firmly into the side plate 75 until the flange 101 is tight against the inside of the side plate and this accordingly serves to position the pivot shaft 100 accurately on the side plate. The opposite side plate 76 of the needle dipping mechanism is provided with a bearing hole at 106 which is aligned coaxially with the stub shaft 100. The bearing hole 106 serves to receive in journaling action the shaft 108 which extends outwardly at 109 to receive the flexible coupling 110 terminating in the coupling block 111, by means of which the apparatus is attached to the shaft 18 of the sewing machine. Upon the shaft 108 there is provided a heavy collar 112 which is pinned to the shaft. The collar 112 can be bored out so as to provide proper balance for the mechanism. Upon the inner end of the shaft 108 there is provided a cam generally designated 115 which is pinned to the shaft 108 so as to be rotatable therewith. The cam 115 has the shape shown best in Figure 11 and has a portion of maximum diameter 116 extending from the radial line 117 to the radial line 118, and a portion of minimum diameter 119 extending from the line 118 around to the line 117. The portion of maximum diameter is generally of less than 180 degrees angularity, whereas the portion of minimum diameter 119 is generally more than 180 degrees. The exact angularity between lines 117 and 118 and hence of the cam portions 116 and 119 is varied slightly for adjusting the device for different sewing machines, but it may be stated that the distance between the cam surfaces 117 and 118 is such that if the machine does not stop at a point just short of where the stitch can be cast off, the sewing machine will be propelled in needle dipping movement to that point and then on the reverse movement of the needle dipping mechanism to propel the machine in a direction opposite to stitch formation so as to bring the needle bar to the raised or fully retracted position so as to cast off the partially formed stitch. A slight allowance in cam angle is usually required at each end of the cam to allow for coasting of the machine at the ends of each of these hand propelled directions of movement.

The gear 95 is provided with a heavy boss portion 120 and is attached coaxially with the member 121. It may be noted that the gear is drilled through at a plurality of places to receive at least two attaching screws 122—122 which extend through the gear and into the member 121, which accordingly holds the gear and the member 121 firmly in coaxial relationship. It is to be understood, of course, that the entire gear 95 and member 121 could be made in one piece if so desired.

The member 121 is provided with a central land 123 which extends partly across the diameter of the member 121 from lines 124 to lines 125 of Figure 10. The land 123 has parallel sides at the lines 124 and 125 and a foreshortened top line at 126. At the sides and along the top of the member 121 there is provided a planar surface 127 which is set at an angle to the axis of the member 121, which is also coaxial with the shaft 100. The slanting portion 127 terminating at its lower end in the normal portion 128 which is at right angles to the axis of the member 121. The land 123 serves as a place for mounting the movable cam engaging member 129 which is pivotally attached to the land by means of the pivot pin 130 set through the member 129 into the land 123, the member 129 being thus free to move pivotally in the direction of arrows 132 and 133 about the pivot pin 130. The member 129 is bifurcated at its lower portion having parts 134 and 135 which extend downwardly along the sides 124 and 125 of the land 123 and pin 130 extends all the way through. The member 129 has a generally circular periphery around a part of its periphery but is provided at its upper end with a protruding boss-like portion 136 which is nevertheless of the same thickness as the entire member 129.

The member 129 is provided with two inset pins 140 and 141, the pin 140 being set closer to the axis of shaft 100 than the pin 141. The pin 140 has a smooth sharp edged planar end 142 which is parallel to the adjacent surface of the cam 115 when the member 129 is in the position shown in Figures 8 and 9. The surface 142 is positioned so that it will fall into abutment with the portion 116 of maximum diameter of the cam generally designated 115 when that portion of maximum diameter 116 is in angular position opposite the pin 140.

The pin 141, which is mounted in the boss 136 of the member 129 is provided with a smoothly rounded outer end and engages upon the arcuate cam generally designated 146 attached to the wall 76 of the needle dipping frame. The cam 146 is of partial segmental shape, as shown in Figure 11, and is provided with a slanted off end at 147 and another slanted opposite end 148, as shown in Figure 10. As the member 121 is rotated about the axis of shaft 100 the pin slides up upon either the cam surface 147 or the cam surface 148 (depending upon direction of rotation) until it reaches the point of maximum height of the cam at 149, at which point the member 129 is held in the position shown in Figures 8, 9 and 10.

Within the member 121 there is a recess 144 into which there is set a slug 150 which is pressed to the left, as shown in Figures 8–10, by means of the spring 151. The slug 150 bears against the back surface of the member 129 and tends to move member 129 in the direction of the arrow 132 so as to move the pin 141 into engagement with the cam 146.

The entire needle dipping mechanical mechanism heretofore described is covered by a cover 153 which extends downwardly along the front of the mechanism and across the top of the mechanism where it is provided with a slot 154 aligned with the handle 89 so as to permit movement of the handle from the full to the dotted-line position shown in Figure 5 and is also provided with the outwardly extending contour at 152 which receives the upper portion of the segmental gear 85 when in the dotted line position of Figure 5. The cover also extends downwardly across the back of the mechanism.

Within the needle dipping mechanism there

are mounted two switches, as shown in Figure 7. One of these switches generally designated 155 is mounted upon the cross frame member 79 and is provided with an insulated actuating bar 156 set in alignment with the edge 92 of segmental gear generally designated 95. The gear is normally moved to the position shown in full lines in Figure 7 but is adapted to be moved in the direction of the solid arrow 145 when actuated by the operator, being returned in the direction of the dotted arrow 157 by the action of spring 83 and lever 82, as previously described. The insulated actuating bar 156 serves, when the gear 95 is in the released position shown in Figure 7, to hold open the pair of contacts 158 and 159, thus open circuiting the connecting wires 160 and 161. The other switch, which is mounted within the needle dipping mechanism, is shown generally at 162 and is provided with an insulated switch actuating member 163 positioned so as to be engaged by the protuberance 136 on the member 129. When the member 129 is in the position shown in Figure 7, which is also the position shown in Figures 8–11 in which the needle dipping mechanism reposes when not actuated by the operator, the insulating actuating member 163 serves to hold contacts 164 and 165 apart, thus open-circuiting the line 160 and line 166. The line 160 is one of the power supply lines of the apparatus, the other power supply line 168 being connected through lead 169 to the safety solenoid 65 and through the lead 170 to the brake release solenoid 55. From the safety solenoid 65 line 161 extends to the switch 155 previously described, and from the brake release solenoid line 166 extends to the switch 162. The switch 155 is adjusted so that it is moved to closed position by the slightest movement of the segmental gear 95 away from the released position shown in Figure 7, and switch 162 is adjusted and the cam surface on the lug 136 is shaped so that switch 162 closes after the switch 155 has closed. Accordingly, when the operator operates the needle dipping mechanism by pulling forwardly on the lever 89 the switch 155 is the first one to be closed, and this accordingly immediately energizes the safety stop solenoid with the result that the link 68 is pulled to the position shown in Figure 4 and the lever 35 is thus prevented from being moved beyond the neutral position and into the running position. As the movement of the lever 89 of the needle dipping mechanism is continued, the switch 162 is closed and this energizes the brake release solenoid 55 with the result that it pulls down on the link 59 and causes the lever 35 to be drawn downwardly to the neutral position shown in Figure 4, but this quick downward movement due to the snap action of the solenoid 55 does not throw the lever beyond the neutral position because of the safety stop feature previously mentioned.

Referring now to Figures 12–29 which illustrate the action of the needle dipping mechanism, it may be stated before beginning the explanation that Figures 12–23 illustrate the sequence of the needle dipping operation when the machine has stopped with a stitch partially completed and beyond that point at which unlocking of the stitch can occur, whereas Figures 24–29 illustrate the first part of the action of the needle dipping mechanism under the condition where a stitch has just been started but has not reached the point just short of unlocking. In explaining the sequence of Figures 24–29 these figures run in sequence from Figure 24 through 29 and then the action continues exactly as in the sequence from Figures 14–23. In all of these figures the same nomenclature has been utilized.

The heavy arrow shown radially on cam 115 is intended to illustrate the position of the needle in the stitch forming operation, it being understood that the needle goes up and down in accordance with the vertical component of the heavy arrow shown in these figures. Thus, in Figure 13 the needle has proceeded beyond the fully down position shown at line 180 and is shown just as it has started its up run. Throughout all of these figures the arrow labeled "Forward" denotes the movement of the sewing machine in the stitch-forming direction, whereas the arrow labeled "Reverse" denotes the movement of the sewing machine in a direction opposite to stitch-formation. The arcuate dotted line dimensional arrows in all of these figures denote an idling operation, whereas the arcuate solid line dimensional arrows denote the condition where the needle dipping mechanism drives the sewing machine in either the forward or reverse direction, depending upon the point in the sequence of operation being depicted. The arcuate space labeled "Coast" denotes the amount of coasting of the sewing machine mechanism beyond the position to which it is driven by the needle dipping mechanism.

Referring now to Figures 12 and 13, the sewing machine has stopped with a stitch partially completed, but beyond the position at which unlocking (casting off) of the stitch will occur. The needle bar and needles of the sewing machine and cam 115, which rotates with the sewing machine, have passed the fully down position 180 for the needle and have come to rest at the position 181 in which the heavy arrow N is shown. The needle dipping mechanism herein illustrated always comes to rest with the lever 89 in the elevated position due to the action of spring 83 and lever 82 upon shaft 81, Figure 6, and accordingly the segmental gear 85 and the gear 95 is driven by handle 89 and the movable cam engaging member 129 carried by gear 95, and which in turn carries pins 140 and 141, comes to rest and is held in the position shown in Figures 10 and 11, which are positions of reference for comparison with the positions shown in Figures 12 and 13. It will be remembered that the cam 115, being attached to the sewing machine drive shaft, therefore always keeps a constant angular position with reference to the sewing machine and cam 115, therefore, is indicative of the position of the stitch-forming mechanism, including the needle bar and other devices for stitch-forming on the sewing machine. Arrow N is merely a reference arrow, the vertical component of which indicates the needle position. In Figure 13 the pin 140 which serves to propel the cam 115 has moved forwardly through an idle run, from the position shown in Figure 11 to the position shown in Figure 13, and during this movement the pin 141 has moved down the inclined cam surface 148 on the cam 146 and therefore permits the pin 140 to drop in behind the surface 118 on the cam 115. Therefore, continued movement of the lever 89 by the operator causes the pin 140 to propel the cam 115 and hence to propel the sewing machine in the forward direction, from the Figure 13 to the Figure 15 position which is the next change in action position. From the position shown in Figure 13 the pin 140 accordingly drives the cam 115

to the position shown in Figure 15, where the pin 141 begins to engage the surface 147 on the cam 146 and accordingly begins to move the pin 140 out from its condition of engagement with the surface 118 on the cam 115. However, complete disengagement of the pin 140 from surface 118 does not yet occur because the cam 141 must continue to ride up on the surface 147 for a slight distance, and therefore as the operator continues to pull the lever 89 in the forward direction (from Figure 15 toward Figure 17), propulsion of the sewing machine (cam 115 via pin 140) continues until the pin 141 rides to the top surface 149 of the cam 146 as shown in Figure 17, the pin 140 being meanwhile completely released from behind the surface 118, and therefore it no longer tends to propel the cam 115. It will be remembered, however, that throughout the entire course of needle dipping operation, the brake of the drive motor, which normally holds the sewing machine shaft immovable, is released and hence the forward movement of the sewing machine, due to the operation of the needle dipper lever 89 continues (coasts) for a slight distance beyond the time of disengagement of the pin 140 from the surface 118 on cam 115. This coasting movement is indicated in Figure 17 as the distance between the lines 182 and 183 and is labeled "coast." The amount of coasting for any individual needle dipping machine can be determined and the amount adjusted by changing the angular position between the surfaces 118 and 117 upon the cam 115. In this way the needle dipping machine may be adjusted to suit any particular sewing machine and particular operator. Ordinarily, no considerable range of adjustment is needed after the needle dipper has once been adapted to a particular sewing machine.

When moving through the range of movements from the position of Figure 13 to the position of Figure 17, the needle has been propelled from its position where it is inserted into the cloth being sewn, as in Figure 13, thence forwardly to a fully retracted position designated by the dotted line 184 of Figure 15, at which time the original stitch is completed. From this point on to the position shown by line 185, the further forward propulsion of the sewing machine starts a second stitch, which is, however, not completed in Figure 15, nor is it completed as the propulsion of the machine in the forward direction comes to a halt, as shown in Figure 17. In this position the second stitch is carried forward but it is stopped short of the condition where the stitch may be unlocked by reverse movement of the sewing machine. This "unlocking" of the stitch is sometimes called "casting off" the stitch. In the position shown in Figure 17 the operator has pulled the handle 89 of the needle dipping mechanism to the fully forward position shown in dotted lines in Figure 5. In this position, lobe 136 on cam 129 again opens switch 162 (see Figure 7), and this action de-energizes brake solenoid 55 and accordingly permits spring 43 to lift arm 35 and set the brake. This prevents excessive coasting (over-travel) of the sewing machine due to the operator's pull on the needle dipping mechanism handle 89. The operator then merely releases the handle or propels it backwardly toward the full line position. By releasing the handle the spring 83 will propel the handle backwardly and will carry all of the mechanisms backwardly with the handle.

Hence, after the needle dipping mechanism has moved the apparatus to the position shown in Figure 17, it is assumed that the handle is released and begins to return in reverse direction to its normal upright position shown in full lines in Figure 5. From the position shown in Figure 17 the pins 140 and 141 move through an idle run from the position of Figure 17, in which the pins 140 and 141 are at line 186, around to the position shown in Figure 19, where they are at line 187. During the first part of this movement the pin 141 slides down the surface 147 of the cam 146 and permits the pin 140 to assume a position such that as the continued rotation of the pins by means of the needle dipping mechanism will later bring the pins into engagement with the surface 117 on the cam 115, as shown in Figure 19. During this idle reverse run the cam 115 and the sewing machine which it propels remain stationary.

After the pin 140 engages the surface 117, as shown in Figure 19, the cam 115 is propelled from the position shown in Figure 19 through the position shown in Figure 21 to the position shown in Figure 23. During that part of this propulsion between Figures 19 and 21, the pin 140 is fully in engagement with the surface 117, but at the position shown in Figure 21, the pin 141 begins to slide up upon the surface 148 and after it has moved beyond the position shown in Figure 21, but before it reaches the position shown in Figure 23, this outward movement of the pin 141 on cam 148 causes the pin 140 to disengage from the surface 117, after which the cam 115 and the sewing machine which it propels, coast to a stop through a distance shown by the dimension labeled "Coast" at 188 in Figure 23. In Figure 23 the machine has stopped with the needle in the fully retracted position, and as previously stated, in this position, the cloth and line of stitching which has been formed, can, when the presser foot is raised, be withdrawn from the machine and the needle thread or threads and the bobbin thread (or looper thread or threads), if used in the particular machine, can be pulled out smoothly any desired distance.

Referring now to Figures 24 through 29, there is in these figures illustrated the operation of the machine when the machine has come to rest with the stitch just barely started and where it has not reached a point "just short of locking." In this condition the needle N is shown at position 190 and the portion 116 of the cam is accordingly positioned so that it is in the way of the surface 142 on the pin 140. As the operator grasps the handle 89 of the needle dipping mechanism and propels it in the forward direction, the pins 141 ride off of the high spot 149 on the cam 146 and in sliding down the cam surface 148 permits the surface 142 of the pin 140 to come into engagement with the flat surface 191 of the cam 115. In the continued movement from the position shown in Figure 25 through the position shown in Figure 27 and to the position shown in Figure 29 the pin 140 slides along the surface 191 of the cam 115, as shown in Figure 25. This is an idle run and has no effect so far as turning the cam 115 and the sewing machine attached thereto. Finally, when the pin 140 reaches the position shown in Figure 29, it passes beyond the surface 117 of the cam 115 and accordingly permits the pin 140 to drop in behind that surface. However, the pins 140 and 141 are being driven in the forward

direction by movement of handle 89 and, therefore, even though the pin 140 has dropped in behind surface 117, it does not yet propel the cam 115 but continues along a further idle run as denoted by the dotted arrow 192 until the pin 140 reaches the dotted line position shown in Figure 29 where it engages the surface 118 on the cam 115. By comparison it will be noted that in this latter position the pin 140 (dotted in Figure 29) is in the same position as shown for Figure 15 and hence continued movement of the pin 140 in the forward and reverse direction, therefore, drives the cam 115 through the sequence of positions shown for Figures 14–22.

Accordingly, regardless of where the sewing machine happens to stop, it is only necessary that the operator grasp the handle 89 and pull it forwardly and then release the same, and the sewing machine stitch forming mechanisms will be carried forwardly and the stitching process of formation will be completed and another stitch partially formed or, if the stitch is already in the desired position, no action will be taken by the cam 115 and the machine will not be driven further in the forward direction. Then this other partially formed stitch is cast off by reverse action of the needle dipping mechanism on the sewing machine, thus completing the needle dipping function to permit withdrawal of the needle and bobbin (or looper) threads. Throughout this action the brake release and safety solenoids are applied, as previously described, so as to release the braking action of the drive mechanism and yet prevent the machine from being driven by the power source.

It will be understood that Figures 12 to 29 are merely illustrative of the action for specific initial stopping positions. However, the action above described will be carried out regardless of the position in the process of stitch formation at which the machine happens to stop.

Referring to Figures 30 and 31 there is illustrated a needle dipping mechanism which is precisely the same as that previously described, except that a gear has been inserted at 200. Accordingly, forward motion of the handle 89 in the direction of arrow 201 causes the gear 95 to be propelled in a direction opposite to that previously described. The needle dipping mechanism shown in these figures is for a sewing machine in which stitch formation is accomplished when the power shaft of the sewing machine is driven oppositely to that shown for the device illustrated in Figures 1–29. Otherwise, the device is precisely the same.

Referring to Figures 32 and 33 there is illustrated a slightly modified form of cam 115 which permits adjustment of the angular position between the lines 117 and 118 on the cam. In the cam structure shown in Figure 32, the cam generally designated 210 is composed of three segments, viz. segments 211, 212 and 213. The segment 213 has a central boss portion 214 and a cam surface portion 215. The segment 212 has a central boss portion 216 and a flanged segmental portion 212, which is positioned radially with respect to the shaft on which the cam parts are mounted so as to be in contact with the outer surface 218 of the cam part 215. The cam portion 211 is a similar segmental part attached to a hub 219. It will be noted that the hubs 214, 216 and 219 are in contact with each other and each is provided with a set screw, not illustrated, by which it is attached to the shaft 18 of the sewing machine. The hub 214 may, if desired, be permanently attached to the shaft 18 and set screws provided for only 216 and 219 to allow adjustment of these elements with reference to the member 213. Thus, by loosening the set screws the hub 216 carrying the cam portion 212 may be adjusted from the full line position to the dotted line position of Figure 33 where it protrudes considerably beyond the ends of the cam portion 215 on hub 214. Similarly, by loosening the set screw in the hub 219 the cam 211 may likewise be adjusted outwardly. The effective portion of the combined cam arrangement is the front surface along the lines 33—33 of Figure 32 and the terminal portions 220 and 221 of the combined hub shown in Figure 33. Accordingly, by suitable adjustment the position of the terminal surface 220 can be changed to any position relative to the shaft 18 and likewise the terminal surface 221 may also be moved to any position relative to the shaft 18. The "narrowest" cam that can be produced is determined by the length 215 of the cam portion, whereas the maximum is shown at the dotted line positions for Figure 33. A greater range of movement from maximum to minimum for cam length can also be achieved by slightly different proportioning of the cam parts. This permits the adjustment of the cam to allow for different sewing machine inertia and also to allow for variation in the speed of actuation by the operator when this is desirable.

As many apparently widely different embodiments of this invention may be made without departing from the spirit and scope thereof, it is to be understood that we do not limit ourselves to the specific embodiments herein.

What we claim is:

1. A needle dipping mechanism for use in conjunction with sewing machines having a random needle stopping position at least one reciprocating thread carrying needle and mechanism cooperating therewith for forming stitches, and a rotary drive shaft for moving said needle and mechanism in said stitch forming relation, comprising a separate rotary drive member and means for limiting the rotation of said member to a predetermined distance first in a direction corresponding to the direction of rotation of said rotary drive shaft for stitch formation and then a predetermined distance in a reverse direction. clutch means for engaging said separate rotary drive member to said rotary drive shaft means cooperating with said clutch means to propel said rotary drive member and hence said rotary drive shaft in stitch forming direction from any place where it may have stopped in the process of stitch formation of the sewing machine through the completion of the stitch which was in the process of being formed when the machine stopped and into the formation of a succeeding stitch but short of the point in stitch formation where said stitch may be cast off and means then to propel said rotary drive member and said rotary drive shaft reversely until the needle of the sewing machine is substantially retracted.

2. The apparatus of claim 1 further characterized in that said rotary drive member includes a rotary shaft and operator controlled means for rotating the shaft forwardly and reversely.

3. The apparatus of claim 2 further characterized in that the operator propelled means includes a lever movable angularly through prescribed limits of travel and means connecting said lever and rotary drive member for rotating

the same forwardly and reversely as said lever is manually moved angularly.

4. The apparatus of claim 3 further characterized in that spring means is provided for normally rotating said rotary drive means in a direction opposite to the direction of stitch formation.

5. A needle dipping mechanism for use in conjunction with sewing machines having no predetermined needle stopping position and at least one reciprocating thread carrying needle and mechanism cooperating therewith for forming stitches, and a rotary drive shaft for moving said needle and mechanism in said stitch forming relation, comprising clutch having a rotary member connected to the rotary drive shaft of the sewing machine so as to rotate in constant synchronism therewith, said rotary member comprising one portion of the clutch, a second portion of the clutch separated from the rotary drive shaft engageable with the first portion so as to form a driving connection therewith, and movable means under the control of the operator and means limiting the movement thereof for rotating said second portion of the clutch a predetermined distance in a forward direction and means for automatically causing the engagement of the second portion of the clutch with the first portion to drive the rotary member and hence the sewing machine first in stitch forming direction from any position in the sequence of movements of stitch formation at which the machine may have stopped through the completion of the stitch in process of formation and thence into the formation of the next stitch, but short of the place in the stitch formation at which the stitch can be cast off, and then a predetermined distance in a direction opposite to the direction of stitch formation until the needle bar of the sewing machine is substantially elevated and means for then automatically disconnecting said clutch.

6. An apparatus of the type set forth in claim 5 further characterized in that said means under the control of the operator for rotating said second portion of the clutch includes a lever movable arcuately between predetermined limits and means connecting the lever and the second portion of the clutch for rotating the latter forwardly or reversely as said lever is moved forwardly or reversely.

7. An apparatus of the type set forth in claim 6 further characterized in that said lever is provided with biasing means for moving it to a datum position.

8. In a needle dipping mechanism for use in conjunction with sewing machines having at least one reciprocating thread-carrying needle and mechanism cooperating therewith for forming stitches, a rotary drive shaft for moving said needle and mechanism in said stitch forming direction, constantly rotating power means and cooperating clutch and brake means for connecting the power means to said rotary drive shaft for propelling the sewing machine in stitch forming direction and for disconnecting said rotary drive shaft from said power means, and for applying the brake for stopping the operation of the sewing machine, said clutch and brake means also including a neutral position where said clutch is disconnected and brake is not set, the improvement comprising a rotary member connected to the rotary drive shaft of the sewing machine so as to rotate in constant synchronism therewith, said rotary member including one part of a clutch, a second portion of the clutch engageable with the first portion so as to form a driving connection therewith, movable means under the control of the operator and means for limiting the movement thereof for rotating said second portion of the clutch and means for automatically causing the engagement of the first portion to drive the rotary members and hence the sewing machine, first in stitch-forming direction from any position in the sequence of movements of stitch formation at which the machine may have stopped through the completion of the stitch in process of formation and thence into the formation of the next stitch, but short of the place in the stitch formation at which said next stitch can be cast off, and then in a direction opposite to the direction of stitch formation until the needle bar of the sewing machine is substantially elevated and means for then automatically disconnecting said clutch, said means under the control of the operator including also means for automatically disconnecting the brake of said drive mechanism and means to prevent engaging the clutch thereof prior to movement of the sewing machine by said means under the control of the operator.

9. An apparatus of the type set forth in claim 8 further characterized in that said means under the control of the operator comprises a lever movable arcuately between predetermined conditions and includes means connecting said lever to said second portion of the clutch for moving the latter forwardly as the lever is moved in one direction and reversely as said lever is moved in the opposite direction.

10. The apparatus of claim 8 further characterized in that said means under the control of the operator includes a first electrical switch and a solenoid energized through said first electrical switch, said first electrical switch being actuated and said solenoid energized when said means under the control of the operator is moved from a normal position so as to actuate said solenoid, and first solenoid operated means operable to disconnect the brake of said power means, without, however, engaging the clutch.

11. The apparatus of claim 10 further characterized in that said means under the control of the operator includes a second electrical switch and a second solenoid energized through said second electrical switch, means to actuate said second electrical switch before the first electrical switch so as to actuate the second solenoid controlled thereby, and second solenoid actuated means operable to prevent movement of said clutch-brake mechanism to a position where the clutch is engaged.

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