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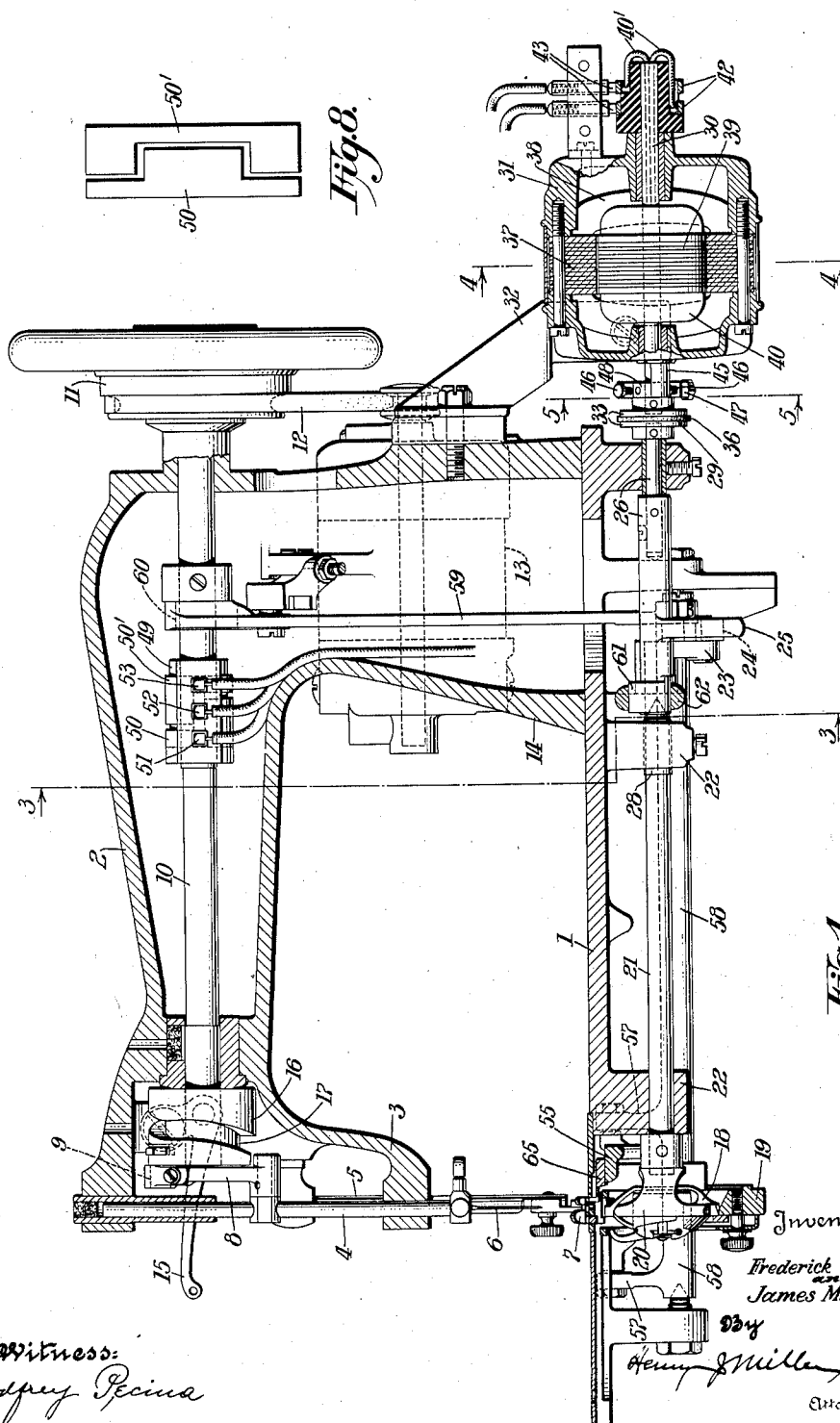
F. DIEHL ET AL

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ELECTROMAGNETIC SEWING MACHINE

Filed June 27, 1939

3 Sheets-Sheet 1



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ELECTROMAGNETIC SEWING MACHINE

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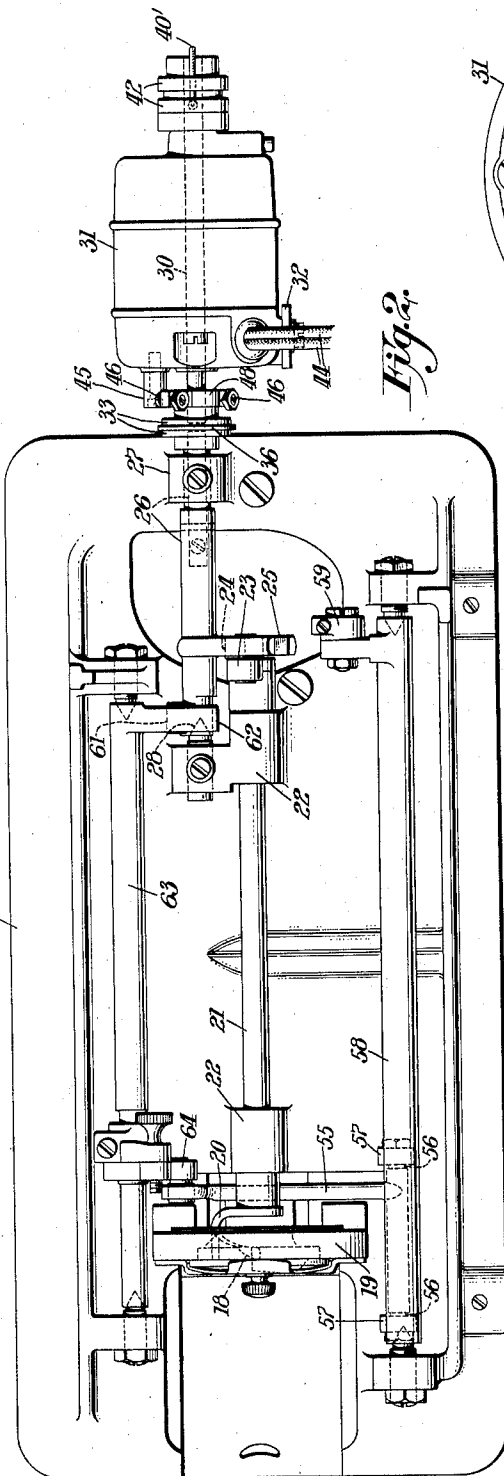


Fig. 2.

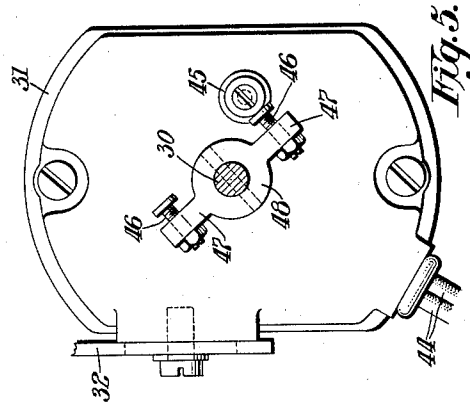


Fig. 5.

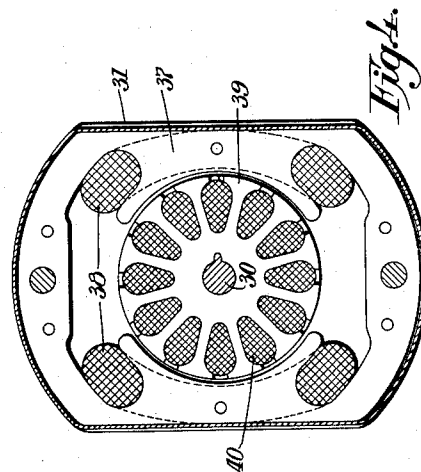


Fig. 4.

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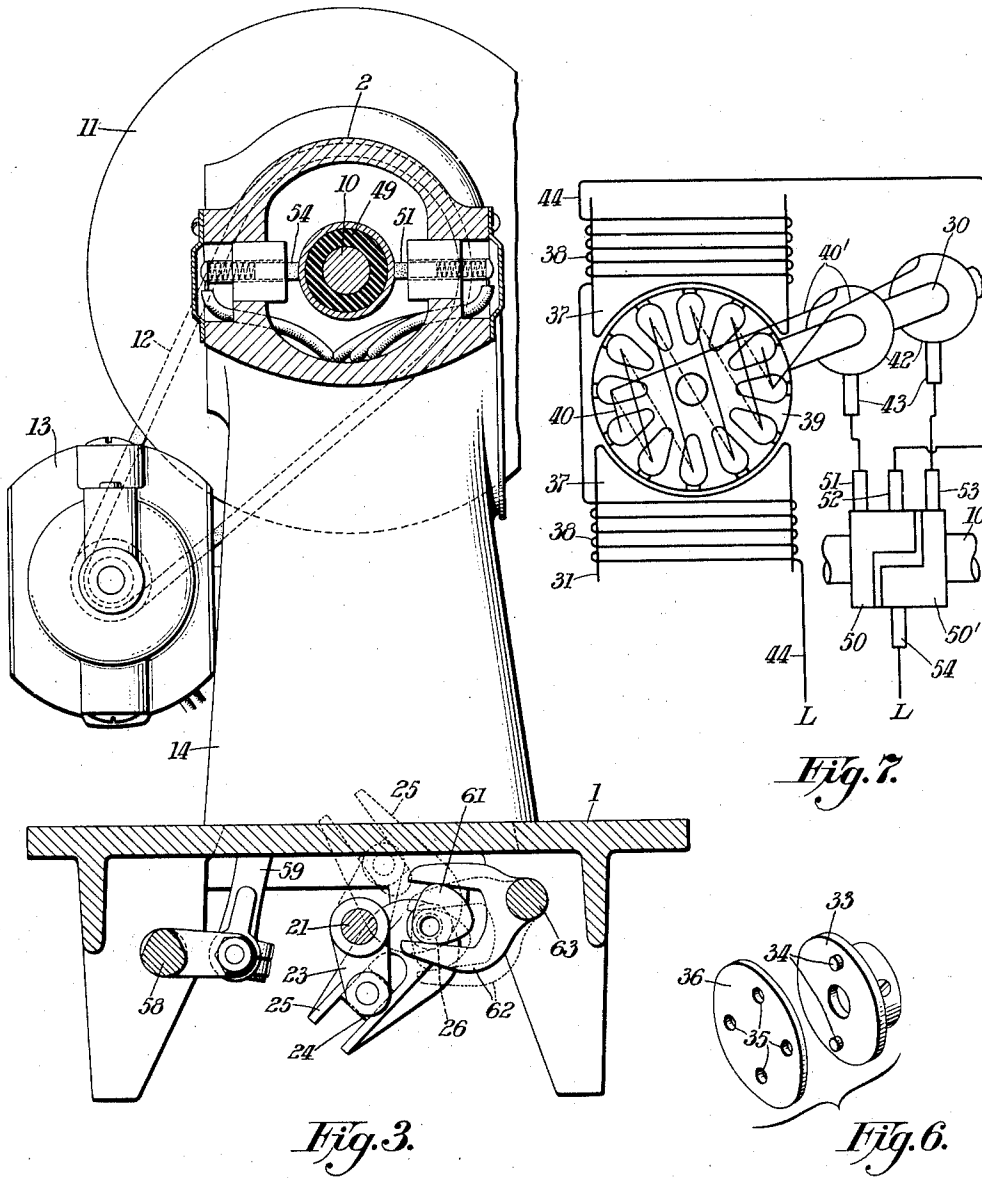
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ELECTROMAGNETIC SEWING MACHINE

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UNITED STATES PATENT OFFICE

2,223,315

ELECTROMAGNETIC SEWING MACHINE

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Application June 27, 1939, Serial No. 281,348

12 Claims. (Cl. 112—220)

This invention relates to sewing machines of the type in which one or more of the component mechanisms of the machine is operated by electromagnetic means of the vibratory or oscillatory type as distinguished from the conventional electric motor which drives by a continuous rotary motion.

The invention has for an object to provide a sewing machine with improved and simplified oscillatory electromagnetic means for actuating one of its component mechanisms. A further object of the invention is to provide a shuttle type machine with electrical means to time the oscillatory motion of the shuttle with reciprocatory motion of the needle. Still further, the invention has for an object to provide a sewing machine with independent, electrically interconnected devices for driving the needle and complementary loop-taker, so that there is no mechanical connection between the two component upper and lower elements of the stitch-forming mechanism.

With the above and other objects in view, as will hereinafter appear, the invention comprises the devices, combinations and arrangements of parts hereinafter set forth and illustrated in the accompanying drawings of a preferred embodiment of the invention, from which the several features of the invention and the advantages attained thereby will be readily understood by those skilled in the art.

Electric sewing machines as heretofore constructed with non-rotary electromagnetic driving devices, have commonly made use of pairs of solenoids, or one solenoid with a recovery spring, to move the actuated part alternately in opposite directions. When a recovery spring is used, the solenoid must be of double strength and correspondingly costly in order to overcome the recovery spring in one direction as well as to carry the load of the part to be actuated. Where a pair of solenoids are used, only one of them can be operated at a time and hence one is idle while the other is active. This requires unnecessary and costly duplication.

According to the present improvement, a polarizing winding is used in the driving device in connection with a current reversing switch to secure a reversal of motion. This winding is never idle for an appreciable time.

In the accompanying drawings Fig. 1 is a vertical longitudinal section of a sewing machine embodying the invention. Fig. 2 is a bottom plan view of the machine. Fig. 3 is a transverse vertical section substantially on the line

3—3, Fig. 1. Fig. 4 is a section on the line 4—4, Fig. 1. Fig. 5 is a section on the line 5—5, Fig. 1. Fig. 6 is a disassembled perspective view of the intermediate and one end element of the universal joint driving connection between the lower oscillatory motor and the shuttle driving rocker. Fig. 7 is an electrical diagram of the lower oscillatory motor and the timer and Fig. 8 is a development of the rotary element of the timer.

The machine has the conventional frame including the bed 1, and hollow bracket-arm 2 terminating in the head 3 in which the usual reciprocatory needle-bar 4 and presser-bar 5 are mounted. The needle-bar carries the needle 6 and the presser-bar carries the presser-foot 7.

The needle-bar has the conventional link 8 and crank 9 connection with the top-shaft 10 which is journaled in the bracket-arm 2 and carries the balance wheel and belt-pulley 11 connected by the belt 12 to any suitable source of power, such as the conventional rotary sewing machine motor 13 mounted at the rear of the bracket-arm standard 14. The electric motor 13 is not, however, an essential part of the present sewing machine.

The take-up 15 is conventional and is actuated by the usual barrel-type cam 16, the take-up actuating groove 17 of which has been modified to cause the take-up 15 to give up thread rapidly before the shuttle is passed through the thread-loop taken from the needle, so that there will be enough slack in the needle-thread for the rapidly advancing shuttle of the present machine. The present take-up has a fast down-motion as well as a fast up-motion.

Cooperating with the needle 6 to form stitches is the conventional oscillatory shuttle 18 which is journaled in the conventional shuttle-raceway 19 and driven by the conventional shuttle-driver 20 on the oscillatory shuttle-driving shaft 21 journaled in the bearing lugs 22 below the bed 1. Fixed to the rearward end of the shaft 21 is the usual crank-arm 23 carrying the pivoted bearing-block 24 which works in a forked arm 25 on the rock-shaft 26 journaled in the bearing lug 27 and steadied by the pintle 28. The axis of the shafts 21 and 26 are offset, as shown in Fig. 3, so that a 90° motion of the shaft 26 produces over 180° of motion of the shuttle-driving shaft 21, which is enough to drive the shuttle completely through the thread-loop taken from the needle.

In the present machine, the shaft 26 of the forked shuttle-driving rocker is connected

through the conventional universal coupling 29 to the shaft 30 of the special oscillatory motor 31 which is mounted on the bracket 32 secured to the arm-standard 14. The universal coupling 29 comprises two opposed disks 33 each having diametrically opposed pins 34 entering holes 35 in the intermediate disk 36, of rubber, fiber, or the like.

The motor 31 has the usual field-frame 37 and field-coil 38 of a conventional direct-current motor. The armature 39, however, has no commutator but has an armature winding 40 arranged to polarize the armature; the terminals 40' of the winding 40 extending through a hollow portion of the armature shaft 30, Fig. 1, to the slip-rings 42 mounted on the shaft 30. The slip-rings 42 are engaged by spring-pressed brushes 43. The field-coils have terminal connection wires 44. The polarity of the armature 39 may be reversed by reversing the current through the armature winding 40. The oscillatory movements of the armature 39 are limited to approximately 100° by the rubber covered stop-pin 45, Fig. 5, mounted on the frame of the motor 31 and engaged by the heads of the adjustable screws 46 on the arms 47 of the stop-collar 48 pinned to the armature shaft 30.

To control and time the shuttle-driving oscillations of the motor-shaft 30, there is mounted on the top-shaft 10, a conventional rotary reversing switch-cylinder 49, Fig. 1, carrying the cylindrical plates 50, 50' with stepped edges, as shown in Fig. 8. This contact cylinder is engaged by three brushes 51, 52, 53, of which the brushes 51 and 53 bear continuously upon the respective cylinders 50, 50'. The intermediate brush 52 bears alternately on the cylinders 50, 50'. Diametrically opposed to the brush 52 is the current lead-in brush 54, Fig. 7, connected to the line L or current supply. The timer or switch 49 has the effect, as the shaft 10 rotates, of connecting the line L alternately to the brushes 51, 53, the brush to which the line is not connected, being connected to the middle brush 52 which runs to the motor field and the other side of the line. The result is that the polarity of the armature is reversed relative to the polarity of the field and the timing of the reversals is controlled by the top-shaft 10. The timer 49 is positioned on the shaft 10 so that when the needle 6 has risen slightly from the lower end of its stroke and has thrown out a loop of needle-thread, the polarity of the armature 39 is reversed and the latter is caused to move quickly in a direction to drive the shuttle through the needle-loop. When the needle reaches the upper end of its stroke, the armature 39 executes a reverse motion and causes the shuttle to quickly recover its initial position ready to take the next needle-loop.

Either alternating or direct current may be used to energize the motor 31. If direct current is used, a permanent magnetic field-frame may, of course, be substituted for the electromagnetic field-frame, as the polarity of the field poles is not reversed.

The oscillatory motor 40 executes an arc of motion of only about 100° but, because of the intermediate fork 25 and crank 23, this motion is increased to about 195° of motion of the shuttle-driving shaft 21, necessary to drive the shuttle 18.

The feed-motion comprises the usual feed-bar 55, Fig. 2, pivoted at 56 to the upstanding arms 57 of the usual feed-rocker 58 which is actuated by the usual feed-pitman connection 59 having a forked upper end embracing the feed-cam 60

on the top-shaft 10. The feed-lift is obtained as usual from the cam 61 on the rocker 26. The cam 61 is embraced by the forked arm 62 of the feed-lift rock-shaft 63 having an arm 64, Fig. 2, which engages the front end of the feed-bar 55; all of the feed connections being conventional.

The quick motion of the rocker 26 caused by the rapidly executed oscillations of the motor 31 effect a rapid lift of the feed-bar 55 at the beginning of the feed-stroke and a quick drop of the feed-bar at the end of the feed-stroke. Thus a substantially rectangular feed-path is traversed by the feed-dog 65 instead of the usual elliptical feed-path. A rectangular feed-path is perfectly flat-topped from beginning to end and is very desirable of accomplishment as is well known by those skilled in the sewing machine art.

The field iron of the motor is polarized by the field winding 38, and the armature iron is polarized by the armature winding 40. By reversing the current in one of said windings relative to the other winding the armature is caused to quickly turn from one extreme position to its other extreme position. The polarizing winding 40 for the movable motor-element is in use for both directions of movement of said element and the need for two alternately excited coils, such as used in machines of the prior art, is thus eliminated and a more powerful motor for the weight of materials used is produced.

Having thus set forth the nature of the invention what we claim herein is:

1. A sewing machine having a reciprocatory needle, a top-shaft connected to drive said needle, a loop-taker complementary to said needle, an oscillatory loop-taker-driving shaft, an oscillatory electromagnetic motor connected to oscillate said loop-taker-driving shaft, and electrical switching means on said top-shaft, to time the oscillatory movements of said motor.

2. A sewing machine having a reciprocatory needle, a top needle-driving shaft, an oscillatory shuttle, an oscillatory shuttle-driving shaft, a rocker for driving said shuttle-driving shaft, a motion amplifying connection between said rocker and shaft, and an oscillatory electromagnetic motor connected to oscillate said rocker.

3. A sewing machine having stitch-forming mechanism including an oscillatory stitch-forming element, a rotary shaft, an oscillatory motor for driving said oscillatory element, said motor including field and armature windings, and means governed by the rotation of said rotary shaft for reversing the current in one of said windings.

4. In a sewing machine, an oscillatory motor having a field magnet, an armature, an armature shaft whereby said armature is supported for oscillation in the field of said field magnet, an armature polarizing winding, a rotary shaft, a current-reversing switch actuated by said shaft and connected to reverse the current in said armature winding, whereby the motor shaft is caused to oscillate in time with the rotation of said rotary shaft, and coaxing stitch-forming devices actuated, respectively, by said oscillatory motor and said rotary shaft.

5. A sewing machine having a reciprocatory needle, a needle-driving shaft, an oscillatory shuttle, an oscillatory shuttle driving rocker, an oscillatory electromagnetic motor having a field-frame and an oscillatory shaft and armature journaled in said field-frame, said oscillatory motor-shaft being directly connected to said rocker.

6. A sewing machine having a reciprocatory needle, a needle-driving shaft, an oscillatory shuttle driving rocker, an oscillatory electromagnetic motor having a field frame and an oscillatory shaft and armature journaled in said field-frame, said oscillatory motor-shaft being directly connected to said rocker, and adjustable stops on said oscillatory motor-shaft to limit the movements thereof in opposite directions.

7. In a sewing machine, an oscillatory motor comprising a field-frame, an armature, a shaft whereby said armature is rotatably supported in said field-frame, a field winding, a polarizing armature winding, a pair of slip-rings on said shaft connected to the terminals of said winding, stop means to limit oscillatory motion of said shaft in opposite directions, current reversing means connected to said armature winding, a rotary shaft for controlling and timing the operation of said current reversing means, and coacting stitch-forming devices actuated, respectively, by said oscillatory motor and said rotary shaft.

8. A sewing machine having a reciprocatory needle, an oscillatory shuttle, an oscillatory electromagnetic motor connected to oscillate said shuttle, a rotary needle-driving shaft, and electric switch means controlled by said shaft to time the oscillations of said electromagnetic motor.

9. A sewing machine having a reciprocatory needle, an oscillatory shuttle, an oscillatory electromagnetic motor connected to oscillate said shuttle, a rotary needle-driving shaft, and electric switch means controlled by said shaft to time the oscillations of said electromagnetic motor, and a needle-thread take-up actuated by

said rotary shaft and timed to complete its thread-giving stroke before the shuttle is actuated to take the needle-loop.

10. In a sewing machine, a reciprocatory needle, a loop-taker, a feed-bar, a feed-dog carried thereby, a rotary shaft and connections for reciprocating said needle and for imparting feed-and-return movements to said feed-bar, oscillatory electromagnetic means to actuate said loop-taker and to impart rising and falling movements to said feed-bar, and means controlled by said rotary shaft to time said oscillatory electromagnetic means.

11. A sewing machine having stitch-forming mechanism including a reciprocatory needle-element, a complementary loop-taker element, means to actuate one of said stitch-forming elements, an oscillatory electromagnetic motor connected to operate the other of said stitch-forming elements, said motor including relatively movable polarized field and armature elements and a polarizing winding for one of said motor elements, and current-reversing means for said polarizing winding connected to be operated and timed by the means which actuates said one of said stitch-forming elements.

12. In a sewing machine, the combination with two movable stitch-forming elements, of oscillatory electromagnetic means including a polarizing winding to operate one of said elements, and a current-reversing switch for said winding having a timing connection with the other of said elements.

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CERTIFICATE OF CORRECTION.

Patent No. 2,223,315.

November 26, 1940.

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It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, first column, line 10; for "field-coil 38" read --field-coils 38--; page 3, first column, line 2, claim 6, before "an" insert the words and comma --an oscillatory shuttle,--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 31st day of December, A. D. 1940.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.