March 22, 1960 H. THEENHAUSEN ET AL 2,929,344

ZIGZAG SEWING MACHINE

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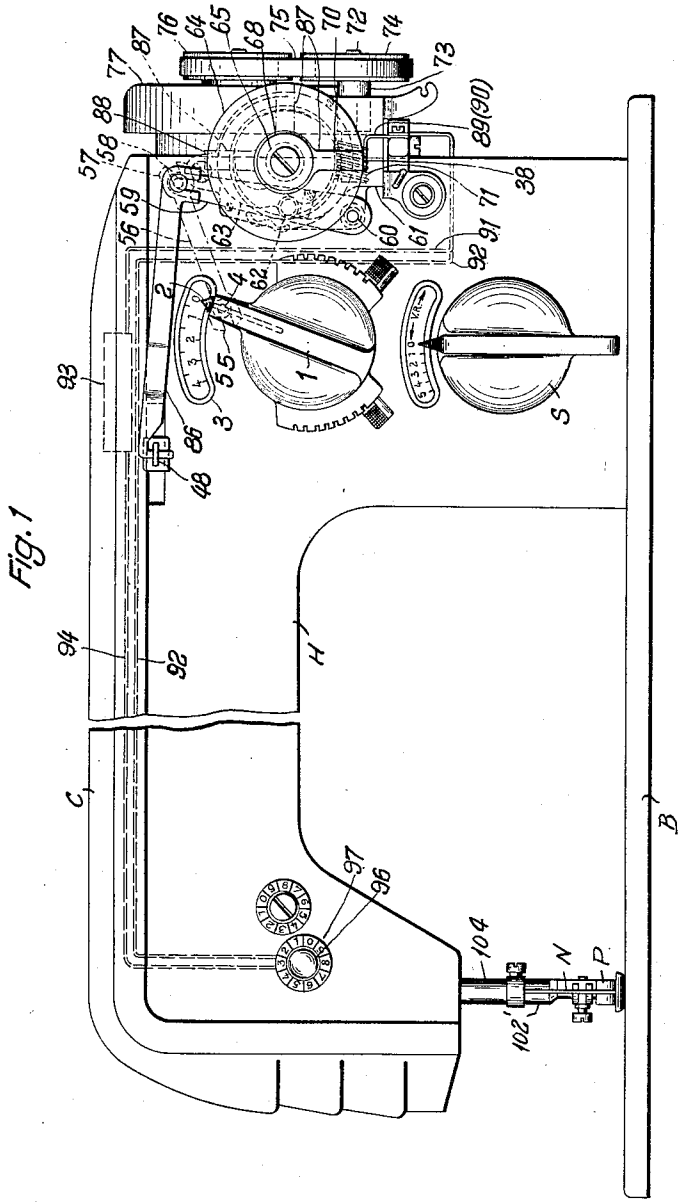

Fig. 1

Inventors
Heinrich Theenhausen
Otto Wank

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Fig. 2

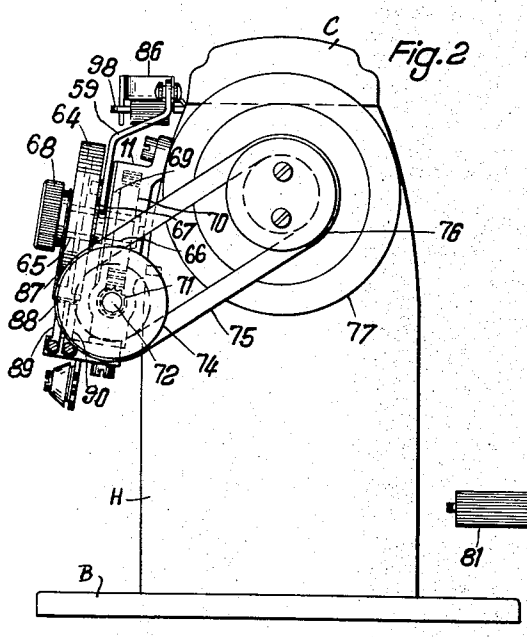

Fig. 3

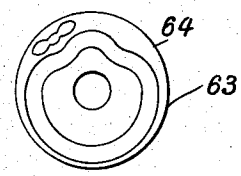

Fig. 4

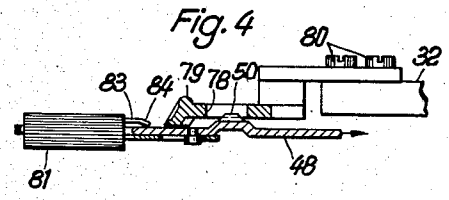

Fig. 5

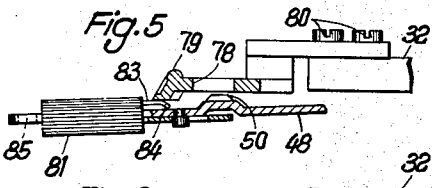

Fig. 16

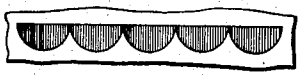

Fig. 6

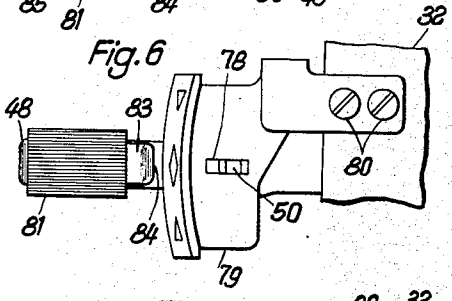

Fig. 17

Fig. 7

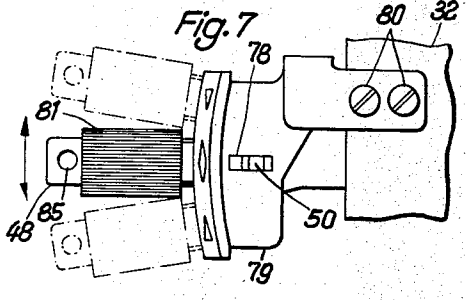

Fig. 18

Fig. 19

Inventors

Heinrich Theenhausen

Otto Wank

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Fig. 20

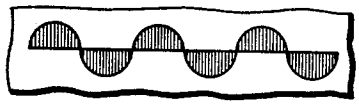

Fig. 8

Inventors

Heinrich Theenhausen

Otto Wank

March 22, 1960 H. THEENHAUSEN ET AL 2,929,344

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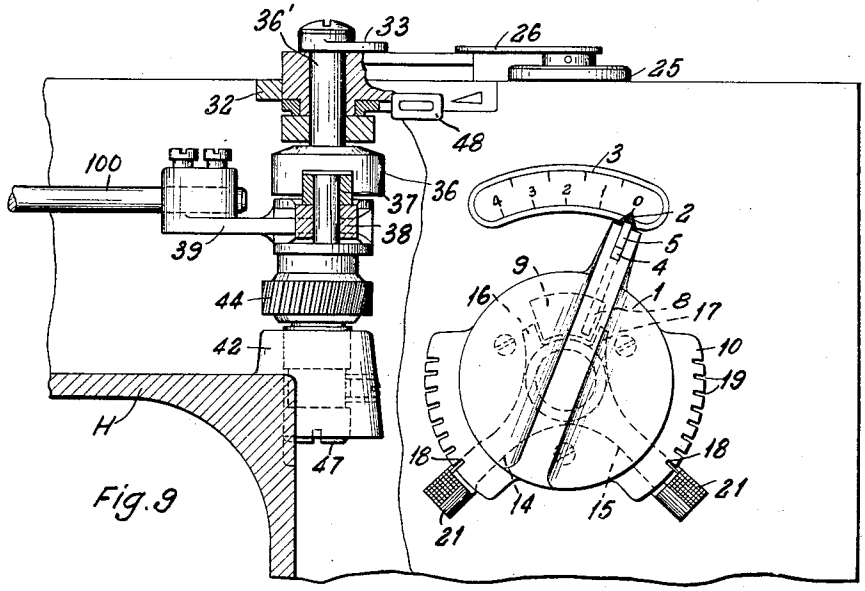
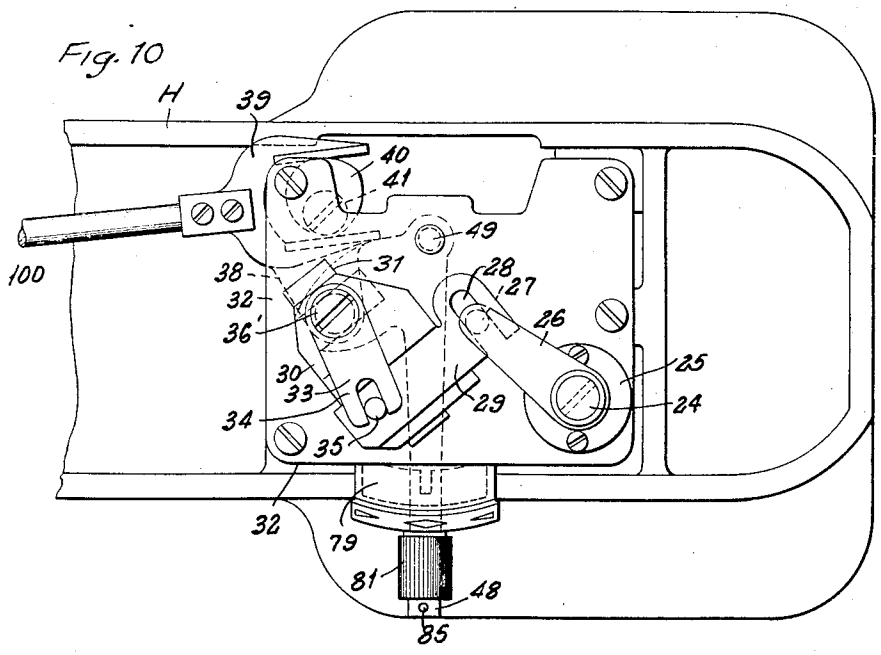


Fig. 9

Fig. 10



Inventors

Heinrich Theenhausen

Otto Wank

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ZIGZAG SEWING MACHINE

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Fig. 11

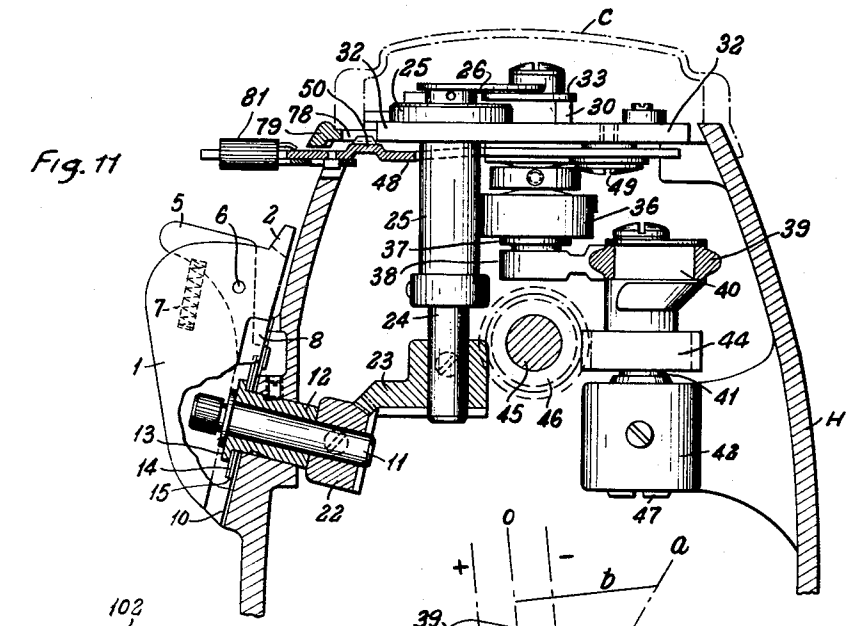
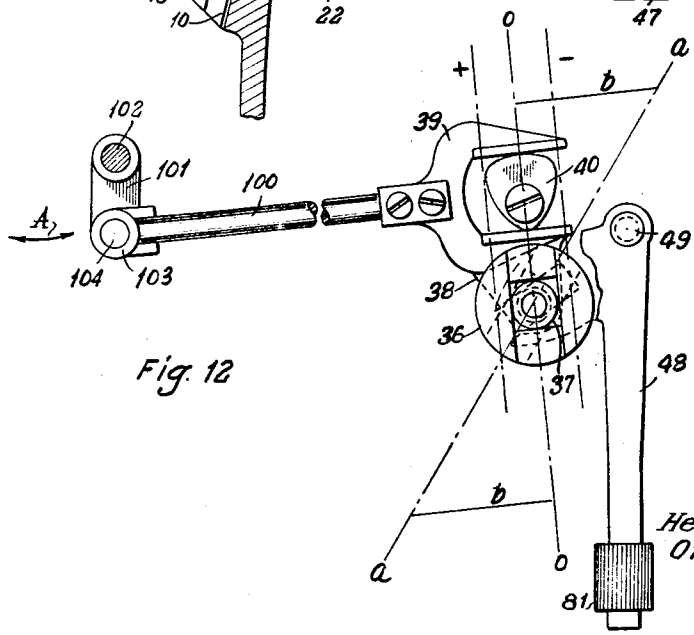


Fig. 12



Inventors
Heinrich Theenhausen
Otto Wank

March 22, 1960 H. THEENHAUSEN ET AL 2,929,344

ZIGZAG SEWING MACHINE

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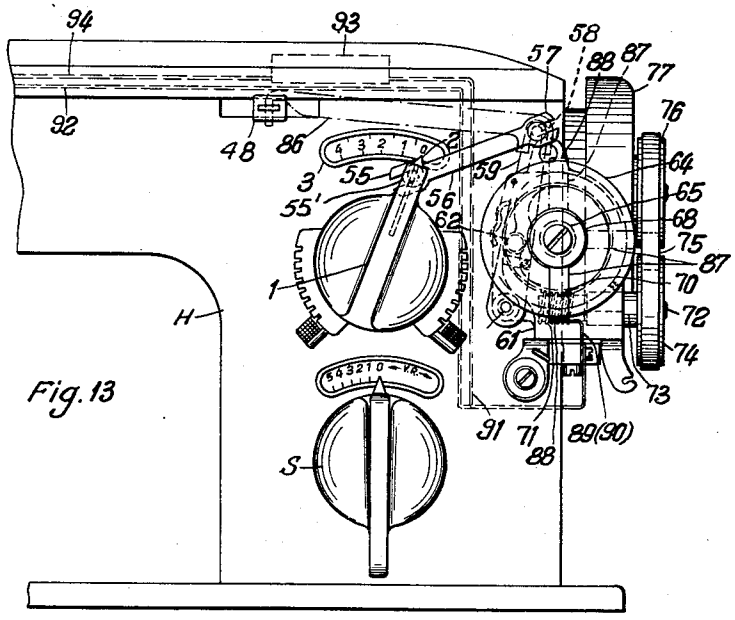

Fig. 13

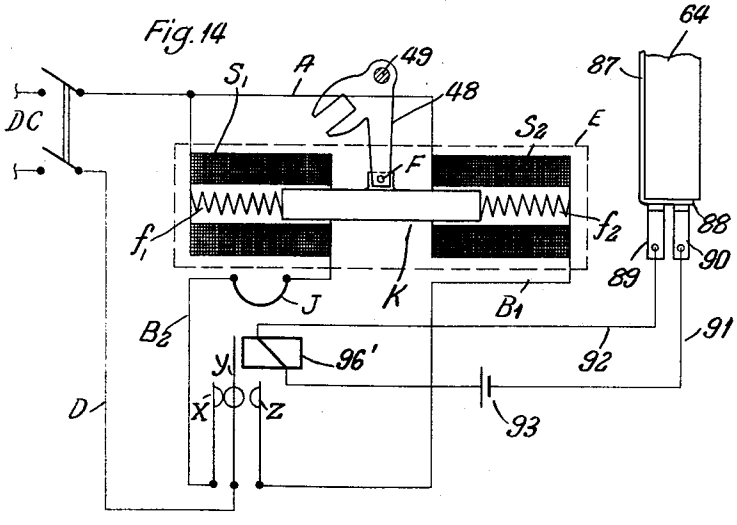

Fig. 14

Inventors
Heinrich Theenhausen
Otto Wank

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ZIGZAG SEWING MACHINE

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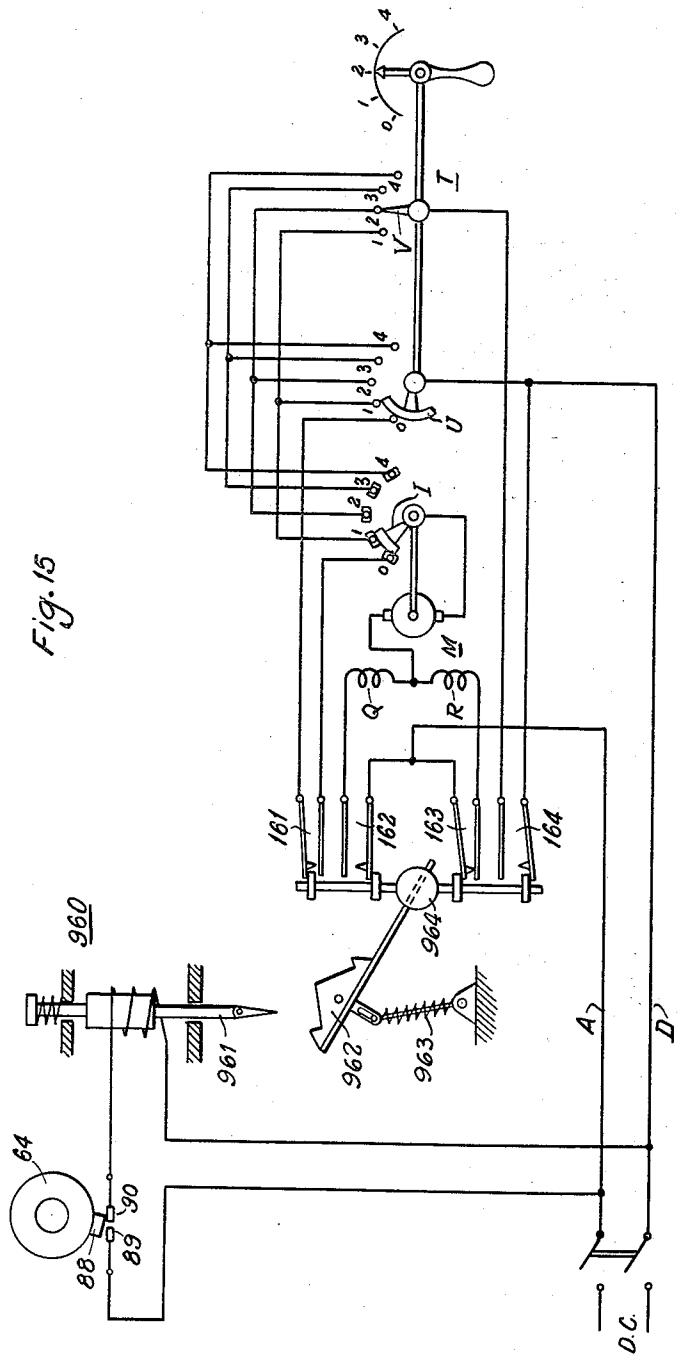

Fig. 15

INVENTORS
Heinrich Theenhausen
Otto Wank

March 22, 1960 H. THEENHAUSEN ET AL 2,929,344

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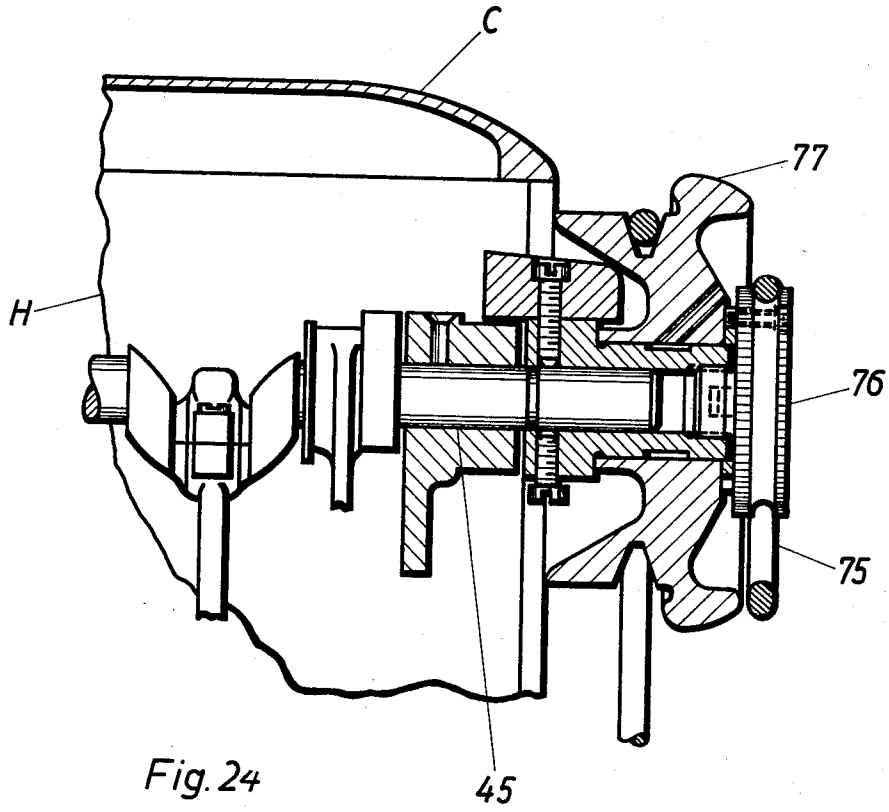

Fig. 24

Inventors

Heinrich Theenhausen

and

Otto Wank

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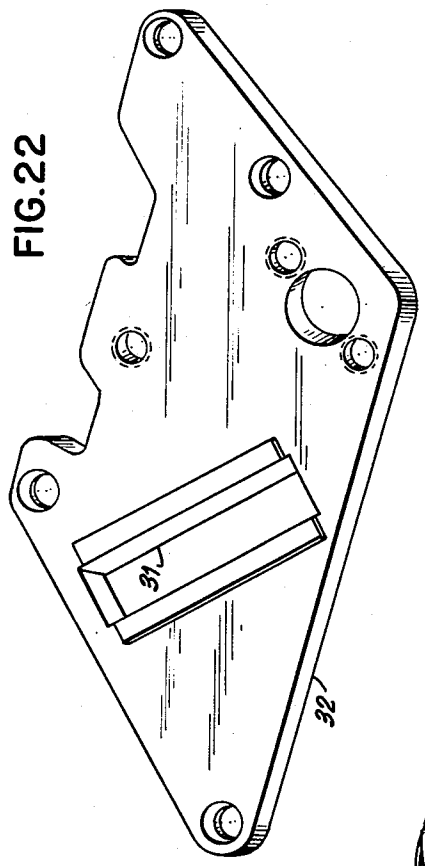

FIG.22

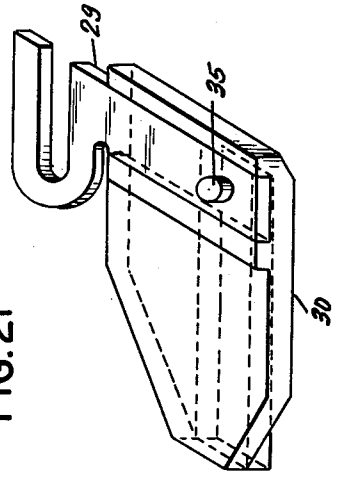

FIG.21

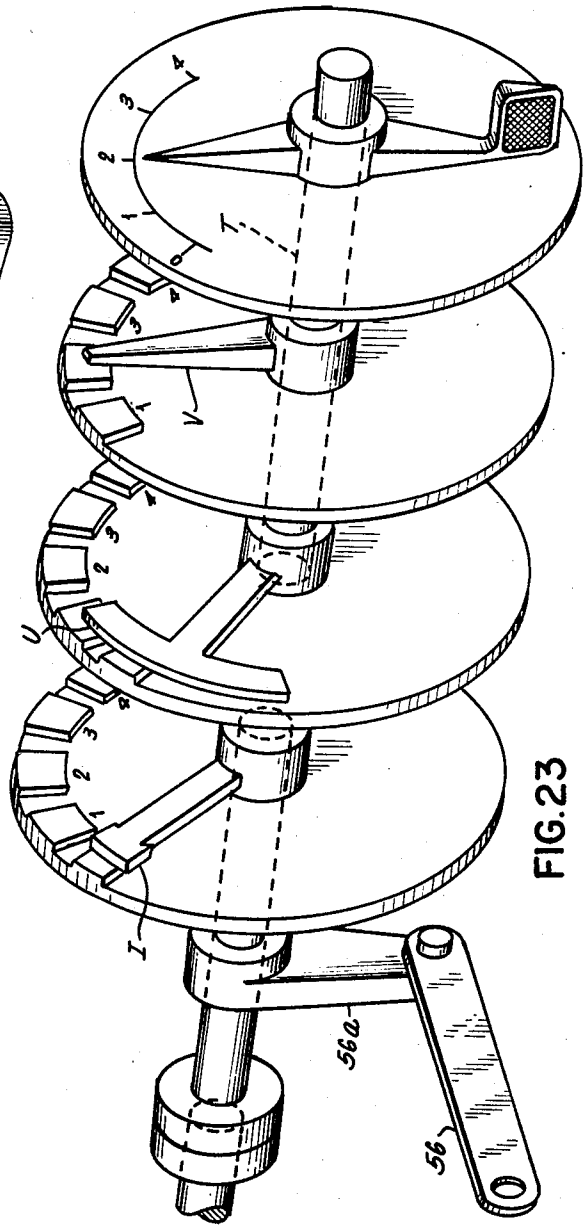

FIG.23

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Patented Mar. 22, 1960

2,929,344

ZIGZAG SEWING MACHINE

Heinrich Theenhausen and Otto Wank, Bielefeld, Germany, assignors to Anker-Werke A.G., Bielefeld, Germany, a corporation of Germany

Application June 9, 1955, Serial No. 514,178

Claims priority, application Germany June 12, 1954

22 Claims. (Cl. 112—158)

Our invention relates to zigzag sewing machines that, aside from other sewing operations, afford the production of embroidery patterns, and is hereinafter described with reference to the drawings in which:

Fig. 1 is a front view of a sewing machine according to the invention as seen from the operator's place.

Fig. 2 is a side view from the right of Fig. 1,

Fig. 3 shows a cam disc for controlling the zig-zagging operation of the machine.

Figs. 4 and 5 are side elevations of a control member, in respectively different positions, for adjusting the stitching area of the machine,

Figs. 6 and 7 are top views of the same control member as drawn in Figs. 4 and 5 respectively,

Fig. 8 is a vertical section through the zig-zag control portion of the machine,

Fig. 9 shows, partly in section, a portion of the machine including the stitching-area control member,

Fig. 10 is a top view onto the same machine portion as shown in Fig. 9, and

Fig. 11 is a vertical section through the same machine portion,

Fig. 12 illustrates separately some of the parts of the machine portion shown in Figs. 9 to 11,

Fig. 13 shows the control portion of the machine and serves to illustrate details obscured in Fig. 11,

Figs. 14 and 15 show two respective electric circuit diagrams of automatic controls applicable with a machine according to the invention,

Figs. 16 to 20 illustrate several of the various embroidery patterns that can be made on the machine,

Figs. 21 and 22 are perspective details of the elements of the stitching-area control linkage mechanism shown in Fig. 10,

Fig. 23 is a perspective of the manual and automatic switches of the circuit of Fig. 15, and

Fig. 24 is a longitudinal vertical section taken at the right end portion of Fig. 13, and showing the details of the release disc and hand wheel.

In the known zigzag sewing machine, the needle movement transverse to the feed direction of the material being sewed is in most cases controlled by selectively exchangeable control cams the choice of which determines the stitching pattern of the machine for work other than straight sewing. While the embroidery patterns shown in Figs. 16 to 20 can be obtained with such a machine, certain patterns, such as those shown in Figs. 17, 19 and 20 cannot be produced by action of the control cam alone but also require a properly timed shifting of manual control means for changing the position of the stitching area and the width of the stitch. Attainment of an accurate pattern in such cases has been dependent upon attention and continuous counting by the operator so as to require much skill and training.

It is an object of our invention to greatly facilitate the production of such patterns and to enlarge the variety of embroidery-type designs or fancy stitching work that can be done on the machine, without requiring particular

attention or skill. Another, more specific object of our invention is to improve the control mechanism of zigzag sewing machines generally of the above-mentioned type so as to reduce or eliminate the demands placed upon the operator when producing stitch patterns that require a repetitive change in setting in addition to the operation of the stitch control cam. Another, more specific object is to provide such a sewing machine with means for facilitating or automatically effecting an accurately timed change in the setting of the controls that determine the position of the stitching area and the width of the stitch.

The novel features which we consider characteristic of our invention are set forth with particularity in the appended claims. The invention itself, however, and further objects and advantages thereof will best be understood from the following description of the illustrated embodiment.

The illustrated machine is suitable for straight sewing as well as for decorative stitching as desired for applique, darning or embroidery work. As far as the design and operation of the basic mechanism for producing straight and zig-zag stitches, feeding the material and forming loop stitches are concerned, the machine, in principle, is similar to various known zig-zag sewing machines, the invention proper being concerned only with improved control means for selecting and controlling the stitching width and stitching area of the zig-zagging operations. However, for more readily understanding the invention, a brief description of the basic zig-zag sewing operation will be helpful and will presently be given.

In accordance with the conventional design of sewing machines, the one shown in Figs. 1 and 2 has a base B on which a machine housing H is mounted. The housing H forms a hollow standard joined with the base and has a horizontal hollow arm portion which, remote from the standard, merges with a dependent needle-bar housing located above, and upwardly spaced from, the sewing area on the top surface of the base. The interior of the housing comprises the needle-bar drive mechanism as well as most of the parts appertaining to the control mechanisms according to the invention. The open top of the housing is closed by a removable cover C. The conventional presser foot P forms an exchangeable part of an assembly 102' which extends vertically upward into the housing H where it comprises a vertical rod **102** shown in Fig. 12. As usual, the presser-foot assembly can be lifted and lowered along the vertical axis of assembly **102'** and rod **102**. The vertically reciprocable needle bar **104** (Figs. 1, 12) carrying the sewing needle N extends parallel to the presser-foot assembly. Its operation for straight sewing is as usual and hence is not further described herein.

Aside from its vertical reciprocations, the needle bar **104** is also capable of lateral swinging movements as required for zig-zag operation. These lateral movements occur about the axis of the presser-foot assembly in a horizontal direction within the plane of illustration of Fig. 1, and they are accompanied by a corresponding swinging movement of the presser foot. The needle bar **104** is vertically slidable in a bearing sleeve **103** (Fig. 12). Sleeve **103** forms part of a swing frame **101** which is mounted on the presser-foot rod **102** and is rotatable together with rod **102** about the vertical axis of rod **102**. For straight sewing the swing frame **101** is stationary, but for zig-zag work an oscillating motion is imparted to the frame **101** by means of a connecting rod **100** which extends through the horizontal arm portion of the machine housing H (Figs. 9, 10) to an assembly of control mechanisms mounted on and within the housing.

It will be recognized from Fig. 12 that the zig-zag stitching width in the directions of the double-headed arrow A corresponds to the amplitude of the oscillations

transmitted by rod 100 to swing frame 101, and that the stitching location or area is determined by the center or zero position of these oscillations. Now, the present invention provides novel and improved means for setting and automatically controlling these two magnitudes, namely the stitching width and the stitching area, by mechanisms acting upon the connecting rod 100 as described hereinafter.

As shown in Fig. 1, the machine has three manually operable control members S, 1, 48 within easy reach of the operator. Member S is a rotatable speed control knob and serves to set the electric drive motor (not shown) of the machine to forward operation at a selected speed or to reverse operation. Member 1 consists of a rotatable control knob and has a pointer 2 in front of a dial scale 3 for setting the desired zig-zag stitching width. Control member 48 is a horizontally displaceable lever for adjusting the stitching area.

The width control member 1 carries a latch pawl 5 which is pivoted on a pin 6 within a slot 4 of member 1 and is biased by a spring 7 (Figs. 9, 11). A nose 8 of pawl 5 enters into a recess 9 of a guide member 10. A shaft 11 secured to control member 1 carries a bushing 12. Two resilient stop levers 14, 15 are mounted on bushing 12 between the guide member 10 and a flange 13 of the bushing 12. Respective extensions 16, 17 of the two levers 14 and 15 coact with the nose 8 of pawl 5. Each of levers 14 and 15 has a tooth 18 engageable with latching notches 19 of the guide member 10 which may be provided with an indicating scale corresponding to the scale 3. The stop levers 14 and 15 carry respective knobs 21.

The shaft 11 carries a bevel gear 22 meshing with a bevel gear 23. Bevel gear 23 is secured to a vertical shaft 24 (Figs. 11, 10) journalled in a bushing 25. Secured to shaft 24 is an arm 26 which has a pin 27 passing through an elongated slot 28 of a slider 29 (Fig. 10). Slider 29 glides in another slider 30 (Fig. 21) which is displaceable in a slot 31 (Fig. 10) of a supporting plate 32 (Figs. 10 and 22). An arm 33 has a bifurcated end 34 engaged by a pin 35 of slider 29 and is firmly connected with the vertical pivot pin 36' (Fig. 10) of a slide-way member 36 (Fig. 11). The pivot pin 36' is revolvably mounted on the slider 30. Guided in member 36 is a slider 37 which cooperates with an arm 38 (Figs. 9 to 12) for displacing a stitch control fork 39. A cam 40 cooperates with fork 39. The shaft 41 of cam 40 is eccentrically journalled in a flange 42 (Figs. 9, 11) of the machine housing H. The central portion of shaft 41 carries a revolvable helical gear 44 (Fig. 9) meshing with a helical gear 46 (Fig. 11) secured to the horizontal main drive shaft 45 of the sewing machine. The end 47 of the eccentric portion of shaft 41 has a slot to permit angular adjustment of the shaft 41 by means of a screw driver for accurate meshing adjustment of gears 44 and 46.

The width control member 1 has on its back near the pointer 2 a horizontal pivot pin 55' straddled by the bifurcated end 55 of a linking rod 56 (Figs. 1, 13). The other end 57 of lever 56 is likewise bifurcated and straddles a pin 58 riveted to a lever 59. The lever 59 is pivoted on a pin 60 riveted to a housing 61 (Figs. 1, 8). Journalled on lever 59 is a cam follower consisting of a roller 62 engageable with the cam groove 63 of a cam disc 64 (Figs. 1, 3, 8). Disc 64 is seated upon a bushing 65 which is mounted on a fixed bearing pin 66 (Figs. 2, 8) riveted to the housing 61. Bushing 65 has a flange 67 in back of the cam disc 64 and is threaded at the front end to receive a nut 68 for securing the cam disc 64 in operative position. The bushing 65 has another flange 69 to which a worm gear 70 is secured by screws. A worm 71 meshing with worm gear 70 has a bearing pin 72 journalled in a bushing 73 which extends through the wall of housing 61 (Figs. 1, 8). Screwed onto the exterior end of pin 72 is a pulley 74 which is driven by a drive belt 75 trained over another pulley 76 (Figs. 1, 13). Pulley or release disc or belt sheave 76 serves also as a hand-wheel release member and is connected in the conventional manner with the hand-wheel 77 on the main drive shaft 45 (Fig. 11) of the sewing machine.

The control member 48 for setting the stitching area is essentially a lever pivoted to the lower side of the supporting plate 32 by means of a pivot screw 49 (Figs. 10, 11). The control lever 48 is elastically deflective and carries a nose 50. Nose 50 is in effect a latch that fixes the center position of the lever 48 by catching into an elongated slot 78 of a catch plate 79 (Figs. 11, 4 to 7) which is fastened by screws 80 to the supporting plate 32. The lever 48 is provided with a displaceable knob 81. Secured to knob 81 is a nose 83 with a sloping end 84. When knob 81 is moved toward plate 79 from the position shown in Fig. 4 to the position shown in Fig. 5, the end 84 engages a marginal projection of plate 79 and forces lever 48 downward thus preventing the nose 50 from catching into the slot 78. The outer end of control lever 48 has a hole 85 (Fig. 7) for engagement by the pin-shaped end of a selectively applicable linking rod 86 (Fig. 1) or for automatic control by a device as shown in Fig. 14 and described below. The other end of linking rod 86 is bifurcated and straddles the pin 58 of lever 59.

A contact member 87, which may be selected from a number of differently designed members, is placed upon the bushing 65 (Figs. 1, 8) and has contact lugs 88 engageable with stationary contacts 89, 90. The contact member 87 is securely fastened to the cam disc 64 by means of the nut 68. This secures a synchronous movement of the contact member 87 with the cam disc. Attached to the stationary contacts 89, 90 are electric wires 91, 92. Wire 92 leads to an optical indicator, such as a light bulb 96 (Fig. 1). Wire 91 leads to a suitable current source shown as a battery 93. Another wire 94 connects the source with the bulb 96. As shown, the bulb 96 is preferably mounted within the adjusting ring 97 of a thread tensioner.

The control apparatus operates as follows:

During revolution of the machine main shaft 45 (Fig. 11), the cam 40 (Figs. 10 to 12), driven through gears 46, 44 (Fig. 11) rotates continuously. When during this rotary motion the slide-way member 36 has the position shown in Fig. 12, the slider 37 mounted on arm 38 of control fork 39 moves along the zero axis 0—0, and the fork 39 performs rotary oscillations about the axis of the needle bar 104 so that the oscillations have no effect upon the position of the needle bar (straight sewing). This is the case when the pointer 2 of width control member 1 (Figs. 1, 9) is set to the position "0" as illustrated.

However, when the control member 1 is set to any one of positions "1", "2" and so forth, then the slide-way member 36 (Figs. 9 and 12) is turned clockwise, for instance, to the position of axis *a—a* in Fig. 12. With this setting of member 1, during rotation of cam 40 and oscillation of fork 39, a lateral resultant movement is imparted to fork 39 and rod 100 which causes the swing frame 101 of the needle bar 104 to reciprocate about the fixed axis of the presser rod 102. The deflection of the swing frame and needle bar, and hence the width of the zig-zag stitch is the larger the more the angular position of the slide-way member 36 departs from the zero axis 0—0. In this manner, the stitching width can be set or varied as desired.

When the area control member 48 is displaced about pivot 49 from the midposition toward the right or left (Fig. 12), then the slide-way member 36 and the slider 37 are moved in the same direction and cause the control fork 39 to be shifted more or less over the cam 40. As a result, the zero axis 0—0 is displaced toward the plus (+) or minus (—) position and the stitching area is shifted accordingly.

The revolution of the main shaft 45 (Fig. 11) or of

the hand-wheel 77 (Figs. 1, 2) is transmitted through the belt drive comprising release disc 76 and elements 75, 77 to worm 71 and worm gear 70 (Figs. 2, 8 and 24). As explained, gear 70 is connected with the cam disc 64 which, when rotating, causes the lever 59 to oscillate. Lever 59, being linked to the stitching-width control member 1 through rod 56, imparts to member 1 a swinging movement. Depending upon the selected setting of member 1, this member transmits a proportionate swinging movement to the needle bar. Thus, the contour 63 of the cam 64 illustrated in Fig. 1 causes a lateral needle-bar movement resulting, for instance, in the embroidery pattern shown in Fig. 16. If a design as shown in Fig. 17 is desired, the setting of control lever 48 must be changed manually. This must be done each time the contact member 87 coacts with contacts 89, 90 to close the signaling circuit and, by lighting the bulb 96, indicates the proper moment for shifting the control lever 48.

The release disc and hand wheel mechanism is shown in detail in Fig. 24. It will be understood by persons familiar with sewing machines that release disc 76 is turned to effect coupling or firm engagement of hand wheel with main drive shaft 45, and in the opposite direction to effect disengagement.

If the same cam disc 64 is to be used for producing the embroidery pattern of Fig. 18, the knob 81 of control lever 48 must be first placed in the position shown in Fig. 5 and then a connection must be established between lever 48 and lever 59 by sticking the pin-shaped end of linking rod 86 through the hole 85 of lever 48. The control member 1 is to be set to a desired stitching width, for instance to width "2" on scale 3; and the linking rod 56 is to be removed or placed out of action. Thus set, the machine will automatically sew a pattern according to Fig. 18.

For producing the embroidery pattern of Fig. 19, the connection between control lever 48 and lever 59 is maintained but, upon each light signal, the member 1 for adjusting the stitching width is alternately moved on scale 3 from position "2" to position "0" and vice versa.

Fig. 3 illustrates the back of a cam disc 64 having a differently shaped cam groove 63 for producing embroidery patterns different from those obtainable with the cam disc shown in Fig. 1.

In lieu of the optical indicator shown in Fig. 1 in connection with a manual switching operation of the adjustment members 1 and 48, respectively, the indicator element 96 may be an acoustic device, such as a buzzer. Moreover, according to another feature of our invention, the optical or acoustical signal as well as the need for manual adjustment is eliminated by providing an electromagnet and actuating it by means of the afore-described circuit system, including the counter contacts 89, 90, so as to automatically switch the control member 1 or 48 at the proper moment. An electric accessory device for performing such a full-automatic operation is shown in Fig. 14 and is described presently.

According to schematic Fig. 14 the control circuit, under control by the cam disc 64 and comprising the contacts 89, 90, the leads 91, 92 and the current source 93, acts upon a contact relay 96' instead of the light bulb described previously. The relay 96' is of the known and commercially available type in which a mechanical switching or locking mechanism operates so that when an electric pulse is received the contact springs of the relay are placed in one position and thereafter are kept in that position until the reception of another switching pulse causes the original relay condition to be reestablished. Note the solenoid operated rod 961, and the pivoted trigger mechanism 962, 963, 964 of Fig. 15 for a relay of this type. The stitching-area control member 48 is controlled by the movable core of two solenoids S_1 and S_2. The core K is normally kept in the zero or central position by the biasing action of two springs f_1 and f_2. When the core K is in zero position, the area control member 48 occupies the midposition shown, for instance, in Fig. 6. The solenoids S_1, S_2 have one end connected through a lead A with one pole of a current supply line DC. The other ends of the solenoids are connected through respective leads B_1 and B_2 to the relay contacts XY or ZY which have a lead D attached to the other pole of the supply line DC. A removable jumper J is inserted into the lead B_2 for a purpose described below.

The solenoids with their common core K and the removable jumper J form together a small, self-contained accessory unit which can readily be plugged into a corresponding mounting place of the sewing machine so located that a pin F of core K engages into the hole 85 (Figs. 7, 10) of the area control member 48. The relay 96', however, is preferably permanently and stationarily mounted within the machine housing.

The production of an embroidery pattern according to Fig. 17 is effected in the following manner with the aid of an electro-mechanical switching unit according to Fig. 14 in combination with a link connection 56 according to Fig. 13.

When the control circuit A—B (Fig. 14) is energized from the supply line DC, solenoid S_1 moves core K and control member 48 to the extreme left-hand position. When during the operation of the sewing machine the contact piece 88 mounted on cam disc 64 reaches the counter contacts 89, 90, this being the case after the cam disc 64 has completed one full revolution, then the circuit of leads 91 and 92 is closed and the relay 96' is excited. This causes the contacts Y and Z to close so that the solenoid S_1 is deenergized and solenoid S_2 is energized. Solenoid S_2 now switches the control member 48 to the extreme right-hand position. Since, as mentioned, the relay 96' switches its contacts only when receiving a voltage pulse, the contacts Y and Z remain closed even when thereafter the contact piece 88, during the continuing rotation of cam disc 64, becomes separated from counter contacts 89, 90 so that relay 96' is no longer excited. After a full rotation of cam disc 64, the contact piece 88 again closes the relay circuit 91, 92 so that relay 96' now closes its contacts X, Y. Solenoid S_1 is energized, and control member 48 is returned to the extreme left-hand position, and so forth.

If it is desired to produce an embroidery pattern according to Fig. 20, then the jumper J is to be removed. This takes the solenoid S_1 out of the operating circuit, and relay 96' now controls only the solenoid S_2. As a result, the control member 48 is moved from the midposition to the extreme right-hand position when one voltage pulse is received, and is returned to the midposition when the next following pulse is received. This operation is repeated as required for the embroidery pattern to be produced.

It will be understood that instead of a solenoid-type device according to Fig. 14, other electrically controllable drive means may be used such as a stepping switch or a midget motor. Thus, the embodiment shown in Fig. 15 is provided with a small reversible motor for the purpose of automatically controlling the setting of the width control member 1, for instance as required for the production of an embroidery pattern as shown in Fig. 19 which requires the stitching width to be different in each alternate section of the pattern.

According to Fig. 15 the cam contact 88 coacts with stationary contacts 89, 90 to control a relay 960 which alternately operates two sets of contacts 161, 162 and 163, 164 in response to successively received pulses. The relay controls a small pilot motor M which actuates the width control member 1 and contact arm I and has two field windings Q, R to run in one or the other direction depending upon which field winding is energized at a time. A manual selector switch T is added. This switch has a contact segment U coacting with a number of fixed contacts "0" to "4", and a movable contact V coacting

with fixed contacts "1" to "4". The switch T is to be set to a desired stitching width.

The contact arm I, mounted on shaft 560 of motor M, is so designed that it bridges two adjacent stationary contacts at a time. That is, as soon as arm I moves clockwise from stationary contact 0 to contact point 1, it connects both contacts 0 and 1 for a certain interval of time until it is fully and entirely located on contact point 1. Thereafter, the arm I advances to contact 2 and temporarily interconnects contacts 1 and 2 before the time it is connected only with contact 2.

Details of the design of switch T, with particular reference to the components I, V and U, are illustrated in Fig. 23. Shown in this illustration is also the lever 56 which can be coupled with the stitching-width control lever 1 in the manner shown in Fig. 1. When thus coupled, the lever 56 displaces the control lever 1 in both directions in dependence upon the direction of rotation of the motor M, such displacement being effected by means of the motor shaft which is linked with the lever 56 by means of another lever 56*a*. As disclosed above, this system can also be used alternatively to switch stitching-area control member 48.

Assume switch T is set to the illustrated position "2" and that the contacts 89, 90 have just been bridged by the contact 88 so that relay 960 has just responded to place its movable contact device into the illustrated position. At that moment the control member I is still in position "0". However, now the motor M is energized in the circuit A, 163, R, 1–"0", 161, U–"0", D. Motor M runs in the forward direction and moves lever I through position "1" to position "2". When position "2" is reached, the motor circuit is interrupted between segment U and the pertaining contact "2" so that motor M stops.

When the next pulse is issued to relay 960 from contacts 88, 89 and 90, the relay switches to its other position. Now the motor M is energized in the circuit: A, 162, Q, 1–"2", V–"2", 164, D. The motor now runs in the reverse direction and moves member 1 back to zero position. When that position is reached, the motor circuit is interrupted at 161 so that the motor stops.

The next current pulse from contacts 89, 90 places the relay 960 back into the illustrated position so that the above-described performance is repeated.

It will be understood by those skilled in the art upon the study of this disclosure that our invention permits of various modifications and may be embodied in devices other than those specifically illustrated and described, without departing from the essence of the invention and within the scope of the claims annexed hereto.

We claim:

1. A zigzag sewing machine, comprising an axially reciprocable needle bar laterally displaceable for producing lateral stitches, a machine main shaft continuously revolving when in operation, a motion-translating mechanism linking said shaft with said needle bar for imparting periodic lateral displacements thereto, said mechanism having two selectively adjustable control means for varying the displacement amplitude and the positional range respectively of said displacements to control the stitching width and stitching area respectively, in combination with signal issuing apparatus having movable control structure, transmission means connecting said structure with said shaft for moving said structure in a given relation to said periodic displacements, electric contact means connected with said structure and operative in dependence upon said structure completing a given cycle of movement, and electric signal-responsive means connected to said contact means, whereby said electric signal-responsive means respond each time a change in setting of one of said control means is required for producing a desired stitching pattern.

2. A zigzag sewing machine, comprising a vertically reciprocable needle bar laterally displaceable for producing lateral stitches, a machine main shaft continuously revolving when in operation, a motion-translating mechanism linking said shaft with said needle bar for imparting periodic lateral displacements thereto, said mechanism having two selectively adjustable control means for varying the displacements amplitude and the positional range respectively of said displacements to control the stitching width and stitching area respectively, in combination with signal issuing apparatus having a rotatable structure, transmission means connecting said structure with said shaft for rotating said structure in a given relation to said periodic displacements, and a signal device connected with said structure and controlled thereby to issue an indicating signal in dependence upon said needle bar completing a given number of periodic displacements, whereby need for a change in setting of one of said control means is indicated to the operator of the machine.

3. A zigzag sewing machine, comprising a vertically reciprocable needle bar laterally displaceable for producing lateral stitches, a machine main shaft continuously revolving when in operation, a motion-translating mechanism linking said shaft with said needle bar for imparting periodic lateral displacements thereto, said mechanism having two selectively adjustable control means for varying the displacement amplitude and the positional range respectively of said displacements to control the stitching width and stitching area respectively, in combination with electric apparatus having pulse-responsive drive means connected with one of said control means for periodically varying the setting of said control means, a movable control structure, transmission means connecting said structure with said shaft for moving said structure in a given relation to said periodic displacements, electric circuit means connecting said apparatus with said structure to control said apparatus in dependence upon said structure completing a given cycle of movement.

4. A zigzag sewing machine, comprising a vertically reciprocable needle bar horizontally displaceable for producing lateral stitches, a machine main shaft continuously revolving when in operation, a motion-translating mechanism linking said shaft with said needle bar for imparting periodic horizontal displacements thereto, said mechanism having two selectively adjustable control means for varying the displacement amplitude and the positional range respectively of said displacements to control the stitching width and stitching area respectively, in combination with electric apparatus having pulse-responsive drive means connected with one of said control means for periodically varying the setting of said control means, a rotatable structure, transmission means connecting said structure with said shaft for rotating said structure in a given relation to said periodic displacements, electric pulse transmitting means connected with said structure for issuing a signal pulse upon completion of a given rotation of said structure, a pulse-responsive relay connected with said pulse transmitting means and having contact means alternately movable between two positions in response to successive signal pulses respectively, pulse-responsive electric drive means connected with said contact means of said relay and having a drive member movable in opposite directions respectively in dependence upon said respective two positions, said drive member being connected with one of said control means for periodically changing the setting of said control means.

5. In a sewing machine according to claim 3, said other control means having a manually adjustable setting member and having normally, during machine operation, a fixed setting while the setting of said one control means is being varied by said electric apparatus.

6. A zigzag sewing machine, comprising a vertically reciprocable needle bar laterally displaceable for producing lateral stitches, a machine main shaft continuously

revolving when in operation, a motion translating mechanism linking said shaft with said needle bar for imparting periodic lateral displacements thereto, said mechanism having two selectively adjustable control means for varying the displacement amplitude and the positional range respectively of said displacements to control the stitching width and stitching area respectively, in combination with electric apparatus having drive means connected with said stitching-area control means for periodically displacing said area, a movable control structure, transmission means connecting said structure with said shaft for moving said structure in a given relation to said periodic displacements, electric circuit means connecting said apparatus with said structure and controlling said apparatus in dependence upon said structure completing a given cycle of movement.

7. A zigzag sewing machine, comprising a vertically reciprocable needle bar laterally displaceable for producing lateral stitches, a machine main shaft continuously revolving when in operation, a motion-translating mechanism linking said shaft with said needle bar for imparting periodic lateral displacements thereto, said mechanism having two selectively adjustable control means for varying the displacement amplitude and the positional range respectively of said displacements to control the stitching width and stitching area respectively, a control device having a rotatable structure mechanically connected with said shaft to rotate in a given relation thereto, a selectively exchangeable cam disc mounted on said structure to rotate together therewith, cam follower means linking said cam disc with said stitching-width control means for varying the setting of said latter control means in dependence upon the cam contour of said disc, an electric contact device having stationary contact means and having movable contact means rotatable together with said structure and disc for issuing an electric pulse in dependence upon completion of a given cycle of stitching operation, and an electric pulse-responsive device connected with and controlled by said contact device, said pulse-responsive device being energized each time a change in setting of said stitching area control means is required for producing a desired stitching pattern.

8. A zigzag sewing machine, comprising a vertically reciprocable needle bar horizontally displaceable for producing lateral stitches, a machine main shaft continuously revolving when in operation, a motion-translating mechanism linking said shaft with said needle bar for imparting periodic horizontal displacements thereto, said mechanism having two selectively adjustable control means for varying the displacement amplitude and the positional range respectively of said displacements to control the stitching width and stitching area respectively, a control device having a rotatable structure mechanically connected with said shaft to rotate in a given relation thereto, a selectively exchangeable cam disc mounted on said structure to rotate together therewith, cam follower means linking said cam disc with said stitching-width control means for varying the setting of said latter control means in dependence upon the cam contour of said disc, an electric contact device having stationary contact means and having movable contact means rotatable together with said structure and disc for issuing an electric pulse in dependence upon completion of a given cycle of stitching operation, a pulse-responsive relay connected with said pulse transmitting means and having contact means alternately movable between two positions in response to successive signal pulses respectively, pulse-responsive electric drive means connected with said contact means of said relay and having a drive member movable in opposite directions respectively in dependence upon said respective two positions, said drive member being connected with said stitching area control means for periodically displacing said area.

9. A zigzag sewing machine, comprising a vertically reciprocable needle bar laterally displaceable for producing lateral stitches, a machine main shaft continuously revolving when in operation, a motion-translating mechanism linking said shaft with said needle bar for imparting periodic lateral displacements thereto, said mechanism having two selectively adjustable control means for varying the displacement amplitude and the positional range respectively of said displacements to control the stitching width and stitching area respectively, a control device having a rotatable structure mechanically connected with said shaft to rotate in a given relation thereto, a selectively exchangeable cam disc mounted on said structure to rotate together therewith, cam follower means engaging said cam disc and movable in dependence upon the cam contour of said disc, and readily removable and operator-accessible linking means insertable between said cam follower means and one of said control means for automatically setting said one control means by said cam disc, the other being set by hand and electric contact means operatively connected with said rotatable structure and operative in dependence upon said structure completing a given cycle of movement, and electric signal responsive means connected to said contact means, whereby said electric signal responsive means responds each time a change in setting of one of said control means is required for producing a desired stitching pattern.

10. A zigzag sewing machine, comprising a vertically reciprocable needle bar laterally displaceable for producing lateral stitches, a machine main shaft continuously revolving when in operation, a motion-translating mechanism linking said shaft with said needle bar for imparting periodic lateral displacements thereto, said mechanism having two selectively adjustable control means for varying the displacement amplitude and the positional range respectively of said displacements to control the stitching width and stitching area respectively, a control device having a rotatable structure mechanically connected with said shaft to rotate in a given relation thereto, a selectively exchangeable cam disc mounted on said structure to rotate together therewith, cam follower means engaging said cam disc and movable in dependence upon the cam contour of said disc, and readily removable and operator-accessible linking means insertable between said cam follower means and said stitching-area control means for varying the setting of said latter control means by said cam disc, and electric contact means operatively connected with said rotatable structure and operative in dependence upon said structure completing a given cycle of movement, and electric signal responsive means connected to said contact means, whereby said electric signal responsive means responds each time a change in setting of one of said contact means is required for producing a desired stitching pattern.

11. In a sewing machine according to claim 3, said stitching area control means comprising a displaceable setting member for connection with and operation by said drive means, and a manually operable part displaceably mounted on said setting member and being adjustable relative to said setting member to a given position, said drive means being operative to displace said setting member only when said part is in said given position.

12. In a sewing machine according to claim 11, said setting member having a latch, a fixed catch plate engageable by said latch when said setting member is in a predetermined position, said part when in a given position being engageable with said plate for releasing said latch, and said drive means being operative upon setting member only when said part is in said given position.

13. In a sewing machine according to claim 9, said stitching-area control means comprising an angularly displaceable lever having a hole accessible to the operator and engageable by said linking means, and a knob mounted on said lever and displaceable on said lever, a stationary catch, said lever having a latch engageable with said catch in the midposition of said lever for arresting said lever in said midposition, said knob having a

releasing means adapted to prevent said latch to engage said catch when said knob is in a given position relative to said lever, and said hole being uncovered by said knob only when said knob is in said given position, whereby said knob prevents said linking means from engaging said hole when said lever is latched.

14. A sewing machine according to claim 7, comprising a hand wheel revolvably mounted on said main shaft and accessible to the operator, a release disc mounted on said shaft for selectively coupling and uncoupling said wheel relative to said shaft, a belt drive having a belt sheave formed by said release disc and connecting said release disc with said control device for rotating said structure and cam disc.

15. A machine according to claim 2, comprising a thread tensioner of annular shape accessible to the operator, and said signal device having an indicator lamp mounted in said thread tensioner.

16. The apparatus defined in claim 4 in which said one of said control means is the stitching-area control means.

17. A zigzag sewing machine, comprising a vertically reciprocable needle bar laterally displaceable for producing lateral stitches, a machine main shaft continuously revolving when in operation, a motion-translating mechanism linking said shaft with said needle bar for imparting periodic lateral displacements thereto, said mechanism having two selectively adjustable control means for varying the displacement amplitude and the positional range respectively of said displacements to control the stitching width and stitching area respectively, in combination with signal issuing apparatus having movable control structure, transmission means connecting said structure with said shaft for moving said structure in a given relation to said periodic displacements, electric contact means connected with said structure and operative in dependence upon said structure completing a given cycle of movement, and electric signal-responsive means connected to said contact means, whereby said electric signal-responsive means responds each time a change in setting of one of said control means is required for producing a desired stitching pattern, and readily removable and operator-accessible linking means insertable between the movable control structure and either one of the two adjustable control means for automatically governing one of the control means by said movable structure, the other being set by hand.

18. A zigzag sewing machine, comprising a vertically reciprocable needle bar laterally displaceable for producing lateral stitches, a machine main shaft continuously revolving when in operation, a motion-translating mechanism linking said shaft with said needle bar for imparting periodic lateral displacements thereto, said mechanism having two selectively adjustable control means for varying the displacement amplitude and the positional range respectively of said displacements to control the stitching width and stitching area respectively, in combination with signal issuing apparatus having a rotatable structure, transmission means connecting said structure with said shaft for rotating said structure in a given relation to said periodic displacements, and a signal device connected with said structure and controlled thereby to issue an indicating signal in dependence upon said needle bar completing a given number of periodic displacements, and readily removable and operator-accessible linking means insertable between the movable control structure and either one of the two adjustable control means for automatically governing one of the control means by said movable structure, the other being set by hand, whereby need for a change in setting of one of said control means is indicated to the operator of the machine.

19. A zigzag sewing machine, comprising a vertically reciprocable needle bar laterally displaceable for producing lateral stitches, a rotary machine main shaft; a motion-translating mechanism linking said shaft with said needle bar for imparting periodic lateral displacements thereto, the motion translating means comprising a rotary cam turned by said main shaft, a follower member for said rotary cam, means operably connected to the needle bar and pivotally linked to said follower member, and positioning means for said follower member to determine the motion transmitted by said cam to the needle bar, said mechanism having two selectively adjustable control means operably connected to said positioning means for steplessly varying the displacement amplitude and the positional range respectively of said displacements to control the stitching width and stitching area respectively; in combination with electric apparatus having pulse-responsive drive means connected with one of said control means for periodically varying the setting of said control means, a movable control structure, transmission means connecting said structure with said shaft for moving said structure in a given relation to said periodic displacements, electric circuit means operatively connecting said electrical apparatus with said structure to control said apparatus in dependence upon said structure completing a given cycle of movement.

20. A zigzag sewing machine, comprising a vertically reciprocable needle bar laterally displaceable for producing lateral stitches, a rotary machine main shaft, a motion-translating mechanism linking said shaft with said needle bar for imparting periodic lateral displacements thereto, the motion translating means comprising a rotary cam turned by said main shaft, a follower member for said rotary cam, means operably connected to the needle bar and pivotally linked to said follower member, and positioning means for said follower member to determine the motion transmitted by said cam to the needle bar, said mechanism having two selectively adjustable normally manually operative control means operably connected to said positioning means for steplessly varying the displacement amplitude and the positional range respectively of said displacements to control the stitching width and stitching area respectively, in combination with electric apparatus having pulse-responsive drive means connected with one of said control means for periodically varying the setting of said control means, a movable control structure, a selectively exchangeable cam disc mounted on said structure, transmission means connecting said structure with said shaft for moving said structure and said cam disc in a given relation to said periodic displacements, electric circuit means operatively connecting said electric apparatus with said structure to control said apparatus in dependence upon said structure completing a given cycle of movement, cam follower means engaging said cam disc and movable in dependence upon the cam contour of said disc, and readily removable and operator accessible linking means selectively insertable between said cam follower means and each of said stitching-area and stitching-width control means for selectively varying the setting of each of said control means by said cam disc.

21. A zigzag sewing machine, comprising a vertically reciprocable needle bar laterally displaceable for producing lateral stitches, a rotary machine main shaft, a motion-translating mechanism linking said shaft with said needle bar for imparting periodic lateral displacements thereto, the motion translating means comprising a rotary cam turned by said main shaft, a follower member for said rotary cam, means operably connected to the needle bar and pivotally linked to said follower member, and positioning means for said follower member to determine the motion transmitted by said cam to the needle bar, said mechanism having two selectively adjustable normally manually operative control means operably connected to said positioning means for steplessly varying the displacement amplitude and the positional range respectively of said displacements to control the stitching width and stitching area respectively, a control device having a rotatable structure mechanically connected with said shaft to rotate in a given relation thereto, a selectively

exchangeable cam disc mounted on said structure to rotate together therewith, cam follower means engaging said cam disc and movable in dependence upon the cam contour of said disc, and readily removable and operator accessible linking means selectively insertable between said cam follower means and each of said stitching-area and stitching-width control means for selectively varying the setting of said control means by said cam disc, and electric circuit means comprising an electric contact device turning correlatively with said cam for periodically modifying a current parameter of said circuit, and means operatively connected to said circuit and controlled by said modifying of a current parameter thereof and linked with one of said control means, to control the setting thereof.

22. A zigzag sewing machine, comprising a vertically reciprocable needle bar laterally displaceable for producing lateral stiches, a rotary machine main shaft, a motion-translating mechanism linking said shaft with said needle bar for imparting periodic lateral displacements thereto, the motion translating means comprising a rotary cam turned by said main shaft, a follower member for said rotary cam, means operably connected to the needle bar and pivotally linked to said follower member, and positioning means for said follower member to determine the motion transmitted by said cam to the needle bar, said mechanism having two selectively adjustable normally manually operative control means operably connected to said positioning means for steplessly varying the displacement amplitude and the positional range respectively of said displacements to control the stitching width and stitching area respectively, a control device having a rotatable structure mechanically connected with

said shaft to rotate in a given relation thereto, a selectively exchangeable cam disc mounted on said structure to rotate together therewith, cam follower means engaging said cam disc and movable in dependence upon the cam contour of said disc, and readily removable and operator accessible linking means selectively insertable between said cam follower means and each of said stitching-area and stitching-width control means for selectively varying the setting of said control means by said cam disc, an electric contact device having stationary contact means and having movable contact means rotatable together with said structure and disc for issuing an electric pulse in dependence upon completion of a given cycle of stitching operation, and an electric pulse-responsive device connected with and controlled by said contact device, said pulse-responsive device being energized each time a change in setting of said stitching area control means is required for producing a desired stitching pattern.

References Cited in the file of this patent

UNITED STATES PATENTS

1,331,099	Francis	Feb. 17, 1920
1,338,074	Eames et al.	Apr. 27, 1920
2,420,275	Winberg	May 6, 1947
2,612,127	Hayes	Sept. 30, 1952
2,684,649	Scarpa	July 27, 1954

FOREIGN PATENTS

517,997	Belgium	Mar. 14, 1953
519,864	Belgium	May 30, 1953
484,230	Italy	Sept. 7, 1953
904,020	Germany	Feb. 15, 1954