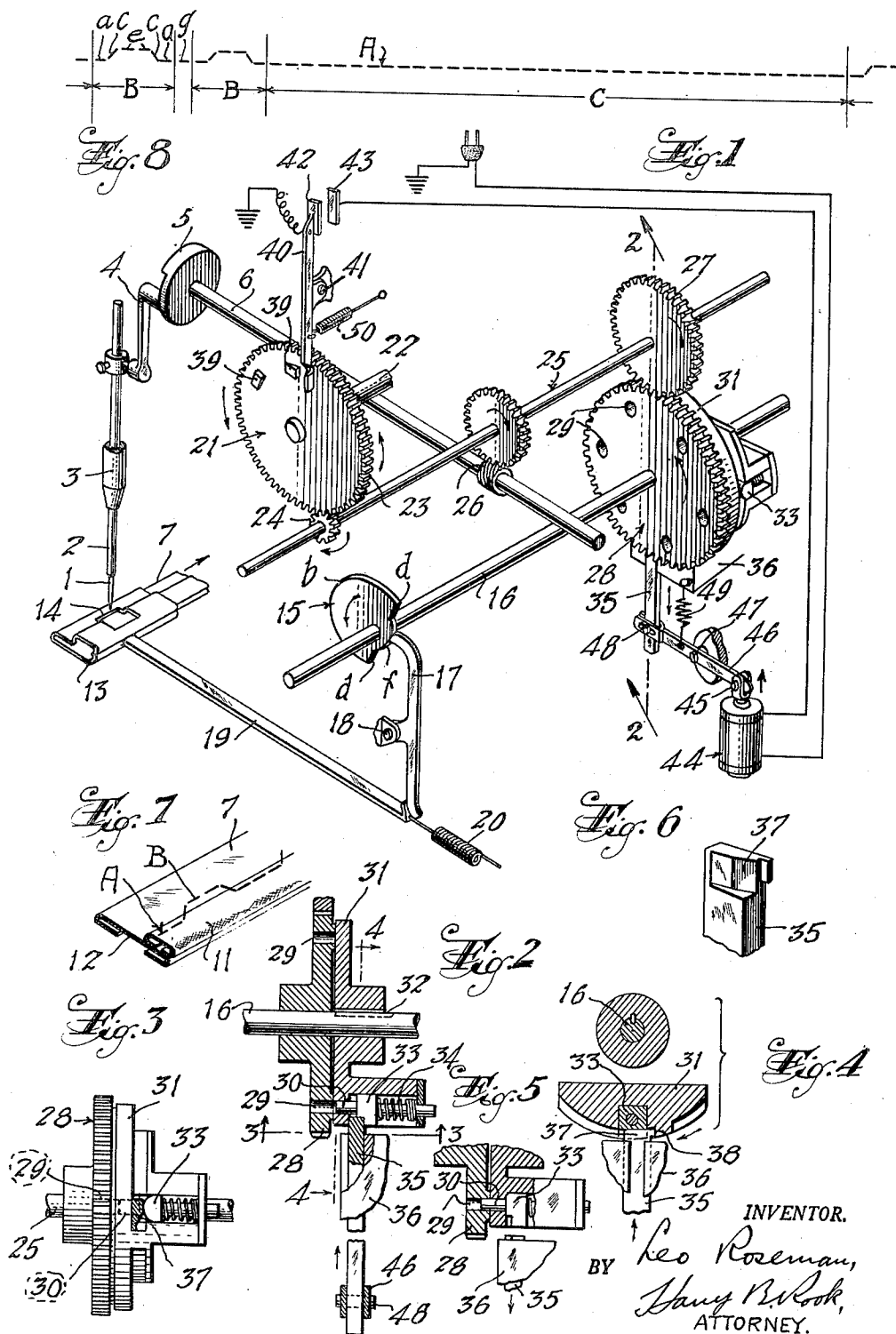


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SEWING MACHINE AND MEANS FOR AUTOMATICALLY
PRODUCING RECURRING OPERATIONS
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SEWING MACHINE AND MEANS FOR AUTOMATICALLY PRODUCING RECURRING OPERATIONS

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This invention relates particularly to sewing machines and methods of the general type wherein special operations such as offsetting certain stitches or groups of stitches relatively to the main line of stitches or forming groups of stitches at spaced points along the main line, either by lateral movement of the needle bar or of the work, or actuation of some other device, are performed at predetermined intervals, all during and in timed relation to the stitching operation.

Known machines of this character include a cam driven by the needle actuating shaft for initiating or controlling said special operations, but said cam is driven continuously by said shaft in repeated cycles during each of which the same operations or sequence of operations is performed. Such a machine is definitely limited by the size of the practical cam and by the continuous rotation thereof in the number, character and relativity of the operations to be performed.

Therefore, a prime object of my invention is to provide a method and a sewing machine of the general character described, wherein the initiation or controlling of the operation of a cam is effected in a novel and improved manner so that the method and machine shall be capable of performing special operations with greater variation in relation to each other, than has been possible heretofore.

Another object is to provide such a machine which shall include a novel and improved combination of an actuating cam mechanism for initiating or performing a special operation, a needle-actuating shaft, and means for automatically starting and stopping said cam mechanism in timed relation to rotation of said needle-actuating shaft.

Further objects are to provide a machine of this character wherein there is a needle-actuating shaft continuously rotated during a sewing operation, a countershaft continuously driven thereby, and a novel and improved combination of a cam mechanism for initiating or performing a special operation, and means for automatically connecting and disconnecting said actuating cam mechanism from said countershaft in timed relation to the stitching operation, whereby said cam mechanism shall be capable of movement relatively to said needle-actuating shaft, and a large number of operations of said cam and wide variations in the relationship thereof can be controlled by the last-named means.

Other objects are to provide such a machine wherein the last-named means shall comprise a clutch between said countershaft and said actuating cam mechanism and an activating or control cam continuously driven by said countershaft in timed relation to operation of said needle-actuating shaft for controlling said clutch, whereby

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the character of the special operation shall be determined by said actuating cam mechanism while the number and relationship of said operations shall be controlled by said control cam.

Other objects, advantages and results will be brought out by the following description in conjunction with the accompanying drawings, in which

Figure 1 is a schematic perspective view of a sewing machine embodying my invention showing the clutch engaged;

Figure 2 is a vertical longitudinal sectional view, taken approximately on the plane of the line 2—2 of Figure 1, showing the clutch disengaged;

Figure 3 is a horizontal sectional view, approximately on the plane of the line 3—3 of Figure 2;

Figure 4 is a fragmentary transverse vertical sectional view, approximately on the plane of the line 4—4 of Figure 2;

Figure 5 is a fragmentary view similar to Figure 2, but showing the clutch engaged;

Figure 6 is a fragmentary perspective view of the actuating nose of the clutch lever;

Figure 7 is a fragmentary perspective view of a piece of work operated upon by the machine, and

Figure 8 is a diagrammatic view showing one of the various lines of stitches that can be produced in accordance with the invention.

Specifically describing the illustrated embodiment of the invention, the machine includes the usual needle 1 carried by the needle bar 2 which is reciprocally mounted in the usual bearing 3 and reciprocable by the usual crank disk through a pitman connection or link 4 by a crank disk 5 which is mounted on and rotated by the needle-actuating shaft 6 that is journaled as usual in the frame or gooseneck of the sewing machine and is driven from any suitable source of power. The threads, bobbins and work feed constitute no part of my invention and therefore have been omitted from the drawings, although it will be understood that in performing stitching operations, the work, such as a hook or eye fastener tape 7, will be moved longitudinally by suitable feed mechanism beneath the needle 1 as the latter reciprocates and the needle will cooperate with the other mechanism to form a line of stitches generally designated A.

The invention contemplates a machine which may be adapted to the performance of a variety of special operations, and for illustrating the principles of the invention, I have shown the special operation as comprising the lateral movement of the fastener tape 7 beneath the needle at predetermined intervals to produce a series of stitches B offset from the main line of stitches C, the stitches serving the purpose of connecting a cover strip 11 of fabric to a base strip 12 with the main line of stitches running along the inner edge

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of the cover strip and with the offset stitches passing through only the main strip to form gaps for insertion of fastener elements between the main strip and the cover strip. Any suitable means may be utilized for laterally moving the work or strip 7, but I have shown a guide tube 13 through which the tape is pulled by the feeding mechanism beneath the needle 1 which passes through openings 14 in the upper and lower walls of the guide tube to form the stitches. The guide tube 13 is moved by an actuating cam mechanism which includes a cam 15 mounted on and to rotate with a cam shaft 16 and cooperating with a follower lever 17 which is pivotally mounted intermediate its ends on a fixed support, as indicated at 18, and has one end following the periphery of the cam and its other end abutting an arm 19 that is secured to and projects from one side of the guide tube 13. A tension spring 20 normally actuates the guide tube 13 into its normal position for producing the main line of stitches A and the cam 15 actuates the tube in the other direction to form the offset stitches B.

No attempt has been made to accurately delineate the contour of the cam 15, but in general each group of stitches B is formed during one revolution of the cam 15, the stitches *a* (see Figure 8) being formed while the follower lever is in contact with opposite ends of the dwell *b* of the cam, the stitches *c* being formed while the work is moving longitudinally and the cam surfaces *d* are passing beneath the follower lever, respectively, and the stitches *e* being formed while the follower lever is in contact with the dwell *f* of the cam. The stitch *g* is formed in the interval while the cam 15 is stationary between its operations to produce two successive groups B of stitches. During the formation of the line of stitches A, the cam 15 is at rest, as will be hereinafter more fully described.

It will thus be seen that the character or nature of the groups B of stitches or other special operations are determined by the shape of the cam 15, and in accordance with the invention, the number and relationship of said groups of stitches or special operations are determined by a control or activating cam 21 which is shown as mounted to rotate on a stub shaft 22 and has a peripheral gear 23 driven by a pinion 24 on a countershaft 25 which is driven by a worm and worm wheel gear 26 from the needle-actuating shaft 6, so that said countershaft 25 rotates continuously with and in timed relation to the needle-actuating shaft during stitching operations. On the countershaft 25 is a gear 27 which meshes with a clutch gear 28 that is freely rotatable on the cam shaft 16 and has a plurality of openings 29 to receive a clutch pin 30 which is slidably mounted in a clutch disk 31 that is keyed at 32 on the cam shaft. The clutch pin 30 is carried by a block 33 and is normally influenced by a spring 34 so as to enter any of the holes 29 which come into register with the pin, and the clutch pin is normally held out of engagement with the clutch gear 28 by a clutch rod 35 that is slidably mounted in a fixed support 36 and has a beveled nose 37 to be engaged by the block 33 when said nose is projected into the path of rotation of said block, as best shown in Figures 2, 3 and 4. When the clutch pin 30 is withdrawn from engagement with the clutch gear, as shown in these figures, its rotation is stopped by engagement of a stop lug 38 on the clutch disk with the nose 37 of the clutch rod, as shown in Figure 4.

When the clutch rod 35 is withdrawn from en-

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gagement with the block 33, the clutch pin 30 is projected into the first hole 29 in the clutch gear that comes into register with the pin, as best shown in Figure 5; and when the pin and clutch gear are so engaged, the clutch shaft 16 is driven through the clutch gear from the gear 27 on the countershaft 25.

The engagement and disengagement of the clutch pin and clutch gear, and consequently the starting and stopping of the cam 15, is controlled automatically by the activating cam 21. For the purpose of performing the special operation here involved, this cam is shown as having two cam projections 39, spaced apart corresponding to the relationship of the group B of stitches. These cam projections cooperate with one end of a follower lever 40 which is pivotally mounted intermediate its ends on a fixed support, as indicated at 41, and has an electrical contact element 42 at its other end to cooperate with another contact element 43 for controlling a circuit from a source of electricity to an electromagnet 44 which includes a coil or winding, an armature, one end of which is pivotally connected at 45 to one end of a lever 46 that is pivotally mounted intermediate its ends on a fixed support, as at 47, and has its other end pivotally connected at 48 to the clutch rod 35, whereby when the coil of the magnet is energized, the armature will move in the direction of the arrow in Figure 1 to actuate the lever 46 and withdraw the clutch rod from the path of movement of the clutch pin block 33, as shown in Figure 5. A spring 49 normally holds the clutch rod in the path of movement of said clutch pin block, as shown in Figures 2, 3 and 4.

The switch lever 40 is normally actuated by a spring 50 to hold one end in the path of movement of the cam projections 39 and to hold the contact elements 42 and 43 out of contact with each other. As the actuating cam 21 is rotated in the direction of the arrow on Figure 1, the cam projections 39 are successively brought into engagement with the switch lever 40.

In operation of the machine and assuming that the formation of the main line of stitches C is being started, the clutch will be disengaged and the cam 15 will be at rest, although the clutch gear 28 and the actuating cam 21 will be continuously driven from the countershaft 25. In this form of the invention, thirty-seven stitches will be formed in the main line C, and the ratio of the gearing is such that after these thirty-seven stitches have been completed, the first cam projection 39 on the activating cam will engage the clutch lever 40 so as to close the circuit through the electromagnet 44, withdraw the clutch rod 35 and permit engagement of the clutch pin 30 with the clutch gear 28 so as to start rotation of the actuating cam 15. Thereupon, the first group 9 of stitches will be formed, the cam 15 rotating in timed relation to the needle-actuating shaft 6 but relatively thereto. Immediately upon release of the switch lever 40 by the first cam projection, the electromagnet 44 is de-energized and the clutch rod returns to its normal position so as to be engaged by the clutch pin block 33 and disengage the clutch after one complete revolution of the cam shaft. While the cam shaft is stationary, the stitch *g* is formed, and thereupon the second cam projection 39 engages the lever 40 to cause formation of the second group 9 of stitches. Then the stitches of the main line are resumed and continued until thirty-seven have been formed, whereupon other groups B of stitches will be formed as above described.

It will be understood by those skilled in the art that any desired number of cam projections 39 may be utilized on the activating cam and the shape of the cam 15 may also be varied in accordance with the operation to be performed. The number of holes 29 in the clutch gear 28 can be varied in accordance with the number of stitches in the special operations e. g. the groups of stitches B. As shown, the speed ratio between the needle-actuating shaft 6 and the cam shaft 16 is six to one, and consequently there are six holes 29, and the cam 15 has been so shaped as to form the six stitches of each group 9 during one revolution of the cam. The ratio of the needle-actuating shaft to the activating cam 21 is fifty to one, while the speed ratio of said activating cam to the countershaft 25 is twenty-five to one, and the speed ratio of the countershaft 25 to the cam shaft 16 is three to one. Obviously, therefore, in the present instance, the needle-actuating shaft will make fifty revolutions to produce fifty stitches, as shown in Figure 8, while the activating cam 21 is making one revolution.

The invention may be embodied in other types of machines and in other details of construction than those shown, within the spirit and scope of the invention; and the cam 15 can be adapted to perform other special operations, for example, to oscillate the needle bar so as to form zigzag or tack stitches.

Having thus described the invention, what I claim is:

1. A sewing machine including a needle-actuating shaft, cam-operated mechanism for performing a certain operation, a rotary element revoluble continuously during and in timed relation to the operation of said needle-actuating shaft, a rotatable device for making and breaking a driving connection between said rotary element and said cam-operated mechanism, and means controlling operation of said device and including a part operable continuously during and in timed relation to the operation of said needle-actuating shaft to make and break in succession said driving connection between said rotary element and said cam-operated mechanism.

2. A sewing machine including a needle-actuating shaft, cam-operated mechanism for performing a certain operation, a rotary element revoluble continuously during and in timed relation to the operation of said needle-actuating shaft, a rotatable device for making and breaking a driving connection between said rotary element and said cam-operated mechanism, means to cause actuation of said rotatable device to make and break said driving connection between said rotary element and said cam-operated mechanism, and an activating cam controlling actuation of said means and rotatable continuously during and in timed relation to the operation of said needle-actuating shaft for making and breaking said driving connection at predetermined times in timed relation to the operation of said needle-actuating shaft.

3. A sewing machine including a needle-actuating shaft, cam-operated mechanism for performing a certain operation, a rotary element revoluble continuously during and in timed relation to the operation of said needle-actuating shaft, a rotatable device for making and breaking a driving connection between said rotary element and said cam-operated mechanism,

means to cause actuation of said rotatable device to make and break said driving connection between said rotary element and said cam-operated mechanism, and an activating cam controlling actuation of said means and rotatable continuously during and in timed relation to the operation of said needle-actuating shaft for making said driving connection at a predetermined time in timed relation to the operation of said needle-actuating shaft and for breaking said driving connection after one revolution of said rotatable device.

4. A sewing machine as defined in claim 2 wherein said rotary element has at least one opening, said rotatable device has a pin to removably enter said opening to connect said rotary element to said rotatable device, said means to cause actuation of said rotatable device includes a clutch rod to cause actuation of said pin to make and break said driving connection, an electromagnetically operated mechanism to actuate said clutch rod and a switch for controlling said mechanism, and said activating cam has cam surfaces to actuate said switch.

5. A sewing machine including a needle-actuating shaft and wherein one stitch is made during each revolution of said shaft, a countershaft driven by said needle-actuating shaft continuously during operation thereof, a cam shaft, a rotatable activating cam driven by said countershaft continuously during operation of the latter, means for connecting and disconnecting said cam shaft respectively to and from said countershaft, means controlled by said activating cam for actuating said means to automatically connect said cam shaft to said countershaft for continuous rotation of the former by the latter and for automatically disconnecting said cam shaft from said countershaft after one revolution of said cam shaft, an actuating cam on said cam shaft, and means actuated by said actuating cam for varying said stitching operation.

6. A sewing machine including a needle-actuating shaft, a countershaft driven by said needle-actuating shaft continuously during operation thereof, a cam shaft, a clutch mechanism for operatively connecting and disconnecting said cam shaft to and from said countershaft including a freely rotatable element driven by said countershaft, a clutch plate rotatable with said cam shaft, a device for connecting and disconnecting said rotatable element to and from said clutch plate, an activating cam driven by the countershaft continuously during rotation thereof at a predetermined ratio with the operation of said needle-actuating shaft and said rotatable element for automatically actuating said device to disconnect said clutch plate from said rotatable element after one revolution of said cam shaft, an actuating cam on and movable with said cam shaft, and means actuated by said cam for performing a certain operation.

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