May 2, 1961 TOSHIO FUJITA 2,982,241

FEED REGULATING MECHANISM FOR SEWING MACHINE

Filed April 7, 1959

Fig. 1

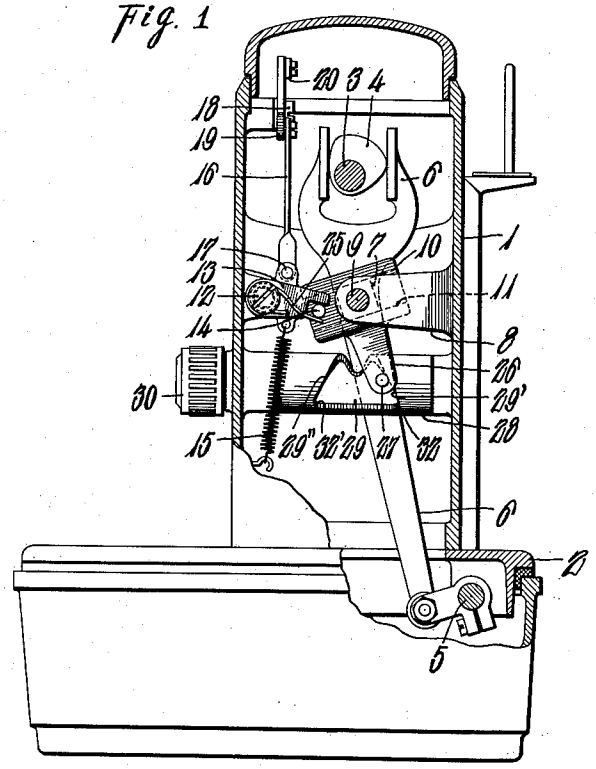


Fig. 3

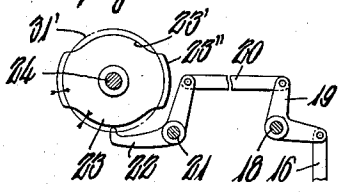


Fig. 2

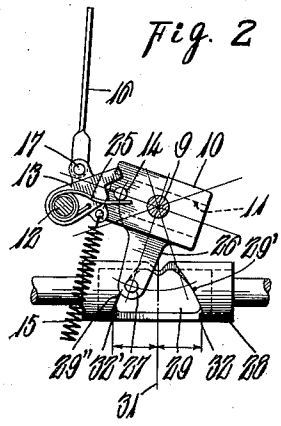


Fig. 4



Fig. 5



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FEED REGULATING MECHANISM FOR SEWING MACHINE

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This invention relates to improvements in a sewing machine having a feeding mechanism which, by means of the motion of a cam, automatically permits the altering of the direction of the feeding motion.

More specifically, the present invention has for an object to provide such a sewing machine with a newly invented mechanism whereby it can be made to automatically and efficiently adjust the volume of both forward and backward feeding so that varied forms of stitching can be produced on the materials.

The present invention comprises such original devices and arrangements of the parts as hereinafter described in detail in connection with the accompanying drawings and as per the claims laid down.

The features and advantages attained by the present invention are, in addition to the abovementioned, (1) the durability of the parts and (2) the simplicity and low costs in the manufacture thereof.

In order to prove that my invention does not produce the same effect or use the same device as that may be produced by or used in any other techniques and that my invention can not be replaced functionally with any other existing mechanism, I shall explain more minutely about the present invention on the basis of the accompanying drawings.

In the drawings:

Figure 1 represents a side elevation of a sewing machine containing the present improvements, showing the sectional view of the rear part of the frame.

Figure 2 represents a front side elevation of the functional parts, showing a feed regulator in the reverse motion actuated by a cam.

Figure 3 illustrates the linking condition of a cam and an operative arm.

Figure 4 illustrates diagrammatically the stitch pattern effected by the standard motion of the cam by itself.

Figure 5 illustrates diagrammatically the stitch pattern effected by the adjusted motion of the cam through the application of my invention whereby the volume of feeding was reduced.

All of these figures refer to only those means and functions which are directly related with or essential to the present invention and all other parts of a sewing machine, which are not related with the essential functions of the present invention are exempted.

The same numerals in all these figures denote the same objects.

Before committing myself to a detailed explanation about the essential functions of the present improvements as substantiated by the accompanying drawings, mention shall be made of the following:

(1) These drawings illustrate the locations and functions of the newly invented devices in the condition wherein those devices are mounted inside the frame of an ordinary sewing machine and not in a portable sewing machine.

Naturally, it is possible for the devices to be mounted in a box underneath the bed plate as observed in a portable sewing machine, together with all other constituent parts of a sewing machine.

Such a matter, however, pertains only to the problem of the location and arrangement of these devices and not to the essential functions of the present invention.

(2) The frame 1 comprising bracket-arm and hollow standard and the bed plate 2 are of the same shapes and constructions as those used for the conventional sewing machine. Similarly, it is to be conceived that the devices mounted in them are of the same constructions as those in any conventional sewing machine.

Now, a cam 4 is rigidly secured to a horizontally disposed main shaft 3 which, extending lengthwise of the bracket-arm, is journaled in bearings at the upper portion of the inside of the frame 1.

Two spaced arms provided at one end portion of a forked connecting rod 6 are engaged with the cam 4 from both sides and the other end portion thereof is connected with a horizontally disposed shaft 5 of the feeding mechanism.

A feed regulator 10 is rotatably secured by means of a shaft 9 to a horizontally disposed bracket protruding inwardly from the wall of the frame 1.

The forked connecting rod 6 and the feed regulator 10 are linked with each other by means of the contact making member 7 of the forked connecting rod 6, which is accommodated in the recessed groove 11 slotted on the feed regulator 10.

On the other hand, there is an arm-piece 13, one end of which is pivotally secured to the frame 1 by means of a pintle 12 and the other end of which is contacted with the upper side of a knock pin 14 protrudingly established on the feed regulator 10.

Simultaneously, a spring 15 is mounted in such a manner that its one end is rigidly secured to the arm-piece 13 and the other end, to the frame 1. Such being the location of the spring 15, the end portion of the arm-piece 13 is constantly forced into engagement with the knock pin 14 by the contracting force of the spring 15.

To the other side of the arm-piece 13 and opposite the location of the spring 15, one end of a connecting rod 16 is rigidly secured by the flat cap screw 17 and the other end portion thereof is also rigidly secured to an end portion of a bell-crank 19 which, in turn, is pivotally secured at its mid-point to the frame by means of a flat cap screw 18.

The other end portion of the bell-crank 19 is connected, through the medium of a pitman 20, with the end portion of a bell-crank-type cam follower 22 which is jointed with each other at the mid-point by a flat cap screw 21 and the tip of the cam follower 22 is brought into contact with the periphery of a cam 23.

The cam 23 is rigidly secured, together with other cams of various shapes, to a cam shaft 24 which receives a rotating motion from the main shaft 3.

On the other hand, a leaf spring 25 is mounted on the arm-piece 13 in such a manner that the end portion of the spring urges the knock-pin 14 constantly upward from the lower side opposite the contacting point of the arm-piece 13. Protrudingly established from the lower side of the feed regulator 10 is an arm 26 which carries a knock-pin 27 at its end and, on the other hand, an adjusting cylinder 28 is horizontally mounted inside the frame 1.

And, on the peripheral surface of the adjusting cylinder, a V-shaped cam groove 29 is slotted so as to accommodate the aforementioned knock-pin 27 therein.

Mention shall, hereinafter, be made of the function of each or the whole part of the newly invented mechanism, which is arranged as mentioned above.

The motion of a dial 30 on the adjusting cylinder causes the cam groove 29 to rotate, thereby altering the contacting position of the knock-pin 27.

Taking advantage of this motion, when the distance of lateral travel of the knock-pin 27 from the right-hand side 29' of the cam groove 29 to the left-hand side 29'' traversing of the boundary line 31 where the direction of the movement of the material is reversed, is adjusted or, in other words, when the amplitude of the lateral travel of the knock-pin 27 traversing the boundary line 31 is narrowed or widened at one's option, the angle of inclination of the feed regulator can be controlled.

In this case, a circle 31' which is drawn along the periphery of the cam 23 in such a manner as to pass the midpoints between the tops 23'' and bottoms 23' of the cam 23, represents simultaneously a boundary line 31' where the direction of the movement of the material is reversed, and the boundary line 31' corresponds to the boundary line 31 on the V-shaped cam groove 29.

I shall now describe in further detail the relations between the V-shaped cam groove 29 and the cam 23.

When the knock-pin 27 and the tip of the cam follower 22 are on the respective border lines 31 and 31', the material being stitched is at a standstill without moving either backward or forward, and when the knock-pin 27 comes into contact with the right-hand side 29' of the V-shaped cam groove 29 and the tip of the cam follower 22 with the bottom 23' of the cam 23, the material makes the forward motion and, conversely, when the knock-pin 27 comes into contact with the left-hand side 29'' of the cam groove 29 and the tip of the cam follower 22 with the top 23 of the cam, the material makes the backward motion.

The above goes to show the following:

The angle of inclination of the feed regulator 10 at the time when the knock-pin 27 comes into contact with the maximum limit 32 of the right-hand side 29' of V-shaped cam groove 29 and that at the time when the tip of the cam follower 22 comes into contact with the bottom 23' of the cam 23 are in complete agreement.

Similarly, the angle of inclination of the feed regulator 10 at the time when the knock-pin 27 comes into contact with the maximum limit 32' of the left-hand side 29'' and that at the time when the tip of the cam follower 22 comes into contact with the top 23'' of the cam 23 are in complete agreement.

The above synchronized contacts of the knock-pin 27 and the tip of the cam follower 22 with the respective maximum limits 32 and 23' actuate the maximum volume of the forward feeding and the similar contacts with the respective maximum limits 32' and 23'' actuate the maximum volume of the backward feeding.

Consequently, if the contacting positions of the knock-pin 27 and the tip of the cam follower 22 can be adjusted and controlled in the course of respective travels from the point of maximum feeding to the point of no feeding, the volume of the movement of the material can be adjusted at one's option.

With regard to the mechanism whereby a cam follower, the tip of which is brought into contact with a cam having the reguired undulations at its periphery, is set in motion by means of the difference of altitude when the tip rises and falls in a manner as dictated by the peripheral shape of the cam and such motion is transmitted to the other substance to make it do the desired function, standard device generally adopted is to bring the cam follower into contact with the cam by means of a spring. In such a conventional device, where the tip of cam follower moves from the top of cam periphery toward the bottom, it is possible to adjust the momentum of cam follower to the desired extent within the limit of the difference of altitude by means of elasticity of a spring, for example, to stop such motion halfway or to turn back the cam follower before it reaches the lowest bottom of cam periphery. However, where the cam follower moves from the bottom of cam periphery toward the top, the adjustment of momentum is absolutely impossible because the cam follower is made to move from the bottom toward the top pressing its tip outwards.

In the present invention, this impossibility has been turned into a possibility by interposing a relative medium simply composed of an arm piece 13 and a leaf spring 25. According to this device, in cases where the material was shifted from forward movement to reverse movement, even if the feed regulator whose momentum was reduced by V-shaped cam groove 29 of adjusting cylinder 28 received more momentum than its reduced momentum from the cam 23, such excess momentum is absorbed by the aforementioned medium and dies away. Thus, various stitch patterns can be produced by adjusting freely the volume of reverse movement of the material.

Figure 4 represents stitch patterns which are obtained by conventional mechanism, i.e., forward movement and backward movement of the material is effected by means of the cam follower, which is in contact with the cam, rising and falling the whole of the difference of altitude between the bottom 23' of the cam 23 and the top 23''. Below I explain in more detail about the stitch patterns as represented by Figure 5 which are obtained by reducing the distance of movement of the material in stitching.

As hereinbefore mentioned, by operating a dial the adjusting cylinder 28 is rotated to predetermine the amplitude of lateral travel of the knock-pin 27, which is accommodated in the V-shaped cam groove, from the right-hand side 29' to the left-hand side 29''. Under this condition, due to the contracting force of a spring 15 the knock-pin 27 is forced to come in contact with the right-hand side 29' at the predetermined contacting position and determine the angle of inclination of the feed regulator 10, which makes the forked connection rod 6 get prepared, led by the recessed groove 11 on the feed regular, for forwarding the material by the volume predetermined. In this case, as the tip of cam follower 22 is held in contact with the cam by dint of the contracting force of the spring 15, during the travel of cam follower from the boundary line 31' of said cam 23 to the bottom 23' there is caused a clearance between the bottom 23' and the tip of cam follower corresponding to the momentum reduced by the adjusting cylinder. This is due to the contracting force of a spring 15, whose elasticity makes it possible to respond easily to the adjustment by the adjusting cylinder and thus the material is forwarded at each stitching by the volume conforming to the angle of inclination of the feed regulator predetermined by V-shaped cam groove of the adjusting cylinder. Then, with further rotation of the cam 23 the tip of cam follower 22 strikes against the raised part of said cam periphery, climbs it up, and mounts entirely on the top 23'' crossing the boundary line 31'. By this action the arm piece 13 is lifted up through the medium of pitman 20, bell crank 19 and a connection rod 16, and changes the condition of feed regulator, with which the arm piece is linked by the spring 25 and the knock-pin 14 provided thereon, from the regulator inclination (the material forward movement angle) to the reverse inclination (the material reverse movement angle). At this time, as said feed regulator is reduced beforehand its angle of inclination, as hereinbefore mentioned, by V-shaped cam groove 29 of adjusting cylinder 28, the knock-pin 27 of the feed regulator will dash against the cam groove 29 at the middle way of the left-hand side 29'' and further movement from that point of the knock-pin is checked. On the other hand, as the tip of the cam follower is at this time on the higest of the top 23'' of the cam 23, the cam forces said cam follower to create the maximum motion in order to transmit the former's motion to the latter, in other words, the cam tries to lift the standing feed regulator upwards through the medium of the arm piece 13. Therefore, if no consideration is given to this matter, some part of such

mechanism must break. In the present invention the arm piece carries a leaf spring 25, which is engaged with the knock-pin 27 of the feed regulator and, therefore, even if excess lift-up motion is imparted to the feed regulator, an elastic leaf spring 25 bends and absorbs such excess motion and thereby keeps the mechanism parts free from breaking.

As hereinbefore described in detail, in a type of sewing machine having a feeding mechanism which automatically permits the altering of the direction of the feeding motion, the present invention provides the machine with free adjustment of the feeding volume, both in forwarding and reversing, and thereby insure efficient work of various stitch patterns.

Having thus described the nature of the invention, what I claim herein is:

1. In a sewing machine, a frame, a pivot secured to said frame, a feeding mechanism for automatically altering the direction of feed for pattern stitching including a feed regulator tiltably secured on said pivot, a knock pin carried by said feed regulator spaced from said pivot, an arm piece having one end pivotally secured to said frame, and having its other end normally engaging said knock pin, spring means biasing said arm piece to normally press against said knock pin to tilt said feed regulator in one direction, leaf spring means mounted on said arm piece in engagement with said knock pin to bias said knock pin toward said arm piece, a rotary pattern-cam, a cam follower riding on said pattern cam, linkage means connecting said cam follower to said arm piece, and adjustable stop means mounted on said frame to limit effective motion of said feed regulator under the influence of said cam.

2. The device of claim 1, in which said feed regulator is provided with an arm, a stop pin on said arm and two adjustable stop surfaces, said stop surfaces being mounted on a common element and movable simultaneously to effect equal adjustment to both stop surfaces simultaneously.

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