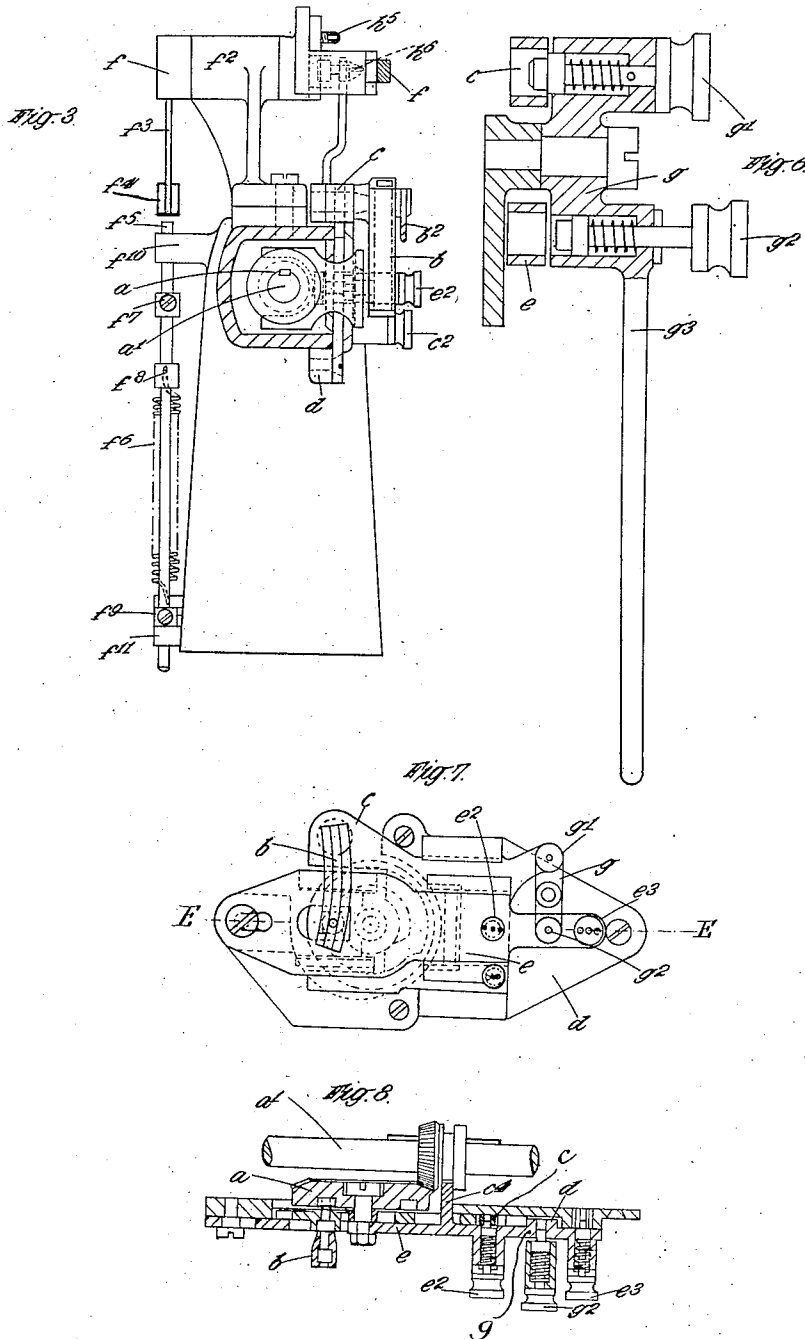


C. E. FRANCIS.
SEWING MACHINE.
APPLICATION FILED SEPT. 16, 1918.

1,331,099.

Patented Feb. 17, 1920.

2 SHEETS—SHEET 2.



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UNITED STATES PATENT OFFICE.

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SEWING-MACHINE.

1,331,099.

Specification of Letters Patent.

Patented Feb. 17, 1920.

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To all whom it may concern:

Be it known that I, CHARLES EDWARD FRANCIS, a subject of the King of Great Britain, residing at Vickers House, Broadway, Westminster, in the county of London, England, have invented certain new and useful Improvements in Sewing-Machines, of which the following is a specification.

The present invention relates to sewing machines having means for vibrating the needle to produce lateral stitches for executing embroidery and the like, of the kind in which provision is made for producing stitches of different characters, that is, stitches which, whatever their lateral length, may take place across a neutral line or to and from a neutral line, the neutral line being understood to be the line the needle would follow if the devices were so adjusted that their operation produced a negative result, that is, no lateral vibration of the needle; and in particular the invention relates to machines comprising also means for changing the position of the neutral line. The main object of the invention is to provide for changing the character of stitch and position of the neutral line by means more simple and readily operable than those heretofore known.

The term "stitch" is not used herein in its strict sense but for the exposed thread from one penetration of the needle to the next.

The aforesaid means comprises a member such as a fulcrumed lever oscillated by a cam or the like which lever by a connection with the needle bar vibrates the needle laterally, the distance between the fulcrum of the lever and the point of operation of the lever on the said connection being adjustable and determining the lateral length of stitch. The said means also comprise provision whereby the path of oscillation of the part of the lever directly operating the connection with the needle bar may be varied to alter the character of stitch from time to time as desired.

According to the said invention the aforesaid lever or the like (hereinafter referred to as a lever) is mounted on or carried by a member, such as a slide, capable of being moved relatively to the body of the machine to vary the position of the neutral line of the stitches and there is combined therewith means for varying the character of stitch

operated by a member such as a slide capable of movement independently of the aforesaid member, and preferably carried thereby. The provision for altering the character of the stitch is therefore operable independently of the slide or member carrying the lever and the position of the lever as a whole may be changed without affecting the said provision with the result that with any character of stitch a number of different positions of the neutral line are provided for in a simple and efficient manner.

In a convenient embodiment of the said invention the path of oscillation of the lever is varied by moving its driver, as for instance a cam, relatively to the fulcrum of the lever. The driver employed may be a cam, the operative part of which consists of a cam groove or rib at the periphery of a cylinder and preferably one in which the cam groove or rib is reversed and crosses itself so that in two revolutions of the cam but one complete oscillation of the lever is effected. The cam is splined or feather keyed on its shaft so that it may be slid along the shaft and actuates the lever through a follower. The cam may be provided with a neck or groove in which is engaged a laterally movable fork to move the cam along the shaft. The said fork is carried by a slide working in or on a slide carrying the lever and is movable relatively thereto. With this construction the cam may be moved by means of the said fork slide into such a position relatively to the lever fulcrum that the stitches take place across a neutral line or into a position in which the stitches are to and from that neutral line on one side of it or into a position in which the stitches are to and from the neutral line on the other side of it. Stitches of these different characters may be produced without moving the lever slide but if the lever slide and parts carried by it be moved the position of the neutral line may be varied whatever be the character of stitch and the cam follows the movement of the slide without disturbance to its position relatively to the lever whatever it may be. A number of different positions for stitches of each character is therefore provided for.

In order that the driver action on the follower may always be correct whatever be the position of the driver the follower is preferably not fixed to the lever but is se-

cured in a member that may slide in a direction parallel to the axis of the driver shaft and this member in turn is connected to the lever by the medium of a pin and slot connection which may be adjacent to the follower or at any part of the said member adjacent to the lever.

In order that the said invention may be clearly understood and readily put in practice it is hereinafter particularly described with reference to the accompanying drawings which illustrate by way of example the preferred embodiments thereof;

Figure 1 of the said drawings is a side view of the bracket arm of a sewing machine on and in which is mounted mechanism embodying the said invention.

Fig. 2 is a fragmentary horizontal section taken along the axis of the driver shaft.

Fig. 3 is a section taken on the line A, A Fig. 2 showing certain parts in elevation.

Fig. 4 is a local section taken on the line B, B Fig. 2.

Fig. 5 is a local section taken on the line C, C Fig. 1.

Fig. 6 is a local section taken on the line D, D Fig. 1.

Fig. 7 is a side view illustrating a modification hereinafter described and Fig. 8 is a horizontal section thereof taken on the line E, E Fig. 7.

Figs. 4, 5 and 6 are drawn to a larger scale than the other figures.

In the following description the parts of the said drawings are referred to by the letters and numerals marked thereon the same letters and numerals indicating the same or like parts in all the said figures.

a is a movable driver being a switch cam as hereinbefore described, the said driver being splined on its driving shaft a^1 so that it may be slid along the said shaft. b is the fulcrumed lever which is oscillated by the cam to produce lateral vibration of the needle as usual, b^1 being its fulcrum. The needle bar is mounted in a known manner so as to be free to be laterally vibrated and is so vibrated by means of the connecting rod b^2 which at its inner end is pivoted to a block slidable in a slot in the lever b to vary the extent of the vibrations of the said rod and consequently of the needle as well known. The mechanical connection between the driver a and lever b consists of a bifurcated member b^3 (usually termed a "follower") pivotally mounted in a slide b^4 having an extension b^5 in which a roller b^6 at the rear of the lever b works, the part of the said extension in which the said roller engages being vertically slotted to provide for vertical movement of the roller relatively to the slide b^4 due to the arcuate movement of the lever b . The cam grooves in the driver a are double and the bifurcated part of the follower b^3 works in the

double grooves (see Fig. 2). The slide b^4 is laterally reciprocated by the driver a and moves in a direction parallel to the axis of the shaft a^1 as distinguished from having an arcuate movement as heretofore usual, whereby the desired action of the cam grooves of the driver a on the follower b^3 is always correct whatever be the position of the driver relatively to the lever b . The fulcrum of the lever b is carried by a slide c which may be moved horizontally and works between guides d^1 , d^1 on a fixed plate d secured in the bracket arm. The driver a has an annular groove a^2 in which engages a fork e^1 on a slide e which may be moved horizontally and works between guides c^1 , c^1 on the slide c (hereinafter referred to as the fulcrum slide). By moving the fulcrum slide c horizontally, the fulcrum of the lever b is moved whereby the position of the neutral line of the lateral stitches is changed and by moving the driver slide e horizontally without moving the slide c the position of the driver a relatively to the fulcrum of the lever b is varied whereby the character of stitch is changed without changing the position of the neutral line. By moving the slides c , e together to the same degree the position of the neutral line of the lateral stitches is changed without changing their character.

The lateral length of stitch is varied by raising or lowering the block at the inner end of the rod b^2 and working on the lever b nearer to or farther from the fulcrum b^1 by angularly turning the two armed lever f centered at f^2 . This lever f has one arm at the front having a bend in its length to bring it over the rod b^2 to which it is connected by a link f^1 . The other arm of the lever f , is to the rear and connected by a link f^3 to an arm f^4 adjustably secured by screw nuts on a vertical rod f^5 which may be moved vertically by the knee of the operator as usual. The said rod f^5 is moved upwardly against the resilience of a helical spring f^6 connected at its lower end to the bracket arm and at its upper end to a collar f^7 adjustably secured on the rod f^5 , so that the tendency of the spring f^6 is to cause the connection between the lever b and needle bar to assume the neutral position that is to cause the block in the slot in the lever b to be coincident with the fulcrum b^1 in which position no lateral movement is imparted to the needle bar. Collars f^8 , f^9 are adjustably secured on the rod f^5 which collars respectively coact with fixed stops f^{10} , f^{11} on the bracket arm to limit the movement of the rod f^5 in either direction to any desired extent whereby the length of lateral stitches produced may be automatically limited to a certain maximum or a certain minimum or both.

Provision is made for securing, for the

time being, the slides c and e in various positions relatively to each other or to the bracket arm by coupling devices consisting in each case of a spring plunger that is mounted on the slide and may be allowed to engage in any one of a series of holes in the part or slide to which it is to be coupled or may be withdrawn from such engagement. In each case in the embodiment illustrated each spring plunger may be caused to engage in any one of the three holes spaced apart in the direction of movement of the slides. e^2 is the spring plunger on the slide e by which it may be connected to the slide c by allowing it to engage in any one of three holes c^3 , c^3 therein (see Fig. 2). e^3 is the spring plunger on the slide e by which it may be connected to the bracket arm by allowing the said plunger to engage in any one of three holes d^2 , d^2 in the fixed plate d (see Fig. 2) and c^2 is the spring plunger carried by the slide c for connecting that slide to the bracket arm in a similar manner. Each of the said spring plungers is of a known kind being forced forward into engagement position by its helical spring and provided with a cross pin working in a slot in the bush of the plunger which pin when the plunger is pulled outwardly by thumb and finger and turned angularly abuts against the outer end of the plunger bush thus withholding the plunger from engagement position. Thus the slides c and e may be connected together in any one of three positions relatively to each other and either be free to move together on the bracket arm or connected to the said arm in any one of three positions. Or the slides c and e may be free to move relatively to each other and either one connected to the bracket arm in any one of three positions. Or the slides c and e may be free to move relatively to each other and each be free to move relatively to the bracket arm. The slides c , e are operated through the medium of a lever g pivoted at the center on the bracket arm and this lever carries spring plungers g^1 , g^2 by which it may be connected to the slides c and e , respectively by engagement of the said plungers in slots in the slides (see Fig. 6) the said spring plungers being similar to those carried by the slides. By means of the said spring plungers g^1 , g^2 the lever g may be connected to or disconnected from either of the slides c and e or connected to, or disconnected from, both at will. The lever g is provided with a handle g^3 by which the said lever may be turned to move the said slides or either of them when it is connected up suitably and they are not secured to the bracket arm. By operating the spring plungers c^2 , e^2 , e^3 , g^1 , g^2 selectively it will be appreciated that various movements of one or both the slides c and e may be allowed or produced by vibrating the lever g . For in-

stance if the plungers g^1 , g^2 be in action and the plungers c^2 , e^2 , e^3 out of action the slides c and e are slid in opposite directions by vibration of the lever g ; if the plungers c^2 , e^3 and g^1 or g^2 be out of action and the others in action then the slides will be reciprocated together; if e^2 , e^3 , g^1 be out of action and g^2 , c^2 in action the slide e will be reciprocated and if c^2 , g^2 , e^2 be out of action and g^1 , e^3 in action the slide c will be reciprocated.

Means are provided whereby the lever g may when desired be rocked automatically according as the means are operated for varying the lateral length of the stitches by actuation of the rod f^5 . These means consist of a short crank arm g^4 on the lever g which is linked up with a lever h fulcrumed at h^1 and connected by a link h^2 with a block h^3 which may be clamped in an arcuate slot in a member h^4 mounted on the lever f . The member h^4 is mounted in vertical guides on the lever f and at its upper part has a vertical slotted ear the slot in which may work over a pin h^5 on the lever f which pin is screwed and carries a fly nut by which the member h^4 may be secured in any position along the slot and the block h^3 may be adjusted in the member h^4 and secured by a clamping fly nut h^6 carried by a screwed pin on the said block. When the block h^3 is coincident with the fulcrum f^2 of the lever f rocking of the said lever does not impart any motion to the lever g but according as the block h^3 is secured nearer to either end of the slot in the member h^4 , so rocking of the lever f imparts a greater rocking motion to the lever g , the member h^4 being itself secured on the lever f by the clamping nut on the pin h^5 . According as the block h^3 is secured on one or other side of the center f^2 so the movement of the slide or slides operated by the lever g is changed compared to the movement of the rod b^2 . The vertical slot in the ear of the member h^4 admits of variation of the vertical position of the said member relatively to the lever f whereby the position of the path of reciprocation of the slides operated by the lever g is varied. When it is desired to operate the lever g by other means the block h^3 is secured coincidentally with the fulcrum f^2 and the clamping nut on the pin h^5 released, the vertical reciprocations imparted to the member h^4 by the rocking of the lever g being then permitted without interference with movement of the lever f , by reason of the slot working over the pin h^5 .

Means may also be provided whereby the lever g may be rocked automatically or mechanically in a predetermined manner and such means are comprised in the mechanism illustrated. The said means consist of a groove cam i rotated from the shaft a^1 by

toothed gear (best shown in Fig. 2) and a lever i^1 that may be rocked by action of the cam i which lever is connected to a short arm g^5 on the lever g by a link i^2 . The lever i^1 is fulcrumed to the bracket arm at i^3 and carries a spring plunger i^4 a roller on the inner end of which may engage in the cam groove in the cam i and when it be not desired to operate the lever g by the said cam the spring plunger i^4 , which is similar to the plungers c^2 , e^2 , e^3 , g^1 , g^2 may be withdrawn from the said groove and caused to remain in inoperative position so long as desired.

From the foregoing description it should be understood that by use of the mechanism hereinbefore described, a very large variety of stitches may be produced. By moving the slide e , the driver a is moved relatively to the fulcrum of the lever b whereby at will the stitches as they increase or decrease in length by movement of the connecting rod b^2 may so increase or decrease across the neutral line or up to or away from a neutral line as it will be understood that when the center of the operative part of the driver a is directly beneath the fulcrum b^1 the stitches may be increased or decreased in length across the neutral line, that is, the variation is equally divided between each end of each stitch. On the other hand, if the driver a be moved on its shaft a^1 in one or the other direction so that the lever b is in its most upright position at the end of a stroke, then all the stitches will end on the neutral line whatever be their length and any variation of the length takes place at the ends of the stitches farther from the neutral line. When the driver is in intermediate positions the stitches will take place across the neutral line but not equally so, that is, each stitch will lie more on one side of the neutral line than the other. If the slides c and e are moved together so as not to interfere with any desired relative position between the driver a and fulcrum b^1 then the position of the neutral line may be changed without altering the character of stitching as designed by a previous adjustment of the said relative position. In work for which sewing machines of the kind referred to are designed it is not often desired to vary the position of the neutral line by retaining the driver in one position and moving the fulcrum b^1 relatively thereto, but if desired this may be done in the mechanism described by retaining the slide e and appropriately moving the slide c . As a general rule, however, it is preferable to vary the position of the neutral line by moving the slides c and e together.

By a suitably designed automatically acting mechanical means for operating the slide or slides, a great variety of regularly changing stitching may be produced. The mechanism comprising a cam i hereinbefore de-

scribed is an example of this. The said cam as shown rotates once for six revolutions of the shaft a^1 and driver a and moves the lever g twice in each rotation that is, once for three revolutions of the driver a . If the slides c and e are relatively disposed in such a manner that the stitches take place to and from the neutral line and the slide c be retained in that position and the lever g connected to the slide e so as to reciprocate it, and also if the relationship between the cam i and the cam grooves in the driver be such that the cam i operates as the needle has left a penetration away from the neutral line and is about to carry a stitch across to the neutral line, the cam i will cause the driver a at that instant to move to its other extreme position on the other side of the neutral line, thus causing the said stitch to be double the length it would otherwise be and be thrown across the neutral line. As the cam i rotates once in six revolutions of the shaft a^1 the said cam will cause the reverse operation during the third rotation of the driver a thereafter, and so on, the result being that stitching is produced consisting of a stitch up to the neutral line, then one from that line, then a long stitch across the neutral line, then one up to the neutral line from that side, then a stitch away from the neutral line on that side, then a long stitch back again across the neutral line, then a stitch up to the neutral line, and so on. The timing of the cam i with the driver a may be varied and if this be done different stitches may be produced from that just described, for instance, if it be timed to act as the needle is leaving a penetration on the neutral line, the next rotation of the driver as it is being slid along, will not transmit any movement to the lever b and so the next stitch will take place along the neutral line, the next stitch to this taking place from the neutral line on the other side to that from which the needle approached when about to make the penetration referred to on the neutral line and with a six to one cam as shown this action will take place at every third stitch, that is, every third stitch will lie along the neutral line, the two intermediate stitches being first on one side of the neutral line and next on the other.

To provide for convenient variation of the timing of the cam i it is mounted so that it may be turned on the gear wheel i^5 and secured thereto by a screw i^6 which in order to produce timing according to either of the examples stated may be engaged in either of two holes in the gear wheel i^5 as the case may be, that one of the said holes not in use for the time being indicated at i^7 in Fig. 1.

The mounting of the follower in a slide is very advantageous as compared with means comprising such a follower as here-

tofore known, as it insures that whatever be the position of the driver relatively to the follower, the various parts of the cam grooves in the driver have precisely their respective actions on the follower.

It is not essential according to the said invention that the driver employed be a switch cam having its cam groove arranged in the outer part of a cylinder as shown in the mechanism illustrated in Figs. 2 to 6. A driver consisting of a cam having a cam groove on one of its sides may for instance be employed and such an arrangement is illustrated in Figs. 7 and 8. In this arrangement, the driver rotates on a pin secured in the slide *e* and is rotated by a bevel wheel splined on the shaft *a*¹ and retained in gear with the driver and caused to move laterally with it by a fork *c*⁴ on the slide *e* engaging in a neck in a collar on the said bevel wheel. The other parts shown in Figs. 7 and 8 are very similar to like parts in the embodiment shown in Figs. 1 to 6 and the equivalent thereof, and need no further description.

It is to be understood that the present invention is not limited to the particular means hereinbefore described in detail for varying the character of stitch, that is the provision for moving the driver relatively to the lever fulcrum, as the said invention may readily be used in connection with known devices for the purpose such as the displacement of a part of the lever directly operating the connection with the needle bar relatively to the part of the lever directly actuated by the driver or the movement of the lever fulcrum relatively to the driver, provided the means for changing the character of the stitch are operable independently of the member carrying the lever as a whole.

What I claim and desire to secure by Letters Patent of the United States is:—

1. A sewing machine comprising in combination a lever, means to oscillate it, a connection between it and the needle bar to vibrate the needle horizontally, means for adjusting the point where the said lever acts on the said connection relatively to the fulcrum of the said lever to vary the lateral length of stitch, a member carrying the said fulcrum, the said member being movable relatively to the body of the machine to vary the position of the neutral line of the stitches, and means for varying and controlling the character of stitch which are operable independently of the said member.

2. A sewing machine comprising in combination a lever, means to oscillate it, a connection between it and the needle bar to vibrate the needle horizontally, means for adjusting the point where the said lever acts on the said connection relatively to the fulcrum of the said lever to vary the lateral length of stitch, a slide carrying the

said fulcrum, the said slide being movable relatively to the body of the machine to vary the position of the neutral line of the stitches, and means for varying and controlling the character of stitch which are operable independently of the said slide.

3. A sewing machine comprising in combination a lever, means to oscillate it, a connection between it and the needle bar to vibrate the needle horizontally, means for adjusting the point where the said lever acts on the said connection relatively to the fulcrum of the said lever to vary the lateral length of stitch, a slide carrying the said fulcrum, the said slide being movable relatively to the body of the machine to vary the position of the neutral line of the stitches, and means for varying and controlling the character of stitch which are carried by the said slide but operable independently thereof.

4. A sewing machine comprising in combination a lever, means to oscillate it, a connection between it and the needle bar to vibrate the needle horizontally, means for adjusting the point where the said lever acts on the said connection relatively to the fulcrum of the said lever to vary the lateral length of stitch, a slide carrying the said fulcrum, the said slide being movable relatively to the body of the machine to vary the position of the neutral line of the stitches, and means on a slide carried by the aforesaid slide, for varying and controlling the character of stitch, the said slides being operable independently of each other.

5. A sewing machine comprising in combination a lever, a displaceable driver to oscillate it, a connection between it and the needle bar to vibrate the needle horizontally, means for adjusting the point where the said lever acts on the said connection relatively to the fulcrum of the said lever to vary the lateral length of stitch, a movable member carrying the said fulcrum, the said driver being displaceable with the said movable member and fulcrum relatively to the body of the machine to vary the position of the neutral line of the stitches and also displaceable relatively to the said member and fulcrum for varying the character of stitch.

6. A sewing machine comprising in combination a lever, a rotatory driver to oscillate it, displaceable along its driving shaft, a connection between said lever and the needle bar to vibrate the needle horizontally, means for adjusting the point where the said lever acts on the said connection relatively to the fulcrum of the said lever to vary the lateral length of stitch, a movable slide carrying the said fulcrum, a slide carried by the aforesaid slide and having means to displace the said driver, the said two slides being at will operable together and also independently of each other.

7. A sewing machine comprising in combination a lever for vibrating the needle horizontally, a rotatory driver for oscillating the said lever, a slide operating between the said lever and driver, a follower carried by the said slide and engaged with the said driver and a pin and slot connection between the said slide and the said lever.

8. A sewing machine comprising in combination a lever, means to oscillate it, a connection between it, and the needle bar to vibrate the needle horizontally, means for adjusting the point where the said lever acts on the said connection relatively to the fulcrum of the said lever to vary the lateral length of stitch, a member carrying the said fulcrum, the said member being movable relatively to the body of the machine to vary the position of the neutral line of the stitches, means for varying and controlling the character of stitch operable by a member movable independently of the aforesaid member, and means operable at will for operatively connecting together the said two members and disconnecting them from each other.

9. A sewing machine comprising in combination a lever, means to oscillate it, a connection between it and the needle bar to vibrate the needle horizontally, means for adjusting the point where the said lever acts on the said connection relatively to the fulcrum of the said lever to vary the lateral length of stitch, a member carrying the said fulcrum, the said member being movable relatively to the body of the machine to vary the position of the neutral line of the stitches, means for varying and controlling the character of stitch operable by a member movable independently of the aforesaid member, and means operable at will for operatively connecting together the said members in different operative positions and disconnecting them from each other.

10. A sewing machine comprising in combination a lever, means to oscillate it, a connection between it and the needle bar to vibrate the needle horizontally, means for adjusting the point where the said lever acts on the said connection relatively to the fulcrum of the said lever to vary the lateral length of stitch, a member carrying the said fulcrum, the said member being movable relatively to the body of the machine to vary the position of the neutral line of the stitches, means for varying and controlling the character of stitch operable by a member movable independently of the aforesaid member, and means operable at will by which either of the said members may be adjustably secured to the body of the machine and operatively released therefrom.

11. A sewing machine comprising in combination a lever, means to oscillate it, a connection between it and the needle bar to

vibrate the needle horizontally, means for adjusting the point where the said lever acts on the said connection relatively to the fulcrum of the said lever to vary the lateral length of stitch, a slide carrying the said fulcrum, the said slide being movable relatively to the body of the machine to vary the position of the neutral line of the stitches, means for varying and controlling the character of stitch which are operable independently of the said slide, and a mechanical operative and releasable connection between the means for varying the lateral length of stitch and the said slide.

12. A sewing machine comprising in combination a lever, means to oscillate it, a connection between it and the needle bar to vibrate the needle horizontally, means for adjusting the point where the said lever acts on the said connection relatively to the fulcrum of the said lever to vary the lateral length of stitch, a member carrying the said fulcrum, the said member being movable relatively to the body of the machine to vary the position of the neutral line of the stitches, means for varying and controlling the character of stitch which are operable independently of the said member, and a mechanical operative and releasable connection between the means for varying the lateral length of stitch and the means by which the character of stitch is varied.

13. A sewing machine comprising in combination a lever, means to oscillate it, a connection between it and the needle bar to vibrate the needle horizontally, means for adjusting the point where the said lever acts on the said connection relatively to the fulcrum of the said lever to vary the lateral length of stitch, a member carrying the said fulcrum, the said member being movable relatively to the body of the machine to vary the position of the neutral line of the stitches, means for varying and controlling the character of stitch which are operable independently of the said member, and mechanical operative and releasable connections between the means by which the lateral length of stitch is varied and the aforesaid member and between the said means and the means for varying the character of stitch.

14. A sewing machine comprising in combination a lever, means to oscillate it, a connection between it and the needle bar to vibrate the needle horizontally, means for adjusting the point where the said lever acts on the said connection relatively to the fulcrum of the said lever to vary the lateral length of stitch, a member carrying the said fulcrum, the said member being movable relatively to the body of the machine to vary the position of the neutral line of the stitches, means for varying and controlling the character of stitch which are operable

independently of the said member, and devices whereby the means last referred to may be actuated by the machine mechanically and automatically.

5 15. A sewing machine comprising in combination a lever, means to oscillate it, a connection between it and the needle bar to vibrate the needle horizontally, means for
10 adjusting the point where the said lever acts on the said connection relatively to the fulcrum of the said lever to vary the lateral length of stitch, a member carrying the said fulcrum, the said member being movable
15 relatively to the body of the machine to vary the position of the neutral line of the stitches, means for varying and controlling the character of stitch which are operable
20 independently of the said member, and devices whereby the said member and the means last referred to may both be mechanically and automatically operated by
the machine.

16. A sewing machine comprising in combination a lever, means to oscillate it, a connection between it and the needle bar to
25 vibrate the needle horizontally, means for adjusting the point where the said lever acts on the said connection relatively to the fulcrum of the said lever to vary the lateral
30 length of stitch, a member carrying the said fulcrum, the said member being movable relatively to the body of the machine to vary the position of the neutral line of the stitches, means for varying and controlling the char-

acter of stitch which are operable independ- 35
ently of the said member, and an operative member for operating the aforesaid member and the said means for varying and controlling the character of stitch, simul-
40 taneously in different operative manners, and means by which the said operative member may at will be disconnected from the member carrying the lever fulcrum and re-connected thereto and disconnected from
45 the means for varying and controlling the character of stitch and re-connected thereto.

17. A sewing machine comprising in combination a lever, means to oscillate it, a connection between it and the needle bar to
50 vibrate the needle horizontally, means for adjusting the point where the said lever acts on the said connection relatively to the fulcrum of the said lever to vary the lateral length of stitch, a member carrying the said fulcrum, the said member being movable
55 relatively to the body of the machine to vary the position of the neutral line of the stitches, means for varying and controlling the character of stitch which are operable independently of the said member, and
60 means whereby the said member and the means for varying and controlling the character of stitch may at will be operated selectively by hand, by automatic means, and by means for varying the lateral length of
65 stitch.

In testimony whereof I affix my signature.
CHARLES EDWARD FRANCIS.