July 9, 1963 L. BONO 3,096,737

FABRIC FEEDER MECHANISM FOR SEWING MACHINE

Filed Jan. 19, 1961 3 Sheets-Sheet 1

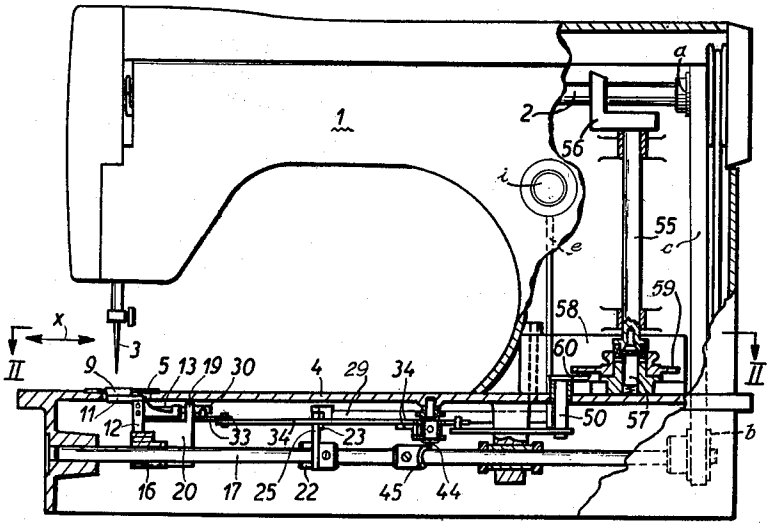


FIG.1

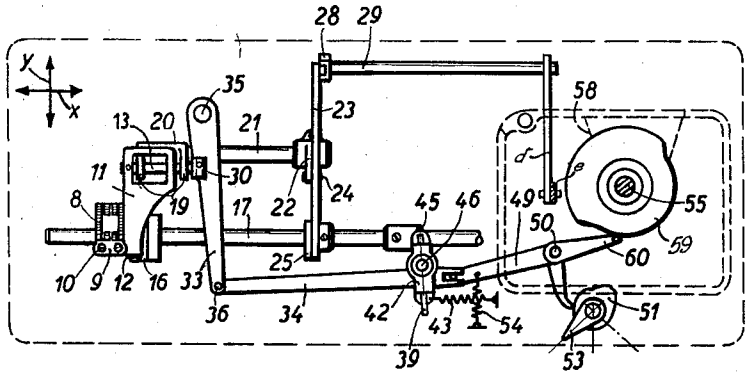


FIG. 2

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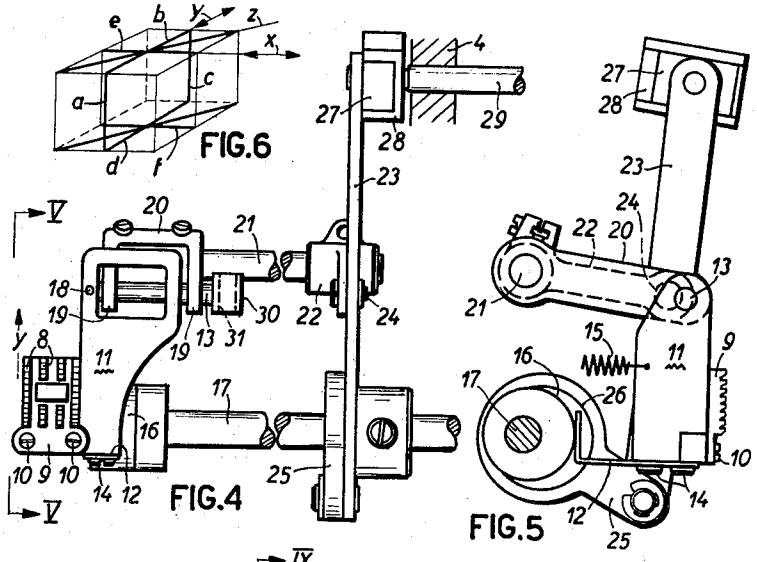


FIG.6

FIG.4

FIG.5

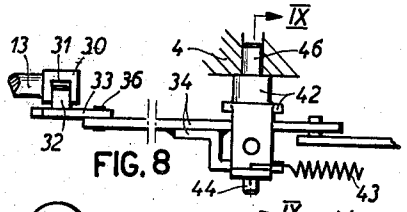


FIG. 8

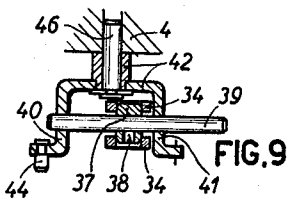


FIG.9

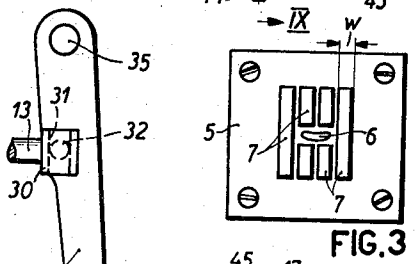


FIG.3

FIG.7

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FIG.10

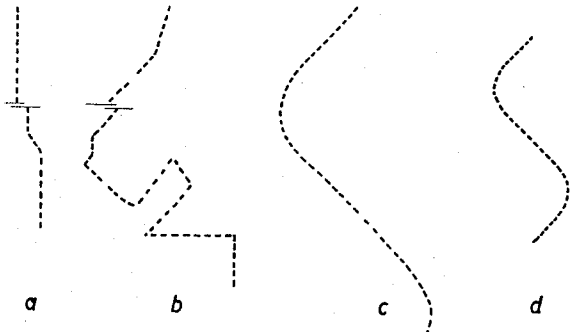


FIG.11

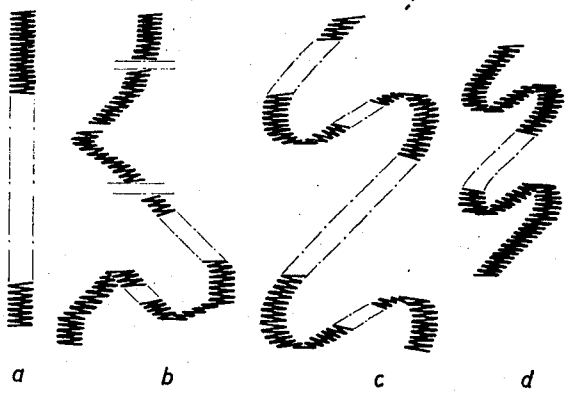
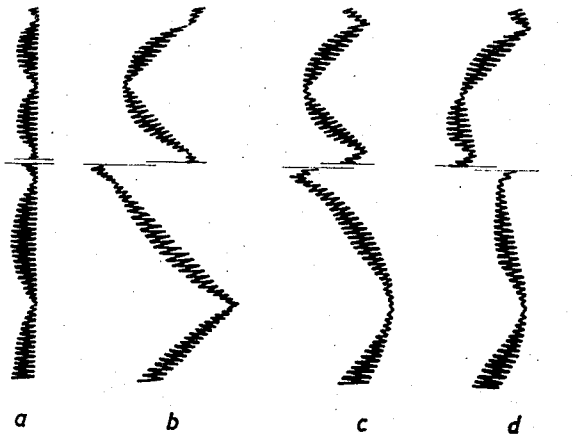


FIG.12



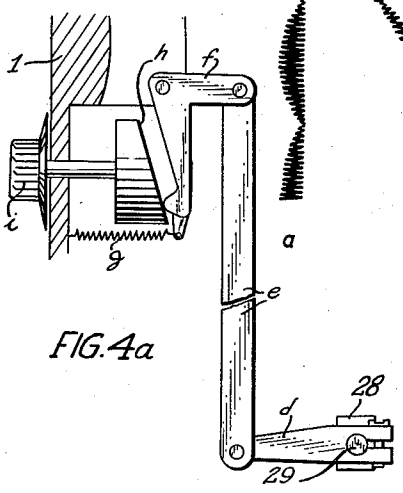


FIG.4a

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United States Patent Office 3,096,737 Patented July 9, 1963

3,096,737

FABRIC FEEDER MECHANISM FOR SEWING MACHINE

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Filed Jan. 19, 1961, Ser. No. 83,832
Claims priority, application Italy May 14, 1960
5 Claims. (Cl. 112—204)

This invention resides in the mechanism of a sewing machine for moving the material past the needle.

The invention has for its principal object the movement of the material in any direction and to any extent.

As another object in cooperation with lateral displacement of the needle, the movement of the material may vary in direction and extent so that the movement of the fabric may contribute to the production of designs of a particularly decorative nature.

A further object is the provision of control means to determine the extent of these movements, the control means being manually settable or actuated by program members operated by the machine driving mechanism to determine a set pattern of control, or responsive to a conjoint operation of both.

FIGURE 1 shows a sewing machine, partially in section, so as to show the device.

FIGURE 2 is a plan view of the device, seen along the line II—II of FIGURE 1.

FIGURE 3 is a plan view, on a different scale, of the needle plate of the machine.

FIGURE 4 is a detail view of a part of the mechanism of FIGURE 2.

FIGURE 4*a* is a detail view of the adjusting control means to vary the amplitude of the lateral movement.

FIGURE 5 is a view along the line V—V of FIGURE 4.

FIGURE 6 is a schematic showing of the possible movements of the feeder.

FIGURE 7 is a detail view of another part of the mechanism of FIGURE 2.

FIGURE 8 is a view along the line VIII—VIII of FIGURE 7.

FIGURE 9 is a cross section along the line IX—IX of FIGURE 8.

FIGURES 10, 11 and 12 show a few examples of sewing designs which can be produced by this machine.

As shown in the drawings, the sewing machine is constructed with the arm **1** in which rotates the driving shaft **2** operating mechanism to reciprocate needle **3** in a known manner. Mechanism may also provide lateral movement of the needle in opposite directions as indicated by the double arrow X in FIGURE 1. This mechanism is well known in zigzag sewing machines, one example being shown in applicant's Patent No. 2,905,119.

On the base **4** of the sewing machine below the needle, there is fastened the needle plate **5** having a slot **6** (FIG. 3) provided for passage of the needle and elongated laterally to allow lateral movement. Slots **7** in the plate **5** receive rows of teeth **8** of the feeder **9** with clearance for necessary movements both from front to rear in the path of advance of the material and laterally of said path. The feeder **9** is mounted on movable support **11** by screws **10**. This support **11** at its rear end is fastened to the horizontal shaft **13** by pin **18** and at its front end is fixed to vertically extending plate **12** by screws **14**. The plate **12** at its lower end is formed with a flange supported on cam **16** fixed to shaft **17**, which on each revolution raises and lowers the support **11** and feeder **9** so the rows of teeth **8** protrude through the slots during feeding movement. Shaft **17** is operatively connected to shaft **2** by a belt *c* disposed on pulleys *a*, *b* fixedly mounted on shafts **2** and **17** respectively.

The shaft **13** is journaled in the upper ends of the two arms **19** of lever **20**, the lower end of which is fixed to one end of shaft **21**. The other end of shaft **21** is fixed to a lever **22** which is pivotally connected intermediate the ends of link **23** by a pin **24**. This link **23** at its forward end is connected to connecting rod **25** actuated by eccentric **26** fixed on the shaft **17**. The rear end of link **23** is pivotally connected to block **27** slidable in a channel in block **28** fixed to shaft **29**. Angular adjustment of shaft **29** may be made as shown in FIG. 4*a* by an arm *d* fastened to shaft **29** connected to a rod *e*, which is connected to another lever *f* which under the action of a spring *g* presses against the surface of cam *h*. A knob *i* disposed outside of arm **1** and is operatively connected to cam *h*. By rotating knob *i*, one varies the angular position of the arm *d* and therefore the block **28** around the axis of shaft **29**. The knob *i* and cam *h* can be replaced in a known manner by cam means, operatively connected to shaft **2** and adapted automatically to control the variation in angular position of the block **28**. Another example of means for varying the angular position of block **28** is illustrated in FIG. 18 of applicant's patent application Ser. No. 13,587, filed March 8, 1960 now Patent No. 3,081,724.

The feeder **9** is moved to feed the material by operation of crank **25** through the link **23**, lever **22**, shaft **21** and lever **20**. The extent and direction of the feed may be adjusted by setting block **28** through adjustment of shaft **29** as described above. This movement of the feeder is indicated by the double arrow *y* in FIGS. 2 and 6.

The feeding movements are synchronized with the raising and lowering movements of the feeder by operation of the cam **16** and eccentric **26** on shaft **17**, as is diagrammatically illustrated in FIG. 6. The first phase of movement is the vertical lifting movement at "*a*" to cause the teeth to protrude through the plate **5**, next a longitudinal displacement "*b*" for feeding the material, which is adjustable in amplitude and direction, then a vertical lowering phase "*c*" and finally a longitudinal phase "*d*" for return to initial position.

The present invention concerns the provision of lateral movements of the support **11** and feeder **9** in the direction of arrow *x*, in addition to the longitudinal movements. The shaft **13** is mounted for sliding movement in its bearings in lever **20** and, together with support **9** and feeder **12**, can move laterally to a limited extent as may be seen in FIG. 4. On one end of shaft **13** is mounted a block **30** having a groove **31** in which is slidable a stud **32** fixed to lever **33**, and one end of lever **33** is pivoted on a fixed pin **35** and the other is connected to lever **34** by a pin **36**. Accordingly longitudinal movement of link **34** moves lever **33** to shift the shaft **13** and feeder **9**.

The link **34** is moved in phase with the longitudinal and vertical movements of feeder **9** by mechanism operated by shaft **17**. For this purpose, the link **34** has a block **37** pivoted in a transverse opening as shown in FIG. 9. A set screw **38** secures a transverse rod **39** passing through openings in the block and link, with sufficient clearance in the link to allow pivotal movement. The link at this point is embraced by arms **40** and **41** of the rocker member **42**, the rod **39** being slidable through openings in said arms. The rocker **42** is pivoted to the frame **4** by a pin **46**, and the link **34** has such clearance between the arms **40**, **41** that one block with the link may slide from one side of the axis of pivot **46** through a coaxial position to the other side. The rocker **42** has a spring **43** connected to one arm tending to rotate it counterclockwise, as seen in FIG. 7, while the other arm carries stud **44** engaging a cam **45** on shaft **17** so that rotation of said shaft oscillates rocker **42** against tension of spring **43**.

The link 34 may be adjusted relative to rocker 42 to position block 37 relative to the axis of pivot 46 by a lever 49 carrying pin 48 engaging in slot 47 in the end of link 34. It will be obvious that if the block 37 is coaxial with pin 46, oscillation of rocker 42 will not affect the link while positioning the block out of the pivotal axis will produce movement of link 34 and lateral shifting of feeder 9 variable in phase and extent in accord with its position.

The lever 49 pivoted on the machine by pin 50 is settable for this purpose by a manually set cam 51 on shaft 52 having a setting knob 53. Lever 49 is maintained in contact with the cam by spring 54.

In addition, the lever 49 may also be adjusted by a cam 59 driven by the driving mechanism and engaging a pin 60 on an arm of lever 49. The means for rotating cam 59 may be, for example, those described in applicant's patent application Ser. No. 13,285, filed March 7, 1960 now Patent No. 3,054,368. Accordingly, to drive cam 59, a shaft 55 has a driving connection at one end at 56 with the drive shaft 2 and at the opposite end through a known driving mechanism mounted on support 58 with cam 59. A slidable member 57 enables the removal and replacement of cam 59. This cam 59 acts as a program device to determine the pattern of lateral movements of the feeder. With such a program device, any selected pattern may be provided to control lateral movements of the feeder 9 either in combination with the manually set cam 51 or independently thereof. Thus, if cam 51 is set with its minor axis in engagement with lever 49, it will have no effect on control by cam 59, while if a point on its periphery having a longer axis is engaged by lever 49, it may limit the effect of cam 59. When block 37 is not coaxial with pivot 46 the support 9 is subjected to a lateral displacement "*e*" in one sense, in the direction of arrow "*x*" during the longitudinal displacement "*b*," and is subjected to a lateral displacement "*f*" during the longitudinal displacement "*d*," so that the trajectory of said support 9 may take place in any direction "*z*" (FIG. 6).

FIGS. 10, 11 and 12 show various designs of stitching. FIGS. 10*a*, 11*a* and 12*a* show examples of how sewing may be made with a laterally movable needle either in a straight line as in FIG. 10*a* or in a zigzag manner as in FIGS. 11*a* and 12*a*. The present machine may sew in the same manner when the block 37 is coaxial with pivot 46. If, however, the block 37 is positioned laterally of the axis of pivot 46, these designs are modified as shown in other figures. FIGS. 10*c* and 11*c* and FIGS. 10*d* and 11*d* differ due to the different transmission ratio between shaft 2 and the cams of the machine that control the movements of the support. FIG. 12*d* shows a variation of the sewing pattern of FIG. 12*c* and is obtained by limiting the effect of cam 59 by means of button 53.

I claim:

1. In a sewing machine of the type including a frame supporting driving means and a bed plate carrying a slotted needle plate, a reciprocating needle driven by said means, a fabric feeder having teeth rows movable in the slotted needle plate, and two operating mechanisms connecting said fabric feeder to the driving means of the machine, a first of said operating mechanisms being of a construction to displace the feeder along a longitudinal trajectory which is substantially rectangular and consisting of a raising phase above the needle plate, of a displacement active phase in one direction, of a sinking phase beneath the needle plate and of a passive displacement phase in opposite sense to the previous one, a second of said operating mechanisms being of a construction to effectuate a lateral displacement of the feeder in one direction at the same time as said active displacement and another and opposite lateral displacement in the opposite direction during the passive displacement, so that the feeder returns to its starting position to repeat the same trajectories, the combination of said operating mechanisms providing for the feeding of fabric in any pre-fixed direction along the bed plate as a consequence of the simultaneous lateral and longitudinal movements, independent control means connected to said operating mechanisms in order to vary the amplitude from zero to a maximum as well as the direction of each one of the lateral and longitudinal displacements of the feeder from a center position.

2. A sewing machine in accordance with claim 1, in which the second operating mechanism includes a rocker pivotally connected to the frame of the machine and operatively connected to the driving means of the machine, and a set of levers connected at one end with said rocker and at the other end with the feeder making the feeder subjected to lateral displacements timed with the longitudinal displacements of the feeder, and sliding and moving parts between said feeder and said levers to allow said lateral displacements of the feeder in a way that the feeder remains connected with the first operating mechanism in order to receive from the first operating mechanism the necessary motion for longitudinal displacements.

3. A sewing machine in accordance with claim 2, in which the end of the lever connected to said rocker is movable through a cam along the rocker to regulate the width of the rocker oscillations and consequently the extent of the lateral shifting of the feeder.

4. A sewing machine in accordance with claim 2, in which said rocker is pivotally connected at its middle point to the frame of the machine and the end of said lever is movable through a cam along the rocker on both sides of the pivot so that the lateral displacements of the feeder can be varied as to extent and direction.

5. A sewing machine in accordance with claim 2, in which the end of the lever connected to said rocker is movable through a cam along the rocker to regulate the width of the rocker oscillations and consequently the extent of the lateral shifting of the feeder, said rocker is pivotally connected at its middle point to the frame of the machine and the end of said lever is movable through a second cam along the rocker on both sides of the pivot so that the lateral displacements of the feeder can be varied as to extent and direction.

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