

April 7, 1964

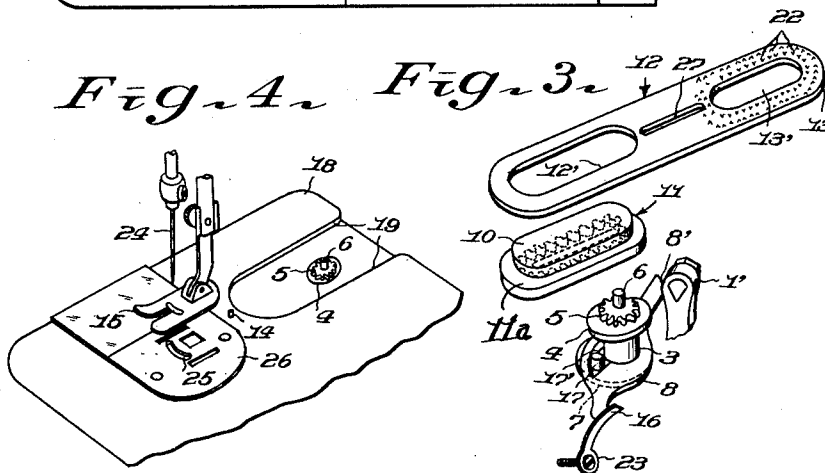
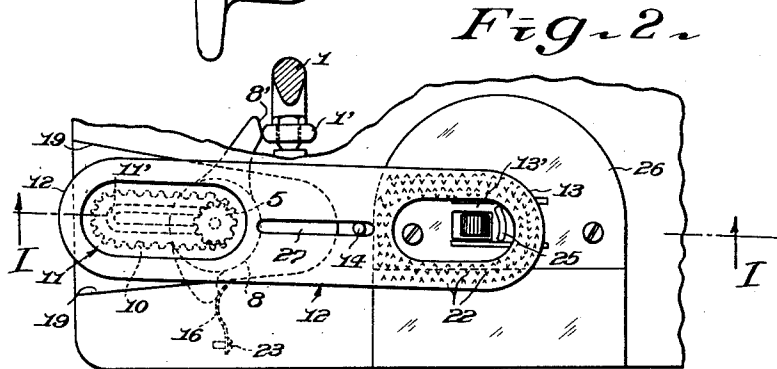
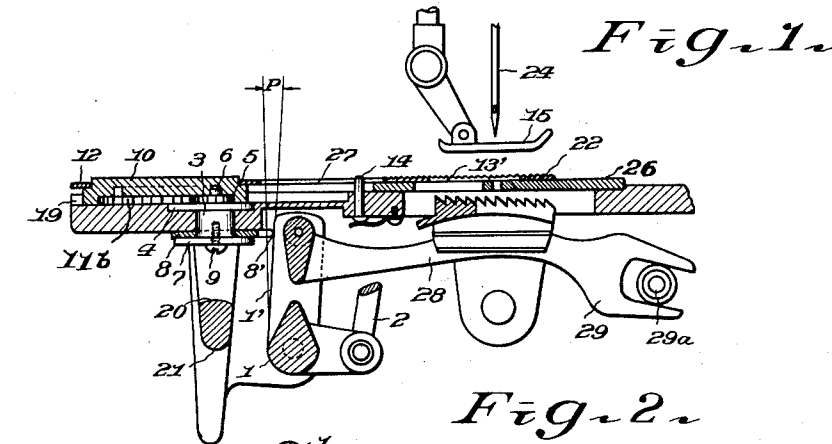
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3,127,856

HOLE STITCHING DEVICE FOR ZIGZAG SEWING MACHINE

Filed Dec. 3, 1959

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

Fig. 5

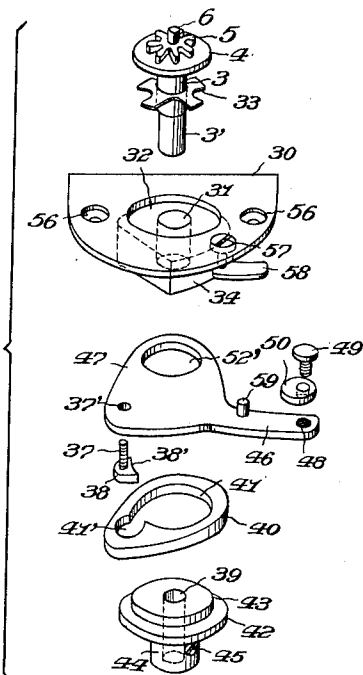


Fig. 6

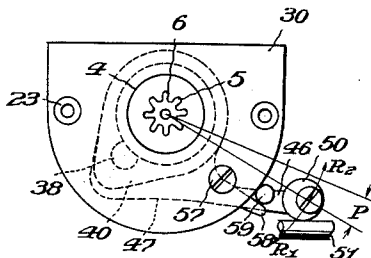


Fig. 7

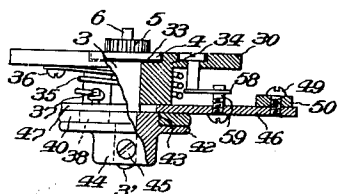


Fig. 8

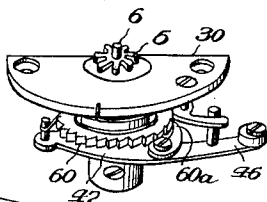
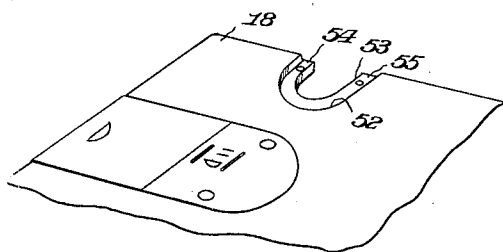


Fig. 9



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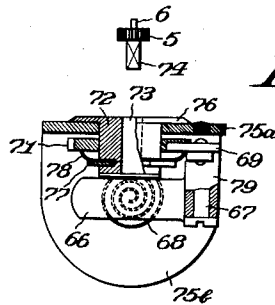


Fig. 10

Fig. 11

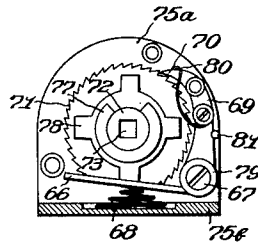


Fig. 12

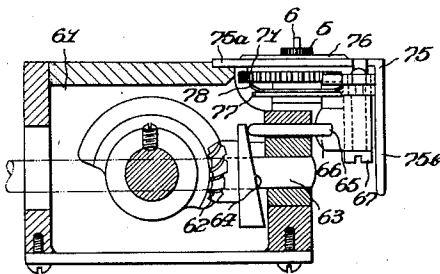
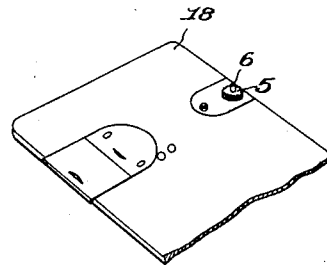


Fig. 13



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3,127,856

HOLE STITCHING DEVICE FOR ZIGZAG SEWING MACHINE

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3 Claims. (Cl. 112-77)

My present invention relates to an attachment for sewing machines, especially those of the zigzag type, adapted to facilitate the stitching of buttonholes.

The general object of this invention is to provide an improved attachment of this character whose use requires only minor structural modifications of an otherwise conventional zigzag sewing machine and which, in a machine so modified, may be conveniently taken into and out of service.

The aforesaid object is realized, pursuant to the present invention, by the provision of a depression in the machine bed of a zigzag sewing machine adjacent the usual needle plate thereof, this depression accommodating an intermittently and unidirectionally rotatable drive pinion whose operation is suitably synchronized with that of the sewing needle; removably received in the depression is a coupling member which, via rack teeth forming an endless track on its underside, meshes with the pinion and in turn fits into an opening of an elongated feed plate overlying the needle plate. In order to keep the feed plate horizontal above the machine bed, the coupling member is formed with a peripheral shoulder which supports the rear end of the feed plate at the level of the needle plate; the front end of the feed plate, resting on the needle plate underneath the usual pressure foot, has an elongated cutout for the needle and is further provided with upstanding serrations to grip a piece of fabric placed on the feed plate and held against it by the pressure foot in its lowered position. An intermediate portion of the feed plate is formed with a longitudinal slot engaged by a stud which rises from the machine bed between the needle plate and the aforementioned depression, the combination of this stud and the suitably shaped endless track serving to displace the feed plate in a buttonhole-stitching pattern past the sewing needle and the pressure foot of the machine. The individual parts of the assembly, i.e. the feed plate and the coupling member, can be disconnected from its driving mechanism and removed from the machine by simply lifting it off the bed, with the coupling member removably fitting into the rear opening of the feed plate so as to be likewise detachable therefrom.

Advantageously, in order that the operation of the machine may not be significantly affected by the use or non-use of my attachment, the feed plate is made of only limited thickness, preferably less than the height of the shoulder of the coupling member on which it is supported.

The invention will be described in greater detail with reference to the appended drawing in which:

FIG. 1 is an elevational view, in transverse section taken on the line I-I of FIG. 2 in a plane near the sewing mechanism of the machine, showing the buttonhole-stitching device of the invention and associated elements;

FIG. 2 is a plan view of the device shown in FIG. 1;

FIG. 3 is an exploded, perspective view of the mechanical parts of the device of FIGS. 1 and 2;

FIG. 4 is a perspective view showing a portion of the left end of the machine bed to which the device of this invention is to be attached;

FIG. 5 is an exploded, perspective view of another em-

bodiment of this invention showing the principal parts constituting a hole-stitching unit;

FIG. 6 is a plan view showing the hole-stitching unit of FIG. 5 in its assembled state;

FIG. 7 is an elevational view, partly in section, of the device shown in FIG. 6;

FIG. 8 is a perspective view showing, in the assembled state, a modification of the unit of FIGS. 5 through 7;

FIG. 9 is a perspective view showing the upper surface of the left portion of a sewing-machine bed wherein a horseshoe-shaped cutout has been provided for the installation of the unit illustrated in FIGS. 5 through 8;

FIG. 10 is an elevational view, partly in section, showing another modification of the hole-stitching unit of this invention;

FIG. 11 is a plan view of the device of FIG. 10;

FIG. 12 is an elevational view, partly in section taken in the vicinity of the installation point of the unit of FIGS. 10 and 11, perpendicular to the longitudinal direction of the sewing machine, showing a portion of the sewing machine and said unit installed therein; and

FIG. 13 is a perspective view showing the upper surface of the left portion of a sewing machine of a type wherein a shuttle bobbin is accessible from the front side thereof, with the unit of FIGS. 10 through 12 installed therein.

The embodiment of FIGS. 1 through 4 is described under the heading "First Embodiment"; the embodiment of FIGS. 5 through 9 under the heading "Second Embodiment"; and the embodiment of FIGS. 10 through 13 under the heading "Third Embodiment."

First Embodiment

As shown particularly in FIG. 3, the principal elements of the novel mechanism according to the invention comprise a fabric-feed plate 12; a coupling member 11 formed on its underside with internal gear teeth 11b defining an endless track; and an assembly composed principally of a pinion 5, which engages the internal gear teeth of member 11, and a clutch mechanism consisting of a roller 17 and a clutch plate 8 for converting the oscillatory drive motion from an oscillating arm 1' of a fabric-feed mechanism, of conventional construction, into intermittent rotation of pinion 5.

As further illustrated in FIGS. 1 through 4, the pinion 5 for driving the rack member 11 is fixed to a pinion shaft 3 over a flange 4 and has a center pin 6. The pinion shaft 3 is inserted rotatably in a bore traversing the left portion of the machine bed 18, more specifically, directly behind the needle slot 25 of the needle plate 26, and the flange 4 lies rotatably in a counterbored depression in machine bed 18. The portion of bed 18 around the pinion 5 is cut out to form a shallow depression 19 having a flat bottom, parallel to the top surface of the machine bed 18, and having a configuration in plan view which will not interfere with the motion of the rack member 11 received with clearance in depression 19. The pin 6 and the pinion 5 above flange 4 project above the bottom surface of the depression 19.

Below the machine bed 18, the roller 17 and the clutch plate 8 are assembled to form a roller clutch on the lower end of the pinion shaft 3, plate 8 having a center hole in which shaft 3 is frictionally received. The clutch plate 8 is engaged from below by a washer 7, which in turn is held in place by a tightening screw 9. The plate 8 is provided with an eccentric slot 17', besides its center hole, and this slot 17' guides the roller 17 in such a manner as to provide a unidirectional clutch which rotates the shaft 3 in only a single direction, e.g. counterclockwise. Accordingly, when the plate 8 is rotated counterclockwise, the shaft 3 is rotated in the same direction as the plate 8, but the shaft 3 does not rotate when the plate

3

8 is rotated clockwise. One arm 8' of the clutch plate 3 is maintained in constant and firm contact, by the force of a spring 16, with one end of the oscillating arm 1' extending from a part 1 of the conventional fabric-feed mechanism, spring 16 being fixed to the machine bed 13 by a screw 23; consequently, the shaft 3 and pinion 5 are intermittently rotated by the oscillating movement of the arm 1'. On the other hand, by the manipulation of the usual fabric-feed control lever (not shown), the oscillation amplitude P (FIG. 1) of the feed-control oscillating arm 1' can be varied at will; consequently, the rotational velocity of the pinion 5, which turns at a speed determined by the movements of arm 1', can be selectively controlled. Numeral 21 designates a reinforcing rib of the machine bed 13. An opening 20 is formed in rib 21 so as to provide clearance for such work as inserting the pinion shaft 3 and assembling the clutch assembly or tightening the washer.

The above-described parts constitute the mechanism installed on the machine bed 13. This mechanism merely utilizes the motive power available from a fabric-feed mechanism already installed in a sewing machine to rotate a pinion at variable speed. While a roller clutch is employed in this embodiment as the transmission element providing the intermittent motion of the pinion, any other suitable means for achieving the same end result may be used as, for example, a stepwise speed-changing mechanism such as a ratchet-wheel-and-pawl mechanism of the single-tooth or plural-tooth type.

The plate 12, which feeds and guides the fabric material during hole-stitching operation, is a single ply of extremely thin hard steel sheet, 1 mm. or less in thickness, punched out to the required plan form and dimensions. Feed plate 12 thus has a thickness which, as clearly seen in FIG. 1, is considerably less than the height of the peripheral shoulder 11a of coupling member 11 on which its rear end is supported on the level of needle plate 26. It has two elongated, slot-shaped punched holes 12' and 13', one near each end thereof. The rear opening 12' is so made that it can fit closely about the raised portion 10 of the rack member 11 whose internal gear teeth can mesh with the aforementioned pinion 5, said raised portion 10 being provided, at its underside, with a guide slot 11' resembling the configuration of a buttonhole. At the other end 13 of the feed plate 12, on its upper surface surrounding the elongated cutout 13', a plurality of sharp teeth 22 are formed for preventing slippage between plate 12 and the fabric material to be placed and held thereon for the stitching operation.

In FIGS. 1 and 4 the elements 24 and 28 are, respectively, a stitching needle and a fabric-feeding rocker arm having a forked end 29 straddling a roller 29a.

For the hole-stitching operation, the rack member 11, fitted by its raised portion 10 closely into the hole 12' of the fabric-feed plate 12, is lowered into such a position that the pinion 5 and the pin 6 are, respectively, in engagement with the internal gear teeth 11b and with the slot 11' as they project above the surface of the depression 19, plate 12 being so disposed that a longitudinal slot 27 provided in its central part engages and accommodates a pivot pin 14 protruding above the upper surface of the machine bed 13 at a predetermined point. The working or front end of the feed plate 12, i.e. the portion having the hole 13', will thus be placed over the needle plate 26 with the teeth 22 on its upper surface. It will be seen that, if the sewing machine is now operated, the pinion 5 will intermittently rotate in accordance with the oscillation of the arm 1'; accordingly, the fabric-feed plate 12 will perform a hole-stitching motion according to the configuration of the internal track 11b of member 11, the transmission of power and motion being effected pantographically.

In conventional buttonhole attachments used heretofore, the fabric-holding teeth have been directed downward, the fabric being placed on the upper surface of the needle

4

plate 26, and the fabric-feed plate being made to press down upon the fabric from above to move said fabric. In contrast, in the device of the present invention the toothed feed plate 12 is placed on the upper surface of the needle plate 26; the fabric material is placed on the upper surface of the said plate 12; the fabric material is held down by the presser foot 15 as the feed plate 12 is moved to feed and guide the fabric which, although held down by the foot 15, is free to slide with respect thereto in all horizontal directions. Consequently, there is the convenience in that the trouble of disconnecting or changing the presser foot 15 is eliminated.

As a result, by the device of this invention the manual procedures before and after hole-stitching are convenient and require a minimum of manipulative time and effort, because it is merely necessary to place a simple assembly, i.e. a rack member of the required configuration and a single sheet-metal member constituting the feed plate 12, onto the pinion 5 so that the pivot pin 14 is accommodated by the slot 27 in preparation for hole stitching, and to lift off the assembly after the hole stitching.

It will thus be seen that, in the embodiment just described, driving power is derived from the existing fabric-feed mechanism of the sewing machine and only a small number of parts as illustrated in FIG. 3 are sufficient for the attainment of the objects of this invention. Moreover, because the density of stitches, or stitching pitch, may be varied at will by moving the feed lever, which is standard equipment of all sewing machines, strong buttonholes such as could not be made by conventional attachments can be produced by the present device.

When hole stitching is not being carried out, the rotation of the pinion 5 is unnecessary. Therefore, the motion of the pinion may be stopped by merely separating the arm 8' of the clutch plate 3 from the oscillating arm 1'; this can be done by means of simple mechanical means such as a lever or a push pin. The pivot pin 14 may be of a retractable type, disappearing into the bed 13 when retracted and reappearing when extended for use.

Second Embodiment

The modified embodiment of this invention illustrated in FIGS. 5 through 9 is a hole-stitching device to be installed in a zigzag sewing machine in which the motive power for the device is again derived from a reciprocating member of the fabric-feeding mechanism of the machine and the same driving pinion 5 as in the preceding embodiment is provided for driving the same combination of an endless rack 11 and a fabric-feed plate 12.

In this modification, however, the hole-stitching device is constituted as an integrated drive unit and, without interfering with or influencing the manufacture of the zigzag sewing machine in any way, is installed therein by being fastened thereto by means of only two screws after completion of the assembly of the machine.

Accordingly, the unit may be produced, assembled, and carefully adjusted in a separate factory if necessary and installed in a sewing machine according to need. This feature affords efficiency and economy in production.

As shown in FIGS. 5-7 and 9, numeral 30 designates an attachment base plate having a bore 31 at its center and a counterbored recess 32 concentric with the bore 31. The recess 32 has a size suitable for accommodating completely the flange 4 of the pinion 5 and an elastic washer 33, the bore 31 being traversed by the shaft 3 of the pinion 5. The lower side of the base plate 30 has a hub-like projection 34, surrounded by a helical spring 35 which is anchored at one end by a screw 36 to the base plate 30 and at the other end to a threaded extension 37 of a wedge-shaped ratchet pawl 38 adapted to be fastened to one portion of an oscillating plate 47, spring 35 imparting a restoring force to plate 47.

In the assembled state of the device, a ring-shaped member 40 is disposed against the lower surface of the

5

oscillating plate 47, ring 40 having a large hole 41 into which a disk 43 rigid with an annular flange 42 fits from below, and a smaller hole 41' which communicates with hole 41 at the edge thereof and which accommodates the aforementioned ratchet pawl 38 having a crescent-shaped concave edge 38'. The assembly of the aforescribed principal parts of the unit is completed, after they have been placed in their relative positions illustrated in FIG. 5, by fitting the center hole 39 of the disk 43 around the lower portion 3' of the shaft 3, and locking the same by means of a set screw 45 in the hub 44 rigid with flange member 42.

An arm portion 46 of the oscillating plate 47, extending outwardly (to the right as viewed in FIGS. 5 through 7), has a tapped hole 48 in which is fixed a screw 49 holding fast an eccentric ring cam 50. The arm portion 46 is so arranged as to position the cam 50 at a location where this cam is in constant contact with a reciprocating member 51 of the fabric-feeding mechanism of the sewing machine, the constant contact being maintained by the aforementioned spring 35. By adjusting the angular setting of cam 50, the amplitude P (FIG. 6) of the oscillating arm 46 can be varied at will within the limits imposed by the eccentric configuration of this cam.

The portion of the oscillating plate 47 encompassing the pinion shaft 3 has a hole 52' which is considerably larger in diameter than the shaft 3 passing through it. The pawl 38 which is attached, by its threaded part 37, to a tapped hole 37' of the plate 47 oscillates with unidirectionally effective wedge action in the small hole 41'. Consequently, in the driving stroke of the ratcheted mechanism, pawl 38 tightly holds the disk 43 fitted into the large hole 41, thus locking the disk 43 to the plate 47. The driving motion of the plate 47 is thus transmitted through the disk 43 to the pinion shaft 3, 3' to which the disk 43 is fixed, and thence to the pinion 5.

On the return stroke of the reciprocating member 51, the oscillating plate 47 is swung back by the force of the restoring spring 35. In this case, however, the crescent-shaped edge 38' of the wedge pawl 38 separates slightly from the disk 43, and the grip of the pawl is released to such an extent that it cannot rotate the disk 43 against the frictional resistance afforded by the elastic washer 33 (FIG. 5). Therefore, the shaft 3 cannot be rotated backward during the return stroke of the oscillating plate 47. Thus, the motion of the plate 47 consists of arcuate oscillations in the directions R_1 and R_2 with the wedge pawl 38 as the pivot. As a net result, the combination comprising the disk 43 and its flange member 42, shaft 3, 3', and pinion 5 is made to rotate in only one direction.

The installation of the unit of the above-described construction is extremely simple, consisting merely in forming a horseshoe-shaped cutout 52, 53, 54 at a suitable position on the machine bed 18 as shown in FIG. 9, mounting the base plate 30 of the unit on the ledge 54, and fastening the same by means of screws passed through holes 56 in the base plate 30 into tapped holes 55 in ledge 54.

The hole-stitching operation of the unit of the above-described construction is the same as that of the first embodiment.

When the above operation is not being carried out, the rotation of the pinion 5 is unnecessary wherefore, preferably, it should be stopped by separating the cam 50 from the reciprocating member 51 of the sewing machine. This power cut-off can be effected by rotating a screw 57, threaded into the base plate 30, with a screwdriver, in the counterclockwise direction, thereby rotating the screw 57 and an arm 58 fixed thereto in the same direction. The arm 58 contacts and pushes a pin 59 fixed to a portion of the arm 46 of the oscillating plate 47, thereby moving the cam 50 away from the sweep of the reciprocating member 51. The screw 57 rigid with arm 58 is held firmly in its selected angular position by such means as a spring (not shown).

6

A unit of an even simpler construction utilizing a ratchet-and-pawl mechanism is illustrated in FIG. 8. A ratchet wheel 60 is provided at the lower end of the shaft of pinion 5 below plate 30a, and a pawl 60a positioned for engagement with ratchet wheel 59 is provided on a portion of the oscillating plate 47 having an arm 46. By this simple means, the pinion 5 is made to rotate by steps in only one direction.

Third Embodiment

The embodiment illustrated in FIGS. 10 through 13 is adaptable principally to zigzag sewing machines of the type having a shuttle facing toward the front, i.e. toward the operator. In this type of sewing machine, various driving mechanisms, such as a gear-and-pinion drive or a crank-type drive, are used; but in almost all cases a gear box 61, housing the drive shaft, gears and other moving parts, extends to the far side (as viewed by the operator) of the machine bed 18, and it is difficult to install the drive mechanisms for the buttonhole-stitching device of this invention in the forms described in conjunction with the preceding figures. The embodiment now referred to has been adapted to overcome this difficulty in a simple manner.

FIGS. 10 through 13 illustrate a conventional construction including a driven gear 62 fixed to a shuttle drive shaft 63. For the installation of the unit of this embodiment, a cam surface with a small stroke of the order of 1 millimeter is formed on the face 64 of gear 62. A pin 65 slidably contacting and following the cam surface 64 is inserted into and slidably supported by a transverse hole drilled in a part of the gear box 61, the axis of the pin 65 being non-coincident with the axis of the shaft 63. In accordance with the rotations of the gear 62 and the cam surface 64, the pin 65 is made to undergo axially reciprocating motion of an amplitude of the order of 1 millimeter by the action of the cam surface 64. The pin 65 is held against cam surface 64 by a pusher plate 66 forming part of the buttonhole-stitching unit of this embodiment. Consequently the pin 65 imparts its motions to the pusher plate 66.

In the assembled state of this unit, the pusher plate 66 is pivoted on a pivotal shaft 67 and is pushed against the pin 65 by a spiral spring 68. An arm 69 fixed to the plate 66 is thereby caused to undergo oscillatory motion, and a ratchet pawl 70 rotatably supported on the end thereof pushes a ratchet wheel 71 in rotational motion. The ratchet wheel 71 is fixed to a shaft 72, which has a throughgoing bore 73 with a square cross-section extending along its axis. A drive pinion 5, similar in function to those of the preceding embodiment, is connected to the shaft 72 by having its square-section shank 74 inserted into the hole 73. Thus, the rotational motion of the shaft 72 is transmitted directly to the pinion 5.

The unit of this embodiment is of an extremely small size as is apparent from FIGS. 10 and 11, which are drawn substantially to full scale, and, as is also apparent therefrom, its construction is simple. It comprises essentially a frame bracket 75 formed into an angle by bending a plate at right angles to provide flanges 75a and 75b with semi-circular ends; the shaft 72 with a shoulder 76, inserted from above into a shaft hole in the center of the horizontal flange 75a; the ratchet wheel 71 fitted upwardly from below onto and about the shaft 72, clamping the flange 75a between itself and the shoulder 76 of the shaft 72 for joint rotation while being held against rotation relative to shaft 72 by a key (not shown) and against movement in the axial direction relative to shaft 72 by a snap-ring 77 acting via a spring washer 78 which is elastically compressed with a force imparting sufficient rotational friction to wheel 71, the ring 77 being locked axially to shaft 72 by elastic engagement in an annular groove about the periphery of the lower end of shaft 72; the pusher plate 66; the oscillating arm 69; a hub sleeve 79 rigidly connecting plate 66 and arm 69; the stepped

pivotal shaft 67 inserted through and pivotally supporting the hub sleeve 79 by being screwed fixedly into and against the lower surface of the flange 75a; the ratchet pawl 70 supported pivotally on arm 69 and engaged by its tip with the ratchet wheel 71; a pawl spring 80 attached at its free end to pawl 70 to impart an engagement force thereto, this spring being anchored to arm 69; the spiral spring 68 seated in a depression of the flange 75b and pushing elastically against plate 66 so as to impart thereto a positive following action with respect to pin 65 and, furthermore, to provide a sufficient restoring force for the oscillating motions of plate 66, sleeve 79 and arm 69; and a stop 81 for limiting the return strokes of these oscillating motions.

As mentioned previously, the oscillating motions cause the ratchet pawl 70 alternately to engage with and disengage from the teeth of the ratchet wheel 71, thereby successively advancing this wheel by one tooth at each cycle.

When the unit of the second or the third embodiment, whichever is more convenient, is applied to a zigzag sewing machine, the driving pinion 5 is used, in the same manner as described in connection with the first embodiment, for driving the same fabric feed plate 12 in order to accomplish buttonhole stitching (cf. FIG. 13).

While I have described particular embodiment of my invention, it will, of course, be understood that I do not wish my invention to be limited thereto, since many modifications may be made; I, therefore, contemplate by the appended claims to cover all such modifications as fall within the true spirit and scope of my invention.

What I claim is:

1. In a sewing machine, in combination, a bed provided with a needle plate and a lowerable pressure foot above said needle plate, said bed being provided with a depression adjacent said needle plate and with a hole in the bottom of said depression;
 - a shaft extending upwardly through said hole, said shaft being provided at its top with a pinion rising above said bottom;
 - a stud rising from said bed between said needle plate and said depression;
 - an elongated feed plate movably disposed on said bed above said depression and said needle plate, said feed plate being provided at one end with a needle-receiving elongated cutout underneath said pressure foot and at the other end with an opening overlying

said depression, said feed plate further having an intermediate portion with a longitudinal slot engaged by said stud, said feed plate being formed at said one end with upstanding serrations for gripping a fabric placed between it and said pressure foot; an oblong coupling member positioned with clearance in said depression, said coupling member being provided with a peripheral shoulder at the level of said needle plate supporting said feed plate and with a projection above said shoulder detachably fitting into said opening for positive engagement between said coupling member and said feed plate, said coupling member being provided on its underside with rack teeth forming an endless oblong track around said pinion and in mesh therewith; and drive means for intermittently imparting unidirectional rotation to said shaft and said pinion, thereby displacing said feed plate in a buttonhole-stitching pattern past said pressure foot.

2. The combination defined in claim 1 wherein said feed plate is of a thickness less than the height of said shoulder above said bottom.

3. The combination defined in claim 1 wherein the underside of said coupling member is provided with a closed guide slot following the outline of said track, said pinion being provided with an upstanding pin projecting into said guide slot.

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