March 6, 1951 T. KOTZIN ET AL 2,544,029

PRESSER FOOT CONTROL APPARATUS

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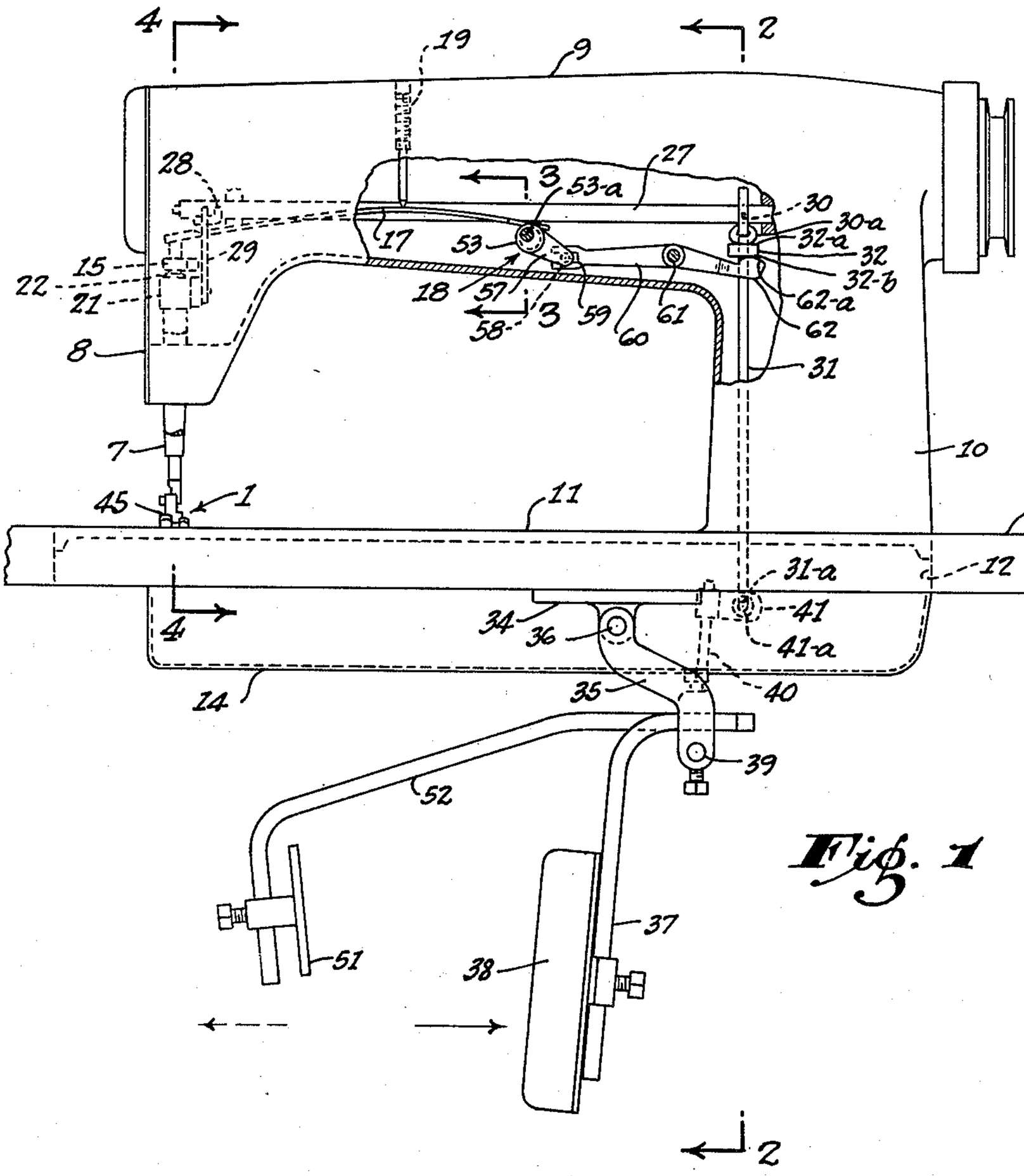

Fig. 1

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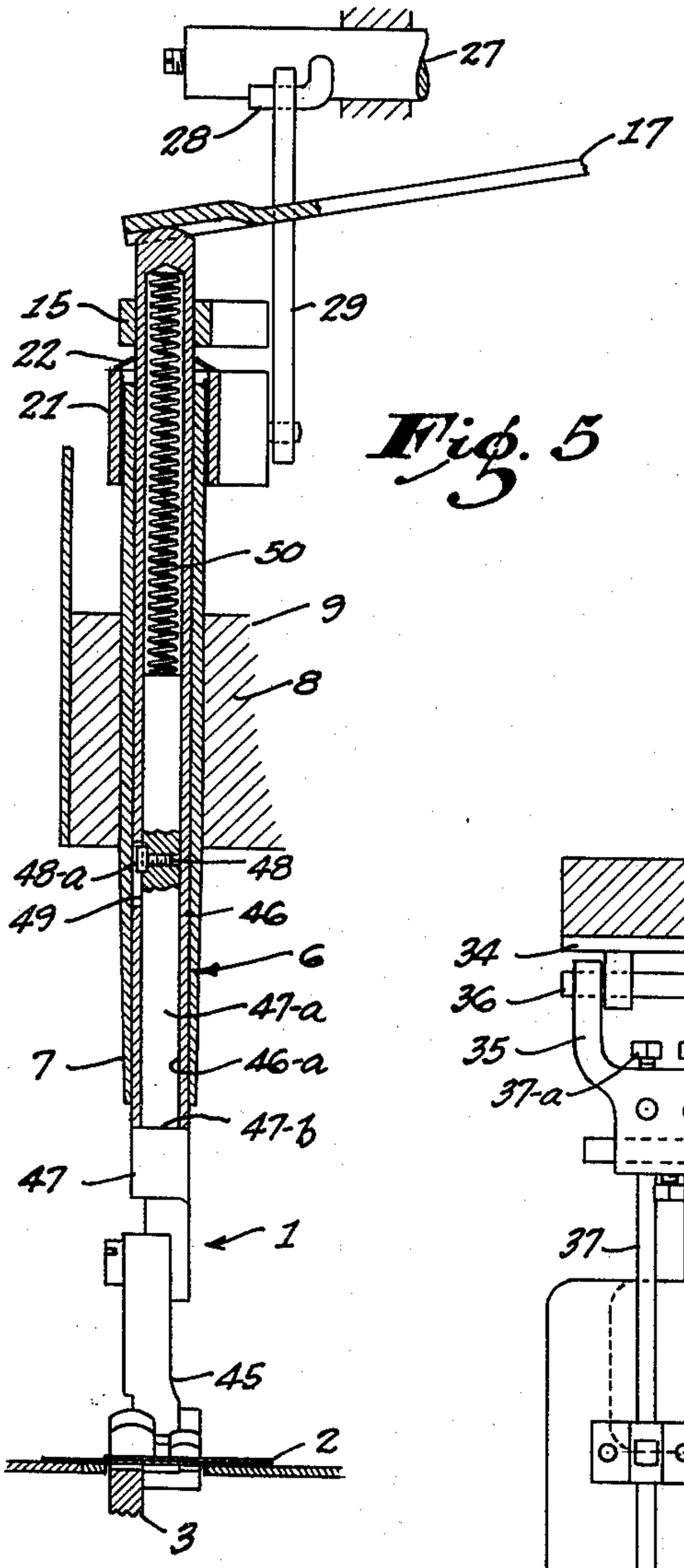

Fig. 5

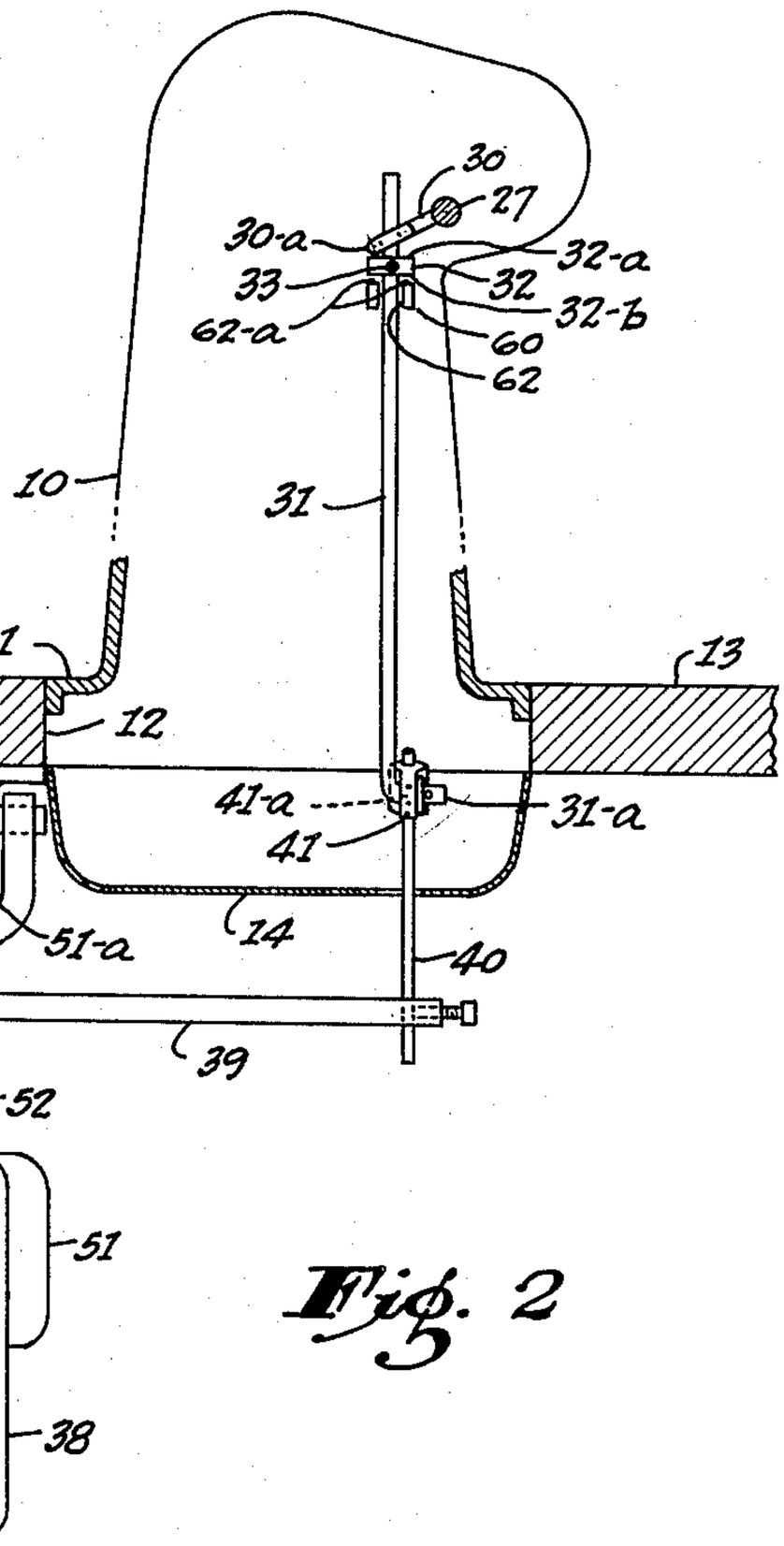

Fig. 2

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Fig. 4

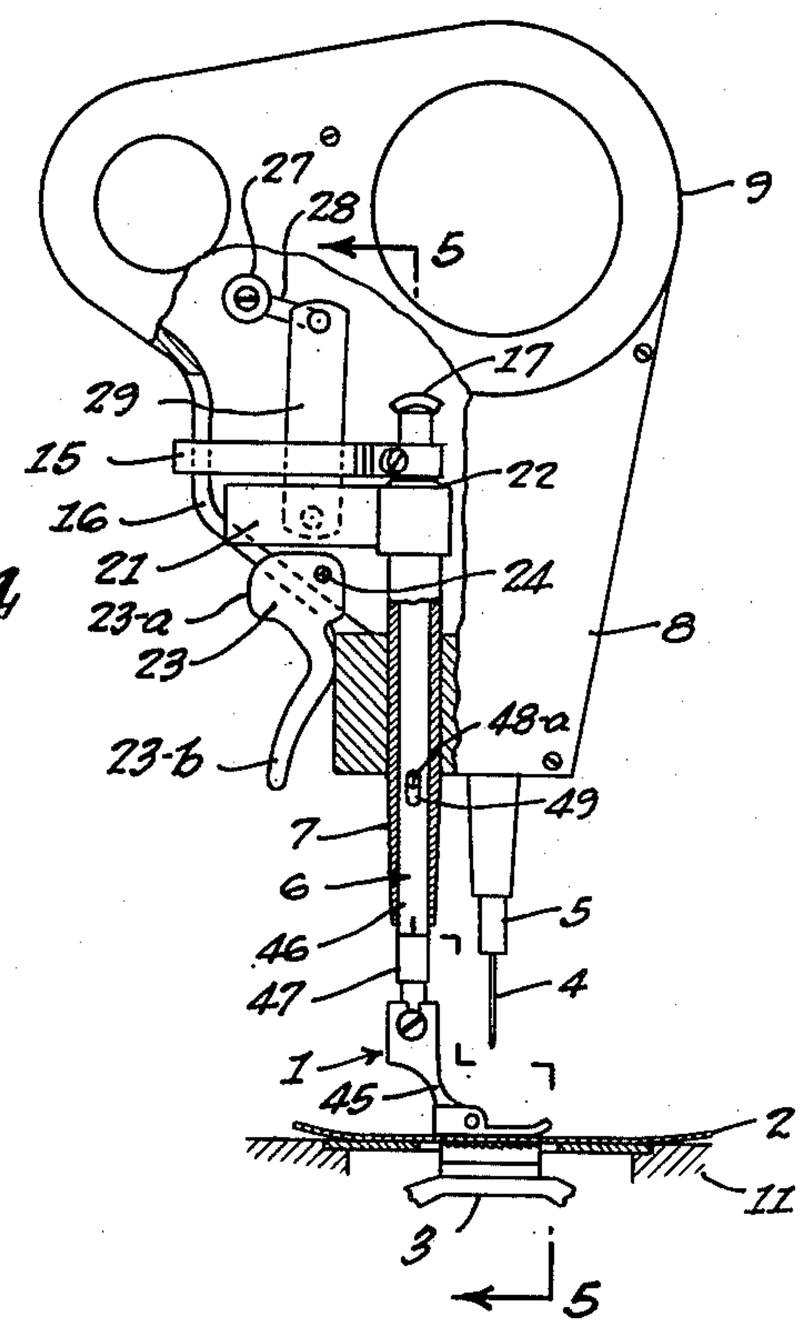
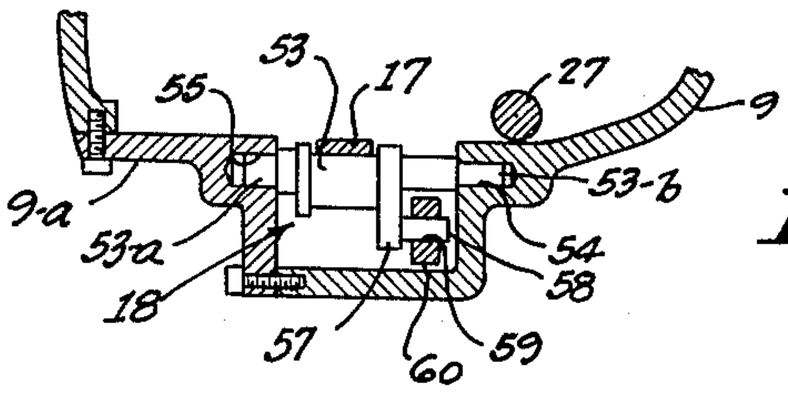


Fig. 3



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Patented Mar. 6, 1951

2,544,029

UNITED STATES PATENT OFFICE

2,544,029

PRESSER FOOT CONTROL APPARATUS

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Application September 10, 1945, Serial No. 615,279

9 Claims. (Cl. 112—236)

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This invention relates to sewing machines; more particularly, it relates to apparatus for controlling the presser foot of such machines.

Sewing machines are commonly provided with mechanism for advancing the work in synchronism with the movements of the needle bar and needle to form stitches. Such mechanism usually includes a feed dog and a spring-urged presser foot for resiliently maintaining the work against the feed dog to be advanced by movement thereof. Means also are provided for lifting the presser foot to free the work from the feed dog to allow removal or adjustment of the work, as well as to facilitate insertion of a new work piece.

In a conventional arrangement, the presser foot is either urged toward the feed dog with substantially the entire pressure of which it is capable, or else it is lifted clear of the work and feed dog. With such an arrangement, when the presser foot is raised to manipulate the work, as, for example, to turn the work at an abrupt angle, the work is loose between the presser foot and the supporting table or throat plate; accordingly, it is apt to follow the needle in its up-and-down movement, and thereby an undesirable condition exists. Further, if the machine happens to stop with the needle out of the work, the work is entirely unrestrained when the presser foot is lifted. Since it is desirable to swing the work about a fixed point, such as a needle, the adjustment of the work for a succeeding operation is rendered more difficult.

In performing certain operations, it is desirable partly to reduce the pressure of the presser foot to permit the operator to control and change the advancing movement of the work, notwithstanding the action of the feed dog. A highly skilled operator may be able to accomplish this by means of the mechanism usually provided for lifting the presser foot, the presser foot being lifted slightly and maintained at exactly the right distance above the throat plate to permit the performing of various operations, such, for example, as "back staying," "darning," "embroidering."

In gentral, however, such control of the presser foot is very difficult to accomplish, since the raising and lowering of the presser foot disturb certain thread take-up and other control devices associated with the thread.

Modern commercial sewing machines operate at a rate of 4,000 to 5,000 or more stitches per minute. To take full advantage of such high speed, it is essential to reduce, in as great a degree as is possible, the time required for manipulating the work between successive stitching operations. It is an important object of this invention to provide means whereby the pressure exerted by the presser foot may be partly reduced in a convenient manner to faciiltate manipulation of the work.

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It is another object of this invention to provide means whereby the usual mechanism for lifting the presser foot serves optionally to reduce the pressure of the foot, or to lift it clear of the work. It may be desirable to increase the pressure exerted by the presser foot above that suitable for normal operation of the machine under certain conditions as, for example, when encountering a portion of the work of unusual thickness. It is thus another object of this invention to provide means whereby the presser foot may be optionally caused to exert increased pressure.

While it is of course common to provide adjusting means to alter the pressure exerted by a presser foot, such adjustment is within comparatively narrow limits, and is not adapted to be altered as an incident to operation of the machine, or while the machine is in motion. It is thus another object of this invention to provide means whereby the pressure of the presser foot may be readily altered as required in the normal operation of the machine.

It is still another object of this invention to provide control apparatus for a presser foot capable of exerting a normal pressure on the work which is optionally operable to reduce such normal pressure, to increase such pressure or to lift the foot from the work.

It is a still further object of this invention to provide, in connection with a presser foot having primary means operative to cause said foot to exert pressure on the work, means for optionally rendering secondary means to become operative in place of said primary means, to cause the pressure foot to exert a reduced pressure.

This invention possesses many other advantages, and has other objects which may be made more clearly apparent from a consideration of one embodiment of the invention. For this purpose there is shown a form in the drawing accompanying and forming part of the present specification. The form will now be described in detail, illustrating the general principles of the invention; but it is to be understood that this detailed description is not to be taken in a limiting sense, since the scope of this invention is best defined by the appended claims.

In the drawings:

Figure 1 is a front elevation of a conventional sewing machine with the presser foot control apparatus of the invention incorporated therein;

Fig. 2 is a transverse section taken as indicated by line 2—2 on Fig. 1;

Fig. 3 is a detail section taken as indicated by line 3—3 on Fig. 1;

Fig. 4 is an elevation on an enlarged scale, as seen from the left of Fig. 1, and partly in section taken as indicated by line 4—4 of Fig. 1; and

Fig. 5 is a detail section taken as indicated by line 5—5 on Fig. 4.

Referring to the drawings, the control apparatus of the invention is shown as applied to a type of sewing machine which is in extensive use; but it is to be understood that the apparatus is equally applicable upon appropriate modification to other types of machines, and without departing from the spirit of the invention. In order to simplify the drawings, only the presser foot and those parts relating to the control thereof are shown.

Referring particularly to Figs. 1 and 4, the presser foot is indicated by the numeral 1 and in a well understood manner serves to releasably and resiliently maintain the work 2 against the feed dog 3 (see Fig. 4) which advances the work from right to left as viewed in Fig. 4 in an intermittent manner in accordance with the movements of the needle 4 and the needle bar 5. The needle operates to form stitches in the work in cooperation with a bobbin and thread (not shown).

The presser foot 1 is carried by a presser bar 6, guided for vertical movement in a sleeve or bushing 7 secured in the free end 8 of the horizontally extending hollow machine arm 9. The arm 9 has a vertical columnar extension 10 at the other end which supports the arm above the bed 11 (see also Fig. 2). This bed is tiltably mounted in a conventional manner in a suitable opening 12 provided by a table 13. A drip pan 14 is provided below the opening 12. The presser bar 6 is additionally guided by a guide member 15 (see also Fig. 5) secured to the presser bar near the upper end thereof and slidably engaging a slot 16 formed in the end 8 of the arm 9.

A leaf spring 17 is provided for continuously exerting a pressure urging the presser foot 1 downwardly and is mounted in the arm 9 (see Fig. 1). One end of the spring 17 engages the upper end of the presser bar 6 (see also Figs. 4 and 5), the other end being supported on a member 18 extending transversely of the arm 9 (see Fig. 3). An adjusting screw 19 threaded inwardly from the upper side of arm 9 engages the spring 17 intermediate its ends, and serves by appropriate adjustment to urge the spring downwardly against its supports, thus urging the presser foot 1 downwardly against the work 2. This provides the primary force exerted by the presser foot, and may be altered by adjustment of the screw 19 to suit the character of the work.

A lifting bracket 21 (Figs. 4 and 5) is slidably mounted on the bushing 7 just below the guide member 15. A spring cushioning member 22, which may be a spring washer, is interposed between the bracket 21 and the guide 15 (see Fig. 4). A lifter 23 is accommodated in the slot 16 and is pivotally mounted in the end portion 8 of the arm 9 by a pin 24. The lifter 23 has a cam face 23—*a* adapted to engage the lower edge of bracket 21 upon clockwise rotation of the lifter from the position shown. Continued rotation

of the lifter 23 raises the bracket 21 on the bushing 7 until the cushioning member 22 engages the guide member 15, whereupon further movement of the lifter 23 will raise the presser bar 6 and the foot 1 against the force of spring 17.

The cam face 23—*a* is so formed that a 90° rotation of the lifter 23 imparts sufficient movement to raise the presser foot 1 clear of the work 2 and to releasably retain the presser foot 1 and the lifter 23 in this position. When it is desired to return the presser foot 1 to engage the work 2, the lifter 23 is rotated counterclockwise to its original position.

The lifter 23 has an extension 23—*b* adapted to be gripped by the operator for lifting the presser foot. While it is apparent that it might be possible to hold the lifter 23 in such position as to merely reduce the pressure of the presser foot 1 on the work 2, it is not well adapted for such purpose, and such operation would require considerable deftness on the part of the operator. Further, the use of the lifter 23 in this manner is not desirable, since it leaves the operator with but one hand free to adjust the work.

Accordingly, additional means are provided for controlling the presser foot 1, which may be actuated by the operator's knee, leaving both hands free. For this purpose, a rock shaft 27 is provided extending lengthwise of the arm 9 and supported by suitable bearings therein. A crank 28 is provided on that end of shaft 27 adjacent the presser foot 1 and is connected to the lift bracket 21 by a link 29, pivoted at its opposite ends to the crank 28 and to the bracket 21 respectively (see Figs. 1, 4 and 5).

A second crank 30 is secured to shaft 27 near its opposite end (see Figs. 1 and 2) and is provided with an eye 30—*a* for slidingly accommodating a lifting rod 31. The rod 31 is provided with an adjustable abutment 32, the upper face 32—*a* of which is adapted to engage the crank 30, whereby upward movement of the lifting rod 31 imparts angular movement to the rock shaft 27.

The abutment 32 may conveniently comprise a set collar, secured on the rod 31 by a set screw 33.

A bracket 34 (Figs. 1 and 2) is secured to the under surface of the table 13 adjacent the extension 10 of arm 9, and pivotally supports a rock lever 35 by means of a pin 36. The rock lever 35 has a downward extension 37 to which is adjustably secured the knee plate 38 as well as a rearward extension 39 adjustably carrying a rod 40. The rod 40 has an arm 41 secured near its upper end having a hole 41—*a* for accommodating a right angle extension 31—*a* formed on rod 31.

The arrangement is such that with the parts in the relative positions shown, the presser foot 1 is urged downwardly with the primary force imparted by the spring 17. Movement of the knee plate 38 to the right, as viewed in Fig. 1, as by appropriate pressure of the operator's knee, will lift the lifting rod 31, imparting angular motion to the rock shaft 27 in a clockwise direction as seen in Fig. 2, and counter-clockwise as seen in Fig. 4. This motion will cause the lift bracket 21 to be raised, which in turn will raise the guide member 15 and lift the presser foot 1 against the force of the spring 17. Release of the pressure on the knee plate 38, will permit the parts to resume their initial positions. In this way the pressure of the presser foot may be rendered ef-

fective or not, and at the same time both of the operator's hands are free. If it is desired to maintain the presser foot 1 free of the work 2 for an appreciable interval, the lifter 23 may be operated to lock the foot in its position free of the work. Mechanism capable of this mode of operation is in general well known.

As previously discussed, it is often desirable to maintain the presser foot 1 against the work 2, but with a reduced pressure. While it might be possible, at least in theory, to accomplish this by appropriate manipulation of the knee pad 38, such is not in general, a practical mode of operation.

To provide for such reduction of pressure in a practical way and without requiring exceptional skill on the part of the operator, means are provided whereby the presser foot 1 may be caused optionally to exert a secondary pressure or force on the work upon removal of the primary force. For this purpose, the foot member 45 of the presser foot 1 is joined to the presser bar 6 through a lost motion connection, and a second spring means is provided which becomes effective during part of the lifting operation of the presser foot to remove the primary force.

Thus as shown in Fig. 5 the presser bar 6 comprises a hollow member 46 having a bore 46—*a* closed at its upper end. The foot member 45 is secured in a conventional manner to a shank 47 having a reduced portion 47—*a* providing an upwardly directed shoulder 47—*b*. The reduced portion 47—*a* is slidingly accommodated in the bore 46—*a*. The shoulder 47—*b* by engagement with the end of member 46 limits downward movement of the member 46 with respect to the shank 47.

A screw 48 having a head 48—*a* is threaded into the reduced shank 47—*a*, a slot 49 being provided in the member 46 for the head 48—*a*. The screw head 48—*a* by engagement with the lower end of the slot 49 limits upward movement of the member 46 with respect to the shank 47. The slot 49 and screw 48 cooperate with the shoulder 47—*b* and the end of the member 46 to form a lost motion connection between member 46 and shank 47. A light compression spring 50 is confined within the member 46 between the upper end of the bore 46—*a* and the top of the reduced shank 47—*a*, urging shank 47 downwardly in member 46.

In normal operation, spring 17 overcomes spring 50, and hollow member 46 is urged against shoulder 47—*b*. The entire presser foot assembly is thus substantially unyielding in the direction of the work. This condition is illustrated in Fig. 5. Therefore, when no lifting force is applied to the presser bar 6, the foot member 45 engages the work 2 and the hollow member 46 is urged downwardly to the limit of movement with respect to shank 47 by the spring 17, the pressure of the spring 17 thus being effective to urge the foot member 45 against the work 2. If now the lifting bracket 21 be operated by link 29 to lift the member 46 slightly, the force of the spring 17 will be entirely supported by member 46 and the bracket 21, while only the force exerted by spring 50 urges the foot member 45 aaginst the work 2. This may be termed conveniently, the secondary force. Continued upward movement of the member 46 will cause engagement of screw head 48—*a* with the lower end of slot 49, further upward movement of the member 46 thereafter lifting the foot member 45 clear of the work.

There is considerable movement of the member 46 after removal of the pressure of the spring 17, during which the pressure of the spring 50 acts, and before the foot 45 is raised, provided by the previously described lost motion connection.

There is thus no critical movement required to cause the presser foot to exert only the secondary force on the work 2. Hence there is a considerable range of movement of the knee plate 38 after the primary force has been removed and before the presser foot 1 is lifted, and no great care or skill is required of the operator.

Means are also provided whereby the primary force acting on the presser foot may be temporarily increased as desired by the operator. For this purpose a supplemental knee plate 51 (Figs. 1 and 2) may be provided which is arranged to increase the pressure exerted by the presser foot upon movement in a direction opposite to the movement of knee plate 38 to decrease such pressure. As shown in Fig. 1, the knee plate 51 conveniently may be so arranged with respect to the knee plate 38 to provide a space for the operator's knee between them so that movement in one direction from a normal or neutral position serves optionally to decrease the pressure of the foot or to lift it from the work, and in the opposite direction to increase such pressure.

Furthermore, it is desirable to use for this purpose as much of the previously described control apparatus as possible. Thus the supplemental knee plate 51 is adjustably mounted on a supplemental extension 52 of the rock lever 35, and the support 18 (Figs. 1 and 3) is arranged to have an adjustable height varied in accordance with the movement of the lifting rod 31. Referring to Figs. 1 and 3, the support 18 is shown as comprising a member 53 upon which the end portion of spring 17 is supported and which is eccentrically mounted for rotation by oppositely extending pintles 53—*a* and 53—*b*. The pintle 53—*b* is rotatably supported in a suitable bore 54 in the arm 9, pintle 53—*a* being supported in an alined bore 55 shown as formed in a detachable section 9—*a* of the arm 9, to facilitate assembly (Fig. 3).

The member 53 has a crank arm or extension 57 with a pin 58 in its outer end engaging the slotted end 59 of a lever 60. The lever 60 is pivoted intermediate its ends on a pin 61 mounted in arm 9 (Fig. 1). The opposite end 62 of the lever 60 is forked to accommodate the lifting rod 31 (see also Fig. 2) and is provided with upwardly facing convex surfaces 62—*a* adapted to be engaged by the under surface 32—*b* of abutment 32. Thus as the lifting rod 31 is moved downwardly from its normal position shown in the drawings, the abutment 32 will cause the lever 60 to swing clockwise about the pin 61, which will rotate member 53 in the opposite direction to increase the effective height thereof under the supported end of spring 17. This will flex spring 17 upwardly about the adjusting screw 19 and increase the pressure on the presser bar.

The knee plate extensions 37 and 52 are secured to the rock lever 35 for independent adjustment by set screws 37—*a* and 51—*a* respectively. Thus by appropriate adjustment the knee plates 38 and 52 may be arranged to encompass the operator's knee and maintain the rock lever 35 in a neutral or normal position where the knee is comfortably placed. Thus by appropriate movement to the right, the primary pressure exerted by the presser foot may be reduced to the secondary

pressure, or the foot lifted to clear the work. By movement to the left, the primary pressure may be increased to a desired extent.

The inventors claim:

1. In a presser mechanism for a sewing machine: a pair of telescoping members; a presser foot carried by one of the members; said members being provided with stops to limit inward and outward extensibility; means resiilently urging said members apart; means for applying a resilient force on that member which does not carry the foot, said force being greater than the force urging the members apart, whereby the members are in the limiting inward position during normal operation; means for optionally releasing said resilient force; and means for optionally increasing said resilient force, including a reciprocably mounted member; and means for moving the said member.

2. In a presser mechanism for a sewing machine: a presser bar; a flat spring having an end urging the bar downwardly, means forming an intermediate support for the spring, and an adjustable rest for the spring for adjusting the force exerted by the spring, comprising an angularly adjustable eccentric upon which the spring rests.

3. In a sewing machine presser foot adapted to exert a primary pressure: means for causing said foot to exert a reduced pressure upon removal of the primary pressure, control means including a movable member having a normal position in which said foot exerts the primary pressure, and means whereby movement of said member in one direction from said normal position renders said primary pressure ineffective, and movement in another direction from said normal position increases the primary pressure.

4. In a sewing machine presser foot adapted optionally to exert a pressure: control means for the presser foot, including a movable member having a normal position in which the foot exerts said pressure, means for increasing said pressure, and means whereby movement of said member from said normal position serves optionally to render said pressure ineffective or to actuate the means to increase the pressure.

5. In a sewing machine a presser foot adapted optionally to exert a primary pressure, a secondary pressure, or to be lifted clear of the work; control means for said foot, including a movable member having a normal position in which said foot exerts primary pressure, and means whereby progressive movement of said member in one direction from said normal position renders said primary pressure ineffective and lifts the foot clear of the work, and movement in another direction causes said foot to exert increased pressure.

6. In a sewing machine presser foot and a presser bar, means joining said foot to said bar

including a lost motion connection, means acting on said bar to urge the foot against the work comprising a spring leaf one end of which engages the bar, a support for the opposite end of said leaf, a pressure member intermediate said ends for flexing said spring leaf against said bar and said support, means for adjusting said support to alter the flexure of said spring leaf and thereby adjust the force exerted by said spring on said bar, and means for lifting said bar against the force of said spring, said lost motion connection causing said foot to remain in contact with the work for a limited lifting movement of said bar, and spring means between said bar and said foot for urging the foot against the work during said limited lifting movement.

7. In a sewing machine presser foot and a presser bar, means acting on said bar to urge the foot against the work comprising a spring leaf one end of which engages the bar, a support for the opposite end of said leaf, a pressure member intermediate said ends for flexing said spring leaf against said bar and said support, means forming an eccentric mounting for said support, movement of said support with respect to the mounting serving to vary the flexure of said spring, and means for moving said support.

8. In a sewing machine: a hollow elongate presser bar; means for guiding the presser bar in an axial direction; a presser foot; a shank for the foot and telescoping within the hollow bar; spring means urging said bar downwardly; resilient means acting upon said bar and shank for urging the shank outwardly of the bar; means limiting said outward movement; and means operating on said bar for raising it against the force of said spring means.

9. In a sewing machine: a hollow elongate presser bar; means for guiding the presser bar in an axial direction; a presser foot; a shank for the foot telescoped within the hollow bar; a spring engaging said bar for urging said bar downwardly; spring means within said bar urging said shank outwardly of the bar; means limiting said outward movement; and means operating on said bar for raising it against the force of said spring.

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