

Sept. 2, 1958

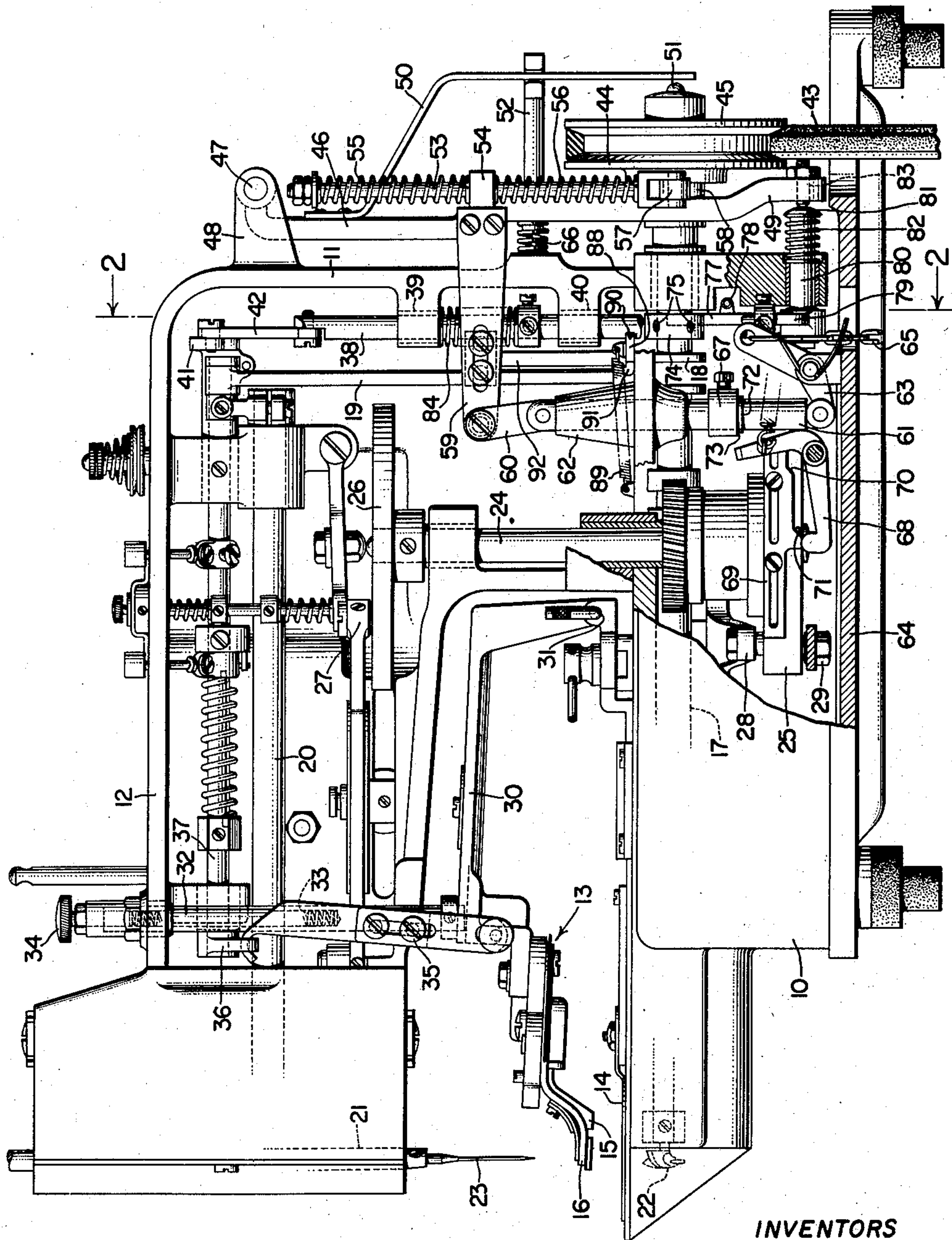
R. D. SWEET ET AL

2,849,971

AUTOMATIC CLAMP OPENING DEVICES FOR SEWING MACHINES

Filed Nov. 1, 1954

3 Sheets-Sheet 1



WITNESS

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Fig. 1

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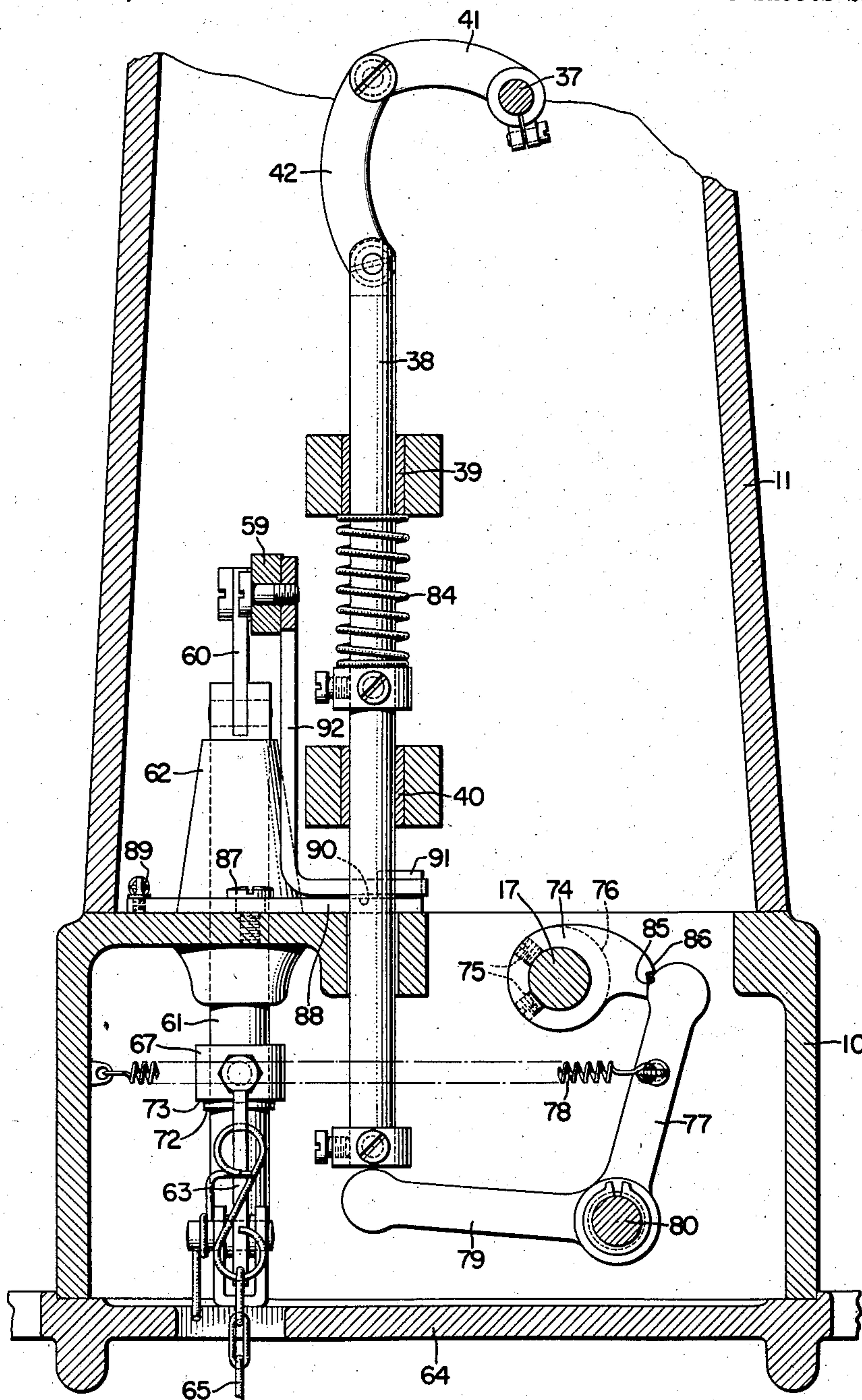


Fig. 2

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Fig. 3

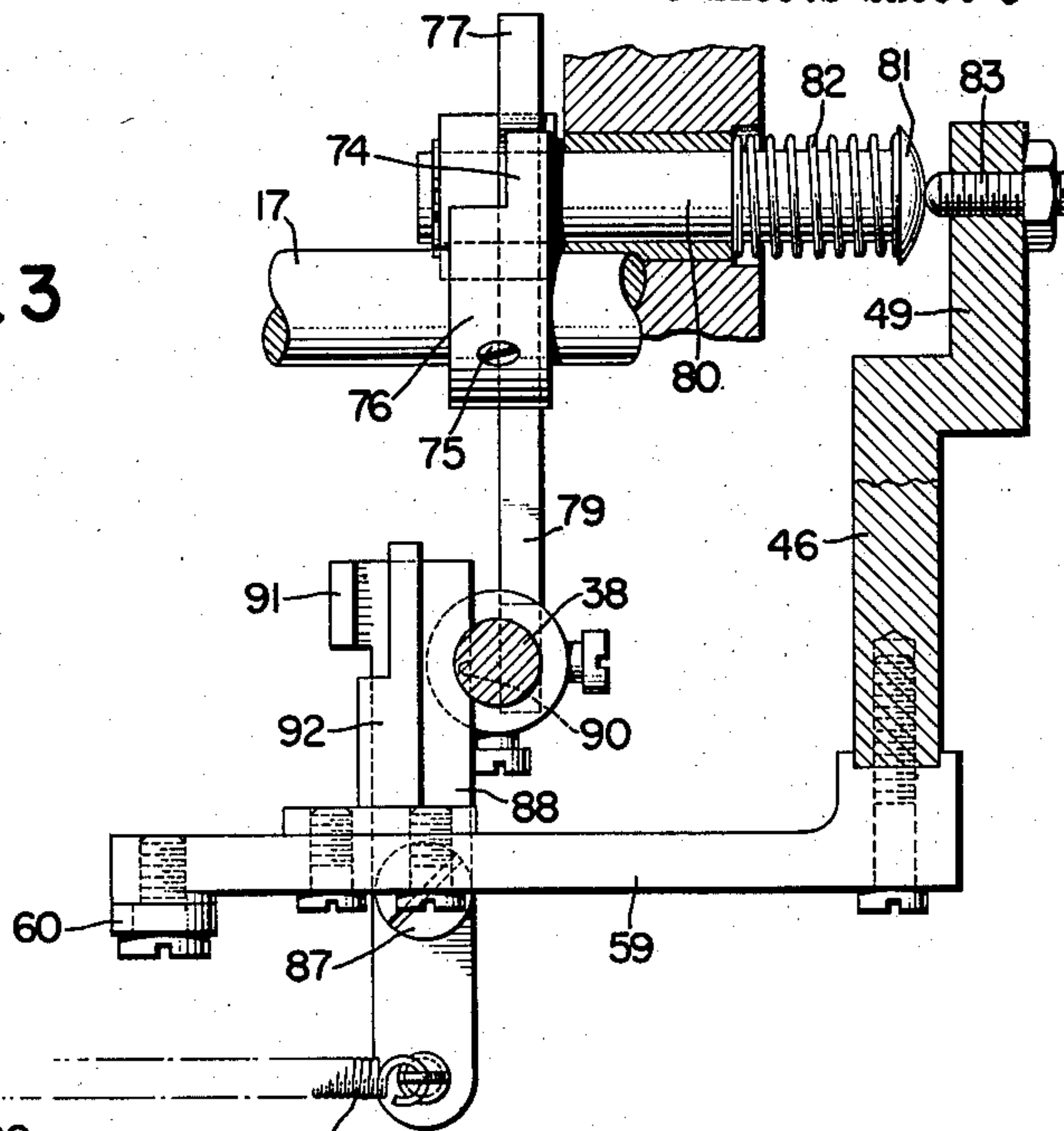


Fig. 4

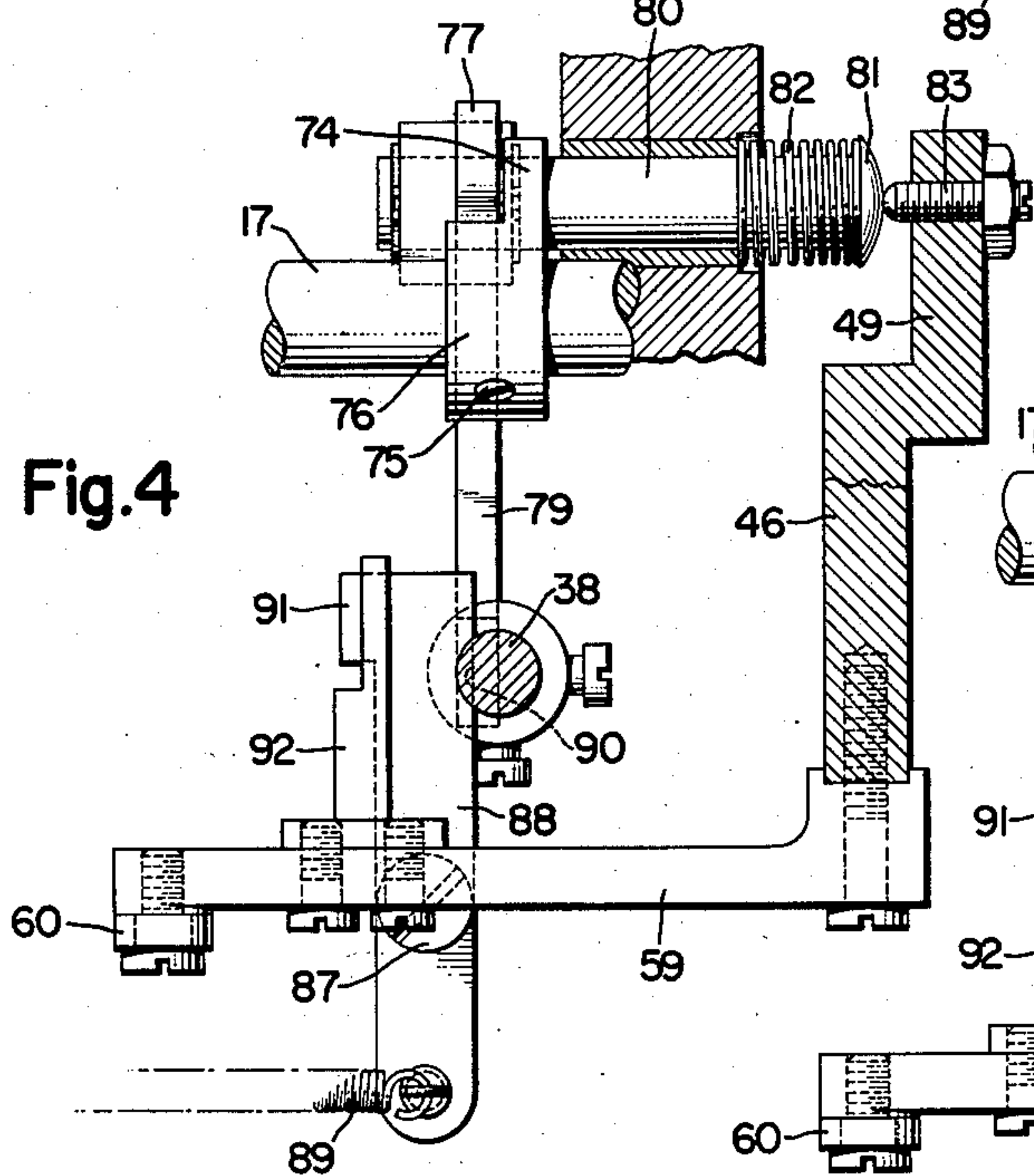
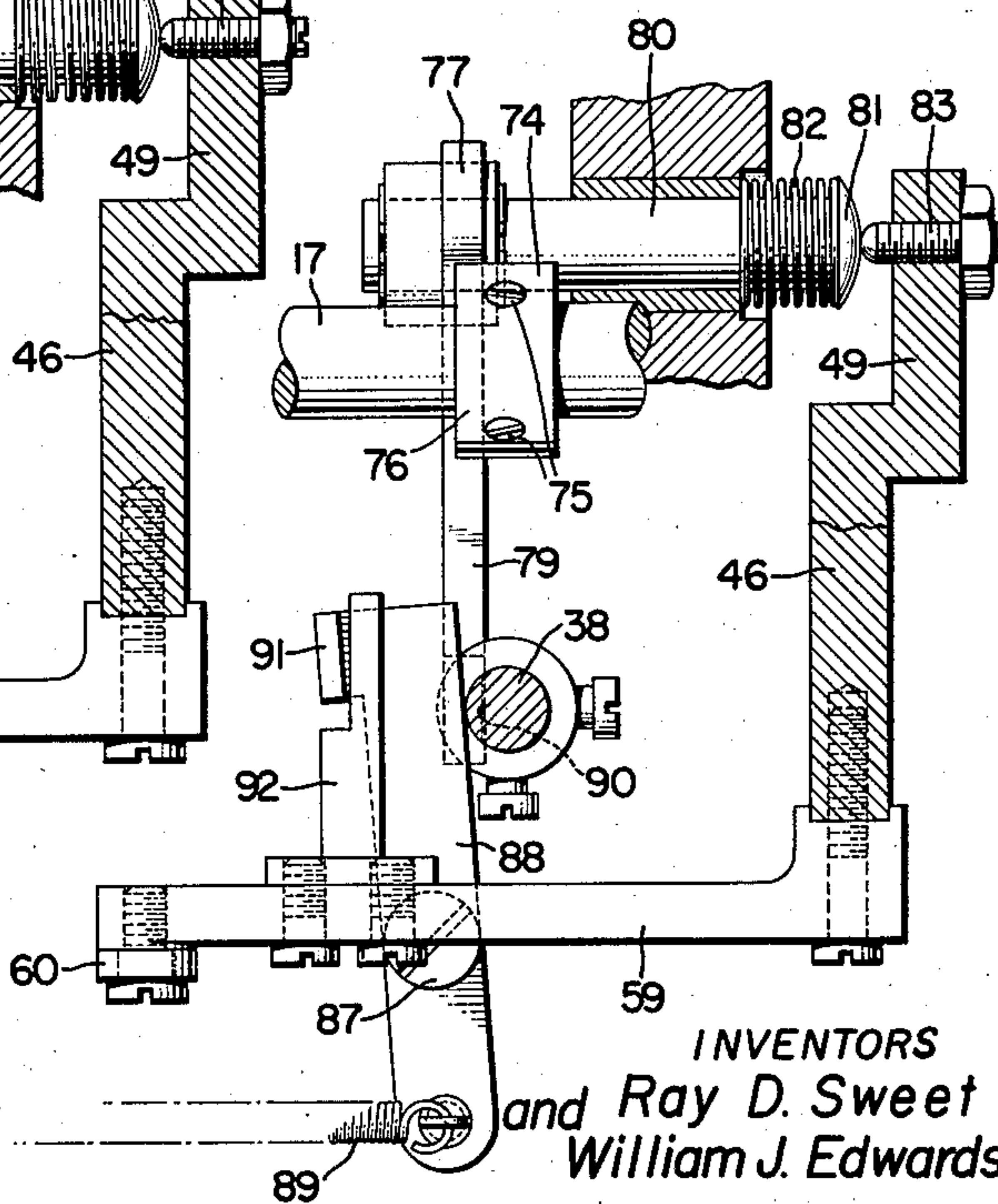


Fig. 5



WITNESS

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AUTOMATIC CLAMP OPENING DEVICES FOR SEWING MACHINES

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Application November 1, 1954, Serial No. 466,034

6 Claims. (Cl. 112—76)

This invention pertains to devices adapted to be driven by a sewing machine for automatically opening a work-gripping clamp and relates, more particularly, to such automatic clamp opening devices as are adapted for use with cyclically operated sewing machines.

It is an object of this invention to provide a novel and efficient mechanism whereby the energy of the driving mechanism of a sewing machine may be harnessed to open a work-gripping clamp.

Another object is to provide an automatic clamp opening mechanism in which a means is employed, apart from the instrumentalities which open the clamp, for holding the clamp in open position.

Still another object of this invention is the provision in a cyclically operated sewing machine of a latch means for assuming the burden of maintaining the work clamp in opened position, and freeing the clamp opening means so that the means may be shifted easily into inoperative position upon initiation of the succeeding cycle of machine operation.

With the above and other objects and advantages in view as will hereinafter appear, this invention comprises the devices, combinations, and arrangements of parts hereinafter described and illustrated in the accompanying drawings of a preferred embodiment in which:

Fig. 1 is a side elevational view of a sewing machine having portions of the machine frame broken away to expose our invention applied thereto.

Fig. 2 is a cross-sectional view of the sewing machine taken substantially along line 2—2 of Fig. 1.

Figs. 3, 4 and 5 are enlarged fragmentary plan views of the clamp opening mechanism, partly in cross section, and with other parts of the sewing machine being broken away or omitted so as to indicate more clearly the relationship of the clamp opening parts in three positions, that is, respectively, in an at-rest position with the clamp open, in an intermediate position as the sewing machine is being started, and in the position which the parts occupy during normal sewing operation of the sewing machine.

Referring to Fig. 1 of the drawings, the clamp opening device of this invention is illustrated as it is applied to a cyclically operated sewing machine. The sewing machine illustrated in Fig. 1 is of the type adapted to secure buttons to a garment fabric and, to this end, it is formed with a frame of conventional type including a bed 10, a standard 11 rising from the bed, and a bracket-arm 12 which extends from the standard to a position overhanging the bed. Disposed above the bed is a work-gripping clamp, indicated generally at 13, which comprises a plate-like fabric supporting lower jaw 14 and an upper jaw 15 formed with opposed spring fingers 16 which cooperate with the lower jaw to grip the work fabric and also serve to grip and support a flat button in position to be stitched to the fabric by the sewing machine. The present invention is not limited to use with a work clamp adapted for flat button sewing, such as is illustrated in the preferred embodiment of the draw-

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ings, but will be useful in opening work clamps adapted to grip fabrics and almost any type of article which it may be desired to subject to a cyclic stitching operation.

Journalled lengthwise in the sewing machine bed is a main drive shaft 17 which, by means of a crank 18 formed thereon and a pitman 19 disposed within the standard is adapted to oscillate a needle driving rock shaft 20 journalled in the bracket-arm and which is operatively connected in the customary manner to impart vertical reciprocatory movements to a needle bar 21. The main shaft also imparts rotary motion to a circularly moving looper 22 which is arranged beneath the bed and is complementary to the needle 23 in the formation of stitches. A cam shaft 24 which is journalled vertically in the sewing machine frame, is also driven by the main drive shaft 17 and carries a pattern cam 25 within the bed and a pattern cam 26 within the bracket-arm of the frame. A cam follower 27 engages the pattern cam 26 in the bracket-arm and serves to jog the needle bar laterally for alternate needle penetration of two different holes in a button. Corresponding jogging motion is imparted to the looper 22 by means of a cam follower 28 which is associated therewith and which engages a cam groove in the upper side of the pattern cam 25 in the bed.

When a four hole button is to be stitched, the above described needle and looper jogging mechanism serves to impart needle penetration alternately in a first pair of holes in the button and the work clamp is bodily moved to position a second pair of holes in the button properly with respect to the stitch-forming instrumentalities by means of a cam follower 29 which engages the under side of the pattern cam 25 in the bed and serves to control the work clamp movements.

The upper jaw 15 of the work clamp is carried by an arched arm 30 which is pivotally connected with the lower jaw 14 of the work clamp as by a pivot pin 31 which hinges the upper and lower jaws together so that the clamp may be opened when the upper jaw is swung upwardly. The pivot pin, however, rigidly secures the upper and lower clamp jaws for movement together in a horizontal direction in response to the tracking of the cam follower 29.

The upper jaw 15 of the work clamp is normally biased downwardly into closed work-gripping relation with the lower jaw 14 by means of a presser bar 32 journalled in the bracket-arm. The lower extremity of the presser bar is disposed in engagement with the arched arm 30 of the work clamp upper jaw and is biased downwardly by a coil spring 33 within the presser bar. The spring is seated against an adjusting screw 34 accessible from the top of the bracket-arm for changing the spring pressure which acts to maintain the work clamp in closed position.

The sewing machine to which this invention is suited preferably is provided with a linkage, movement of which will serve to effect opening of the work clamp in opposition to the coil spring 33. To this end a link 35 is arranged between the arched arm 30 of the upper clamp jaw and a rock arm 36 of a clamp lifting rock shaft 37 which is journalled in the bracket-arm. The clamp lifting rock shaft 37 is controlled by means of a push rod 38 journalled vertically in bearings 39 and 40 in the machine standard with a rock arm 41 and a link 42 serving to interconnect the push rod 38 with the clamp lifting rock shaft.

Article attaching sewing machines, such as the button sewing machine of the present preferred embodiment of my invention, are cyclic in operation, that is, the machines include a mechanism called a stop-motion mechanism for interrupting the sewing machine driving means and for bringing the stitch-forming mechanism to a stop after a predetermined number of stitches have been formed. The stop-motion mechanism illustrated in this

preferred embodiment is constructed substantially in accordance with that which forms the subject of the co-pending patent application of R. D. Sweet, Serial No. 413,228, filed March 1, 1954, to which application reference may be had for a detailed description of the stop-motion. Only so much of the stop-motion mechanism as is necessary for an understanding of the present invention will now be described here.

The motion necessary to drive the sewing machine is delivered from any conventional source of power by means of a V belt 43 which engages a two part separable pulley having an inner pulley portion 44, which is fixed for rotation with the main drive shaft 17, and an outer pulley portion 45, which is freely journaled on the main drive shaft and which is free to move axially thereof. The loose outer pulley portion 45 may be urged inwardly so as to compress and pinch the side of the V belt frictionally against the fast inner pulley portion 44 so that the belt will drive the sewing machine main shaft. Similarly, when the force urging the loose outer pulley inwardly is discontinued, the belt will ride idly upon the outer loose portion of the pulley and the transmission of power to the sewing machine will be interrupted. In order to control the loose outer pulley portion 45, a swinging stop-motion frame 46 is pivoted at 47 to lugs 48 extending outwardly from the sewing machine standard. The stop-motion frame depends from the pivot 47, loosely embraces the main drive shaft 17, and terminates in a downwardly and laterally extending arm 49 which, as will be described in detail later, serves to control the automatic clamp lifting mechanism of this invention. Riveted to the stop-motion frame near the pivot pin 47 is a relatively flat spring member 50 which extends downwardly and into axial engagement with an anti-friction thrust bearing ball 51 which is journaled at the outer extremity of the loose outer pulley portion. The spring member 50 is embraced and stiffened by a support member 52 which extends from the swinging frame. Movement of the swinging frame will thus serve to control the transmission of power to the sewing machine.

The swinging frame 46 also serves to bring the sewing machine to a definite predetermined at-rest position and to lock the machine in this position until initiation of a succeeding cycle of operation. To this end, a rod 53 is journaled for endwise movement vertically in a lug 54 which is formed to extend from the stop-motion frame. The rod is resiliently centered with respect to the lug by means of coil springs 55 and 56 and is provided at its lower extremity with a stop block 57 which cooperates with a notched stop cam 58 formed on the hub of the fast inner pulley portion 44. Thus, after the stop-motion frame is turned so that the loose pulley portion becomes free on the main drive shaft and the power to the sewing machine is discontinued, further movement of the stop-motion frame will bring the stop block into engagement with the notched stop cam 58 and the machine will be brought to a cushioned stop in a definite position determined by the position of the stop cam on the main drive shaft.

Briefly, the mechanism for controlling the stop-motion frame, as is best illustrated in Fig. 1, comprises an arm 59 extending from the stop-motion frame, a pivoted link 60, and a slide bar 61 which is journaled vertically in a bearing 62 carried in the machine bed. A bell crank 63, which may be carried by the support for the sewing machine such as a sub-base 64 and is adapted to be operated at the will of the sewing machine operator by means of a pull chain 65, bears beneath the slide bar 61 and serves to shift the stop-motion frame in opposition to a coil spring 66 between the machine standard and the stop-motion frame to initiate a cycle of stitches. A latch collar 67 fast on the slide bar cooperates with a latch lever 68 pivoted with respect to the machine bed to lock the stop-motion frame in operative position until the latch lever is tripped by a cam member 69 secured

to the periphery of the pattern cam 25 beneath the machine bed. As shown in Fig. 1, the cam member 69 is formed with two spaced trip-points 70 and 71 and the latch collar is correspondingly formed with two spaced latch surfaces 72 and 73 so that the stop frame will be released in two steps, first to interrupt the transmission of power to the sewing machine and after a coasting period, to bring the machine to a definite stopped position.

It is often desirable in cyclically operated sewing machines for the work-gripping clamp to be opened at the completion of each cycle of sewing operation. To this end, a clamp opening cam 74 is fixed for rotation with the main drive shaft 17, as by set screws 75, 75. The cam 74 is formed at one side with a straight cylindrical hub portion 76 of a diameter corresponding to the smallest diameter of the cam so that the cam blends with the hub over a portion of its periphery. Cooperating with the clamp lifting cam is a bell crank lever having a follower arm 77 biased by a spring 78 into engagement with the clamp lifting cam, and a second arm 79 arranged to underlie the clamp lifting push rod 38. The bell crank lever is pivotally mounted on a stud shaft 80 which is slidably journaled for endwise movement in a bearing in the sewing machine bed. The free extremity of the stud shaft 80 is formed with an enlarged head portion 81 biased by a spring 82 into engagement with an adjustment screw 83 carried in the downwardly extending arm 49 of the stop-motion frame. The follower arm 77 of the clamp lifting bell crank is shiftable with the stud shaft 80, and therefore will be moved by the stop-motion frame into an inoperative position in engagement with the straight cylindrical hub portion of the cam while the machine is operating, and into an operative cam-engaging position by the spring 82 when the stop-motion mechanism shifts into stopped position. Since the cam and the hub share a common diameter over a portion of their periphery, movement of the bell crank follower arm from the hub to the cam is facilitated.

Generally, it will be understood that the clamp lifting cam will be timed in relation to the notched stop-motion cam 58 so that the clamp will be raised as the machine is being locked in stopped position. The specific conformation of the clamp lifting cam, however, and its specific timed relation with the stop-motion mechanism form important features of this invention as will now be described.

Opening of the work gripping clamp by the bell crank lever must be accomplished in opposition to the clamp presser bar spring 33 as well as to a coil spring 84 on the push rod 38 which acts to insure return of the clamp opening mechanism. When the pressure of these two springs is assumed by the arm 79 of the bell crank in engagement with the bottom of the push rod, the frictional resistance to movement of the bell crank axially with its supporting stud shaft 80 becomes excessive. For this reason, the clamp opening cam 74, as best shown in Fig. 2, is formed with a notched portion 85 of reduced diameter into engagement with which the follower arm 77 moves as the machine turns into its stopped position. The apex 86 of the cam is timed preferably to engage the follower arm just prior to the final stopped position of the sewing machine so that the clamp reaches maximum opened position before the machine comes to rest. Carried by a pivot screw 87 on the machine bed is a latch lever 88 which is biased by a spring 89 into engagement with one side of the clamp opening push rod 38. The push rod is formed with a notch 90 which is disposed to receive the latch lever 88 when the push rod is shifted into the maximum raised position by the apex 86 of the clamp opening cam. As the notched or reduced portion 85 of the cam then passes into engagement with the bell crank follower arm 77, the push rod will be held in raised position by the latch lever 88 which, in engagement with the push rod notch 90, will assume

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the entire burden of the spring pressure in the clamp opening mechanism. The bell crank, therefore, will be free between the push rod 38 and the clamp lifting cam 74 when the machine stops, as shown in Figs. 1 and 2 both of which illustrate the sewing machine in stopped position. When a new cycle is to be initiated the bell crank may, therefore, be shifted axially with little or no effort.

The latch lever 88 is formed with an upstanding tang 91 disposed in the path of a depending finger 92 which is secured to the actuating arm 59 of the stop-motion frame for the purpose of retracting the latch lever when a new cycle of stitching is initiated.

Figs. 3, 4 and 5 illustrate the sequence of operation of the various parts of the clamp opening mechanism when a new cycle of stitching is initiated. As shown in Fig. 3, which illustrates the at-rest position of the parts, the bell crank follower arm 77 is disposed in engagement with the clamp opening cam 74, the latch lever 88 engages the push rod notch 90, and there is a clearance between the depending finger 92 and the tang 91 of the latch lever 88. Fig. 4 illustrates the position of the parts after the initial movement of the starting lever, and shows the relative position of parts at the moment of contact between the depending finger 92 with the tang 91. As the tang 91 is engaged, the follower arm of the bell crank will have been shifted out of the path of action of the clamp lifting cam by the adjustable screw in the depending arm of the stop-motion frame so that upon actuation of the sewing machine the clamp lifting cam will rotate idly out of contact with the bell crank. Fig. 5 illustrates the position of the parts upon completion of the movement of the starting bell crank lever 63 and represents the position that the parts will occupy during the operation of the machine throughout the cycle. The depending finger 92 engages and holds the latch lever 88 away from the push rod 38 while the adjusting screw 83 in the depending arm 49 of the stop-motion frame maintains the stud shaft 80 and consequently the bell crank lever out of engagement with the clamp lifting arm.

From the above it will be apparent that the clamp opening mechanism, as viewed in Fig. 2, will be held in opened position while the machine is stopped by the latch lever 88 seated in the notch 90 of the clamp opening push rod 38. Similarly, when the machine is stopped, the notched portion 85 of the clamp opening cam occupies a position in engagement with the arm 77 of the clamp opening bell crank and there will be clearance between the arm 79 of the bell crank and the push rod 38, the burden of work clamp presser spring 33 and the push rod return spring 84 being assumed by the latch lever 88. The latch 88 thus acts to free the bell crank lever when the machine is stopped so that little, if any, frictional resistance need be overcome in shifting the bell crank axially when a new cycle of operation is to be initiated.

Having thus set forth the nature of the invention, what we claim herein is:

1. In a sewing machine having a frame, stitch-forming instrumentalities, actuating mechanism therefor, and a work clamp carried by said frame, work clamp opening means comprising cam means disposed in constant driven relation with said actuating mechanism, mechanism carried by said sewing machine frame and operatively arranged to open said work clamp, means shiftable into an operative position interconnecting said cam means and said clamp opening mechanism, and latch means arranged between said sewing machine frame and said work clamp opening mechanism to restrain said clamp in opened position.

2. In a sewing machine having a frame, stitch-forming instrumentalities, actuating mechanism therefor, and a work clamp carried by said frame, work clamp opening mechanism comprising cam means disposed in constant driven relation with said actuating mechanism, a push

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rod carried by said sewing machine frame and operatively arranged to open said work clamp, means shiftable into an operative position interconnecting said cam means and said push rod, and latch means arranged between said sewing machine frame and said push rod to maintain said clamp in opened position.

3. In a cyclically operated sewing machine having a frame, stitch-forming mechanism arranged therein, a work-gripping clamp, and a stop-motion device for said stitch forming mechanism including a stop-motion controlling frame shiftable supported on said frame for movement into a first extreme position in which said stop motion device is effective to lock said sewing machine in a predetermined stopped position and a second extreme position in which said stop motion device is ineffective, automatic work clamp opening mechanism comprising, a clamp opening linkage, driving means associated with said stitch-forming mechanism for imparting operative movement to said clamp opening linkage, a connecting member shiftable into and out of operative position between said driving means and said clamp opening linkage, a latch member for restraining said clamp opening linkage in a clamp open position, said latch member shiftable supported on said sewing machine frame for movement into and out of operative position with respect to said clamp opening linkage, and means operatively interconnecting both said connection member and said latch member with said stop-motion controlling frame for movement of each of said members into operative position in response to movement of said stop motion control frame into said first extreme position.

4. In a cyclically operated sewing machine having a frame, stitch-forming mechanism arranged therein, a work-gripping clamp, and a stop-motion device for said stitch-forming mechanism including a stop-motion controlling frame shiftable supported on said frame for movement into a first extreme position in which said stop motion device is effective to lock said sewing machine in a predetermined stopped position and a second extreme position in which said stop-motion device is ineffective, automatic work clamp opening mechanism comprising, a clamp opening linkage including an endwise shiftable member journaled in said sewing machine frame, cam means associated with said stitch-forming mechanism for imparting operative movement to said clamp opening linkage, a connection member shiftable supported for movement into and out of operative position between said cam means and said clamp opening linkage, latch means for restraining said clamp opening linkage in clamp-open position including a latch member shiftable supported on said sewing machine frame and a latch receiving notch formed in the endwise shiftable member of said clamp opening linkage, and a pair of arms extending from said stop-motion controlling frame, one of said arms extending into operative engagement with said connection member and the other of said arms extending into operative engagement with said latch member, said arms being disposed to shift said connection member into operative position and said latch member into said latch receiving notch in response to movement of said stop motion controlling frame into said first extreme position.

5. In a cyclically operated sewing machine having a frame, stitch-forming mechanism arranged therein, a work-gripping clamp, and a stop-motion device for said stitch-forming mechanism including a shiftable stop-motion controlling frame, automatic work clamp opening mechanism comprising, a clamp opening linkage, cam means associated with said stitch-forming mechanism for imparting operative movement to said clamp opening linkage, a clamp opening lever, means defining a pivotal axis for said clamp opening lever with respect to said sewing machine frame, means for shifting said clamp opening lever axially into and out of operative relation between said cam means and said clamp opening link-

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age, latch means for restraining said clamp opening linkage in clamp-open position including a latch member shiftably supported on said sewing machine frame, and means responsive to a movement in one direction of said stop motion controlling frame for shifting in seriatim first the clamp opening lever out of operative relation between said cam means and said clamp opening linkage and then the latch member out of operative position restraining said clamp opening linkage in clamp open position.

6. In a cyclically operated sewing machine having a work-gripping clamp, stitch-forming mechanism, and actuating mechanism therefor, a stop cam and a clamp opening cam operatively associated in predetermined timed interrelation with said actuating mechanism, a clamp opening mechanism shiftable into operative relation with said clamp opening cam, said clamp opening cam being timed with respect to said stop cam so that the maximum opened position of said clamp will be attained before said stop cam becomes effective to stop said

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stitch-forming mechanism, and mechanism for restraining said work clamp opening mechanism in said maximum opened position including a latch member shiftably supported on said sewing machine for movement into operative engagement with said clamp opening mechanism when said clamp opening mechanism is in position corresponding to that of the maximum opened position of said work clamp.

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