June 19, 1923. 1,459,374

B. T. LEVEQUE

BUTTONHOLE SEWING MACHINE

Filed April 28, 1917 6 Sheets-Sheet 1

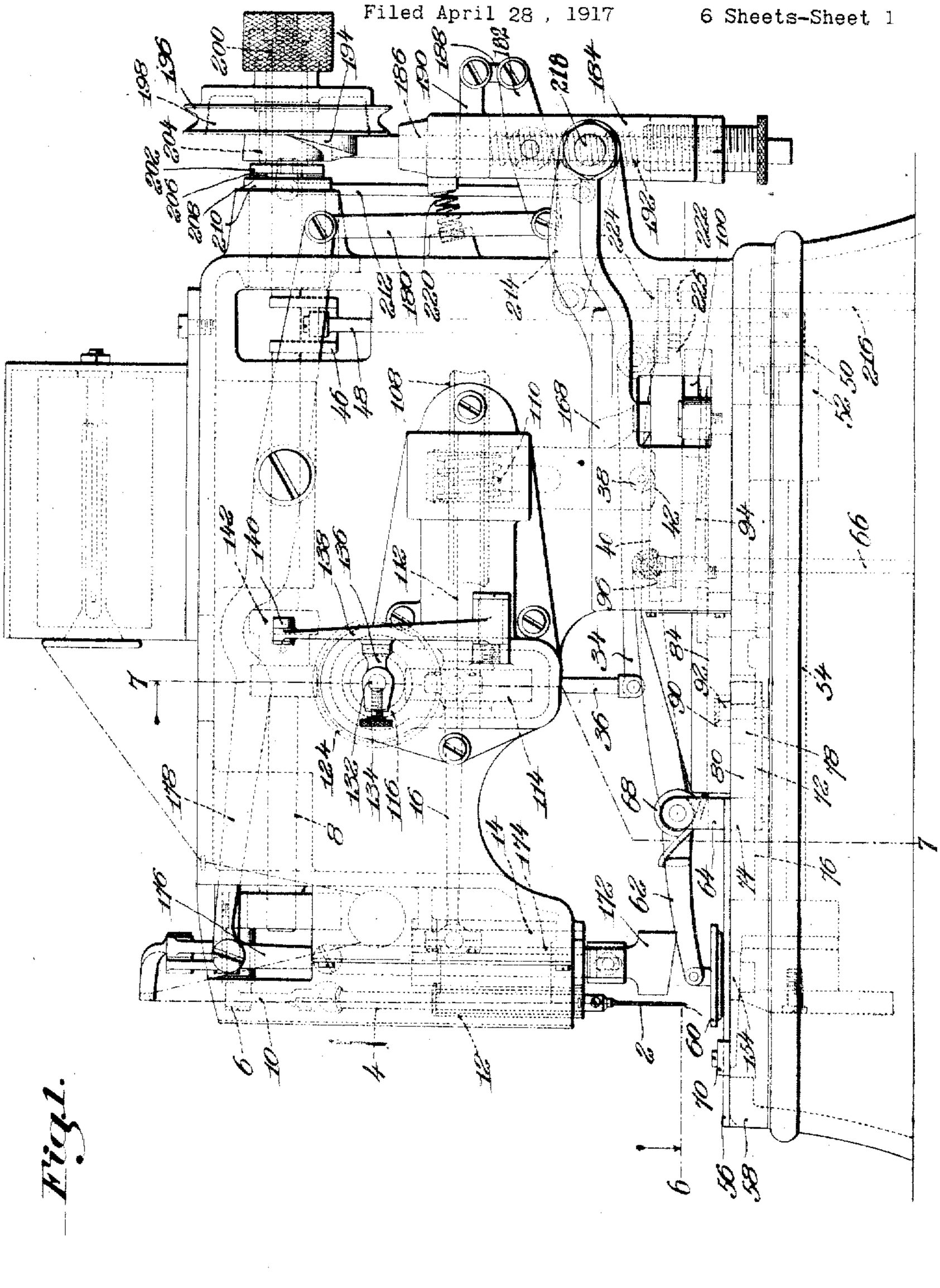

Fig. 1.

Witness
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BUTTONHOLE SEWING MACHINE

Filed April 28, 1917

6 Sheets-Sheet 2

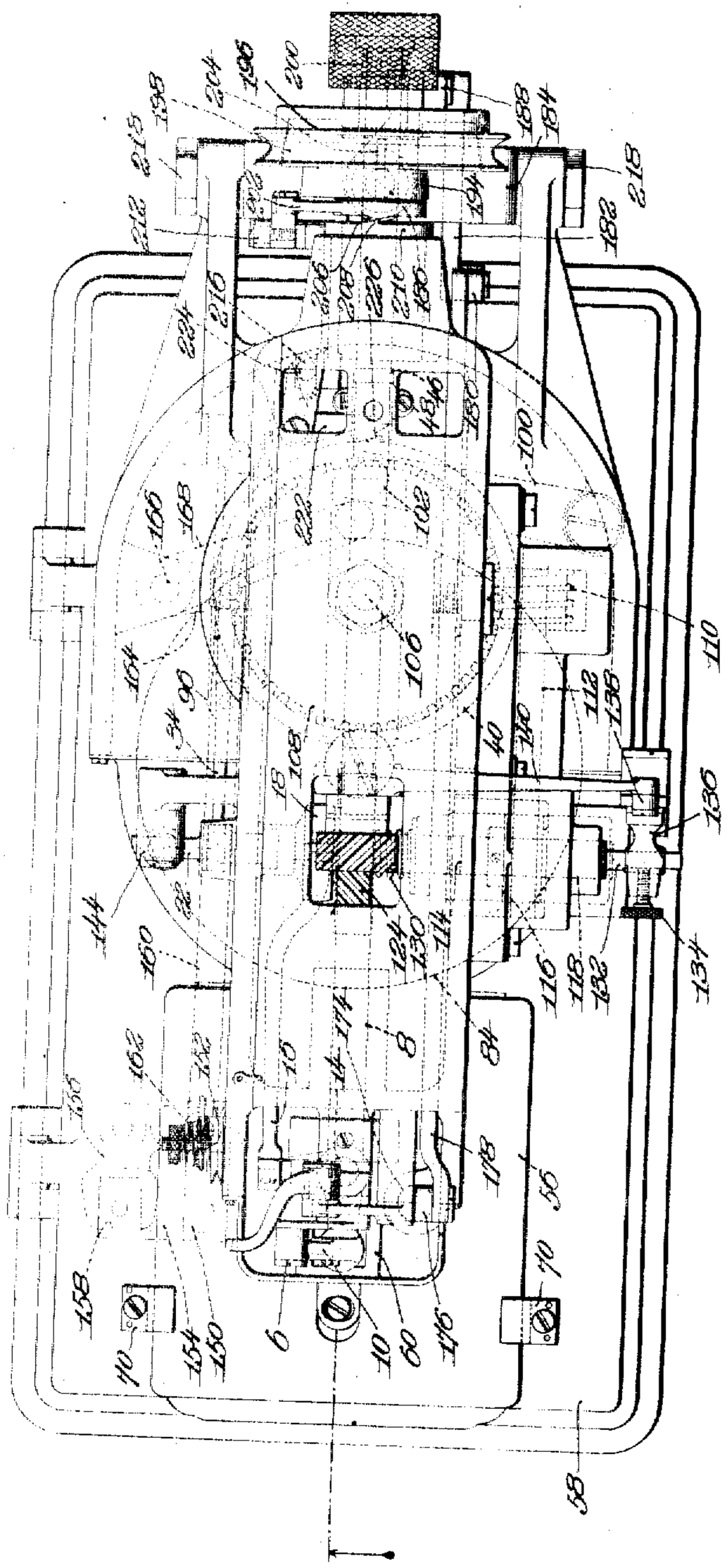

Fig. 2.

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1,459,374

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BUTTONHOLE SEWING MACHINE

Filed April 28, 1917

6 Sheets-Sheet 3

Fig. 3.

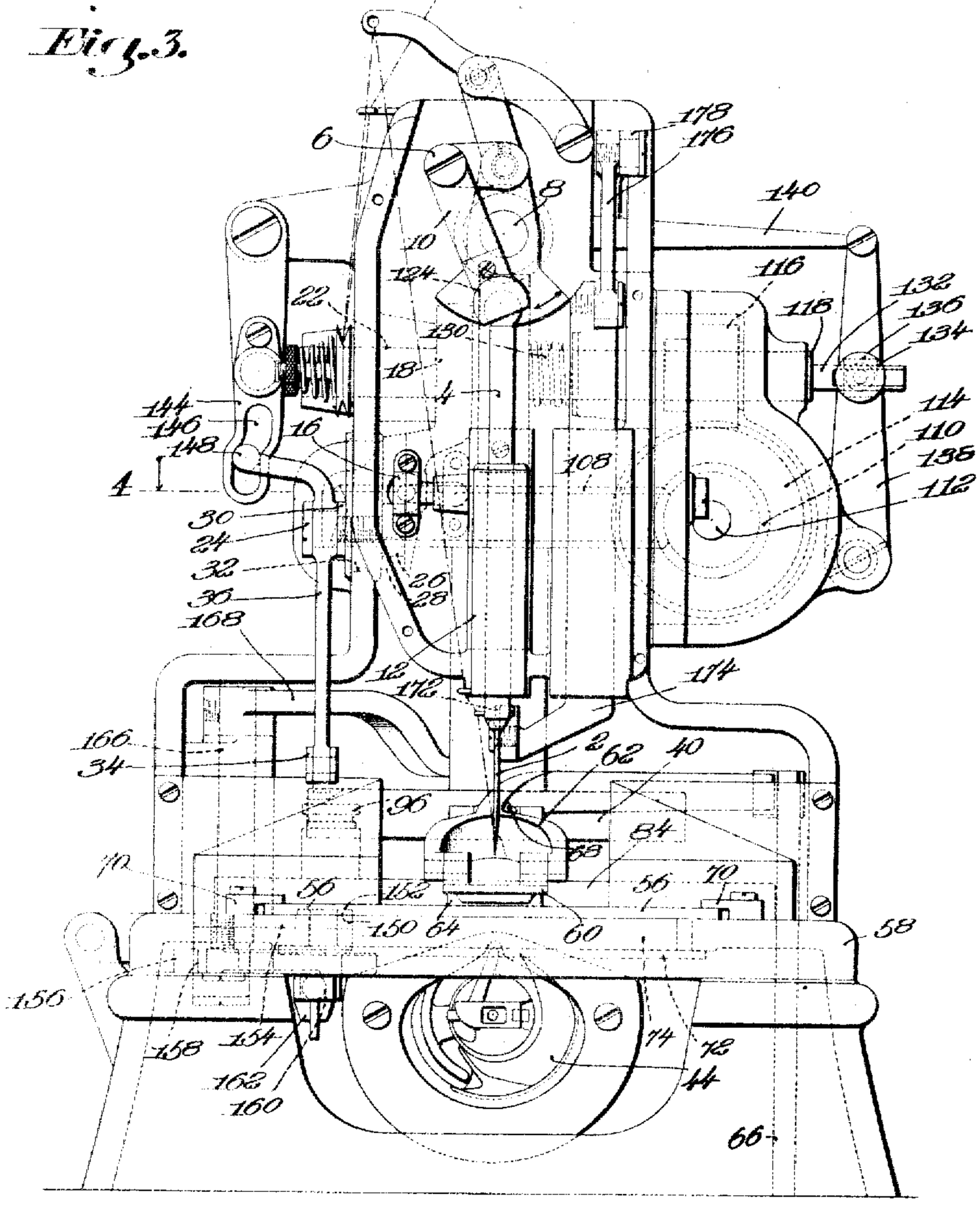
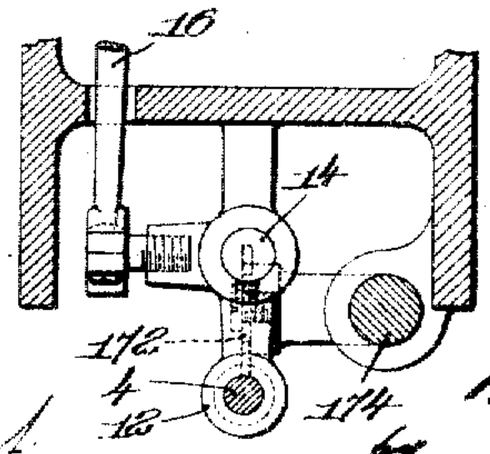


Fig. 4.



Witness

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1,459,374

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BUTTONHOLE SEWING MACHINE

Filed April 28, 1917

6 Sheets-Sheet 4

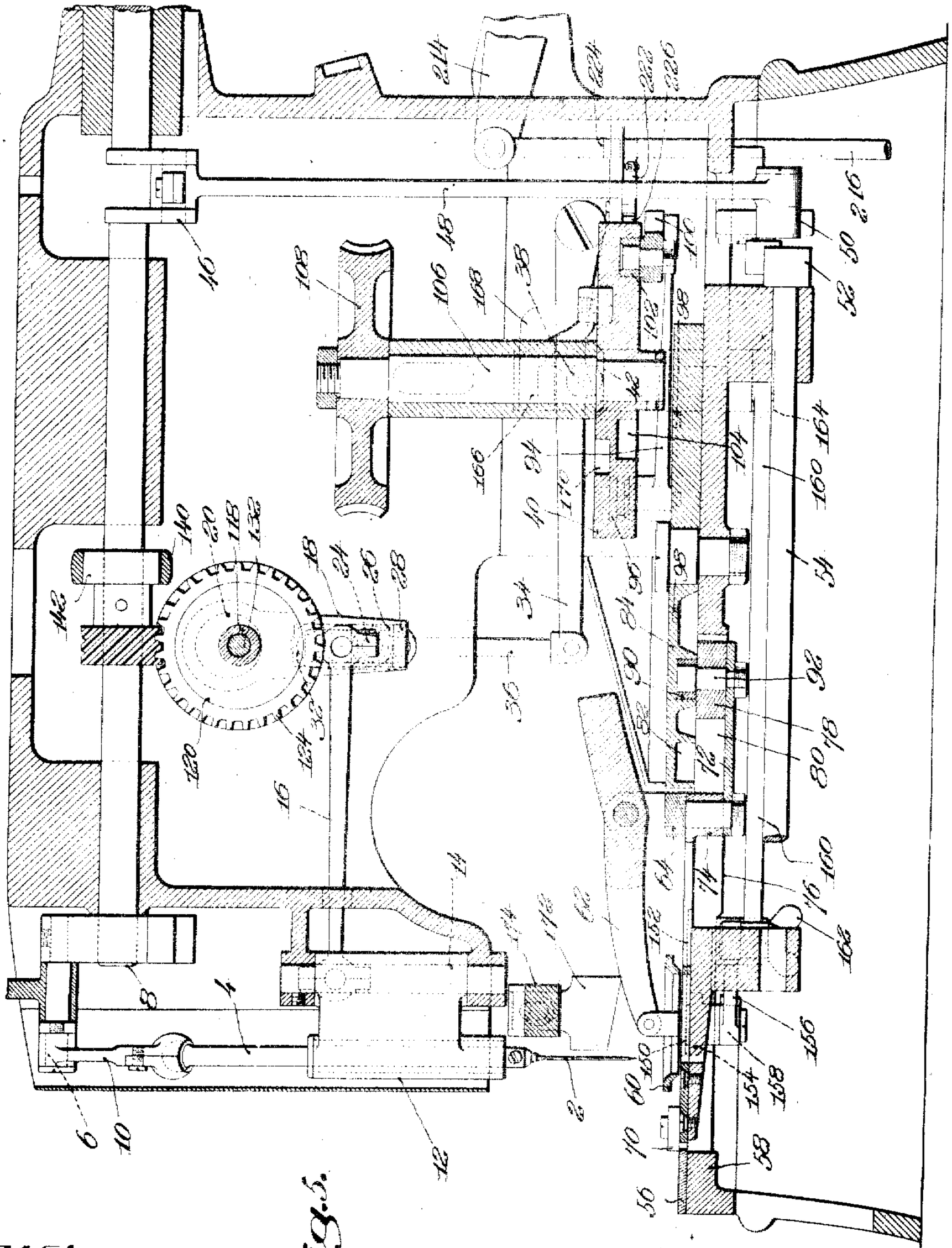

Fig. 5.

Witness

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June 19, 1923. 1,459,374

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BUTTONHOLE SEWING MACHINE

Filed April 23, 1917 6 Sheets-Sheet 5

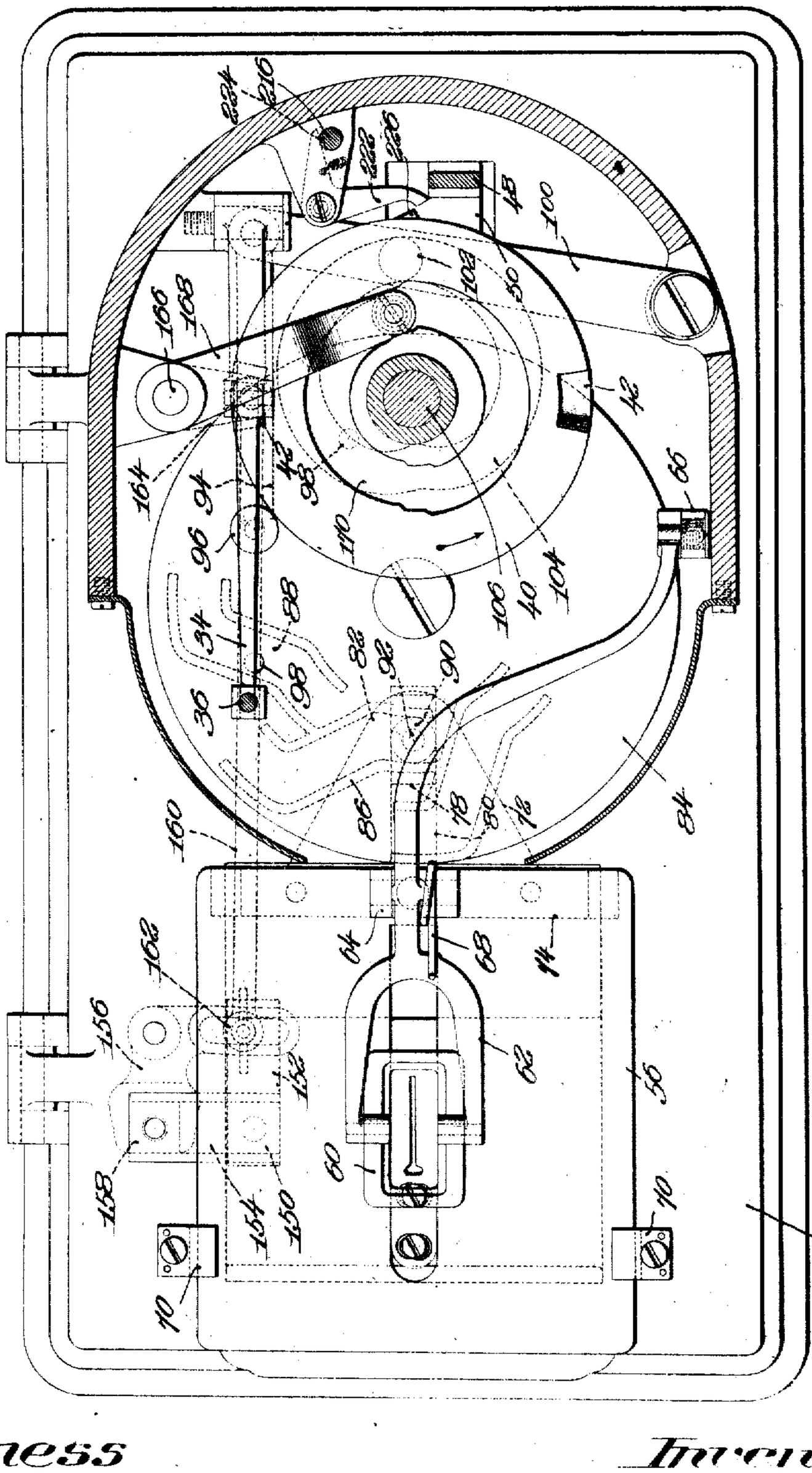

Fig. 6.

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1,459,374

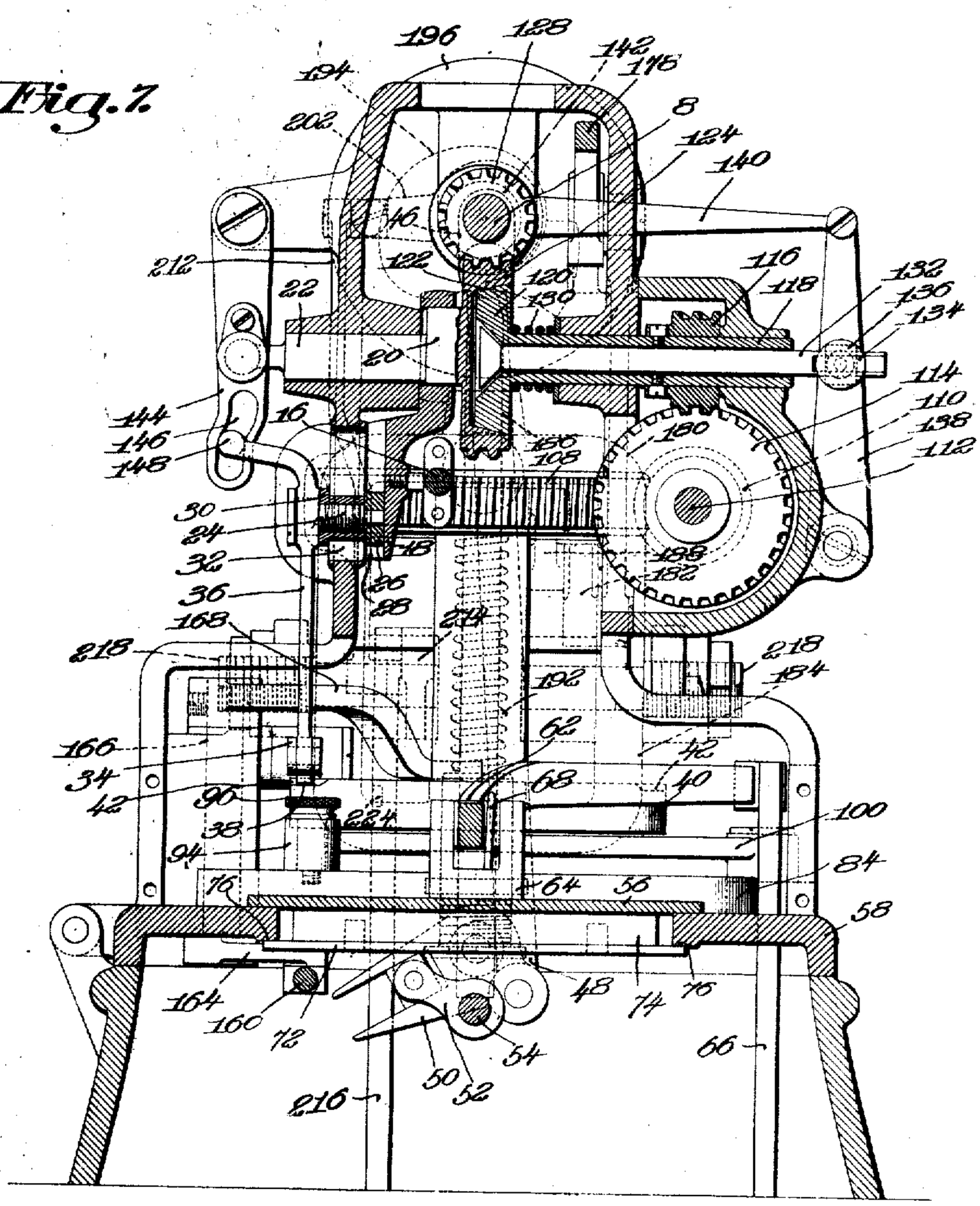
B. T. LEVEQUE

BUTTONHOLE SEWING MACHINE

Filed April 28, 1917

6 Sheets-Sheet 6

Fig. 7.



Witness

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Patented June 19, 1923. 1,459,374

UNITED STATES PATENT OFFICE.

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BUTTONHOLE-SEWING MACHINE.

Application filed April 28, 1917. Serial No. 165,105.

To all whom it may concern:

Be it known that I, BERNARD T. LEVEQUE, a citizen of the United States, residing at Wenham, in the county of Essex and State of Massachusetts, have invented certain new and useful Improvements in Buttonhole-Sewing Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The invention relates to buttonhole sewing machines for working and barring the ends of straight buttonholes, although some of its features are applicable to other types of buttonhole making machines.

It is the object of the invention to provide novel and improved feeding mechanism which may be readily adjusted for sewing different lengths of buttonholes; to provide novel and improved actuating means for the feeding mechanism which is well adapted for securing accurate spacing of the stitches when operating at high speed, and which may be readily adjusted for different lengths of buttonholes or different spacing of the stitches; to provide novel and improved means for varying the extent of the lateral vibration of the needle and the speed of the feed mechanism in forming the side and barring stitches; and to otherwise improve and simplify the various parts and mechanisms of the machine.

To these ends the invention comprises the features of construction and combinations of parts hereinafter described and referred to in the claims, the advantages of which will be apparent to those skilled in the art from the following detailed description of a machine embodying the various features of the invention in their preferred forms.

In the drawings, Figure 1 is a side elevation of a machine embodying the invention; Fig. 2 is a plan view; Fig. 3 is a front elevation; Fig. 4 is a sectional view on line 4, Fig. 3; Fig. 5 is a sectional view on line 5, Fig. 2; Fig. 6 is a sectional plan view on line 6, Fig. 1; and Fig. 7 is a sectional view on line 7, Fig. 1.

In the drawings the invention is shown embodied in a machine for making straight buttonholes with straight barring stitches across each end of the buttonhole. The machine comprises in general a stitch forming mechanism consisting of a vertically reciprocating and laterally vibrating needle and a shuttle located below the work and co-operating with the laterally vibrating needle in forming the overseam stitches along the sides of the buttonhole, and the barring stitches across the ends of the buttonhole; a work clamp which is moved longitudinally to space the stitches along the sides of the buttonhole, and is moved laterally to bring the work into position for sewing along the opposite sides of the buttonhole, and into position for the forming of the barring stitches at the ends of the buttonholes; and a cutter for cutting the buttonhole slit after the sewing is completed, which is operated from the mechanism which stops the machine at the completion of the sewing.

As shown, the needle 2 is secured in a needle bar 4 which is reciprocated by a crank 6 carried on the end of the main driving shaft 8, and connected with the upper end of the needle bar by a link 10. The needle bar is mounted to reciprocate in a swinging carrier 12 supported on a stud 14 and oscillated to laterally vibrate or jog the needle bar and needle through a link 16, the rear end of which is connected to an actuating lever 18. The lever is oscillated by an eccentric 20 which engages a bearing in the upper end of the lever, and is formed on a shaft 22 which makes one revolution for each two revolutions of the shaft 8, as will be more fully described. The lever 18 oscillates about a fulcrum stud 24 which carries a fulcrum block 26 engaging a groove 28 in the lever. The fulcrum stud 24 is secured in a slide 30 which is mounted in a vertical guideway 32 in the frame of the machine, and may be raised or lowered to vary the position of the fulcrum for the lever 18, and thereby vary the lateral or jogging movement of the needle and needle bar in sewing the comparatively short overedge stitches along the sides of the buttonhole, and the comparatively long barring stitches across the ends of the buttonhole. The slide is moved vertically at proper intervals by a cam lever 34 connected by a link 36 with the slide, and carrying a roll 38 arranged to engage the upper surface of a cam wheel or disc 40 which makes one revolution for each buttonhole. The disc is provided with two diametrically opposite depressions 42 which

register with the cam roll 38, and cause the slide 30 to move downward, and thus increase the lateral vibration of the needle during the sewing of the barring stitches. As the barring is completed the roll rides out of the depression, thus raising the slide 30 and reducing the lateral vibration of the needle during the sewing along the sides of the buttonhole. The shuttle 44 for co-operating with the laterally vibrating needle is of well-known construction, and is oscillated from a crank 46 on the shaft 8 through a link 48, lever 50, arm 52, and rock shaft 54, of usual construction.

The holder for carrying the work comprises a plate 56 mounted to move longitudinally and laterally on the base plate 58 of the machine, and a clamp 60 carried on a clamp lever 62 mounted on the plate. The lever is pivoted in a support 64 secured on the upper side of the plate, and the rear end of the lever is connected by a link 66 with a treadle (not shown), by which the operator may open the clamp to insert or space the work. The clamp is normally held closed by a spring 68. The work holder plate 56 is retained on the upper surface of the base plate 58 by the overhanging lugs 70, and by a plate 72 which is secured to the under side of a cross bar 74 on the rear edge of the plate. The plate 72 engages bearing surfaces 76 on the under side of the base plate 58, and is pivotally connected near its rear end to a block 78 which is mounted to slide in a guideway 80 formed in the base plate.

The mechanism for advancing and retracting the work holder during the sewing comprises a series of feed cams having varying throws, and a master feed cam actuating the feed cams to give the work holder a length of travel corresponding to the throw of the cam which is actively connected with the work holder. The series of cams are so mounted that any one of the series may be actively connected with the work holder and with the master cam to regulate or adjust the travel of the work holder in accordance with the length of buttonhole which it is desired to make. The cams may be and preferably are provided with dwells at their opposite ends, so that the work holder may be retained in fixed position during the sewing of the barring stitches at each end of the travel of the work holder, and thus the barring stitches be formed one on top of the other. In the construction shown the series of cam grooves 82 are formed on the under side of a cam disc 84, the sides of the grooves being formed by ribs 86 projecting from the under face of the disc. Three only of the cams are shown, but it will be understood that any desired number of cams may be formed on the under surface of the disc. Each cam is provided with concentric portions or dwells at its opposite ends, and the concentric portions are connected by inclined portions 88, the length of which determines the length of travel imparted to the work holder by that particular cam. The cam disc is so mounted that any one of the cams on its under face may be brought into engagement with a roll 90 carried by the stud 92 which connects the block 78 with the plate 72 of the work holder. The outer ends of the cam slots 82 are open and unobstructed, so that the roll may pass in or out of this end of the cam in changing from one cam of the series to another.

The cam disc 84 is oscillated during the sewing of a buttonhole through a link 94, one end of which may be connected by a pivot screw 96 with any one of a series of holes 98 in the disc 84, and the other end of which is connected to a cam lever 100. The cam lever carries a roll 102 which engages a cam groove 104 formed on the under face of the cam wheel 40. The cam groove 104 forms a master feed cam of constant throw, which oscillates the cam carrying disc 84 during the sewing of a buttonhole, the movement imparted to the work holder being determined by the cam 82 which is engaged by the cam roll on the holder.

The number of stitches which should be formed during a single rotation of the cam wheel 40 and a single oscillation of the feed cam carrier disc will depend upon the feed cam which is actively connected with the work holder and with the cam wheel, and the mechanism for rotating the cam wheel is therefore so constructed that the speed of the cam wheel with relation to the sewing mechanism may be varied in accordance with the length of buttonhole being sewed. It is also desirable that the number of barring stitches formed at each end of the buttonhole should be the same, whatever the length of the buttonhole, and the mechanism for rotating the cam wheel is therefore also so controlled that the speed of the cam wheel is the same during the barring, whatever its adjustment for the side stitches. In the construction shown, the cam wheel 40 is secured upon the lower end of a shaft 106, the upper end of which carries a worm wheel 108 engaged by a worm 110 on a shaft 112. The shaft 112 is driven through a spiral gear 114 secured thereto, and engaged by a spiral gear 116 of one-half its diameter which is secured to a shaft 118. The inner end of the shaft 118 is provided with the driven member 120 of a friction clutch, the driving member 122 of which is in the form of a spiral gear 124 formed on the end of the shaft 22 which is mounted in axial alignment with the shaft 118. The shaft 118 is mounted for limited axial movement in its bearings, and is forced in a direction to hold the clutch member 120 in engagement with

the clutch member 122 by a spring 130. The clutch forming part of the driving connections between the main shaft 8 and the cam wheel is one form of means for enabling these connections to be broken for an interval during each stitch forming cycle to determine the speed of the cam wheel with relation to the stitch forming mechanism. In the construction shown the clutch is engaged and disengaged during each revolution of the shaft 8, and therefore during each stitch forming cycle, by axial movement of the shaft 118 and the driven clutch member 120. The means for thus moving the shaft and clutch member comprise a rod 132 extending through the shaft and provided at its inner end with a conical head adapted to engage a conical recess in the clutch member. The outer end of the rod is connected by a clamping screw 134 with a block 136 pivotally connected to a lever 138. The upper end of the lever is connected to the outer end of the link 140, the inner end of which is provided with a bearing engaging an eccentric 142 on the shaft 8. Through this mechanism the shaft 118 and the clutch member 120 are moved axially during each revolution of the shaft 8, and during each stitch forming cycle, to engage and disengage the clutch members and impart an intermittent movement to the feed cam and work clamp. The speed of the cam wheel 40, and of the feed cam carrier with relation to the sewing mechanism for each stitch, will depend upon the length of the period during which the clutch members are in engagement. This period may be varied in accordance with the length of the buttonhole being sewn or the number of stitches in a given length of buttonhole, by adjustment of the rod 132 in the block 136. This adjustment will vary the lost motion between the conical end of the rod and the clutch member 120, and consequently vary the relative lengths of the periods during which the clutch members are engaged and disengaged.

In order that the speed of the cam wheel may be the same during the sewing of the barring stitches, whatever the adjustment of the rod 132, means is provided for automatically controlling the clutch to secure this result. In the construction shown this result is secured by mounting the shaft 22 so that it may have a limited axial movement, and providing means for moving the shaft so that the clutch members will remain in engagement during the entire revolution of the shaft 8, or for a period which is as long as the period during which the clutch is in engagement when the disengaging mechanism is adjusted for the shortest buttonhole. The means for moving the shaft 22 axially comprises a lever 144 pivotally connected to the end of the shaft, and provided near its lower end with a cam slot 146 which is engaged by a pin 148 on the upper end of the link 36, which, as heretofore described, forms a part of the mechanism for varying the amplitude of the lateral vibrations of the needle. When the lever 34 to which the link 36 is connected is lowered to increase the amplitude of the vibrations of the needle for the barring stitches, the finger 148 engages the lower part of the cam slot 146 and forces the shaft 22 and driving clutch member 122 toward the right, as in Fig. 7. This movement also carries the driven clutch member 120 toward the right, thus increasing the lost motion between the rod 132 and the driven clutch member, so that the engagement of the clutch member is not affected by the reciprocation of the rod 132, or is only affected to the same extent as when the rod is adjusted for the shortest buttonhole within the capacity of the machine. The movement imparted to the cam wheel and feed cam carrier disc will be the same during the barring, therefore, whatever may be the adjustment of the mechanism for engaging and disengaging the clutch during each edge stitch forming cycle.

The mechanism for moving the work support laterally to properly position the work for sewing along the opposite sides of the buttonhole, and to position the work for the barring stitches and for the cutting of a buttonhole slit, comprises a guide block 150 arranged to engage a slot 152 in the under surface of the work holder plate 56, and pivoted upon the upper side of a slide 154 which is mounted in a guideway in the base plate. The slide is operated through a bell crank lever 156, one end of which is slotted to embrace a pivot block 158 on the under side of the slide, and the other end of which is adjustably connected to a link 160 by a pivot stud 162. The rear end of the link is connected to an arm 164 on the lower end of a rock shaft 166, the upper end of which is provided with an arm 168 carrying a roll engaging a cam groove 170 in the upper face of the cam wheel 40.

The means for cutting the buttonhole slit after the sewing has been completed comprises a cutter blade 172 secured on the lower end of a bar 174 which is mounted to slide vertically in a bearing in the machine frame. The upper end of the cutter bar is connected by a link 176 to the front end of a lever 178, the rear end of which is connected by a link 180 to a lever 182 mounted on the support 184 for the stop plunger 186 of the stop mechanism. The other end of the lever 182 is connected by a link 188 with an arm 190 secured to the stop plunger. When the stop mechanism operates to stop the machine, the plunger 186 is forced down against the tension of a spring 192 by a cam 194, and during this movement the cutter is operated to cut the

buttonhole slit through the connection described, the parts being returned to their normal position, as indicated in Fig. 1, when the plunger rises into the stopping depression following the cam 194.

The mechanism for driving and stopping the machine is similar in general construction to the driving and stopping mechanism shown and described in Patent No. 1,181,766, May 2, 1916. It comprises a driving pulley 196 carrying one member of a friction clutch, the other member 198 of which is secured to the shaft 8. The driving pulley is forced in a direction to engage the clutch members by a spring 200. The clutch members are engaged and disengaged through a rocking cam disc 202, one side of which engages pins 204 passing through the clutch member 198 and engaging the hub of the driving pulley, and the other side of which carries cams 206 arranged to engage corresponding cams 208 on a fixed disc 210. The rocking cam disc 202 is connected by a link 212 to an arm 214 projecting from the support 184, and connected by a rod 216 with a starting treadle (not shown). The support 184 for the stop plunger is mounted to swing on trunnions 218 to move the upper end of the stop plunger 186 into and out of the path of the braking and stop cam 194. The support is forced in a direction to bring the stop plunger into the path of the cam by a spring 220. When the machine is to be started, the treadle is operated to draw down the rod 216, and thus swing the stop plunger out of the path of the stop cams, and at the same time to rock the cam disc 202 in a direction to engage the driving clutch. The parts are retained in this position by a latch lever 222, one arm of which is arranged to engage a notch 224 in the side of the rod 216. When the sewing of the buttonhole has been completed a cam 226 on the cam wheel 40 operates the latch lever 222 to disengage it from the notch in the rod 216, thus releasing the support 184, so that it is swung in a direction to bring the stop plunger into the path of the stop cam by the spring 220. This movement of the support also rocks the cam disc 202 to disengage the clutch members. During the forward revolution of the driving shaft 8 the stopping and braking cam 194 forces the stop plunger downward, thereby operating the cutter as above described, and as the shaft comes into final position the stop plunger moves upward into the stopping depression in the cam 194.

While it is preferred to employ the specific construction and arrangement of parts shown and described in embodying the invention in a machine for sewing straight buttonholes with barred ends, it will be understood that this construction and arrangement is not essential, but may be varied or modified as found desirable or best suited to the construction and arrangement of the parts of the machine in which it is to be embodied. It will also be understood that certain features of the invention are not confined in their application to a machine of the type shown and described, but may be embodied with advantage in other forms or types of buttonhole making machines.

Having explained the nature and object of the invention, and specifically described one form of mechanism in which it may be embodied, what is claimed is:—

1. A buttonhole sewing machine, having, in combination, stitch forming mechanism, a work holder, feed mechanism for relatively feeding the stitch forming mechanism and work holder, a clutch rotating in a uniform direction for actuating the feed mechanism, and mechanism for engaging the clutch for an interval during each stitch forming cycle.

2. A buttonhole sewing machine, having, in combination, stitch forming mechanism, a work holder, feed mechanism for relatively feeding the stitch forming mechanism and work holder, a clutch rotating in a uniform direction for actuating the feed mechanism, mechanism for engaging the clutch for an interval during each stitch forming cycle, and means for varying the interval of engagement.

3. A buttonhole sewing machine, having, in combination, stitch forming mechanism, a shaft for driving the same, a work holder, feed mechanism, driving connections between the shaft and feed mechanism including a clutch rotating in a uniform direction, and mechanism for engaging the clutch for an interval during each revolution of the shaft.

4. A buttonhole sewing machine, having, in combination, stitch forming mechanism, a shaft for driving the same, a work holder, feed mechanism, driving connections between the shaft and feed mechanism including a clutch rotating in a uniform direction, mechanism for engaging the clutch for an interval during each revolution of the shaft, and means for varying the interval of engagement to regulate the movement transmitted to the feed mechanism during each stitch forming cycle.

5. A buttonhole sewing machine, having, in combination, stitch forming mechanism, a work holder, a driving shaft for the stitch forming mechanism, feed mechanism, driving connections between the shaft and feed mechanism including two concentric clutch members, and means for disengaging said clutch members by relative axial movement for an interval during each stitch forming cycle.

6. A buttonhole sewing machine, having, in combination, stitch forming mechanism,

a work holder, a driving shaft for the stitch forming mechanism, feed mechanism, driving connections between the shaft and feed mechanism including two concentric clutch members, means for disengaging said clutch members by relative axial movement for an interval during each stitch forming cycle, and means for varying the interval.

7. A buttonhole sewing machine, having, in combination, stitch forming mechanism, a work holder, a driving shaft for the stitch forming mechanism, feed mechanism, a driving clutch member rotated in a uniform direction from the shaft, a driven clutch member geared to the feed mechanism, and means for engaging the clutch members for an interval during each revolution of the shaft.

8. A buttonhole sewing machine, having, in combination, a needle bar, mechanism for laterally vibrating the same, a work holder, feed mechanism, a clutch for actuating the feed mechanism, mechanism for engaging the clutch for an interval during each stitch forming cycle, and mechanism for temporarily increasing the extent of vibration of the needle bar to form barring stitches and for increasing the clutch engagement interval during the barring.

9. A buttonhole sewing machine, having, in combination, stitch forming mechanism including a laterally vibrating neddle, a work holder, a cam wheel, a feed cam thereon, a cam thereon for laterally shifting the work holder, and a cam thereon for causing differing movements to be transmitted to the cam wheel and for varying the amplitude of vibration of the needle.

10. A buttonhole sewing machine, having, in combination, stitch forming mechanism, a work holder, a feed cam wheel, a clutch for driving the cam wheel, mechanism for engaging and disengaging the clutch by relative axial movement of its members during each stitch forming cycle, and mean operated by the cam wheel for varying the action of the clutch mechanism.

11. A buttonhole sewing machine having, in combination, stitch forming mechanism, a work holder, a cam disc provided with a series of cams having different throws, any one of which may be connected to the work holder, a master feed wheel connected to oscillate the cam disc, and mechanism for giving the master wheel a single revolution during the sewing of each buttonhole.

12. A buttonhole sewing machine having, in combination, stitch forming mechanism, a work holder, a cam disc provided with a series of cams having different throws, any one of which may be connected to the work holder, a master cam having a constant throw connected to oscillate the cam disc, and mechanism for giving the master cam a single revolution during the sewing of each buttonhole.

13. A buttonhole sewing machine, having, in combination, stitch forming mechanism, a work holder, a series of feed cams having varying throws, a master feed cam having a uniform throw, and means for connecting any of the series of cams with the master cam and with the work holder, and means for turning the master cam through a single cycle during the sewing of each buttonhole.

14. A buttonhole sewing machine, having, in combination, stitch forming mechanism, a work holder, a cam disc provided with a series of cams having different throws, any one of which may be connected with the work holder, a cam wheel connected to oscillate the cam disc, mechanism for giving the cam wheel a single revolution during the sewing of each buttonhole, and means for adjustably regulating the movement imparted to the cam wheel during each stitch forming cycle.

15. A buttonhole sewing machine, having, in combination, stitch forming mechanism including a laterally vibrating needle, a work holder, a series of cams having different throws, any one of which may be connected with the work holder, a cam wheel connected to operate the cam, means operated from the cam wheel for varying the amplitude of the vibrations of the needle, mechanism for turning the cam wheel through a single revolution during the sewing of a buttonhole, and means operated from the cam wheel for varying the speed of the cam wheel.

16. A buttonhole sewing machine having, in combination, stitch forming mechanism including a laterally vibrating needle, a work holder, a series of cams having different throws, any one of which may be connected with the work holder, a cam wheel connected to operate the cams, means operative from the cam wheel for varying the amplitude of the vibrations of the needle, and mechanism for turning the cam wheel through a single revolution during the sewing of a buttonhole.

17. A buttonhole sewing machine having, in combination, stitch forming mechanism, feed mechanism for relatively moving the stitch forming mechanism and work, a clutch for operating the feed mechanism comprising concentric clutch members, and mechanism for moving one of the clutch members axially into and out of engagement with the other clutch member during each stitch forming cycle.

18. A buttonhole sewing machine having, in combination, stitch forming mechanism, feed mechanism for relatively moving the stitch forming mechanism and work, a clutch for operating the feed mechanism comprising two concentric clutch members one of which is connected to operate the feed mechanism, mechanism for actuating the

other clutch member, and mechanism for engaging and disengaging the clutch members by relative axial movement during each stitch forming cycle to intermittently operate the feed mechanism.

19. A buttonhole sewing machine having, in combination, stitch forming mechanism, feed mechanism for relatively moving the stitch forming mechanism and work, a shaft connected to make one revolution for each stitch forming cycle, two concentric clutch members one of which is connected to operate the feed mechanism, and an eccentric on the shaft connected to axially reciprocate one of the clutch members.

20. A buttonhole sewing machine having, in combination, stitch forming mechanism including a laterally vibrating needle, work holder, mechanism for relatively feeding and laterally shifting the stitch forming mechanism and work holder to sew edge and barring stitches, actuating means therefor adjustable to vary the speed of the feed mechanism for buttonholes of different lengths, means operated by the feed mechanism for varying the amplitude of vibration of the needle and for controlling the actuating mechanism to secure a uniform movement of the feed mechanism during the barring of all lengths of buttonholes.

21. A buttonhole sewing machine having, in combination, stitch forming mechanism including a laterally vibrating needle, a work holder, a cam wheel, a feed cam thereon, and cams moving with the feed cam for laterally shifting the work holder, for causing differing movements to be transmitted to the cam wheel and for varying the amplitude of vibration of the needle.

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