No. 776,328. PATENTED NOV. 29, 1904.

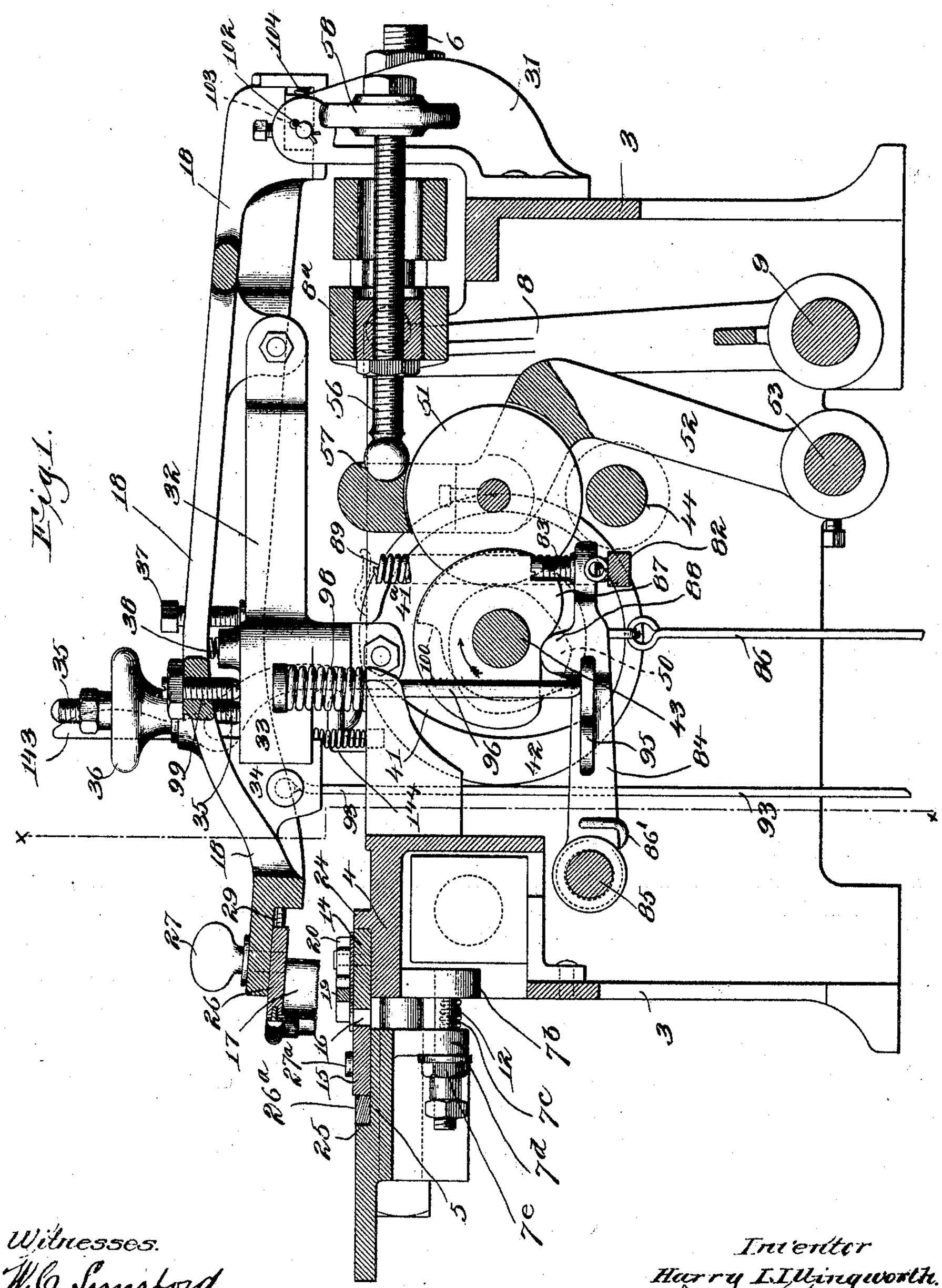
H. I. ILLINGWORTH.

FOLDING MACHINE.

APPLICATION FILED APR. 14, 1902.

NO MODEL. 5 SHEETS—SHEET 1.

Fig. 1.



Witnesses.
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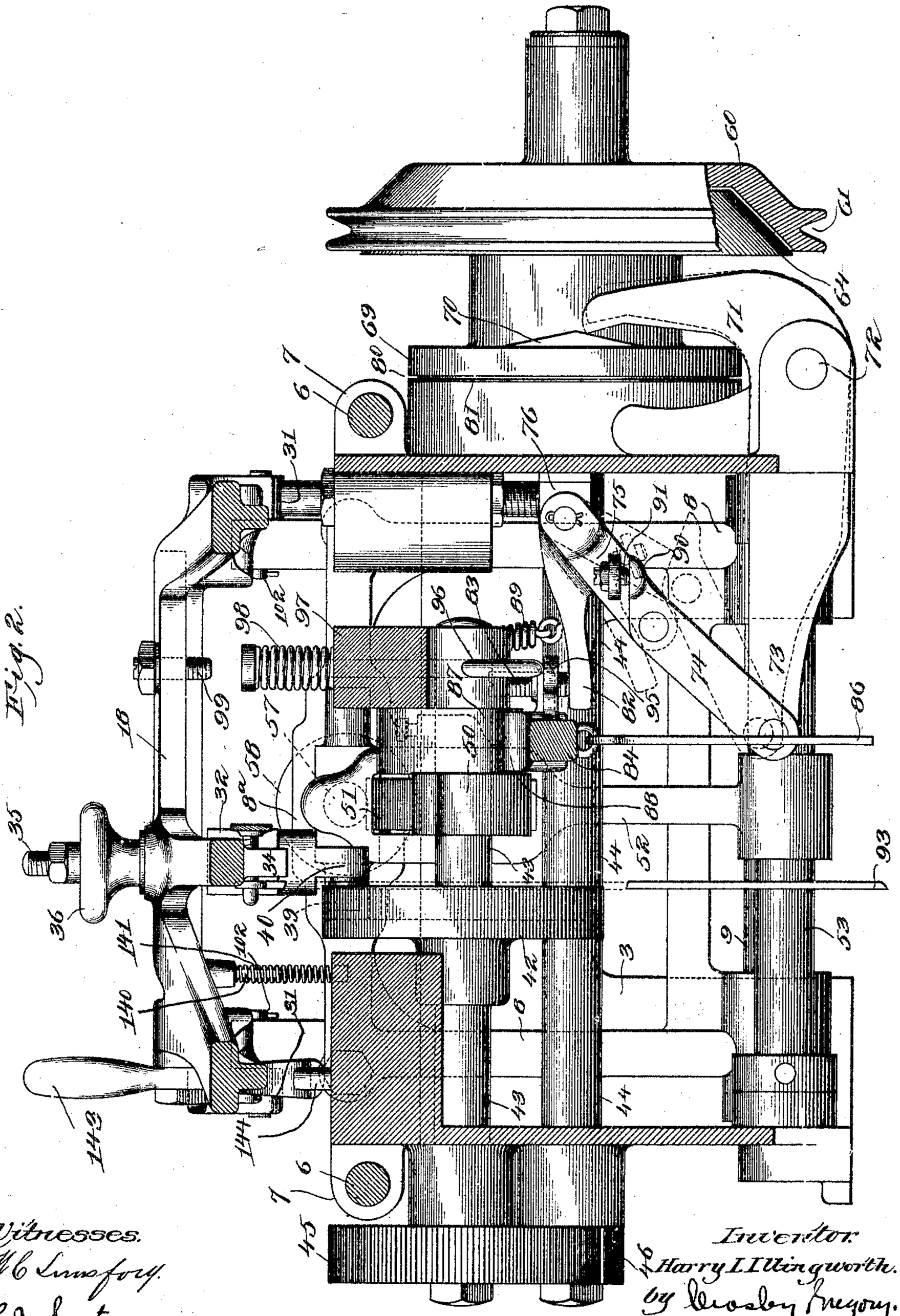
NO MODEL. 5 SHEETS—SHEET 2.

Fig. 2.



Witnesses.
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NO MODEL. 5 SHEETS—SHEET 3.

Fig. 3.

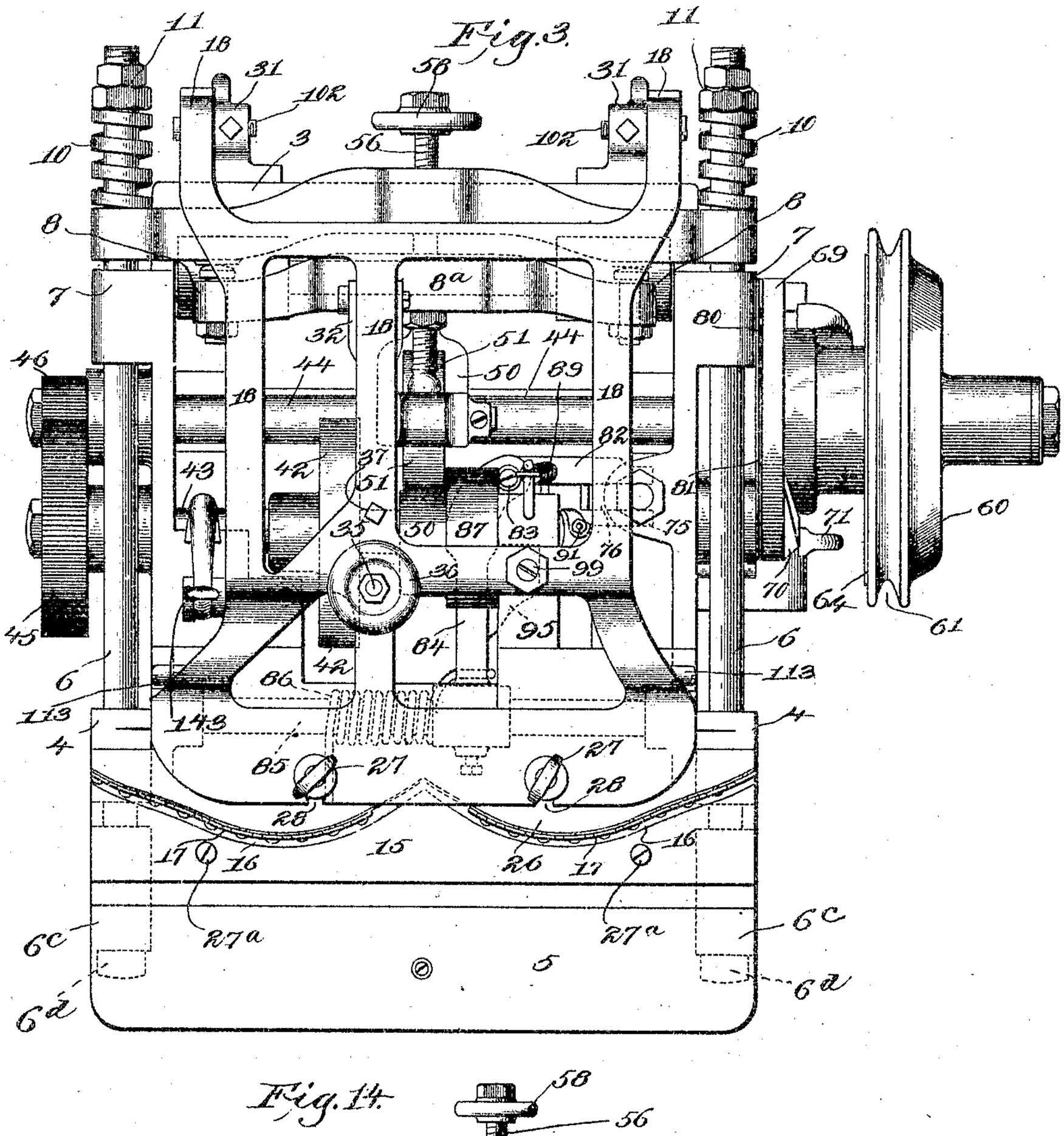
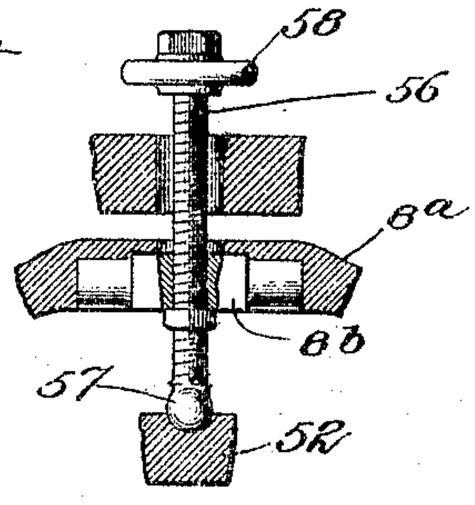


Fig. 14.



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NO MODEL. 5 SHEETS—SHEET 4.

Fig. 4.

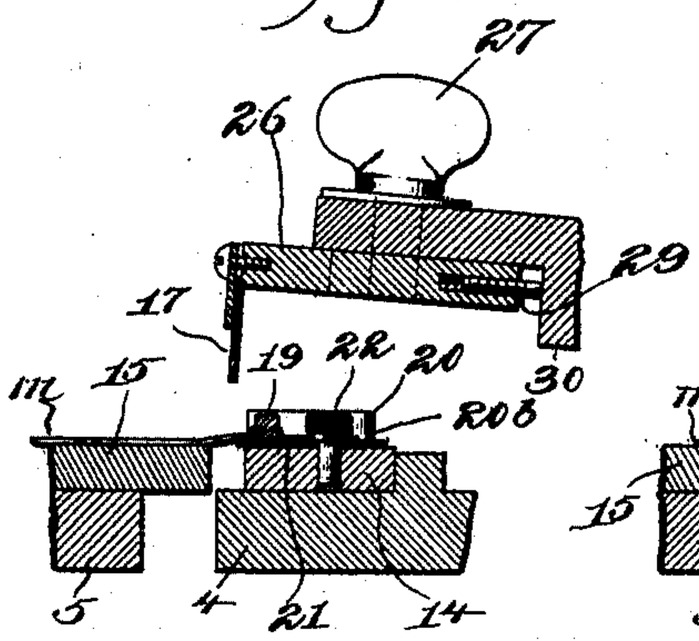


Fig. 5.

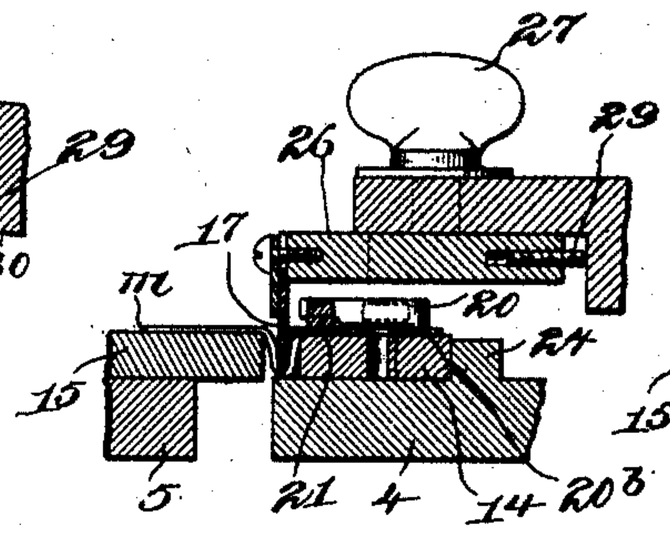


Fig. 6.

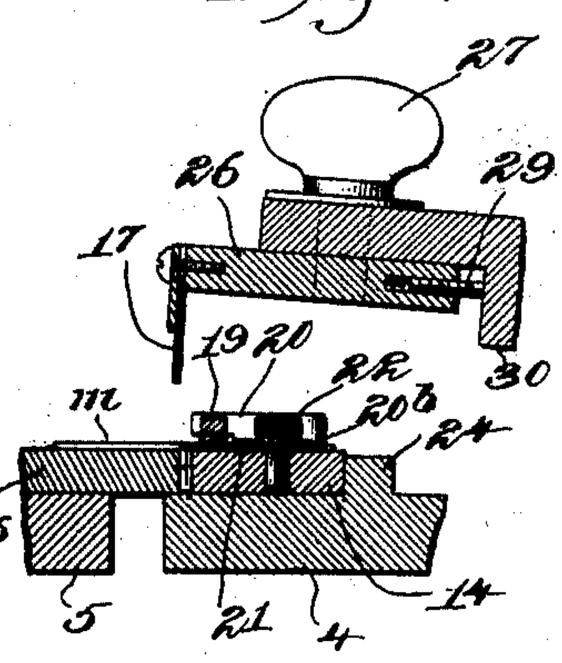


Fig. 7.

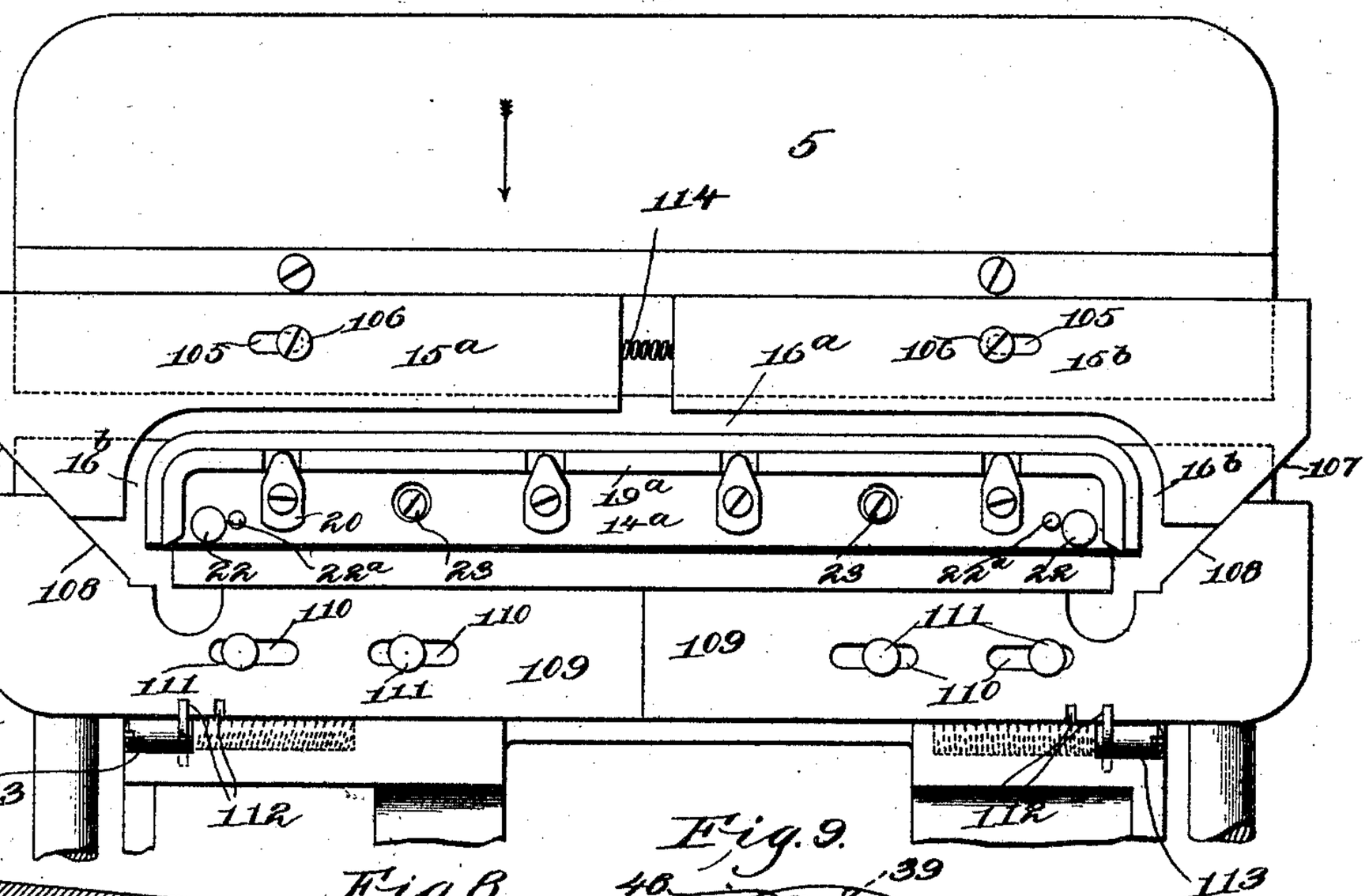
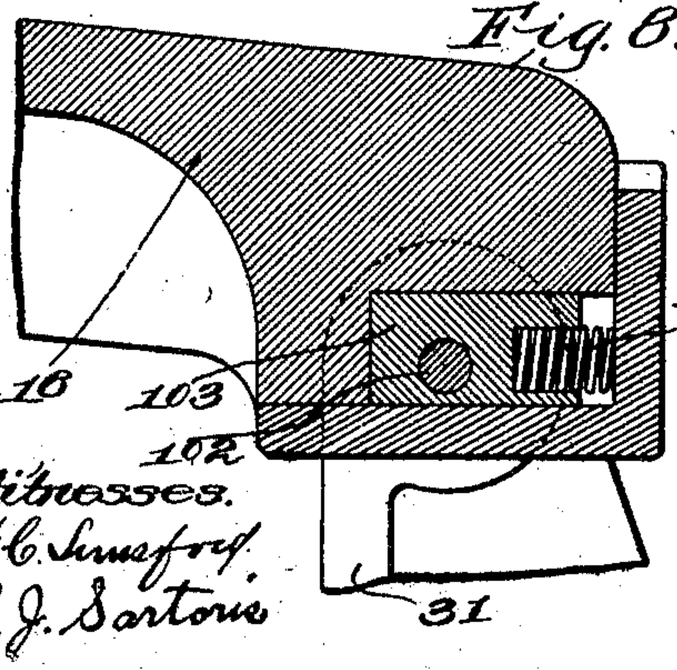
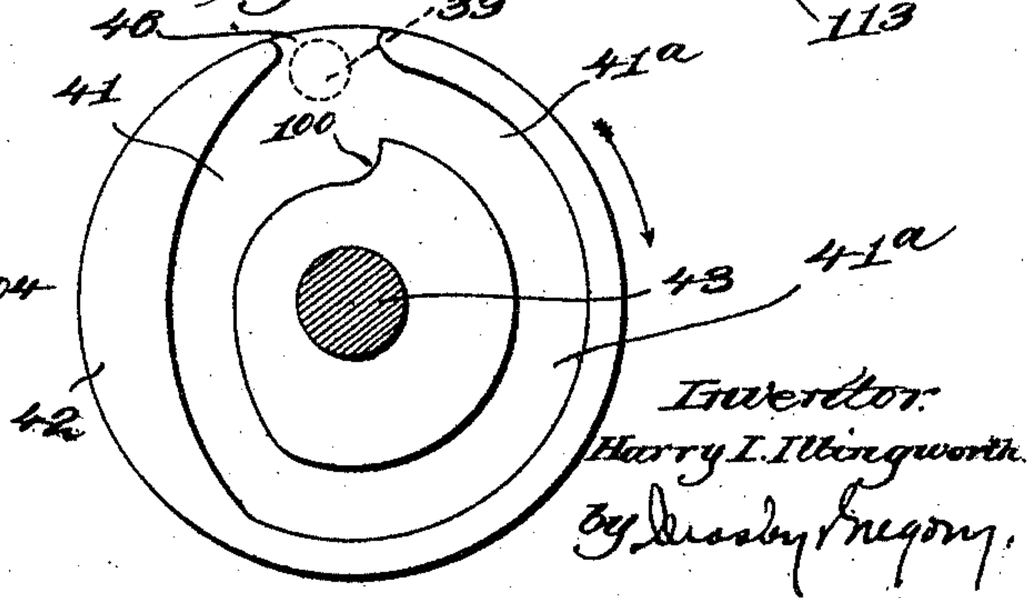


Fig. 9.

Fig. 8.





Witnesses.
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H. I. ILLINGWORTH.

FOLDING MACHINE.

APPLICATION FILED APR. 14, 1902.

NO MODEL. 5 SHEETS—SHEET 5.

Fig. 10.

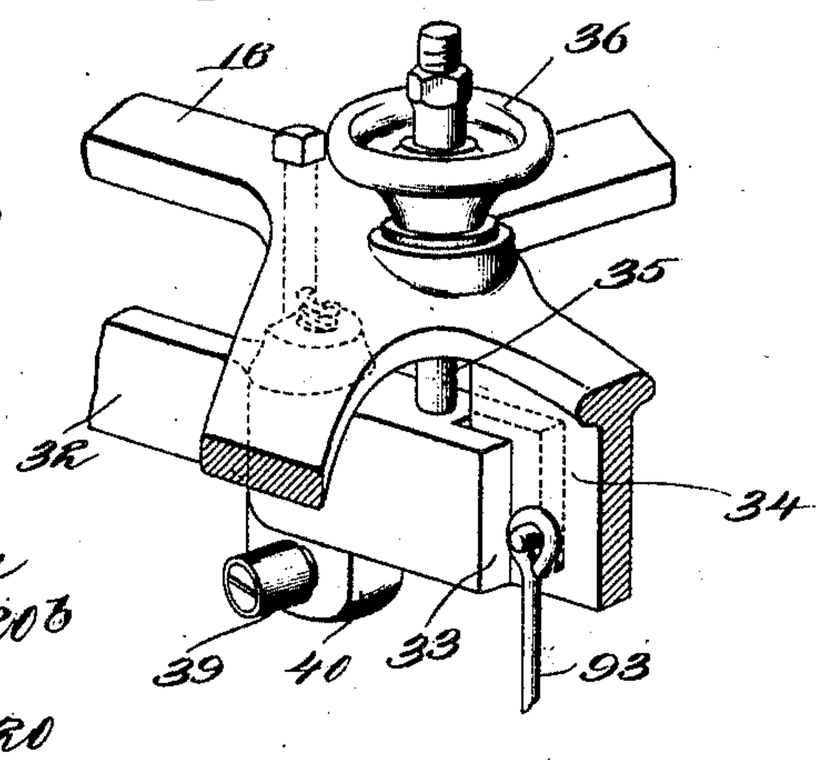


Fig. 12.

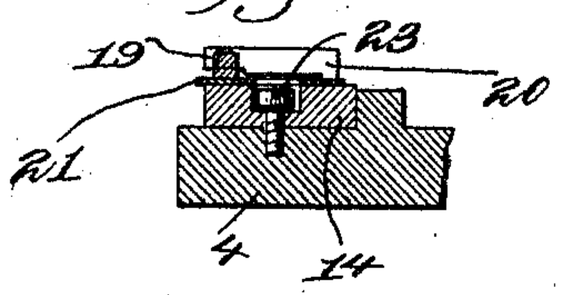


Fig. 13.

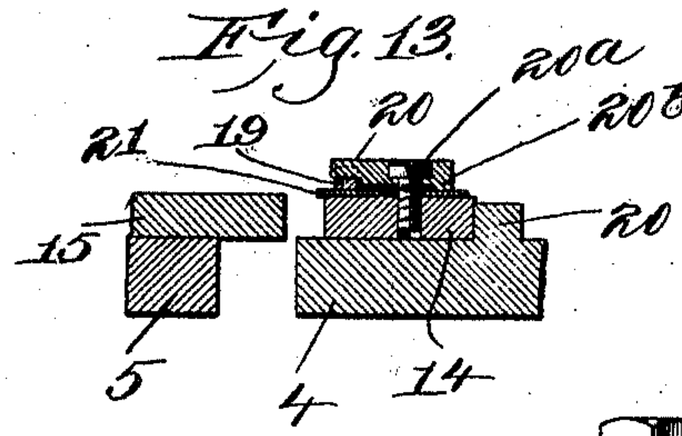
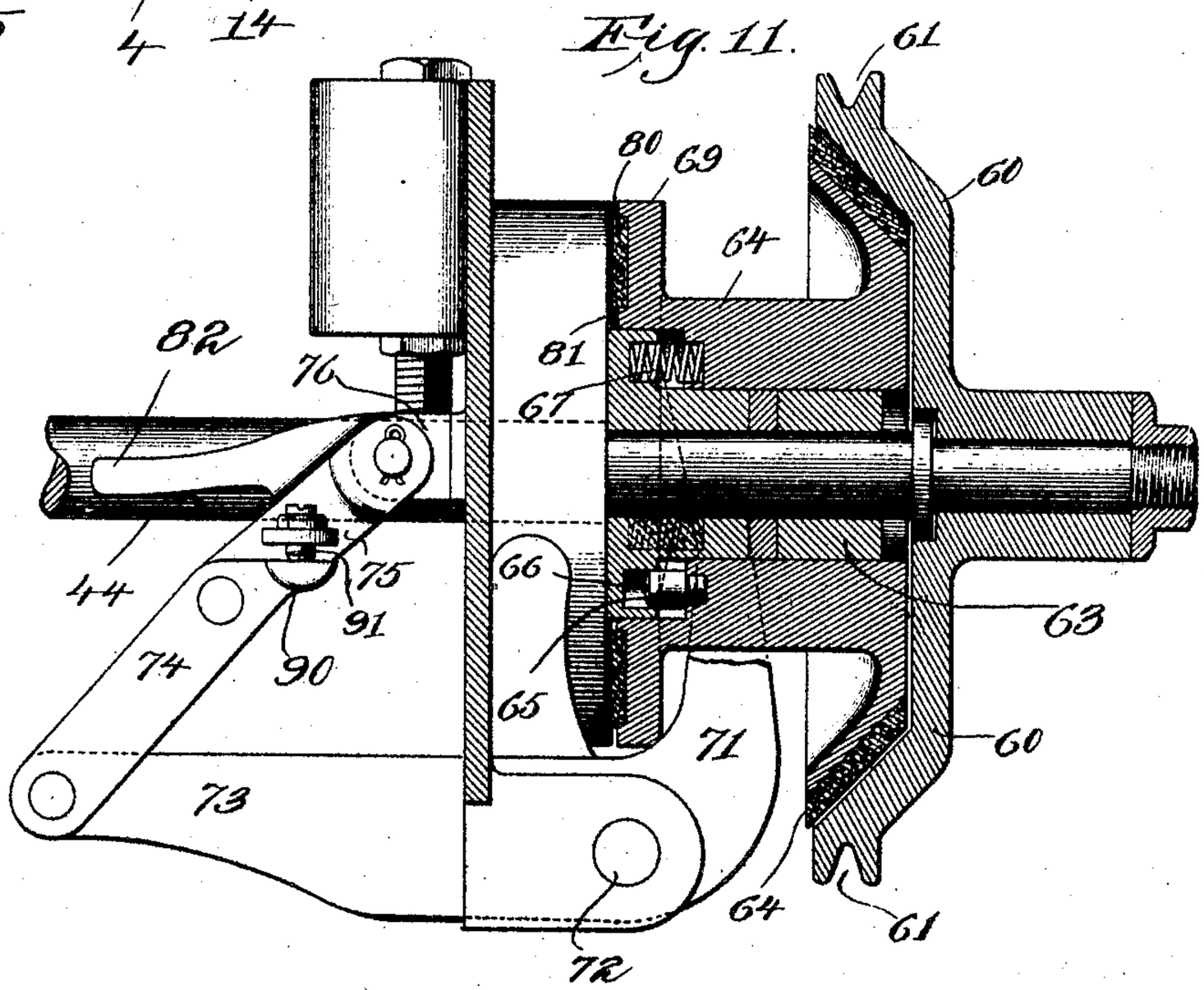


Fig. 11.



Witnesses.
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No. 776,328. Patented November 29, 1904.

UNITED STATES PATENT OFFICE.

HARRY I. ILLINGWORTH, OF SWAMPSCOTT, MASSACHUSETTS, ASSIGNOR TO CHARLES E. RILEY, OF NEWTON, MASSACHUSETTS.

FOLDING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 776,328, dated November 29, 1904.

Application filed April 14, 1902. Serial No. 102,710. (No model.)

To all whom it may concern:

Be it known that I, HARRY I. ILLINGWORTH, a citizen of the United States, residing at Swampscott, in the county of Essex and State of Massachusetts, have invented an Improvement in Folding-Machines, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

This invention has for its object the production of a novel folding-machine for folding pieces of leather or any other material, and relates to that class of folding-machines comprising in their construction a folding-groove formed by two jaws or presser members which are movable toward and from each other and a folding-blade movable into and out of the groove and which is adapted to crowd or force the material to be folded into the groove in the form of a fold. In this class of machines suitable means are provided for moving one of the presser members toward the other after the fold of material has been forced into the folding-groove by the folding-blade, the folding-blade being withdrawn from the folding-groove as the presser members or "pressers," as I shall hereinafter call them, approach each other, the movement of the pressers toward each other serving to compress and set the folds. It frequently happens in the use of this class of folding-machines that the fold of the material will adhere to the folding-blade as the same is withdrawn from the groove, and the material will consequently be entirely or partially withdrawn from the groove, so that the result of the operations is an imperfect fold; and it is one of the objects of my invention to improve this class of machinery by providing means for positively maintaining the fold of the material in the folding-groove during the time that the blade is withdrawn from the groove, thereby insuring the making of a perfect fold.

It is another object of my invention to provide a folding-machine of such a construction that a great variety of shapes may be folded thereon, this being accomplished by providing means for detachably securing the pressers and folding-blade to the machine, whereby any particular shape of die and the corresponding shape of folding-blade may be readily removed from the machine and a pair of pressers and a folding-blade of a different shape be substituted therefor.

It is also another object of my invention to improve the general structure of this class of folding-machines, as will be hereinafter more fully set forth, and pointed out in the claims.

Figure 1 is a vertical central section of my improved folding-machine. Fig. 2 is a section on the line $x\,x$, Fig. 1. Fig. 3 is a top plan view. Figs. 4, 5, and 6 are detail views showing the manner of making the fold. Fig. 7 is a partial plan view showing the modified form of presser member or presser. Fig. 8 is a detail of the hinge for the folding-blade carrier. Fig. 9 is a detail of the cam used for operating the folding-blade. Fig. 10 is a detail of the means for adjusting the extent of movement of the folding-blade. Fig. 11 is a vertical central section of the clutch I preferably employ. Fig. 12 is a detail hereinafter described; and Fig. 13 is a section through the fixed presser, showing the manner of clamping the gage and shedder-plate thereto. Fig. 14 is a horizontal section through the cross-bar 8^a of the swinging frame 8, showing the rocking nut 8^b.

The framework of the machine is designated by 3, and it may be of any suitable shape or size adapted to support the operative parts of the device. My machine has a bed-plate on which the pressers which form between them the folding-groove are supported, and the bed-plate is illustrated in this embodiment of my invention as including the fixed portion 4 and the movable portion 5, the said movable portion having secured thereto the rods 6, which pass through suitable guides 7 on the frame of the machine and which are connected at their rear ends to the rocking frame 8, mounted to rock about the pivot or shaft 9 on the frame.

Suitable mechanism to be hereinafter described is employed for rocking the frame 8 toward the right, Fig. 1, and thereby through

the rods 6 drawing the movable member 5 of the bed-plate toward the fixed member. The said bed-plate members are normally maintained in their separated position by means of suitable springs 12, suitably supported between the bed-plate members.

While my invention is adapted to fold flexible material of any character, it is designed primarily for the folding of differently-shaped pieces of leather for use in making shoes, and in Figs. 1 and 3 I have shown pressers and folding-blade of a shape to fold the edges of shoe-uppers. The pressers which form between them the folding-groove are designated 14 and 15, respectively, the presser 14 being detachably supported upon the bed-plate member 4 and the presser 15 being similarly supported on the bed-plate member 5. The two pressers have only a movement toward and from each other, and consequently in every position of said members there is a space 16 existing between them which forms the folding-groove above referred to, and the relative movement of the pressers merely serves to vary the width of the groove.

The folding-blade (designated by 17) is detachably secured to a suitable carrier 18, which will be more fully hereinafter described, and suitable means are provided for moving the folding-blade into and out of the folding-groove 16, as usual in this class of machines.

One of the features of my present invention is to provide means for positively retaining the fold of the material in the folding-groove while the blade is being withdrawn therefrom, thus preventing the material from being lifted from the groove by the withdrawal of the folding-blade and before the fold can be set, an occurrence which not infrequently happens in the use of existing folding-machines of this class.

The presser member or presser 14 has the usual gage 19 secured thereto, and in this embodiment of my invention said gage is illustrated as being held in place by means of clamps or buttons 20, which are secured to the presser by means of clamping-screws 20^a.

Projecting from the presser member 14 and extending partially over the folding-groove is a projection which is adapted to engage the edge of the material folded and retain the fold in the groove, while the blade is withdrawn, and in this embodiment of my invention the said projection is formed by means of a shedder or stripper plate 21, which is shown as being clamped to the presser member 14, between the same and the gage 19, and the edge of which is of a shape to conform to the folding-groove and projects slightly over the groove, as seen in Figs. 1, 5, and 6.

Upon referring to Figs. 12 and 13 it will be seen that one end of the clamps or buttons 20 rest in recessed portions in the gage 19, while the other ends thereof are provided with heel portions 20^b, which engage the shedder. Screws 20^a, which pass through the clamps and shedder and into the presser, therefore operate not only to adjustably clamp the gage in place, but also to firmly hold the shedder in its adjusted position.

The operation of forming a fold will be apparent from Figs. 4, 5, and 6. At the beginning of the folding operation the blade 17 is in the position shown in Fig. 4, and the material *m* to be folded will be placed upon the movable bed-plate and presser member 15 and against the gage 19. Thereafter the blade 17 is depressed by mechanism hereinafter to be described, and the material *m* is forced into the folding-groove, as seen in Fig. 5, the edge of the material which abutted against the gage springing under the projecting lip of the shedder 21, as seen in Fig. 5. It will be observed that the sheet of material to be folded lies across the folding-groove and that the folding is done by a movement of the folding-blade at right angles to the plane of the material to be folded. The result is that the folding edge of the folding-blade strikes the material squarely and forces it into the folding-groove in a direction at right angles to the plane of the sheet of material. This step distinguishes the operation of my machine from those machines wherein the folding is done by the wiping action of a wiper or folding-jaw around the folding-blade. The next step in the folding process is the withdrawal of the folding-blade and the simultaneous reduction of width of the folding-groove and the pressing of the fold to set the same between the presser members, as shown in Fig. 6.

From the above it will be seen that by the use of the shedder 21 the fold of material is prevented from being withdrawn from the groove by its adhesion to the folding-blade and the forming of a perfect fold is insured.

In folding material of different thicknesses it is desirable to vary the amount that the lip of the shedder projects over the groove, and to provide for this I have provided said shedder and the presser member 14 with two sets of apertures, the apertures of one set in the shedder being situated slightly out of the line in a direction longitudinally of the machine of the apertures of the corresponding set in the presser member. Shedder-positioning pins 22 are placed in the apertures of either set and serve to hold the shedder properly positioned, the amount that the shedder projects over the groove the pins are in being determined by the set of holes in which the pins are placed.

In Figs. 4 and 6 I have shown the pins 22 passing through one set of holes in the shedder, and in Fig. 5 I have shown a section through one of the holes of the other set.

From Fig. 5 it will be seen that if the pins 22 were inserted in the apertures therein

shown the shedder will be projected farther over the folding-groove than shown in said figure.

In Fig. 7 I have illustrated the pins 22 in one pair or set of holes and have designated the other set of holes by 22^a. From said figure it will be seen that the apertures 22^a in the presser are offset slightly from those in the shedder, so that if the pins 22 were transferred to the apertures 22^a the shedder-plate would be projected farther over the folding-groove than now illustrated.

My improved folding-machine is constructed so as to be capable of folding a great variety of shapes, this being accomplished by providing each folding-machine with a set of differently-shaped pressers and correspondingly-shaped folding-blades. The pressers are detachably secured to the portions of the bed-plate by means of screws 23, and to accurately position each presser the bed-plates are provided with the positioning-shoulders 24 and 25, against which the pressers rest. The shoulder 25 is preferably of such a depth as to bring the top of the movable portion 5 of the bed-plate on substantially a level with the top of the presser 15, so as to form a level surface to support the material being folded. (See Fig. 1.)

I may, if desired, employ a suitable filling or spacing member 26^a between the movable presser 15 and the shoulder 25. By reason of the construction of pressers above described when it is desired to change a pair of pressers having one form for a pair having another it is simply necessary to remove the retaining-screws 23, when both members of the pair may be removed bodily from the bed-plate, together with the gage and stripper or shedder, and a new pair substituted.

The means for securing the presser 14 to the bed-plate is entirely independent from the means for securing the gage and the shedder to the presser, and consequently the removal of the presser does not affect in any way the adjustment of the gage or shedder, for the said presser-gage and shedder form practically a single structure, which may be removed from the machine or replaced thereon without disturbing in any way the relative position of these parts. After the gage and shedder have once been properly adjusted on any one presser therefore the removal of the presser from the machine or the replacing of it may be accomplished without affecting the proper adjustment of the parts, and by use of the positioning-shoulders 24 and 25 the absolutely correct positioning of the pressers when they are being replaced is insured without any experiment. The work of changing the pressers is therefore reduced to a minimum, it only being necessary to take out the screws 23, substitute for the pressers being used a new pair, and replace the screws 23, no further or supplemental adjustment of the parts being necessary. The folding-blade 17 is also detachably supported by its carrier 18, said blade being shown as secured to a suitable head 26, into which are screwed the retaining-screws 27, the shanks of the screws setting in suitable notches 28 in the carrier 18.

The position of the blade 17 is adjusted by means of adjusting-screws 29, which are screwed into the head 26 and rest against a shoulder 30 on the carrier, and after the said adjusting-screws are properly adjusted for any one blade it is simply necessary in making a change to loosen the screws 27, pull the head 26 to the left, Figs. 1 and 4, to withdraw the screws 27 from the notches 28, when a differently-shaped blade may be inserted in place, and after the adjusting-screws 29 for any one blade are once properly positioned no special adjustment is necessary when any change of blades is made.

By my improved method of connecting the pressers and the blade to their supporting portions a change of the pressers and blade of one form to those of another form is but a minute's work.

The mechanism for moving the folding-blade 17 into and out from the folding-groove will now be described.

As stated above, the folding-blade is supported by a carrier 18, shown as an arm or frame, pivoted to suitable brackets 31 at the rear of the frame, so that the said carrier may be turned back out of the way when desired. Pivoted to the carrier is an arm 32, shown as having a forked end 33, which receives and is guided by a web or guiding-flange 34 on the carrier. The end of the arm 32 has projecting upwardly therefrom a screw-threaded pin 35, which passes through the frame 18 and has at its upper end an adjusting-nut 36. A set-screw 37, passing through the carrier 18 and engaging the top of the arm 32, is also preferably employed, said set-screw 37 and adjusting-bolt 35 providing means for adjusting the relative position of the arm 32 with reference to the carrier 18. I may, if desired, employ a suitable spring 38 between the arm and carrier in addition to the adjusting means above described. The arm 32 carries a suitable roll 39, shown as supported upon a depending lug or projection 40, which roll is adapted to engage a cam-groove 41 in a cam 42, mounted upon the cam-shaft 43. The cam-shaft 43, which is supported in suitable bearings in the frame 3, is driven from the main shaft 44, likewise carried by the frame, the said shafts being connected by gears 45 and 46, said gears being so proportioned that the main shaft will make a plurality of revolutions, preferably three, to each single revolution of the cam-shaft.

In Fig. 9 the relative position of the roll 39 with reference to the cam-groove is illustrated by dotted lines, and from said figure it will be seen that if the mechanism is set in

operation and the cam rotated in the direction of the arrow for the first quarter-revolution of the cam the roll will be forced toward the center of the cam and the folding-blade will be depressed into the folding-groove, and during the second quarter-revolution the blade will be gradually raised out of the groove and will be held in the raised position during the time that the roll is traveling in the concentric portion 41[a].

During the time that the blade is moved into the groove, as illustrated in Fig. 5, the folding-groove is at its maximum width, but as the blade is retracted from the groove the movable bed-plate member 5 and the movable die member 15 are carried to the right, Figs. 1 and 6, to set the fold.

Since the roll 39 is carried by the arm 32 and since by means of the adjustable connection between the arm 32 and the carrier 18 the relation between the said arm and carrier may be adjusted, it will be obvious that the distance the blade 17 is carried into the groove by the fixed and definite vertical movement of the arm 32 may be varied according to the character of the material being folded.

The mechanism for thus pressing or setting the fold will now be described.

Mounted on the cam-shaft 43 is a second cam 50, (shown in dotted lines, Fig. 1,) which bears against a roll 51, carried by a swinging arm 52, supported by a rock-shaft 53. The upper end of the arm 52 is suitably connected to the swinging frame or equalizer 8, above referred to, so that as the shaft 50 rotates in the direction of the arrow, Fig. 1, the swinging arm 52, and consequently the equalizer-frame 8, are both carried to the right, thereby through the rods 6 moving the die member 15 toward the coöperating die member. The swinging arm 52, which, it will be seen from Fig. 2, is situated centrally of the machine, has at its upper end a socket 57, in which is received the end of the thrust member 56, which thrust member is shown as having screw-threaded engagement with a rocking nut 8[b] in the cross-bar 8[a] of the swinging frame. When now the cam 50 forces the swinging arm 52 to the right, such movement will be communicated through the thrust member to the swinging frame and from thence to the movable die member. By providing the thrust member 56 with a screw-threaded engagement with the frame 8 and providing said member with the handle 58 the distance between the arm 52 and the frame 8 may be adjusted, and consequently the minimum width of the folding-groove may be varied to suit the thickness of the material being folded.

By employing the equalizer-frame 8 and the swinging arm 52 I am enabled to employ a single centrally-situated actuating-cam and transmit the force generated by said cam equally to the two ends of the movable bed-plate member. This I consider quite important, as it provides putting an even pressure upon the fold throughout the entire length of the folding-groove.

The connection between the rods 6 and the movable portion of the bed-plate is a sliding connection, the said rods passing through and having heads 6[d] engaging lugs 6[c] on the movable member of the bed-plate.

It is sometimes desirable to control the width to which the folding-groove will open, and I have therefore constructed the fixed bed-plate member 4 with the lugs 7[b], in which are mounted adjustable set-bolts 7[c], said bolts passing through lugs 7[d], depending from the movable bed-plate member and having adjustable stop-nuts 7[e] thereon. By adjusting the nuts 7[e] the width to which the folding-groove will be opened may be adjusted.

In the operation of this class of folding-machines it is necessary that after the machine is set in operation some means be provided for automatically stopping it when one cycle of operations has been completed—that is when the folding-blade has been moved into and out from the groove and the presser members have been brought together to set the groove and afterward separated to receive the next fold.

I have found in practice that in order to successfully set the folds by this class of machine it is necessary that a large amount of pressure be brought upon the fold by means of the pressers. These machines, too, are commonly employed in shops where a round leather belting is used for driving machinery, and it is extremely convenient therefore that the power should be applied to the machine by means of such belting. If, however, the driving-pulley driven by such round belting were applied directly to the cam-shaft 43, the belt would not be capable of transmitting to the shaft sufficient power to give the requisite pressure to the fold. In order, therefore, to obtain the requisite amount of pressure and at the same time to provide for using this machine with the round belting above referred to, I have applied my power to the drive-shaft 44, which, as above described, is geared to the cam-shaft 43 by means of reducing-gearing, whereby the power delivered to the drive-shaft will be multiplied. Since, however, reducing-gearing is employed between the power-shaft and the cam-shaft, it follows that the power-shaft will make a plurality of revolutions during each revolution of the cam-shaft. Each revolution of the cam-shaft represents one cycle of operations, and when the machine is set in operation means must be provided to stop the rotation of the cam-shaft when the same has made one complete revolution, so that the shaft will always be stopped in the position shown in Fig. 1.

The reducing-gearing I have herein shown is such that the power-shaft makes three revo-

lutions to each one revolution of the cam-shaft, and I have therefore provided a suitable form of clutch mechanism which when thrown into operation will allow the main shaft 44 to be rotated three times and then will become automatically disengaged, so as to stop the cam-shaft when the same has made one revolution.

The clutch I have herein illustrated is in some respects similar to the clutch which is illustrated and claimed in my Patent No. 694,550, granted March 4, 1902.

The main shaft 44 has loose thereon the continuously-rotated clutch member 60, provided with a friction-surface and with a groove 61 for the reception of the driving-band. Fast to the shaft 44 is a sleeve 63, (see Fig. 11,) on which is supported a coöperating clutch member 64, said clutch member being locked to the sleeve by means of a pin 65, which sets into a recess 66 in the said sleeve.

Suitable springs 67 are employed to normally throw the clutch members into engagement. The clutch member 64 is provided with a suitable flange 69, having on one face thereof the cam projection 70, which is adapted to coöperate with a clutch-disengaging lever 71, suitably pivoted, as at 72, to the frame. The end 73 of said lever is controlled by a knuckle or toggle joint comprising the members 74 and 75, the member 75 being pivoted to an adjustable block 76, as in my patent above referred to.

When it is desired to start the machine in operation, the toggle-joint will be buckled, as shown in dotted lines, Fig. 2, thereby carrying the arm 71 out of engagement with the projection 70, when the springs 67 will throw the clutch members into engagement and the mechanism will be operated. As soon, however, as the knuckle-joint is straightened the clutch-disengaging arm 71 will be brought into the path of the projection 70, and the engagement of the projection with the arm will cause the clutch members to be disengaged. To stop the mechanism at exactly a predetermined point, I have provided the flange 69 with a friction-brake surface 80, which is adapted to engage a coöperating fixed friction-brake surface 81, the said brake-surfaces being thrown into engagement by engagement of the cam projection 70 with the clutch-disengaging lever 71.

I have provided manually-operated means for breaking the toggle-joint, and thereby releasing the clutch-disengaging lever when it is desired to start the machine, and, as illustrated, the member 75 of the toggle-joint has integral therewith an arm 82, which is adapted to be engaged by an adjustable projection in the form of an adjusting-screw 83, carried by the end of a manually-controlled lever 84, the said lever being pivoted to a suitable shaft 85. I will preferably provide a suitable spring 86′, which surrounds the rock-shaft 85, one end of which is fixed to the frame and the other end of which engages the lever 84, said spring serving to normally hold said lever elevated. The lever 84 may be connected to any suitable operating-lever, such as a hand-lever or a foot-treadle, by means of a link 86. It will now be obvious that when the foot-treadle or hand-operated lever is operated to draw the link 86 downward the downward movement of the lever 84 through the arm 82 will break the toggle-joint, and thereby allow the clutch members to be thrown into engagement. To hold the clutch-disengaging lever in its inactive position while the clutch makes a plurality of revolutions, I have provided a clutch-controlling cam 87, which is carried by the cam-shaft 43 and which engages a suitable projection 88 on the manually-controlled lever 84.

The cam 87 is of such contour, as will be seen from Fig. 1, that it holds the lever 84 depressed, and consequently the toggle-joint is maintained broken during the time that the cam-shaft makes substantially one revolution; but just before the revolution is completed the projection 88 passes off the rise of the cam, and the spring 86′ raises the lever 84 and allows the toggle-joint to become straightened under the influence of a suitable spring 89, which is connected at one end to the frame or other fixed support and at the other end to the arm 82. This straightening of the toggle-joint brings the clutch-engaging lever into the path of the cam projection 70 and causes the mechanism to stop.

I will preferably provide one of the members of the toggle-joint with a shoulder and the other with a stop to coöperate therewith to limit the movement of the members when they are being straightened, the shoulder and stop being of such a construction as to allow the levers to pass just beyond the dead-center point in order that they may become locked. The shoulder is designated by 90 and is carried by the member 74, while the stop is illustrated in the form of an adjusting-screw 91, carried by the member 75.

When an unskilled person is operating the machine, it sometimes happens that in holding the piece of material to be folded over the folding-groove the fingers of the operator will be in position to be injured by the movement of the blade into the groove. I have accordingly improved this class of machinery by providing means whereby the blade may be given its initial movement manually, such initial movement carrying the blade into contact with the work and being entirely under the control of the operator. If, therefore, the operator's fingers should be in the way of the blade during such manual movement thereof, the movement may be stopped before any injury is done, whereas if the entire movement of the blade were controlled by the cam it would be impossible to stop the machine until the complete cycle of operations had

been performed. I have also provided means whereby after the blade has been brought into contact with the work further manual operation thereof will serve to throw the clutch into operation when the further movements of the machine are controlled by the gear mechanism.

The carrier 18 has secured thereto a suitable link 93, which may be operated by a foot-treadle or a hand-lever in any suitable way in order to give the carrier its first or initial manual movement.

The manually-operated lever 84 has a suitable rib or shoulder 95 projecting therefrom, on which rests an actuating-pin 96, said pin extending through a suitable guide 97 on the frame and being yieldingly sustained in the position shown in Fig. 2 by means of the spring 98.

The carrier 18 has extending therethrough an adjustable projection 99, which when the carrier is depressed through the link 93 is brought into engagement with the actuating-pin 96, when further movement of the carrier through the link 93 serves to depress said pin and through the rib or shelf 95 depress the lever 84, and thus throw the clutch into engagement.

The projection 99 will normally be so adjusted that it will not be brought into engagement with the actuating-pin 96 until the blade 17 contacts with the work, so that when the treadle controlling the link 93 is operated the power mechanism will not be started until after the blade is brought into contact with the work and until after all danger of the blade injuring the fingers of the operator is passed.

Referring again to Fig. 9 it will be noticed that the cam 42 is provided with the cut-away portion 100, which admits of the downward movement of the roll 39 during the manual manipulation of the carrier 18. I will preferably provide the cam 42 with the open throat 48, through which the roll 39 may pass when the carrier is thrown back.

It sometimes happens that the material being folded will vary in thickness at different portions thereof; but by providing a yielding connection between the frame 8 and each of the rods 6 such unevenness may be compensated for, and the final pressure which will be given to the fold will be substantially the same at all portions thereof, and any crushing of the thicker portion of the material is avoided. Such yielding connection is provided for in this embodiment of my invention by the springs 10, which surround the rods 6 and are confined between the frame 8 and nuts 11 on the ends of said rods. The tension of these springs will preferably be so adjusted that they will yield just before the pressure to which they are subjected is sufficient to crush or injure the material being folded. When, therefore, a piece thicker than usual is being folded, the springs will prevent the piece being injured, as would be the case if the rods were unyieldingly connected to the swinging frame 8. Moreover, these springs permit of folding a piece of material which varies in thickness from one end of the fold to the other without injuring the thickest portion of the material. I have also illustrated my carrier 18 as having a yielding pivotal connection with the brackets 31, so that the front or blade end of the carrier may yield slightly in a transverse direction to accommodate differences in the width of any piece of material being folded.

As illustrated in Fig. 8, the brackets 31 have pivots 102, which enter suitable boxes 103 in the carrier 18, said boxes being yieldingly held in position by means of springs 104. These springs while normally holding the boxes in the position shown in Fig. 8 will yield to accommodate the differences in thickness of the material.

As stated above, my device is adapted to fold a great variety of shapes, and the pressers and blades are therefore made so as to be readily detached without in any way varying their adjustment.

In Fig. 7 I have illustrated one particular form of presser which has special advantages, although it will be understood that various other shaped pressers than those illustrated herein may be employed. The pressers shown in Fig. 7 form between them a folding-groove having a straight transverse portion 16^a and the side portions 16^b at right angles thereto. With this form of folding-groove it will be seen that if the movable presser member moves toward the fixed presser member in a direction parallel to the portion 16^b of the groove the width of the transverse portion of the folding-groove will be decreased, but the width of the right angle portion or longitudinally-extended portions 16^b will not be affected unless at the same time or subsequently the movable member be given a transverse movement. This particular form of the invention is especially applicable to folding edges of a shoe-upper.

In my improved machine I have provided means for giving the movable presser member where the folding-groove is of the form shown in Fig. 7 both a transverse and a longitudinal movement, whereby all parts of the folding-groove are simultaneously decreased in width.

In Fig. 7 the fixed presser member is designated by 14^a and the gage by 19^a, said gage being secured to the member by the buttons 20, as above described. The movable presser member in this embodiment of my invention comprises two portions 15^a and 15^b, which are supported on the movable portion 5 of the bed-plate for movement transversely thereto. For this purpose the portions of the movable presser member are shown as having slots

105 therein through which pass the retaining-screws 106. The ends of the portions 15^a and 15^b have the cam-surface 107, which is adapted to engage a corresponding cam-surface 108 on a fixed cam member 109. From this it will be seen that when the bed-plate member 5 is moved in the direction of the arrow the engagement of the cam-surface 107 and 108 will force the portions 15^a and 15^b of the movable presser member transversely to thereby decrease the width of the portion 16^b of the folding-groove to the same extent that the portion 16^a is decreased by the movement of the presser member in the direction of the arrow. A suitable spring 114 is employed to give the members 15^a 15^b an outward lateral movement when the folding-groove is opened.

I have herein shown the cam members 109 as being adjustable, they being provided with slots 110, through which guiding-screws 111 pass, and being provided with notches 112, which are engaged by a collar on an adjusting-screw 113, carried by the frame. By manipulating the adjusting-screw 113 the cam-faces 108 may be separated or drawn together, as desired.

I have illustrated the carrier 18 as being yieldingly supported by the spring 141, which is secured at its lower end to the frame and at its upper end receives a guide-pin 140 depending from the carrier. The spring normally tends to hold the carrier sufficiently elevated so that the roll 39 is above the cam 42, and to hold the roll in operative position I provide a pivoted latch 143, which is adapted to engage a keeper 144.

While I have herein illustrated one form of my invention, yet I do not desire to be limited to the precise construction shown, as various changes may be made in the details of the device without in any way departing from the spirit of the invention as expressed in the appended claims.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a folding-machine, a bed-plate comprising two presser-supporting members movable toward and from each other, a presser detachably secured to each member of the bed-plate, a gage and a shedder-plate, and means to secure said gage and shedder-plate to one of the pressers, said means being independent from the means for securing the latter presser to the bed-plate.

2. In a folding-machine, a bed-plate comprising two members movable toward and from each other, a presser for each member of the bed-plate, means to detachably secure each presser to its bed-plate member, a gage and a shedder-plate, and means to adjustably secure said gage and shedder-plate to one presser, said means being independent from the means for securing the presser to its bed-plate member.

3. In a folding-machine, a bed-plate comprising two presser-supporting members movable toward and from each other, a presser detachably supported on each bed-plate member, said pressers forming between them a folding-groove, a gage and a shedder-plate carried by one of the pressers, a carrier, and a folding-blade detachably supported thereby and movable into and out of the groove, the construction being such that the pressers and the blade may be bodily removed and another blade and pressers of a different shape substituted therefor.

4. In a folding-machine, a bed-plate comprising two members movable toward and from each other, a presser detachably supported on each bed-plate member, said pressers forming between them a folding-groove, a gage, and a shedder-plate, means to adjustably secure said gage and shedder-plate to one of the pressers, said means being independent from the means for securing the presser to the bed-plate member, in combination with a carrier, and a folding-blade detachably mounted thereon and adapted to move into and out of the folding-groove.

5. In a folding-machine, a pair of pressers forming between them a folding-groove, a folding-blade, manual means to give the blade its initial movement toward the folding-groove, means to carry the blade into and out of the groove to make a fold of material, means to move one presser toward and from the other, a clutch for operating said mechanism, and means whereby the initial movement of the blade throws said clutch into operation.

6. In a folding-machine, a pair of pressers forming between them a folding-groove, a folding-blade, manual means to give the blade its initial movement toward the groove, means to carry the blade into and out of the groove to make a fold of material, means to move one presser toward and from the other, a clutch for operating said mechanism, means whereby the initial movement of the blade throws said clutch into operation, and means to throw the clutch out of operation when one cycle of operations has been performed.

7. In a folding-machine, pressers forming between them a folding-groove, a folding-blade, manually-operated devices for giving to the blade its initial movement toward the groove, and power mechanism rendered operative by the manual movement of the blade to carry the blade into the groove, to make a fold in the material and withdraw the blade from the groove.

8. In a folding-machine, pressers forming between them a folding-groove, a folding-blade, manually-operated devices for moving the blade toward the groove, cam mechanism for carrying the blade into and out of the

groove, and means operated by the manual movement of the blade to render said cam mechanism operative.

9. In a folding-machine, pressers forming between them a folding-groove, a folding-blade, manually-operated devices for giving the blade its initial movement toward the groove, power mechanism to carry the blade into and out of the groove, a clutch for operating said mechanism, and means operated by the manual movement of the blade to render the clutch operative, said movement of the blade into the groove operating to form a fold in the material.

10. In a folding-machine, pressers forming between them a folding-groove, a folding-blade, manually-operated devices for giving the blade its initial movement toward the groove, power mechanism rendered operative by the manual movement of the blade to carry the blade into and out of the groove, and means to stop the action of the power mechanism when one cycle of operations has been performed.

11. In a folding-machine, pressers forming between them a folding-groove, a folding-blade, manually-operated devices for moving the blade toward the groove, cam mechanism for carrying the blade into and out of the groove, means operated by the manual movement of the blade to render said cam mechanism operative, and means to stop the action of the cam mechanism when one cycle of operations has been performed.

12. In a folding-machine, pressers forming between them a folding-groove, a folding-blade, manually-operated devices for giving the blade its initial movement toward the groove, power mechanism to carry the blade into and out from the groove, a clutch for operating said mechanism, means operated by the manual movement of the blade to render the clutch operative, and means to stop the action of the clutch when one cycle of operations has been performed.

13. In a folding-machine, pressers forming between them a folding-groove, a folding-blade, means to yieldingly hold said blade above the groove, manually-operated means to give to the blade its initial movement toward the groove and bring it against the material to be folded, and power mechanism rendered operative during the initial movement of the blade to carry said blade into and out of the groove to make the fold.

14. In a folding-machine, folding mechanism, a cam-shaft to operate said mechanism, said cam-shaft rotating once during each cycle of operations, a driving-shaft, reducing-gearing between said shafts, whereby the driving-shaft makes a plurality of revolutions during each rotation of the cam-shaft, and means to stop the rotation of the driving-shaft when one cycle of operations has been performed.

15. In a folding-machine, folding mechanism, a cam-shaft to operate said mechanism, said folding mechanism performing one cycle of operations during each rotation of the cam-shaft, a driving-shaft, reducing-gearing between the driving-shaft and cam-shaft, a clutch for operating said driving-shaft, and a clutch-controlling cam on the cam-shaft, said cam permitting the disengagement of the clutch when the cam-shaft has made one complete rotation.

16. In a folding-machine, folding mechanism, a cam-shaft to operate said mechanism, a driving-shaft, reducing-gearing between the driving-shaft and cam-shaft, a clutch for operating said driving-shaft, a clutch-disengaging lever operating to normally hold the clutch members disengaged, manually-controlled means to render said clutch-disengaging lever inactive, whereby the clutch is thrown into engagement, and a clutch-controlling cam on the cam-shaft, said clutch-controlling cam operating to hold said clutch-disengaging lever inactive, while the cam-shaft makes one complete revolution, and then allowing said lever to assume its operative position, whereby the clutch is disengaged.

17. In a folding-machine, a pair of pressers forming between them a folding-groove, a folding-blade, devices to move the blade into and out of the groove, devices to move the pressers toward and from each other, cams for operating said devices, a driving-shaft for operating said cams, said shaft making a plurality of revolutions for each revolution of the cams, a clutch for said driving-shaft, and a clutch-controlling cam, operating to permit the disengagement of the clutch when the cams have made one complete revolution.

18. In a folding-machine, a pair of pressers forming between them a folding-groove, means to move said pressers relative to each other to decrease the width of the groove, said means comprising a pair of slidably-mounted rods connected to one presser, a rocking frame to which said rods are connected, and means to rock the frame.

19. In a folding-machine, a pair of pressers forming between them a folding-groove, means to move one of said pressers toward the other to decrease the width of the groove, said means comprising a pair of slidably-mounted rods connected to the movable pressers, a swinging frame having a yielding connection with each rod, and means to swing the frame.

20. In a folding-machine, pressers forming between them a folding-groove, a folding-blade movable into and out of the groove, a carrier for said blade, a support for the carrier, and a yielding, pivotal connection between the carrier and support.

21. In a folding-machine, pressers forming between them a folding-groove, a folding-blade movable into and out of the groove, a

carrier for said blade, a pair of brackets to which said carrier is pivoted, and a yielding, pivotal connection between each bracket and the carrier.

22. In a folding-machine, a pair of pressers forming between them a folding-groove, means to move one of said pressers toward and from the other, said means comprising a rocking frame, connections between the latter and one of said pressers, a cam for rocking said frame, and adjustable connections between the cam and frame, whereby the minimum width of the groove may be regulated.

23. In a folding-machine, a bed-plate comprising a fixed and a movable member, a presser on each member, a rocking frame, a connection between each end of said frame and the corresponding end of the movable bed-plate member, and a centrally-situated cam to rock said frame.

24. In a folding-machine, a bed-plate comprising a fixed and a movable member, a presser carried on each member, an oscillating frame, connections between each end of said frame and the corresponding end of the movable bed-plate member, an actuator engaging the central portion of said frame and operating to oscillate the same whereby the movable bed-plate member is operated.

25. In a folding-machine, a bed-plate comprising a fixed and a movable member, a presser supported on each member, a rocking frame, and yielding connections between each end of said rocking frame and the corresponding end of the movable bed-plate member, and a centrally-situated cam to rock said member.

26. In a folding-machine, a frame, a movable bed-plate member supported thereon, a rocking equalizing member, rods slidably mounted in said frame and connecting each end of the equalizing member with the corresponding end of the movable bed-plate member, and a centrally-situated cam for rocking said member.

27. In a folding-machine, a pair of pressers forming between them a folding-groove having two portions at an angle to each other, and means to move said pressers toward and from each other in a direction to vary the width of the folding-groove equally at all parts thereof.

28. In a folding-machine, a fixed presser and a movable presser, said pressers forming between them a folding-groove having two portions at an angle to each other, and means to impart to the movable presser both a transverse and a longitudinal movement whereby the width of the folding-groove is varied uniformly throughout its length.

29. In a folding-machine, a bed-plate comprising a fixed and a movable member, a presser supported on each member, means to move the movable bed-plate member toward and from the fixed member, and means to give the movable presser a movement transversely to the direction of movement of the movable bed-plate member.

30. In a folding-machine, a pair of pressers forming between them a folding-groove, a folding-blade movable into and out of the groove, and a projection extending laterally from one wall of the groove and constructed to engage the folded material and retain the fold in the groove as the blade is withdrawn.

31. In a folding-machine, presser members forming between them a folding-groove, a folding-blade adapted to force material into said groove, and a projection extending laterally from one wall of the groove and having a fixed position relative thereto, whereby as the material is forced into the groove by the blade the edge of the material passes beneath the projection.

32. In a folding-machine, pressers forming between them a folding-groove, a folding-blade, means to move the blade into and out of the groove, and a shedder-plate secured to one of said pressers and projecting beyond the wall of the groove.

33. In a folding-machine, pressers forming between them a folding-groove, a folding-blade, means to move the blade into the groove to make a fold in the material and to withdraw the blade from the groove, and a projection secured to one of the pressers and extending partially over the mouth of the groove and adapted to engage the edge of the folded material and retain it in the groove as the blade is withdrawn.

34. In a folding-machine, pressers forming between them a folding-groove, a folding-blade, and means to move the latter into and out from the groove, one wall of the groove having a retaining-shoulder under which the edge of the folded material is forced by the folding-blade, said shoulder operating to hold the material in the groove as the blade is withdrawn therefrom.

35. In a folding-machine, pressers forming between them a folding-groove, means to move one presser toward and from the other, one of said pressers having a projection which extends beyond the wall of the groove and which operates to retain the folded material in the groove as the blade is withdrawn.

36. In a folding-machine, a pair of pressers forming between them a folding-groove, means to move one of said pressers toward and from the other, a folding-blade movable into and out of the groove, and a shedder-plate secured to the fixed presser and projecting partially over the groove.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

HARRY I. ILLINGWORTH.

Witnesses:
JOHN C. EDWARDS,
LOUIS C. SMITH.