May 17, 1932. J. A. GILES 1,858,706

BOX MACHINE

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Fig. 1.

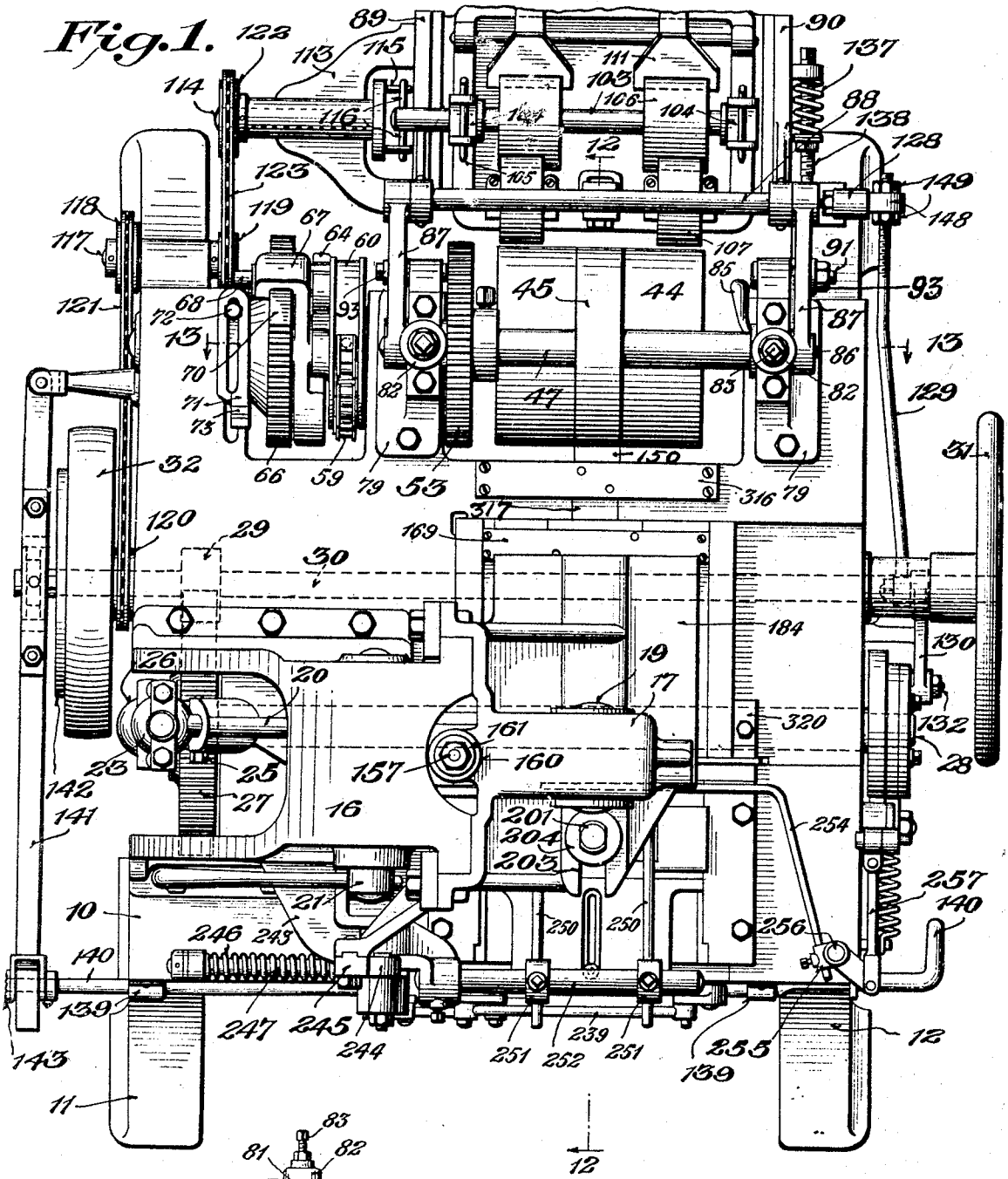
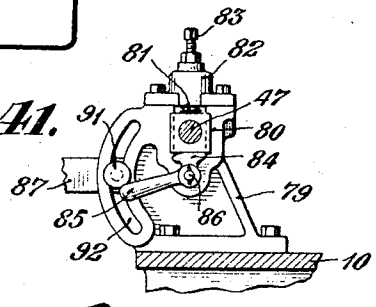



Fig. 41.




INVENTOR

Julian A. Giles,

BY

ATTORNEY

WITNESS:-

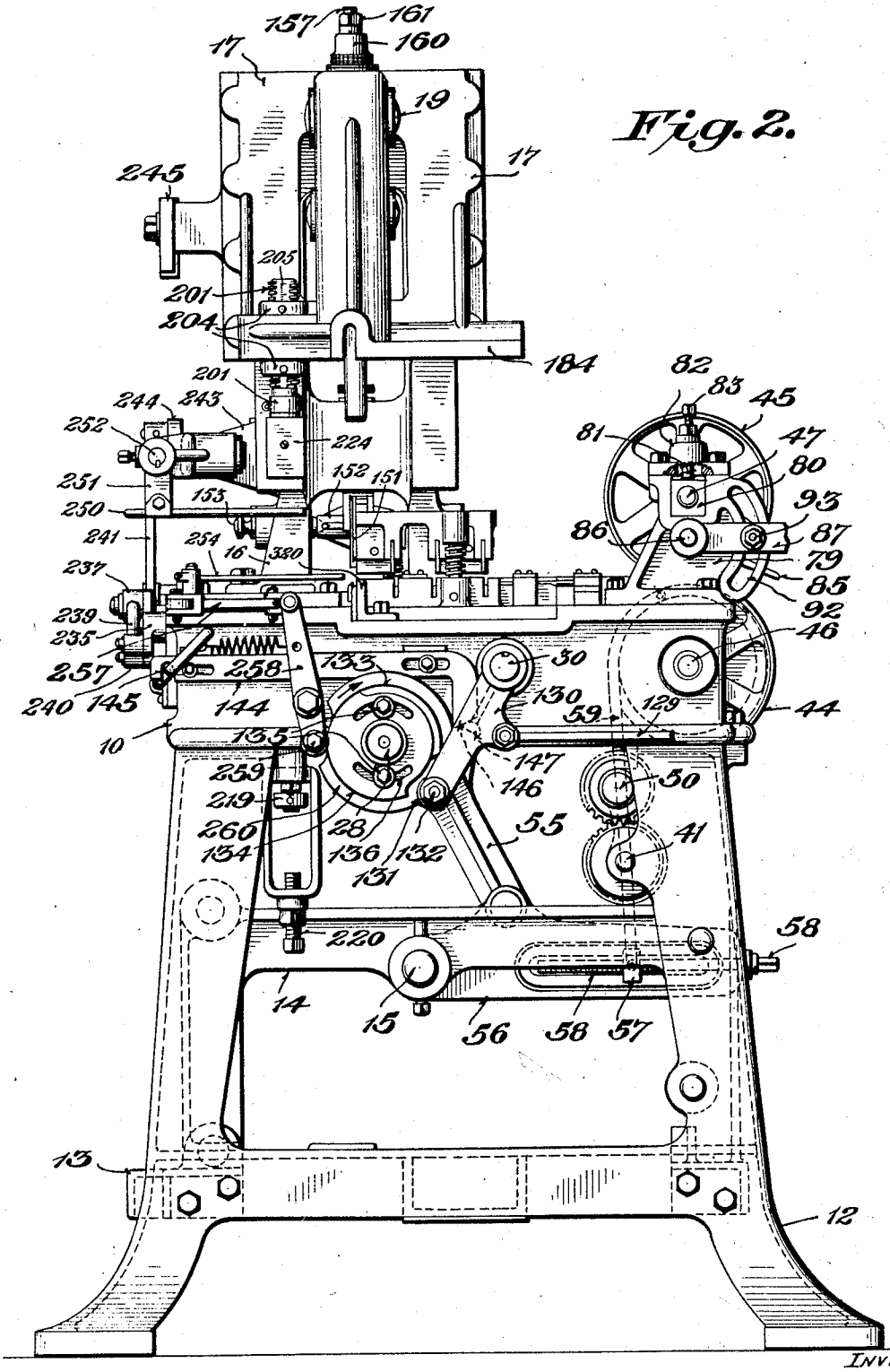
Chas. L. Griesbauer

May 17, 1932. J. A. GILES 1,858,706

BOX MACHINE

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Fig. 2.




INVENTOR

Julian A. Giles,

BY George G. Nall

ATTORNEY.

WITNESS:-

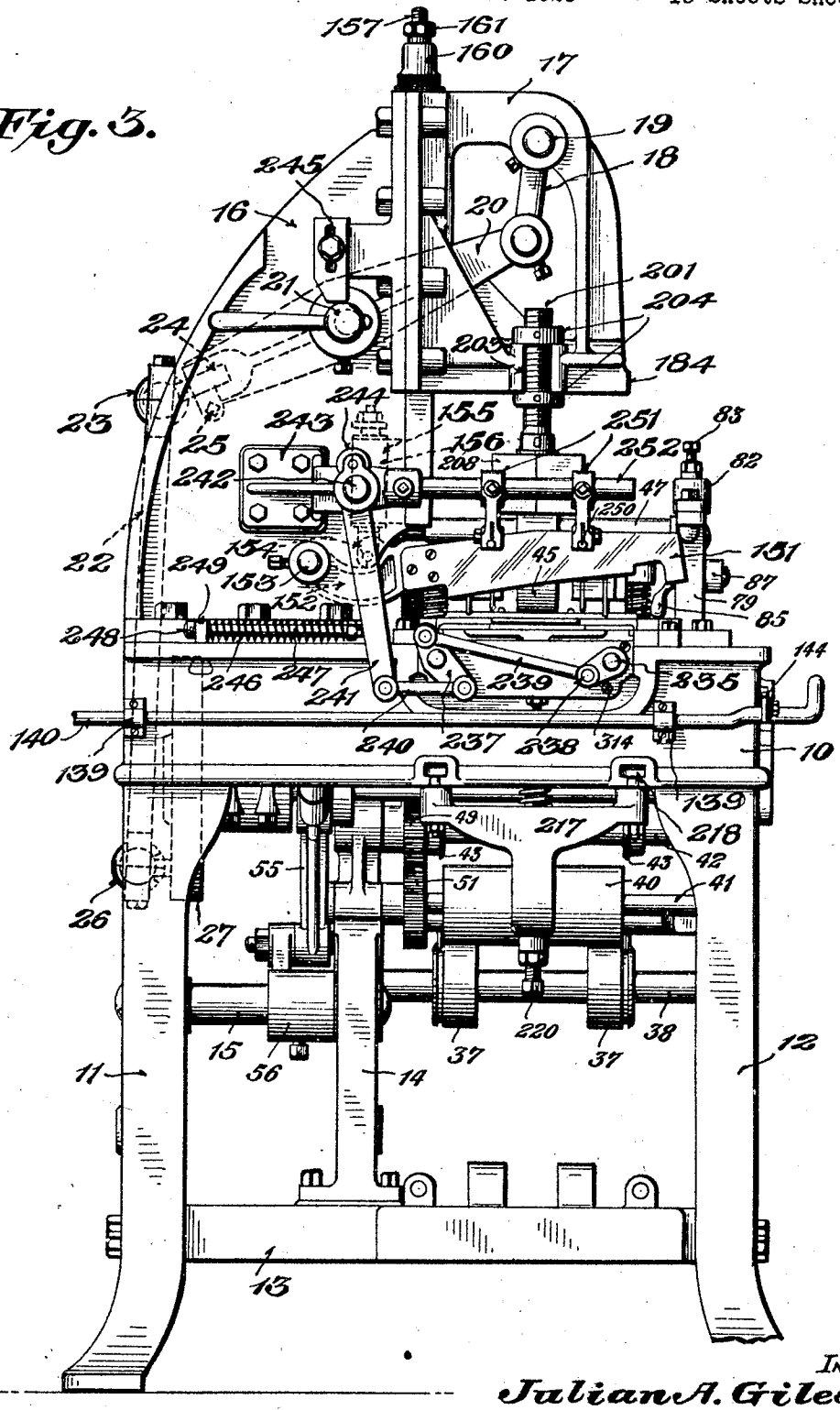
Chas. L. Griesbauer

May 17, 1932. J. A. GILES 1,858,706

BOX MACHINE

Filed Nov. 2, 1928 16 Sheets-Sheet 3

Fig. 3.




INVENTOR
Julian A. Giles,
BY
ATTORNEY.

WITNESS:-
Chas. L. Griesbauer

May 17, 1932. J. A. GILES 1,858,706

BOX MACHINE

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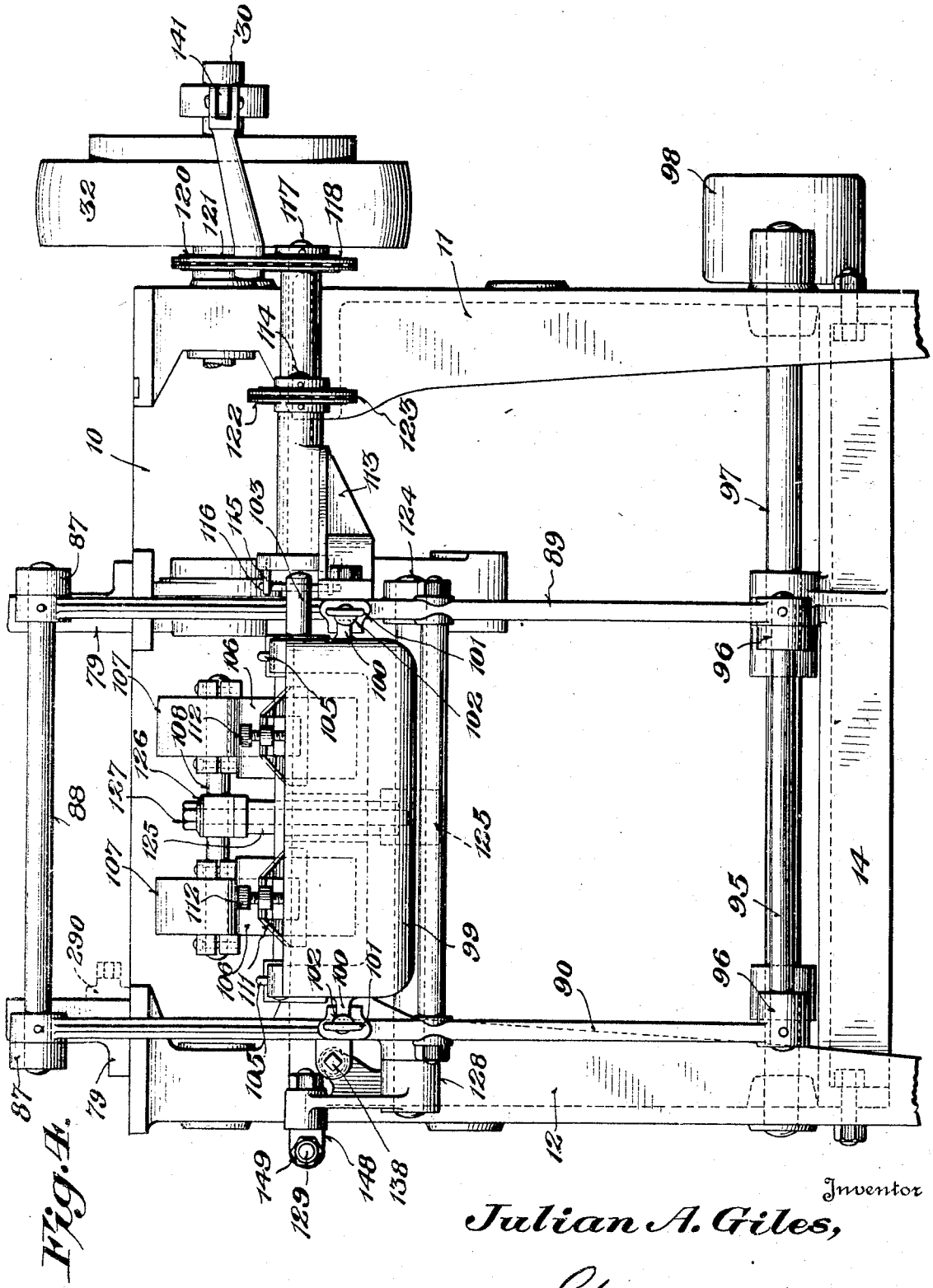



Fig. 4.

Inventor

Julian A. Giles,

By Hugh O'Neill

Attorney

May 17, 1932. J. A. GILES 1,858,706

BOX MACHINE

Filed Nov. 2, 1928 16 Sheets-Sheet 5

Fig. 5.

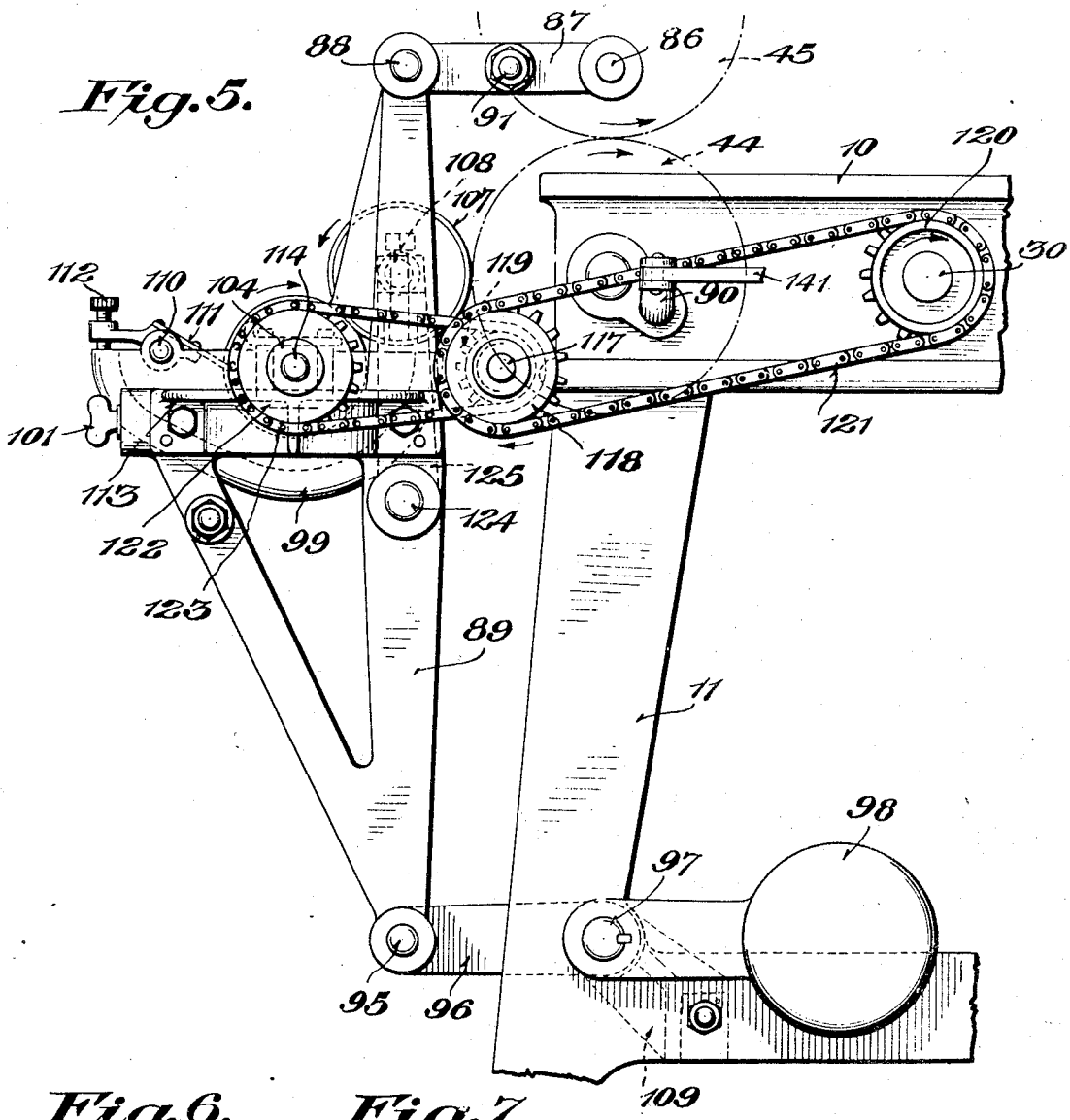



Fig. 6.

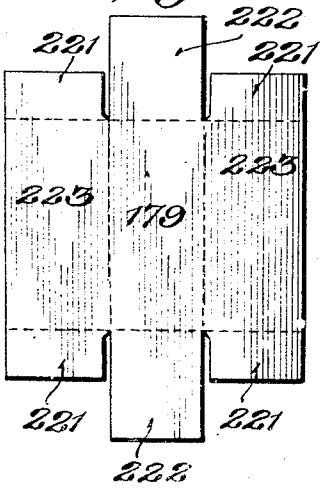
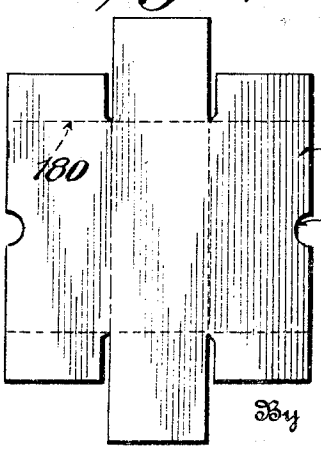



Fig. 7.




Inventor

Julian A. Giles,

By

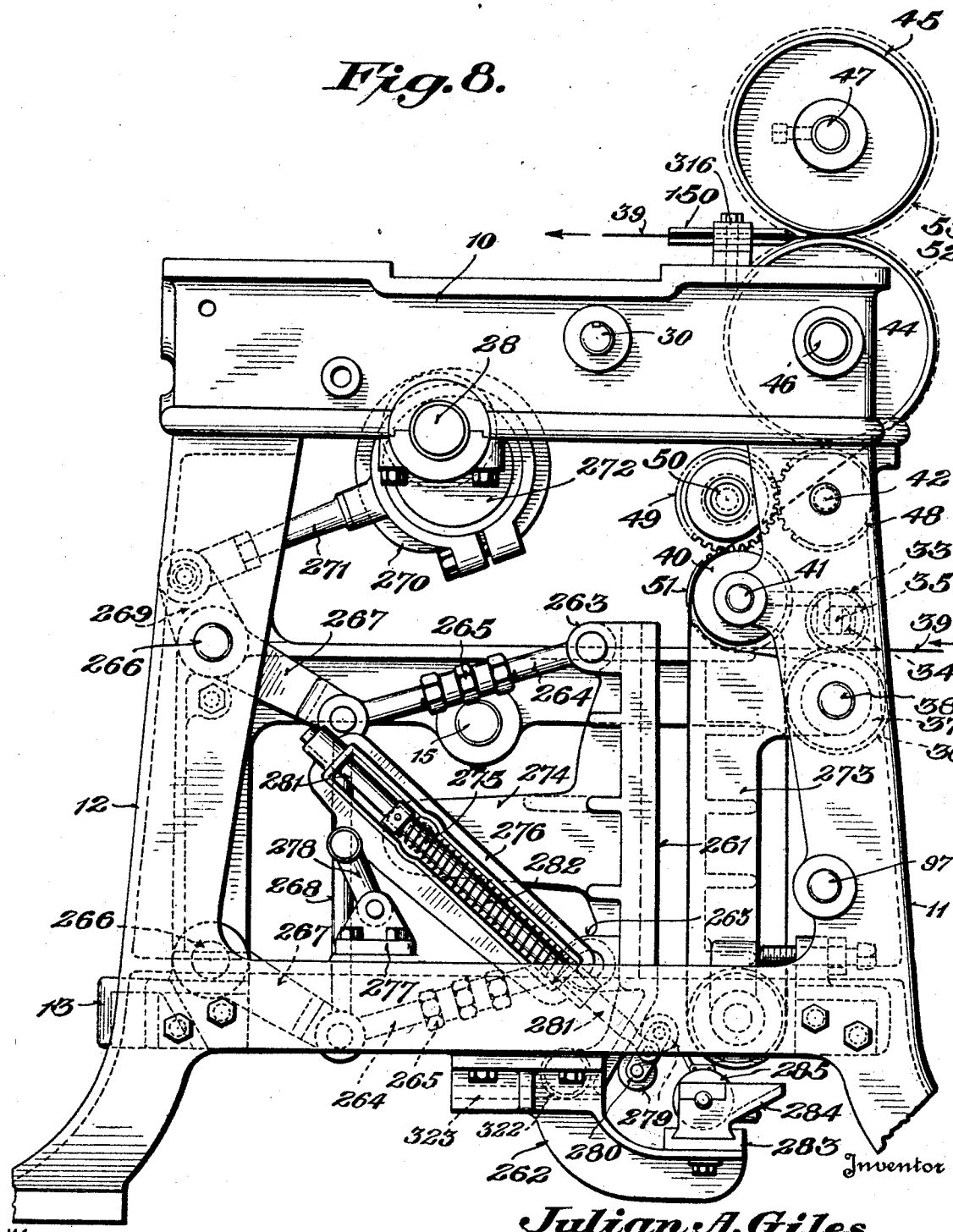
Attorney

May 17, 1932. J. A. GILES 1,858,706

BOX MACHINE

Filed Nov. 2, 1928 16 Sheets-Sheet 6

Fig. 8.




Inventor

Julian A. Giles,

By George Hall

Attorney

Witness:-

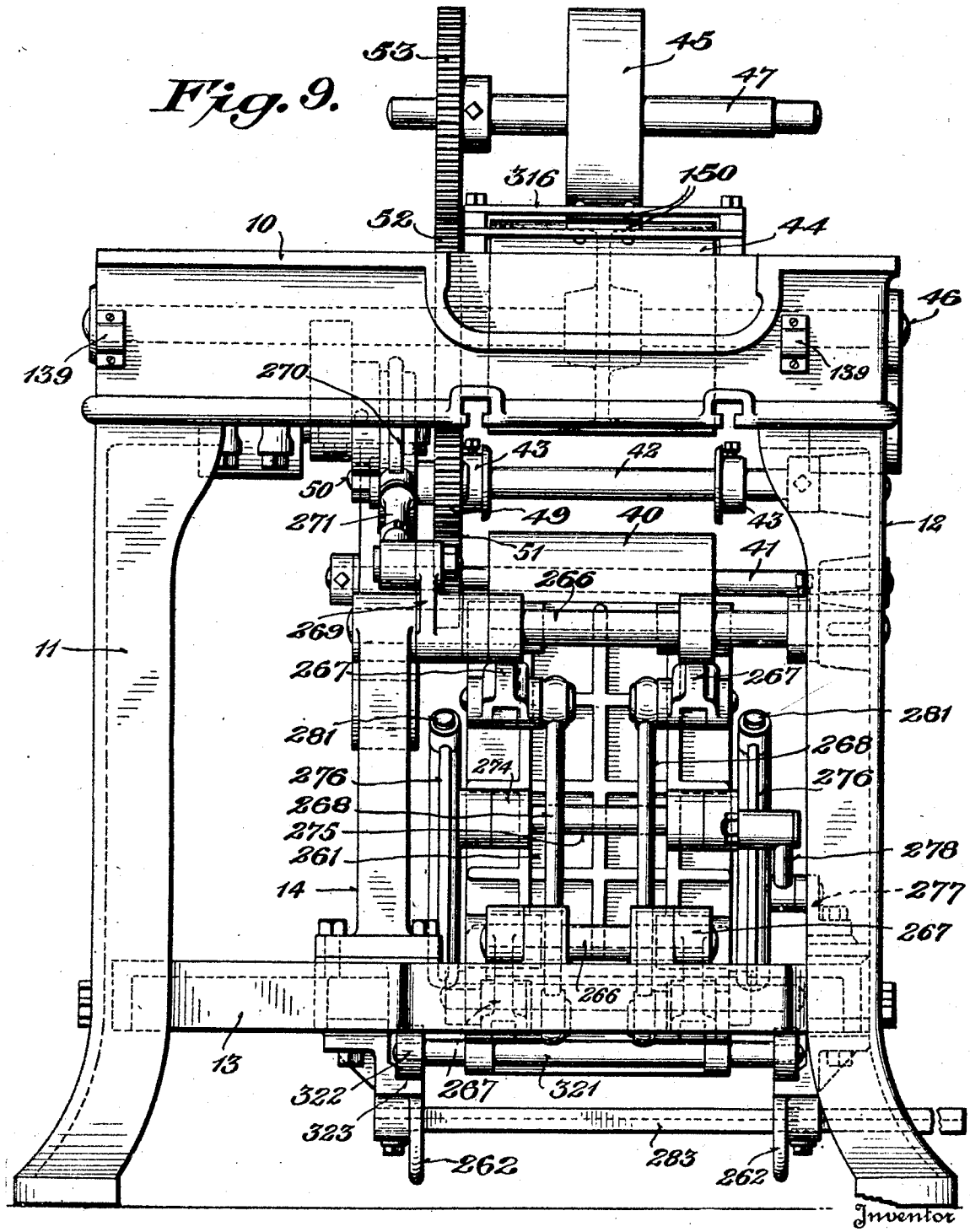
Chas. L. Greisbauer

May 17, 1932. J. A. GILES 1,858,706

BOX MACHINE

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Fig. 9.




Inventor

Julian A. Giles,

Witness:-
Chas. L. Griesbauer

By George H. Hall

Attorney

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BOX MACHINE

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Fig. 10.

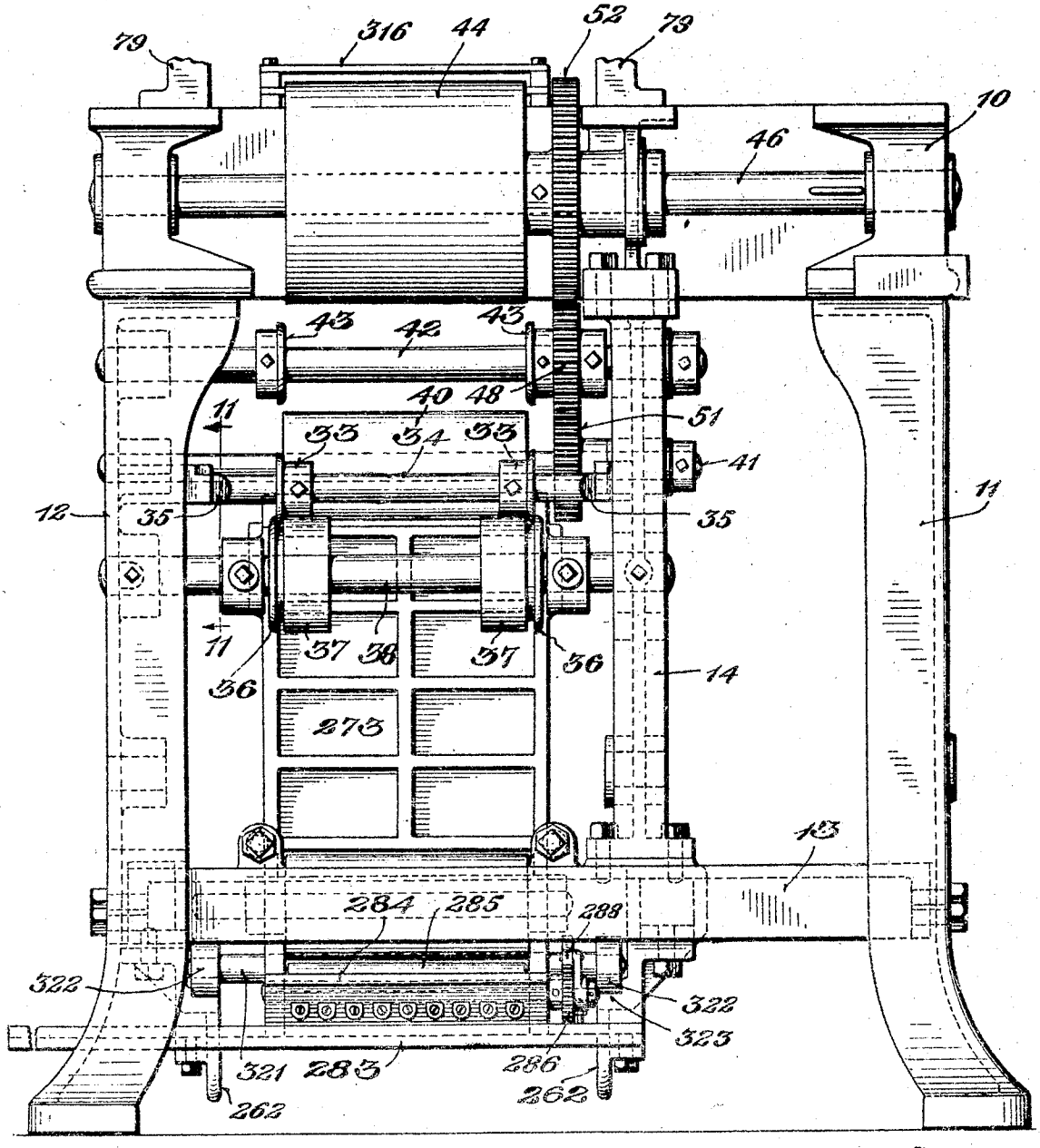
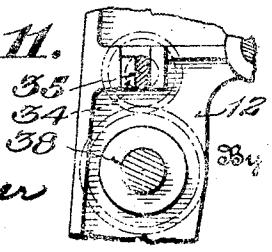



Fig. 11.




Inventor

Julian A. Giles,

By

Attorney

WITNESS:-

Chas L. Griesbauer

May 17, 1932. J. A. GILES 1,858,706

BOX MACHINE

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Fig. 12.

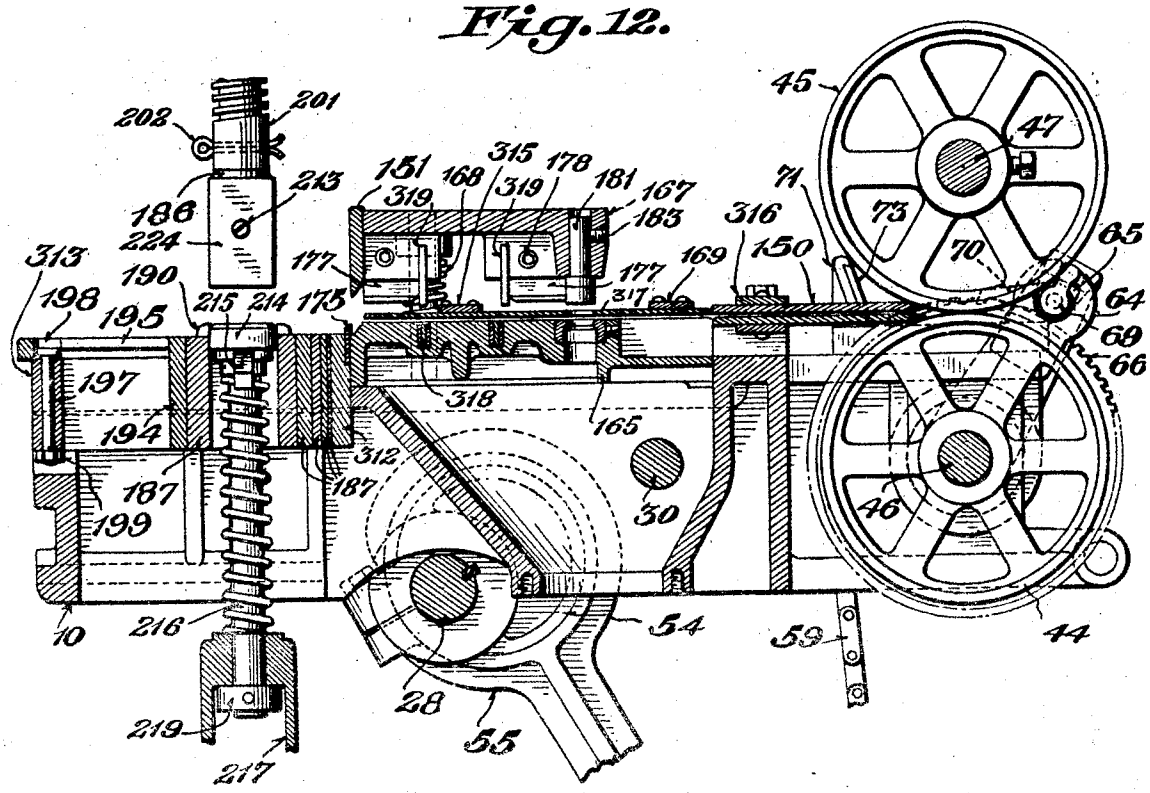
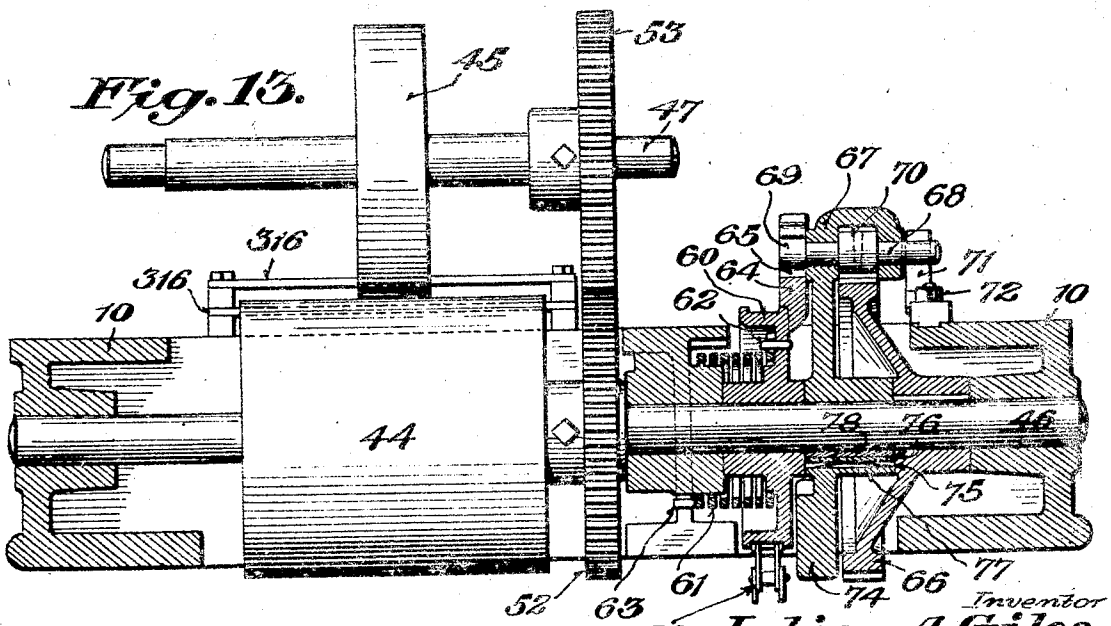



Fig. 13.




Inventor

59 Julian A. Giles,

By Geo. G. Hall

Attorney

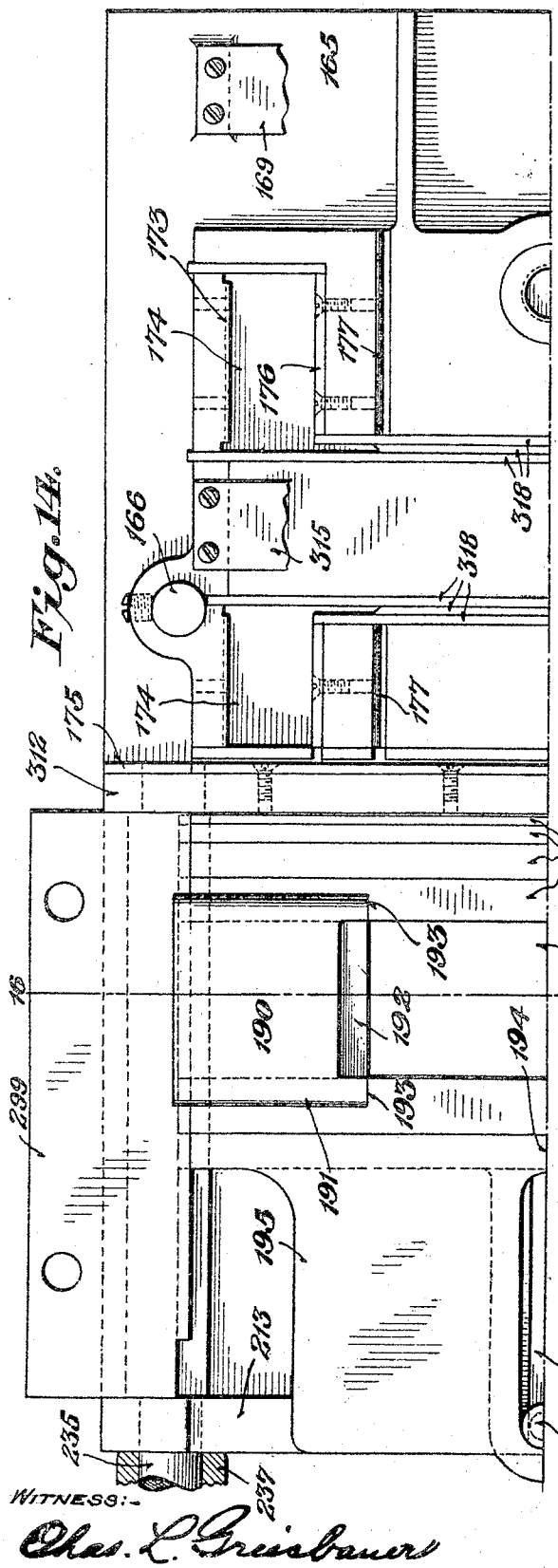
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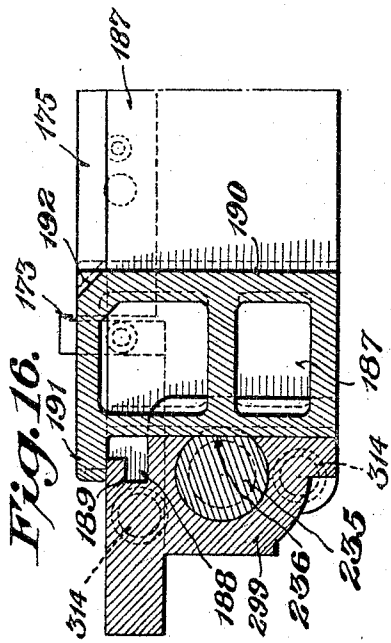
Chas. L. Greenbauer

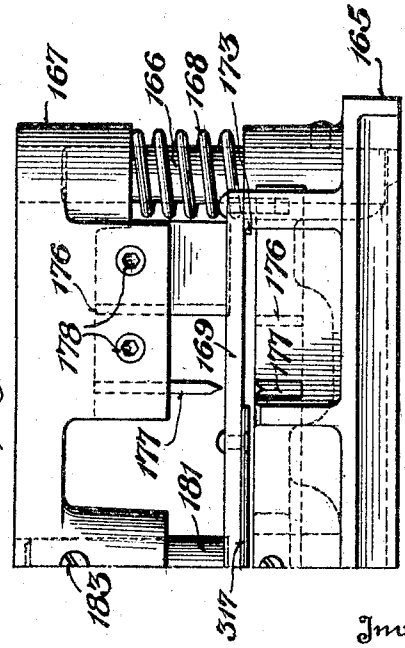
May 17, 1932. J. A. GILES 1,858,706

BOX MACHINE

Filed Nov. 2, 1928 16 Sheets-Sheet 10




Inventor

Julian A. Giles,

By George P. Hall

Attorney

WITNESS:-

Chas. L. Greisbauer

May 17, 1932. J. A. GILES 1,858,706

BOX MACHINE

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Fig. 17.

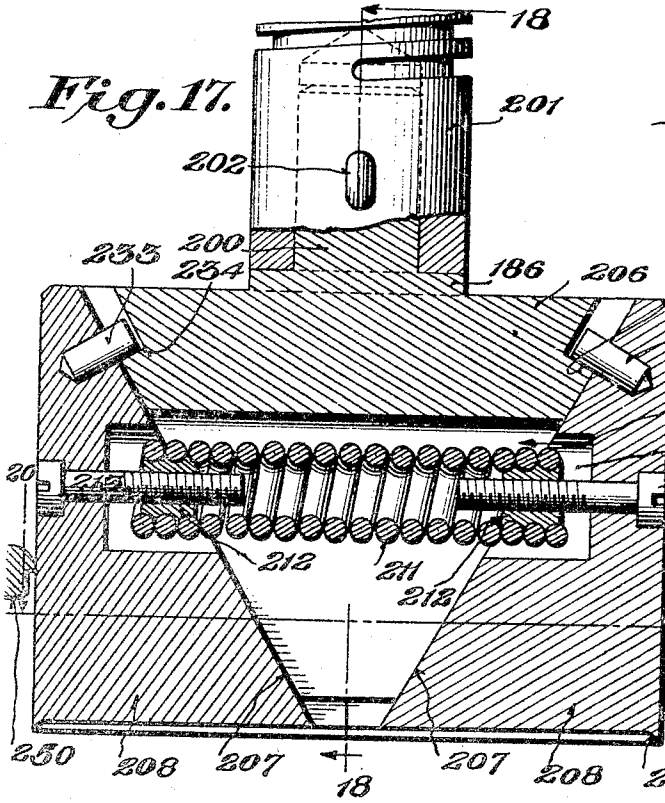



Fig. 18.

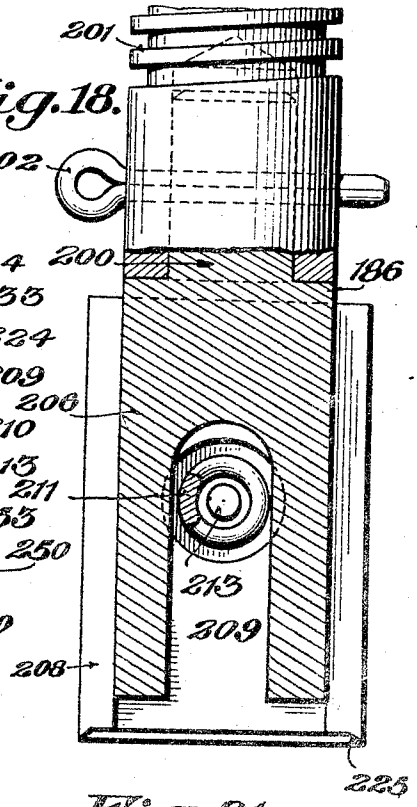



Fig. 19.

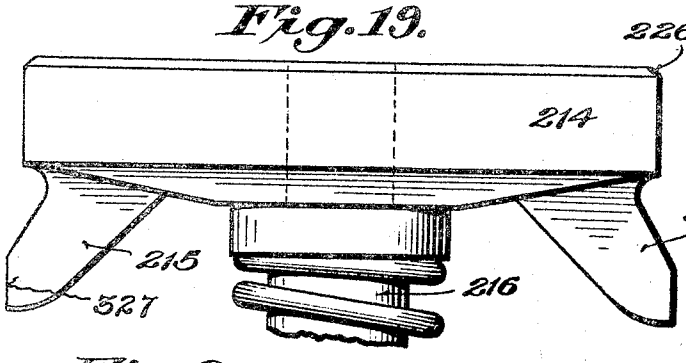



Fig. 21.

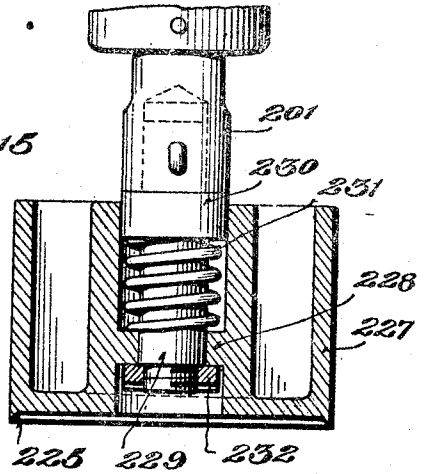
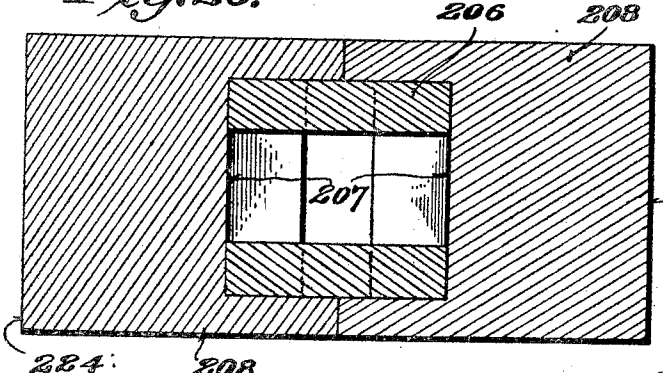



Fig. 20.




Inventor

Julian A. Giles,

By Geo. P. Hall

Attorney

Witness:-

Chas. L. Griesbauer

May 17, 1932. J. A. GILES 1,858,706

BOX MACHINE

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Fig. 24.

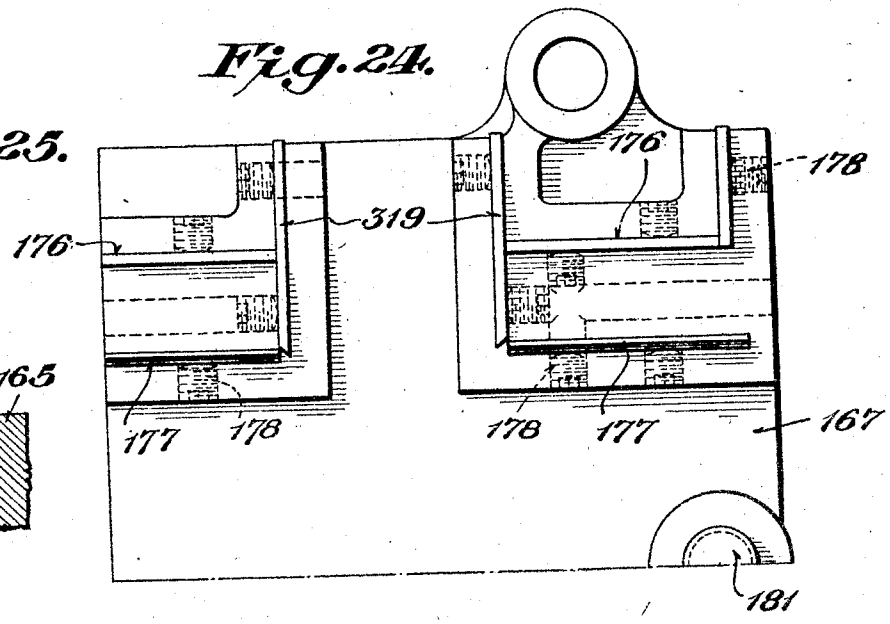



Fig. 25.

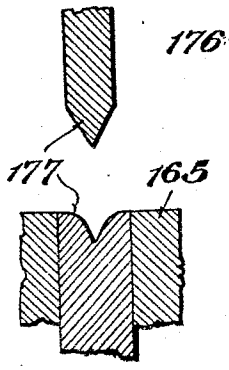



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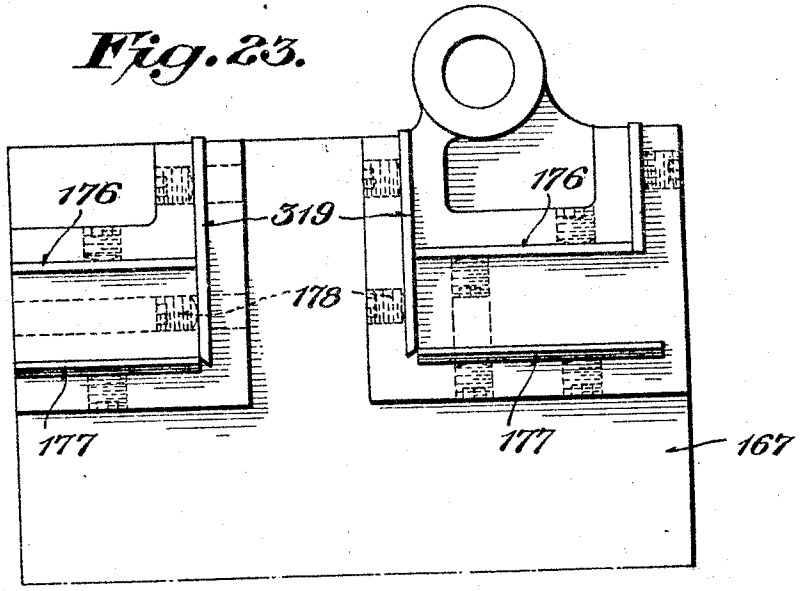
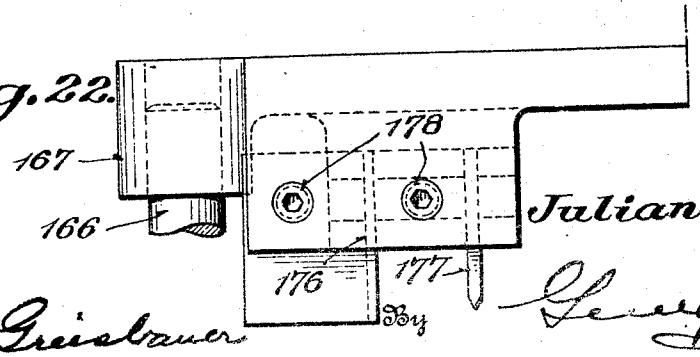



Fig. 22.




Inventor

Julian A. Giles,

By George P. Kelly

Attorney

WITNESS:-

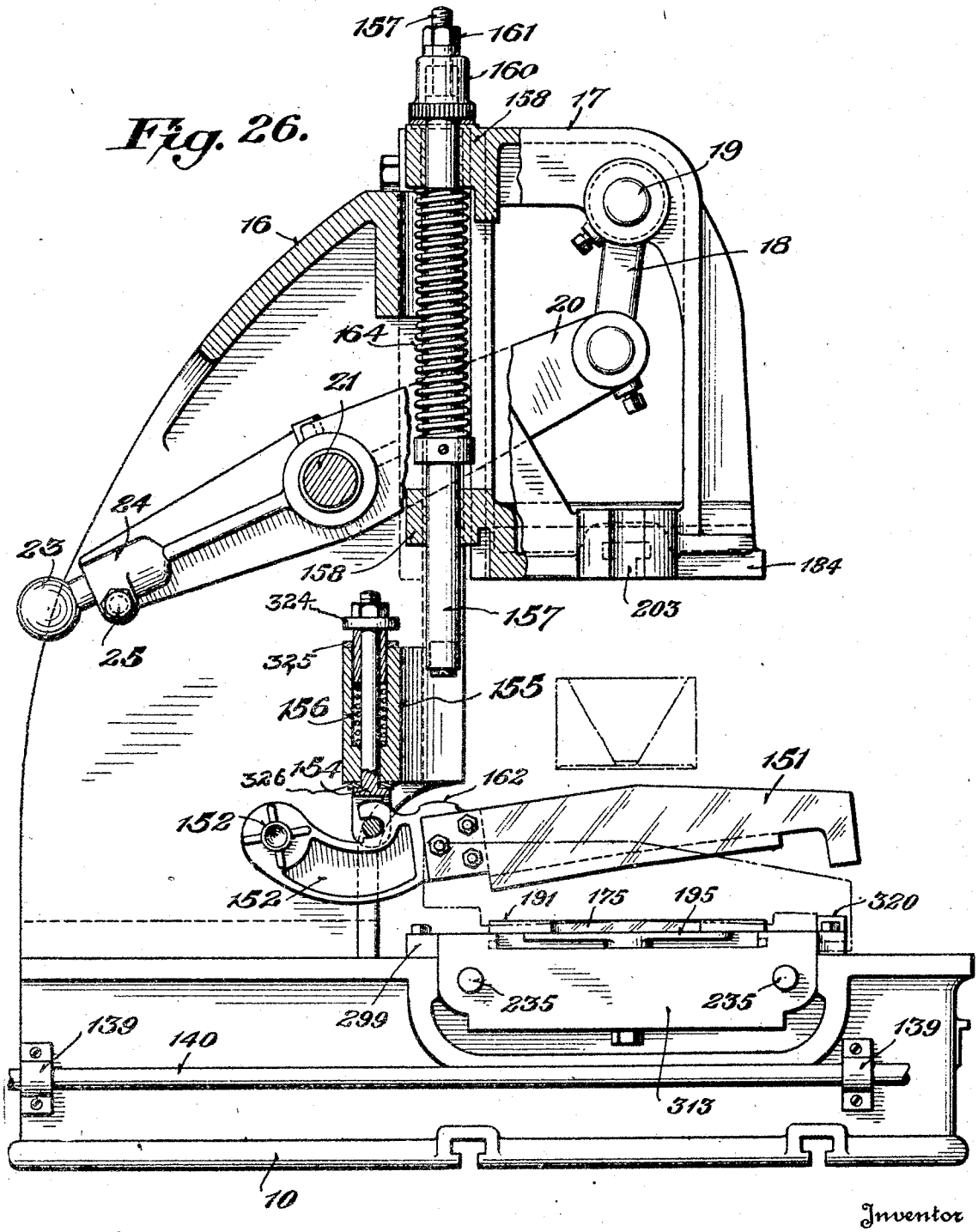
Chas. L. Greisbauer

May 17, 1932. J. A. GILES 1,858,706

BOX MACHINE

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Fig. 26.




Inventor

Julian A. Giles,

By Gregory & Wall

Attorney

WITNESS:-

Chas. L. Greenbauer

May 17, 1932. J. A. GILES 1,858,706

BOX MACHINE

Filed Nov. 2, 1928 16 Sheets-Sheet 14

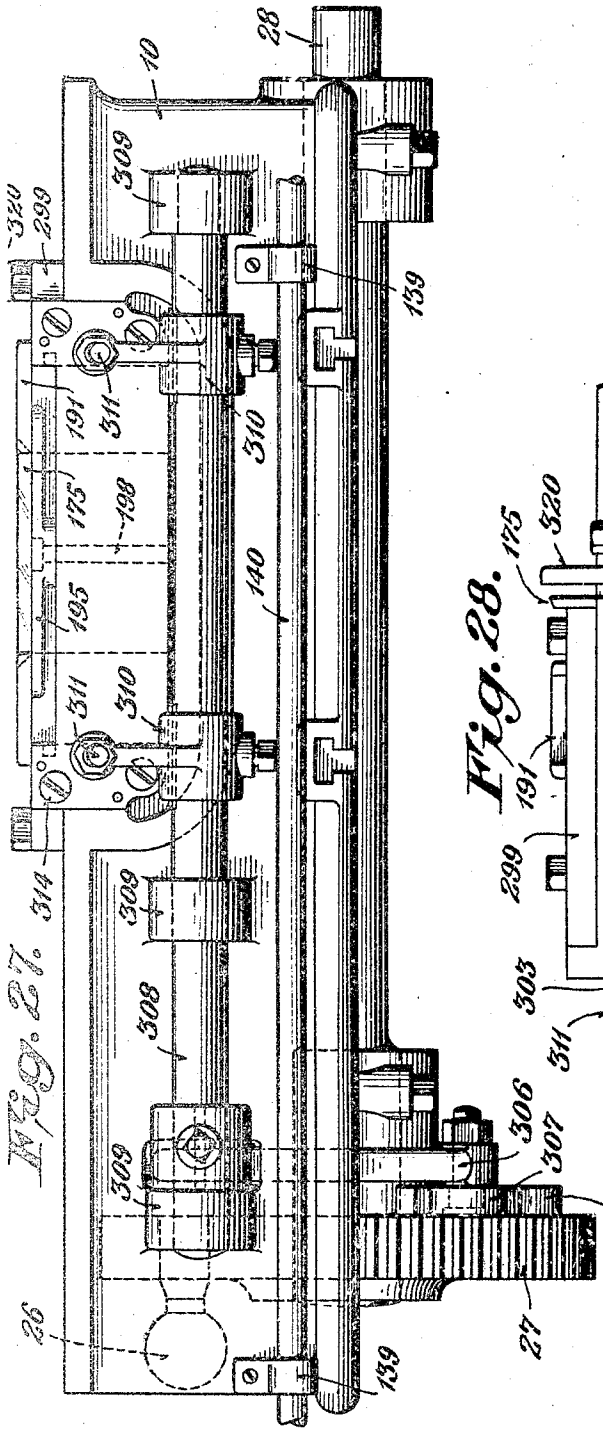



Fig. 27.

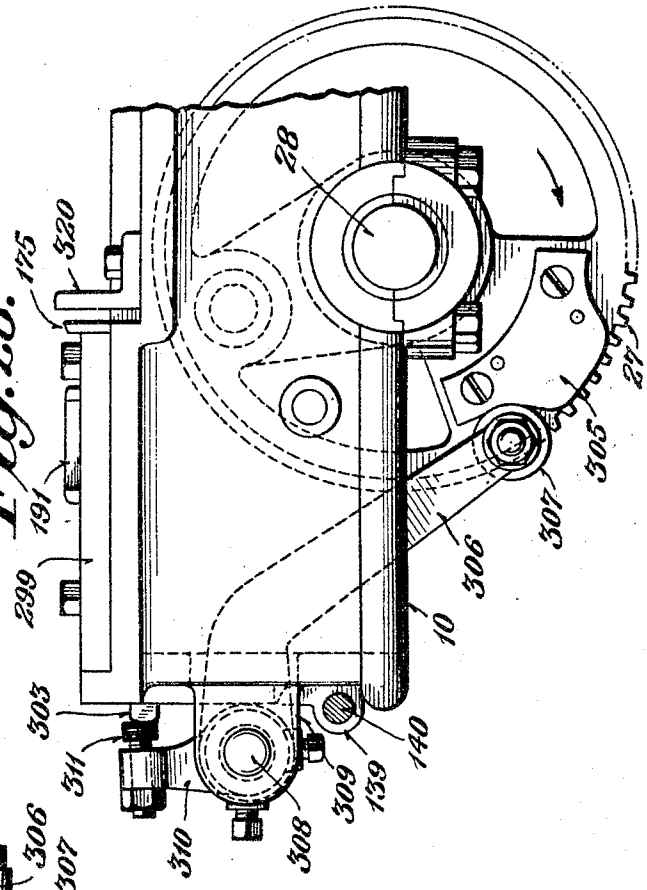



Fig. 28.

Inventor
Julian A. Giles,
By Dwight Davis
Attorney

Witness:-
Chas. L. Goodman

May 17, 1932. J. A. GILES 1,858,706

BOX MACHINE

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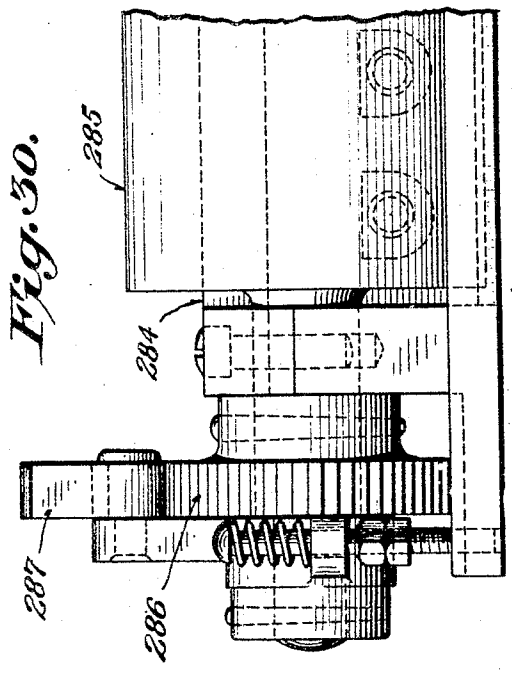



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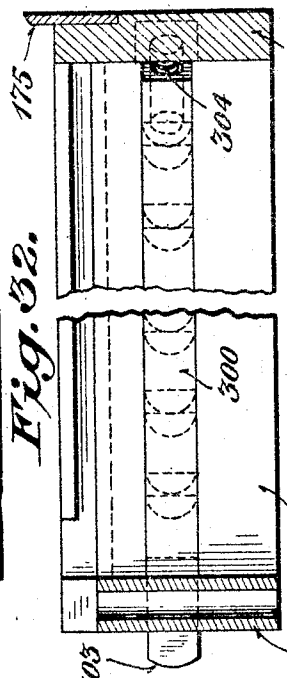



Fig. 32.

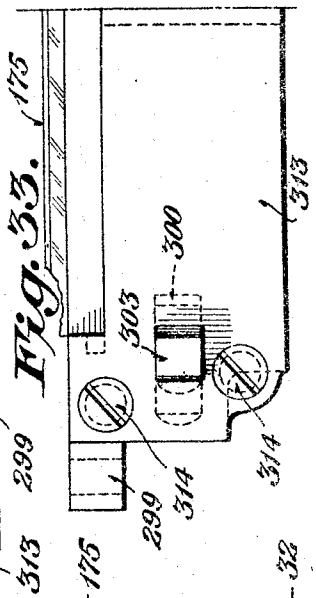



Fig. 33.

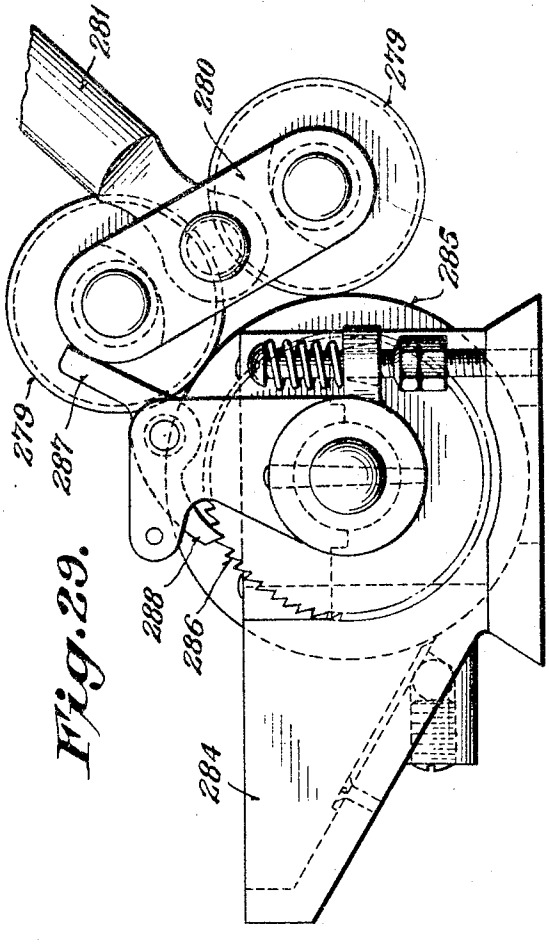



Fig. 29.

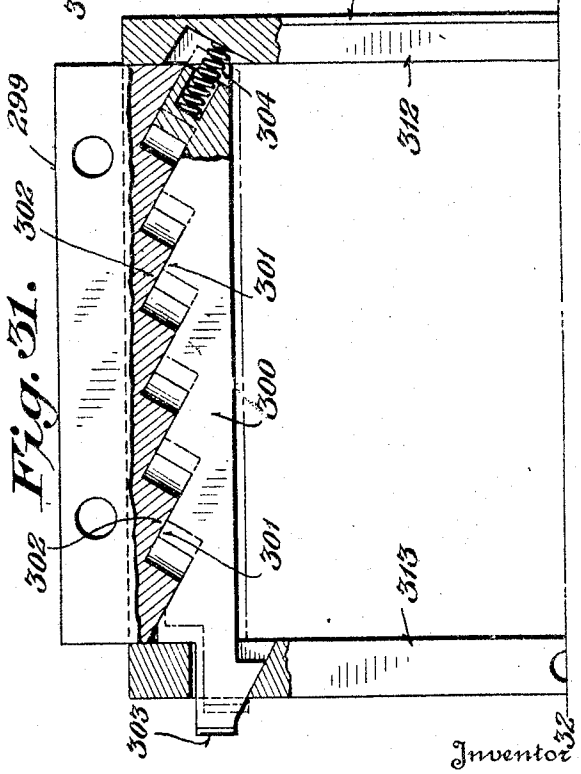



Fig. 31.

Inventor

Julian A. Giles,

By George Hall & Co

Attorney

May 17, 1932. J. A. GILES 1,858,706

BOX MACHINE

Filed Nov. 2, 1928 16 Sheets-Sheet 16

Fig. 34.

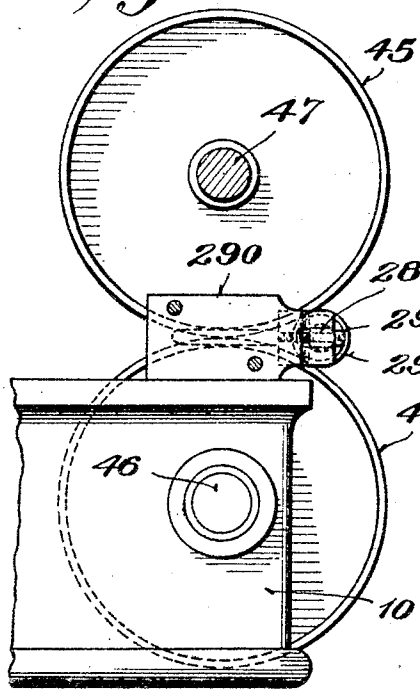



Fig. 35.

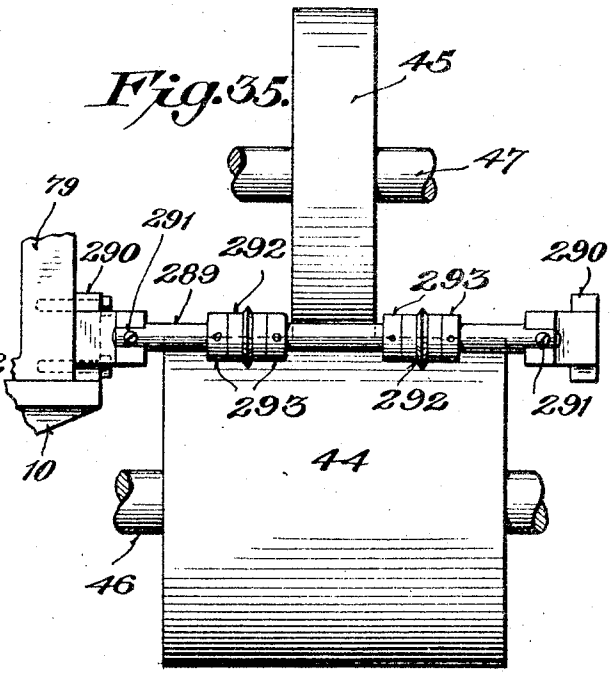



Fig. 37.

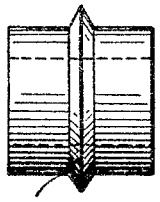



Fig. 38.

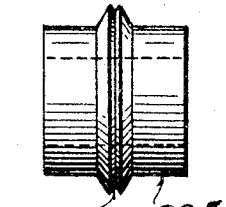



Fig. 36.

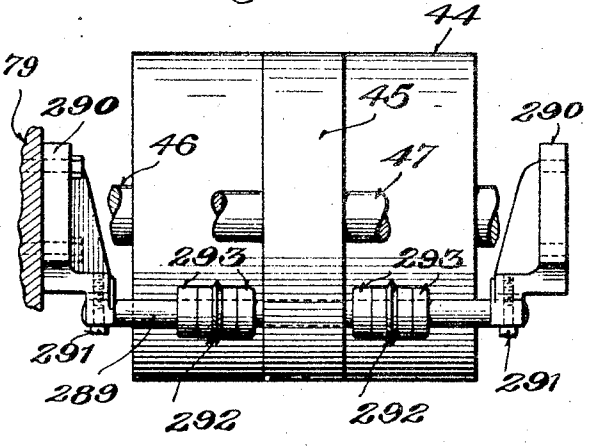



Fig. 39.

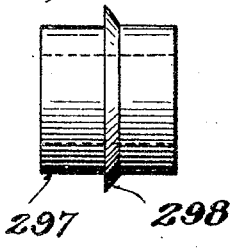
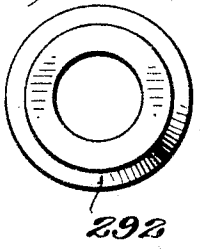



Fig. 40.




Inventor

Julian A. Giles,

Witness:- Chas. L. Griebauer

By George H. Lacy

Attorney

Patented May 17, 1932 1,858,706

# UNITED STATES PATENT OFFICE

JULIAN A. GILES, OF DERBY, CONNECTICUT

## BOX MACHINE

Application filed November 2, 1928. Serial No. 316,683.

This invention relates to a new and improved box machine of the type wherein boxes are automatically produced from a roll or web of paper or card-board.

It is the object of this invention, among other things, to provide a machine of this character that is adapted by adjustment of its parts to produce boxes of various sizes, that will occupy the minimum floor space and sufficiently light to permit its installation without special foundations, etc., composed of parts that are accessible and will enable all operations to be readily observed, to design and arrange the parts so that the same may be quickly changed for another size box, to provide dies and punches that are adapted for various size boxes, to provide a gluing mechanism that may be moved into or out of position as may be necessary and that will apply glue in the proper place for any combination of box sizes within the range of the machine, to provide means for pinching all boxes after the glued portions of the blank are in contact with each other, to provide an improved detachable printing mechanism, and in these and other ways, as will more fully appear, to produce a box machine that will perform the maximum number of required operations with mechanism that is simple in construction, readily assembled and produced at the minimum cost.

In the drawings accompanying and forming part of this specification, wherein like numerals of reference indicate like parts in the several figures;

Figure 1 is a fragmentary plan view of my improved machine;

Figure 2 is a front view of a portion thereof;

Figure 3 is a view of the left side of the machine;

Figure 4 is a view of the gluing mechanism and adjacent parts;

Figure 5 is a detail side view of the gluing mechanism and adjacent parts;

Figure 6 is a view of a blank from which a box is formed;

Figure 7 is a similar view for the box cover;

Figures 8, 9 and 10 are views of the printing mechanism and adjacent parts;

Figure 11 is a fragmentary sectional view of some of the parts shown in Figure 9, those in section being taken generally upon line 11—11 of Figure 10;

Figure 12 is an enlarged transverse sectional view of the feed mechanism, punch and die mechanism, and box forming mechanism, the parts in section being taken generally upon line 12—12 of Figure 1;

Figure 13 is a sectional view of the parts, taken upon line 13—13 of Figure 1;

Figure 14 is a plan view of the rear half of the die and box forming mechanism;

Figure 15 is an end view of a portion of the die looking toward the right of Figure 14, with the rear half of the punch associated therewith;

Figure 16 is a transverse sectional view of a portion of the die forming mechanism, taken upon line 16—16 of Figure 14;

Figure 17 is a fragmentary sectional view of the upper plunger;

Figure 18 is another sectional view thereof, the parts in section being taken generally upon line 18—18 of Figure 17;

Figure 19 is a side elevation of the upper plunger;

Figure 20 is a transverse sectional view of the upper plunger, taken upon line 20—20 of Figure 17;

Figure 21 is a fragmentary sectional view of another form of upper plunger;

Figure 22 is an end elevation of the punch;

Figure 23 is a view of the underside thereof showing the arrangement of the cutting and scoring knives to form a box;

Figure 24 is a similar view illustrating the position of the scoring and cutting knives to form a cover;

Figure 25 is an enlarged view of the scoring knives and associated parts;

Figure 26 is an enlarged sectional view of the standard and some adjacent parts;

Figure 27 is a detail end view of a portion of the sizing block mechanism and adjacent parts;

Figure 28 is another view of the parts illustrated in Figure 27;

Figures 29 and 30 are enlarged views of the ink fountain and some adjacent parts;

Figure 31 is a fragmentary plan view of a portion of a forming die and a sizing block associated therewith;

Figure 32 is a sectional view thereof, the parts in section being taken generally on line 32—32 of Figure 31;

Figure 33 is an end view of the parts shown in Figure 31;

Figures 34, 35 and 36 are views of the feed rolls and a form of rotary scoring device;

Figures 37, 38, 39 and 40 are views of various forms of scoring rolls; and

Figure 41 is a detail view of the mechanism for lifting one of the feed rolls.

Referring to the drawings, 10 designates the bed plate supported by legs 11 and 12, between which are the frames 13 and 14, in the latter of which is journaled one end of the feed lever shaft 15.

Fixed on the bed plate is a standard 16, upon which the slide 17 is reciprocated through the link 18 on the shaft 19 and connected with the rock lever 20 on the shaft 21. A ball joint connection 23, the shank 24 of which projects into the rock lever 20, and held in its adjusted positions by the screw 25, unites the rock lever 20 with the rod 22. This rod is also connected with the ball bearing pin 26, fixed in the gear 27 on the shaft 28. The teeth of this gear mesh into those of a pinion 29 fixed on the shaft 30 having a hand wheel 31 thereon for convenience in manual operation of the machine for purpose of adjustment, testing work, etc. On the end of the shaft opposite to the hand wheel is a friction clutch pulley 32 by means of which the machine is belt driven.

The paper 39 (Figure 8) for making boxes is taken from a roll or web of paper mounted on a floor stand (not shown), as is usual, and passes under stationary shaft 34 between the flanged collars 33 thereon. The flattened ends 35 of this shaft project into slots in fixed parts and hold the shaft from turning but permit a limited movement up and down.

The collars 33 are adjustably fixed on the shaft 34 and the flanges thereon project into the grooves 36 of the rolls 37 rotatable on the shaft 38. These collars and rolls form a guide for the paper and can readily be adjusted for different widths of paper and may also serve as a drag to keep the paper taut.

The strip of paper 39 then passes partly around the roll 40 mounted upon shaft 41, just touching the shaft 42, on which is adjustably mounted the flanged collars 43—43 that function as guides. The paper then passes partly around the lower feed roll 44 and under the upper feed roll 45, respectively mounted upon the shafts 46 and 47.

I find it convenient to have the lower feed roll 44 of substantially the same width as the maximum width of the paper strip within the capacity of the machine, and the upper feed roll 45 the width of the inside of the smallest box.

The roll 40 is driven from the pinion 48 on the shaft 42 through a gear 49 rotatably mounted on a stud 50 in frame 14 which drives the pinion 51 on shaft 41. The feed rolls 44 and 45 are positively driven by the gears 52 and 53 mounted upon the shafts 46 and 47, respectively, from a ratchet wheel 66. From these feed rolls the paper strip 39 travels horizontally to the punching and scoring dies, cutting off knife and forming die. The feed mechanism is operated in timed relation with associated mechanism from an eccentric 54 mounted on the shaft 28, around which is an eccentric strap 55, which is connected with the feed lever 56 journaled upon the shaft 15.

Within the slot in the feed lever 56 is a block 57 that is moved by a screw 58 threaded therethrough. Pivotally connected with the block 57 is a chain 59 which is fastened at its opposite end to a drum 60 which revolves upon the shaft 46, being operated for a feed movement of the paper strip 39 by the chain and returned to its original position by a coil spring 61.

One end of the spring is connected with a pin 62 in the drum 60 and the other end is held stationary in a notch 63 in the bed plate 10. Projecting radially from the drum 60 is an arm 64 having an opening 65 in the outer end thereof.

Secured on the shaft 46 is the ratchet wheel 66 and journaled therein is the pawl carrier 67, in which is journaled the shaft 68 having a head 69 thereon which projects into the opening 65 of the arm 64. On the shaft 68 is a pawl 70. The opening 65 is enlarged at the point where it passes over the head 69 of the shaft 68, so that there is a slight lost motion therein which is sufficient to throw the pawl into and out of mesh with the ratchet wheel 66 when the drum 60 is operated. This construction does not allow the pawl to drag over the teeth of the ratchet when moved backwardly thereover and will positively insure engagement of the pawl with the teeth of the ratchet wheel when moved forwardly. When the drum 60 is about to move and impart a forward feed movement to the strip of paper 39, the pawl 70 engages the ratchet and the feed rolls 44 and 45 rotate a sufficient distance to advance the strip the desired distance. The extent of this movement is regulated by the position of the block 57 within the feed lever 56.

On the bed plate 10 is a stop block 71 which is held in any of its adjusted positions by means of the screw 72. This stop block 71 is so adjusted that the pawl shaft 68 in its extreme forward position will be engaged thereby and prevent the pawl jumping out of

the ratchet and allow the feed to jump ahead and operate at fast speeds.

A piece of leather, hard rubber or the like, 73, may be imbedded in the face of the stop block 71, if desired, to minimize any noise that might arise from the engagement of the shaft therewith.

The pawl carrier 67 oscillates slightly on the shaft 46 and is provided with a counterbalance weight 74 to facilitate ease in operation.

The head 69 of the shaft 68 is smaller in diameter than the opening in the arm 64, therefore, it has limited relative movement therein. The outer end, however, of the head 69 (Figure 12), while rounded on its sides, is the same width as the radial slot in the arm 64, that extends from said enlarged opening but fitted so as to rock therein. As the arm 64 is actuated by the chain 59, through the drum 60, moving to the left as shown in Figure 12, the nose of the pawl 70 is thrown into engagement with the teeth in the ratchet wheel 66. During the reverse movement there is a slight travel of the arm 64 before the head 69 engages one wall of the enlarged opening therein, during which time the outer end of the head 69 moves with the arm. This rocks the head 69 with the pawl 70 thereon and lifts the outer end thereof out of the teeth of the ratchet wheel 66. Thereafter, the pawl moves as a unit with the arm 64 during the completion of the travel of the arm 64 in this direction. Reverse actions take place at the reverse movement of the arm 64, that is, when the arm starts its travel toward the left, as in Figure 12, the arm 64 advances slightly until the wall of the enlarged opening engages the head 69, at which time the pawl 70 is actuated and the nose thereof thrown into engagement with the teeth of the ratchet wheel as before.

By this construction and operation a positive feed even at fast speeds is assured, there being a constant pressure upon the pawl to project and maintain it in contact with the teeth in the ratchet wheel 66.

The stop block 71 is adjusted after the length of the feed has been determined, and at the extreme limit thereof the shaft 68 contacts therewith and brings the feed to a full stop. This prevents the pawl from jumping out at the end of the stroke and also a possible overfeed by reason of the momentum of the parts. The stop block 71 is especially advantageous where the machine is operating at high speeds but is not so essential where the speed is slow, because the momentum is much reduced in the latter speed over and above the former.

In the hub of the pawl carrier 67 is a spline 75, within which is a pressure plate 76, a spring 77, and a leather friction block 78. The spring 77 is of such strength as to apply sufficient pressure on the shaft 46 through the block 78 to hold the pawl carrier against independent relative movement.

Fixed on the bed plate 10 are two housings 79, in which are movably mounted the journal boxes 80 for the shaft 47. A constant downward pressure is applied to each of these boxes by the springs 81, within the caps 82, the tension of which is varied by the screws 83.

To permit the strip 39 to pass between the feed rolls, the upper roll 45 is temporarily raised through a cam 84 which bears against the underside of one of the boxes 80 and manipulated through a lever 85 connected therewith. Pressure of this cam is resisted by the coil spring 81, which returns the upper feed roll to its operative position for a feed movement when the lever 85 has relieved the tension of the cam 84 thereagainst.

In each housing 79 is a pin 86, upon the inner end of which is journaled the cam 84 and upon the outer end is a link 87. The opposite ends of these links are joined by a shaft 88, upon which is fixed the frames 89 and 90. Each of the links 87 has a stud 91 that projects through a radial slot 92 in the housings 79 and through the nuts 93 thereon holds the links in any adjusted position.

The lower ends of the frames 89 and 90 are connected with a shaft 95 in arms 96 which are keyed to a shaft 97 journaled in the legs 11 and 12 and the brackets 109 fixed to said legs. Upon the shaft is a counterweight 98 which is a complete balance for the gluing mechanism. The gluing pan 99 is preferably made with a double bottom, between the walls of which steam is admitted to provide hot glue if desired, although in practice glue on machines of this type is generally used cold.

The gluing pan 99 is supported upon each side by the ribs 100 which project into grooves upon the inside faces of the frames 89 and 90 and held therein by the screws 101. When these screws are positioned so that the flat sides of the collar 102 are adjacent to the side walls of the gluing pan the latter may be withdrawn.

The gluing roll shaft 103 is journaled in boxes 104, which are locked against accidental disengagement from the frame by the pin 105. The gluing rolls 106 on shaft 103 pass through the liquid glue within the pan 99 and pick up glue which is deposited upon the transfer rolls 107 mounted on the idler shaft 108.

On the shaft 110 journaled in the pan 99 is a scraper 111 for each of the gluing rolls 106 and held in contact therewith under the required tension by screws 112.

Journaled in a bracket 113 on the frame 89 is a shaft 114 having projecting therefrom two drive pins 115, which contact with a pin 116 that projects from the shaft 103.

Journaled in the bed plate 10 is the shaft

117, upon the opposite ends of which are fixed the sprocket wheel 118 and 119, the former being connected by the chain 121 with a sprocket wheel 120 on the hub of pulley 32, and the sprocket wheel 119 being connected with the sprocket wheel 122 on the shaft 114 by the chain 123, so that a positive rotary movement is imparted to the gluing roll shaft 103 from the drive shaft 30.

The distance between the centers of the sprockets 118 and 122 is the same as the distance between the centers of the shaft 88 and pin 86. Therefore, the gluing mechanism as it is raised or lowered moves on an arc around the circumference of the lower feed roll 44, thus allowing the strip 39 to be glued in different positions, which is necessary on account of the blanks being of varying widths for different size boxes, it being prerequisite that the gluing should be done while the strip is moving.

In the frames 89 and 90 is a shaft 124, having a lever 125 thereon, to one end of which is bolted the squared center portion of the shaft 108 by means of the bolt 127 and spring washer 126.

The transfer rolls 107 are moved toward and away from the feed roll 44 in timed relation with the feed of the strip 39 through a rock lever 128 on the shaft 124 and connection rod 129 between the rock lever 128 and rock lever 130 having a stud 132 thereon.

The rock lever is actuated by the cams 133 and 134, which may be adjusted relatively to each other to acquire the proper length of glue contact of the transfer rolls 107 on the strip 39 by the bolts 135 which pass through the slots 136 in the cams and threaded into the cam 260. These cams are so shaped and timed that they hold the transfer rolls 107 against the gluing rolls 106 when there is no feed of the strip 39.

The spring 137 on the bolt 138 which contacts with the lever 128 holds the transfer rolls 107 against the paper strip 39 until the cams 133 and 134 return them to the gluing rolls 106.

The rod 129 has a universal joint connection with the lever 128 through the stud 148 and is adjusted relatively thereto by the nuts 149.

Slidable in the brackets 139 on the bed plate 10 is the shipper rod 140 which is connected through the member 143 with the clutch lever 141, by means of which the clutch 142 and pulley 32 are moved into and out of engagement with each other. This clutch mechanism and the means for operating the same constitute no part of my present invention and are not therefore shown herein more in detail.

Slidably mounted on the bed plate 10 is a stop bar 144, the inner end 146 of which engages a part 147 on the rock lever 130 when in the position shown in Figure 2 and holds the roll 131 out of contact with the cams 133 and 134, hence there is no movement of the transfer rolls 107 toward the feed roll 44 and no glue is transferred to the strip 39.

An offset portion of the shipper rod 140 near the front of the machine projects into a notch 145 when in the position shown in Figure 2. When the handle on the shipper rod 140 is turned about 90° it carries the bar 144 to the left, as shown in Figure 2, and in the inner end 146 thereof out of contact with the rock lever 130, which is then subject again to the action of the cams 133 and 134.

In operation, the strip 39, after passing the feed rolls 44 and 45, is fed between the guides 150 that are secured to support bars 316, then between the punching and scoring dies, which brings it to the cutting knife 151 on the knife head 152, which is rotatable on the centering pins 153 in the standard 16. This knife head is positioned by a spring bolt 154, movable in a lug 155 on the standard 16, the spring 156 associated therewith being of sufficient tension to return the knife 151 to its up position, as shown in Figures 3 and 26. The knife is operated for its cutting stroke by the plunger bar 157 that is movable within the lugs 158 on the slide 17 and having an adjusting nut 160 and a lock nut 161 thereon. During the down stroke of the slide 17 the lower end of the plunger bar 157 engages the surface 162 of the knife head 152 and moves the same upon its pivot mounting across the knife 175 fixed to the forming die side plate 312, at which time a portion of the blank is cut off. The block 320 forms a guide for the knife and prevents the same from springing away from the knife 175. The spring 164 surrounding the plunger bar 157 is of sufficient strength to overcome the tension of spring 156 and apply sufficient power to the knife to cut the paper strip.

The knife is returned to its up position by the spring 156. In its down position the knife 151 is prevented from moving away from the knife 175 by the guide block 320.

The down position of the cutting knife 151 is determined by the engagement of the washer 324 with the washer 325, the position of the former being variable on the spring bolt 154. The washer 325 is of soft material to minimize the noise caused by the contact of the washer 324 therewith, but is not essential to the operation of the machine, as washer 324 can contact with the top of the lug 155. A similar washer 326 is located under the lug 155 to perform a similar function at the completion of the up stroke of the spring bolt 154.

In the die 165, secured to the bed plate 10, are two pins 166 which pass through openings in the punch 167 and surrounded by springs 168 which normally hold the die 165 and

punch 167 apart a sufficient distance to permit the strip 39 to be fed therebetween.

The guide 317 is an extension of the guide 150 and is supported by the support 169 at one end which is secured to the lug 170 and projects over the lower die 165 with an open space therebetween sufficient also to permit the strip 39 to pass therebetween and near the opposite end by the support 315 also secured in a fixed position.

The shoulder 173 on the die 165 serves as an edge guide for the strip 39. The die 165 and punch 167 are both provided with grooves, into which are inserted either cutting or scoring knives, designated 176, 177, 318 and 319, respectively, as may be necessary and as hereinafter described, and which may be secured in position by set screws 178 or other similar means.

There are generally two styles of boxes made on a machine of this type, one style being made of thin paper grooved on the inside and the other from heavier paper and scored or cut partly through at the corners on the outside. This latter box is then covered with a wrapper that provides a smooth finish and the edge of the wrapper is turned over the edge of the box and projects on the inside of the box for a limited distance. A die for this purpose is shown in Figure 14. With this method of mounting the cutting and scoring knives it is merely necessary in the die bed or punch to cut a groove and place therein a piece or narrow strip of steel instead of as heretofore, making the punch and die of steel and having the cutting and/or scoring knives integral therewith. As the steel for the cutting and scoring knives in my invention may be made of standard size stock it further minimizes the cost of production.

The die 165 is provided with openings 174 therethrough surrounded in part by the knives 176 so as to produce a blank substantially as shown in Figure 7 and designated 179, the scoring knives scoring the paper on the broken lines 180 and the punch 181 in the punch 167, making the finger openings 182 in the sides thereof. The openings 174 in the die 165 are provided to permit the escape of sections, as scrap pieces of the strip, to pass therethrough after being cut from the strip. These finger openings are provided in the box cover but are not required in the body of the box, as shown in Figure 6. The punch 181 is separably secured in the punch 167 by a screw 183, or the like. In making box bodies this punch 181 is not used but may be when making covers.

The punch for cutting the opening for the finger hold in the cover of the box by punch 181 cuts a round hole or other shape, if desired, and one-half of this opening cut in the paper strip is in that portion of the strip that is to be next formed into a box and the remaining portion of the opening is in that portion of the strip next following. In brief, the opening is cut through the paper which is subsequently cut so that such opening is in two separate covers. By reason thereof the opening is formed in the paper at a point distant from the cut-off knife.

As the slide 17 moves downwardly the platen 184 thereon engages the upper surface of the punch 167 near the lower limit of its downward stroke and moves the same toward the die 165 against the tension of the springs 168. This movement cuts from the strip 39 all portions of the blank except on the edge adjacent to the feed mechanism which is then fed forward and is severed from the strip between the knives 151 and 175, thus completing the blank, as shown in Figures 6 and 7.

Adjacent to the punch and die is the box folding mechanism, which consists essentially of a forming die frame 299 having an opening 185 therethrough of substantially the same area in cross section as the outside of the finished box or cover and directly below the plunger 186. The size of this opening is determined by filler plates 187 which are supported by laterally projecting lips 188 which slide in a recess 189 in the forming die frame 299 and end blocks 190, which have an overhanging head 191 which rests upon the bed plate 10 at the rear end and upon the filler blocks upon its sides.

The upper inner edge of each of the end blocks 190 is provided with an inclined face 192 of the same width as the box, leaving the portions adjacent thereto with sharp corners, as at 193, for a purpose hereinafter to be described. All of these plates are locked against movement by the adjustable frame 194, which is secured in its adjusted positions by the bolt 197, having the nuts 199 thereon, which projects through the slot 196 in the apron 195, with its head 198 resting upon the shelf adjacent to the slot.

The plunger 186 is provided with a shank 200 which projects into a recess in the lower end of the screw 201 and secured therein by a cotter pin 202 or the like. The sides of this screw are flattened to be received by the slot 203 in the slide 17 and is secured in its adjusted positions therein by the nuts 204. For convenience in adjustment of the plunger for various size boxes, one of the flat sides of the screw 201 is provided with graduations 205. The head 206 of the plunger 186 is provided with two angular faces 207 and is surrounded by two shoes 208, which have corresponding angular faces. Lying within a pocket 209 in the head 206 and in the pockets 210 of the shoes 208 is a coil spring 211, which is secured at its opposite ends to nuts 212, through each of which is threaded a screw 213. The tension of the spring is such that the angular faces on the inside of the shoes 208 are maintained in frictional con-

tact with the angular faces 207. When these parts are relatively positioned, as shown in Figures 17 and 20, the cross sectional area of the shoes 208 is substantially the same as the inside of the box or cover.

The lower plunger 214 is provided with wings 215 and is fixed on a shank 216 which projects through an opening in the upper end of the yoke 217 adjustably secured to the bed plate 10 by the T-bolts 218 and nuts thereon. On the lower end of the shank 216 is a collar 219 which limits the upward position of the plunger 214 so that the top thereof is slightly higher than the end block 190.

The extreme down position of the lower plunger 214 is limited and predetermined by the set screw 220, which contacts with the lower end of the shank 216. The wings 215 on the lower plunger 214 assures the centering thereof in the opening in the die.

In operation, as the blank is fed from the forming die, the plunger 186 moves downwardly and engages the top surface of the central portion of the blank. During the continued movement of the plunger 186 and blank the corner flaps 221 of the blank strike against the sharp corners 193 of the end block 190 and are turned upwardly in advance of the end flaps 222, which ride over the faces 192. At this time the side portions 223 are folded inwardly, bringing the corner flaps 221 inside of the end flaps 222, in which relative positions the blank with the portions turned upwardly, as above indicated, surrounds the shoes 208 and moves downwardly into the opening 185 against the tension of the lower plunger 214.

When the upper plunger first contacts with the blank 179 the end flaps 222 project over that portion of the end block 190 in extension of the inclined face 192 and the corner flaps 221 upon opposite sides thereof. As the plunger moves downwardly the corner flaps 221 are first partially turned on the scoring lines at their base because they lie upon the flat non-inclined portion of the end block 190, followed by the end flaps 222, which are turned inwardly by the inclined face 192. Thus, the corner flaps 221 are folded inside of the end flaps 222. When the plunger is in this extreme down position, determined by the screw 220, the shoes 208 can move no farther parallel with the axis of the plunger 186, but the latter has a slight additional movement. The shoes 208 are therefore forced outwardly a limited distance and the ends 224 thereof pinch the blank that is between the corner flaps 221 and end flaps 222, thus insuring a pressure upon the glued surface of the blanks and a permanent engagement therebetween.

The bottom surface of the shoes is provided with a recess having beveled corners 225 and the lower plunger 214 has similar beveled faces 226. When these plungers are adjacent to each other a slight depression is formed in the bottom of the box, which permits a slight expansibility thereof at the corners and minimizes any possibility of a break in the paper at these corners.

This slight depression in the bottom of the box insures the sides of the box being held straight and square with the bottom of the box and without an outward bulge at the top of the box. This depression also permits a slight straightening out of the bottom of the box when the contents of the box rest thereon instead of as heretofore bulging the bottom of the box downwardly and the sides outwardly.

Stop pins 233 in the shoes 208 by engagement with the surfaces 234 on the head 206 limit the inward position of the shoes 208.

In Figure 21 I have shown a modified form of the upper plunger, wherein the shoe 227 is a rigid structure, having substantially the same outside dimensions as the inside of the box with a lug 228 thereon, through which projects the shank 229 of the plunger head 230, between which and the lug 228 is the coil spring 231. This plunger mechanism operates substantially as above described with any excess movement of the screw 201, being accommodated by the spring 231 and the nut 232, limiting the upward relative movement of the plunger head 230 therein. The form of plunger shown in Figure 21 is used with the type of forming die illustrated in Figures 31, 32 and 33.

The rods 235 are rotatably mounted in the forming die frame 299 and each has one flat face 236, which is in contact with one of the faces of the end block 190. On the end of each of these rods are the rock levers 237 and 238, which are connected by a link 239. The rock lever 237 is connected by a link 240 to a lever 241 mounted upon a stud 242 in a bracket 243 fixed to the standards 16.

On the lever 241 is a roll 244, which is in the path of movement of the cam block 245 adjustably secured to the slide 17, this adjustment being designed to properly time the closing of the end block 190 on the box when the upper plunger 186 is in its proper relative position. When the slide 17 is near the limit of its down stroke the cam block 245 engages and passes the roll 244, thus causing the lower end of the lever 241 to move to the left as shown in Figure 3, and by means of the links 240 and 239 to impart a rocking movement to the rods 235, thus forcing the end block 190 inwardly. As the slide 17 moves upwardly, the cam block 245 moves out of engagement with the roll 244, and the spring 246 on the spring bolt 247 connected with the lever 241 returns the rods 235 to their former positions. The inner position of this spring bolt 247 is limited by the head 248 engaging a lug 249 on the bed plate 10.

While the round portion of the rods 235 is

against the face of the end blocks 190 the shoes 208 are moved outwardly and apply pressure to the ends of the box.

At the completion of the down stroke of the plunger, the rods 235 rotate and bring their flat sides opposite the end blocks 190. As the lower plunger moves upwardly with the upper plunger after the box has been formed, it carries and lifts the box out of the forming die, the outer end of the wings 215 contact with the lower corner of the end blocks 190 and push them outwardly, and thereafter the outer face 327 of the wings 215 ride against the inner face of the end blocks 190, thus maintaining these end blocks in their out position and also steadying the lower plunger while passing through the forming dies.

The box is stripped from the shoes 208 during the up movement of the plunger 186 by the stripper rods 250 supported in arms 251 adjustably mounted upon the rods 252 fixed in the bracket 243. These stripper rods 250 are preferably formed with lips 253, which project over the top of the box and prevent upward movement thereof with the plunger 186. The box as it is stripped from the plunger falls on the lower plunger and forming die and is swept therefrom into a receptacle conveniently arranged to receive it by a clearing lever 254 that is adjustably connected with the rock lever 255 upon a stud 256 on the bed plate 10. This latter lever is connected by a link 257 to a rock lever 258 mounted on the bed plate 10 having a cam roll 259 thereon in contact with the face of the cam 260 upon the shaft 28.

The timing of this clearing mechanism is such that there is no movement of the lever 254 except during the instant after the box is stripped from the upper plunger.

I have provided in connection with my new and improved machine a printing mechanism, which may be used or not, as desired, this being so arranged that the strip 39 may pass therethrough before reaching the gluing mechanism. The type is mounted in a movable platen 261 supported by the bracket 262. On the back of this platen 261, at each corner, are lugs 263, in which are pivotally connected the inner ends of a connecting rod 264, having a turn buckle nut 265 to vary the length thereof.

Journaled on the shafts 266 are the rock levers 267, to one end of each of which is joined the connecting rod 264, and both of said rock levers are joined by the rods 268. Also fixed on the upper of the shafts 266 is a rock arm 269, which is connected to an eccentric strap 270 on the shaft 28 by the rod 271.

The rotation of the eccentric 272 imparts a parallel movement of the platen 261 toward and away from the platen 273 over which the paper passes when traveling to the feed mechanism. This latter platen may be steam heated if desired to insure quick drying of the ink. On the lower end of the platen 261 is a shaft 321 carrying rolls 322 which ride on the tracks 323 to provide a convenient anti-friction support for the platen.

The platens 261 and 273 are of such size as to permit the placing of the type thereon in such position that it will register with the glue spots on the paper as it passes therebetween and avoid that portion of the strip thereafter to be cut therefrom.

To operate the machine without the printing mechanism the key that fastens the rock arm 269 to the shafts 266 is removed, thus rendering the printing mechanism inoperative.

Projecting rearwardly from the movable platen 261 are the arms 274, in which is mounted the shaft 275, upon the outer ends of which are fixed the inking levers 276, one being connected with a standard 277 by a link 278.

The ink rollers 279 are in the frame 280 that is pivotally connected with the rod 281 movably mounted in the inking levers 276 and surrounding which is a spring 282. These ink rollers ride across the face of the type in the platen 261 and ink the same during the rocking movement of the inking levers 276 in a well known manner.

Adjustable in the bracket 262 is the plate 283, in which is dove-tailed an ink fountain 284 of the usual form, within which is rotatably mounted an inking roller 285. On the end of the roller 285 is a ratchet 286, which is operated when the frame 280 strikes the arm 287 of the pawl 288 when the platen 261 approaches the platen 273.

In Figures 27, 28, 31, 32 and 33, I have illustrated mechanism wherein cam bars are used to move the end blocks to pinch the paper against the plunger 186 so as to more securely hold the glued portion together. Each of the cam bars 300 is constructed with a straight front face and a plurality of cams 301 upon its rear face, which cooperate with similar cams 302, upon the forming die frame 299 to move the end block as when actuated by the rods 235. These cam bars terminate at one end in the tips 303 which project through the forming die side plates 313, and are provided at the other end with a recess in which is a spring 304 which projects into an opening in the forming die side plate 312 and exerts its tension so as to move the cam bars to the left, as shown in Figure 31. The side plate 313 is held in position by the screws 314.

These cam bars are moved to the right and inwardly against the tension of the spring 304 from a cam 305 on the gear 27, through a rock lever 306, having a cam roll 307 thereon which lies in the path of said cam. This rock lever is fixed on a rock shaft 308 jour-

naled in the lugs 309 upon the bed plate 10. When the lugs 309, which may be integral or separable, as desired, are provided, the position of the brackets 139 may be changed to conform therewith, as shown in Figures 27 and 28. On this shaft 308 are two rock arms 310, each of which carries an adjustable screw 311 that contacts with the tip 303. By this mechanism the box around the plunger 186 during the downward movement thereof passes in front of the cam bars. When in this position the cam bars through pressure from the cam 305 and intermediate mechanism, in co-operation with the cams 301 and 302, are moved inwardly against the tension of the spring 304. When in this position a substantial pressure is applied to the box and the glued surfaces are pinched together with sufficient force to become fixed. After the pressure upon the cam bars 300 is released the spring 304 returns them to their former positions.

As the paper is advanced between the upper and lower plungers 214 and 186 (Figure 12) the lower plunger 214 is slightly above the top of the end blocks. At the completion of the feed the upper plunger moves downwardly and engages the paper between the two plungers just before the knife 151 cuts off the strip, thus the paper is held tightly between these plungers before being cut off and buckling of the paper by an over-feed or for other reasons is thereby prevented.

Frequently in machines of this type the vibration of the machine and the moving parts sometimes shift the paper after it has been cut and before the plungers engage therewith, in which case an imperfect box results. Even a current of air sometimes, with light paper, will disturb the paper and move it out of its proper position.

For some classes of work it is desirable to score the paper before it passes between the punch and die. In such case the scoring knives 177 are omitted. This latter scoring mechanism is preferably of the rotary type and is particularly shown in Figures 34 to 40 of the drawings, being supported in brackets 290 attached to the housings 79 having a slot in the outer end thereof. The flattened portions of the shaft 289 are movable in these slots by the screws 291 which pass freely through the shaft and are threaded into the brackets 290. Upon this shaft the scoring rolls are rotatably mounted. The type of roll used is dependent upon the type of scoring desired. These rolls are adjustable on the shaft 289 and held in their adjusted positions against endwise movement by the collars 293.

The scoring roll 292 is the most common type used, and the shaft 289 is adjusted in the brackets 290 so that the scoring edge thereof almost touches the periphery of the feed roll 44, its distance therefrom being determined by the depth of the scoring groove. The scoring roll 297 has one straight face and one angular face 298 and is generally used for scoring light paper or board. The scoring roll of the type designated 295 has companion scoring edges and an intermediate groove 296. With this latter form of scoring rolls, two parallel scoring grooves are made in the paper instead of one, which facilitates the bending of heavy board or paper without breaking.

Having described my invention, what I claim is:

1. In a machine for forming boxes having end and corner flaps; a box folding mechanism, comprising a die having an opening therethrough; one or more filler plates supported by said die and projecting into said opening; and blocks projected into said opening and supported by said dies, said blocks being formed so that as the blank moves thereby the corner flaps will be turned inwardly in advance of the end flap; and means for actuating said blocks whereby pressure will be applied to all of said flaps after the same have been moved into their permanent position.

2. In a machine for forming boxes; a box folding mechanism, comprising a die having an opening therethrough; one or more filler plates supported by said die and projecting into said opening whereby means are provided to vary the length of the box; blocks projecting into said opening and supported by said dies; a plunger movable into and out of said dies; and means for moving said blocks toward each other when the plunger is within the die.

3. In a machine for forming boxes; a box folding mechanism comprising a die having an opening therethrough; one or more filler plates supported by said die and projecting into said opening; and blocks projecting into said opening and supported by said dies, the inner edge of each of the blocks having an inclined face; and means for locking said filler plates against relative movement.

4. In a machine for forming boxes; mechanism for shaping the box from a strip of material, comprising in part a plunger; means for limiting the extent of movement thereof an enclosing element, a second plunger having a head portion with angular walls; pressure members enclosing the said head portion, and provided with angular walls, movable on the head portion, with an angular wall of each pressure member in frictional engagement with an angular wall of the said head portion; yielding means for maintaining contact of the angular walls of each of the pressure members with an angular wall of the second plunger; and means for moving the second plunger toward and away from the first plunger, said movement continuing after the pressure members are held against

movement parallel to the axis of the plungers whereby a lateral movement is imparted to each of said pressure members.

5. In a machine for forming boxes; mechanism for shaping the box from a strip of material, comprising in part companion plungers; an enclosing element, one of the plungers having a head portion with angular walls, pressure members having similar angular walls movable on the head portion, with the angular wall of one pressure member in frictional engagement with an angular wall of the head portion, and held against lateral movement by said head portion, and a yielding member extending from one pressure member to another pressure member and through an opening in the said head portion.

6. In a machine for forming boxes; mechanism for shaping the box from a strip of material, comprising in part companion plungers; an enclosing element, one of the plungers having a head portion with angular walls and pressure members having similar angular walls movable on the head portion with the angular wall of one pressure member in frictional engagement with the angular wall of the head portion and each provided with sides that lie substantially parallel with the sides of the head portion and prevent lateral movement relative thereto.

7. In a machine for forming boxes; mechanism for shaping the box from a strip of material, comprising in part companion plungers; an enclosing element, one of the plungers having a head portion with angular walls, and pressure members having similar angular walls movable on the head portion, with the angular wall of one pressure member in engagement with an angular wall of the head portion; and stop means associated with said angular walls for limiting the movement of the members relatively to each other.

8. In a machine for forming boxes; mechanism for shaping the box from a strip of material, comprising in part companion plungers; an enclosing element, one of the plungers having a head portion with angular walls, and pressure members having similar angular walls movable on the head portion, with the angular wall of one pressure member in engagement with an angular wall of the head portion; and interior tension means for maintaining the angular walls in frictional engagement with each other, comprising a spring, each end of which is fixed to a pressure member.

9. In a machine for forming boxes; mechanism for shaping the box from a strip of material, comprising in part companion plungers; an enclosing element, one of the plungers having a head portion with angular walls and a recess therein that is open at both ends at the angular walls, and pressure members having similar angular walls movable on the head portion with the angular wall of one pressure member in engagement with an angular wall of the head portion; and interior tension means connected with each of the pressure members and extending through said recess for moving the pressure members toward each other and maintaining the angular walls in frictional engagement with each other.

In testimony whereof, I have hereunto affixed my signature.

JULIAN A. GILES.