

No. 661,331.

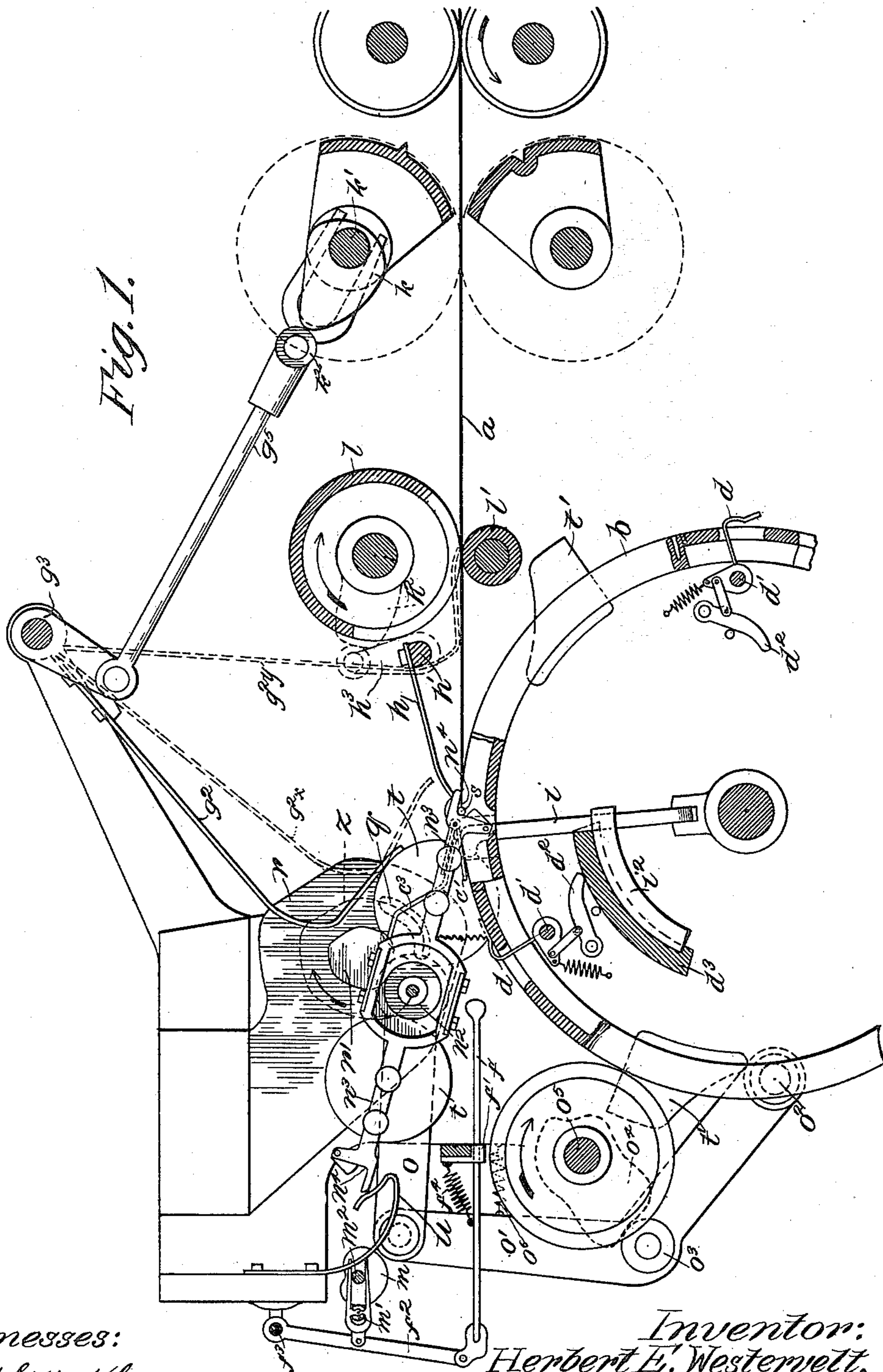
Patented Nov. 6, 1900.

H. E. WESTERVELT.
PAPER BAG MACHINE.

(Application filed Oct. 21, 1899.)

(No Model.)

6 Sheets—Sheet 1.



Witnesses:
J. M. Skinkle:
H. H. H. Leach

Inventor:
Herbert E. Westervelt,
By J. W. Barton,
Attorney.

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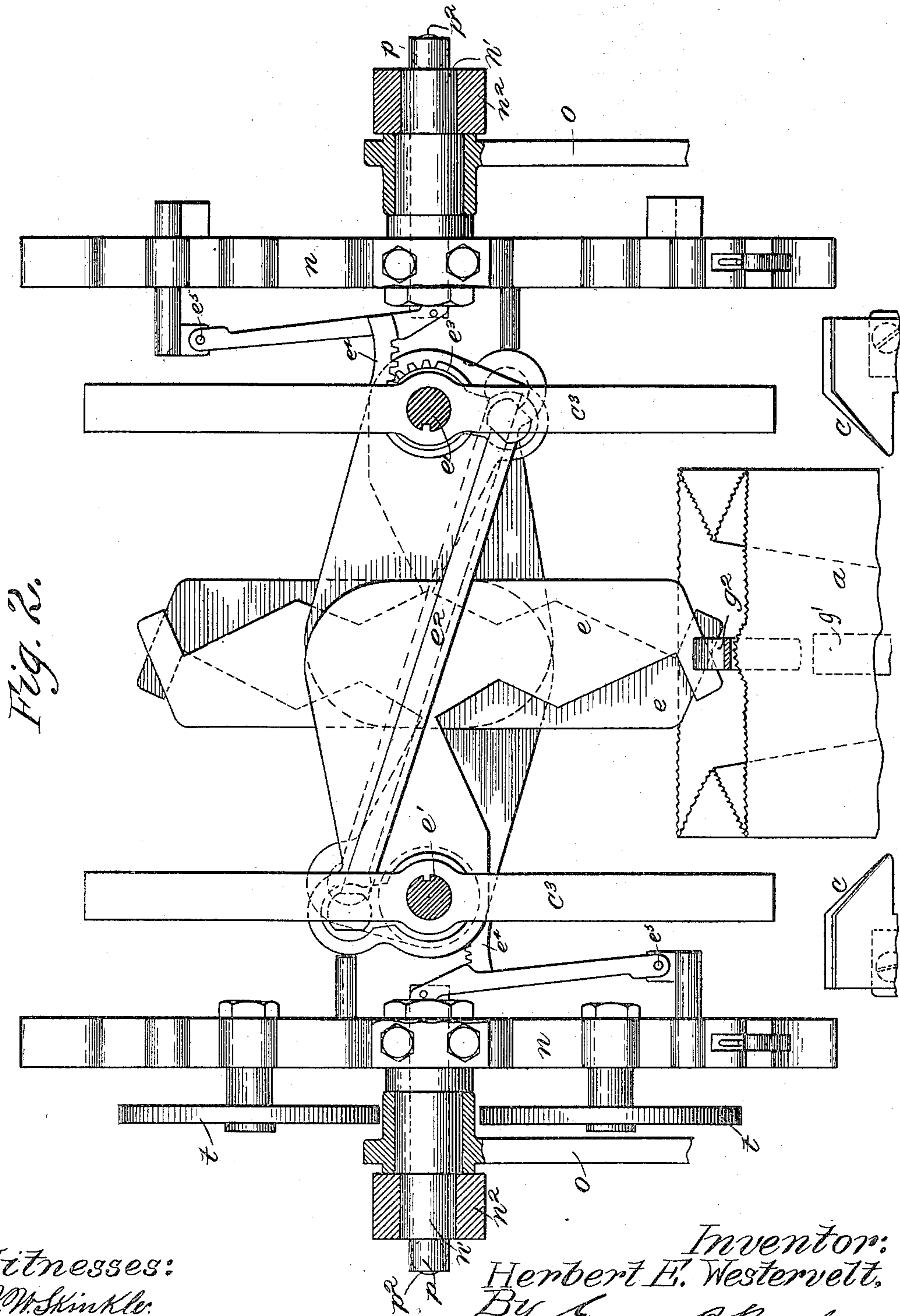
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J. M. Skinkle.
H. H. Lach

Inventor:
Herbert E. Westervelt.
By George P. Barton,
Attorney.

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6 Sheets—Sheet 3.

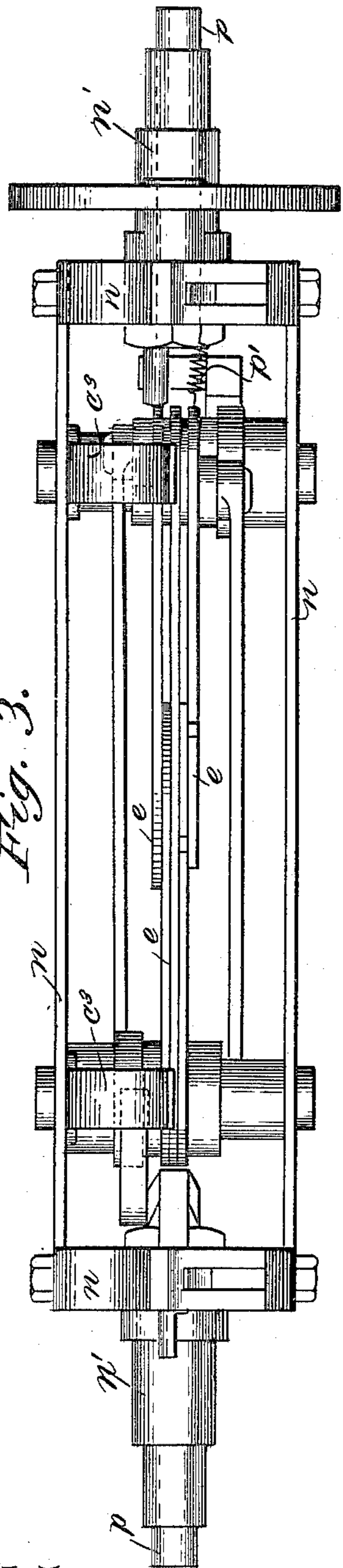


Fig. 3.

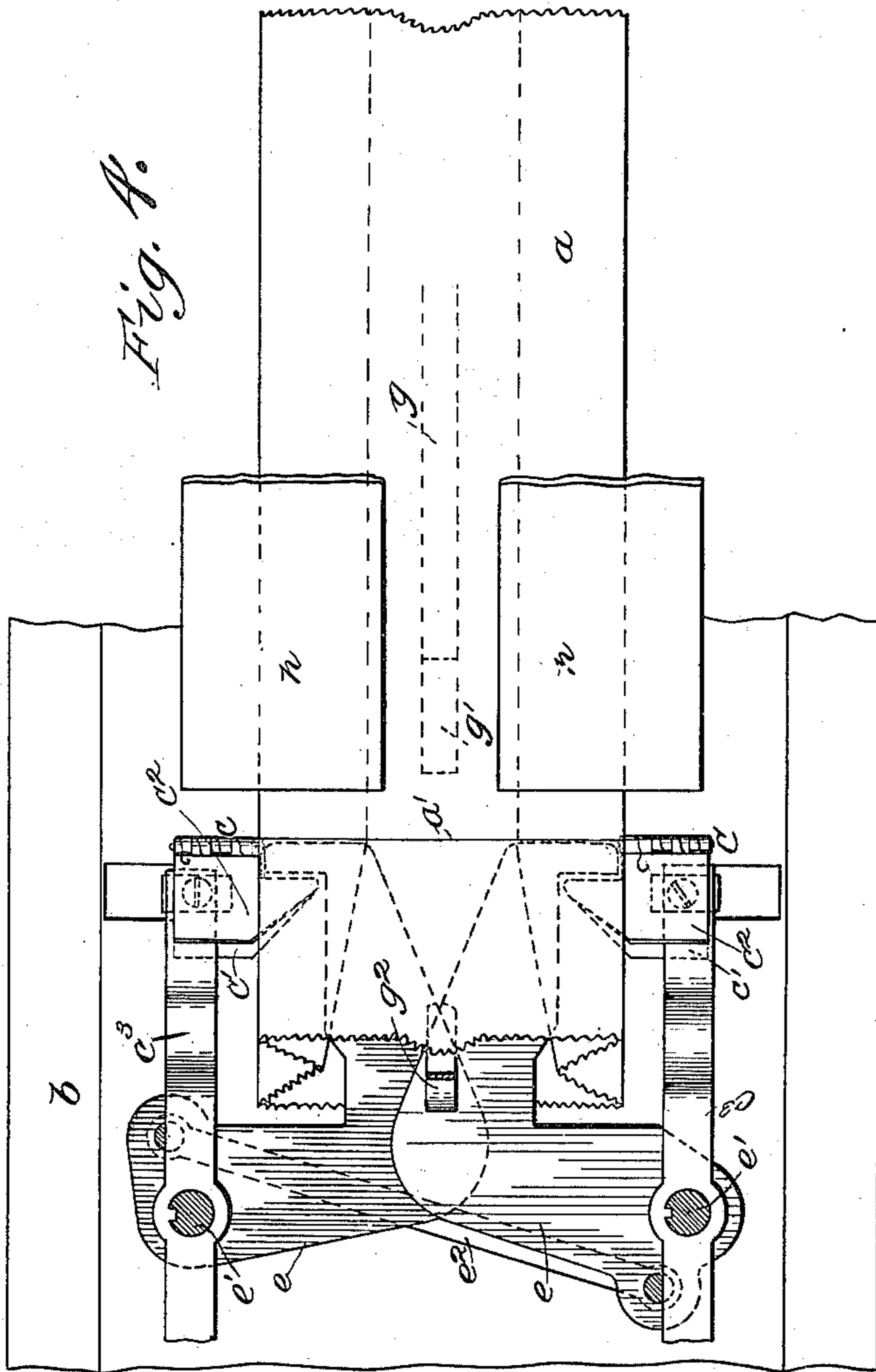


Fig. 4.

Witnesses:
J. M. Skinkle.
W. H. H. Leach.

Inventor:
Herbert E. Westervelt.
By George P. Barton
Attorney.

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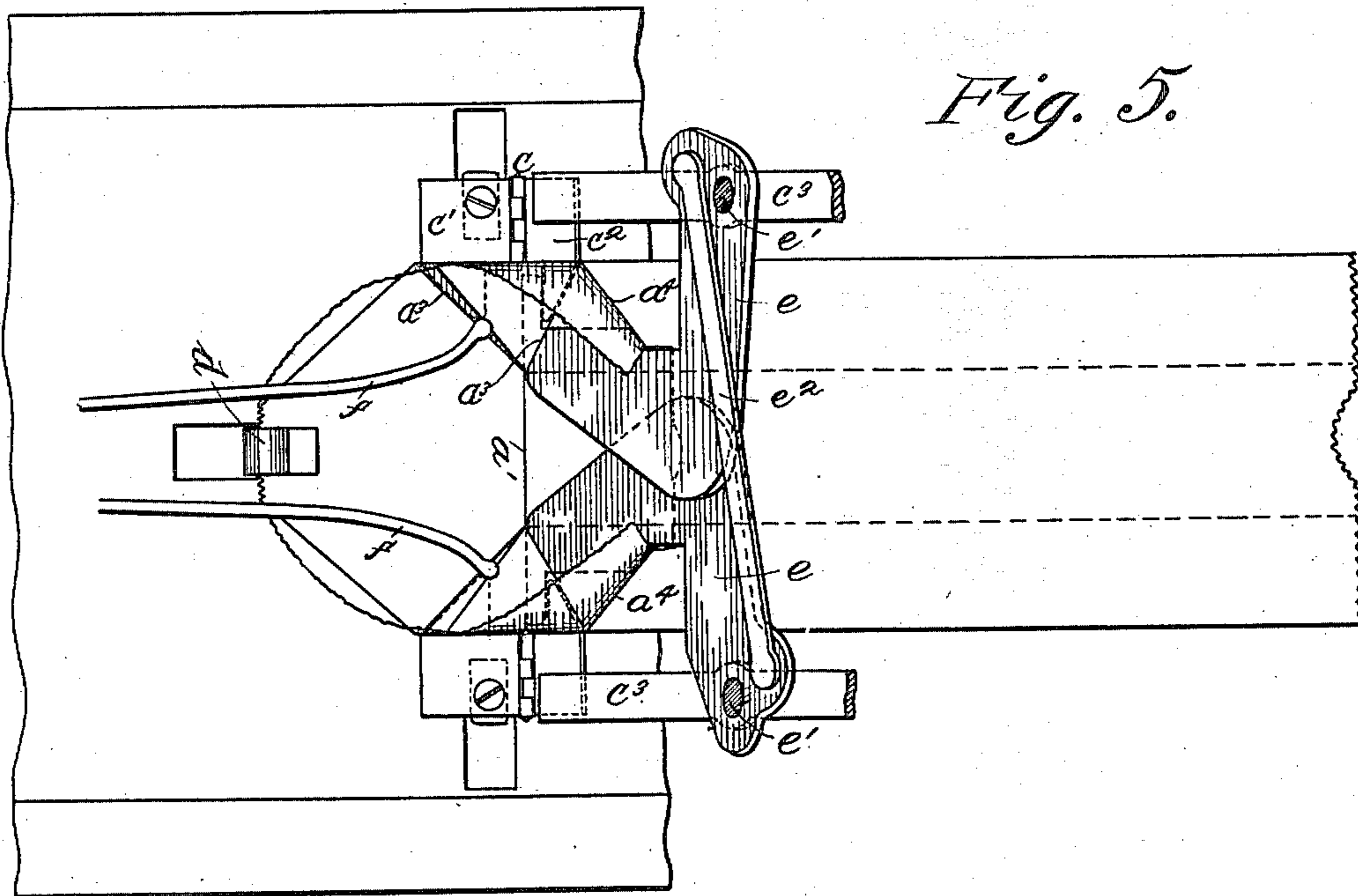


Fig. 5.

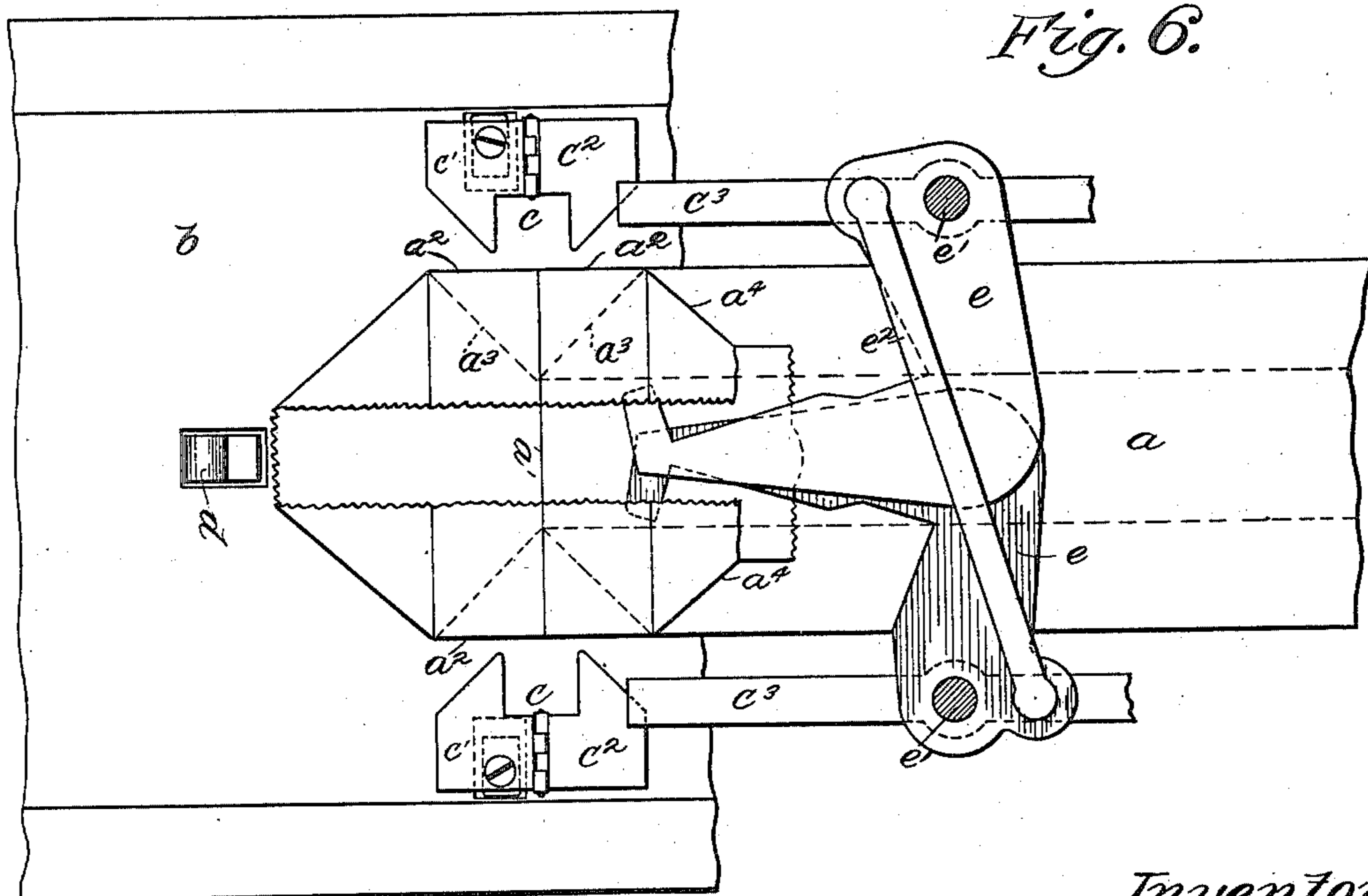


Fig. 6.

Witnesses:
J. McKinkle:
W. H. H. Leach.

Inventor:
Herbert E. Westervelt,
By George P. Barton.
Attorney.

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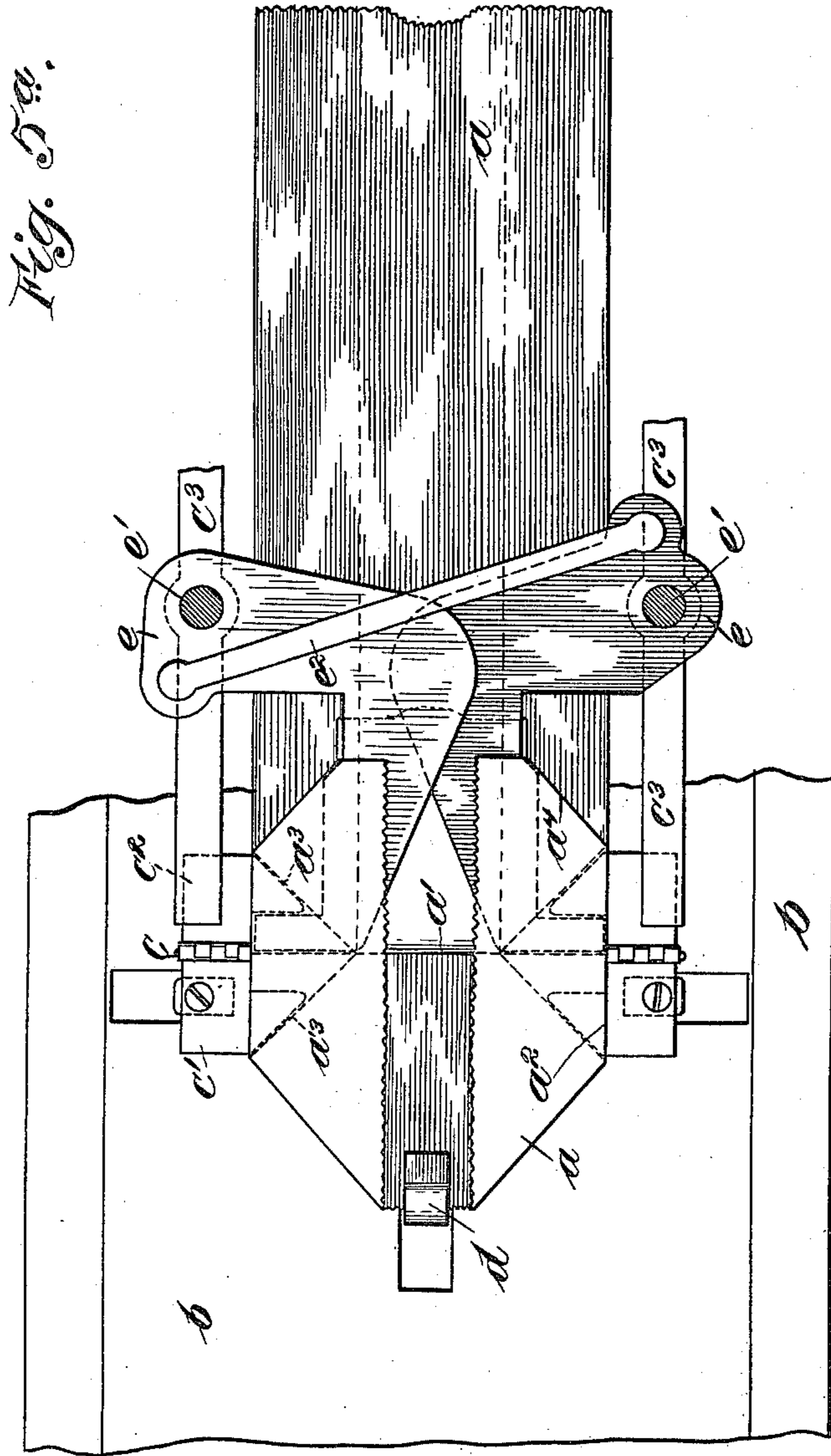
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6 Sheets—Sheet 5.



Witnesses:
J. M. Skinkle,
W. H. Leach

Inventor:
Herbert E. Westervelt,
By Guy R. Barton
Attorney.

No. 661,331.

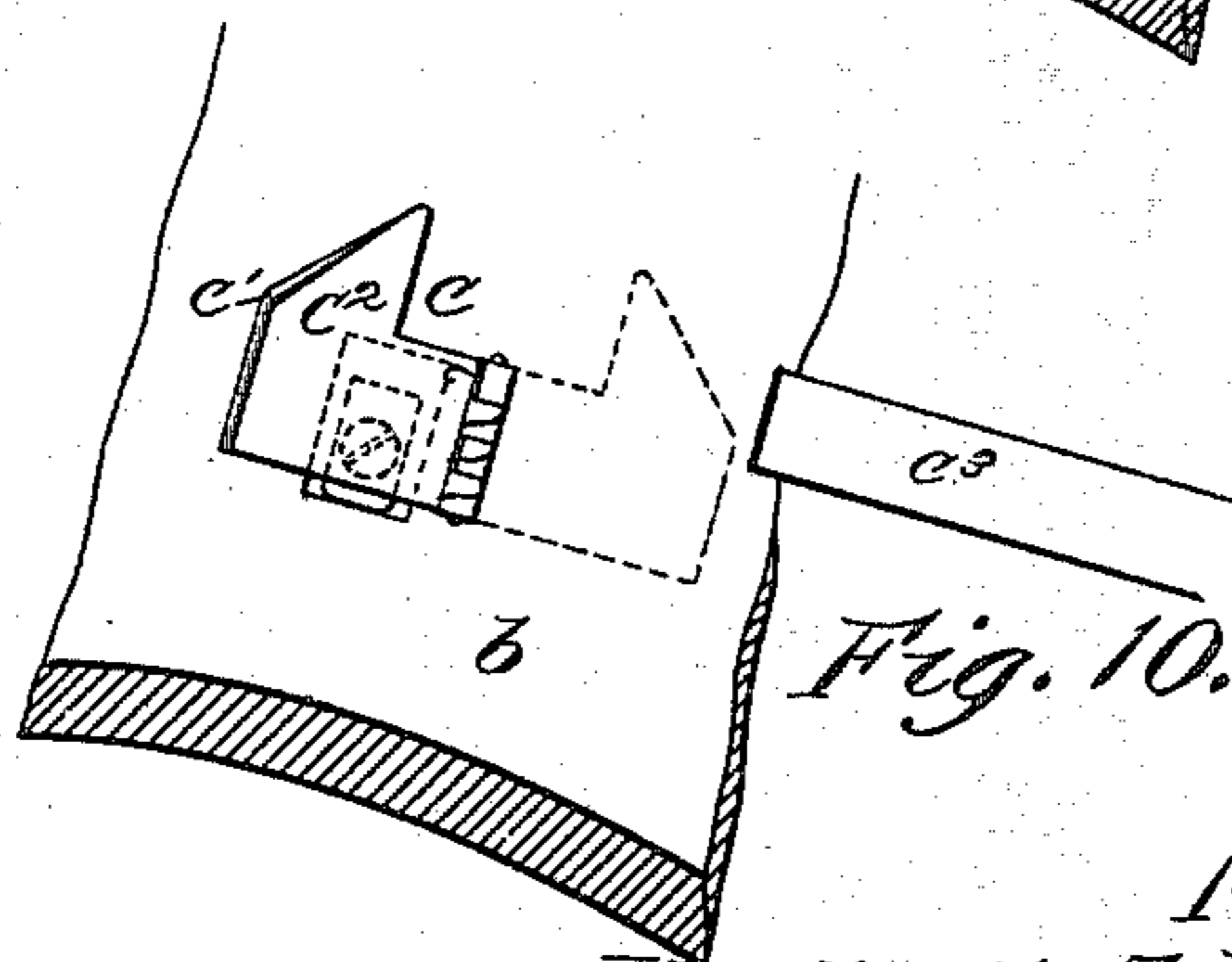
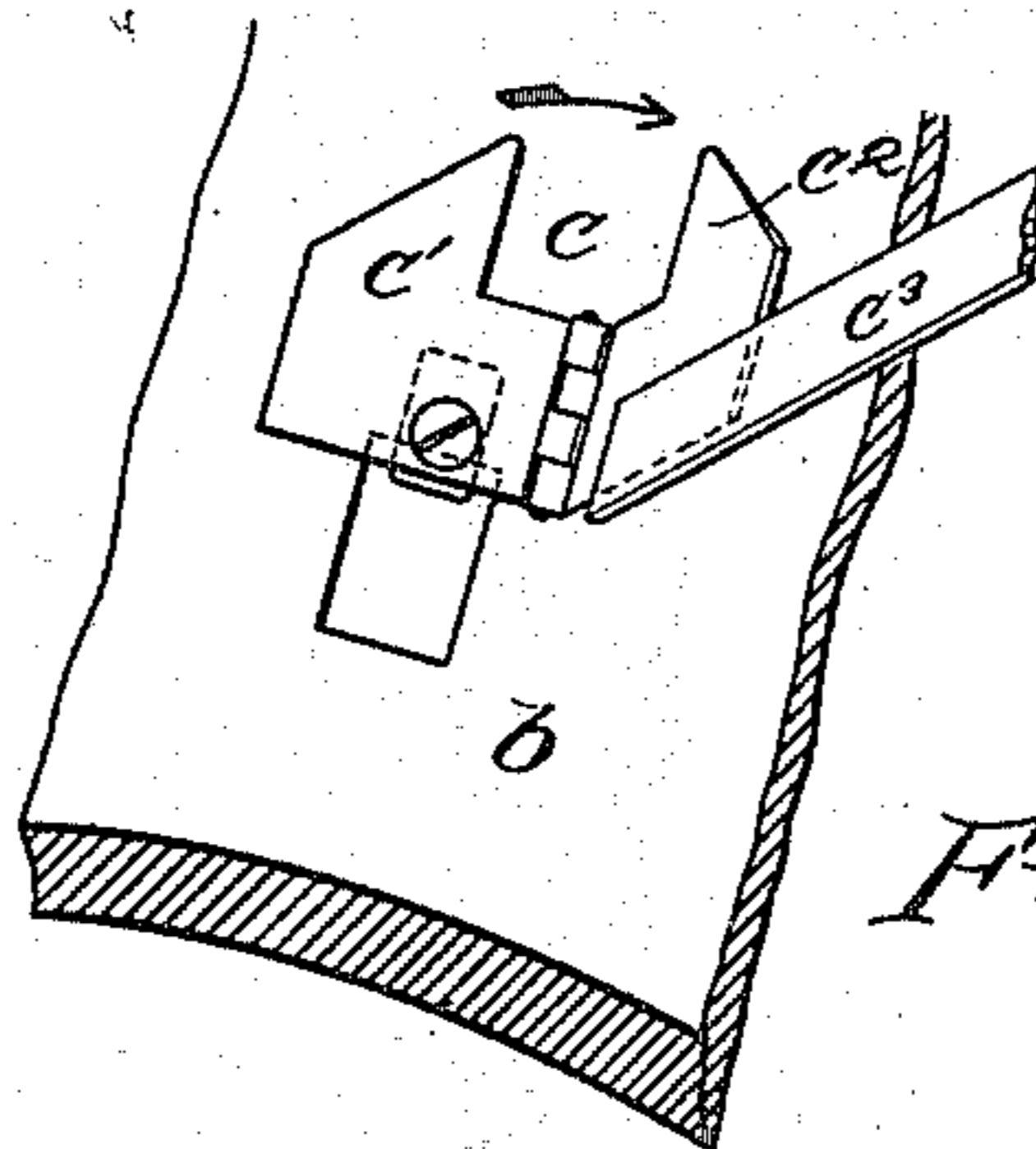
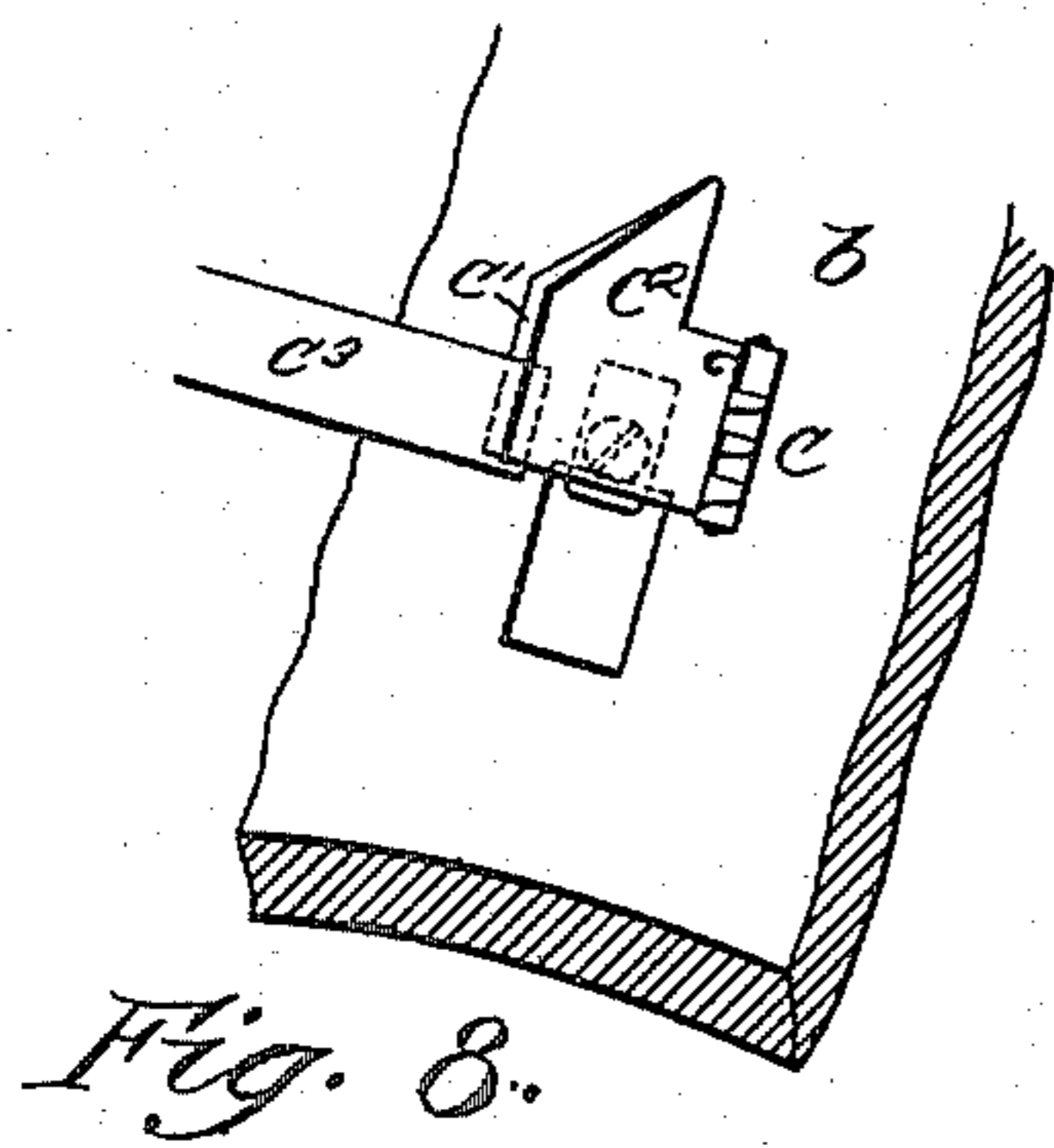
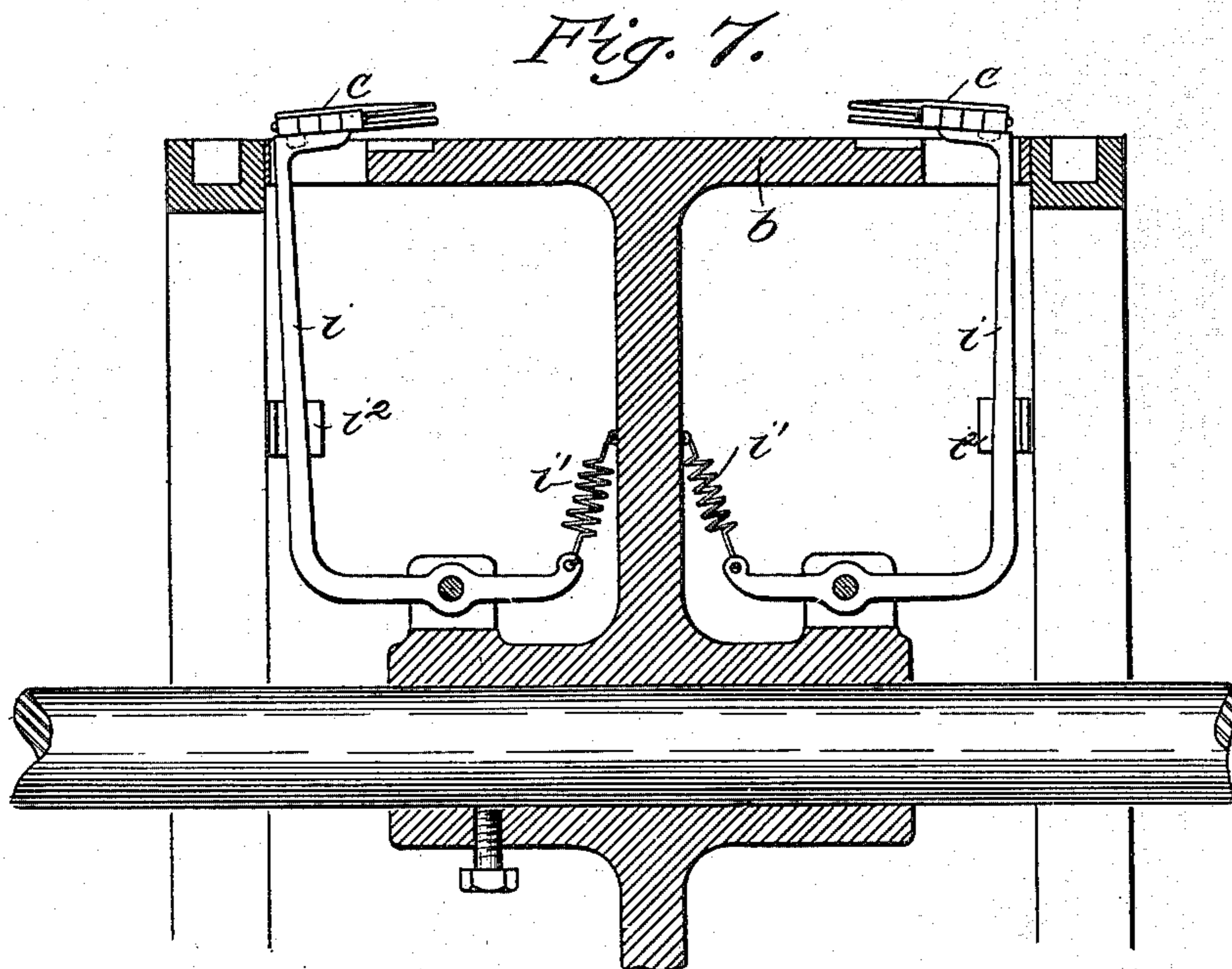
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(No Model.)

6 Sheets—Sheet 6.



Witnesses:
J. M. Skinkle,
W. H. H. Leach.

Inventor:
Herbert E. Westervelt,
By *George Barton*
Attorney.

UNITED STATES PATENT OFFICE

HERBERT E. WESTERVELT, OF SOUTH BEND, INDIANA.

PAPER-BAG MACHINE.

SPECIFICATION forming part of Letters Patent No. 661,331, dated November 6, 1900.

Application filed October 21, 1899. Serial No. 734,365. (No model.)

To all whom it may concern:

Be it known that I, HERBERT E. WESTERVELT, a citizen of the United States, residing at South Bend, in the county of St. Joseph and State of Indiana, have invented a certain new and useful Improvement in Paper-Bag Machines, (Case No. 2,) of which the following is a full, clear, concise, and exact description.

My invention relates to improvements in paper-bag machines, and has for its object the provision of more efficient mechanism for forming the diamond fold in the bottoms of square satchel-bottomed bags. In the formation of this fold it is necessary that the bel-
lows-folded bag-blank be securely held in place upon the folding-bed, while suitably-constructed parts engage various portions of the said blank and by reason of various motions imparted to such mechanical parts the necessary tension and constraint are placed upon the blank in such manner as to cause its forward portion to fold back against itself and form the characteristic diamond fold. Various instrumentalities have been designed and constructed to form this fold in connection with bag-making machinery; but these commonly present various undesirable features in construction and operation, which my present invention is designed to overcome.
There are described in United States Letters Patent No. 621,881, issued to myself March 29, 1899, and in my application for United States Letters Patent, Serial No. 727,788, filed August 19, 1899, bag-making machines to which my improvements may be readily applied. However, various other types of existing bag-making machines may advantageously be equipped with my improvements. The present invention, however, is particularly well adapted for use in connection with the bag-making machine disclosed in my last-named patent application, to which I respectfully refer and in connection with which machine I will now disclose my improvements. These may be briefly summarized as consisting of expansible or hinged folding members, which members are adapted to enter the side tucks and engage a double ply of the paper-bag blank and shape and fold the triangular bottom tucks of the bag. These folding members, preferably, are mounted upon and form a part of the side

grippers, which grippers are provided with separate actuating devices permitting their independent movement and adjustment. In connection with my hinged folding members I also employ a defining-plate, which in the present embodiment is laterally cut away and serves to relieve the single ply of the bag-blank engaged thereby from strain at certain points.

The features of my invention will be more readily understood by reference to the accompanying drawings, in connection with which I will now describe the same more at length.

Figure 1 is a vertical sectional elevation of a portion of a paper-bag machine embodying my invention, wherein certain well-known parts are omitted or broken away for the sake of clearness. Fig. 2 is a plan view of the defining-plate carriage and its associated parts, illustrating the members of the defining-plate in a contracted position previous to entering the mouth of the bag-blank. Fig. 3 is a front elevation of the carriage and defining-plate. Fig. 4 shows in plan view the defining-plate and associated parts in the initial stage of forming the diamond fold in a bag-blank. Figs. 5, 5^a, and 6 are views illustrating successive steps in the formation and completion of said diamond fold. Fig. 7 is a vertical sectional view of the cylindrical folding-bed, showing the combined side grippers and hinged folding members; and Figs. 8, 9, and 10 are fragmentary views showing a portion of the folding-cylinder with the hinged side-folding members and the actuating folding-fingers in various positions for forming the triangular side tuck in the bag-bottom.

The same letter of reference is used to designate like parts in each of the several figures of the drawings.

As in my last-named patent application I will describe in brief the general operation of my improved machine in forming the diamond fold before proceeding with a detailed description of the several instrumentalities cooperating to produce said fold. This operation is graphically set forth in Figs. 2, 4, 5, and 6, showing parts of the machine and the bag-blank in various stages of completion of the diamond fold.

The bellows-folded tubular bag-blank *a*,

which is formed from a roll of paper by means well known in the art, is fed through the machine onto the rotary cylindrical folding-bed *b*, whereon the forward end of the blank is
 5 attacked by the folding mechanism of my invention. The folding bed or cylinder *b* is provided with side grippers *c c*, which are adapted to engage the lower ply of the tubular blank from the sides, entering the bellows
 10 fold between the upper and lower ply and serving to assist in defining certain creases of the diamond fold while holding said lower ply tightly down upon the surface of the cylinder. The cylinder is further provided with
 15 a front or center gripper *d*, which is adapted to engage the lower forward edge of the open mouth of the bag-blank as the latter is advanced, holding this part of the blank down to the surface of the cylinder and coacting
 20 with the side grippers to define the creases which are presently to be formed in the blank. To keep the mouth of the forward end of the bag-blank open as it advances onto the cylinder a reciprocating tongue *g*, carrying upon
 25 its end a pair of distended fingers *g' g'*, is provided within the tubing, moving forward as the bag-blank advances onto the cylinder and later moving rearwardly again, so as to be out of the way when the rear end of the
 30 bag is cut off. I provide an auxiliary tongue *g²*, which is adapted to engage the upper edge of the open mouth of the oncoming bag-blank as the tongue *g* recedes, said auxiliary tongue serving to hold the mouth of the bag open at
 35 the time the contracted members of the defining-plate are inserted between the folds of the upper ply thereof—that is to say, the inner reciprocating tongue, with its distending-fingers *g' g'*, opens the mouth of the bag sufficiently to allow the tongue *g²* to enter, where-
 40 upon as the tongue *g* recedes the upper edge of the bag-blank is transferred from its distending-finger *g'* to the tongue *g²*, which in turn transfers the upper ply of the bag-blank
 45 to the defining plate. As soon as the defining-plate is well within the mouth of the bag-blank the finger *g²* is quickly withdrawn and returned to its initial position. The expansible folding or defining plate, which is formed
 50 by two reciprocally-acting flat arms or members *e e*, is moved into position to be automatically entered between the folds of the upper ply of the bag-blank as the latter is fed forward onto the cylinder *b*, and after having
 55 been expanded within the upper ply of the blank the plate is given a rearward circular sweep about its lower edge as an axis to fold the paper. The creases in the upper ply of the bag-blank incident to the diamond-folded
 60 bag-bottom are thus defined by the outer edges of the expanded folding-plate, the primary cross-crease *a'* being formed by the lower edge of the plate which presses against the surface of the cylindrical folding-bed *b* and forms the
 65 axis about which the plate rotates in making its rearward sweep. Immediately preceding the entry of the expansible defining-plate

within the open mouth of the bag-blank the combined side grippers and hinged folding members *c* are actuated to enter within the
 70 bellows fold upon either side of said blank and clamp the lower double ply of the bag-blank upon the folding-table. The forward edges of both portions *c' c²* of the hinged folding members, as the same are entered within
 75 the fold or tuck, form an angle with the interior longitudinal edge of said fold substantially of forty-five degrees, which devices co-acting with the defining-plate and front gripper *d* serve to form the angular creases which
 80 obtain in the interior bottom portion of a square satchel-bottomed bag. Immediately following the entry of the defining-plate within the expanded mouth of the bag-blank and during the period of its expansion therein the
 85 folding-fingers *c³*, carried upon the defining-plate frame or carriage, enter between the upper and lower portions of the hinged folding members *c' c³*. Just as the carriage of the defining-plate, with its associated parts, is
 90 beginning its rearward sweep or folding movement about the forward edge of the defining-plate a pair of striking-fingers *f f* are suddenly engaged with the inner edges of the bellows fold at the mouth of the oncoming
 95 bag-blank, giving these edges an outward push to start the formation of the creases *a² a²*, which extend at right angles with the inner longitudinal bellows crease and which when the bag is completed constitute two of
 100 the opposite edges of the square bag-bottom.

More specific reference to Figs. 2, 4, 5, and 6 will serve to make perfectly clear the several stages in the formation of the diamond
 105 fold.

In Fig. 2 are shown the defining-plate frame with the members of the defining-plate contracted immediately before the same enters within the upper fold of the expanded mouth of the oncoming bag-blank. The tongue *g*
 110 has transferred the upper ply of said blank to tongue *g²*, which holds it open to receive said defining-plate. The front gripper *d* is raised and is about to engage the lower forward edge of the bag-blank.
 115

In Fig. 4 the bag-blank is shown securely clamped to the folding-table by means of the forward gripper *d*, which engages the front edge of the bag-blank, and the side grippers *c*, which have entered at either side of the
 120 bellows fold and clamped the double ply of the bag-blank in position. The defining-plate is shown fully expanded within the bag-blank immediately beneath the upper ply, while the folding-fingers *c³* have entered be-
 125 tween the upper and lower portions or wings *c' c²* of the folding members. A depressing-plate *h* engages the exterior surface of the upper ply of the blank a short distance beyond the parallel edge of the defining-plate
 130 and serves to keep the bellows fold tightly closed. This assists in securing the expansion of the defining-plate within the upper bellows fold immediately below the upper

ply of the blank and above the tucks and also coacts with the defining-plate to some extent in preventing wrinkles in the primary cross-crease about to be formed at the lower edge of the defining-plate.

In Fig. 5 the defining-plate is shown about midway in its rearward sweep, the mouth of the bag being open, wherein are shown the striking-fingers f , which are in the act of expanding the bellows fold at this point. The folding members c , actuated by the folding-fingers c^3 , are shown part way open in the act of forming creases a^3 of the entering triangular tuck in the bag-bottom auxiliary to the diamond fold. The primary crease is partially formed while the upper shoulders of the defining-plate engaging the upper extremities of the diamond fold are exerting tension upon the mouth of the bag-blank, tending to cause the middle portion thereof to fold inwardly.

The diamond fold is fully completed in Fig. 6, both side and front grippers being withdrawn from their positions of engagement with the bag-blank. The defining-plate, which now lies in a plane substantially parallel with the body portion of the blank, has folded the upper ply of the portion of the bag-blank beyond the primary crease back against itself, and the defining-plate is about to withdraw entirely from the mouth of the blank. The folding-fingers also are shown in position immediately before being disengaged from the folding members. Springs at the hinged connections of said folding members immediately thereafter will serve to actuate the members c^2 back to their first relative positions with relation to the gripper member c' , in which positions they form small angles therewith. During the rotation of the defining-plate frame about the lower edge of the defining-plate the rigid fingers c^3 , in engagement with the upper wings of the folding members c^2 , serve to turn said wings of the latter upon their hinged connections and exert tension upon the double plies of the bag-blank with which they are engaged, serving to exert tension thereon and in conjunction with the defining-plate cause the formation of the diamond fold. This will be fully understood by a reference to the figures of the drawings under consideration.

The mechanism for forming a strip of paper into bellows-folded tubing and the mechanism for feeding the tubing forward onto the cylindrical folding-bed and for cutting off sections of the tubing as bag-blanks is well known in the art and will not be described. I have omitted from the drawings as many of the old and well-known parts of the paper-bag machine as possible to avoid uselessly obscuring the drawings with a multiplicity of unimportant details, retaining, however, enough to show clearly the application of my invention. The mechanism for operating tongue g has not been illustrated, since the same forms part of the prior art.

I will now proceed to describe at greater length the mechanism shown in the accompanying drawings, illustrating an embodiment of my invention.

The auxiliary tongue g^2 is mounted upon a rock-shaft g^3 , whereby it may be oscillated, causing it to assume various positions, as indicated by the dotted lines. A rotating cam-plate k , carried by one of the shafts k' of the machine, is adapted to reciprocate said tongue g^2 at proper intervals. A connecting-rod g^5 , which carries a cam-roller k^2 , engaged by the cam-plate k , is connected with an operating-lever attached to the shaft. The auxiliary tongue g^2 is shown by means of dotted lines in two alternative positions. Position g^{2x} is assumed when the tubular bag-blank is transferred to the defining-plate, while position g^{2y} is that of said tongue when the bag-blank is being transferred to it from the distended ends of the sliding tongue g . The tongue g^2 , as shown in full lines, Fig. 1, has reached the forward end of its journey after having transferred the bag-blank to the defining-plate and is on the point of quickly returning to the position g^{2y} , which is out of the path of the carriage or frame of the defining-plate when the same makes its rearward sweep, and at the same time said tongue is in position to receive the oncoming upper edge of the succeeding bag-blank.

Referring now to the feeding-rollers l l' , serving to supply the bellows-folded tubing to the cylinder b , it will be seen that the upper roller l is mutilated, having a portion of its periphery cut away, so that it will engage the length of bellows-folded paper tubing during only a portion of its rotation. This mutilation of the roller l permits the tubing to be readily opened out or expanded for the purpose of inserting the defining-plate, as already described. The speed at which the paper is fed forward is preferably less than the surface speed of the cylinder. This permits various lengths of bags to be made on the one machine without changing or adjusting the cylinder or the speed thereof, the slower speed of the feed-rollers acting to hold the paper tubing back while each section or bag-blank is carried swiftly forward by the rotary cylinder.

In the machine herein shown I preferably provide three sets of front grippers and side-folding members c , which are mounted thereon at equidistant intervals upon the periphery of the folding cylinder or bed. This merely involves a duplication of parts for increasing the capacity of the machine, and I have chosen to illustrate herein but one of these three sets. The front gripper d is a small flat finger bent rearwardly to extend over the edge of the bag-blank. This front or central gripper is mounted upon a rocking shaft d' , which is adapted to be operated by a cam-lever d^2 . A cam d^3 , stationarily mounted upon the frame of the machine, is adapted to be engaged by the cam-lever d^2 of each

front gripper. This cam d^3 is shown in Fig. 1 and is of such length that the front gripper is caused to engage the front edge of the lower ply of the bag-blank during the same time that the bellows folds thereof are engaged by the side grippers—that is, during the time that the diamond fold is being formed.

The construction of the combined side grippers and hinged folding members c will be fully understood by referring to Figs. 7 to 10, inclusive. These are pivotally mounted upon the shaft-collar of the cylinder b at the ends of arms i , springs i' serving normally to maintain said grippers out of engagement with the bed of the cylinder. The arms i extend through slots cut in the periphery of said cylinder, wherein they have lateral play sufficient to permit the grippers to clear the edges of the bellows-folded paper tubing. Cams i^2 , stationarily mounted in the machine, are provided, with which the arms i are adapted to engage at proper intervals, causing them to rock inwardly, and thereby entering the two wings c' c^2 of the hinged folding members within the tucks of the oncoming bag-blank and clamping the same securely in place upon the folding-bed. At the hinged connection of each of the wings of the folding member a spring is provided which is adapted by reason of the construction of said hinge to maintain the two wings closed sufficiently to insure their insertion within the tuck, but slightly separated from each other at their forward edges, whereby the folding-finger c^3 is caused to enter between the two wings and effect the formation in the bag-bottom of the triangular side tuck, as already explained. From the construction and mounting of the said folding-fingers c^3 the same in executing their rearward sweep rotate upon an axis—namely, the edge of the defining-plate—which is substantially identical with that of the hinges, thus causing the upper wings of the hinged folding members to execute precisely the same movement as does the carriage of the defining-plate and its several parts. As already stated, the defining-plate is cut away, so that the same only partially conforms to the creases of the diamond fold. This will be fully apparent by referring to Fig. 5, wherein it is seen that the mutilated angular shoulder engages only a short portion of the crease a^4 . This is desirable in making certain classes of bags, by reason of the fact that the defining-plate, if it fully conforms to the folds a^2 and a^4 , as shown in my prior patent application, is likely when placing tension upon relatively thin paper to tear the bag material at the obtuse angular corners formed at the junctions of the creases or folds a^2 and a^4 . This is because the defining-plate operates upon a single ply of the bag-blank, and when expanded in the mouth thereof a very appreciable tension is necessary to cause the formation of the diamond fold when the defining-plate executes its folding movement. This is particularly true in a bag-making ma-

chine which is to operate at a high rate of speed. I have therefore in my improved machine provided the side-folding members c , which being inserted within the tuck of a bag-blank necessarily operate upon double thicknesses of paper and which conforming to the triangular bottom tuck of the bag greatly assist in forming the diamond-fold with very much less likelihood of tearing some classes of paper-bag materials than in prior structures.

Referring now to Figs. 1 and 5, I will describe the means for causing the striker-fingers $f f$ to perform their function. These striker-fingers, it will be remembered, push the inner edges of the bellows folds or creases outward just as the defining-plate is beginning its rearward circular sweep and serve to start the paper in a direction to form the creases a^2 a^3 . The striker-fingers $f f$ are mounted to move longitudinally in a bearing-block f' and are connected with an operating-lever f^2 , pivoted at f^3 to the frame of the machine. A spring f^4 tends to move the fingers in a direction to strike the paper—that is, in a rearward direction—and a cam m is provided for controlling this striking movement. The cam m is engaged by a cam-roller m' , which is connected with the operating-lever f^2 , said cam m being mounted upon a suitably-driven shaft m^2 .

In Figs. 2 to 6, inclusive, the defining-plate and its operating mechanism are shown with considerable detail, which have already been considered briefly in describing the function and operation of these parts. The members $e e$ of the defining-plate are pivoted at $e' e'$ and are connected together by a cross-lever e^2 , which causes them to act reciprocally. A toothed wheel e^3 is carried by one of the members of each defining-plate, which is adapted to be engaged by a segmental rack e^4 , pivoted at e^5 to the framework of the carriage n . The carriage is formed with trunnions $n' n'$ at its ends, which are carried by the arms $o o$, whereby the carriage may be rotated or turned end for end upon its trunnions. The trunnions are hollow, and reciprocating rods or pins $p p$ are mounted to be moved longitudinally within the bores thereof. Each rod p is connected with one of the segmental racks e^4 for rocking the same upon its pivot, so that as the rods are moved to and fro within the bores of the hollow trunnions the defining-plates associated with the said rods through the medium of the toothed wheels e^3 and segmental racks e^4 will be expanded or contracted, accordingly as said rods move out or in. Springs $p' p'$ are provided upon the carriage n , which tend to maintain the defining-plates in a contracted position—that is, with the pins $p p$ protruding from the ends of the trunnions $n' n'$ —and when the pins are pushed in until they are substantially flush with the ends of the trunnions the defining-plates will be expanded. Cam-rollers $p^2 p^2$ are provided in the ends of the pins $p p$ for en-

gaging certain cam-grooves hereinafter to be described, whereby the defining-plates may be expanded and contracted.

In order to cause the defining-plate to occupy its proper angular positions and to make its rearward circular sweep, the carriage *n*, upon which the two sets of defining-plate members are mounted, is caused to rotate upon its trunnions, and the trunnions are themselves moved around in the path indicated by the dotted line *z* in Fig. 1, an arrow serving to indicate the direction of such motion. Cam-rollers *n*² *n*² are provided upon the projecting ends of the trunnions *n*¹ *n*¹ of the carriage, said cam-rollers being adapted to travel upon the peripheries of cams *r*¹ *r*¹, formed upon the plates *r* *r*, which are stationarily mounted upon the frame of the machine. Cam-grooves *q* *q* are cut in the plates *r* *r*, into which the extremities of the pins *p* *p* are adapted to be forced during a portion of their journey, permitting the defining-plates to be contracted at such times, while during the remainder of the journey the cam-rollers *p*² *p*² in the ends of the pins simply ride upon the surface of the plates *r* *r*, thus maintaining the defining-plates expanded. The cam-grooves are of such length and position that the defining-plates are maintained expanded during the formation of the diamond fold and contracted when they are removed from the fold and until they have been entered in the mouth of the succeeding bag-blank.

The arms *o* *o*, which directly support the carriage *n*, are pivoted at their ends to cam-levers *o*¹ *o*¹, the opposite ends of which cam-levers are pivoted at *o*² *o*² to the framework of the machine. Cam-rollers *o*³ *o*³ are carried by the levers *o*¹, said rollers being engaged by rotating cam-plates *o*⁴, which are mounted upon the shaft *o*⁵. Springs *o*⁶ connect the levers *o*¹ with rigid portions of the frame and serve to maintain the rollers *o*³ in operative engagement with their respective cam-plates.

The carriage *n* is formed with projecting arms *n*³ *n*³, which have jaws *n*⁴ *n*⁴ formed upon the ends thereof, said jaws being adapted to be engaged by transverse pins *s* *s*, carried by the cylinder *b*. In Fig. 1 one of the pins *s* is shown at the beginning of its engagement with the jaw formed at one of the ends of the arm *n*³. It will be understood, then, that as the cylinder rotates the pins *s* *s*, carried thereby, engage the extensions or arms *n*³ of the carriage *n* and cause the same to turn upon its trunnions. There is, however, a certain arc through which the carriage cannot be turned merely by the action of the cylinder—that is to say, from the position assumed when the carriage has been rotated through an arc approximately of one hundred and ten degrees with that shown in Fig. 1 to a position exactly similar to that of said figure assumed when the carriage has completed one-half of its rotation. Therefore the carriage must be rotated by other means. Such means are provided in the

shape of the wheels *t* *t*, which are mounted at one end of the carriage and which are adapted to be engaged by cam-plates *t*¹ *t*¹, carried by the rotary cylinder *b*. Further, a projecting arm *u* is mounted upon the frame of the machine, having the extremity thereof formed with an inclined surface, whereon the extremity of the arm *n*³ is adapted to slide, causing that end of the carriage to be elevated as the other end is pushed on by the movement of the cylinder. The rotation of the carriage upon its trunnions is thus accomplished partly by the cams *t*¹, which engage the wheels *t* of the carriage, next by the engagement of the extremity of the arm *n*³ with the inclined surface of the arm *u*, and then by the operation of the pins *s* *s*, which engage the jaws *n*⁴ of the carriage. The whole mechanism thus coacts to give the defining-plates their proper rearward sweep, and the relation of the cam-grooves *q* *q*, which cause the expansion and contraction of the blades or members of the defining-plates, is such that the said defining-plates will be expanded and contracted at the proper time, as has been explained.

The depressing-plate *h* is mounted on a rock-shaft *h*¹, which is actuated by means of a cam *h*² and its coacting lever *h*³. (Shown in dotted lines, Fig. 1, of the drawings.)

It will be evident to those skilled in the art that many modifications can be made in the structure shown in the drawings without departing from the spirit of my invention, and therefore I do not desire to be understood as limiting myself to the precise construction set forth; but,

Having thus described one embodiment of my invention, I claim as new, and desire to secure by Letters Patent, the following:

1. In apparatus for forming the diamond fold in paper-bag machines, the combination with hinged folding members *c* comprising upper and lower wings adapted to enter the side tucks of the bellows-folded blank, of folding-fingers *c*³ adapted to enter between the upper and lower wings of said hinged folding members, and means for causing the rearward folding movement of said folding-fingers substantially in the axis of rotation of the hinged members, substantially as described.

2. In apparatus for forming the diamond fold in paper-bag machines, the combination with a central or front gripper, of combined side grippers and hinged folding members *c* comprising upper and lower wings adapted respectively to engage the forward edge and the side tucks of the bag-blank, folding-fingers *c*³ adapted to enter between the upper and lower wings of the hinged folding members, and means for rotating said folding-fingers and the upper wings of the hinged folding members rearwardly substantially in the axis of rotation of the movable wings of said hinged members, substantially as described.

3. In apparatus for forming the diamond

fold in paper-bag machines, the combination with folding members shaped substantially to conform when opened to the triangular side tucks of the paper bag, of actuating parts c^3 , means for causing their operative engagement with and actuation of said folding members, an interiorly-acting defining-plate and gripping mechanism operating in conjunction with said folding members, substantially as described.

4. In apparatus for forming the diamond fold in paper-bag machines, the combination with side-folding members comprising upper and lower wings shaped to conform to the triangular side tucks of a completed bag, the same being adapted to enter the side tucks of the bellows-folded bag-blank, of an expansible defining-plate adapted to enter the mouth of the bag and form the primary cross-crease, a carriage therefor, means for causing its rotation substantially about the edge of the defining-plate, and folding-fingers c^3 mounted upon said carriage adapted to enter between the upper and lower wings of the folding members, substantially as described.

5. In apparatus for forming the diamond fold in paper-bag machines, the combination with grippers adapted to engage the front and sides of the bag-blank and clamp said parts to the folding-bed, of a defining-plate adapted to enter the mouth of the bag-blank, said plate being laterally mutilated or cut away to prevent its engagement with the bag-blank at the intersection of creases a^2 and a^4 , and means for rotating the defining-plate with respect to the folding-bed substantially about the line of its outer or engaging edge as an axis, substantially as described.

6. In apparatus for forming the diamond fold in paper-bag machines, the combination with grippers adapted to engage the front and sides of the bag-blank and clamp the same to the folding-bed, of a defining-plate having lateral portions cut away corresponding to the folds or creases a^2 a^4 , whereby the bag-blank is relieved from strain, and means for imparting to said defining-plate a rearward sweep or folding movement, whereby tension is placed upon the mouth of the paper-bag blank when the diamond fold is formed, substantially as described.

7. In a machine of the class described, the combination with gripping mechanism adapted temporarily to secure the bag-blank upon the folding-bed, of side-folding members adapted to enter the side tucks of the bellows-folded bag-blank, said members having upper and lower wings conforming in shape to the triangular side tucks to be formed in the completed bag, a defining-plate having lateral portions cut away corresponding to the folds or creases a^2 a^4 , whereby the bag-blank is relieved from strain, folding-fingers c^3 adapted to enter between the upper and lower wings of the folding members, and means for imparting to the defining-plate and folding-fingers a rearward sweep or folding movement,

whereby tension is placed upon the mouth and tucks of the paper-bag blank when the diamond fold is formed, substantially as described.

8. In a machine of the class described, the combination with gripping mechanism adapted temporarily to secure the bag-blank upon the folding-bed, of side-folding members comprising upper and lower wings adapted to enter the side tucks of the bellows-folded blank, said members being provided with movable wings, folding-fingers c^3 adapted to enter beneath the movable wings of said folding members, an expansible defining-plate adapted to be inserted within the mouth of the bag-blank, and means for causing the rearward folding movement of said folding-fingers and defining-plate substantially in the axis of rotation of the side-folding members, substantially as described.

9. In a machine of the class described, the combination with grippers adapted temporarily to secure the bag-blank in position upon the folding-bed, of an expansible defining-plate adapted to enter the mouth of the bag-blank, said defining-plate having a forward or outer edge adapted to form the primary cross-crease a' and mutilated shoulders adapted to engage the bag-blank throughout a portion only of the length of creases a^2 and a^4 , and means for rotating the defining-plate substantially about its forward edge as an axis, substantially as described.

10. In a machine of the class described, the combination with grippers adapted temporarily to secure the bag-blank upon the folding-bed, of a folding member adapted to enter the side tuck of the bellows-folded bag-blank, an expansible defining-plate having lateral portions cut away to relieve the bag-blank from strain, adapted to be inserted in the mouth of said bag-blank, and means for causing the rearward folding movement of said folding member and defining-plate, substantially about the forward edge of the latter as an axis, substantially as described.

11. In apparatus for forming the diamond fold in paper-bag machines, the combination with a gripper adapted to engage the forward end of the lower ply of the bag-blank and clamp the same to the folding-bed, of an expansible defining-plate adapted to enter the mouth of the bag-blank, said plate being laterally mutilated or cut away to prevent its engagement with the bag-blank at the intersection of creases a^2 and a^4 , and means for expanding the defining-plate and for rotating the same with respect to the folding-bed, substantially about the line of its outer or engaging edge as an axis, substantially as described.

In witness whereof I hereunto subscribe my name this 13th day of October, A. D. 1899.

HERBERT E. WESTERVELT.

Witnesses:

J. W. SKINKLE,

ALBERT LYNN LAWRENCE.