D. E. VANVACTOR.

STAVE PUNCHING MACHINE.

APPLICATION FILED JULY 18, 1908.

928,289.

Patented July 20, 1909.

6 SHEETS—SHEET 1.

Fig. 1.

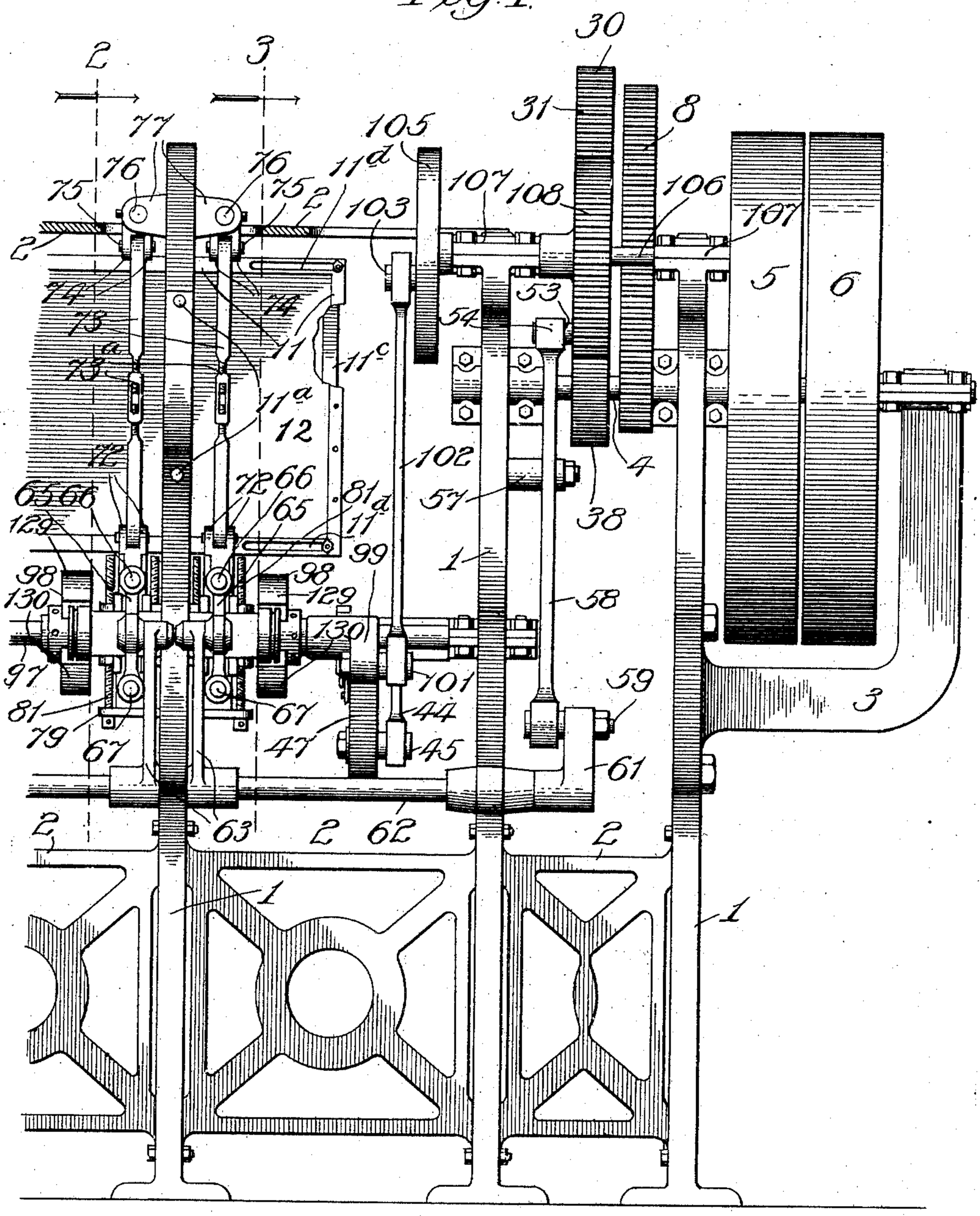

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Fig. 2.

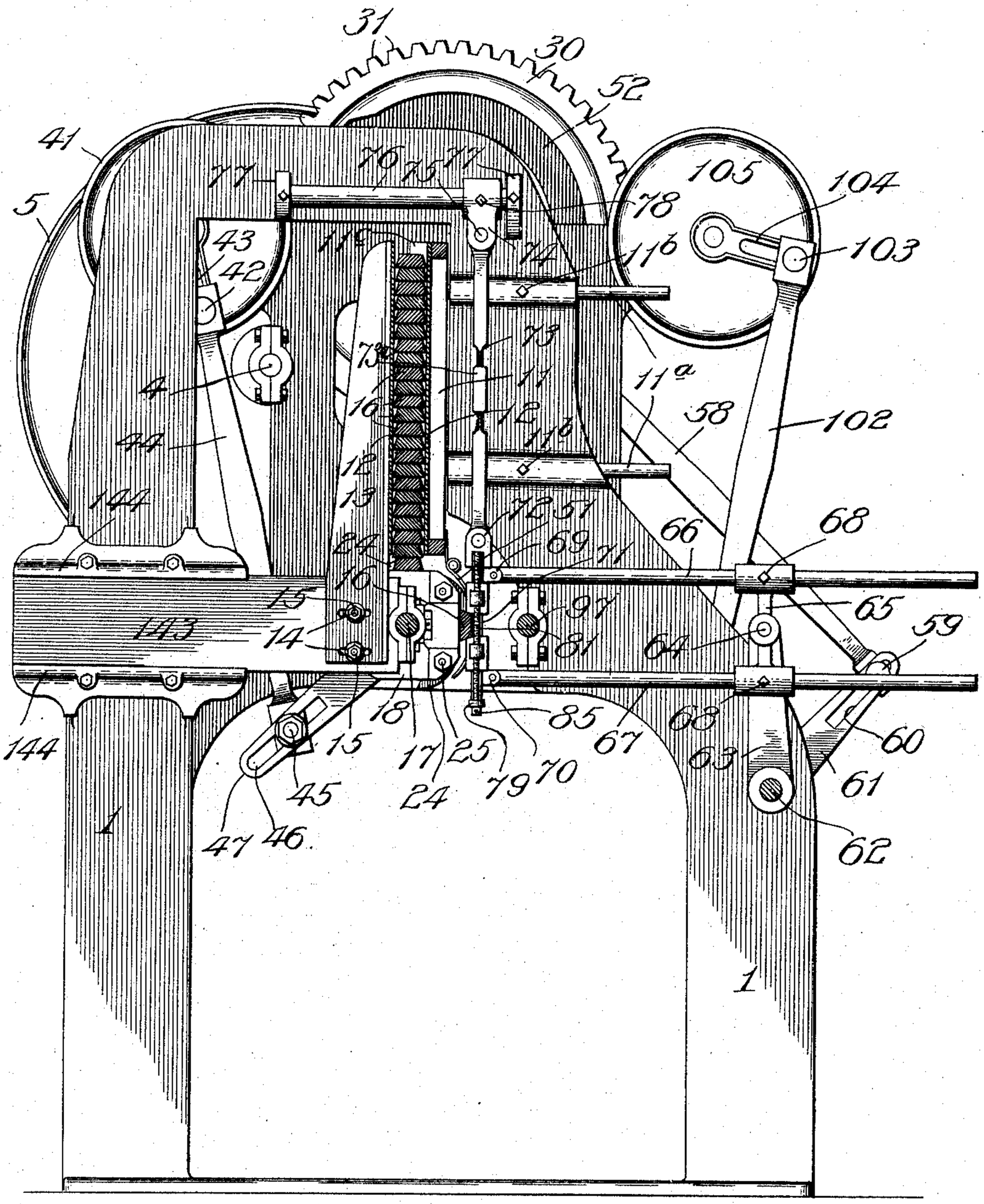

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Fig. 3.

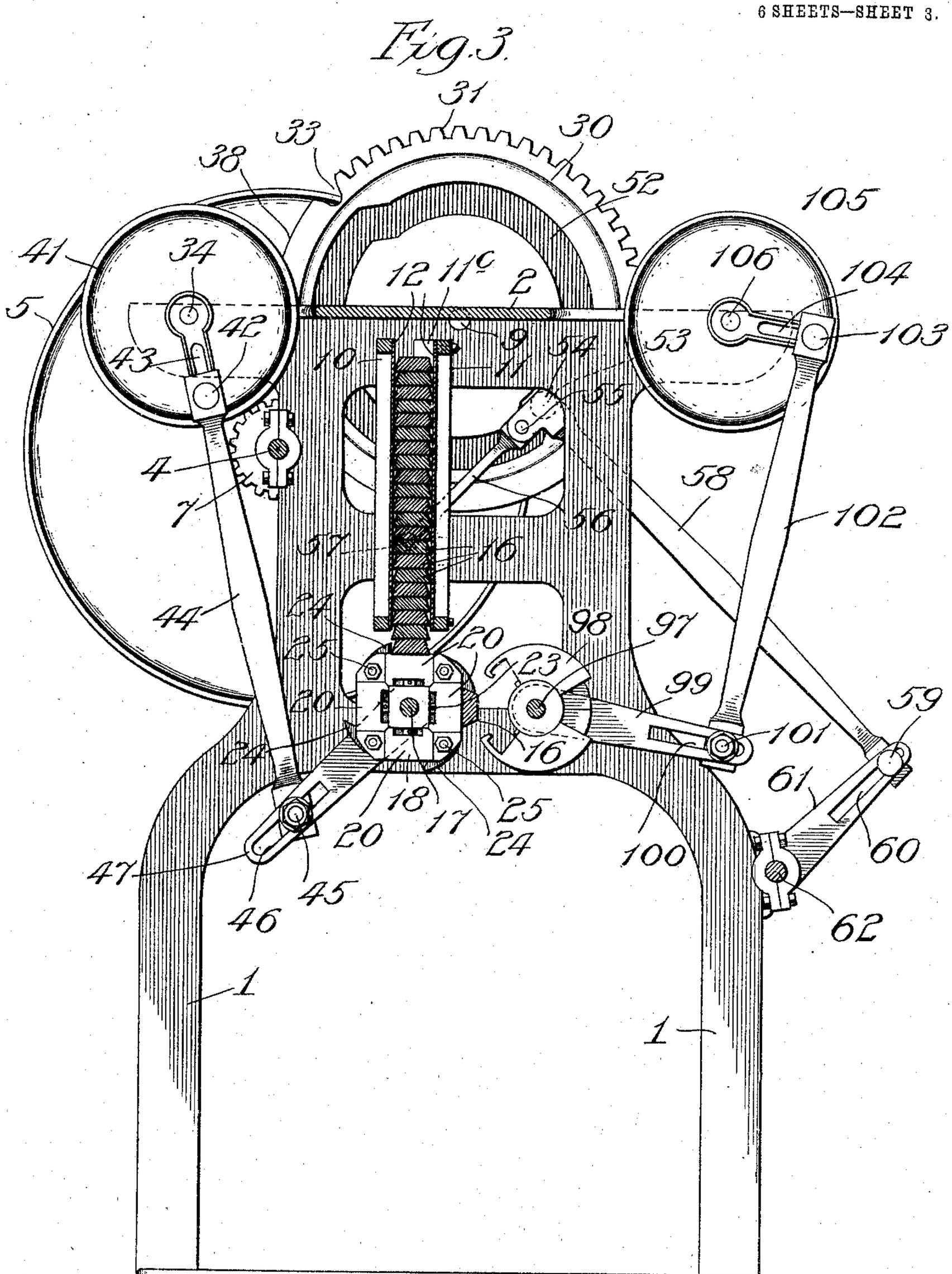

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Fig. 4

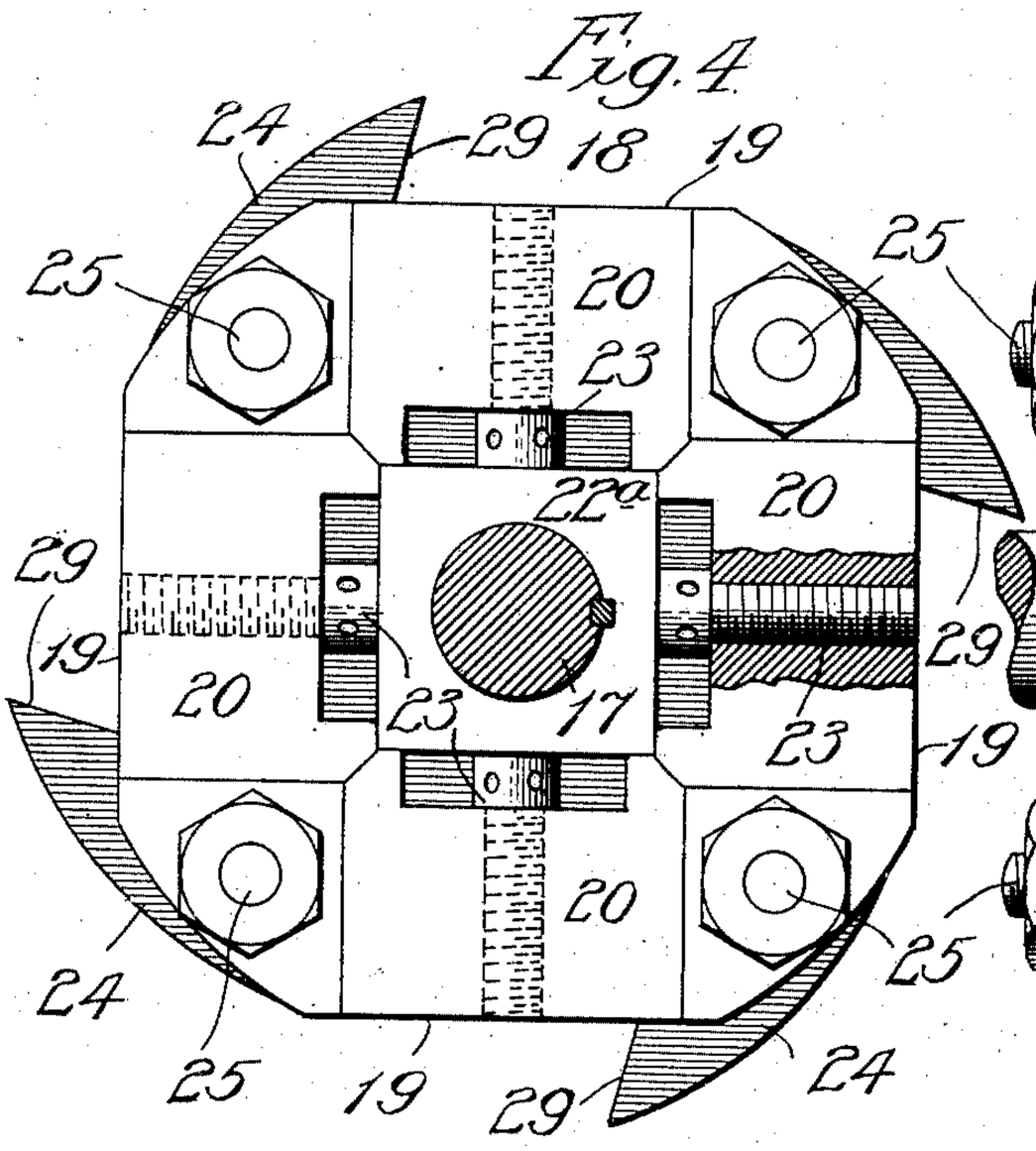

Fig. 6.

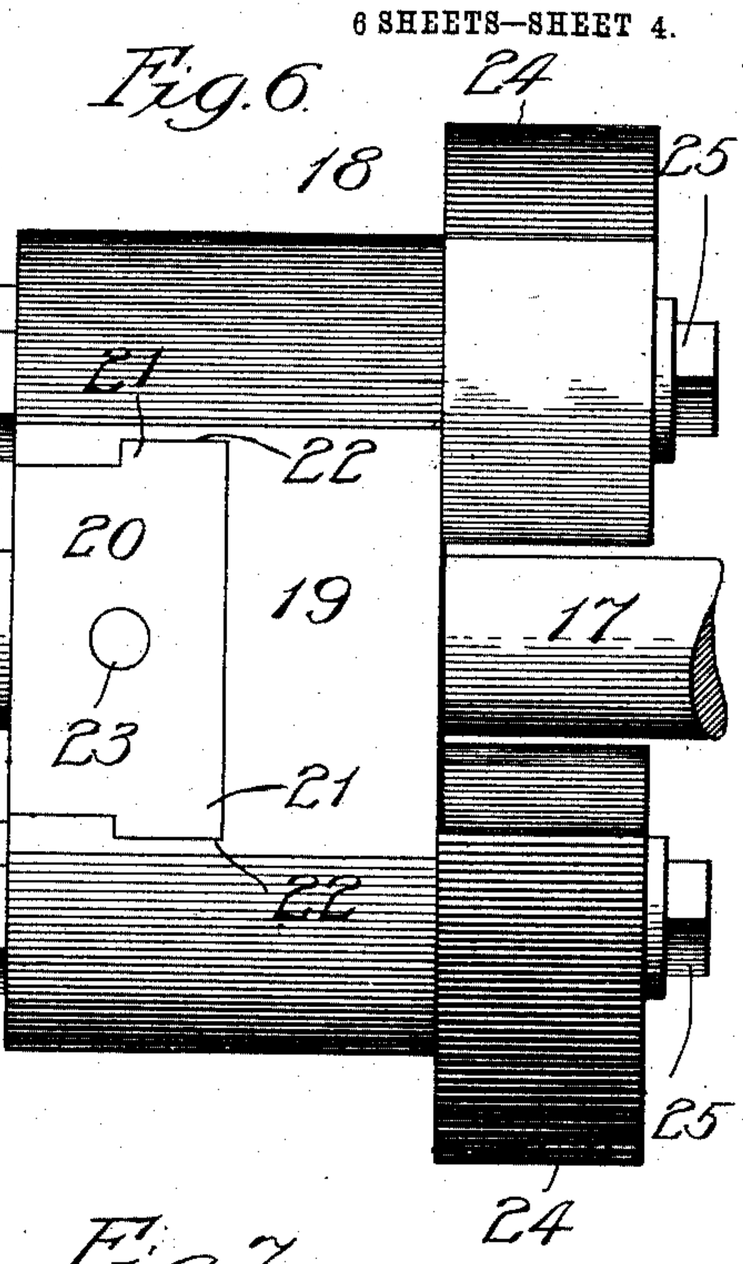

Fig. 5.

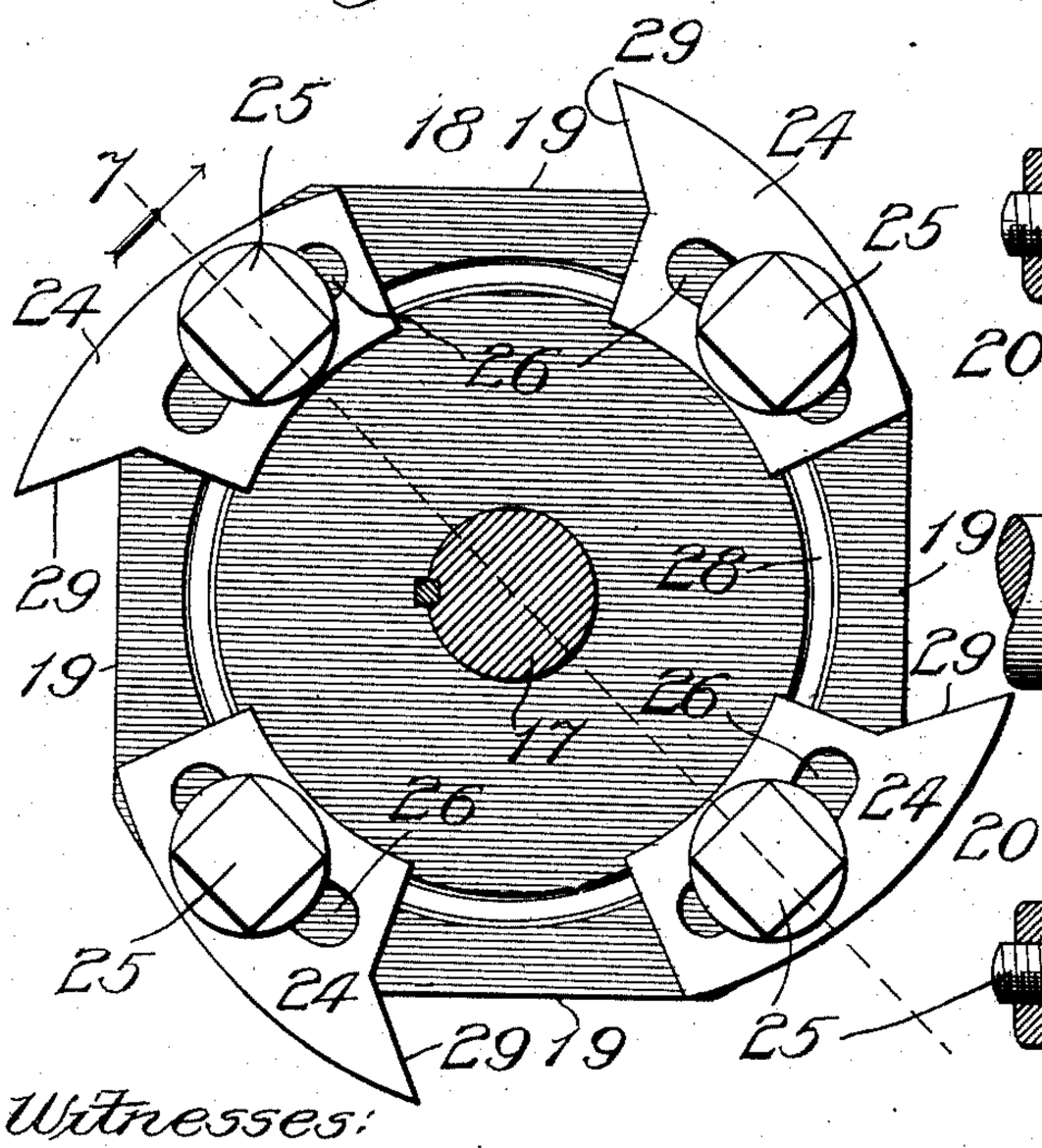

Fig. 7.

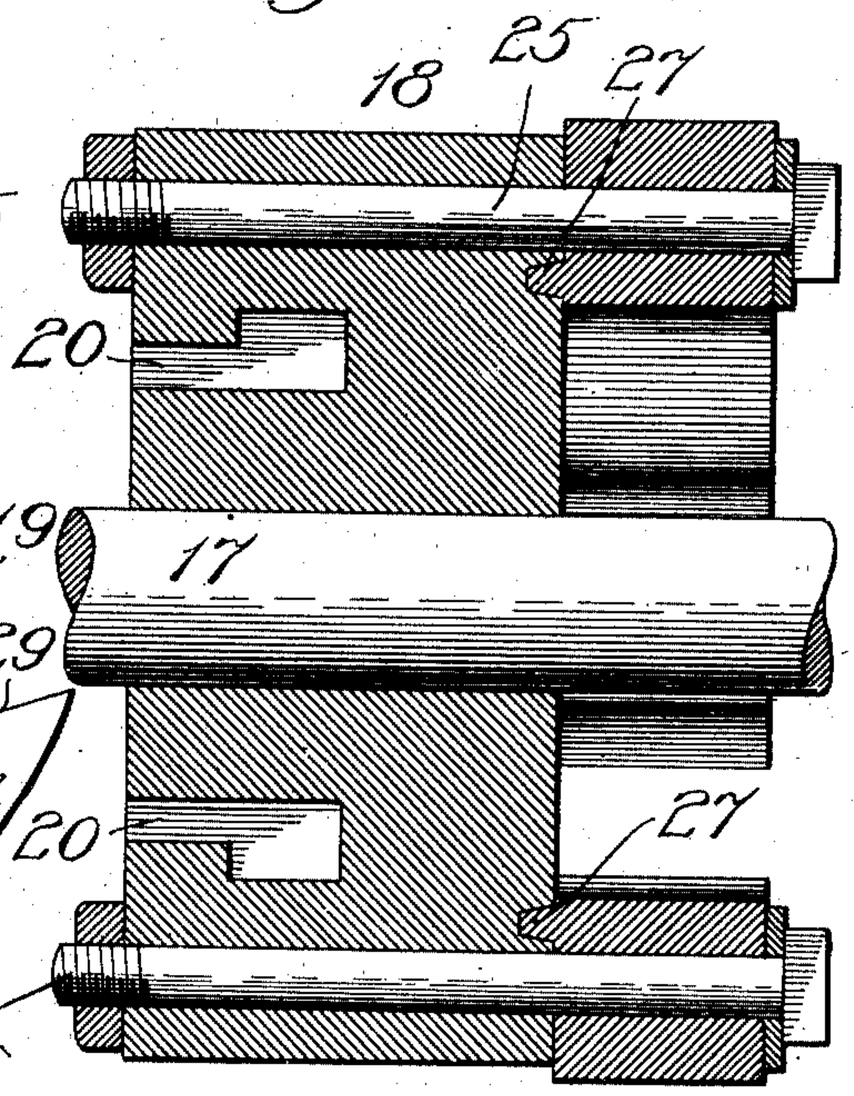

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Fig. 8.

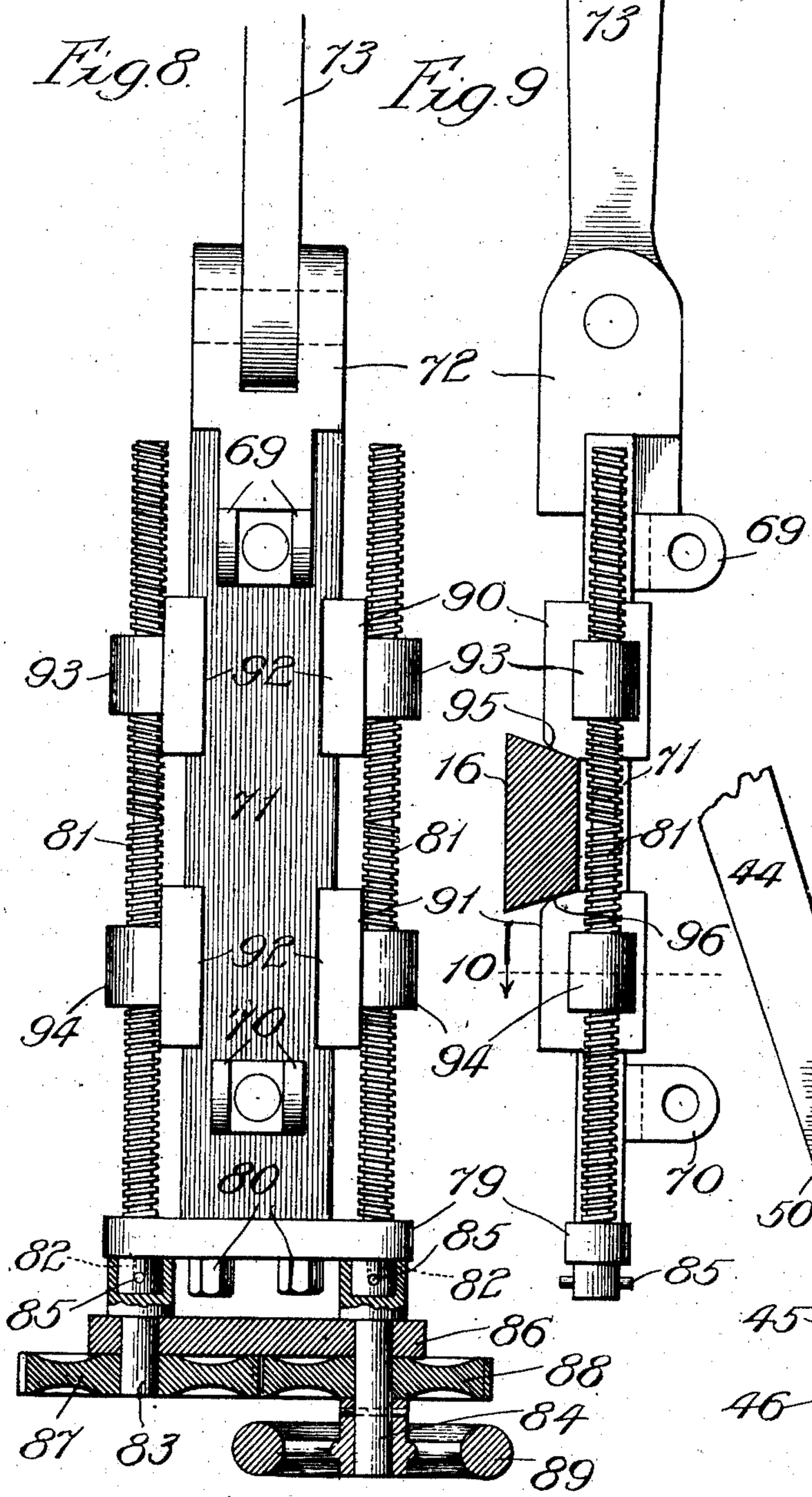


Fig. 9.

Fig. 10.

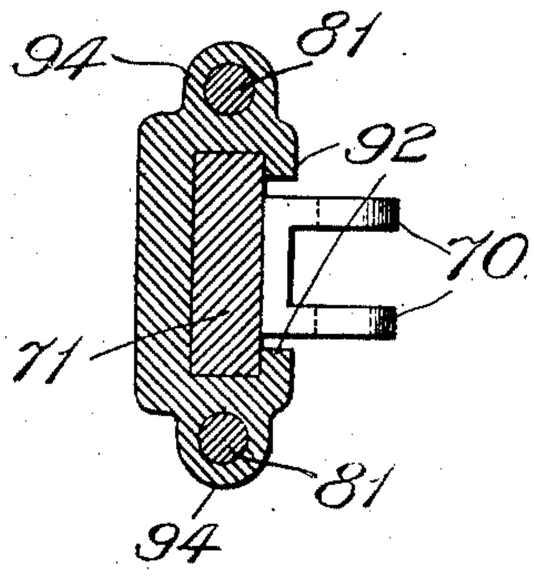
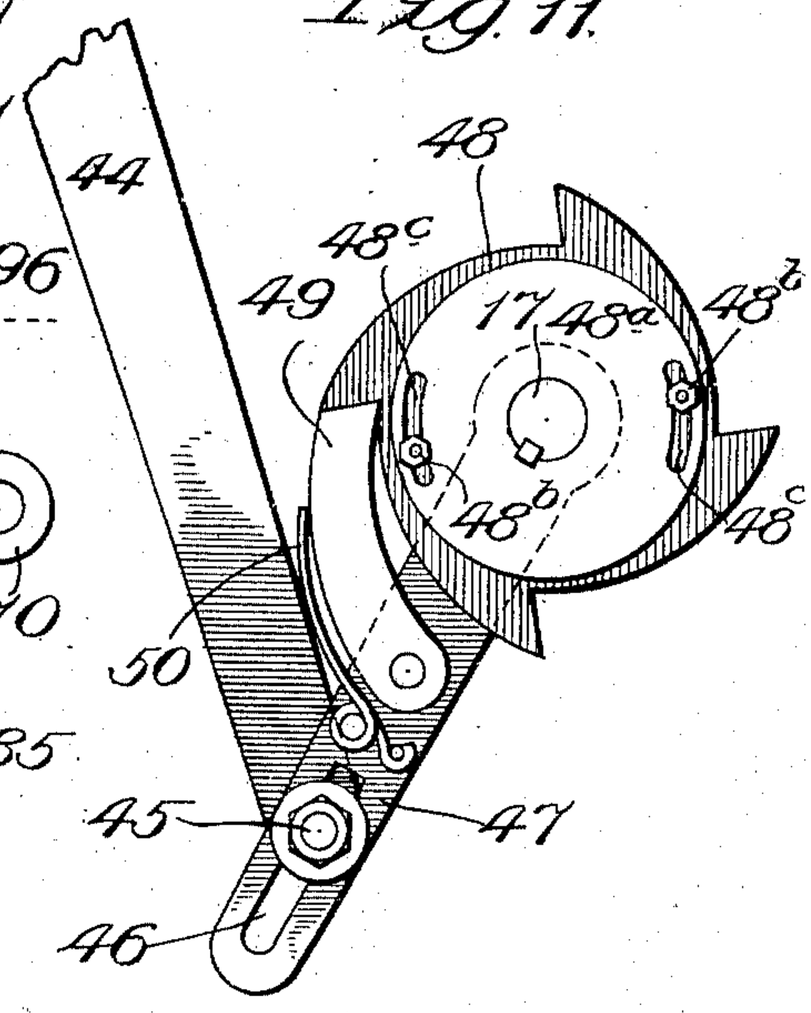


Fig. 11.



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6 SHEETS—SHEET 6.

Fig. 12.

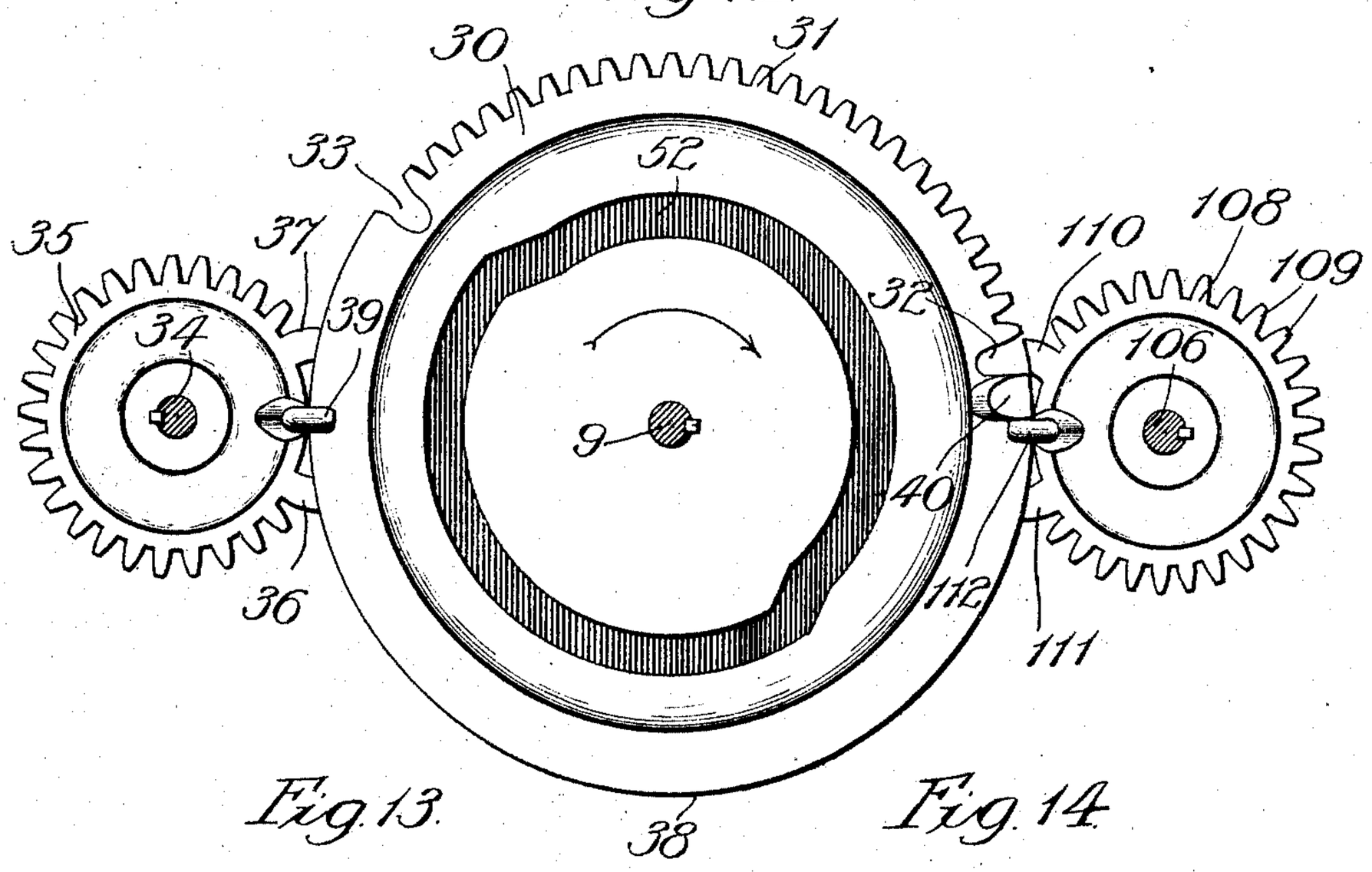
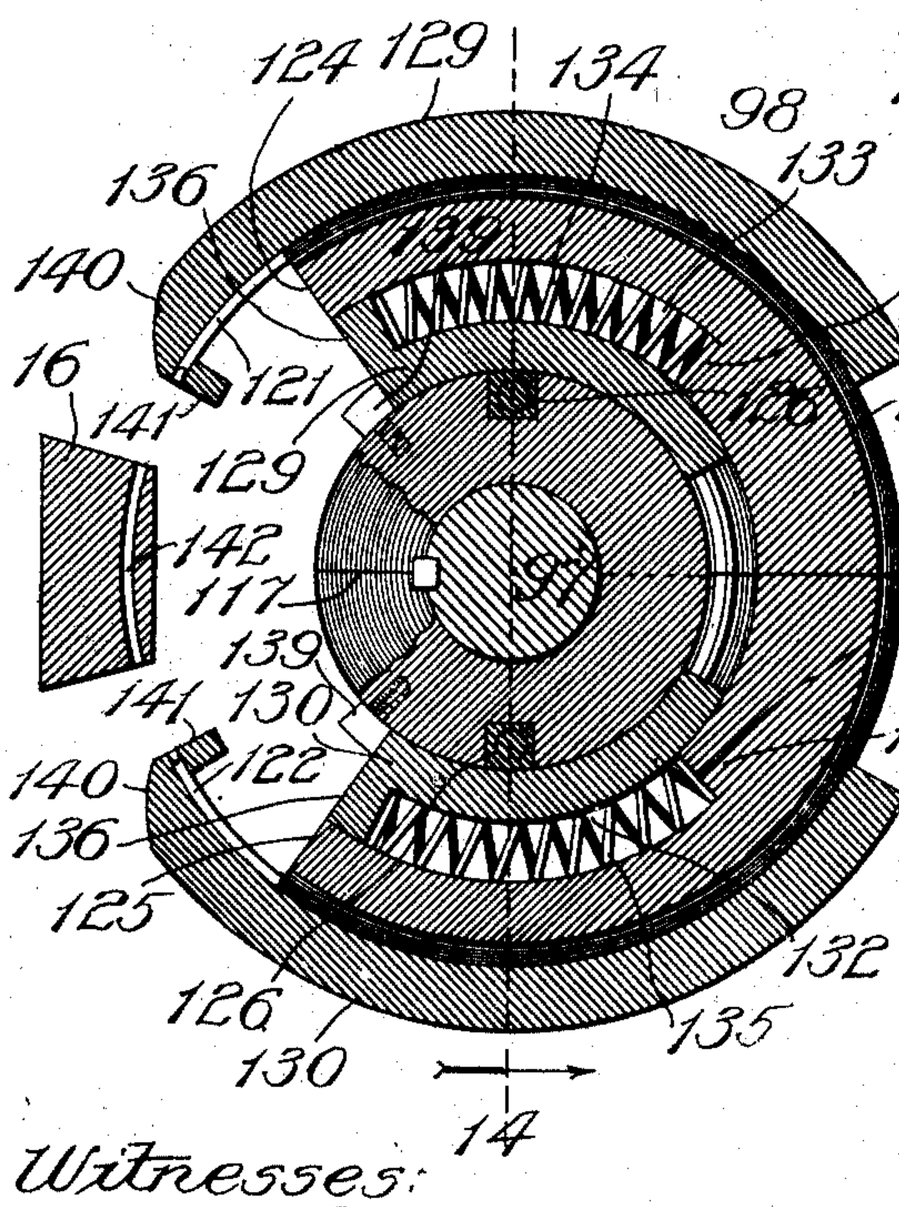
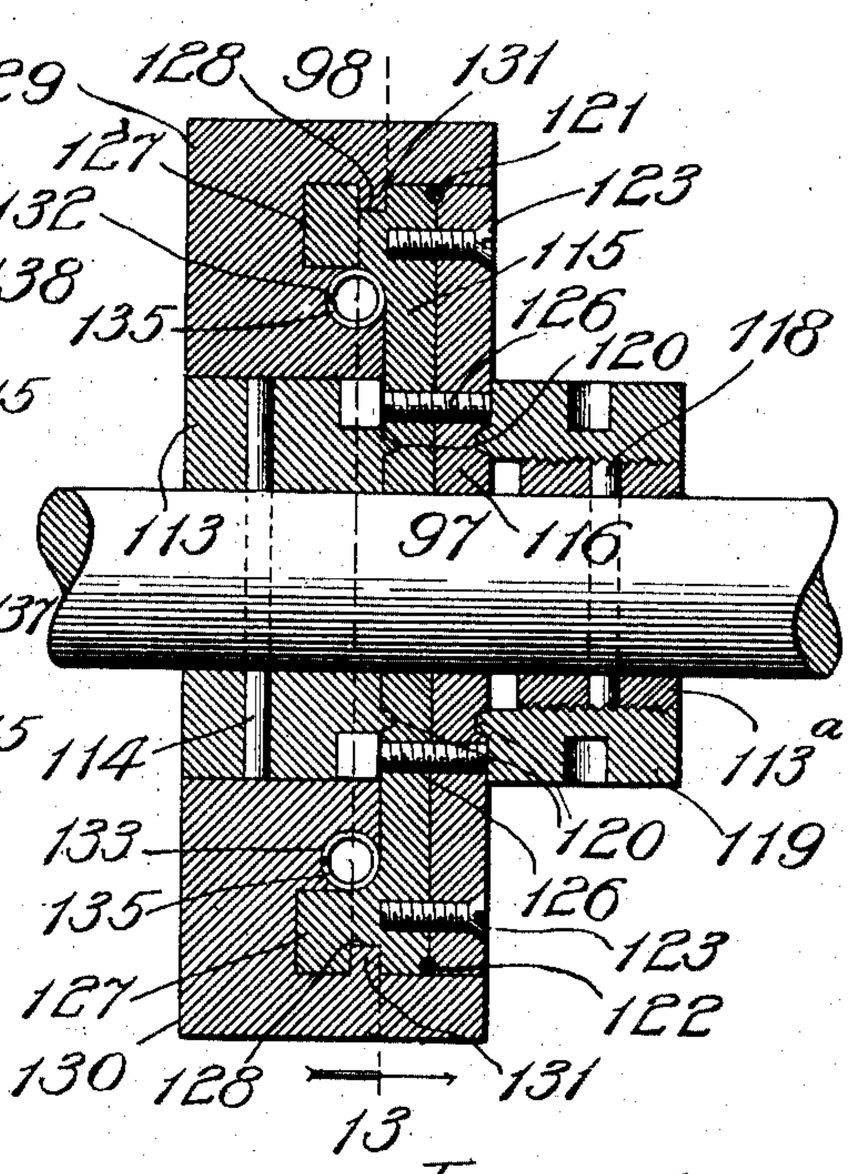


Fig. 13.

Fig. 14.





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UNITED STATES PATENT OFFICE.

DAVID E. VANVACTOR, OF ARGOS, INDIANA.

STAVE-PUNCHING MACHINE.

No. 928,289. Specification of Letters Patent. Patented July 20, 1909.

Application filed July 18, 1908. Serial No. 444,284.

To all whom it may concern:

Be it known that I, DAVID E. VANVACTOR, a citizen of the United States, residing at Argos, in the county of Marshall and State of Indiana, have invented certain new and useful Improvements in Stave-Punching Machines, of which the following is a description, reference being had to the accompanying drawings, forming a part of this specification, in which corresponding characters of reference in the different figures indicate like parts.

My invention has reference to the formation of holes or bores in staves such as are used in the construction of columns or for any purpose requiring a hollow cylindrical structure built up from staves which are intended to be held together by means of bands threaded in said bores.

The object of my invention is to provide a machine for rapidly and accurately punching such staves, so that the holes in successive members may register with each other, thereby enabling bands to be readily inserted in the holes for the purpose of connecting and binding them together.

A further object is to provide means whereby said holes may be curved so that the arc represented by the hole in a given stave may be concentric or substantially so, with the circle described by the complete structure formed from the assembled staves. To these and other subsidiary ends, my invention consists in the combination of elements hereinafter more particularly described and definitely pointed out in the claims.

In the drawings, Figure 1, is a side elevation of a portion of the machine, the part not shown containing only a duplication of certain of the parts represented. Fig. 2, is a vertical sectional view taken upon the line 2—, Fig. 1, viewed in the direction of the arrow there shown, Fig. 3, is a like view taken upon the line 3—, Fig. 1, viewed in the direction of the arrow there shown, Fig. 4, is an end view of one of the feeder heads, showing adjusting mechanism, Fig. 5, is an opposite end view from that shown in Fig. 4, of a feeder head, showing means for adjusting the hooks or stave abutments, Fig. 6, is a side elevation of a feeder head, Fig. 7, is a sectional view thereof taken upon the line 7—, Fig. 5, viewed in the direction of the arrow there shown, Fig. 8, is an enlarged side elevation of the stave clamping mechanism, Fig. 9, is a view thereof taken at right angles thereto, showing a stave in section as it would appear when secured between the clamps, Fig. 10, is a sectional view in plan taken upon the line 10—, Fig. 9, Fig. 11, is an enlarged view of the feed shaft, together with the ratchet and crank mechanism for actuating the same, Fig. 12, is a face view of the mutilated gears for actuating the punching mechanism, the main gear showing the cam-way for controlling the automatic clamping mechanism, Fig. 13, is a section taken upon the line 13, of the punch carrying head, and Fig. 14, is a section taken upon the line 14—, Fig. 13.

Referring to the drawings, 1 Figs. 1, 2 and 3, represent the main standards or frame elements of the machine, which are arranged parallel to each other and connected by means of frame braces 2, Fig. 1. Mounted in said frame and partially supported by means of an end bracket 3, Fig. 1, is a driving shaft 4, upon which is mounted fast and loose pulleys 5 and 6 respectively. Keyed to the shaft 4 is a driving pinion 7, Fig. 3, which meshes into a spur-gear 8 upon a shaft 9.

Before describing in detail the successive operating parts of the machine in the order of transmission from the primary driving element, I will describe generally the stave receiving and manipulating devices in order that the action of the other elements may be more readily understood.

Attached to the frame-work and extending lengthwise through a portion of the machine, is an adjustable stave-receiving guide-frame or rack, made up of vertically arranged parallel frame elements 10, 11, and brackets 13, Figs. 1, 2 and 3, preferably having a lining 12 formed from sheet metal or other suitable material. The brackets 13, Fig. 2, having slots 14 therein, are attached to the frame by means of bolts 15, thereby enabling said brackets to be adjusted for the purpose of varying the width between the guide faces for the reception of staves of varying width.

The part 11 may be adjusted in an opposite direction by means of rods 11^a secured in guides in the frame and set-screws 11^b. The guide or feeding frame is open at bottom and top for the reception of staves 16 to be punched, which staves are piled one upon the other with the ends abutting against a stop 11^c, Figs. 1, 2 and 3, which is

attached by means of bolts to the power end of the machine, said bolts being projected through slots 11[d] to permit the same to be adjusted to staves of varying lengths. The purpose of the stop is to gage the holes relatively to the ends of the staves.

Located beneath and in the same vertical plane with the pile of staves, is a shaft 17, upon which is mounted a series of feeder-heads, also shown in Figs. 4 to 7 inclusive, generally designated by 18, which are provided with four flat peripheral faces 19, arranged in planes at right angles to each other, and so positioned with reference to the shaft 17, that when the latter is at rest, the uppermost face will be horizontal. The faces 19 serve as a support for the staves which rest thereon in the manner shown in Figs. 2 and 3. Said heads are located at such distances from each other as may be determined upon for forming the punch holes in the staves, the number varying according to the length of the staves.

I prefer to make the feeder-heads adjustable to staves of varying thickness, which result may be accomplished as follows: Formed in each of said heads are four recesses for the reception of extension blocks 20, Figs. 2, 3, 4 and 6, having shoulders, 21, fitted to slide in counterpart grooves 22. The inner ends of said blocks are adapted to abut against a square hub portion 22[a], Fig. 4, and when so abutting, the outer face of each block is flush with the flat face 19 of the head. Adjusting screws 23, better shown in Figs. 4 and 6, having bores in the heads for the insertion of an adjusting tool, are tapped into the blocks 19, with their ends bearing against the square hub portion 22[a]. Upon turning said screws, the heads may be projected radially beyond the faces 19 to meet any desired adjustment in the thickness of staves. Adjustable feed hooks, generally designated by 24, are clamped to one end of each feeder-head by means of bolts 25 which pass through bores in the heads and thence through slots 26, Fig. 5, in said hooks. Curved ribs 27, Fig. 7, are fitted to slide in a circular groove 28. By loosening the nuts upon the bolts, the hooks may be adjusted to any desired position, to conform to staves of varying widths.

Having described the feeder-heads, I will next describe the means by which the staves are caused to be moved into position and clamped, preparatory to being punched. Keyed to the shaft 9, bearing the driven gear 8, Figs. 1, 3 and 12, is a mutilated gear 30 having a segmental toothed portion 31, at the ends of which are located deep notches 32, 33, respectively, the purpose of which will be presently stated. Keyed to a shaft 34, Figs. 3 and 12, which is supported in suitable bearings, in the frame, is a mutilated gear 35 which I prefer to designate as the feed-gear. The gear 35 is provided with two elongated teeth 36, 37 adapted to enter the notches 32, 33 respectively of the gear 30, as hereinafter described. The ends of said teeth are fitted to conform to the arc described by a smooth peripheral portion 38, upon the gear 30. A laterally extended tooth 39 is formed upon the gear 30 in a plane midway between the teeth 36 and 37, and so constructed as to overlap the rear face of the gear 30, in position to be engaged by a laterally projecting tooth 40 upon one face of the gear 30. These teeth I term the starting teeth. The segmental teeth of the gear 30 are sufficient to cause a complete revolution of the gear 35, as a result of the partial revolution of the former. Keyed to the shaft 34 is a crank-wheel 41, Figs. 2 and 3, having a wrist-pin 42, adjustably secured to a radial slot 43 formed therein. Connected with said wrist-pin is a link 44, also shown in Fig. 11, which is provided with a wrist pin 45, adjustably secured in a well-known way within a slot 46, formed in an arm 47, the hub of which is loosely mounted upon the shaft 17, bearing the several feeder-heads. A ratchet-wheel 48, Fig. 11, having four equi-distant teeth is adjustably attached to a disk 48[a] by means of bolts 48[b] extending through slots 48[c] in the disk 48[a], which is keyed to the shaft 17. Attached to the arm 47 is a pawl 49, adapted to be thrown into engagement with the ratchet-teeth by means of a spring 50. The several parts are so adjusted that one revolution of the crank-wheel 41 will cause a quarter revolution of the shaft 17, carrying the feeder-heads. Without giving a description, at this time, of the complete operation of the mutilated gears, it is sufficient to say that as a result of the partial revolution mentioned of the feeder-head shaft, the lowermost stave 16, in the stack, is pushed by the hooks or fingers 24, on the feeder-heads, from beneath the stack and moved in the arc of a circle to the position shown in Figs. 2 and 3. In order to hold it firmly against the fingers and bearing abutments of the heads, during this movement, so that it may be kept in proper position to be engaged by clamping mechanism, next to be described, I provide a series of depending curved retaining springs 51, Fig. 2, which are attached to the frame and bear against the outer face of the stave during said movement.

The position of the stave, in a plane parallel to that of the axis of the shaft, as described, is that in which it is intended to be held during the operation of punching; but inasmuch as the utmost accuracy is required in the position of the holes in order to produce perfect registration for threading said holes for the purpose of ultimately connecting the staves, it is essential that they be firmly and accurately positioned previous

to the act of punching. For this purpose I provide the following described mechanism: Formed in the face of the gear 30, is a cam groove 52, adapted to receive a cam-wheel 53, Figs. 1 and 3, upon a head 54, which is jointedly connected at 55, to a link 56, Fig. 3, the opposite end of which is jointedly connected to a stud 57, shown in full lines in Fig. 1, and in dotted lines in Fig. 3. The head 54, is integral with a link 58, Figs. 1, 2 and 3, the lower end of which is connected to a wrist-pin 59, adjustably secured within a slot 60 in an arm 61, keyed to a rock-shaft 62, supported in suitable bearings in the frame. Arms 63, Figs. 1 and 2, which are preferably arranged in pairs upon opposite sides of certain of the standards as represented in Fig. 1, are keyed to the shaft 62. A pin 64, Fig. 2, is extended through a bore in the ends of said arms and serves to connect them with vertical cross-heads 65, through bores in the upper and lower ends of which parallel rods 66, 67, are adjustably secured by means of set-screws 68. The inner ends of said rods are jointedly connected respectively, to lugs 69, 70 also shown in Figs. 8 and 9, attached near the upper and lower ends of a flat bar 71, shown also in Fig. 10, having lugs 72, which are jointedly connected through links 73, to lugs 74, by means of pins 75. The lugs 74 are in turn suspended upon rods 76, which are attached to brackets 77, upon the frame. The lugs 74 are adjustably secured to the rods 76 by means of set-screws 78, Fig. 2, which enables them to be moved forward or back to the desired position, for the purpose hereinafter stated. A tie-plate 79, Figs. 8 and 9, is rigidly attached to the lower end of the plate 71, by means of screws 80, through which is loosely projected adjusting screws 81, 81 having right and left hand screw threads. The lower ends of the screws 81 project through the plate 79 so as to enter sockets having notches 82, indicated in dotted lines, said sockets being found in the upper ends of short shafts 83, 84. Pins 85 upon said extensions are adapted to enter said notches to enable the screws 81 to be rotated by the turning of the shafts. Said shafts extend through bores in a plate 86, and are connected by means of gears 87, 88, beneath the plate. A hand-wheel 89 upon the shaft 84 enables the shafts to be rotated in unison to actuate the adjusting screws 81. This device may be permanently connected with said screws, but it is preferably removable. Clamping blocks 90, 91, are arranged to slide upon the plate 71, being held in place by means of flanges 92. The blocks 90 are provided with laterally extended lugs 93 which are tapered to receive the threads upon the upper half of the screws 81, while blocks 91, are provided with similar lugs 94, which are tapped to engage the reverse threads upon the lower half of said screws. The lower front faces of the clamping blocks 90 are rounded as shown at 95, Fig. 9, while the upper faces of the blocks 91, are also rounded as shown at 96, to engage the beveled edges of the staves 16.

From the foregoing, it will be seen that the stave clamping mechanism is suspended upon the rods 73 and is adapted to swing outwardly away from the feeder heads, in order to permit the staves to be carried around opposite thereto. The clamps are then intended to swing in to engage said staves and press them against the feeder heads. In order to accomplish this, it is essential that the space between the clamping blocks 90 and 91, as well as their relative height, should be accurately adjusted. The former may be accomplished by means of the adjusting screws 81, actuated by the hand wheel 89, and its co-acting parts, by means of a turnbuckle 73^a in the link 73. Upon turning said hand-wheel in a given direction the blocks 90 and 91 may be caused to move in opposite directions so that they may be brought closer together or separated, thereby enabling them to accurately engage the opposite edges of the stave. Inasmuch as such adjustment need only to be made but once, for a given sized stave, I prefer to use the adjusting mechanism as a tool merely and to attach it only when its use is required. For this reason it is not shown in Figs. 1 and 2.

In order to enable the staves to be moved in position for punching and to be clamped therein, the cam-groove 52 is so timed as to cause the clamping mechanism to be swung away from the feeder heads during the time said heads are being rotated to place a new stave in position and then to be moved forward into the position shown in Fig. 2, to clamp said stave and hold it firmly in place until the punching operation is completed.

The punching is accomplished by means of the following described mechanism:— Mounted upon a rock-shaft 97, supported in bearings in the frame parallel to the feeder shaft 17, are a series of punching-heads designated generally by 98, Figs. 1, 3, 13 and 14. Keyed to said rock-shaft, is an arm 99, Figs. 1 and 3, having a slot 100 in which is adjustably secured a wrist-pin 101, connected by means of a link 102, to a like pin 103, adjustably secured in a slot 104, in a crank-wheel 105, mounted upon a shaft 106, supported in bearings 107. A mutilated gear 108, Figs. 1 and 12, is keyed to the shaft 106, in position to be engaged by the gear 30. Said gear 108 is identical in every respect with the gear 35 being provided with a toothed segment 109, for engagement with the teeth of the segment 31, elongated teeth 110, and 111, respectively for engaging the notches 32 and 33, and a laterally projecting

tooth 112, corresponding to the tooth 39, upon the gear 35. The gear 108 is adapted to make one revolution while driven by the toothed segment of the gear 30; the first half revolution causing the arm 99, Fig. 3, to be raised and lowered through a given arc and the second half of the same revolution causing said arm to be first lowered and then raised, thereby causing the shaft 97 to be rocked forward and back a predetermined distance and then forward and back in reverse directions, for the purpose of alternately inserting and withdrawing oppositely disposed punching elements, carried by the punching heads, in other words the punching head is turned a short distance in one direction by the elevation of the arm 99 and then the shaft 97 is rocked in the opposite direction to the extent of its movement and then rocked back to bring the parts into position from which they are started, the punching head making but one cycle of movement, as hereinafter more fully described.

Mounted upon the shaft 97, is a collar 113, Fig. 14, which is secured in place by means of a pin 114, and also keyed thereto. Segmental plates 115, 116, separated at 117, Fig. 13, to permit removal, are placed together next to the collar 113. A second collar 113ª is secured upon the shaft by means of a pin 118, said collar being screw threaded to receive a clamping-nut 119. Both the collar 113 and clamping nut 119, is provided with an annular tongue 120 which engage in corresponding grooves in the outer faces of said plates, to hold said plates in position concentric with the shaft. Curved punches 121, 122, the curve of which conforms to the peripheral curve of said plates, are fitted in suitable grooves and rigidly clamped between said plates by means of screws 123, Fig. 14. Said punches project beyond the faces 124 and 125 as shown in Fig. 13, to an extent to enable each to pass somewhat more than half way through the stave 16. The extent of the projection of the punches may be varied by loosening the screws 123. Screws 126, the heads of which are embedded in recesses in the collar 113, are passed through the plates 115, 116, which serve to locate the plates upon the shaft with respect to the actuating crank, as well as to insure rigidity of position. The plates 115 are provided with curved lateral extensions 127 and peripheral grooves 128. Punch guides 129, 130, provided with curved interior grooves or recesses, are slidably fitted upon said extensions, said guides being provided with tongues 131, which fit the grooves 128, and hold said guides in place. Curved recesses 132, 133, are formed in the guide elements 129, 130 for the reception of coiled spring 134, and 135. The forward ends of said springs rest against shoulders 136, upon the forward parts of said sliding guide elements and the opposite ends against shoulders 137, 138, upon the plates 115. Removable stops 139 upon the collar 113, limit the forward movement of the guides. The plates 115, being rigid with the shaft, the tendency of said springs is to force said guides outwardly in advance of the faces 124, 125 of said clamping plates. Each of said guides is provided with an extension 140 which projects normally beyond the forward ends of the plates and is provided with depending lugs 141, which are adapted to abut against said faces when the guides are pushed back against the action of the springs. Said lugs are bored to permit the passage of the punches 121 and 122, the outer ends of which latter are normally flushed with the outer faces of said lugs. The fact that the punches are curved, which would tend to cause them to bend or break when forced into the wood without support, necessitates the use of the guides. When pressure is applied to the punches, the tendency of the latter to bend outwardly is resisted by the inner face of the guide which prevents breakage.

When the shaft 97 is rocked toward the left, the punch-head is moved with it until the lug 141 bears against the beveled face of the stave 16. A further movement of the shaft causes the punch 121, to enter the wood; thereby punching a hole 142, somewhat more than half way through the stave,—the lug 141, resting against the edge of the stave during the entry and withdrawal of the punch, by the reverse movements of the rock-shaft. The reversed movement of the shaft then causes the punch 122, to enter the lower edge of the stave in alinement with the path of the punch 121, and its subsequent withdrawal, when the parts of the punch-head assume their respective normal positions as shown in Fig. 13, until a new stave is presented. The points of the punches are wedge-shaped so as to cut crosswise of the grain of the stave, and the extent of movement of the head should be such as to cause the point to pass the middle of the stave far enough to produce a hole of uniform size throughout, so as not to interfere with the subsequent passage of a threading band.

Having thus described the various parts of my improved machine, I will now give a more comprehensive explanation of its general operation. Referring at the outset more especially to Figs. 3 and 12, the machine is shown in the former, with a stave 16, in position to be punched, and in the latter as ready to begin the revolution of the gear 108 which operates the punches. The gear 30 being rotated continuously in the direction indicated by the arrow, the tooth 40 thereon being in engagement with the tooth 112, serves to initiate the rotation of the gear 108. The tooth 110, enters the notch 32,

when the rotation is continued until the tooth 111 will have engaged and been released from the notch 33, when the movement of the gear 108 is arrested and held stationary during the completion of the rotation of the gear 30, by the teeth 110 and 111 being in contact with the smooth portion upon the periphery of said gear. This action imparts one complete rotation to the crank-wheel 105. The first quarter of said rotation causes the link 102, Fig. 3, to be raised to its highest point, thereby raising the arm 99, and rocking the shaft 97, toward the left and forcing the punches 121 of all the punch-heads upon the shaft, into the stave. The next quarter revolution serves to reverse the action of the rock-shaft and to withdraw said punches. The third quarter revolution results in moving the link 102 to its lowest point, thereby forcing the punches 122, upwardly into the arc, while the completion of said revolution results in their withdrawal; leaving the punches in their respective normal positions as shown in Figs. 3 and 13. During the operation described, the gear 35, which serves to actuate the feed mechanism, is at rest; being locked in position with the teeth 36 and 37 in contact with the smooth surface of the gear 30. It will be noted that the segment of cogs upon the gear 30 is shorter than the smooth portion. The purpose of this is to permit the cam, controlling the clamping mechanism, to act for the purpose of unclamping or clamping the stave, while both feeding and punching mechanisms are at rest. Upon the completion of the revolution of the gear 108, the cam-wheel 53 is shifted from the concentric portion of the cam-groove 52 nearest the center, to that portion farthest from the center; thereby, through the link 58, and arm 61, rocking the shaft 62, and moving the rods 66, 67, withdrawing the clamps from the punched stave throughout its length and releasing it. Thereupon, the segment of cogs under the gear 30 engage the gear 35, thereby rotating the crank-wheel 41, and through the link 44, arm 47, and ratchet mechanism shown in Fig. 11, imparting a quarter of a revolution to the shaft 17, carrying the feeder heads and through the latter, simultaneously carrying the punched stave around beneath the heads, when it falls to the floor, and feeding the lower stave in the stave-way over and opposite to the punch-heads in position to be punched. At this point the gear 105 is still disengaged and while it is at rest the cam-wheel 53 is drawn toward the center of the gear 30, thereby operating the clamping mechanism and clamping the stave in position as hereinbefore described, when the punching mechanism is again actuated.

In order that the curve in the staves for structures of different dimensions may be proportionately varied, it becomes necessary to provide adjustment therefor as follows: The feeder-head shaft, 17, is carried in bearings supported by adjusting arms 143 secured to the frame by guide flanges 144, Fig. 2. The opposite side of stave-rack 11 is rendered adjustable by means of the rods 11^a, held in place by set-screws 11^b, Fig. 2. The clamping mechanism is made adjustable by means of the rods 66 and 67 held by set-screws 68, and on rod 76 held by set-screws 78. To adjust the machine to punch staves for a given diameter of structure, the required set of punching heads are secured upon the rocking shaft 97. The sliding arms 143 are so adjusted to it as to cause the punches 121 and 122 to enter the stave 16 at the required point. The standards 13 and 11 are adjusted to conform to the width of the stave to be punched. The clamping mechanism is then adjusted to the feeder-head by the means described. The proper relative position axillary of the feeder-head shaft is secured by the adjustment of the ratchet 48 to the disk 48^a.

Having thus described my invention I claim:

1. In a machine of the class described, the combination with an oscillatory punch-head, of curved punches, the curves of which form arcs of a common circle, the points of said punches being directed toward each other with a space between for the reception of a stave, means for supporting a stave in the arc of said circle between said points, means for alternately forcing said punches into the edges of the stave in opposite directions, curved guides slidably mounted upon the exterior periphery of the punch heads and against the outer surface of said punches to cause the punches to maintain said curve while under stress.

2. In a device of the class described, the combination with stave feeding, clamping, punching and releasing mechanism, of a continuously revoluble mutilated driving gear, mutilated feed and punching gears arranged to be alternately actuated thereby, and a cam arranged to operate in harmony with said driving gear for alternately actuating said clamping mechanism to clamp and release the stave during the intervals preceding the starting of said driven gears respectively and while the two are at rest.

3. In a device of the class described, the combination with an oscillatory head, of a curved punch mounted thereon with its curved outer edge coinciding with the arc of the circle described by the outer edge of the head by which it is supported, and a yielding punch supporting element slidably mounted upon said head and having an inner curved surface fitted to the outside surface of said head, said surface being arranged to bear

against the outer curved edge of the punch from the point of its support in the head substantially to its outer end.

4. In a device of the class described, the combination with an oscillatory punch-carrying head, of a curved punch mounted thereon having a curve concentric with the axis of the head, a punch supporting element having an inner face fitted to conform to the outer curve of the punch, an inturned lip upon its outer end bored to permit the passage of said punch, and a spring for normally holding said support projected substantially to the outer end of the punch to enable the latter to be continuously reinforced from the work which it is intended to enter to its point of support in the head.

5. In a device of the class described, the combination with revoluble feeder heads having bearing faces for staves, of abutments for engaging the beveled edges of the staves, and means for adjusting said abutments to cause the central line of the stave to coincide with the radial line of the shaft which extends midway between the edges of said bearing faces, which edges are parallel to the axis of the shaft.

6. In a device of the class described, the combination with revoluble feeder-heads having bearing faces for staves arranged in the planes at right angles to radial lines extending through the axes of said heads, and circular grooves in one of the side faces of said heads, of abutments arranged to engage the beveled edges of the staves, curved tongues upon the bodies thereof to engage said circular grooves, and means for adjustably securing said abutments in position.

7. In a device of the class described, the combination with a rock-shaft, of punch-heads having punch-holding elements for holding oppositely disposed curved punches in a common plane, a pair of opposing collars rigidly attached to said shafts for each of said punch-heads, said collars being arranged to rigidly clamp said punch holding elements to cause them to move in the arc of a circle while held by said collars, said punch-holding elements being diametrically separable from each other and provided with means for slidably connecting them with and disconnecting them from the collars when the latter are loosened.

8. In a device of the class described, the combination with a shaft, of punch heads composed of diametrically separable, opposed punch-holding elements, means upon the outer sides thereof for engaging collars upon the shaft and collars rigidly secured to the shaft and fitted to engage said engaging means upon the sides of said punch holding elements.

9. In a device of the class described, the combination with a shaft, of punch-heads composed of diametrically separable punch-holding elements having curved grooves in the outer side of each, the curve of which is concentric with the axis of the shaft, and supporting collars mounted upon the shaft, said collars having tongues formed thereon to enter said grooves.

10. In a machine of the class described, the combination of a feed-shaft having feeder-heads mounted thereon, means for supporting a stave therein, punch-heads mounted upon a shaft parallel to said feed-shaft, means for rotating said feed-shaft to move a stave in punching position opposite to said punching heads, curved opposing punches upon each of said punch-heads, the curves of which are concentric with the axis of the heads, the punches upon each head being arranged to point in opposite directions, and means for rocking the shaft bearing said punch-heads, to alternately insert and withdraw said opposing punches.

11. In a machine of the class described, the combination of a stave-rack, a feed-shaft provided with feeder-heads having means thereon for engaging the lowermost stave to move it from the rack when the shaft is rotated, means for intermittently moving said shaft a predetermined partial revolution, clamping means for holding a stave against said feeder-heads when the shaft is so rotated, a plurality of punch-heads mounted upon a shaft parallel to said feed-shaft, each of said punch-heads bearing curved punches pointing in opposite directions toward the clamped stave and means for oscillating the shaft bearing said punch-heads to alternately force the punches into opposite edges of the stave.

12. The combination, in a device of the class described, of a shaft carrying a plurality of feeder-heads, to move a stave to a punching position, a parallel shaft carrying a plurality of punch-heads, each having curved punches arranged to enter the stave from opposite edges, and means for alternately actuating said shafts.

13. In a device of the class described, the combination of a revoluble feeder head for presenting the staves to punching mechanism, of punching mechanism, clamping mechanism for clamping the stave against said feeder heads while undergoing the operation of punching, and means for temporarily holding the stave in position pending the action of the clamping mechanism.

14. In a device of the class described, the combination of means for successively feeding staves to a punching position, means for clamping the same therein, means for punching the same while clamped, means for releasing them when punched and means for actuating one of said previously named means, in the order of its requirement, while the others are at rest.

15. In a device of the class described, the

combination with an oscillatory punch-carrying head, of curved punches projecting in opposite directions therefrom, in a common plane, the curves thereof being concentric with the axis of the head, of spring-controlled movable curved guides arranged to extend substantially to the pointed ends of said punches, said guides bearing against said punches and conforming to the outer curve thereof.

16. In a device of the class described, the combination with an oscillatory punch-carrying head, of curved punches projected in opposite directions, said punches being in a common plane with the curves thereof concentric with the axis of the head, of spring controlled movable curved guides arranged to extend substantially to the pointed ends of said punches, the inner faces of said guides conforming to the outer curve of the punches, inturned lips upon the outer end of each of said guides, each of said lips having a bore therein to permit the passage of the punch, and means for limiting the movement of said guides.

In testimony whereof, I have signed this specification in the presence of two subscribing witnesses, this 16th day of July 1908.

DAVID E. VANVACTOR.

Witnesses:

D. H. FLETCHER,

CARRIE E. JORDAN.