

No. 670,104.

Patented Mar. 19, 1901.

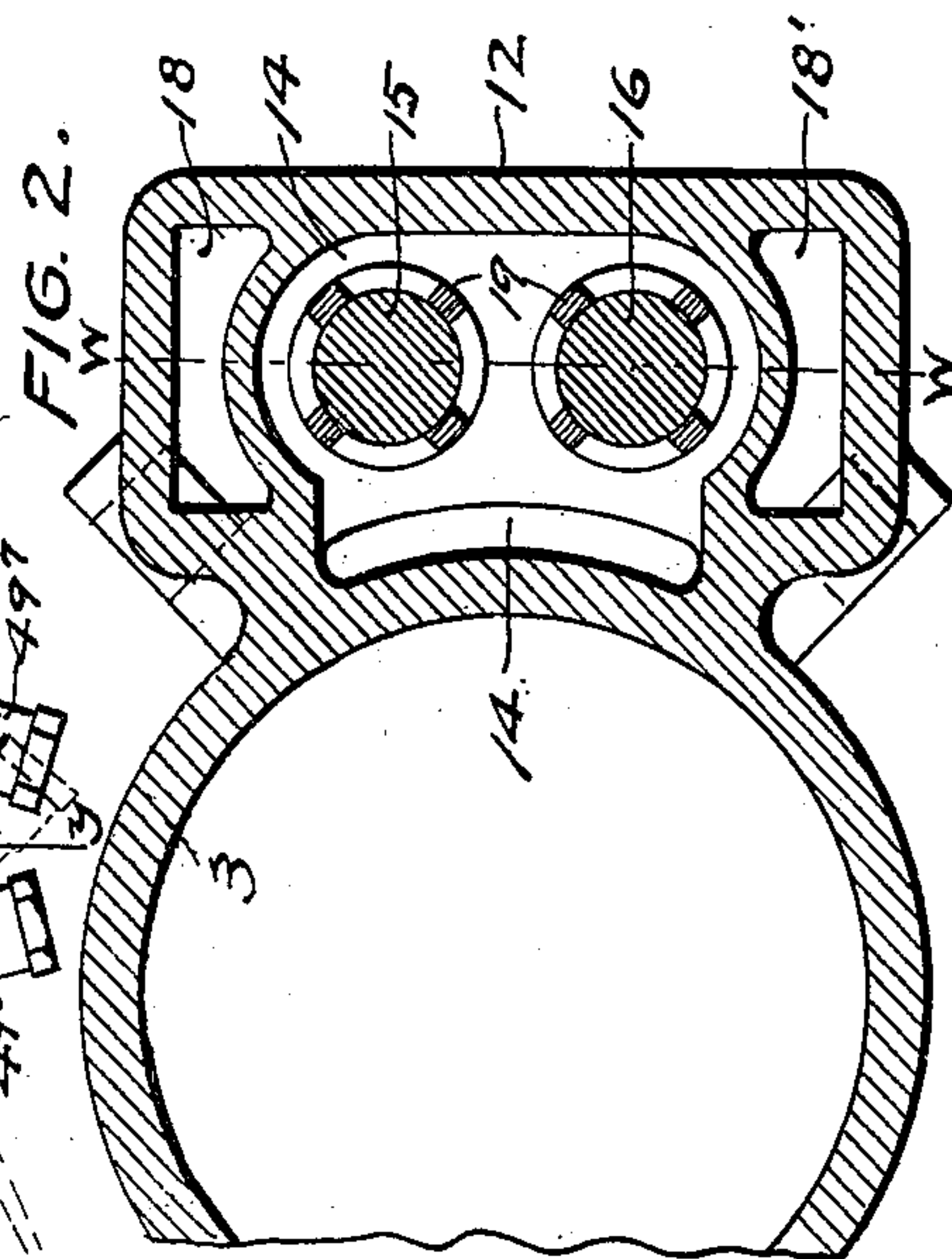
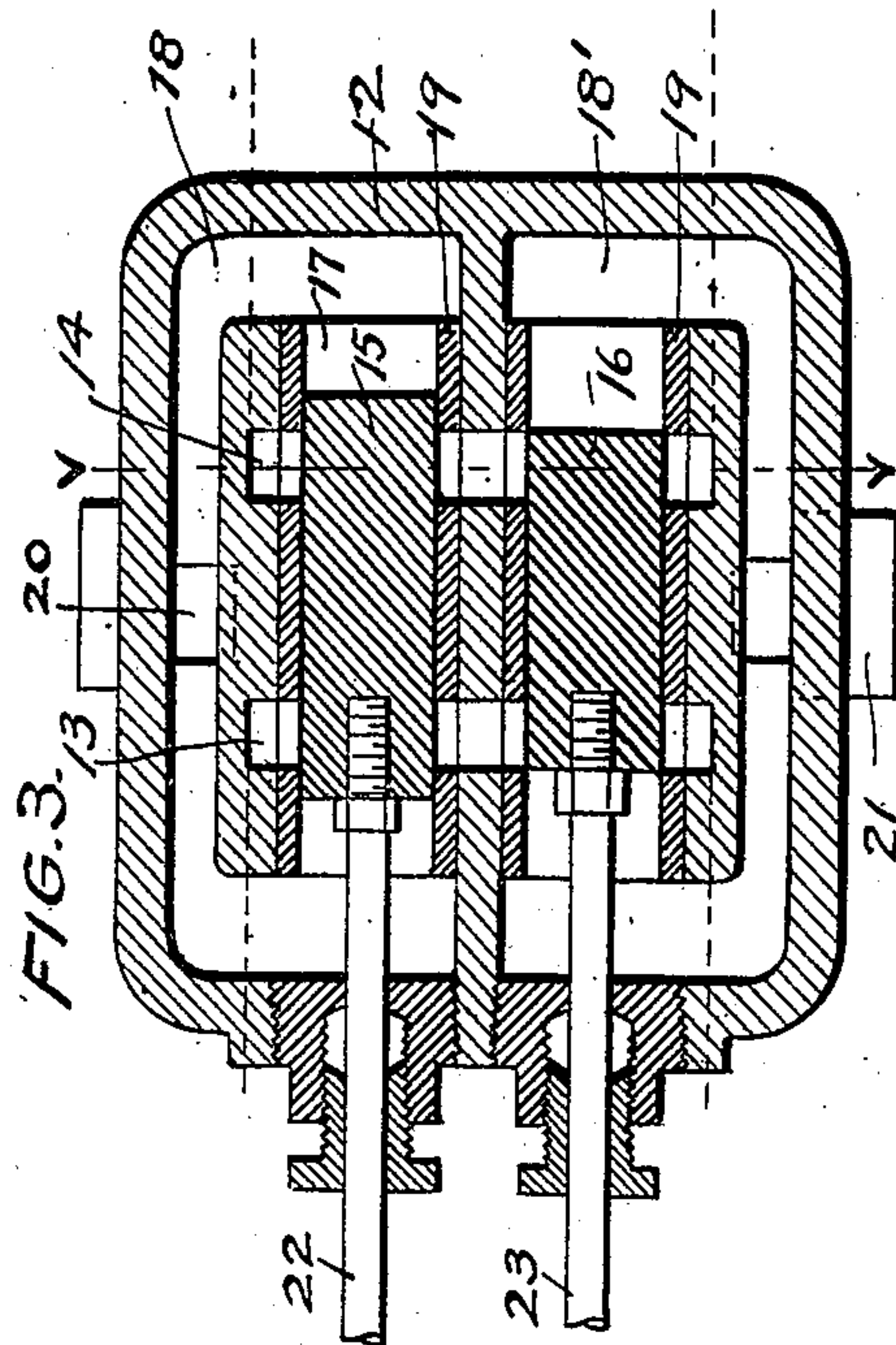
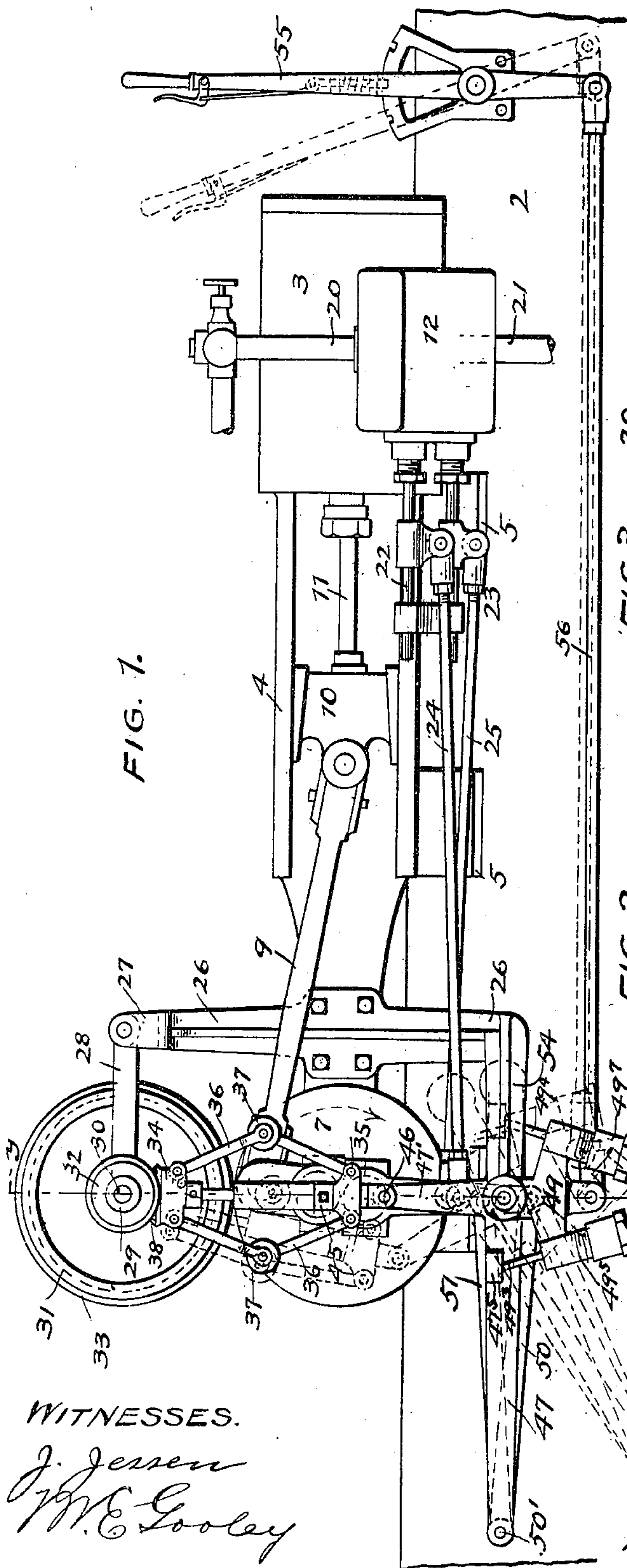
O. HOVE.

ENGINE VALVE GEAR.

(Application filed Dec. 14, 1899.)

(No Model.)

3. Sheets—Sheet 1.



WITNESSES.

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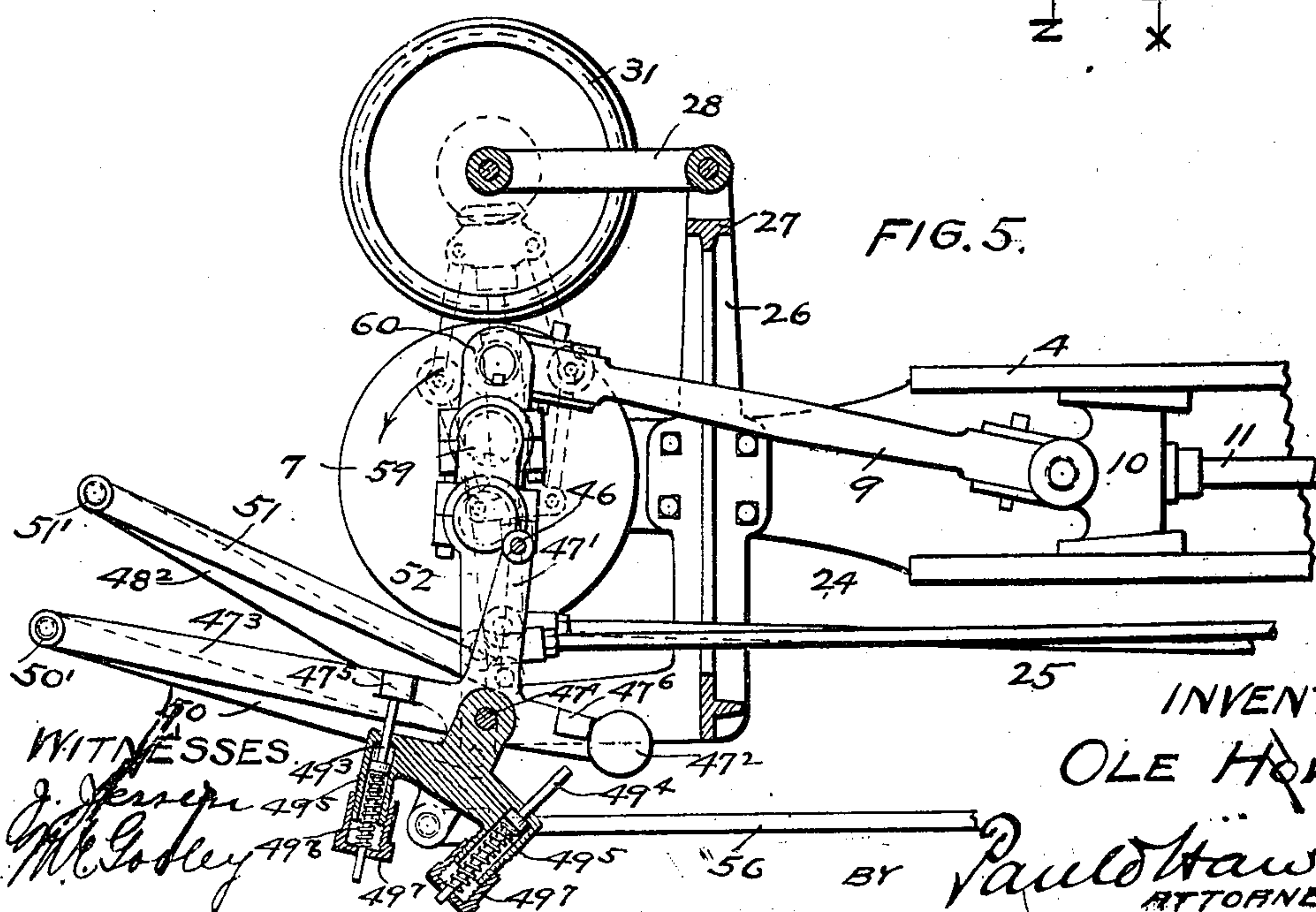
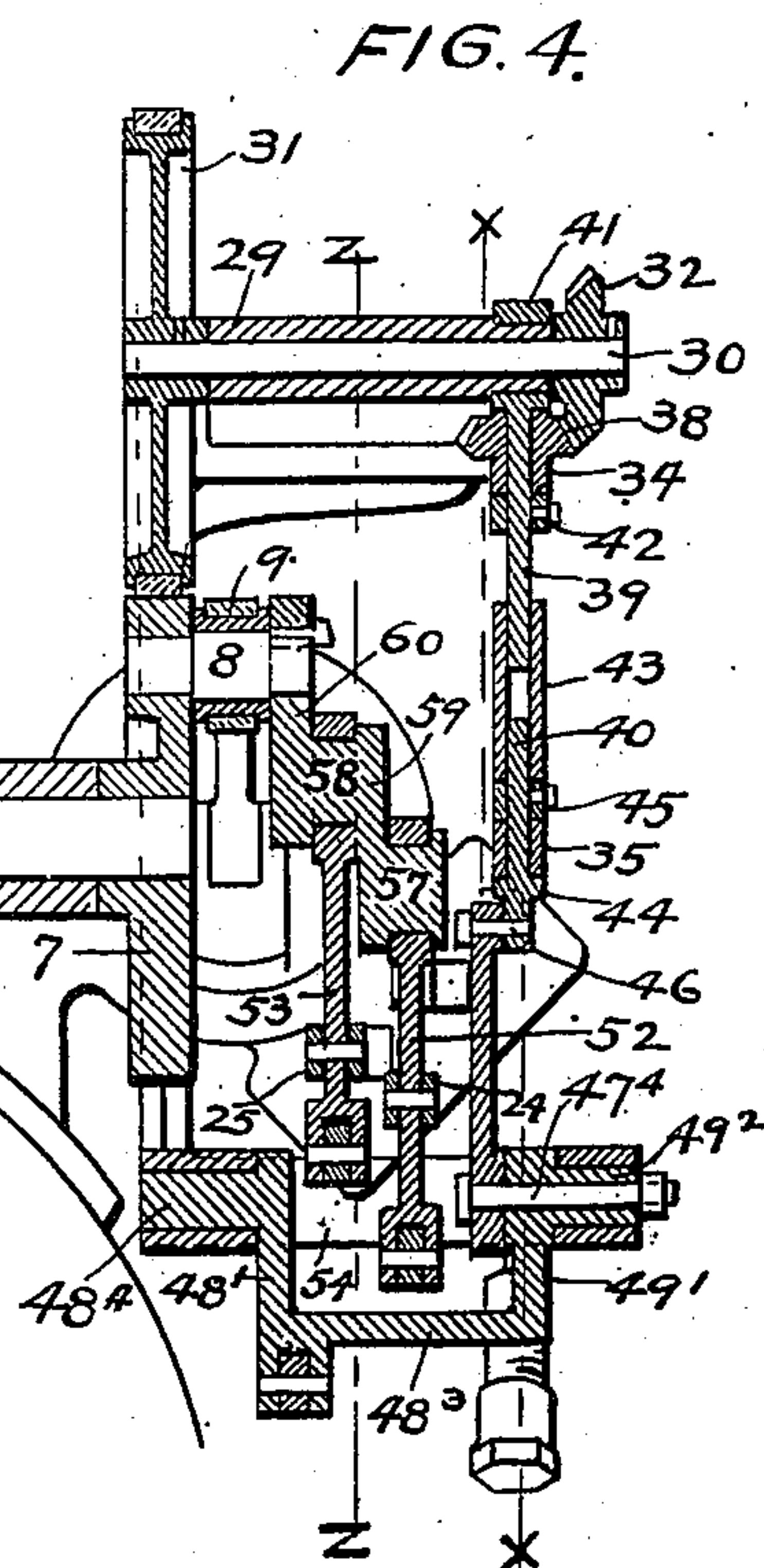
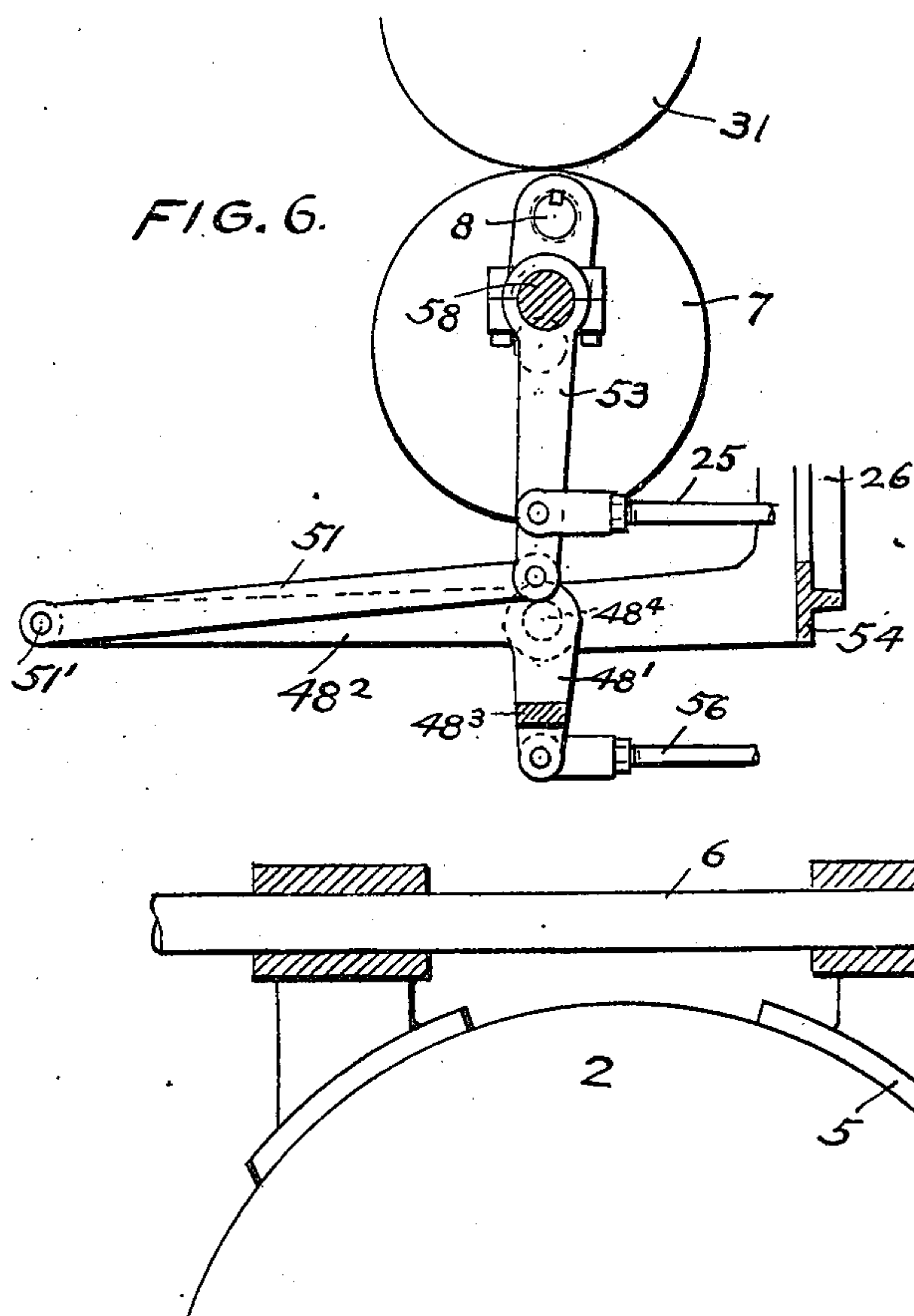
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3 Sheets—Sheet 2.



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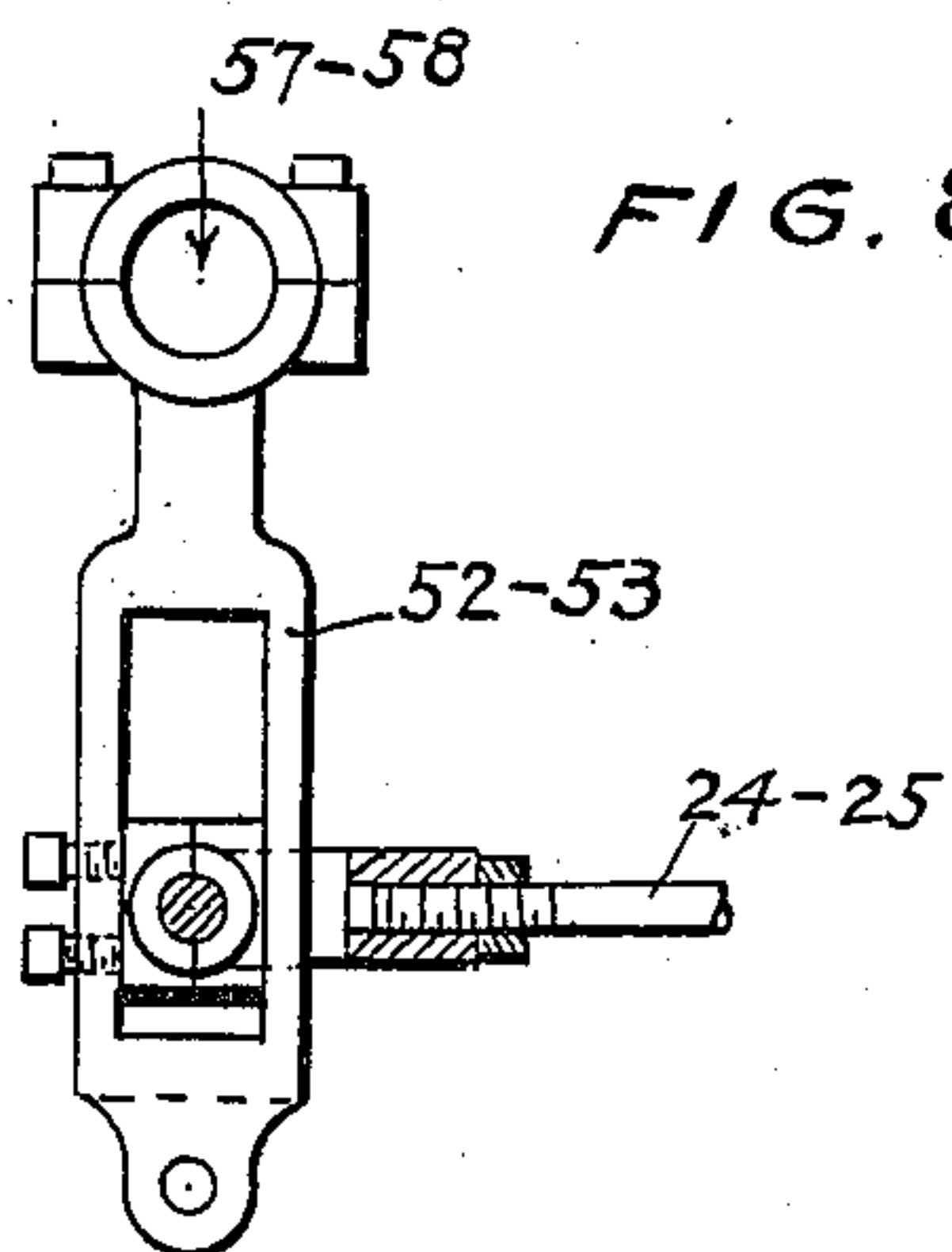
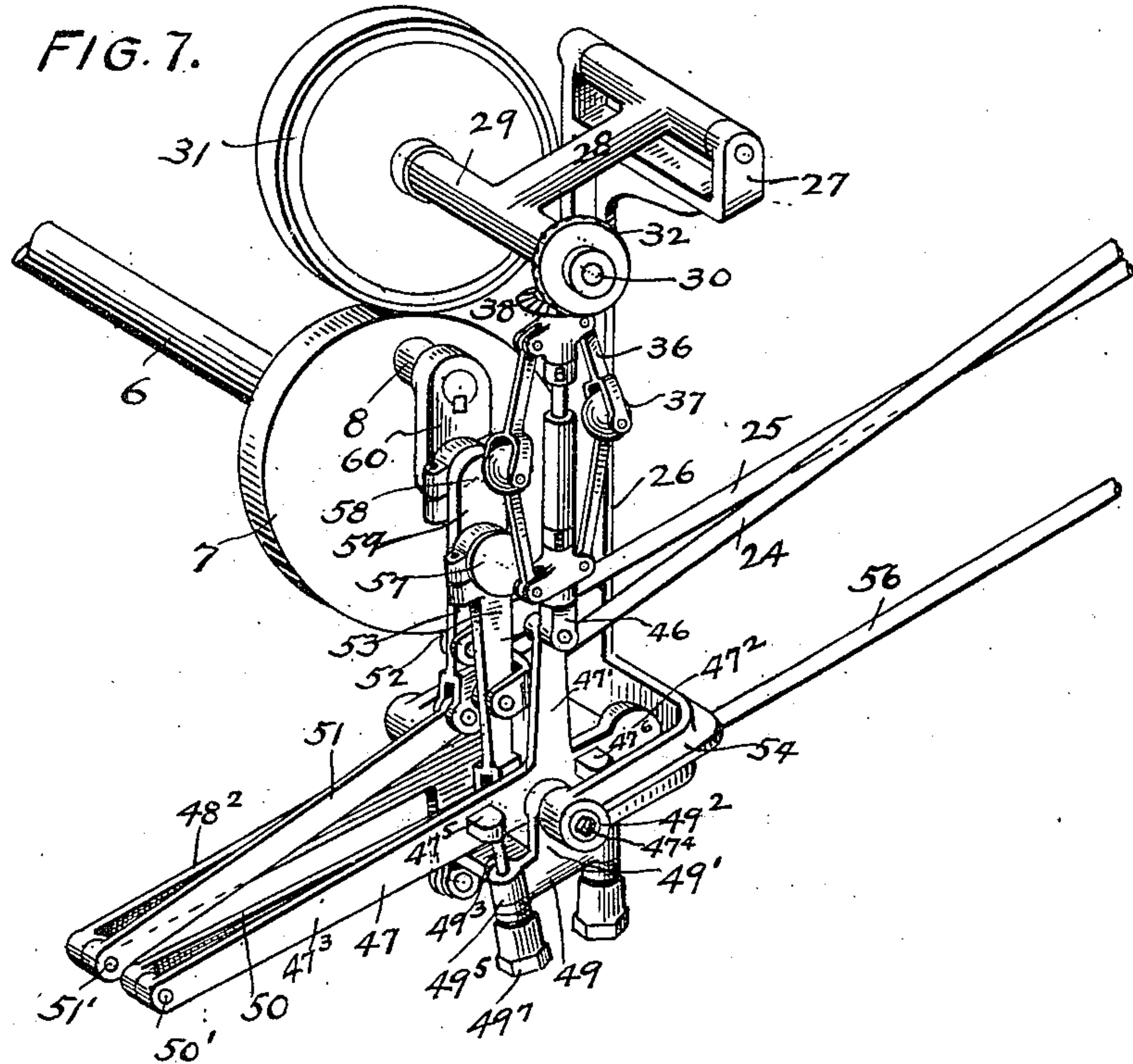
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(No Model.)

3 Sheets—Sheet 3.



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UNITED STATES PATENT OFFICE.

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ENGINE VALVE-GEAR.

SPECIFICATION forming part of Letters Patent No. 670,104, dated March 19, 1901.

Application filed December 14, 1899. Serial No. 740,331. (No model.)

To all whom it may concern:

Be it known that I, OLE HOVE, of the city of Elpaso, Pierce county, Wisconsin, have invented certain new and useful Improve-
5 ments in Engine Valve-Gears, of which the following is a specification.

This invention relates to traction-engines, and particularly to a new and improved valve-gear for engines.

10 One object of the invention is to provide an engine of such construction as to permit of its being placed close to the top of the boiler of the traction-engine and to dispense with the usual governor-belt; and another ob-
15 ject is to provide a valve-gear that is made up of positively-connected parts, all sliding connections or joints being avoided and greater accuracy being secured in the play of the valves.

20 The particular object of my invention is to provide a reversible valve-gear having a variable governor-controlled cut-off for the admission of steam that will permit steam to be admitted to the cylinder at the proper time
25 of the stroke and still admit of sufficient steam lap in the steam-valve; and another particular object of the invention is to provide a valve-motion which, with a fixed (non-varying) exhaust-valve, will retain the steam
30 in the cylinder almost to the end of the stroke and then give a quick and free exhaust, thus avoiding undue compression before the piston, while thereafter quickly closing the ex-
35 haust-port and providing a sufficient cushion for the piston, all with a view to economy of steam and simplicity and cheapness of construction.

My invention consists generally in a steam-engine of the constructions and combinations
40 of parts as hereinafter described, and particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is a side elevation of an engine embodying my invention. Fig. 2 is a cross-section of the
45 steam-chest on the line *v v* of Fig. 3. Fig. 3 is a longitudinal section of a steam-chest on the line *w w* of Fig. 2. Fig. 4 is a sectional view on the line *y y* of Fig. 1. Fig. 5 is a vertical section on the line *x x* of Fig. 4.
50 Fig. 6 is a detail on the line *z z* of Fig. 4. Fig. 7 is a perspective view of the variable

governor-controlled valve-gear. Fig. 8 is a detail of one of the throw-rods.

In the drawings, 2 represents the boiler of the traction-engine. 3 is the engine-cylin- 55
der; 4, the engine-frame; 5, the brackets whereby the engine is secured on the boiler-top, and 6 the crank-shaft. On the crank-shaft is the crank-disk 7, from the crank-pin 8 upon which the connecting-rod 9 extends to 60
the cross-head 10, that is connected to the piston-rod 11 of the piston within the cylinder.

12 represents the steam-chest upon the side and preferably on the lower part of the engine-cylinder. The ports from the ends of 65
the cylinder lead into this steam-chest, terminating in the ports 13 14. I prefer to employ two valves, one for the steam and the other for the exhaust, in place of the usual single slide-valve. These valves are simple 70
sliding plungers or pistons 15 16, the steam-valve plunger being longer than the exhaust-plunger and both being adapted to close both ports 13 14. The plungers 15 16 slide in the
75 valve-cylinders 17, the ends of which open into the ducts 18 18' of the steam-chest for the live and exhaust steam, respectively. I prefer to provide the sleeves 19 in the valve-cylinders, which sleeves may be removed
80 when worn and replaced by others. The live steam enters through the connection 20, and the exhaust-steam escapes through the connection 21 at the bottom of the steam-chest. The valve-rods 22 and 23, belonging
85 to the valve-plungers 15 and 16, respectively, extend through stuffing-boxes in the end of the steam-chest and are guided in a lug or bracket upon the part 5. From the outer
90 ends of the rods 22 and 23 connecting-rods 24 and 25 extend to the valve-operating mechanism or valve-gear. I prefer that the valve-gear shall be applicable to any engine, the engine being provided, preferably, with a new steam chest and valve at the same time.

26 is a double bracket carrying the valve- 95
gear, and I prefer that this vertical arm or bracket 26 be cast independently of the engine-frame and bolted thereto, as shown, the gear being thereby made applicable to almost
100 any engine. The upper end of this arm 26 is provided with a yoke 27, in which is pivoted the rear end of the link 28, which at its free

end has a bearing 29 for the short shaft 30. On opposite ends of this shaft 30 are the governor-driving wheels 31 32. The wheel 31 is of considerable weight and rests upon the crank-disk 7, by which it is driven. To prevent undue slippage, the driving-wheel 31 is preferably provided with a rubber, paper, or leather tire or rim. The link 28 may be provided with a stud or hanger for additional weights. The disk 7 and the wheel 31 are of about the same size; but the wheel 31 may be smaller upon a low-speed engine. The governor may be of any desired type. I prefer a ball-governor, as shown.

34 and 35 represent the blocks to which the toggles 36 are pivoted, said toggles being provided with the weights or balls 37. A bevel-gear 38 is provided in connection with the block 34 and meshes with the bevel 32 to drive the governor. The governor-spindle is divided into two parts 39 and 40, non-rotating, to be drawn together by the action of the balls, and upon which the blocks 34 and 35 rotate. The governor as a whole is pivoted or swung upon the bearing 29 by means of a strap or eye 41, formed at the upper end of the spindle 39, and the bevel-gear 34 is held in mesh with its mate by means of the collar 42 upon said spindle 39. The parts of the spindle are joined and held in line by the sliding sleeve 43. The block 45 is held against longitudinal movement upon its spindle 40 by means of the shoulder 44 and the collar 45 thereon. The governor forms a part of the valve-gear, the lower end 46 of its spindle being pivotally attached to that part of the valve-gear which controls the live-steam valve.

In addition to the governor the valve-gear comprises the shifters 47 and 48, joined by a resistance device 49, the carrying-links 50 and 51, the throw-rods 52 and 53, to which the valve-rods 24 and 25 are connected, and the throw-pins upon the crank-disk. The governor is connected with the shifter 47. The shifter 47 comprises the three arms 47¹ 47² 47³, the arm 47² being weighted to counterbalance the longer arm 47¹, which latter furnishes the moving pivot 50¹ for the carrying-link 50. The governor pivotally engages the arm 47¹. The shifter 48 for the exhaust side comprises depending arm 48¹ and the long arm 48², which latter provides the pivot 51¹ for the carrying-link 51. A bridge 48³ extends from the depending arm 48¹ across beneath the shifter 47 and is provided with an upwardly-extending part 49¹, having a stud 49², that is concentric with the stud 48⁴ on the opposite side, extending from the arm 48. These two studs are journaled in the ends of the yoke 54, provided upon the lower end of the frame arm or bracket 26. The center of the shifter 47 is concentric with the center of the shifter 48, the same being journaled upon the pin 47⁴, which extends through the stud 49². The shifters 47 and 48 are yieldingly connected by means of the resistance device 49, before

mentioned, and comprising the spring-pins 49³ 49⁴, that are slidable in the cases 49⁵, provided upon the part 49. These pins are normally thrust out by springs 49⁶ within the cases, the pressure of which springs is adjustable by means of the screw-caps 47⁷ for said cases. These pins normally bear against the studs 47⁵ and 47⁶, provided upon opposite sides of the pivot or center of the shifter 47. Both of the shifters may be moved from their horizontal position into the elevated or the depressed positions by means of the reversing-lever 55, preferably having three positions, as shown in Fig. 1, and connected by means of the rod 56 to the lower end of the depending arm 48¹ of the shifter 48. The throw-rods 52 and 53 have their lower ends pivotally held by the carrying-links 50 and 51, respectively, and the connecting-rods 24 and 25 are attached to the throw-rods 52 and 53 at points intermediate of the ends thereof. The throw-rods are preferably of the same length, and their upper ends are journaled upon the throw-pins 57 and 58 on the crank-disk. The whole valve-gear mechanism might be arranged back of the crank-disk; but for traction-engines it is more convenient to arrange the same upon the face of the disk. To this end it is necessary to provide the overhanging brackets 59 and 60, attaching the latter to the extended end of the crank-pin 8. The brackets 57 and 58 may be integral, and the throw-pins may be integral therewith. The pins 57 and 58 are preferably arranged in line with the center of the crank-disk and the crank-pin 8, it being unnecessary to provide at these points for taking up the lap and lead in the valves as in ordinary valve-motions, the same being accomplished in this instance by the arrangement of the connecting-rods 24 and 25 at intermediate points upon the throw-rods. By changing the point of attachment of the rods 24 and 25 to their throw-rods the valves are adjusted to the exact lap provided therein and may be adjusted to take up lost motion. (See Fig. 8.) Should the connecting-rods 24 and 25 be attached at the pivotal points between the carrying-links and the throw-rods, the action would be the same as though the ordinary eccentrics were employed, except that it would be necessary to provide for the lead by changing the positions of the throw-pins upon the crank-disk. It is obvious that eccentrics may be substituted for the throw-pins and straps provided upon the throw-rods; but as the same would be more bulky and expensive I prefer the construction shown.

The operation of the valve-gear is as follows: To start the engine, the lever 55 is thrown into the dotted-line position, Fig. 1. This, through the rod 56, throws down the shifters 47 and 48 into the position shown in Fig. 1. As the throw-pins are upon opposite sides of the crank-disk center, the carrying-links 50 and 51 will occupy different positions, and when the shifters are moved one link will be

thrown forward and the other moved back of the pivotal center of the shifters, thereby opening the steam-valve at one end of the cylinder and opening the exhaust-valve at the opposite end. The valves are thus opened to start the engine, whereupon the throw-rods are moved about the crank-center, changing the angles thereof and raising and depressing the links 50 and 57 to open and close the valves. As soon as the governor is rotated the same begins to exert a tension upon the shifter 47, that is connected to the steam-valve, and the same is lifted slightly from the dotted-line position, Fig. 1, to decrease the throw of the steam-valve by carrying the inner end of the link 50 more closely to a vertical plane, including the crank-center. Under a light load and at a high speed the governor will tend to draw the shifter 47 up to nearly the horizontal position, thereby changing the point of cut-off, the link 50 moving up and down in nearly a straight line, so short is the arc. The swinging movement of the links when inclined operates to open the valve-ports, and the swinging movement imparted to the throw-rods by the rotation of the cranks operates to take up the valve lap, both of which movements take place quickly with the requisite pauses therein. The slight variation between the arc of travel of the link ends 50 51 and a straight line compensates for the quicker movement of the engine-piston in its backward stroke, so that the valve speeds are accelerated to correspond with the accelerated speed of the piston. When the shifters are in a horizontal or middle position, the valves will be operated only to the extent of their lap, (slightly less,) so that no steam will be admitted to the cylinder, and to reverse the engine the shifters are thrown into the upper position, as shown in Fig. 5. The resistance device 49 operates continually against the governor, regardless of the position of the shifters, owing to the arrangement of the resistance device upon the arbitrarily-movable shifter 48, which latter is through the locked lever 55 made stationary during the operation of the engine in either direction.

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

1. The combination of the engine comprising a cylinder, piston, crank-shaft and connecting members, said cylinder having independent inlet and exhaust valves, with a valve-gear comprising members connected with said inlet and exhaust valves, and independently operable thereon, said valve-gear being driven from said crank-shaft, and the governor also driven from said crank-shaft and interposed in the portion of the valve-gear which is connected with said inlet-valve whereby the admission of steam to the cylinder may be governed independently of the action of the exhaust-valve, substantially as and for the purpose specified.

2. The combination of the engine provided

with independent inlet and exhaust valves, with a reversible valve-gear having two driven parts connected respectively with said valves, a cushion interposed between said parts and a governor adapted to automatically vary the operation of the inlet-valve-gear part, substantially as and for the purpose specified.

3. The combination of the engine provided with inlet and exhaust valves independently operable, with the governor driven from the crank-shaft of said engine, and a variable valve-gear also driven therefrom, and wherein said governor is interposed and is positively connected with that part of the gear which operates the inlet-valves, substantially as specified.

4. The combination, with the engine having independent inlet and exhaust valves, of the governor driven by the engine, and the positively-connected variable throw-levers connected with said governor and the inlet and exhaust valves, substantially as described.

5. The combination, of the engine and the independently-movable inlet and exhaust valves thereof, with the throw-rods driven from the crank-shaft of the engine, the carrying-links whereto the free ends of said throw-rods are attached, the valve-rods intermediately connected to said throw-rods, and means for changing the positions of said carrying-links, substantially as described.

6. The combination, with the engine, and the independently-movable inlet and exhaust valves thereof, of the throw-rods driven from the crank-shaft of said engine, the carrying-links whereto the free ends of said throw-rods are pivotally connected, the adjustable shifters for said links, the governor-resisting device interposed between said shifters, the governor driven from said crank-shaft and connected with one of said shifters, and the valve-rods connected to said throw-rods at intermediate points thereon, substantially as described.

7. The combination, of the cylinder, crank-shaft and connecting members, with the overhanging cranks upon said crank-shaft, the throw-rods, the carrying-links having adjustable centers, means for adjusting the same, the inlet and exhaust valves and valve-rods respectively, the latter connected to said throw-rods, and the constantly-driven governor positively connected with one of said throw-rods and its carrying-link, to automatically shift the center of said carrying-link, for the purpose specified.

8. The combination, of the engine-frame, cylinder, piston-valve, connecting-rod and crank, with the overhanging cranks or throw-pins in connection with said crank, the overhanging governor, and the valve-gear parts positively connecting said governor and throw-pins with the valves of the engine, said parts being adjustable, as described.

9. The combination, with the engine and the crank-disk thereof of the governor-driv-

ing wheel resting upon said disk, the governor driven therefrom, and the valve-gear interposed between said governor and said crank-disk, and controlling the operation of the engine-valves, substantially as described.

10. The combination, of the engine having independent inlet and exhaust valves, with a valve-gear driven by said engine and having two parts connected with said valves respectively, said valve-gear also having the positively-connected variable throw-levers, a cushion or resisting device interposed between said levers and a governor driven by the engine and connected with the throw-lever of the inlet-valve as and for the purpose specified.

11. The combination, of the engine and the independently-movable inlet and exhaust valves thereof, with the throw-rods driven from the crank-shaft of the engine, the carrying-links whereto the free ends of said throw-rods are attached, the pivoted shifters whereto the other ends of the links are connected, the governor-resisting device interposed between said shifters, reversing means for adjusting said shifters and securing one thereof, the valve-rods intermediately connected to said throw-rods, and the governor driven

from said crank-shaft and connected with the free shifter, whereby the admission of steam is automatically controlled regardless of the operation of the exhaust-valve, substantially as set forth.

12. The combination, of the engine and the independently-movable inlet and exhaust valves thereof, with the throw-rods driven from the crank-shaft of the engine, the valve-rods intermediately connected to said throw-rods, the links pivotally connected to the free ends of said throw-rods, the exhaust-side shifter and the inlet-side shifter whereto the ends of said links are respectively pivoted, a governor-resisting device interposed between said shifters and the governor driven from said crank-shaft and connected with the inlet-side shifter to alter the relation thereof to the exhaust-side shifter, substantially as and for the purpose specified.

In testimony whereof I have hereunto set my hand this 11th day of December, 1899, at Minneapolis, Minnesota.

OLE HOVE.

In presence of—
RICHARD PAUL,
C. G. HAWLEY.