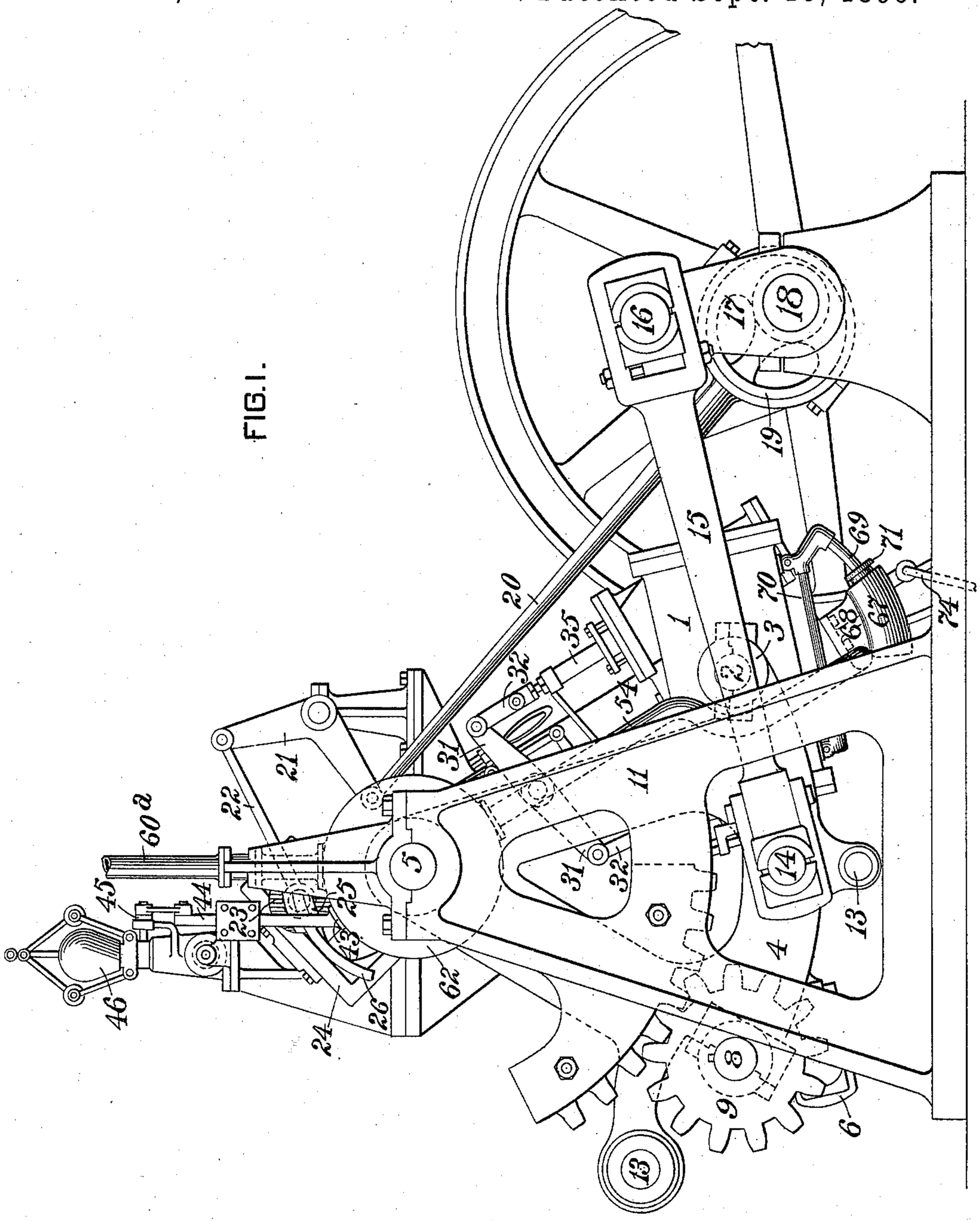
(No Model.) 6 Sheets—Sheet 1.

P. LERSCH.

STEAM ENGINE.

No. 567,747. Patented Sept. 15, 1896.

FIG. 1.



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(No Model.) 6 Sheets—Sheet 2.

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FIG. 2.

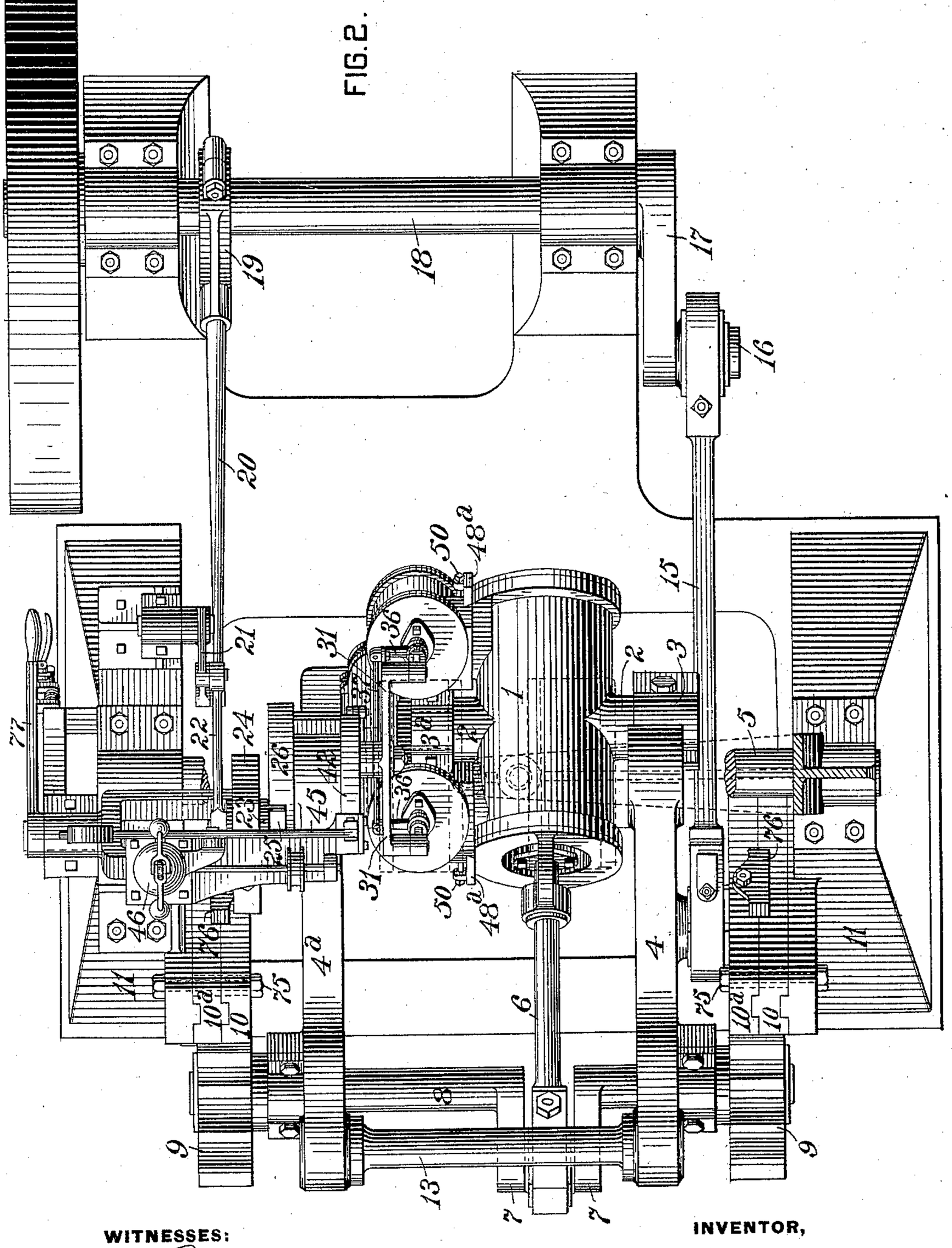

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FIG. 12.

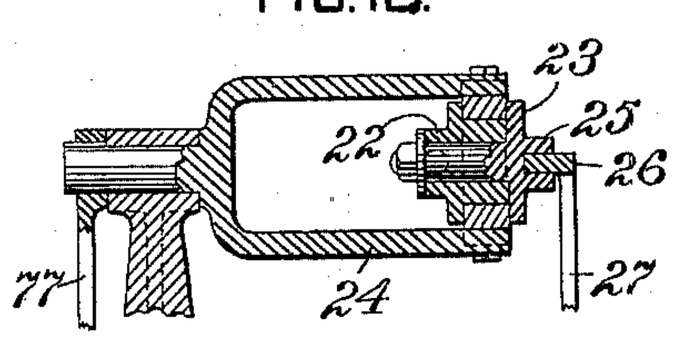


FIG. 3.

FIG. 13.

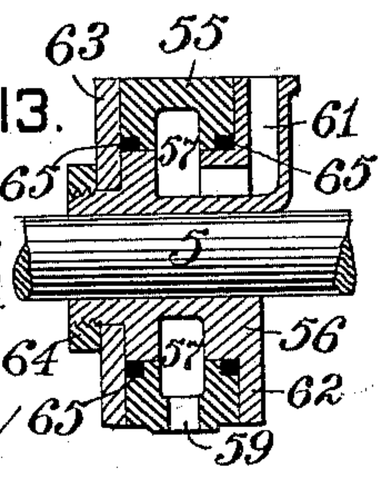
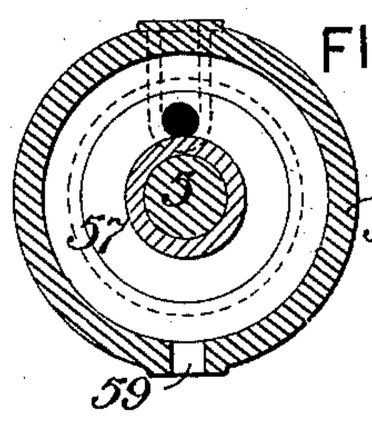


FIG. 14.



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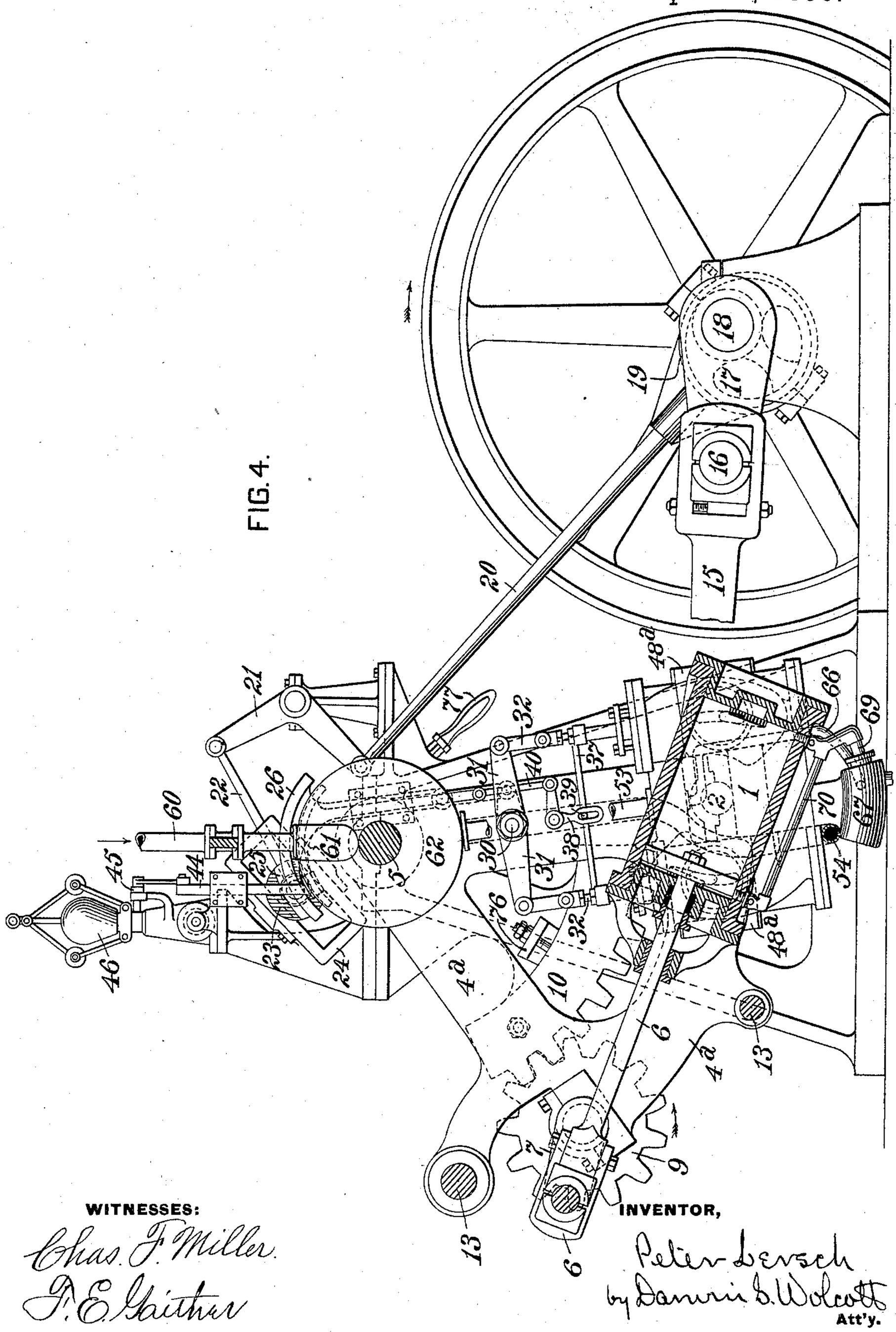
STEAM ENGINE.

No. 567,747. Patented Sept. 15, 1896.

FIG. 4.



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STEAM ENGINE.

No. 567,747. Patented Sept. 15, 1896.

FIG. 5.

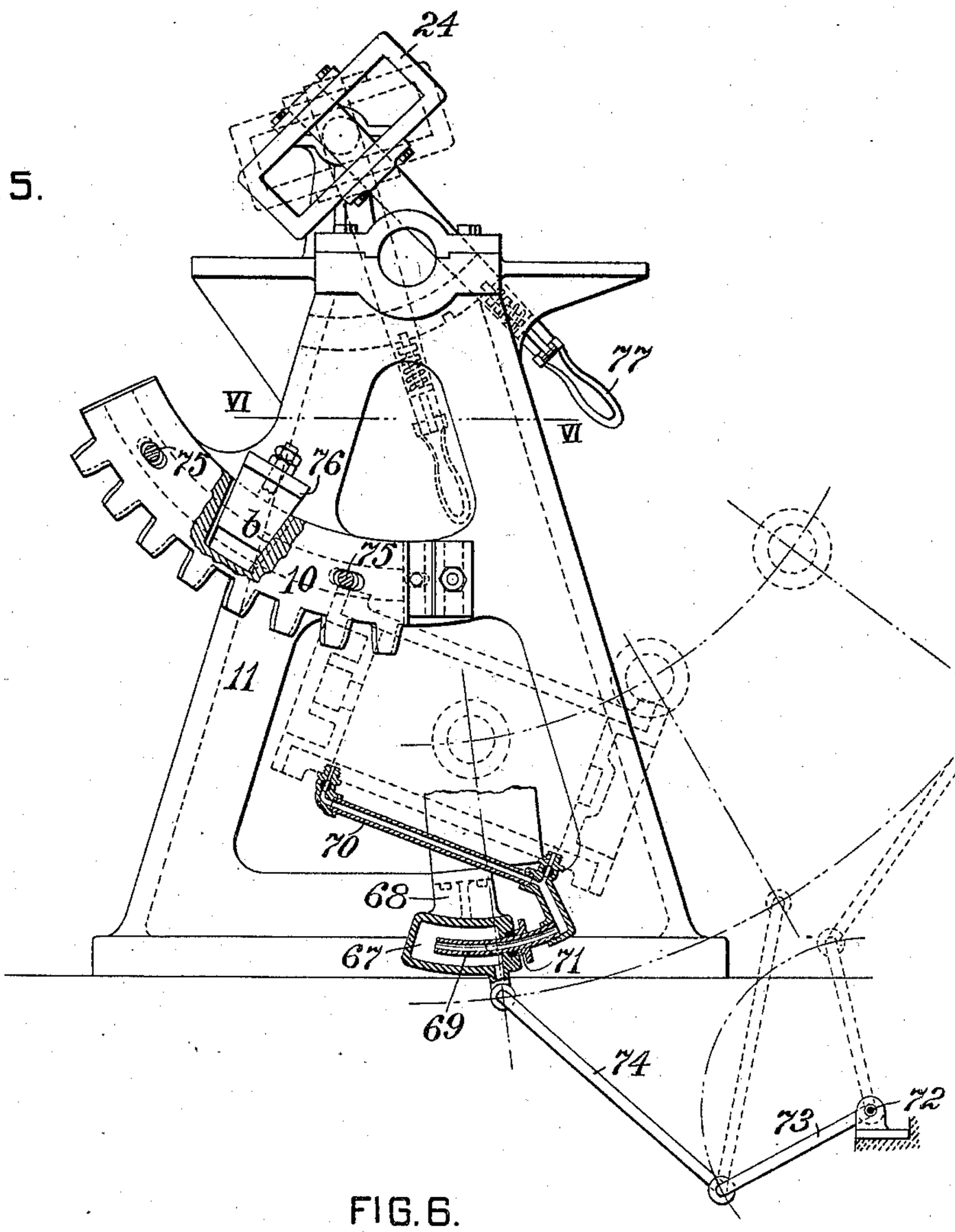
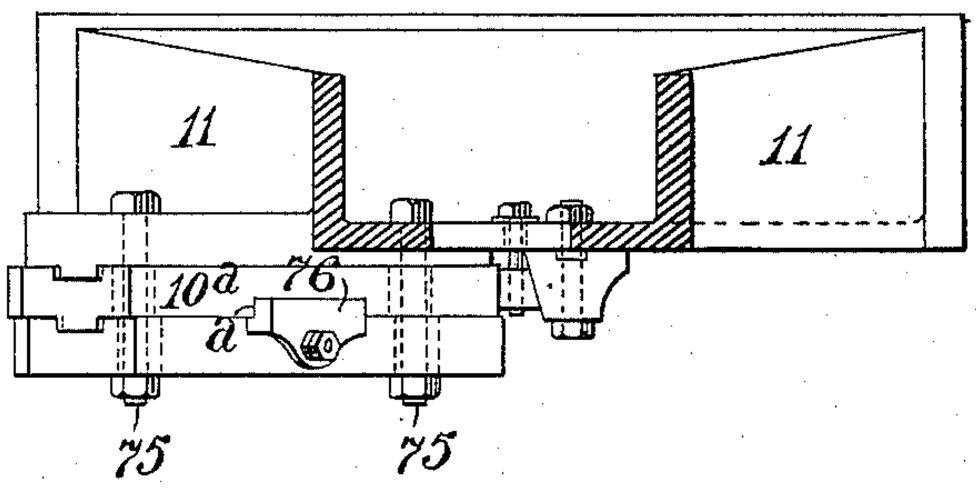


FIG. 6.



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STEAM ENGINE.

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FIG. 10.

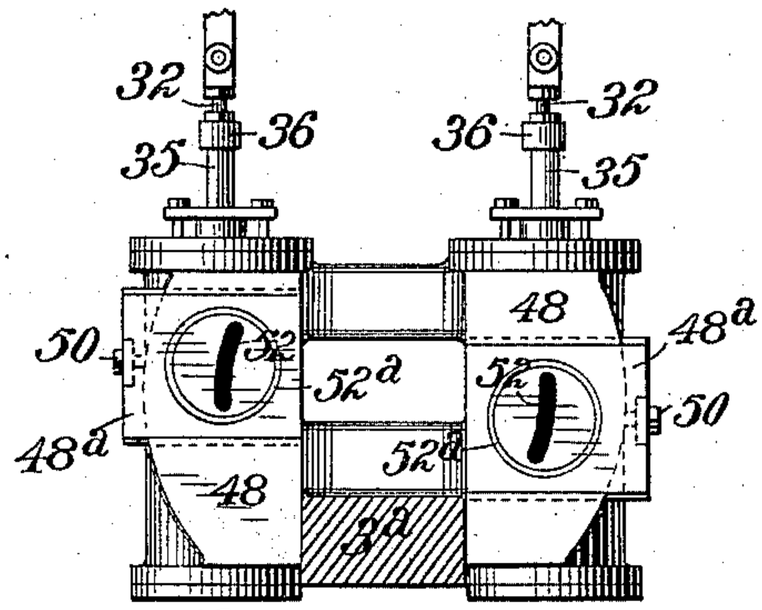


FIG. 11.

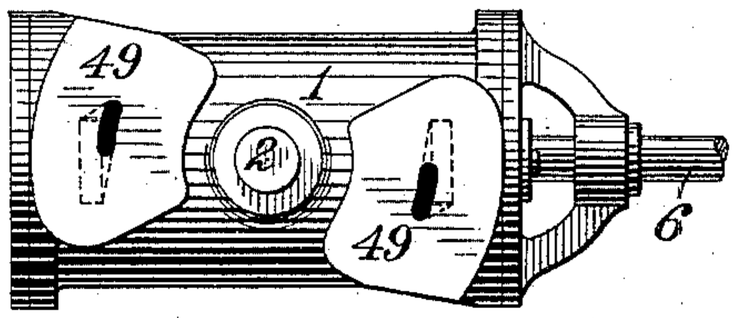


FIG. 7.

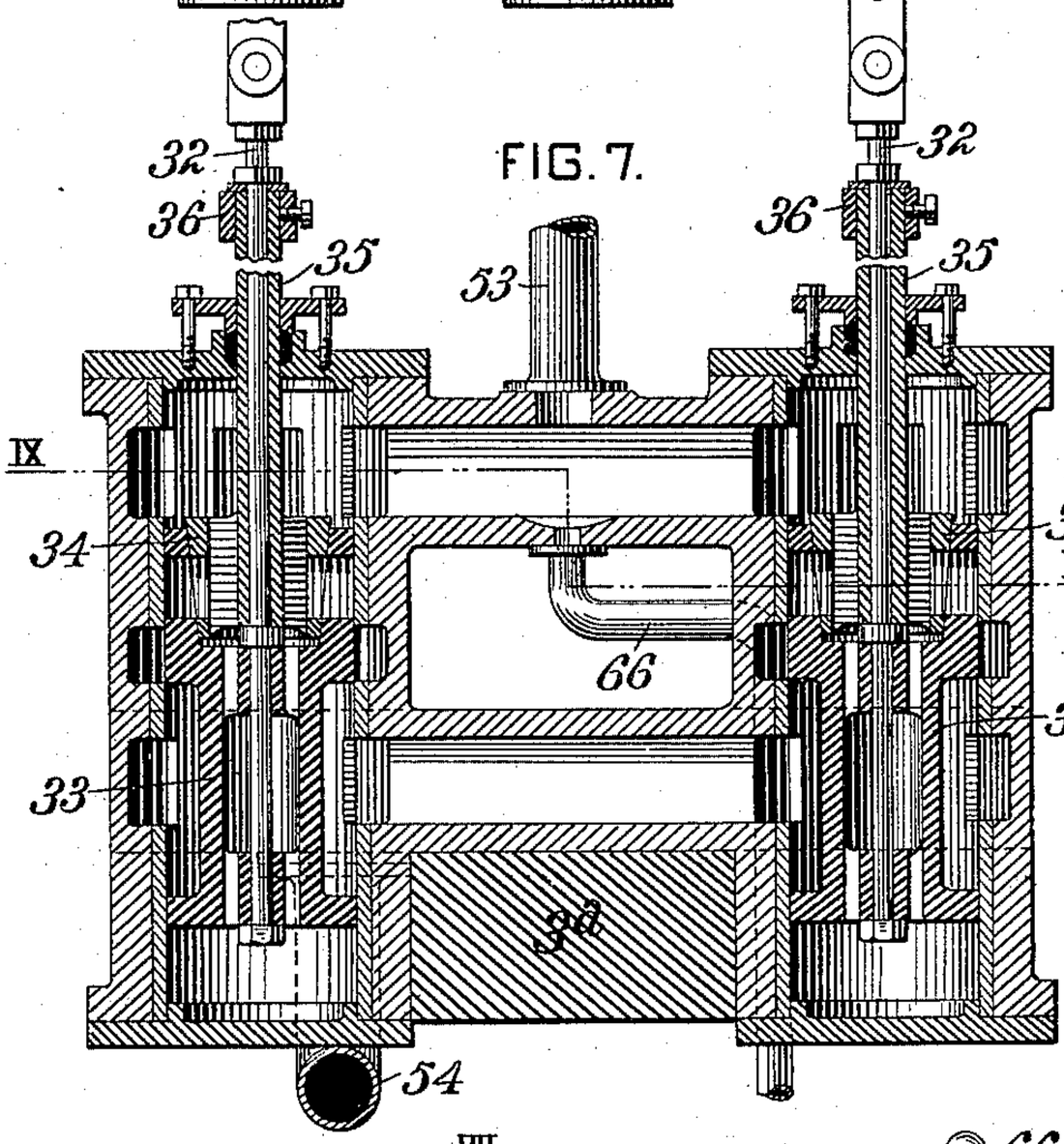


FIG. 8.

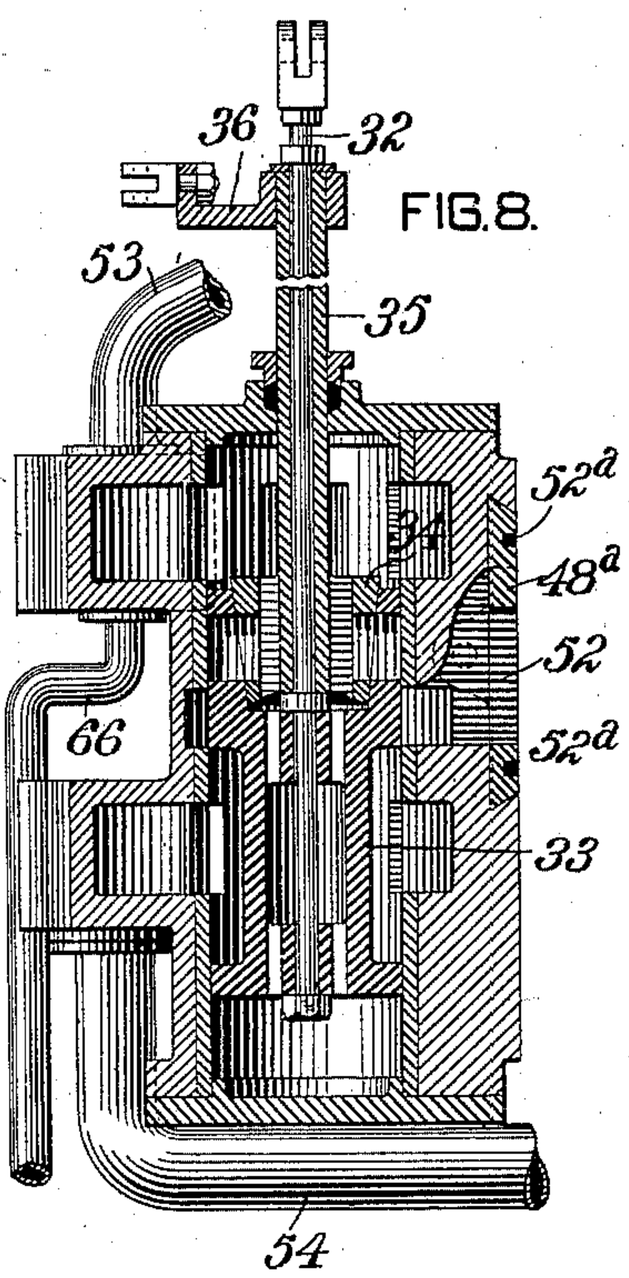
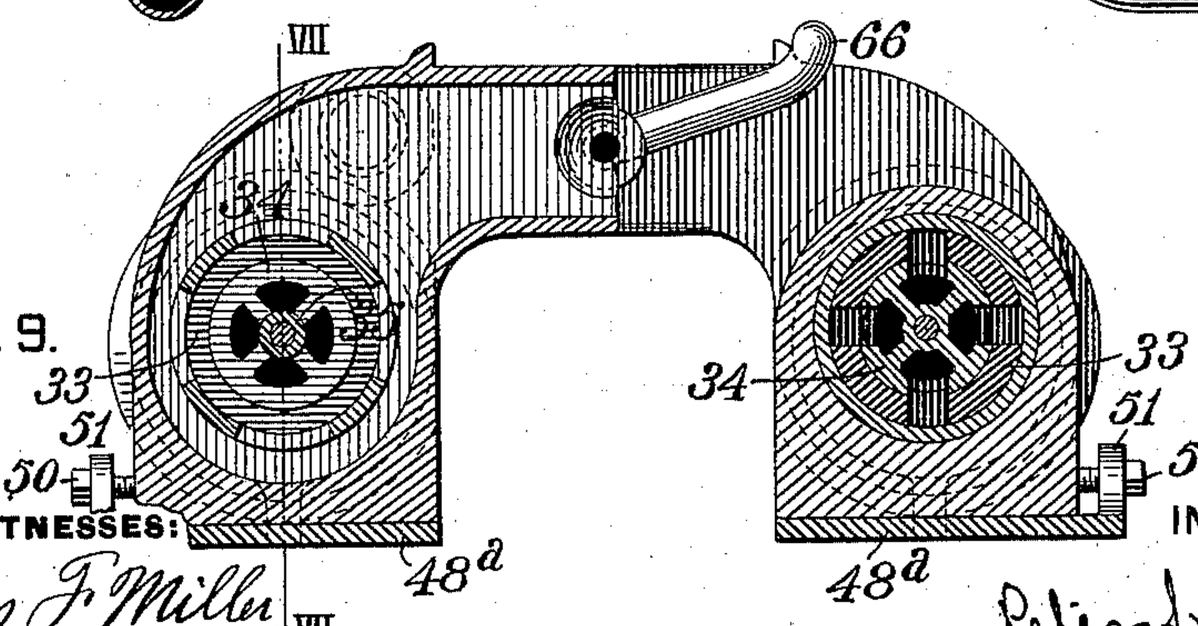


FIG. 9.



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UNITED STATES PATENT OFFICE.

PETER LERSCH, OF SPRING GARDEN, ALLEGHENY COUNTY, PENNSYLVANIA.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 567,747, dated September 15, 1896.

Application filed January 18, 1896. Serial No. 575,988. (No model.)

To all whom it may concern:

Be it known that I, PETER LERSCH, a citizen of the United States, residing at Spring Garden, borough, in the county of Allegheny and State of Pennsylvania, have invented or discovered certain new and useful Improvements in Steam-Engines, of which improvements the following is a specification.

The invention described herein relates to certain improvements in steam-engines, and has for its object a construction and arrangement of mechanism whereby the reciprocating movement of a comparatively short-stroke piston is transformed with a considerable increase in effectiveness to a rotary movement, having a radius approximately equal to the stroke of the piston.

In general terms the invention consists in the construction and combination substantially as hereinafter more fully described and particularly claimed.

In the accompanying drawings, forming a part of this specification, Figure 1 is a side elevation of my improved engine. Figs. 2 and 3 are a top plan and an end elevation, respectively, of the engine. Fig. 4 is a sectional elevation, the plane of section being indicated by the line IV IV, Fig. 3. Fig. 5 is a side elevation of the frame with certain connections shown in sectional detail. Fig. 6 is a sectional view of one side of the frame, the plane of section being indicated by the line VI VI, Fig. 5. Figs. 7 and 8 are sectional views, on an enlarged scale, at right angles to each other, of the valve mechanism. Fig. 9 is a sectional plan view of the valve mechanism, the plane of section being indicated by the line IX IX, Fig. 7. Fig 10 is a side elevation of the valve-case, showing the ports leading to the cylinder. Fig. 11 is a side elevation of the cylinder, showing the ports therein. Fig. 12 is a sectional detail view of a portion of the valve-operating mechanism, and Figs. 13 and 14 are detail views of steam-boxes surrounding the supporting-shaft for connecting the movable and stationary portions of the steam and exhaust pipes.

In the practice of my invention the cylinder 1 is provided on its sides with trunnions 2, which are mounted on extensions 3 3^a of arms 4 and 4^a. These arms are mounted on the shaft 5 in such manner as to permit of their being oscillated back and forth, as hereinafter described. The piston-rod 6 is connected to a crank 7, formed in the shaft 8, which is mounted in suitable bearings on the arms 4 4^a. On the ends of the shaft 8 are keyed pinions 9, adapted to intermesh with racks 10, bolted to the inner faces of the standards 11, which are provided at their upper ends with bearings for the shaft 5.

The arms 4 4^a are connected and stayed as against independent swinging movement by transverse rods 13 and by the shaft 8 and the trunnions on the cylinder. One of the arms, as 4, is provided with a pin 14, to which is connected one end of a pitman 15, the opposite end thereof being connected to a pin 16 on the crank 17 of the power-shaft 18.

On the shaft 18 is keyed the eccentric 19, the strap of which is connected by a rod 20 to one arm of a bell-crank 21, the other arm of said crank-arm being connected by a rod 22 to the block 23. This block is adapted to be reciprocated in the pivotally-mounted link 24, and is provided on its face with two curved ribs 25, forming a groove for the reception of the curved head 26 on the rod 27, which passes down through a guide-sleeve 28, secured on one side of the swinging arm 4^a, and has its lower end attached to a short arm 29 on the rocker-shaft 30. This rocker-shaft is mounted in a suitable bearing in the arm 4^a, and is provided with oppositely-projecting arms 31, which are connected by rods 32 to the piston-valves 33, controlling the flow of steam to and from the cylinder. The rotary cut-off valves 34 are attached to sleeves 35, surrounding the rods 32, and provided at their upper ends with arms 36, which are connected to opposite ends of a bar 37, as shown in Figs. 3, 4, 7, and 8. This bar is reciprocated for the rotation of the sleeves and the cut-off valves by a bell-crank lever 38, having one arm slotted for the reception of a pin 39 on the bar 37. The other arm of the bell-crank is attached to the lower end of the rod 40, which passes up through a guide 41 on the arm 4^a, and is provided at its upper end with a curved head 42, engaging a groove in the block 43 at the lower end of the slide 44. This slide is connected to a lever 45, which is operated by the governor 46.

The valve case or shell is supported on the

angular extension 3^a on the arm 4^a, as shown in Fig. 3, and its faces 48 are held against the faces 49 of the cylinder by the rods 13, connecting the arms 4 4^a. Portions of the bearing-faces of the valve case or shell are formed by removable plates 48^a, as shown in Figs. 8, 9, and 10. These plates are preferably formed with inclined or beveled edges and fit tightly within correspondingly-shaped recesses in the valve-case. These plates are held from sliding out by means of bolts 50, passing through ears or lugs 51 on the plates and screwing into the valve case or shell. The steam-ports 52 of the valve case or shell are formed through the removable plates, and in the faces of the latter are formed circular grooves surrounding the ports 52 and adapted to receive a suitable packing 52^a, whereby the escape of steam between the wearing-faces of the valve-case and cylinder is prevented. The arrangement of the packing in the removable plates permits of the renewal of the packing without disturbing the cylinder or valve-case. It will be observed by reference to Figs. 10 and 11 that the ports 52 in the valve-case are elongated and formed on the arc of a circle whose center coincides with the axis of the trunnions of the cylinder, so that the ports in the cylinder will register with the ports 52 during the movement of the cylinder on its trunnions.

One end of the steam-pipe 53 and the exhaust-pipe 54 is connected to the valve case or shell, as shown in Figs. 3 and 8, while the opposite ends are connected to collars 55 55^a, mounted on blocks 56 56^a, loosely mounted on the shaft 8. Annular grooves 57 are preferably formed partly in the collars and partly in the blocks, as shown in Figs. 13 and 14, and are connected to the pipes 53 and 54 by openings 59 through the collars. These grooves are connected with the stationary steam and exhaust pipes 60 60^a by passages 61, formed in the blocks 56 56^a. The collars are held in place on the blocks by means of flanges 62, formed on the blocks and disks or washers 63, which are held in place by nuts 64, screwing on threaded stems projecting from one end of the blocks. The joints between the collars and blocks are rendered tight by means of packing-rings 65, preferably formed of metal. This construction forms a tight flexible joint or connection in the steam and exhaust pipes, allowing the portions thereof adjacent to the valve-case to move freely therewith.

In order to provide for the drainage of the valve-case, it is connected by a pipe 66 with a shell 67, which is supported by a bracket 68, attached to the extension 3 of the arm 4^a, as shown in Figs. 3 and 5. The drainage of the cylinder is effected by a curved pipe 69, connected to the ends of the cylinder by the pipe 70 and projecting through a stuffing-box 71 into the shell 67. The curvature of the pipe 69 corresponds to the arc of a circle, whose center coincides with the axis of the trunnions of the cylinder, so that as the latter rocks on its trunnions the pipe will move back and forth in the stuffing-box. The shell is connected with a stationary pipe 72 by means of pipe-sections 73 and 74, united by flexible joints, thereby maintaining constant connection between the shell and the stationary pipe during the oscillations of the cylinder.

In order to compensate for wear and to take up any lost motion between the pinions 9 and the racks 10, the latter are formed in two sections adapted to be shifted one along the other, thereby moving the teeth on one section slightly ahead of those on the other section. The two sections are held together and in position on the standards by means of bolts 75, passing through slots in the sections, as shown in Figs. 5 and 6. The slots are so arranged that when the sections are placed together with their teeth in line the bolts will be at one end of the slots in one section and at the opposite end of the slots in the other section. In the adjacent faces of the sections are formed recesses having the wall *a* on one side of the recess in one section inclined and the wall *b* on the opposite side of the recess in the other section oppositely inclined, thereby forming a wedge-shaped recess for the reception of the adjusting-wedge 76. The recesses are so formed that when the sections are placed together with their teeth in line and the wedge inserted the edges of the latter will bear against the walls *a* and *b*, but not against the other walls, as shown in Fig. 5. It results from this construction that an inward movement of the wedge will shift the sections 10 10^a in opposite directions, so that the teeth on one section will be slightly in advance of the teeth on the other section.

In order to provide for a reversal of the engine, a lever 77 is secured to the shaft supporting the link 24 for the purpose of changing the angular position of the link and thereby reverse the direction of travel of the valves.

In describing the operation of the engine it will be supposed that the piston is at the left-hand limit of its movement and the several parts in the position shown in Fig. 4. It will be observed that the crank 7 corresponds in length to the radius of the pitch-line of the pinion 9, so that whatever power is applied to the crank-pin may be considered as being applied to the pinion at a point on its pitch-line. As the piston moves to the right the pinion will be rotated in the direction of the arrow, and, rolling along the rack-bar 10, will shift the arms 4 4^a to the right, thereby rotating the crank 17, which is connected to the arm 4 by the pitman 15. On the return movement of the piston the rotation of the pinions is reversed, which, rolling along the racks, shift the arms 4 4^a in the opposite direction. The length of the cylinder, the operative perimeter of the pinions, and length of racks are proportioned in ac-

cordance with the desired length of crank 17 in the power-transmitting shaft. In the construction shown the parts are proportioned so as to apply, approximately, the full pressure on the piston to a crank having a throw approximately equal to the length of the cylinder. If the pressure on the piston is equal to one hundred pounds, such pressure will be applied to the pin of crank 7, which in the construction shown is the same as applying it to a point on the pitch-line of the pinion 9. This pinion operates as a lever of the first class, having as its fulcrum the shaft 8, so that a pressure of two hundred pounds is applied on said shaft to shift it and its connected parts to the right. The full two hundred pounds is not effective on the crank-pin 16, for the reason there is a pressure against the cylinder-head equal to that against the piston, *i. e.*, one hundred pounds, which tends to force the arms 4 4ª in the opposite direction to that produced by the pinions and racks. Thus it will be seen that the full pressure on the piston, disregarding friction, &c., is applied to the pin of crank 17, which has a throw, approximately, equal to the length of the cylinder.

I claim herein as my invention—

1. The combination of a reciprocating frame or carrier, a cylinder mounted on the frame or carrier, a shaft having its crank connected to the piston of said cylinder and mounted on the frame or carrier, and means operated by said shaft for reciprocating the frame or carrier, substantially as set forth.

2. The combination of a reciprocating frame or carrier, a cylinder mounted on the frame or carrier, a shaft mounted on the frame or carrier and having its crank connected to the piston of the cylinder, means operated by said shaft for reciprocating the frame or carrier, a power-transmitting shaft and a suitable connection from the reciprocating frame or carrier for rotating the power-transmitting shaft, substantially as set forth.

3. The combination of a reciprocating frame or carrier, a cylinder mounted on the frame or carrier, a shaft mounted on the frame or carrier and having its crank connected to the piston of said cylinder, a pinion mounted on said shaft, and a stationary rack-bar arranged to intermesh with the pinion, substantially as set forth.

4. The combination of pivotally-supported arms, a cylinder provided with trunnions mounted in suitable bearings on said arms, a crank-shaft connected to the piston of said cylinder and mounted in bearings on the arms, a pinion keyed to the shaft and a stationary rack-bar arranged to intermesh with the pinion, substantially as set forth.

5. The combination of pivotally-supported arms, a cylinder provided with trunnions mounted in suitable bearings on said arms, a crank-shaft connected to the piston of said cylinder and mounted on the arms, a pinion operated by said shaft, a rack-bar arranged to intermesh with the pinion, and a valve mechanism mounted on one of the arms independent of the cylinder, substantially as set forth.

6. The combination of a reciprocating frame or carrier, a cylinder pivotally mounted on the frame or carrier, a valve case or shell fixed on the carrier, fixed valve-operating mechanism and an automatically-adjustable connection to the valves whereby the shifting of the valves by the valve-case is prevented, substantially as set forth.

7. The combination of a reciprocating frame or carrier, a cylinder pivotally mounted on the frame or carrier and provided with curved elongated ports for the passage of steam, a valve case or shell fixed on the carrier, and provided with ports registering with the ports of the cylinder, fixed valve-operating mechanism and an automatically-adjustable connection to the valves, whereby the shifting of the valves by the valve-case is prevented, substantially as set forth.

8. The combination of an oscillating and rocking cylinder, an oscillating valve-case, an oscillating drainage shell or receptacle having a fixed connection with the valve-case, a pipe movable back and forth in the drainage shell or receptacle and connected with the cylinder, and an automatically-adjustable connection from the drainage-receptacle to a stationary drain-pipe, substantially as set forth.

9. The combination of an oscillating cylinder and valve-case, a rotatable ring mounted on a stationary block, said parts being provided with a groove, a passage in the ring connected to the valve-case and communicating with the groove, a passage in the block connected to the stationary steam or exhaust pipe and communicating with the groove and packing-rings between the ring and block, substantially as set forth.

10. The combination of a cylinder, a piston arranged therein having a certain predetermined stroke, a crank having a throw differing from half the length of the movement of the piston, and connections between the piston and crank whereby approximately the full power on the piston is transmitted to the crank and effects a full revolution of the same, substantially as set forth.

11. The combination of a cylinder, a piston arranged therein, a crank having a throw greater than half the length of the movement of the piston, and connections between the piston and crank whereby approximately the full power on the piston is transmitted to the crank and effects a full revolution of the same, substantially as set forth.

In testimony whereof I have hereunto set my hand.

PETER LERSCH.

Witnesses:
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DARWIN S. WOLCOTT.