No. 816,047.

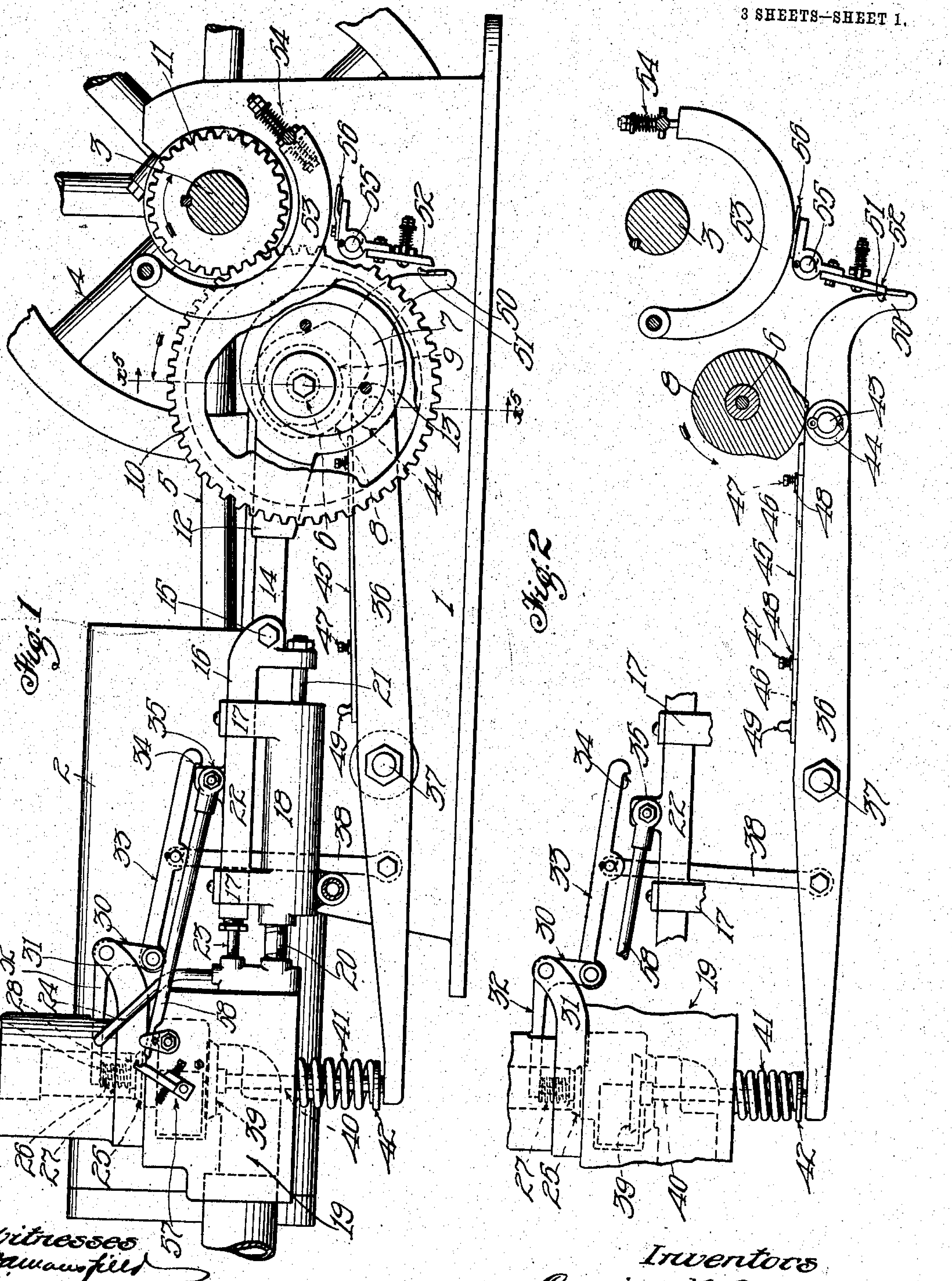
PATENTED MAR. 27, 1906.

C. M. SMITH & S. B. WELCOME.

VALVE MECHANISM FOR GAS ENGINES.

APPLICATION FILED JAN. 12, 1905.

3 SHEETS—SHEET 1.



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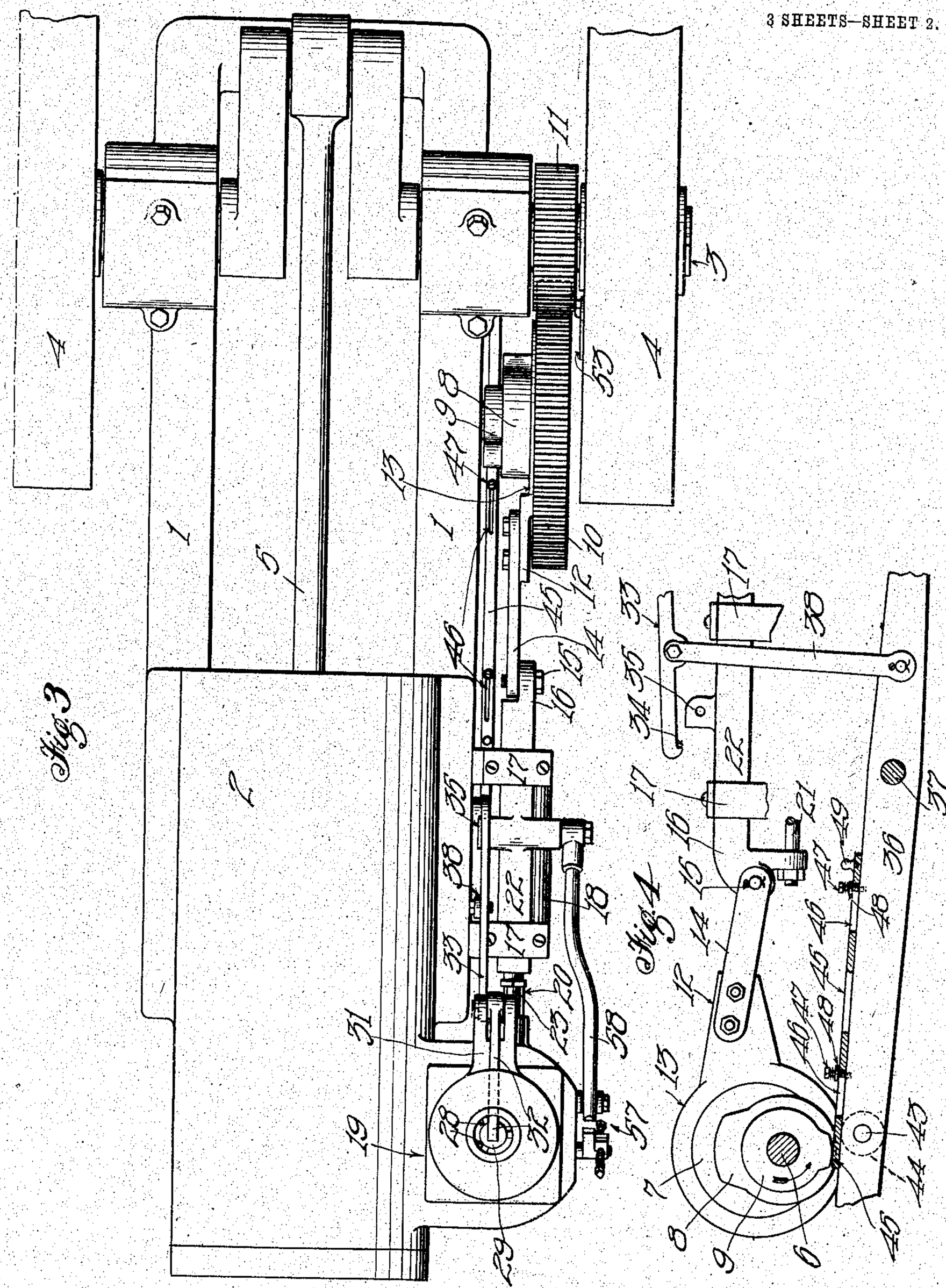

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3 SHEETS—SHEET 3.

Fig. 5

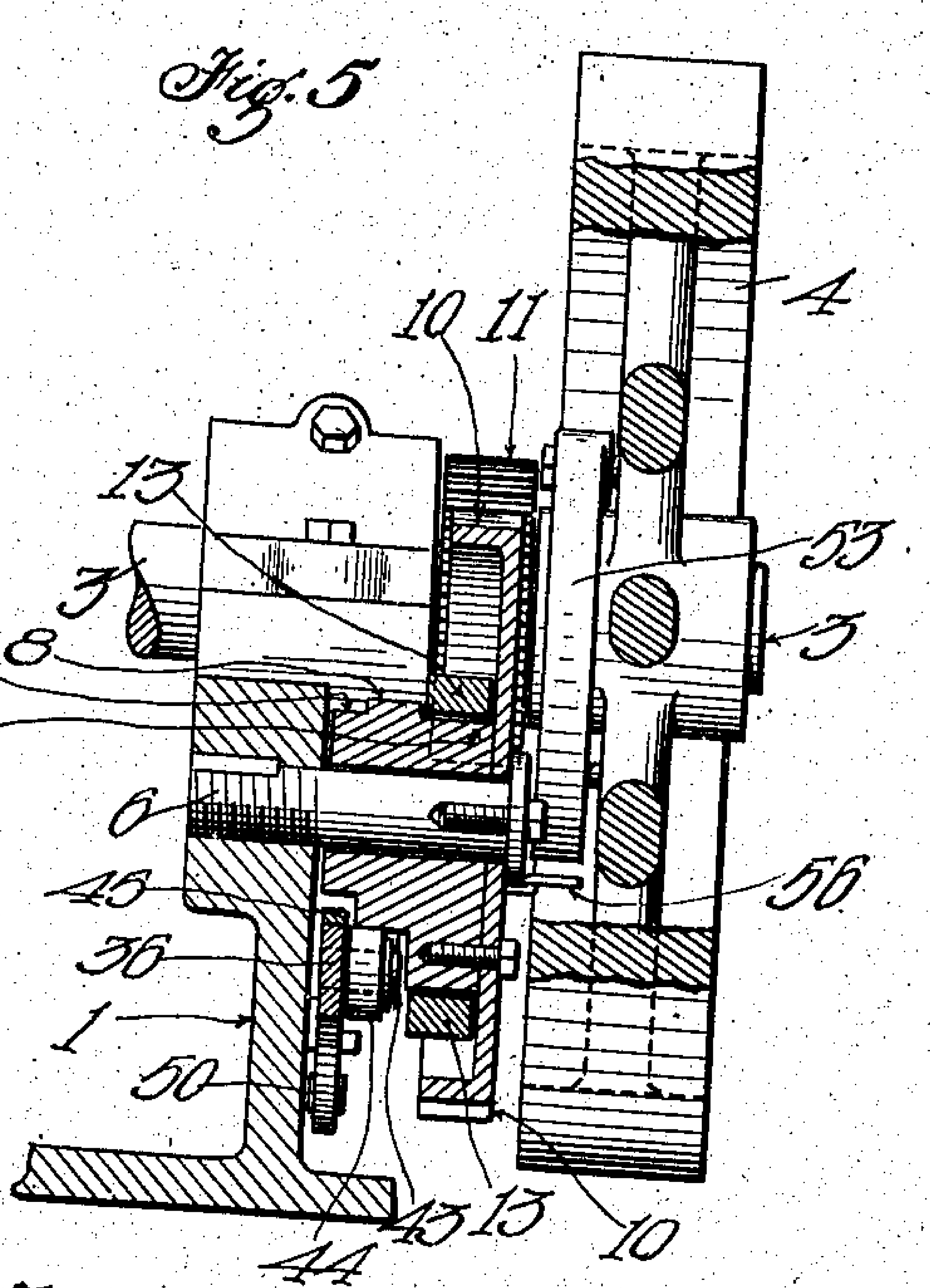


Fig. 6

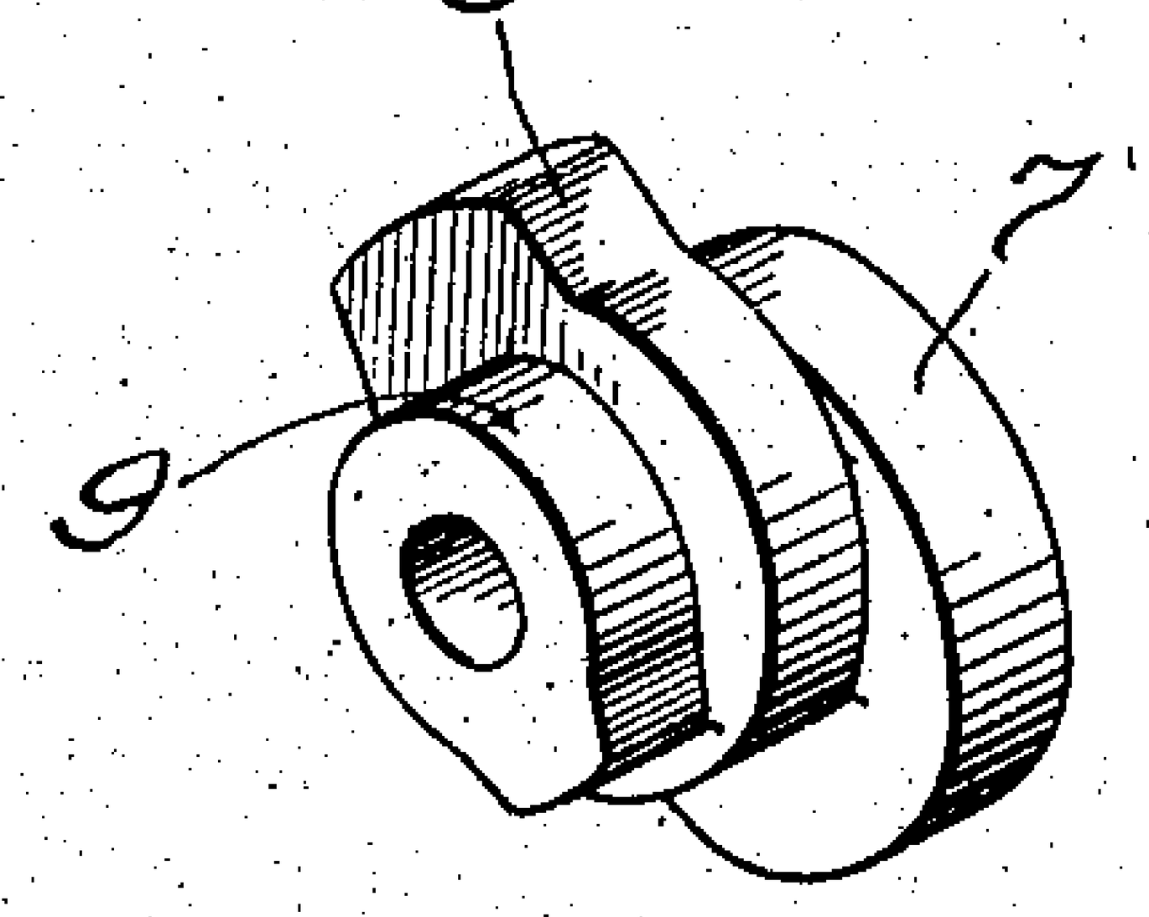
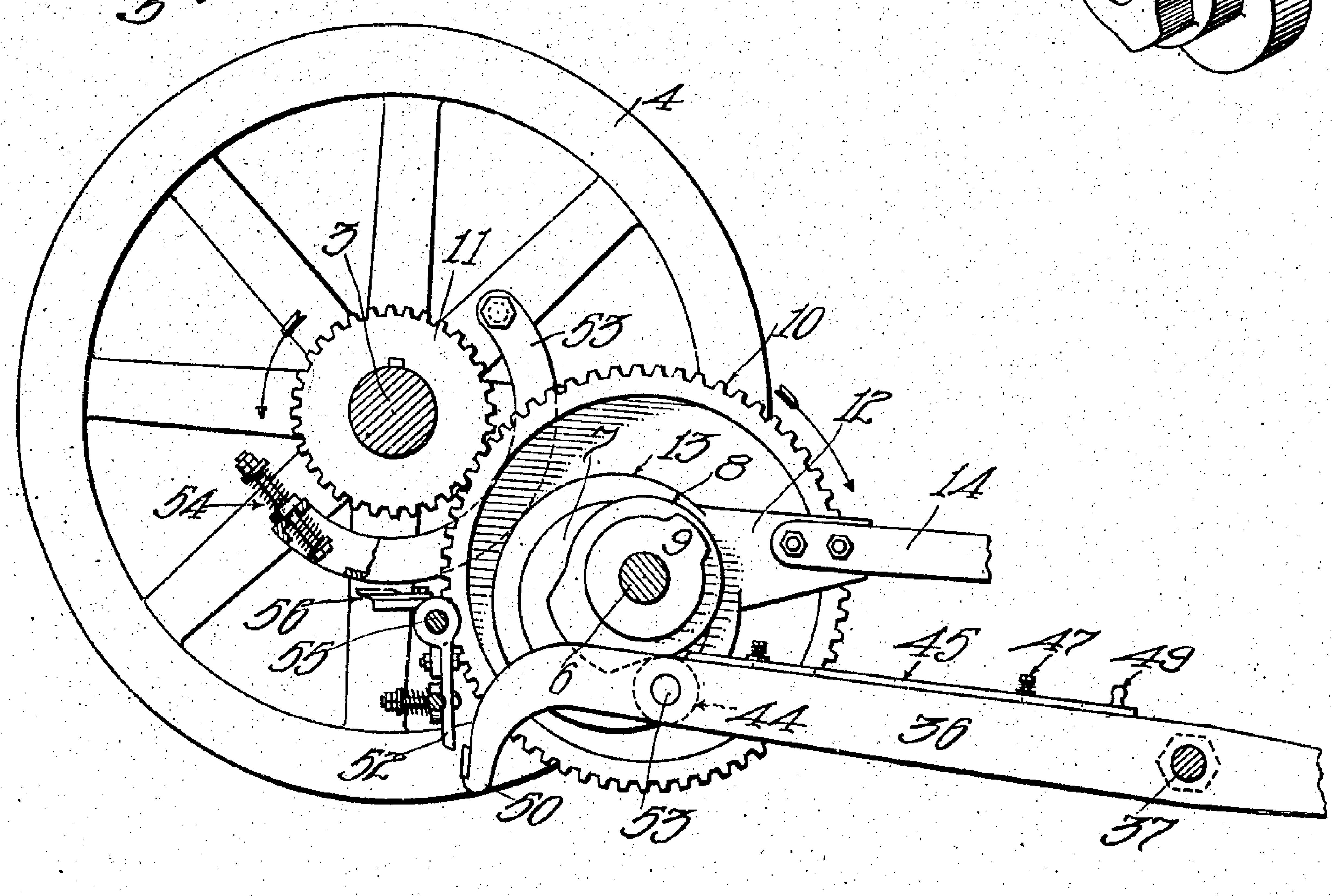


Fig. 7



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UNITED STATES PATENT OFFICE.

CASSIUS M. SMITH AND SOLON BYRON WELCOME, OF LOS ANGELES, CALIFORNIA, ASSIGNORS TO WESTERN IRON WORKS, A CORPORATION OF CALIFORNIA.

VALVE MECHANISM FOR GAS-ENGINES.

No. 816,047. Specification of Letters Patent. Patented March 27, 1906.

Application filed January 12, 1905. Serial No. 240,673.

To all whom it may concern:

Be it known that we, CASSIUS M. SMITH and SOLON BYRON WELCOME, citizens of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented a new and useful Valve Mechanism for Gas-Engines, of which the following is a specification.

This invention relates to that type of gas-engines which have mechanically-operated valves. In the present case both the inlet and outlet valves are mechanically actuated; and the main object of the invention is to provide a novel means for actuating the inlet and outlet valves and for controlling the operation of said valves in such manner as to secure a constant speed of the engine.

Another object of the invention is to provide means for placing the valve-operating mechanism in such condition that the exhaust will be partially opened automatically as the crank-shaft is turned to reduce pressure within the cylinder while the crank-shaft is being turned in starting up the engine, thus allowing the engine to be easily started by hand.

Another object of the invention is to provide a mechanism of the character described which is simple in construction, effective in operation, and very compact in form.

Other objects and advantages of the invention will appear from the following description.

The accompanying drawings illustrate the invention.

Referring to the drawings, Figure 1 is a side elevation of an engine equipped with the valve mechanism forming the present invention, showing the parts in one position. Fig. 2 is a view similar to Fig. 1, the engine-frame being removed, showing the parts in another position. Fig. 3 is a plan view of what is shown in Fig. 1. Fig. 4 is a view showing the reverse side of the mechanism in Fig. 2, except that the governor and valve-chamber of the engine have been removed. Fig. 5 is a section on the line X^5 X^5 in Fig. 1. Fig. 6 is a perspective of the eccentric and cams. Fig. 7 is a view similar to Fig. 4, showing in addition the governor.

1 designates the main frame of an engine, which is provided with a cylinder 2 and crank-shaft 3, upon which is mounted the fly-wheel 4, the crank-shaft 3 being driven by a connecting-rod 5, operated by the usual piston (not shown) within the cylinder 2. A stud forming a stationary cam-shaft 6 is mounted on the main frame 1, as shown in Fig. 5, and journaled thereon is an eccentric 7, carrying a primary cam 8 and a secondary cam 9.

Rigidly attached to the eccentric 7 is a gear 10, which meshes with a pinion 11, mounted on the crank-shaft 3. An eccentric-head 12, having an eccentric-strap 13, mounted on the eccentric 7, is rigidly connected to an eccentric-rod 14, the end of which is pivoted at 15 to a slide-head 16, which is slidably mounted in ways 17, formed, preferably, integral with a cylinder 18. The cylinder 18 may comprise a pump for maintaining water circulation and may be bolted to the main frame 1 in any suitable manner.

Attached to the cylinder 2 is a valve-chamber 19. The valve-chamber and cylinder may have a suitable water-jacket, and the circulation therethrough may be obtained by means of the pump 18, which is connected with a water-jacket by a pipe 20 and is operated by a piston-rod 21, carried by the slide-head 16. Fuel may be supplied to the valve-chamber from a pump 22, the cylinder of which may be formed on the end of the slide-head 16, the piston of which is stationary and is mounted on a hollow stationary piston-rod 23, over which the cylinder plays and which communicates with a suitable pipe 24 for conducting fuel therefrom to the valve-chamber. As the water and fuel pumps do not form a part of this invention, they are but generally mentioned.

Mounted within the upper part of the valve-chamber 19 is an inlet-valve 25, having a stem 26. The inlet-valve 25 is resiliently pressed upwardly against a conical seat by means of a coil-spring 27, interposed between a spider 28, formed in the valve-chamber, and a flange 29 on the stem 26.

A bell-crank lever 30 is pivoted to a bracket 31 and has an arm 32, which extends into the valve-chamber and bears upon the top of the valve-stem 26. The other arm of the bell-crank lever 30 has pivoted thereto an operating-rod 33, with a hook 34, which normally lies in the path of movement of a boss 35, projecting upwardly from the slide-head 16. Thus as the engine operates and the slide-

head 16 moves toward the crank-shaft the boss 35 engages the hook 34 and draws the operating-rod 33 along with it, thus tilting the bell-crank lever 30, the arm 32 of which, pressing down upon the valve-stem 26, depresses and opens the valve 25. Upon the reverse stroke the operating-rod 33 is retracted along with the slide-head 16 through the medium of the bell-crank lever 30, which is returned by the upward movement of the valve-stem 26, produced by the coil-spring 27.

A rock-lever 36 is pivoted at 37 to the main frame 1 and is connected by a link 38 with the operating-rod 33.

An exhaust-valve 39 is mounted within the valve-chamber 19 and is provided with a valve-stem 40 and is normally held depressed and in its conical seat by means of a coil-spring 41, which bears against a flange 42. The lower end of the valve-stem 40 bears against the end of the rock-lever 36. The rock-lever 36, near its other end, carries a stud 43, upon which is mounted a roller 44, which lies under the primary cam 8, so that as the latter revolves it acts upon the roller 44 and oscillates the rock-lever 36. The ratio of the pinion 11 to the gear 10 is one to two, so that the gear 10 and the cam 8 are given one complete revolution to every two revolutions of the crank-shaft 3, the engine being a four-cycle engine. As the rock-lever 36 is oscillated it causes the opening and closing of the exhaust-valve 39, opening the valve positively by pressing upward against the valve-stem 40, the valve being closed by the expansion of the coil-spring 41 during the return movement of the rock-lever. During the intake-stroke of the piston the inlet-valve 25 is opened through the medium of the slide-head 16, operating-rod 38, and bell-crank lever 30, and during the return stroke or compression-stroke the inlet-valve is closed, and the exhaust-valve 39 is also closed. After the explosion as the piston moves through its working stroke the valves remain closed; but at the end of the working stroke the cam 8 moves against the roller 44 and tilts the rock-lever 36, opening the exhaust-valve 39 and holding it open during the exhaust-stroke, the face of the cam 8 being concentric with the shaft 6 and extending through approximately one-quarter of a circle, so that at the end of the exhaust-stroke the cam 8 moves off from the roller 44 and allows the spring 41 to expand, which closes the exhaust-valve 39 and restores the rock-lever 36 to its original position.

In order to relieve the pressure within the cylinder to allow the engine to be more readily started by hand in securing initial compression, a slide-bar 45 is provided, which is slidably mounted on the rock-lever 36, having longitudinal slots 46, through which bolts 47 pass, which are screwed into the rock-lever 36. Spring-pressed washers 48 are provided for frictionally holding the slide-bar in position on the rock-lever 36. One end of the slide-bar 45 has a handle 49, by means of which it may be moved into either of its positions on the rock-lever. By pushing the slide-bar 45 toward the shaft 6 its end is brought under the sweep of the secondary cam 9, so that when the engine is being started by hand as the cams 8 and 9 rotate the rock-lever 36 is actuated and the exhaust-valve is opened during the regular exhaust-stroke by the operation of the cam 8 acting upon roller 44 and is also opened slightly during the compression-stroke by means of the cam 9 pressing down upon the end of the slide-bar 45, as illustrated in Fig. 4, thus relieving the compression to a considerable degree. When the slide-bar 45 is manually slid from under the cam 9, the latter ceases to tilt the rock-lever 36, and the latter is then operated regularly by the cam 8 and is not given the intermittent short tilt by the cam 9.

The end of the rock-lever 36 has a toe 50, with a notch 51, which is adapted to engage a detent 52, which forms part of a governing mechanism which includes a centrifugal-acting semicircular weight 53, pivoted to the fly-wheel 4, as shown in Fig. 1, the sensitiveness of its movement being regulated by an adjustable spring device 54. The detent 52 is pivoted to a stud 55 and has a shoe 56, over which the curved weight 53 is adapted to ride. With the adjustment properly made while under a load and at a normal speed the weight 53 lies free from the shoe 56, and upon a decrease of the load on the engine or for any other cause which produces a higher speed in the engine the weight 53 swings out and acting upon the shoe 56 tilts the detent 52 into a position in which it will engage the notch 51 and result in holding the rock-lever 36 in the position shown in Fig. 2, which keeps the exhaust-valve open, and by reason of the operating-rod 33 being also raised the inlet-valve 25 is retained closed by means of a coil-spring 27. Thus admission of fresh fuel to the explosion-chamber is prevented until the speed of the engine is reduced sufficiently to release the detent 52 and allow the rock-lever 36 to resume its normal operation.

The igniting device 57 may be actuated by an operating-rod 58, pivoted to the boss 35.

While we have shown and described the preferred embodiment of this invention, it should be understood that various changes and modifications may be made without departing from the scope of the invention.

What we claim is—

1. In a gas-engine, an inlet-valve, an outlet-valve, a bell-crank lever for operating the inlet-valve, an operating-rod pivoted to the bell-crank lever and having a hook on its end, a slide-head having an eccentric operated by the engine, an eccentric-rod connecting the slide-head and eccentric, a primary cam car-

ried by the eccentric, a pivoted rock-lever operated by the primary cam for actuating the exhaust-valve, a link connecting the rock-lever and said operating-rod, and means operable when starting the engine for automatically tilting the rock-lever intermittently a less degree than obtained by the primary cam.

2. In a gas-engine, an inlet-valve, an outlet-valve, a bell-crank lever for operating the inlet-valve, an operating-rod pivoted to the bell-crank lever and having a hook on its end, a slide-head having means for engaging said hook, an eccentric operated by the engine, an eccentric-rod connecting the slide-head and eccentric, a pivoted rock-lever for actuating the exhaust-valve, a link connecting the rock-lever and the operating-rod, means carried by the eccentric for operating the rock-shaft long and short strokes, alternately when starting the engine, and means for restricting the last means to produce the long stroke solely during normal operation of the engine.

3. In a gas-engine, an inlet-valve, an outlet-valve, a bell-crank lever for operating the inlet-valve, an operating-rod pivoted to the bell-crank lever and having a hook on its end, a slide-head having a boss for engaging said hook, an eccentric-rod connecting the slide-head and eccentric, a rock-lever with operative connection with both the outlet-valve and operating-rod, and means carried by the eccentric for actuating the rock-lever.

4. In a gas-engine, an inlet-valve, an outlet-valve, means for operating the inlet-valve, means for operating the exhaust-valve, a device operated by said last means for intermittently rendering the first means inoperative and manually-controlled means for automatically imparting a secondary movement to the exhaust-valve alternating with its regular movement for relieving the pressure in the cylinder.

In testimony whereof we have hereunto set our hands, at Los Angeles, California, this 5th day of January, 1905.

CASSIUS M. SMITH.
SOLON BYRON WELCOME.

In presence of—
GEORGE T. HACKLEY,
JULIA TOWNSEND.