No. 717,417. Patented Dec. 30, 1902.

E. E. KOKEN.

GASOLENE ENGINE.

(Application filed June 14, 1901.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 1.

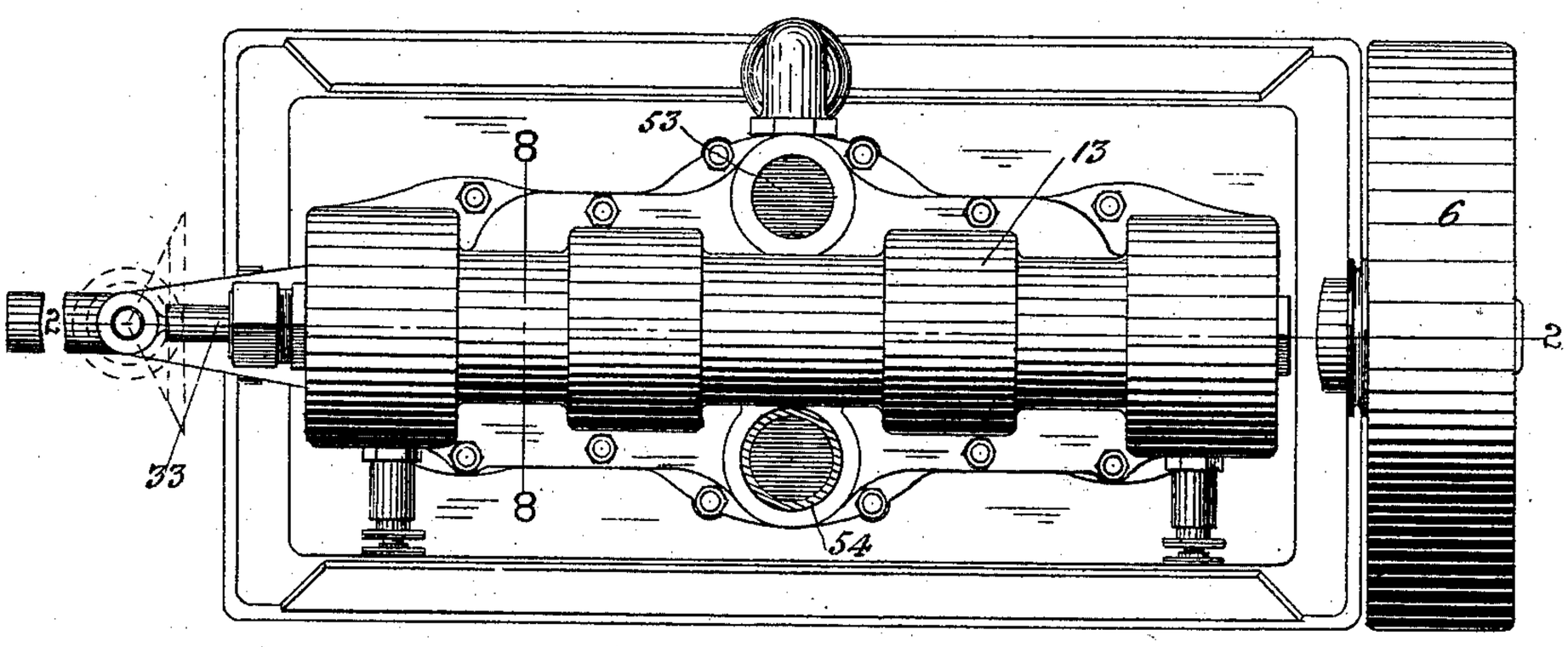
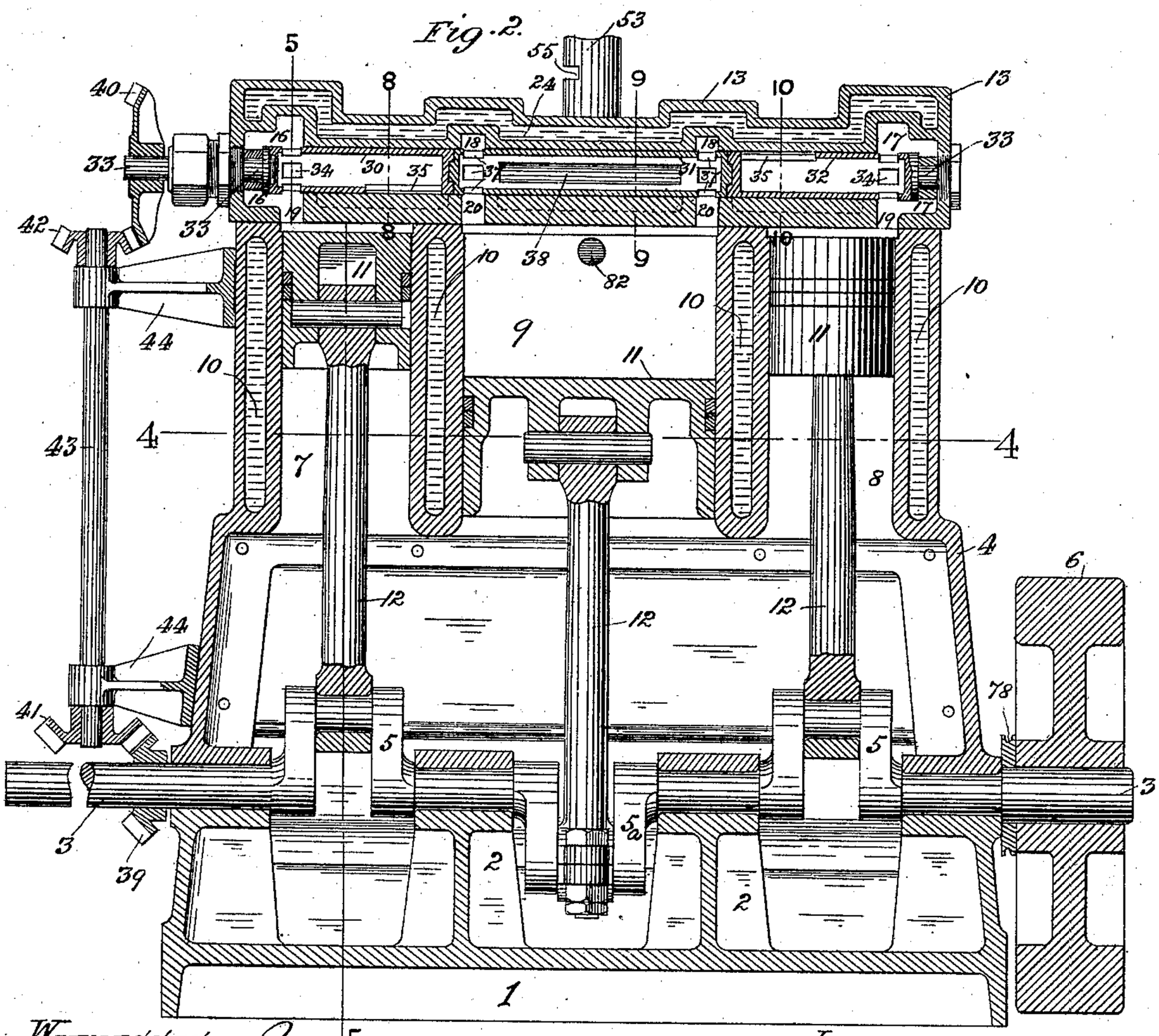


Fig. 2.



WITNESSES:
Edward W. Turrell
O. Reicenstein

INVENTOR:
Ernest E. Koken,
by Hugh K. Wagner,
His Attorney.

No. 717,417. Patented Dec. 30, 1902.

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(No Model.) 4 Sheets—Sheet 2.

Fig. 3.

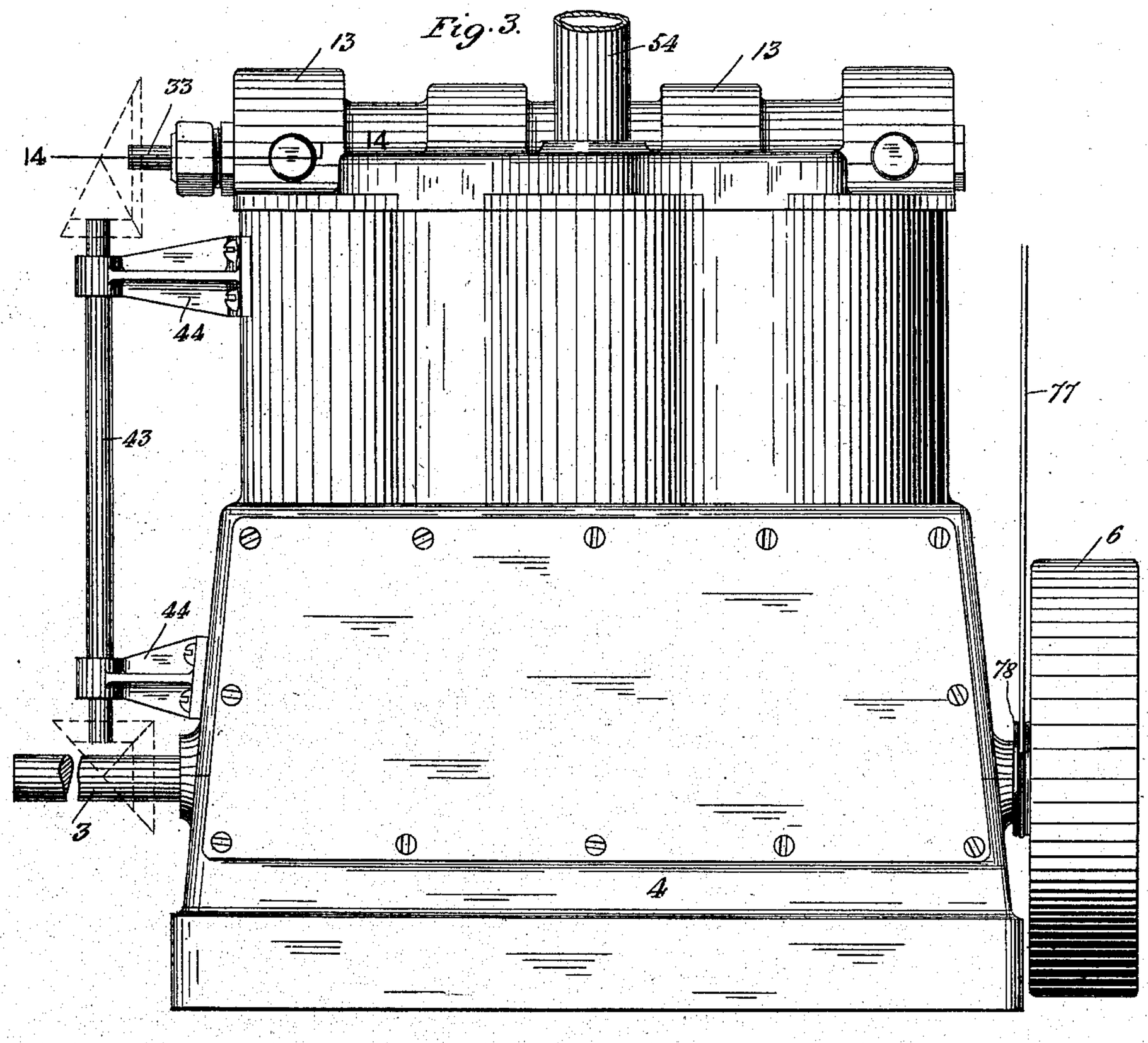
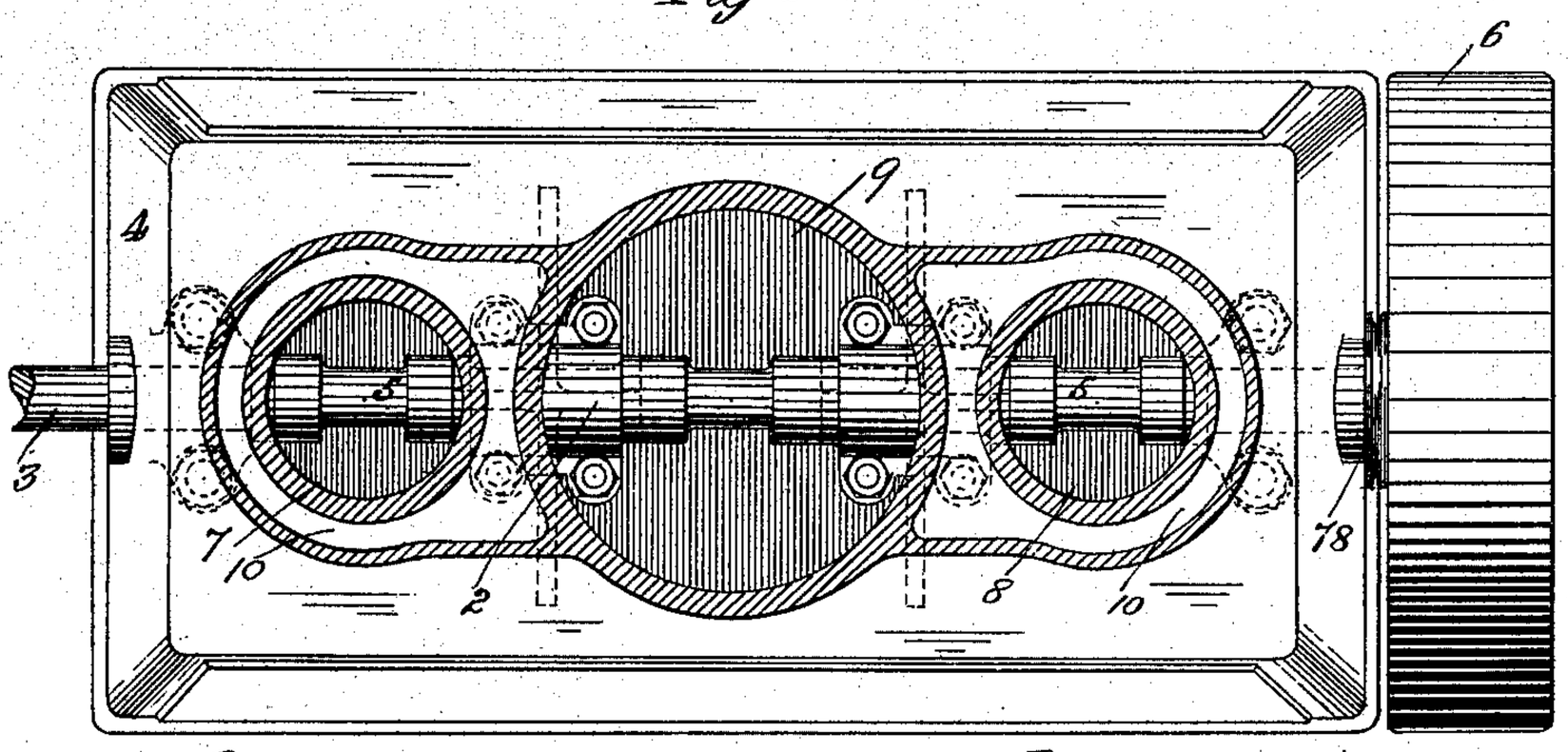


Fig. 4.



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His Attorney.

No. 717,417. Patented Dec. 30, 1902.

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(No Model.) 4 Sheets—Sheet 3.

Fig. 5.

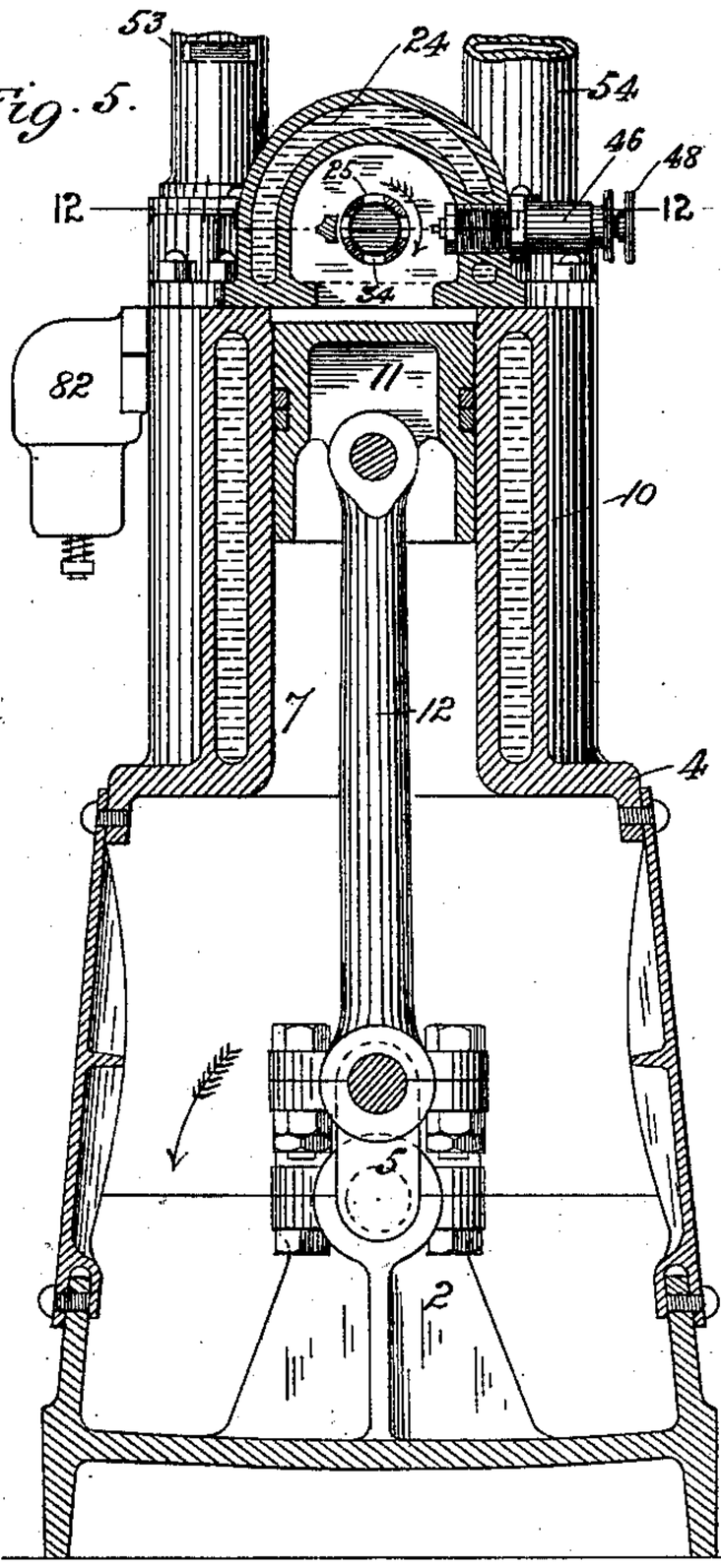


Fig. 6.

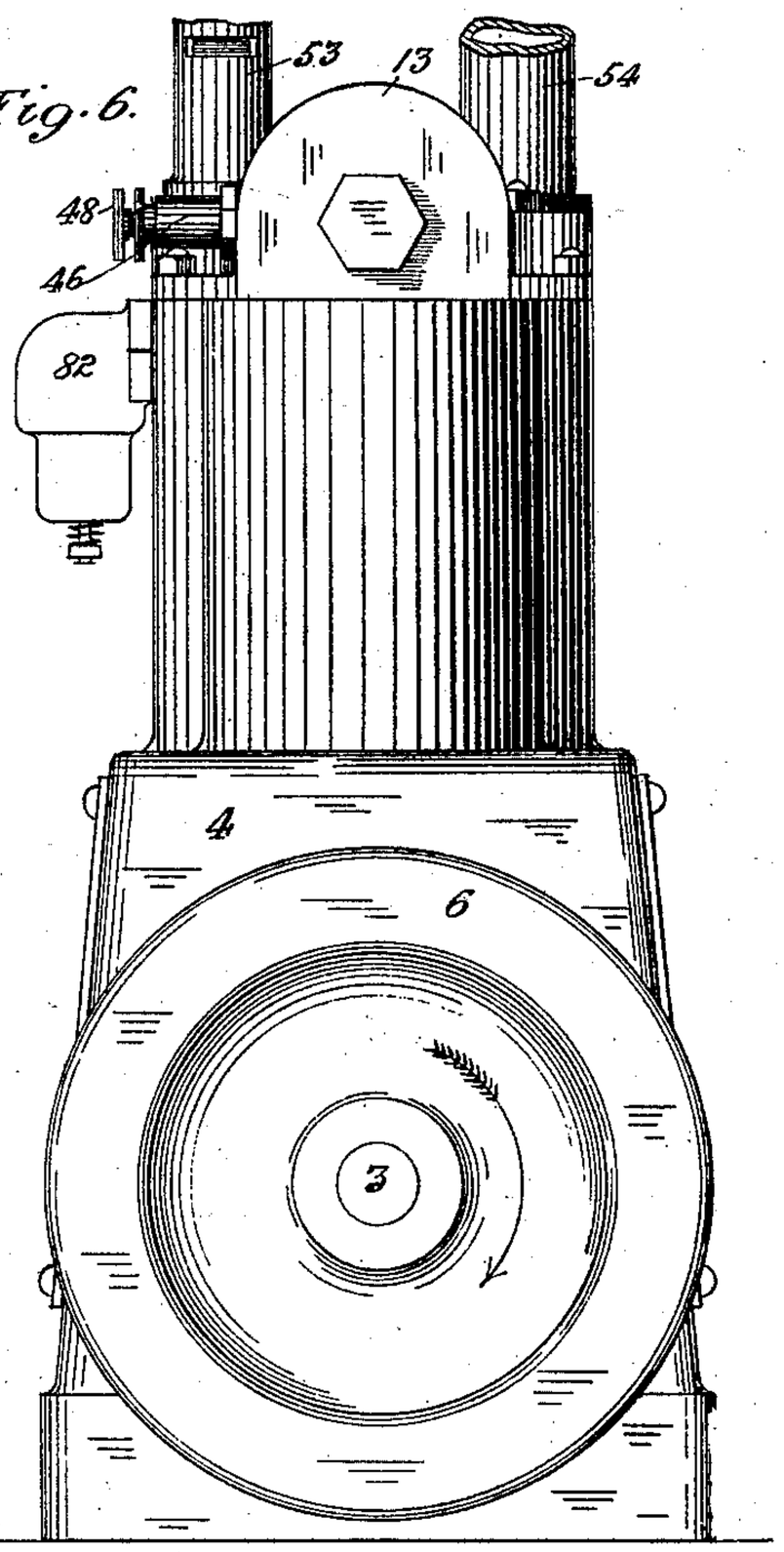


Fig. 7.

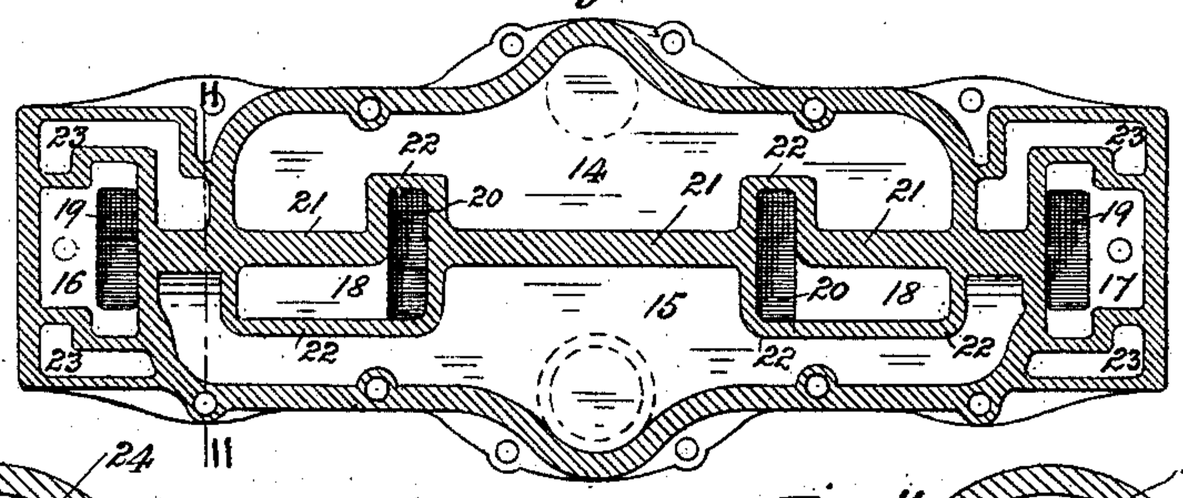


Fig. 8.

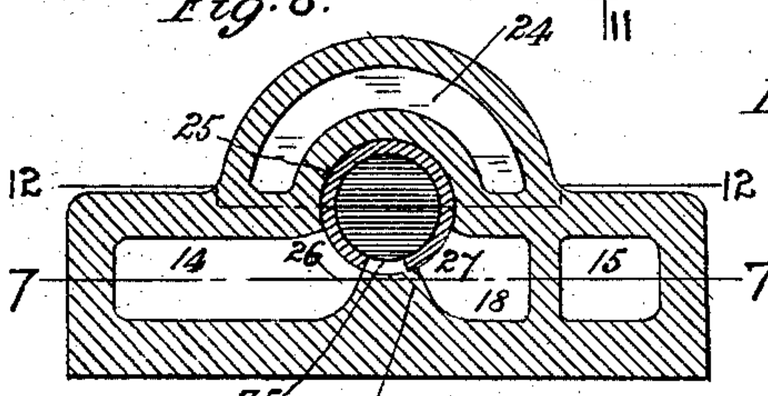


Fig. 9.

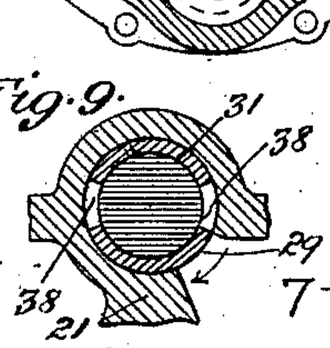


Fig. 10.

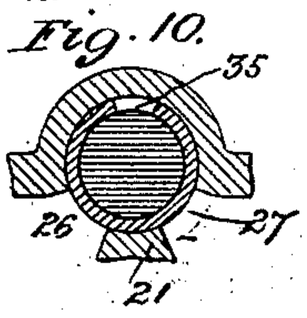
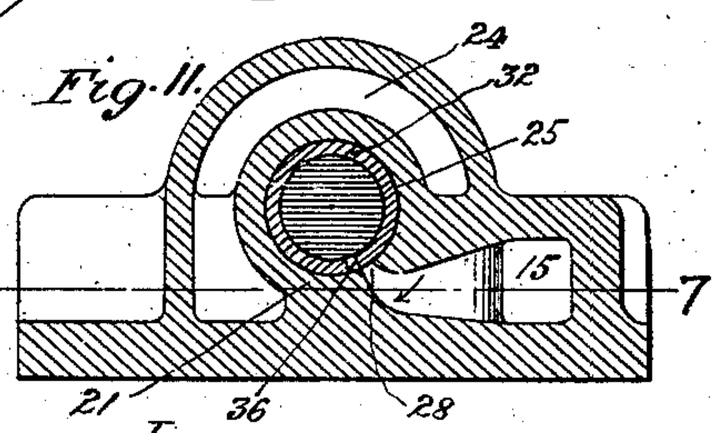


Fig. 11.



WITNESSES:
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GASOLENE ENGINE.

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(No Model.) 4 Sheets—Sheet 4.

Fig. 12.

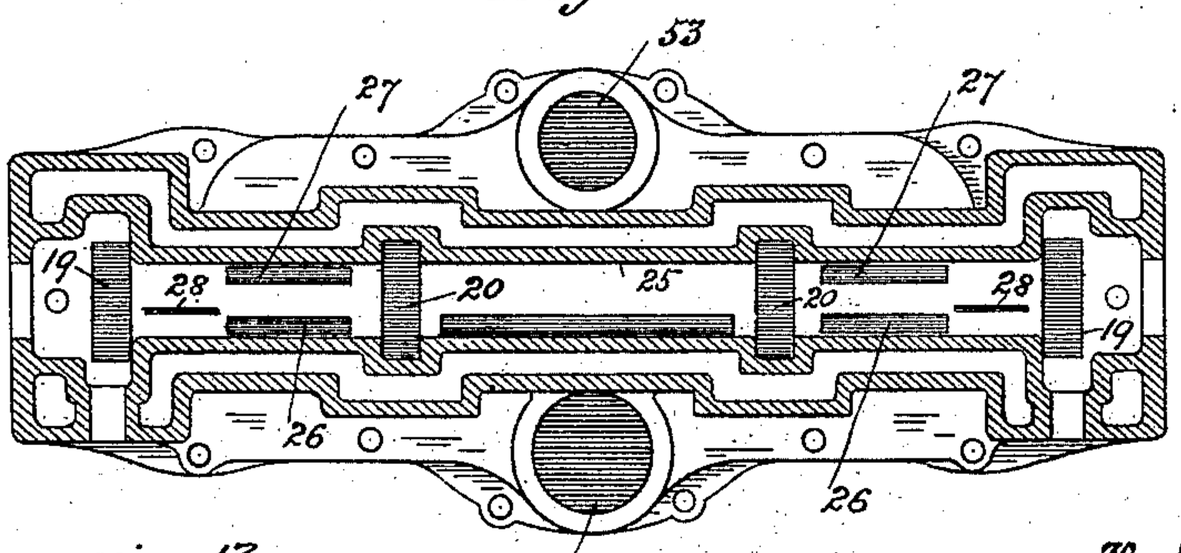


Fig. 13.

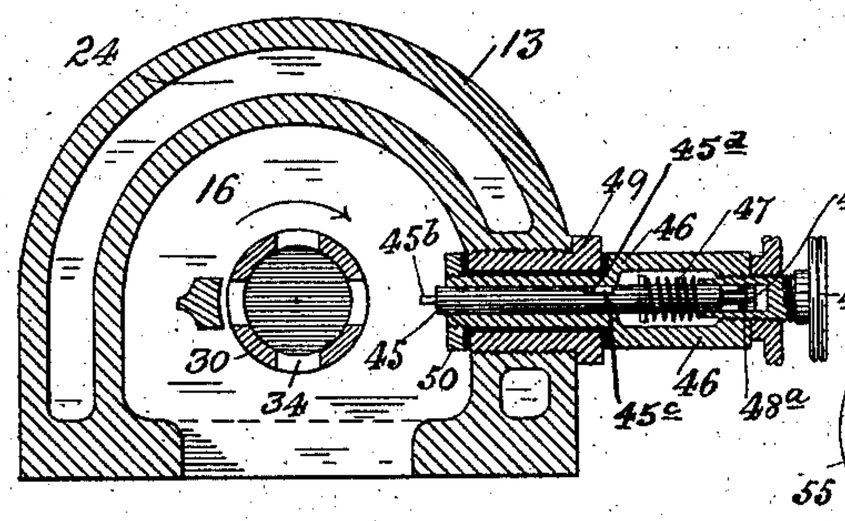


Fig. 14.

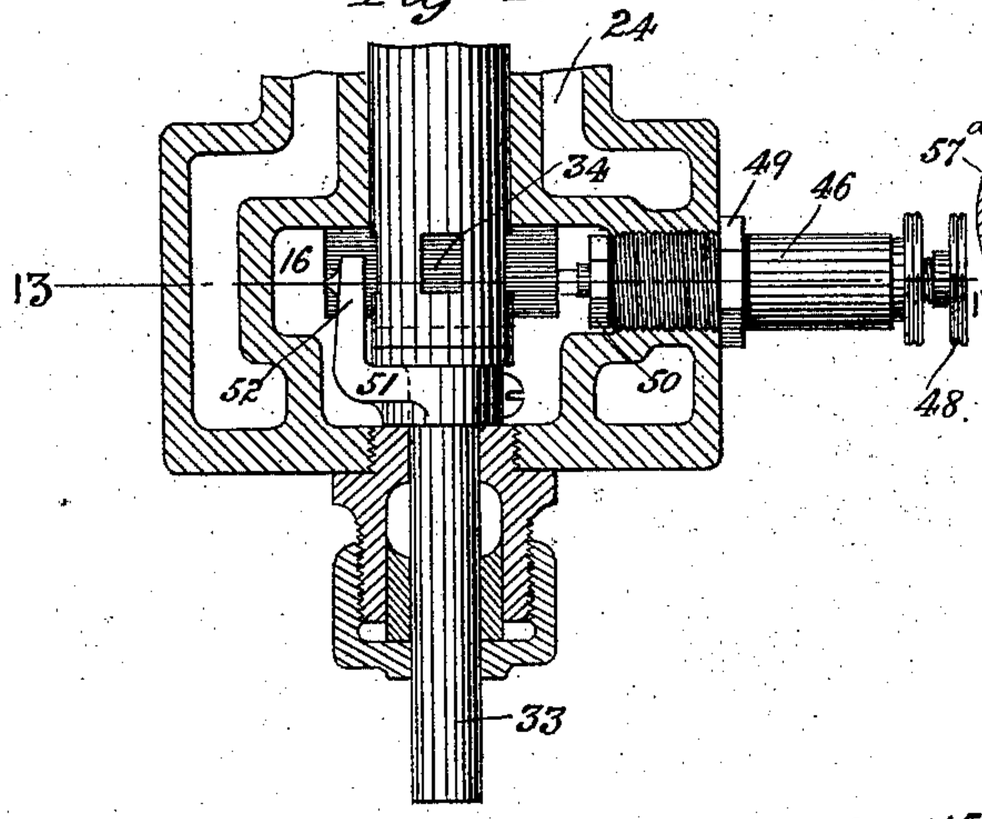


Fig. 15

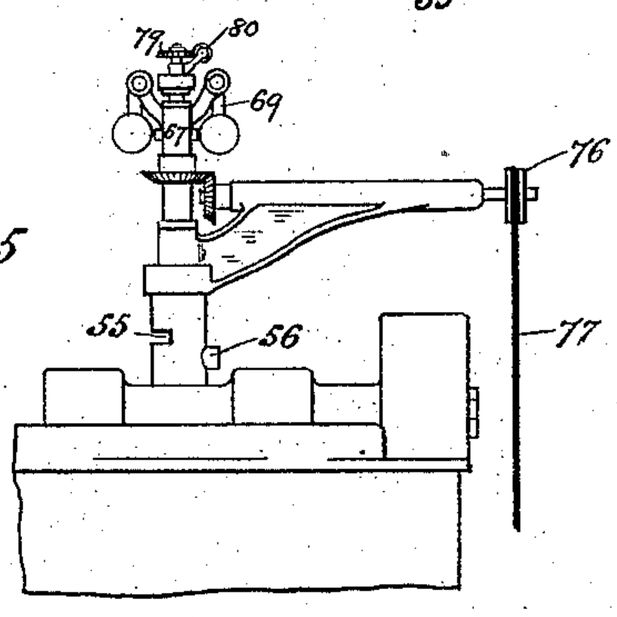


Fig. 17.

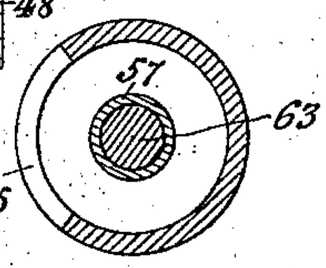


Fig. 18.

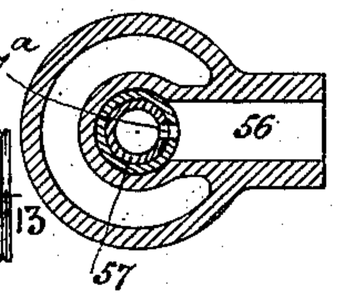


Fig. 16.

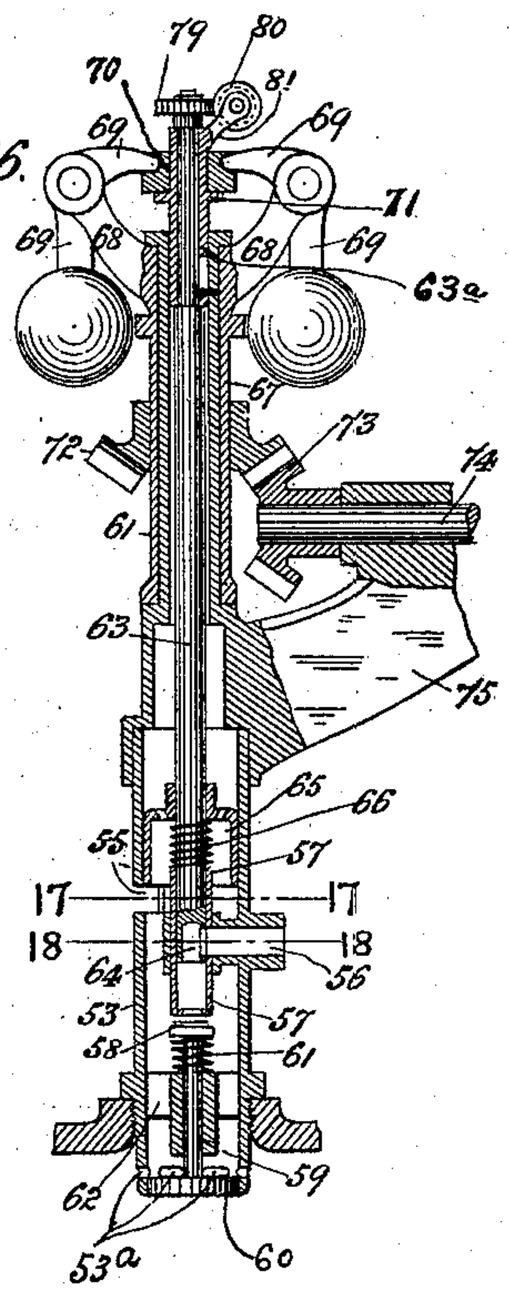
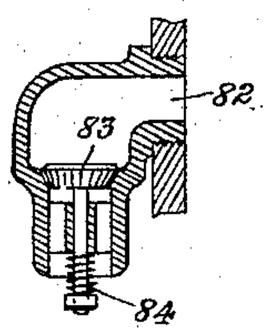


Fig. 19.



Witnesses
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Inventor:
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His Attorney.

UNITED STATES PATENT OFFICE.

ERNEST E. KOKEN, OF ST. LOUIS, MISSOURI.

GASOLENE-ENGINE.

SPECIFICATION forming part of Letters Patent No. 717,417, dated December 30, 1902.

Application filed June 14, 1901. Serial No. 64,498. (No model.)

To all whom it may concern:

Be it known that I, ERNEST E. KOKEN, a citizen of the United States, residing at the city of St. Louis, State of Missouri, have invented certain new and useful Improvements in Gasolene-Engines, of which the following is a full, clear, and exact specification, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, forming part of this specification.

The object of this invention is to provide a simple, reliable, and compact motor which will utilize to a larger extent than has heretofore been attained the dynamic force of the motive fluid and at the same time increase the smoothness of the running of the machine by imparting impulses of power to the crank-shaft at more than one point thereof, whereby the use of a fly-wheel of undue size is avoided.

Another object of this construction is the elimination of the noise ordinarily caused by the clicking and hammering of cams and by the sudden explosive expulsion of gases from the exhaust, as is usual in such engines as now commonly constructed.

This invention relates to new and useful improvements in gasolene and oil engines; and its primary object is to provide a device of this character employing both high and low pressure cylinders, which communicate through a novel arrangement of both parts and valves.

With these and other objects in view the invention consists in the novel construction and combination of parts hereinafter more fully described and claimed, and illustrated in the accompanying drawings, showing the preferred form of my invention, in which—

Figure 1 is a top plan view. Fig. 2 is a longitudinal vertical section on the line 2 2 in Fig. 1. Fig. 3 is a side elevation. Fig. 4 is a horizontal section on the line 4 4 in Fig. 2. Fig. 5 is a vertical transverse section on the line 5 5 in Fig. 2. Fig. 6 is an end elevation. Fig. 7 is a horizontal section through the valve-casing near its base on line 7 7 in Figs. 8 and 11. Fig. 8 is a transverse section through the valve-casing and valve on line 8 8 in Fig. 2. Fig. 9 is a transverse section through the valve-casing and valve on line 9 9 in Fig. 2. Fig. 10 is a transverse section through the valve-casing and valve on line 10 10 in Fig. 2. Fig. 11 is a transverse section through the valve-casing and valve on line 11 11 in Fig. 7. Fig. 12 is a horizontal section on line 12 12 in Fig. 8, the valve being omitted. Fig. 13 is a transverse section on the line 13 13 in Fig. 14. Fig. 14 is a horizontal section on the line 14 14 in Fig. 3, broken away. Fig. 15 is a detached view, to a reduced scale, of the upper right-hand portion of Fig. 3, showing the governor for controlling admission of liquid and air to the engine. Fig. 16 is an enlarged vertical longitudinal section through the governor. Figs. 17 and 18 are transverse sections, to enlarged scales, on lines 17 17 and 18 18, respectively, in Fig. 16. Fig. 19 is a sectional detail view of the check-valve on the large cylinder as shown in Figs. 2, 5, and 6.

Referring to the figures of the drawings by numerals of reference, 1 is the base, having standards 2 thereon, within which is journaled a shaft 3, projecting from and journaled in the sides of a casing 4, formed with the base 1. Cranks 5, two in number, are arranged upon the shaft, preferably circumferentially, opposite to crank 5^a, and a suitable fly-wheel 6 is secured to one end of the shaft. Within the upper end of the casing 4 are preferably formed two high-pressure cylinders 7 and 8 and an intermediate low-pressure cylinder 9, the last-mentioned cylinder being larger in diameter than the cylinders 7 and 8. Water-jackets 10 inclose the high-pressure cylinders and are provided with suitable inlets and outlets. (Not shown.) A piston 11 is arranged in each cylinder 7, 8, and 9, and each piston is connected by means of a piston-rod 12 with one of the cranks before referred to. The pistons are preferably in the form of inverted cups, the rods 12 being pivoted at their inner ends therein.

Secured upon the upper end of the casing of the cylinders is the valve-casing 13 of the engine. Within this casing are formed six chambers—*i. e.*, an inlet-chamber 14, an exhaust-chamber 15, explosion-chambers 16 and 17 for the cylinders 7 and 8, respectively, and two passages 18, which connect with the low-pressure cylinder 9. Ports 19 connect the cylinders 7 and 8 with the chambers 16 and 17, and similar ports 20 perform like service for the cylinder 9 and the passages 18. A

longitudinally-extending partition 21 separates the inlet and exhaust chambers 14 and 15 and is intersected by the ports 20. This partition, together with small partitions 22, incloses the passages 18 and their ports, as shown in Fig. 2. The exhaust-chamber 15 extends along three sides of each passage 18 and lies between said passages and the explosive-chambers 16 and 17. These latter are formed in the casing between its ends and the ends of partition 21. Water-jackets 23 are arranged at the sides of the chambers 16 and 17 and are provided with suitable inlets and outlets. (Not shown.) A water-jacket 24 envelops the valve-chamber 21 and communicates at its ends with the jackets 23. (See Fig. 11.)

Above the upper edge of the partition 21 is formed a cylindrical passage 25, which communicates through ports 26 with the inlet-chamber 14, through ports 27 with the passages 18, (see Figs. 8 and 10,) and through ports 28 and 29 with the exhaust-chamber 15. (See Figs. 9 and 11.)

Revolubly mounted in the passage 25 is a revoluble valve formed of three tubular sections 30, 31, and 32. The end sections 30 and 32 project into the explosion-chambers and are secured to shafts 33, journaled in the valve-casing. The inner ends of these sections 30 and 32 engage the ends of the central section 30, and the three parts of the valve can thus be revolved in unison. By constructing this valve with a plurality of sectional parts greater flexibility is obtained, with the result that the valve seats more tightly upon the ports in the casing.

That portion of each valve 30 and 32 which lies in the explosion-chamber is provided with a series of apertures 34, making same practically open and allowing same to communicate freely with their respective cylinders, while a longitudinally-extending slot 35 is formed in each of these two valves adjacent to their inner ends and is adapted to register with the outlet-ports 27, opening into the passages 18. (See Fig. 8.) The slots 35 in the two valves are so arranged as to register with their ports 27 alternately at regular intervals and with their ports 26 also alternately successively. A third aperture 36 (shown in Fig. 11) is provided in each valve 30 and 32, and these are adapted to register with ports 28 (see Figs. 11 and 12) as the slots 35 pass out of register with their ports. The slot 35 in each end valve-section is so arranged as to register with its ports 27 and 26 successively, the section 30 being at an opposite point of its rotation from section 32.

The ends of the central valve-section 31 lie within the chambers 18 above the ports 20 and are provided with a series of apertures 37. Oppositely-disposed longitudinally-extending slots 38 are also arranged in this valve-section and are adapted to register successively with the port 29 (shown in Fig. 9) and which communicates with the exhaust-chamber.

Beveled gears 39 and 40 are secured upon the shaft 3 and one of the valve-shafts 33, and these gears mesh with gears 41 and 42, secured at opposite ends of a shaft 43, journaled in brackets 44, extending from the side of the casing 4. In this or any other suitable manner rotary motion is imparted from the crank-shaft 3 to the valves 30, 31, and 32 during the operation of the engine, there being two revolutions of the shaft 3 to one revolution of the valve.

Projecting into each explosive-chamber 16 and 17 is a pin 45. Same is slidably mounted in a tube 46 to allow the arm 52 to pass said pin with ease and without undue friction. A coiled spring 47 serves to hold the pin normally projected from the inner end of the tube 46 into the path of arm 52, and a screw-cap 48 is provided as a means for delicately adjusting at will the extent to which the pin projects into the path of arm 52. The tube 46 is surrounded by a hollow plug, between them being insulating material, the device being secured in position by screwing the plug into the casing, the whole being readily removable from the valve-casing, while the nut 50 ordinarily holds the insulating material in place with the aid of the flanges on plug 49.

In the inner tubular portion of the screw-cap 48 are located pins 48^a, which extend through the sides of said tubular or hollowed-out portion, and therefore move therewith. These pins pass on both sides of the pin 45 and by reason of the head 45^a prevent the latter from being pressed unduly inwardly by the spring 47.

The pin 45 is flattened at its extreme inner end at the point marked 45^b, which part is designed to come in contact with arm 52 to produce the spark. In order that said flattened portion may always be in the same position, I provide a place upon the surface of pin 45 exterior to the valve-casing, where the circumference is broken, and a bearing-place 45^c, provided for a pin or set-screw 45^d.

To each shaft 33 is secured a collar 51, (see Fig. 14,) from which extends a revolubly-adjustable lateral arm 52. These arms are adapted, when the shafts 33 are turned, to contact with the pins 45 and press them inward, and when the shaft and the pins are respectively connected to the two wires of an electric circuit it will be readily understood that a spark will be made each time the arms 52 and their pins 45 are brought into and removed from contact with each other. The adjustable collars permit the arms to be so set as to produce early or late explosions.

An inlet-pipe 53 and an outlet or exhaust pipe 54 communicate with the chambers 14 and 15, respectively. Within the inlet-pipe is located a valve of peculiar construction having a governor whereby such an amount of explosive mixture is admitted to the engine at all times as to insure uniform speed. This governor is constructed as follows: An

air-inlet port 55 is arranged on one side of the pipe 53, and extending into the opposite side of the inlet-pipe 53 is a pipe 56 for conducting gasolene or oil to the engine. This pipe communicates with a short vertical tube 57, arranged in the center of the pipe 53 and open at both ends. The lower end is normally closed by a valve 58, arranged at the inner end of the stem 59, bearing at its lower end a piston 60, located in the outlet end of pipe 53 below the openings 53^a, and a spring 61 serves to hold the valve 58 normally seated and openings 53^a normally closed by the piston 60. In the drawings the valve is shown open, as when the inlet occurs. Cross-strips 62 serve as supports for the tube 59^a. A rod 63 extends into the upper end of the tube 57, and its lower end 64 is cored out and slotted at one side, as shown in Fig. 16. It will thus be seen that when the slotted portion is adjacent to corresponding slot at the inner end of the pipe 56 gasolene or oil can flow into the tube 57 through the slot 57^a therein and downward; but wher the rod 63 is given a turn the flow of gasolene is retarded or else entirely cut off (according to the amount of turn given) by that portion of the end 64 remaining opposite slot 57^a. The rod 63 extends upward through the pipe 53, and a cup-shaped plunger 65 is secured thereto and slidably mounted in the pipe. This plunger normally rests just above the air-inlet 55, a spring 66 holding the same and the rod 63 normally raised. A sleeve 67 is revolubly mounted upon the upper portion of the pipe 53, and the arms 68 extend from opposite sides thereof. Pivoted to these arms are weighted bell-crank arms 69, the inner free ends of which engage a collar 70, loosely mounted on the rod 63 and bearing on a flange 71 inclosing the rod. A beveled gear 72 is secured to the sleeve 67 and meshes with a similar gear 73, secured to one end of a shaft 74. This shaft is journaled in an arm 75, extending from the pipe 53, and a pulley 76 is secured to the outer end thereof. Motion is imparted to this pulley and its shaft through a cord or belt 77, which passes over a pulley 78, secured to the shaft 3, adjacent to the fly-wheel 6. A worm-wheel 79 is secured to the upper end of rod 63 and is engaged by a second wheel 80, mounted in a bracket 81, extending from tube 63^a. By means of this worm-gear the rod may be slowly turned, thereby gradually shutting off or opening the gasolene-inlet 56. An air-inlet port 82 is provided for the intermediate or low-pressure cylinder 9. This port is provided with a valve 83, which is held normally seated by a spring 84.

During the operation of the engine the sleeve 67 and governor-arms 69 are revolved from the shaft 3 through belt 77 and gears 72 and 73. The weights of arms 69 will be thrown outward by centrifugal force, thereby pressing the collar 70 downward and sliding rod 63 in pipe 53. The movement of the rod will be in proportion to the speed of the engine, as is obvious, and as the rod slides inward the inlets 55 and 56 and 57^a are partly or entirely closed by the plungers 65 and 64, respectively. By turning the worm-gear 79 80 the rod 63 can be revolved, so as to regulate the proportion of gasolene or oil and air to be supplied to the engine. The gasolene or oil flows down into the tube 57 and, opening the valve 58, passes into pipe 53 and mixes with air, which is admitted through port 55. This mixture flows through valve 60 and into the inlet-chamber 14. Motion, as hereinbefore described, is imparted to the valves 30, 31, and 32 from shaft 3 through shaft 43 and gears 39, 41, 42, and 40 or other suitable means, and as these valves revolve the explosive mixture will flow through a slot 35 and into valve 30 as soon as said slot registers with its port 26. The downward movement of the piston 11 in cylinder 7 draws the gas from valve 30 via apertures 34, and upon the return of the piston the gas is compressed in the explosion-chamber 16. When the compression is nearly at its height, the arm 52 of the igniter swings into contact with the stem 45 and causes the formation of a spark, which explodes the gas. The expansion resulting from the explosion forces piston 11 of cylinder 7 outward, and at the extremity of its travel slot 35 moves into register with port 27 and permits the gas to flow from the explosion-chamber through the valve 30 and into passage 18 and its port 20. A slot 36 in valve 30 registers with port 28 just as slot 35 passes out of register with port 27, and all burned gases remaining in the explosion-chamber 16 are thus enabled to pass directly into the exhaust-chamber 15.

The construction of valve herein provided permits such adjustment that the valves are open during almost the entire time during which the stroke of the piston is taking place for the intake or expulsion of gases.

The gas which enters port 20 passes into the low-pressure cylinder 9, and if enough gas is not supplied thereto to prevent the formation of a vacuum as the piston in said cylinder moves outward air will be sucked into the cylinder through the valved inlet 82. Upon the return movement of the piston in cylinder 9 the gas will pass into the apertures 37 in valve 31, and a slot 38 in said valve will move into register with its port 29, thereby permitting the gas to flow into the exhaust-chamber. The valves 30, 31, and 32 are so arranged that explosive mixture is admitted to the cylinders 7 and 8 alternately; but the course of the mixture is the same as the above described when admitted to either cylinder 30 32.

The engine is started by turning the wheel 6 manually.

In the foregoing description I have shown the preferred form of my invention; but I do not limit myself thereto, as I am aware that

modifications may be made therein without departing from the spirit or sacrificing the advantages thereof, and I therefore reserve the right to make such changes as fairly fall within the scope of my invention.

I hereby reserve to myself the right hereafter to file applications and obtain patents for the speed-regulating device or governor hereinbefore described and also for the form of sparking igniter described above, same being herein described only in order that my improved explosive-engine may be seen in its entirety.

I claim—

1. The combination with a high and a low pressure cylinder and an inlet and exhaust chamber; of a rotary valve for the high-pressure cylinder adapted to serve as a means for communication from the inlet-chamber to the said cylinder, and from said cylinder to the low-pressure cylinder and to the exhaust-chamber successively.

2. The combination with a high and a low pressure cylinder, and an inlet and exhaust chamber; of pistons in said cylinders, a shaft operated thereby and a revoluble valve for the high-pressure cylinder operated from said shaft, and adapted to serve as a means for communication from the inlet-chamber to the said cylinder, and from said cylinder to the low-pressure cylinder and to the exhaust-chamber successively.

3. The combination with a high and a low pressure cylinder, and an inlet and an exhaust chamber; of a valve-casing, ports connecting the interior of said casing and each cylinder, and a revoluble tubular valve for each cylinder, said valves having apertures one of which is continually open to the port of its cylinder, the high-pressure valve being provided with apertures adapted to register successively with a port of the inlet-chamber, a port of the low-pressure cylinder, and a port of the exhaust-chamber.

4. The combination with high-pressure cylinders, an intermediate low-pressure cylinder, and an inlet and exhaust chamber; of a rotary tubular valve to each cylinder, said valve having apertures constantly communicating, through ports, with their respective cylinders, the high-pressure valves having apertures adapted to register successively with ports of the inlet-chamber, the inlet-port of the low-pressure cylinder and the exhaust-chamber, and the remaining valve having apertures adapted to register successively with the exhaust-port.

5. The combination with a high-pressure and an intermediate low-pressure cylinder; of a valve-casing thereabove having an explosion-chamber communicating with each high-pressure cylinder, a tubular rotary valve to each cylinder, and a sparker in each explosive-chamber, said valves having apertures constantly communicating, through ports, with their respective cylinders, the high-pressure valves having apertures adapted to register successively with ports of the inlet-chamber, the inlet-port of the low-pressure cylinder and the exhaust-chamber, and the remaining valve having apertures adapted to register successively with the exhaust-port.

6. The combination with a high and low pressure cylinder, and an inlet and exhaust chamber; of a valve-casing, ports connecting the interior of said casing and each cylinder, a revoluble tubular valve for each cylinder, said valves having apertures one of which is continually open to the port of its cylinder, the high-pressure valve being provided with apertures adapted to register successively with the low-pressure cylinder and the exhaust-chamber, and the remaining valve having apertures adapted to register successively with the exhaust-port, a valve to admit air to the low-pressure cylinder, when the pressure therein falls below that of the atmosphere, pistons in the cylinders, a shaft operated thereby and means for revolving the valves from the shafts.

7. In an engine the combination of a plurality of sections to a revoluble valve with a plurality of cylinders, said valve-sections being adapted to govern the admission and exhaust of fluid into and from said cylinders.

8. In an engine the combination of a plurality of cylinders and a revoluble valve consisting of a plurality of sections, said sections engaging each other so as to rotate synchronously, and being adapted to control the admission and exhaust of fluid into and from said cylinders.

In testimony whereof I have hereunto affixed my signature, in the presence of two witnesses, this 3d day of June, 1901.

ERNEST E. KOKEN.

Witnesses:
HUGH K. WAGNER,
E. REICENSTEIN.