H. LEE.

INTERNAL COMBUSTION ROTARY ENGINE.

APPLICATION FILED APR. 16, 1908.

904,974. **Patented Nov. 24, 1908.**

4 SHEETS—SHEET 1.

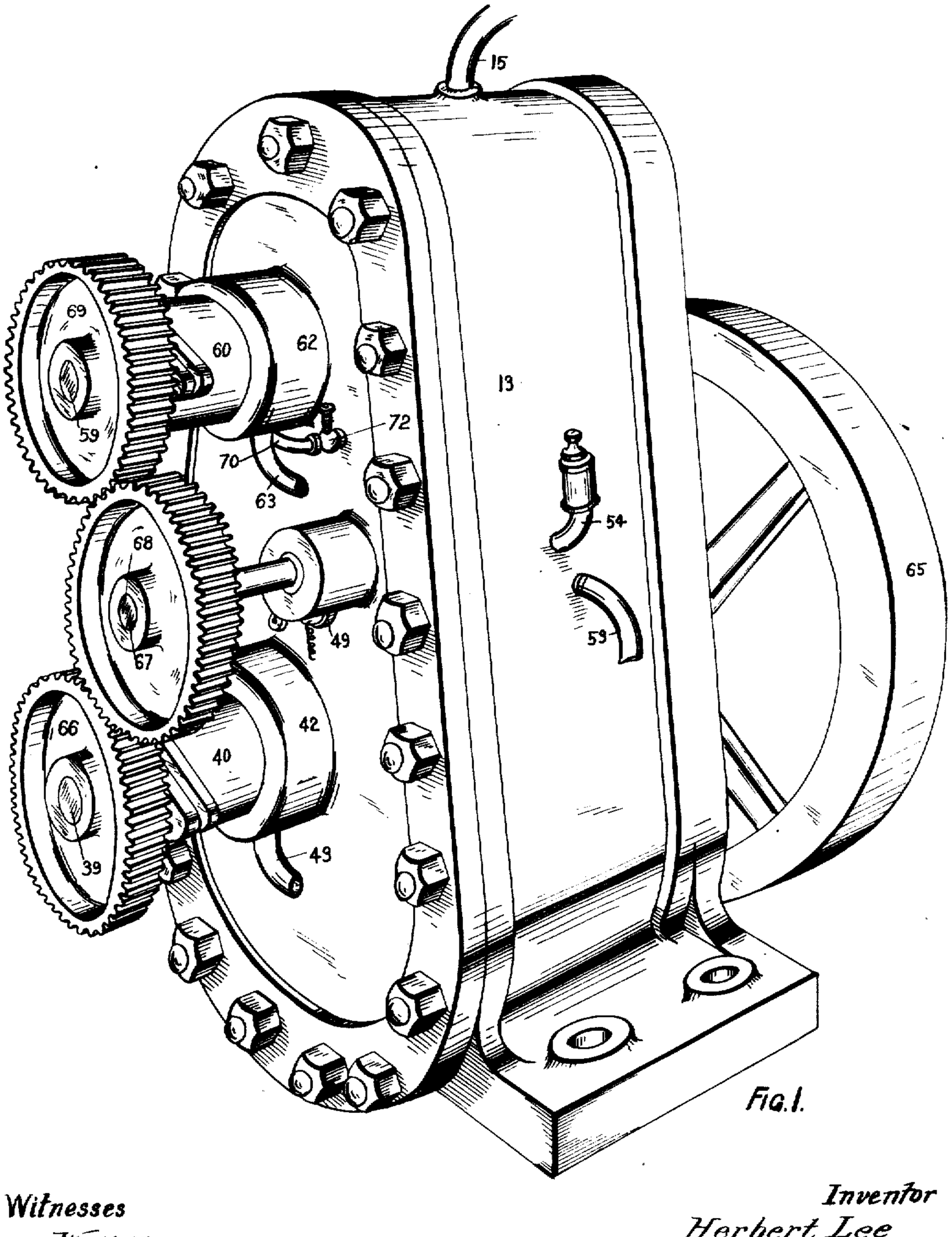

FIG. 1.

Witnesses

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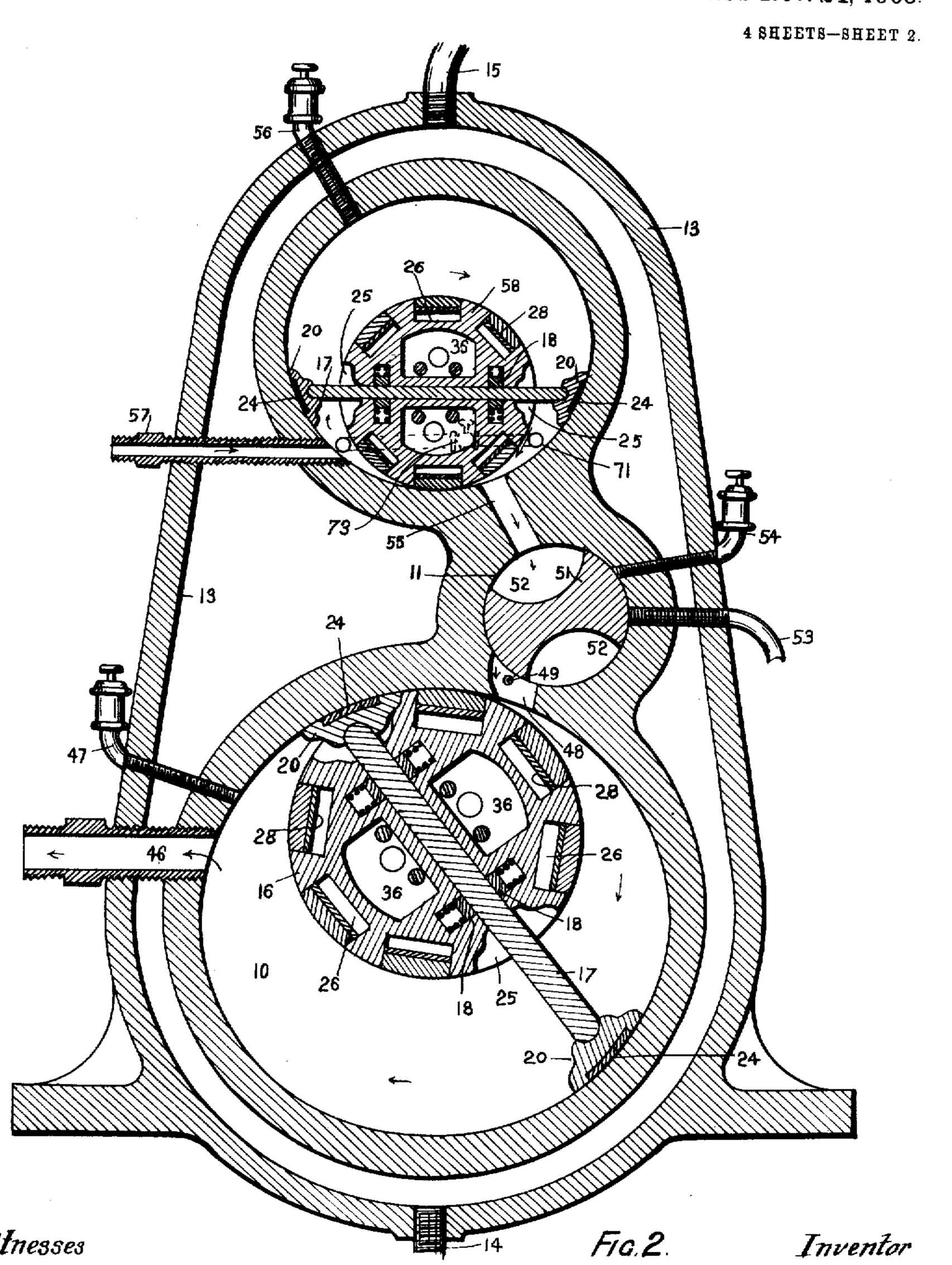

FIG. 2.

Witnesses

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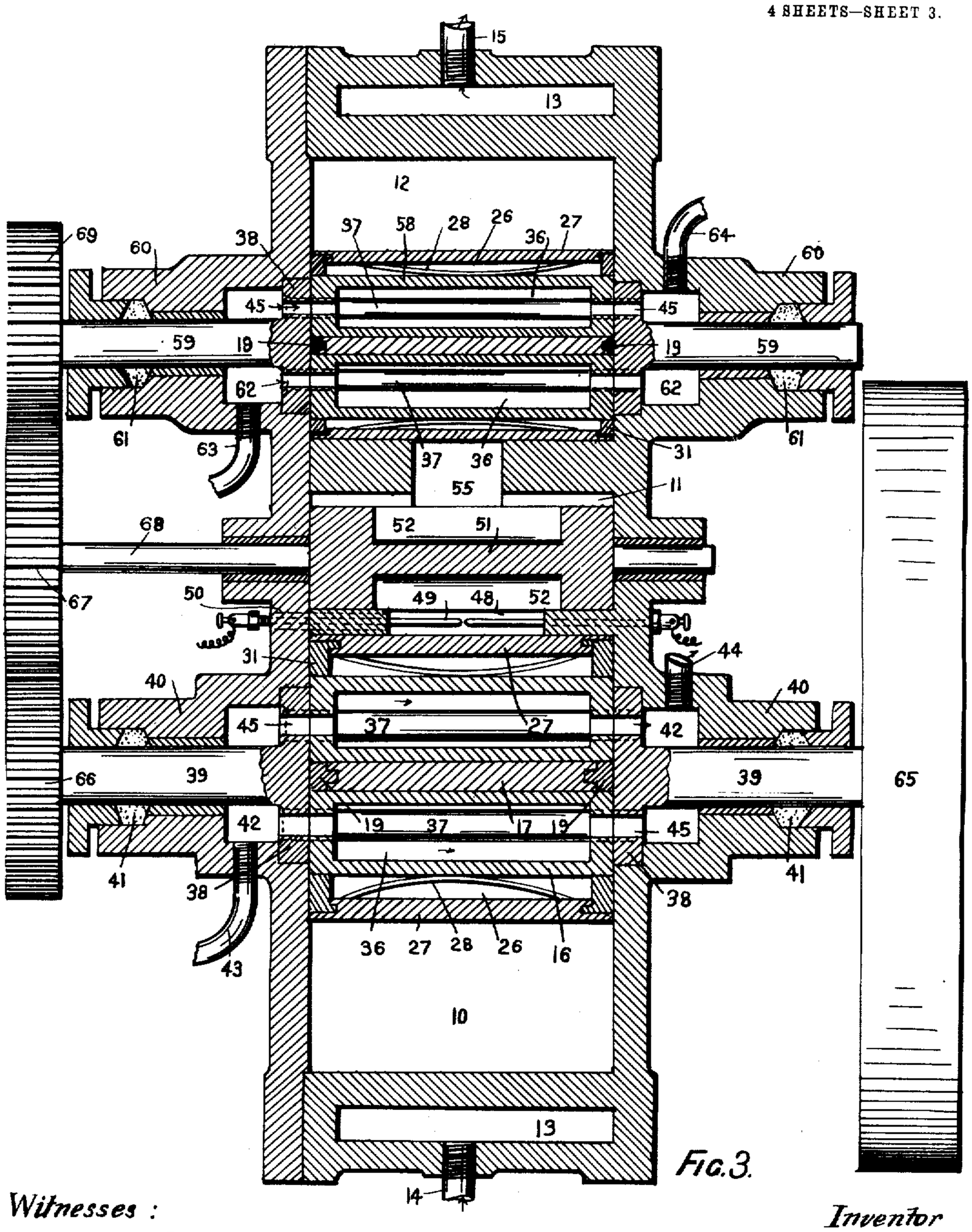

Fig. 3.

Witnesses :

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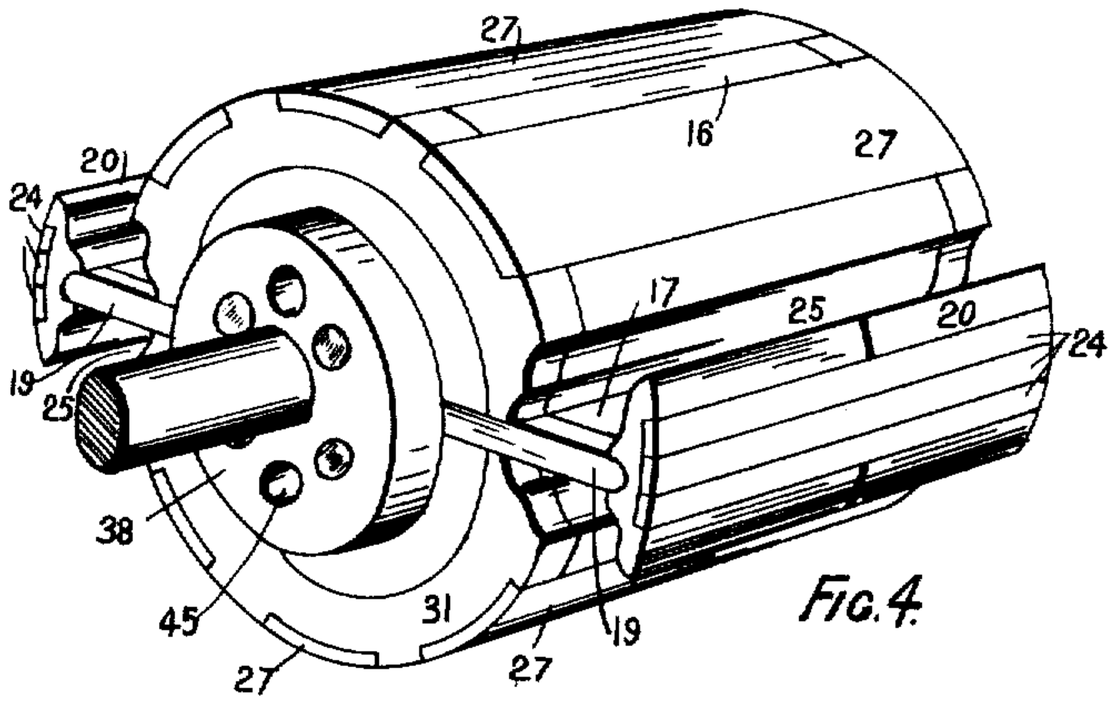

Fig. 4.

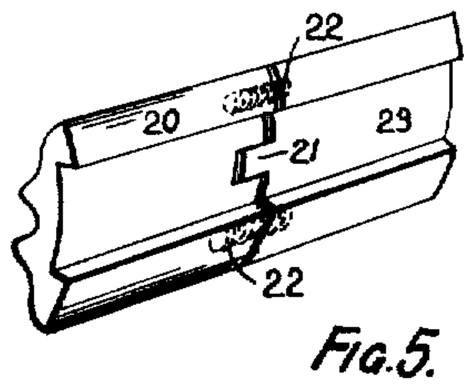

Fig. 5.

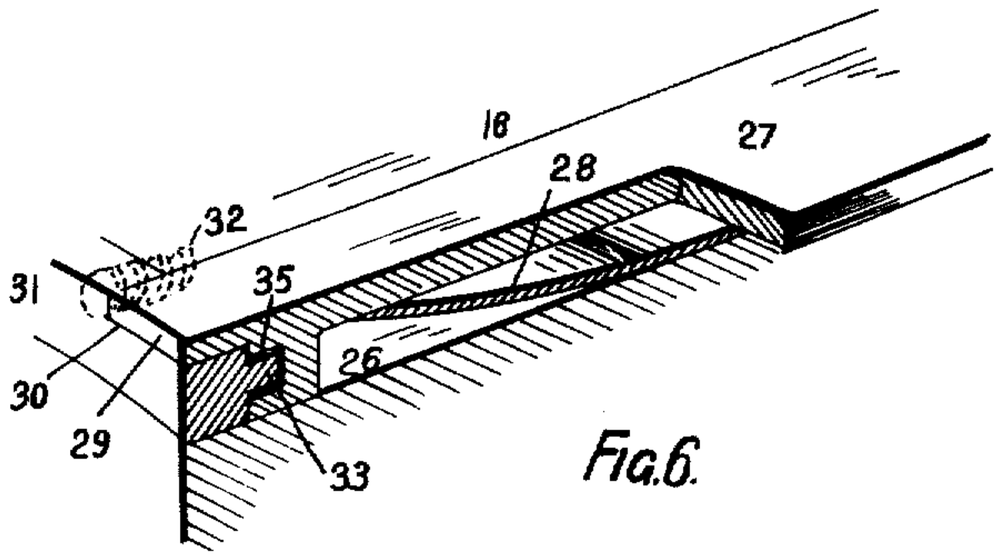

Fig. 6.

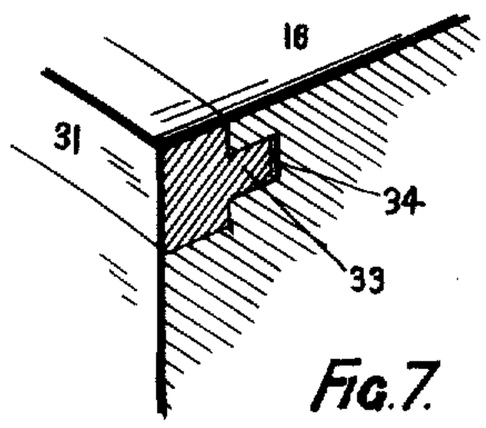

Fig. 7.

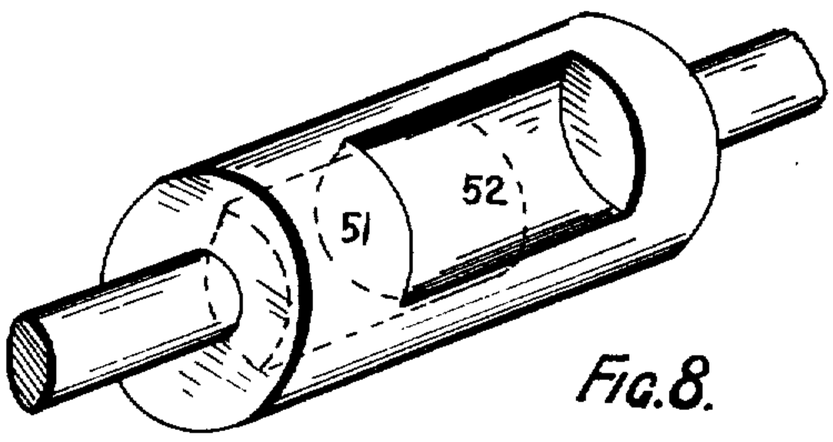

Fig. 8.

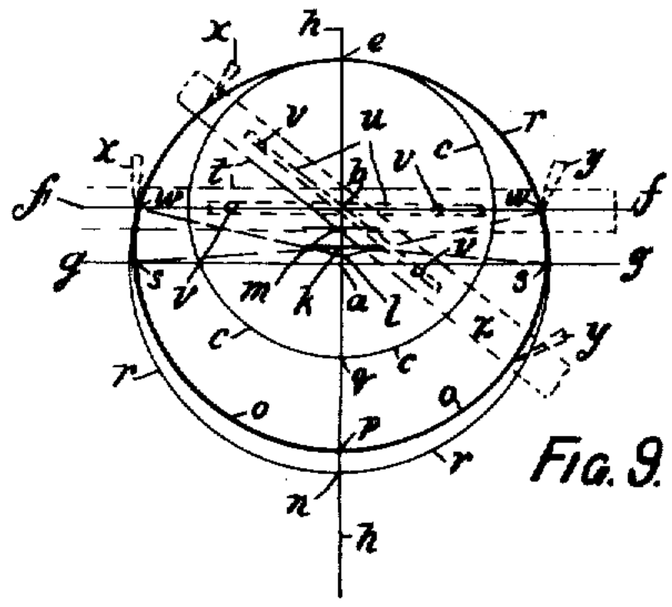

Fig. 9.

Witnesses

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UNITED STATES PATENT OFFICE.

HERBERT LEE, OF KENSINGTON, NEAR SYDNEY, NEW SOUTH WALES, AUSTRALIA.

INTERNAL-COMBUSTION ROTARY ENGINE.

No. 904,974. Specification of Letters Patent. Patented Nov. 24, 1908.

Application filed April 16, 1908. Serial No. 427,337.

To all whom it may concern:

Be it known that I, HERBERT LEE, a subject of the King of Great Britain and Ireland, residing at Bowral street, Kensington, near Sydney, in the State of New South Wales, in the Commonwealth of Australia, engineer, have invented certain new and useful Improvements in Internal-Combustion Rotary Engines, of which the following is a specification.

The purpose of this invention is to provide an internal combustion engine working on the rotary principle, which will utilize the power of the gases generated by the explosion more fully than has hitherto been done. Its essential features consist of a rotary compressor, an intermediate rotary valve and a nave or rotor carrying a sliding piston within a chamber of peculiar construction and varying contour. But in order that the invention may be clearly understood reference will now be made to the accompanying drawings in which:—

Figure 1 is a perspective view of the machine. Figs. 2 and 3 are sectional elevations thereof. Fig. 4 a perspective view of the rotor. Fig. 5 a similar view of one of the terminal piston shoes with expansion strips removed. Figs. 6 and 7 are enlarged detail views of the arrangement of the expanding plates and rings. Fig. 8 a perspective view of the intermediate valve. Fig. 9 is a diagrammatic view showing the method of ascertaining the contour of the periphery of the piston chamber (hereinafter called the cylinder) and the position of the rotor therein.

The cylinder 10, the valve-chamber 11 and compression-chamber 12 are all integral. They are surrounded by the water-jacket 13 provided with intake and delivery pipes 14 and 15 respectively.

Within the cylinder is the hollow rotor 16 eccentrically placed, carrying a sliding piston 17 and provided with internal expansion-strips 18, for the purpose of providing gas-tight joints. The piston has side expansion strips 19 and is fitted with terminal shoes 20 fulcrumed on its ends and bearing against the inner periphery of the cylinder, so as to form a gas-tight joint therewith throughout the whole of its revolution. These shoes are centrally divided and tongued as shown at 21 (see Fig. 5) and provided with expanding-springs 22 and a longitudinal recess 23 to receive the expansion-bars 24. In the outer face of the rotor are cut the recesses 25, for the purpose of receiving the shoes. Fitting within the recesses 26, provided therefor along the face of the rotor, are a series of spring packing-bars 27, bearing upon the flat springs 28. These packing bars have lips 29 fitting in the recesses 30 within the rings 31 provided with expanding springs 32. The rings 31 have concentric tongues 33 fitting within the annular recesses 34 of the rotor, also into the recesses 35 in the ends of the spring packing-bars 27.

Within the rotor, which is secured by the bolts 37 to the flanges 38 integral with the spindle 39, is the central cavity or chamber 36 for the reception of the cooling medium. The spindle has bearings 40 with stuffing boxes 41 and hollow annular chamber 42 for reception of the cooling medium, also intake pipe 43 and delivery 44. The rotor and flanges are both provided with openings 45 to permit the circulation of the cooling medium. The exhaust 46 and the lubricating cup 47 connect with the chamber 10.

Connecting the cylinder with the valve-chamber is the port 48 having a sparking device 49, one terminal of which passes through insulating material 50 (see Fig. 3).

Within the valve-chamber revolves the rotary valve 51 provided with two concaved recesses or chambers 52 diametrically opposite one another; and leading from the valve-chamber is an exhaust pipe 53, while the lubricating cup 54 also connects therewith. From this chamber the port-passage 55 leads into the compression chamber 12 which is fitted with the lubricating cup 56 and a vapor supply pipe 57. The compressor consists of a rotor and piston 58 similar in construction to that operating within the cylinder 10, the parts bearing similar numerals of reference, while the flanges 38 are integral with spindle 59, working in bearings 60 and having stuffing-boxes 61, also hollow annular chambers 62 for the reception of a cooling medium; with intake and delivery pipes 63 and 64 respectively.

The driving shaft 39 carries a fly-wheel 65 and a gear wheel 66 engaging with gear wheel 67 on the valve-spindle 68 which again gears with the gear wheel 69 on spindle 59 of the rotor 58.

Near the entrance to the port passage 55

and leading therefrom are two by-passes 70 (see Fig. 1) and 71 (see Fig. 2) one having a safety valve 72 and the other a regulating valve 73.

The method of obtaining the contour of the cylinders is as follows:—Referring to Fig. 9:—With the point *b* as center describe the circle *ccc* of a diameter equal to that of the required rotor. Through the point *b* draw the vertical line *hh* cutting the circle *ccc* at the points *e* and *q*. From *eq* cut off a portion *ea* bearing the relation to *eb* (the diameter of the rotor) of four to three. With *a* as center and *ae* as radius, describe the circle *rrr* cutting the line *hh* at *e* and *n* and meeting the circle *ccc* at *e*. Through the point *a* draw the line *gg* at right angles to *hh*. Through the point *b* draw the line *ff* parallel to *gg* cutting the circle *rrr* at the points *ww*. Trisect *ab* (the line connecting the centers of the two circles) at the points *k* and *m*. With *k* as center and with *ae* (the radius of the larger circle) as radius, describe the arc *oo* meeting the line *gg* at the points *ss*. Bisect the line *ak* at the point *l*. With *l* as center and *lw* as radius, describe the arcs *ws* which will connect these points and complete the contour of the inner periphery of the required chamber. The same contour can be obtained by mechanical means as follows:—Construct a disk *cc* to represent the rotor and a slide *z* (provided with a central longitudinal slot *u* and the guide pins *vv* fastened in the said disk) to represent the piston. Place this slide along the line *ff* with the pointers *x* and *y* on the points *w* and *w* as shown. Move the disk (carrying the slide) clockwise with the pointer *x* following the curve of the circle *rrr* between the points *w* and *w*, when the pointer *y* will describe the curve *w*, *s*, *o*, *p*, *o*, *s*, *w* thus completing the required contour.

The method of operation is as follows:—The charge of vaporized oil enters the compression chamber 12 by the intake 57, being drawn in by the rotation of the piston 17. The forward movement of this piston then compresses the charge into one of the chambers 52 of the rotary valve. The compressed charge is carried around by the rotation of the valve and exploded in the cylinder by means of a sparking plug or other suitable device. The explosion chamber consists really of the valve chamber 52, the port-passage 48 and a small area of the cylinder confined between its inner walls and the surface of the rotor in the immediate vicinity of the said port-passage. Meantime, the second chamber of the valve has received a charge of the compressed vapor which is in turn carried around and exploded, thus giving an explosion at each half revolution of the piston. The expended gas exhausts through the port 46.

The exhaust 53 is provided for the purpose of clearing the valve-chambers after each explosion so as to prevent the possibility of back-firing into the compression chamber.

The parts as shown in Fig. 2 indicate the position they would take up just after an explosion had taken place, the next would occur immediately when the end of the piston shown approaching the port 48, shall have passed it.

I do not bind myself to the relative capacities of the compression chamber, the rotary valve and cylinder shown in the drawings, as under various working conditions, modifications therein may be found advantageous. Also if, for certain classes of engines, it should be considered desirable to increase the number of explosions at each revolution of the piston, this can be accomplished by a corresponding increase in the number of chambers provided in the rotary valve. It would also be possible to provide a second piston crossing at right angles to that shown herein. This would necessitate a corresponding alteration in the position of the exhaust 46; but though such modification might possess certain advantages there would be a material deficiency in the utilization of the expansion of the gas as compared with the construction which I have shown.

What I claim and desire to secure by Letters Patent is:—

1. An internal combustion rotary engine, comprising a compression chamber, a rotor in the chamber and having a sliding piston provided with a shoe at each end, an explosion chamber, a rotor in said chamber and having a sliding piston provided with a shoe at each end, a valve chamber between the compression and explosion chambers, and having ports leading therefrom to said compression and explosion chambers, and a rotary valve in the valve chamber and having two oppositely arranged chambers.

2. An internal combustion rotary engine, comprising a compression chamber, an explosion chamber, a valve chamber between the compression and explosion chambers and having ports leading therefrom to said compression and explosion chambers, a rotary valve in the valve chamber and having two oppositely arranged chambers, and rotors in the compression and explosion chambers, each rotor having a central chamber for a cooling medium and provided with a sliding piston having a pivoted shoe at each end.

3. An internal combustion rotary engine, comprising a compression chamber, an explosion chamber, a valve chamber between the combustion and explosion chambers and communicating therewith through ports, a rotary valve in the valve chamber and having peripheral chambers, and rotors in the compression and explosion chambers, each rotor having a central chamber for a cooling medium and provided with spring pressed pe-

ripheral packing strips and with a sliding piston having a pivoted shoe at each end.

4. An internal combustion rotary engine, comprising a compression chamber, an explosion chamber, a valve chamber between the compression and explosion chambers and communicating therewith through ports, a rotary valve in the valve chamber and having peripheral chambers, roters in the compression and explosion chambers, each rotor having a central chamber and provided with a sliding piston having shoes at its ends, bearings for the shafts of the rotors and having annular chambers communicating with the chambers of the rotors, and gearing between the rotor of the explosion chamber and valve and rotor of the compression chamber.

5. In an internal combustion rotary engine, a compression chamber, an explosion chamber, a valve chamber communicating with the compression and explosion chambers, a rotary valve in the valve chamber, and rotors in the compression and explosion chambers, each rotor having oppositely arranged peripheral recesses, and provided with a piston sliding through the rotor and having at each end a pivoted shoe adapted to be seated in the said recesses.

In testimony whereof I affix my signature in presence of two witnesses.

HERBERT LEE.

Witnesses:
WILLIAM NEWTON,
WALTER TIGMONT.