No. 865,891. PATENTED SEPT. 10, 1907.

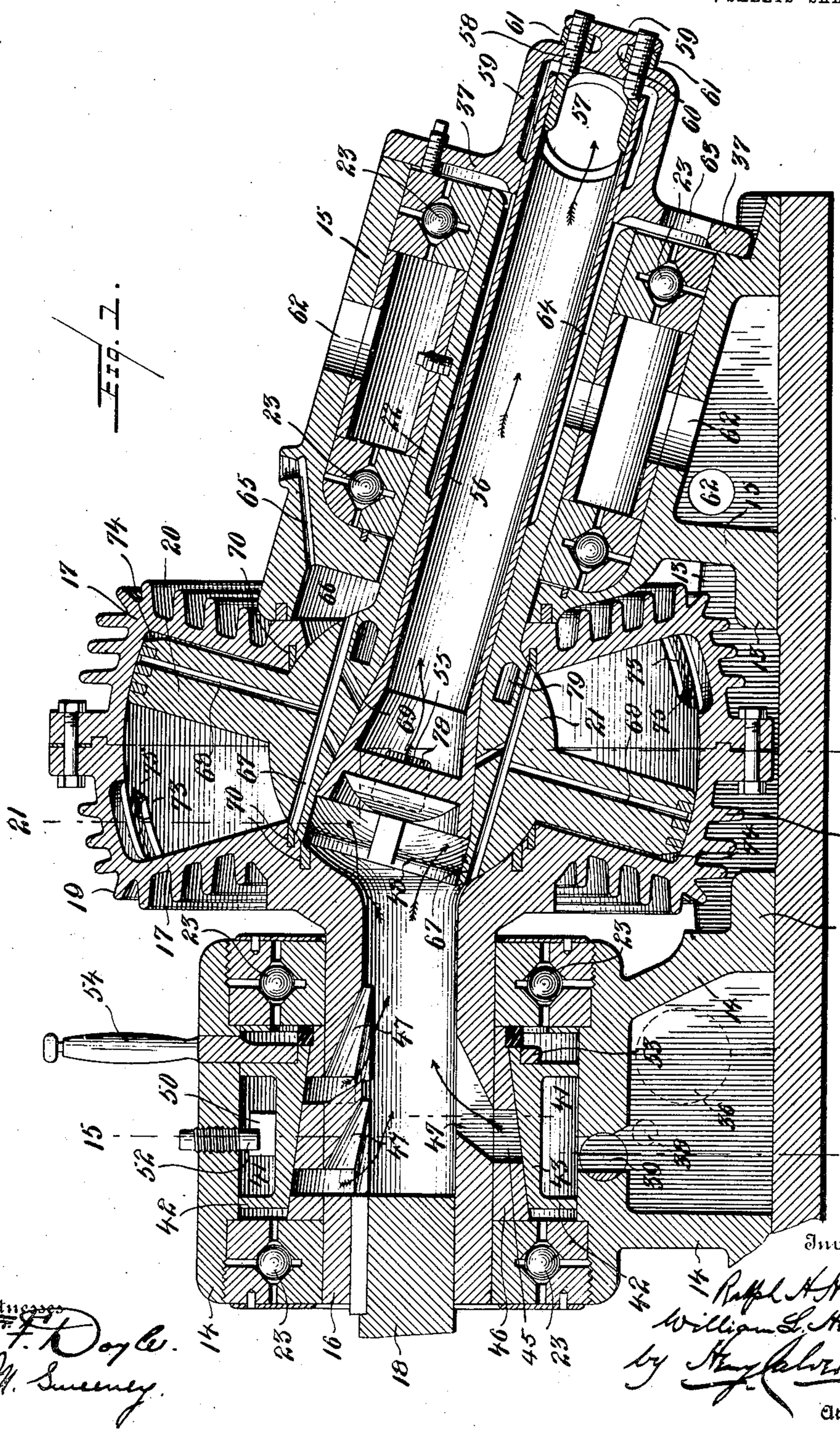
R. H. & W. L. HEBERLING.

ROTARY ENGINE.

APPLICATION FILED OCT. 25, 1906.

7 SHEETS—SHEET 1.

Fig. 1.



Witnesses:
W. F. Doyle.
C. M. Sweeney.

Inventors:
Rudolph H. Heberling
William L. Heberling
by Henry Orth
Attorney.

No. 865,891 PATENTED SEPT. 10, 1907.

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7 SHEETS—SHEET 2.

Fig. 2.

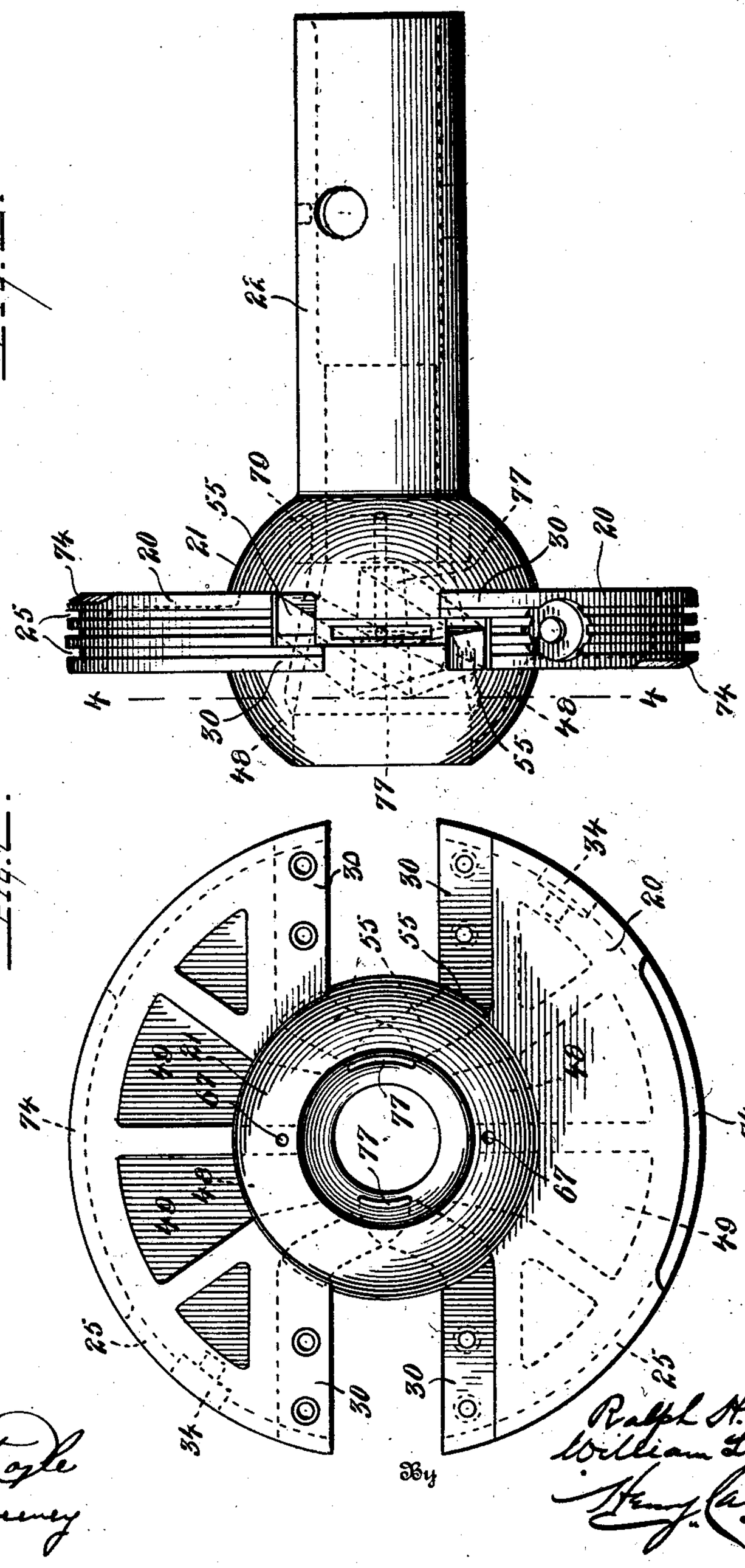

Fig. 3.

Witnesses:
H. F. Royle
C. M. Sweeney

Inventors:
Ralph H. Heberling
William L. Heberling
By Henry J. Cahill
Attorney.

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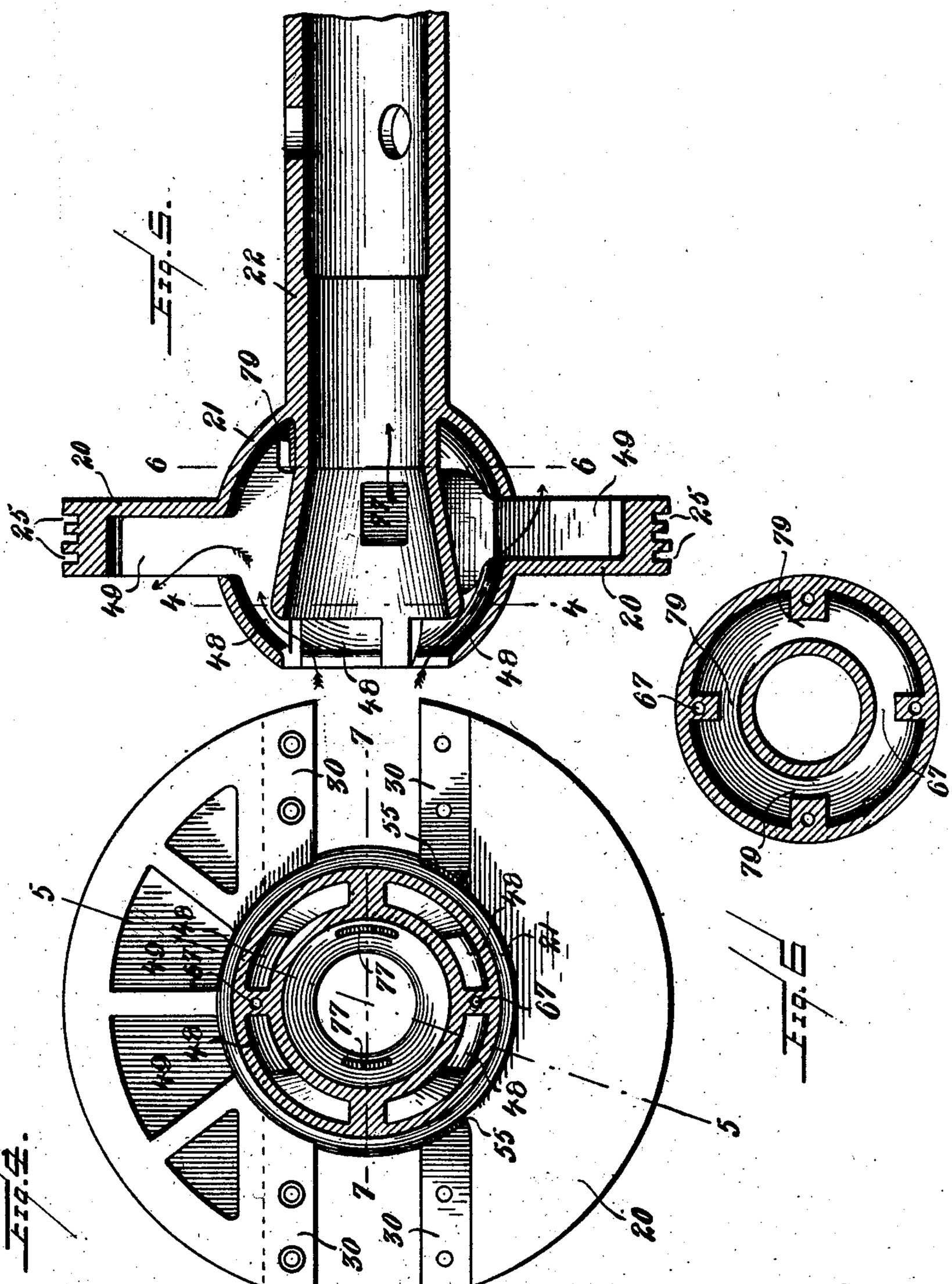
7 SHEETS—SHEET 3.



Witnesses:
H. F. Kyle.
C. M. Sweeney.

Inventors:
Ralph H. Heberling.
William L. Heberling.
By Henry Kalver
Attorney.

No. 865,891. PATENTED SEPT. 10, 1907.

R. H. & W. L. HEBERLING.

ROTARY ENGINE.

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7 SHEETS—SHEET 4.

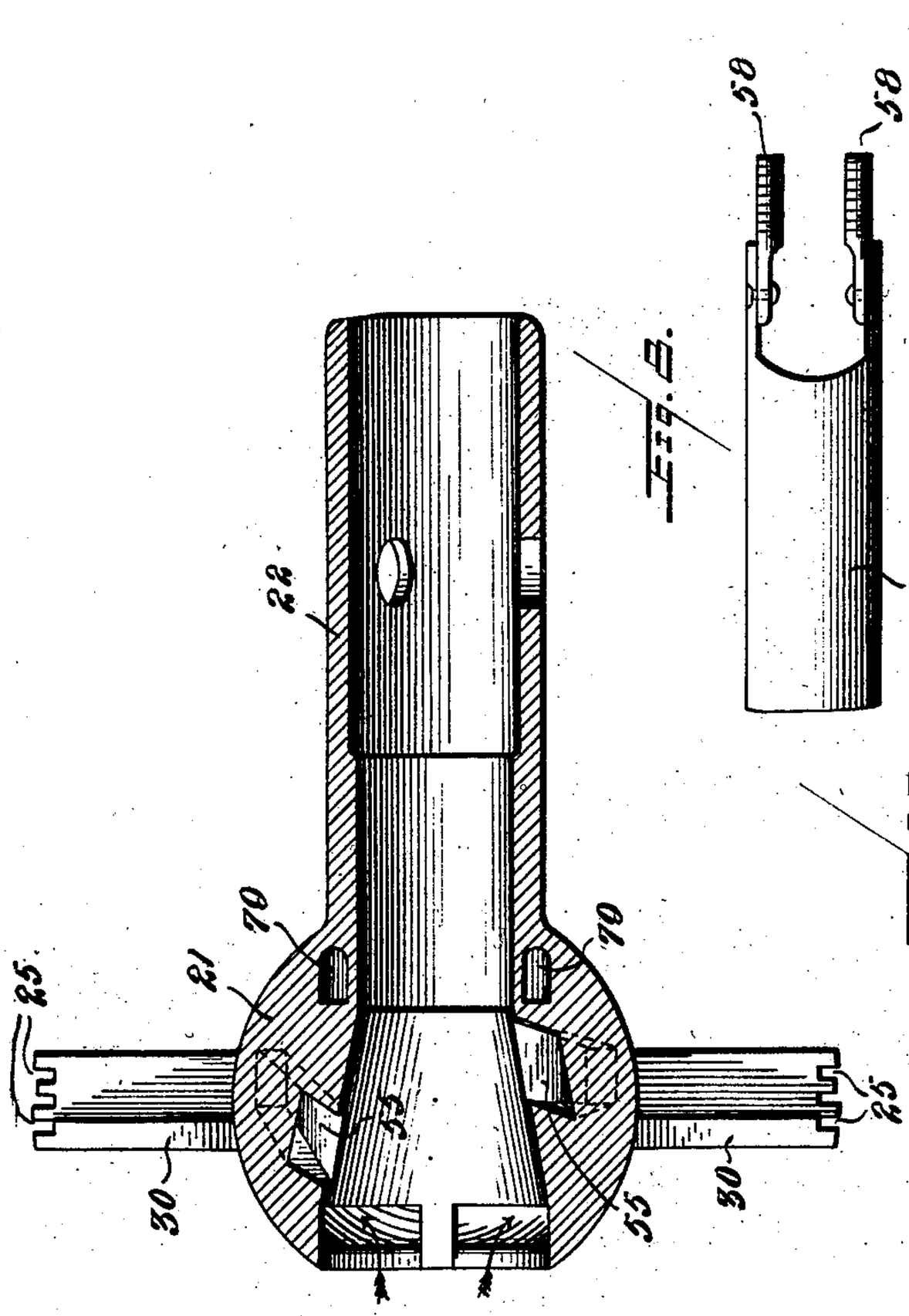


Fig. 8.

Fig. 10.

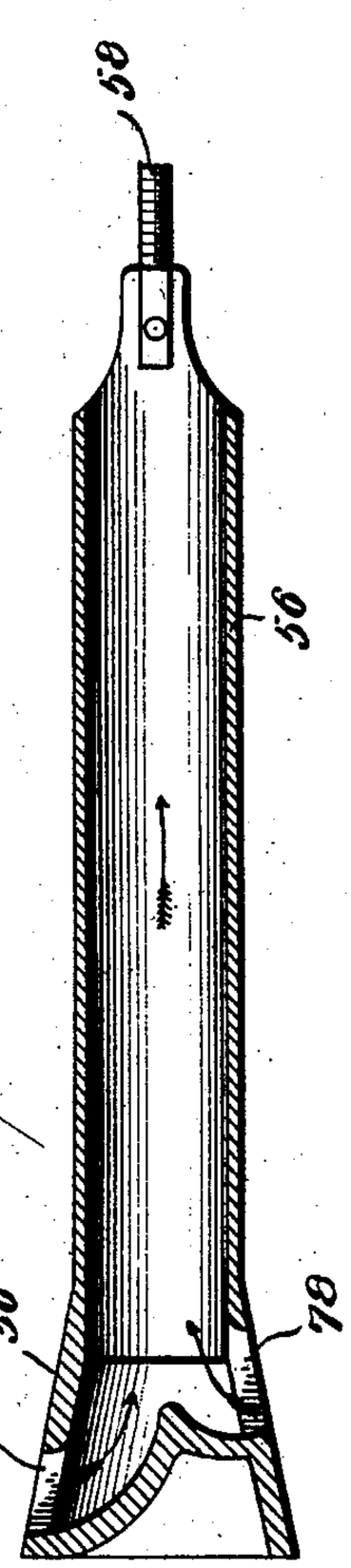


Fig. 9.

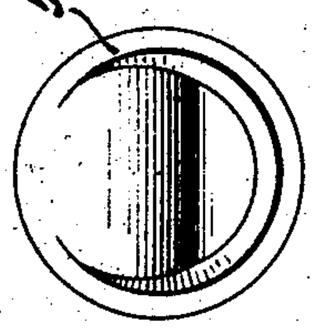


Fig. 7.

Witnesses
H. C. Doyle.
C. M. Sweeney.

Inventors:
Ralph H. Heberling
William L. Heberling
By Thompkins
Attorney.

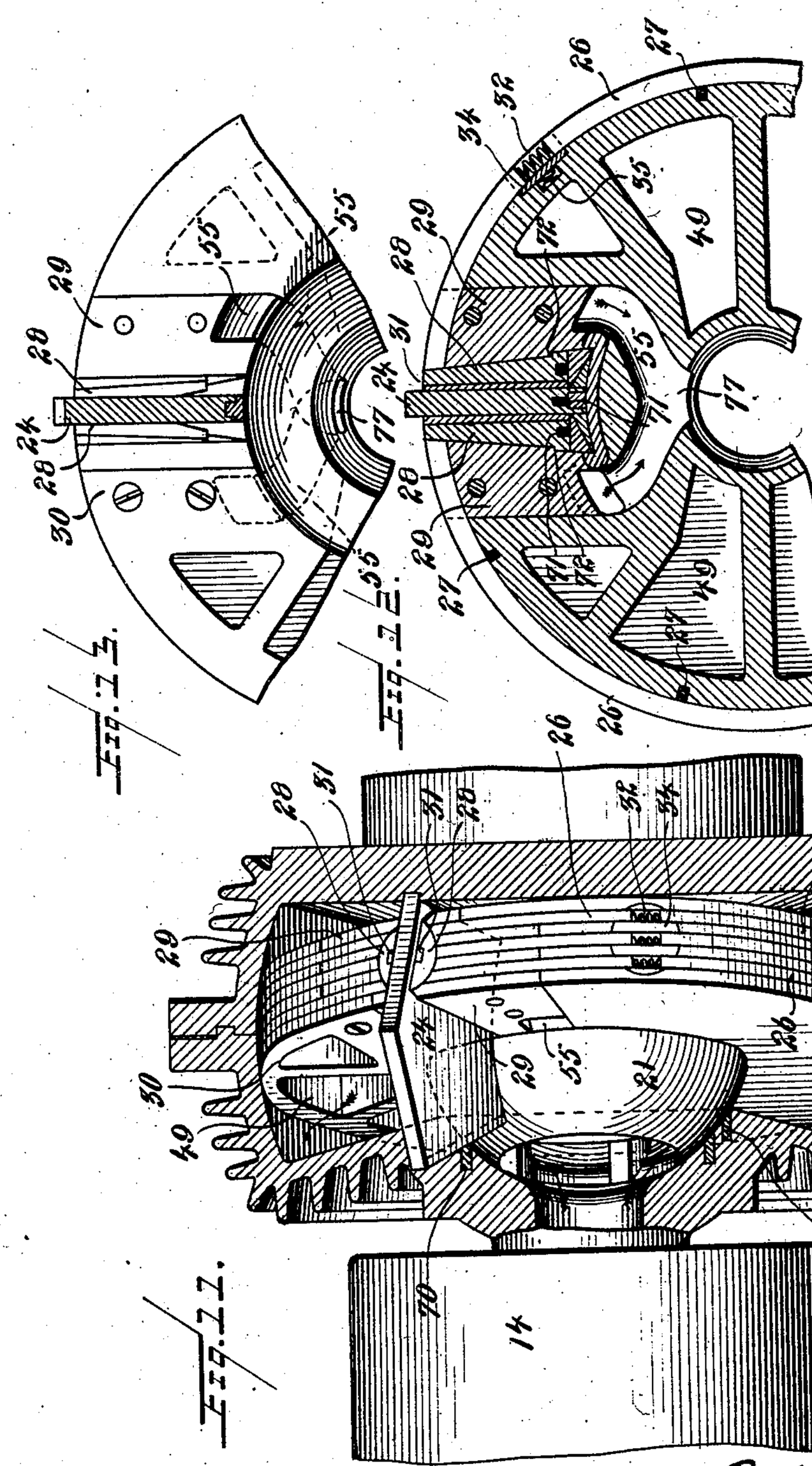
No. 865,891 PATENTED SEPT. 10, 1907.

R. H. & W. L. HEBERLING.

ROTARY ENGINE.

APPLICATION FILED OCT. 25, 1906.

7 SHEETS—SHEET 5.



Witnesses:
W. F. Doyle.
C. M. Sweeney

Inventors:
Ralph H. Heberling
William L. Heberling
By Henry Calvert
Attorney.

No. 865,891. PATENTED SEPT. 10, 1907.

R. H. & W. L. HEBERLING.

ROTARY ENGINE.

APPLICATION FILED OCT. 25, 1906.

7 SHEETS—SHEET 6.

Fig. 17.

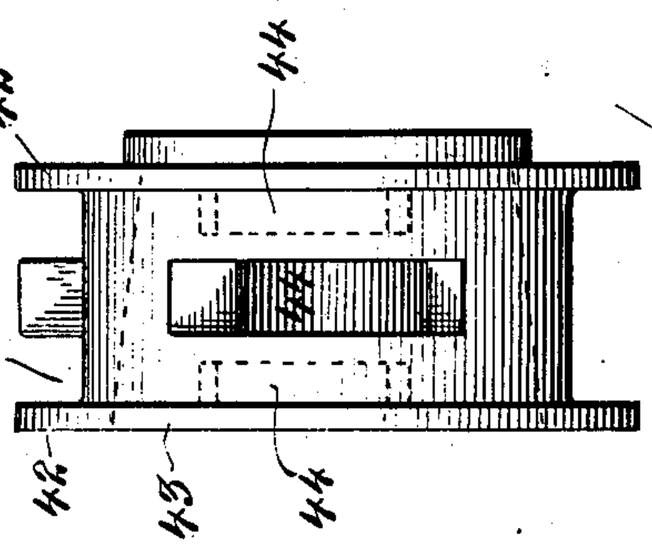


Fig. 18.

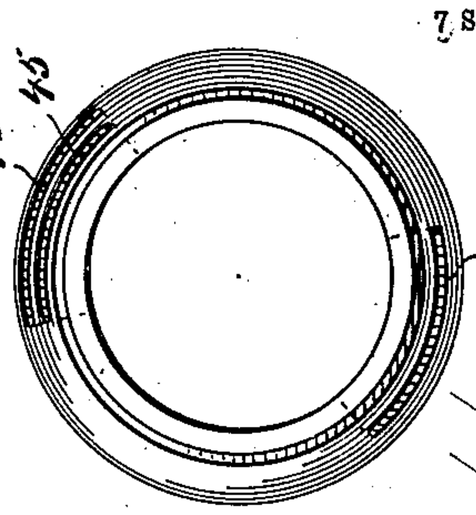


Fig. 19.

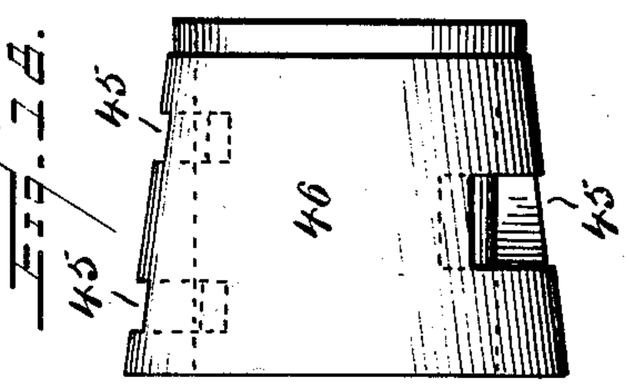


Fig. 20.

Fig. 15.

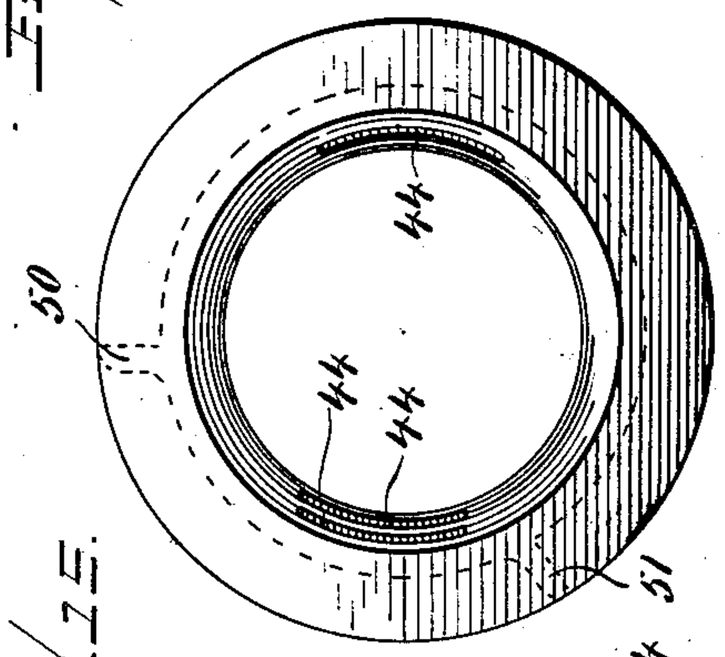
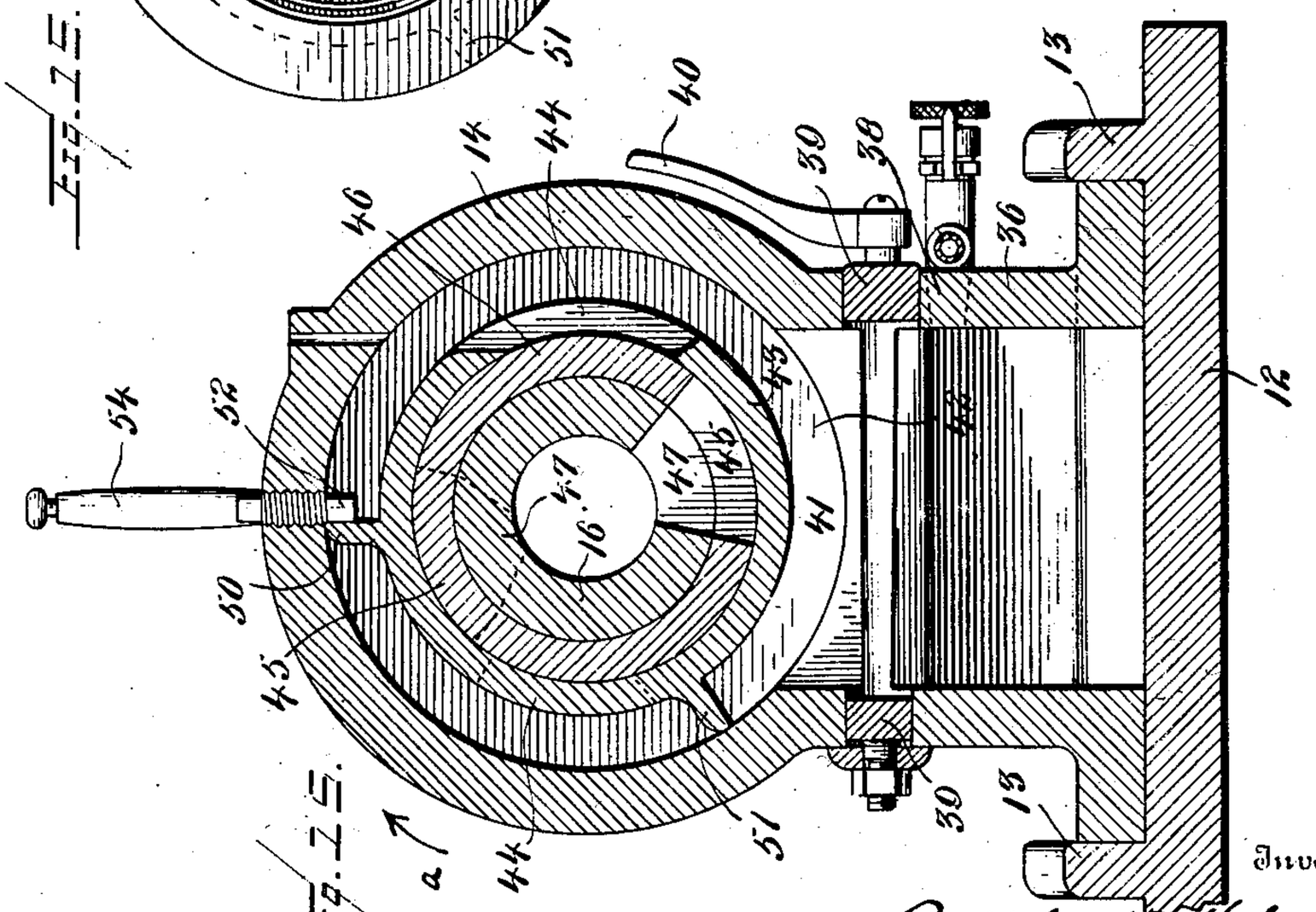


Fig. 14.



Witnesses
H. F. Coyle.
C. M. Sweeney

Inventors:
Ralph H. Heberling
William L. Heberling
By Henry Calver
Attorney.

No. 865,891. PATENTED SEPT. 10, 1907.

R. H. & W. L. HEBERLING.

ROTARY ENGINE.

APPLICATION FILED OCT. 25, 1906.

7 SHEETS—SHEET 7.

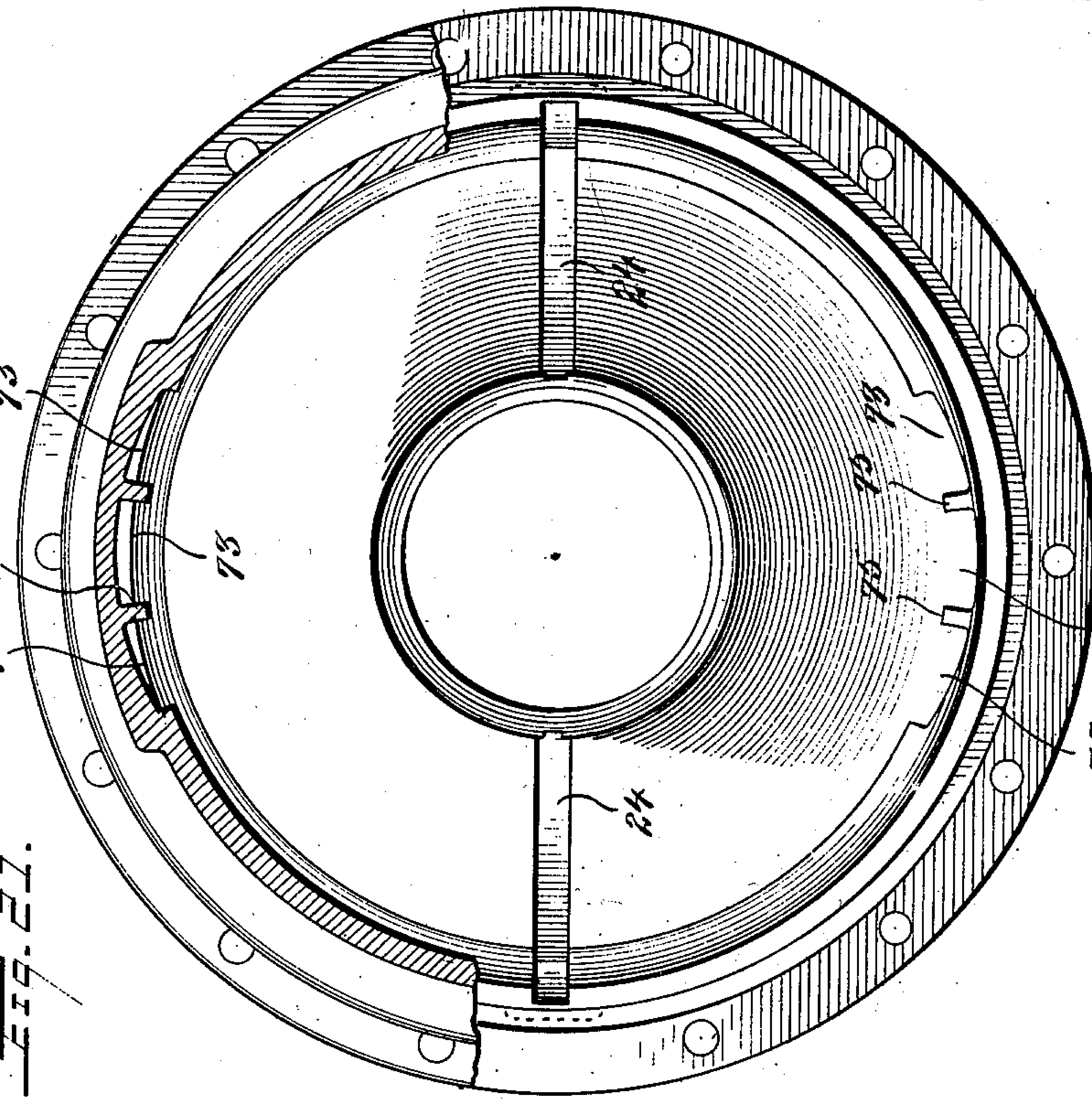


Fig. 21.

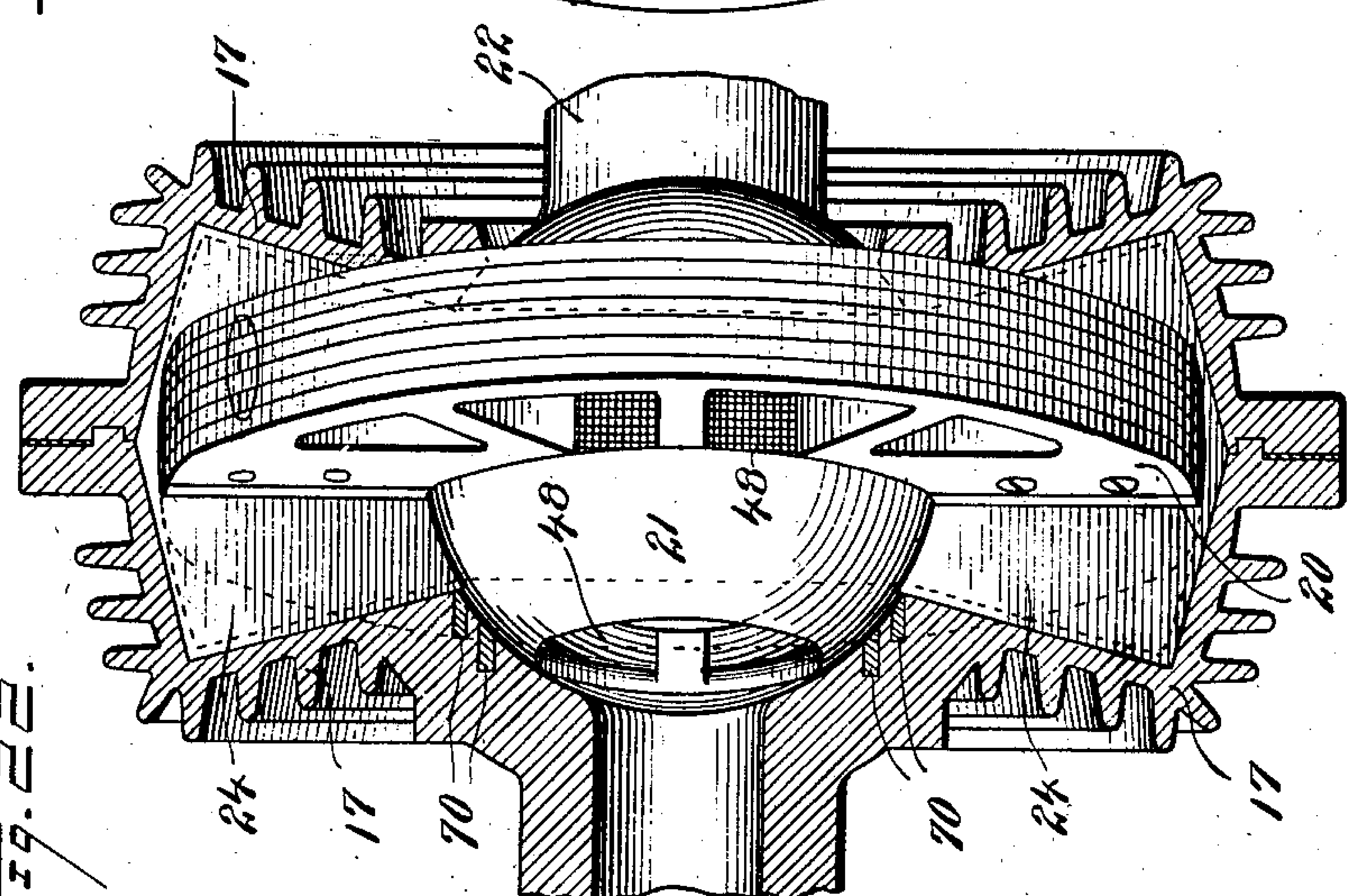


Fig. 22.

Witnesses
W. F. Kohle
C. M. Sweeney

Inventors:
Ralph H. Heberling
William L. Heberling

By Henry Calver

Attorney.

UNITED STATES PATENT OFFICE.

RALPH H. HEBERLING AND WILLIAM L. HEBERLING, OF HAVANA, ILLINOIS.

ROTARY ENGINE.

No. 865,891. Specification of Letters Patent. Patented Sept. 10, 1907.

Application filed October 25, 1906. Serial No. 340,528.

To all whom it may concern:

Be it known that we, RALPH H. HEBERLING and WILLIAM L. HEBERLING, citizens of the United States, residing at Havana, in the county of Mason and State of Illinois, have invented or discovered certain new and useful Improvements in Rotary Engines, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to rotary engines, and more particularly to that type known as disk engines, and the invention has for its object to provide an engine of this class which, while comparatively simple in construction, will be efficient in operation, and in which convenient facilities will be afforded for properly packing the rotary parts of the engine, which have relative movements to each other or to the stationary parts, so that tight joints will be afforded to properly confine the pressure medium and direct the same through the engine.

While the invention in its preferred form is intended for use as an internal-combustion or explosion engine of the two-cycle class, it will be understood that, with slight modifications of the valves and some other parts, the invention may be utilized in a four-cycle internal-combustion engine, as also in a steam engine, and the improved engine may also be adapted for use as a pump or air compressor.

In the accompanying drawings, Figure 1 is a central longitudinal section, in a vertical plane, of an engine embodying the invention. Fig. 2 is an end view of the rotary disk and the parts integral therewith, and Fig. 3 is a side view of the same. Fig. 4 is a partial section through the hub of the rotary disk on line 4—4, Fig. 5. Fig. 5 is a longitudinal section of the hub of the rotary disk and parts integral therewith on line 5—5, Fig. 4. Fig. 6 is a detail section of the hub of the rotary disk on line 6—6, Fig. 5. Fig. 7 is a section of the hub of the rotary disk on line 7—7, Fig. 4. Figs. 8, 9 and 10 are detail views of a stationary sleeve which serves as a valve seat and exhaust passage. Fig. 11 is a detail view of the revolving cylinder showing the rotary disk in the same and one of the division plates which form the chambers in the cylinder. Fig. 12 is a partial sectional view of the revolving disk showing the shoe holders and shoes and their relations to one of the division plates. Fig. 13 is a partial elevation of the same. Fig. 14 is a detail view of one of the slotted blocks inserted in the revolving disk and serving as a holder for springs bearing against the ends of the packing segments. Fig. 15 is a transverse section of the engine on line 15—15, Fig. 1. Figs. 16 and 17 are detail views of the normally stationary valve-seat ring. Figs. 18 and 19 are detail views of the rotary valve ring or sleeve. Fig. 20 is a detail view of the throttle valve. Fig. 21 is a section through the rotating cylinder on line 21—21, Fig. 1, and Fig. 22 is a section of the rotating cylinder and disk taken at right angles to the section of Fig. 1.

Referring to the drawings, 12 denotes the base-plate of the machine frame provided with upwardly projecting flanges 13 between which are received the bases of the standards 14 and 15, these parts constituting the framework of the engine. Journaled in the standard 14 is a sleeve 16 formed integral with the rotating cylinder 17 and to which sleeve is suitably splined or fixed a shaft 18 from which the power of the engine is taken, or which, if the engine is to be used as a pump or air compressor, will serve as the driving shaft therefor. The engine herein illustrated being intended for use as an internal combustion or explosion engine, the rotary cylinder 17 is shown as being provided with cooling ribs 19.

Inclosed within the rotary cylinder 17 is a rotary disk 20 having a spherical hub portion 21 fitted to suitable bearings within the said cylinder; and extending from said hub portion 21 is a sleeve 22 having a suitable bearing in the standard 15. The rotary sleeves 16 and 22 are preferably mounted on ball bearings 23 in the standards 14 and 15.

The bearing sleeve 22 is disposed at an angle to the sleeve 16 so that the axis of rotation of the disk 20 is inclined relative to the axis of rotation of cylinder 17, and thus there will be a relative lateral or side movement of the said disk in the chamber of said cylinder, as the latter and the said disk rotate together. In other words, while the said cylinder and disk always maintain their general relative positions, as shown in Fig. 1, the rotation of the cylinder will cause its interior peripheral wall to rub back and forth on the periphery of the disk.

Within the cylinder 17, and extending through the rotary disk 20, are, in the style of engine herein illustrated, two radially disposed division plates 24 fixed to said cylinder and located diametrically opposite each other, and which division plates, together with said disk, form four chambers within said cylinder. The radially-disposed division plates 24, which are notched into or otherwise suitably fixed to said cylinder 17, so as to rotate therewith, pass through transverse slots or openings in said rotary disk 20, thus connecting said cylinder and disk rotatively, so that said cylinder and disk must rotate together. (See Fig. 11.) To provide for a tight joint between the rotary disk and the interior wall of the rotary cylinder the said disk is provided at its periphery with annular grooves 25 in which are seated packing segments 26 of any proper material, preferably some suitable metal. These packing segments are preferably forced outward against the interior wall of the rotary cylinder by spiral springs 27 inserted in suitable pockets in the rotary disk and pressing against said segments.

To form tight joints between the rotary disk 20 and

the division plates 24 suitable shoes 28 are confined in shoe-holders 29 bolted to overlapping flange portions 30 of the rotary disk; the said shoes being provided with packing bars or strips 31 which are in contact with the division plates 24. The shoes 28 are preferably tapered outward so that they may be held to their seats in the holders 29 by centrifugal force which will preferably be assisted by springs 71, and thus the packing strips 31 carried by said shoes will be held in yielding contact with the division plates 24. To positively limit the outward movement of the said shoes they are provided with shoulders 72 which engage similar shoulders formed in the holders 29.

The packing segments 26 are held in endwise contact with the packing shoes 28 by springs 32 inserted in grooves 33 in blocks 34 which are seated in the peripheral portion of the rotary disk, and which springs are interposed between the ends of the packing segments 27 extending into the said grooves in said blocks. Beneath the said blocks are preferably located springs 35 which also have a tendency to force the packing segments outward against the interior wall of the chamber of the cylinder.

In the present embodiment of the invention, intended as a two-cycle combustion engine, the standard 14 is provided near its base with an opening 36, for the admission of air, and with a needle-valve 38 for the admission of a suitable fluid fuel. Journaled in the said standard 14 is a throttle-valve 39 provided with a handle 40 by which it may be turned, the opening in said valve communicating with a chamber 41 between the flanges 42 of a normally stationary valve-seat ring 43 having openings 44 communicating, at proper intervals, with openings 45 in a valve ring 46 which rotates with the sleeve 16 of the rotary cylinder 17, and which sleeve is provided with openings 47 communicating with the said openings 45.

The chamber in the sleeve 16 communicates with the chamber of the rotary cylinder through suitable openings 48 in the spherical hub 21 of the rotary disk and also through openings 49 in the said disk. The normally stationary valve-seat ring 43 is provided with peripheral lugs 50 and 51 arranged to come in contact in one or the other of the positions which said valve seat ring may assume, with a stop-screw 52. When the engine is running forward, or in the direction denoted by arrow *a* in Fig. 15, the lug 50 will be in contact with the said stop pin to restrain the normally stationary valve-seat ring from rotating with the rotary valve-ring and the sleeve of the rotary cylinder 17; but when the engine is reversed the position of the normally stationary valve seat ring will be changed, by frictional contact with the rotary valve-ring, so that the stop-lug 51 will come in contact with the said stop-pin 52 for proper adjustment of the valves in the reverse direction of rotation of the engine.

Surrounding the normally stationary valve-seat ring 43 is a manually adjustable spark-timing ring 53 provided with a handle 54 by which it may be turned to vary the timing of the sparking; but as this feature does not constitute a part of the present invention and is not herein claimed it need not be herein further described.

The chambers of the rotary cylinder communicate through passageways 55 with an exhaust passage afforded by the sleeve 56 held stationary relative to the frame portion of the casing 15, and provided with an exit opening 57. To provide for holding the said sleeve 56 stationary and still to allow of a proper longitudinal adjustment thereof, for the purpose of suitably fitting or seating the enlarged and tapered end of said sleeve in the spherical hub 21, screw bolts 58 the inner flattened portions or shanks of which are riveted to the said sleeve are provided. Said bolts pass loosely through suitable openings in the outer end portion 59 of the casing 15; and disposed in suitable recesses 60 in the said outer end part 59 are adjusting nuts 61 which may be turned to effect an endwise adjustment of the said sleeve, the said bolts, of course, restraining the said sleeve from rotation. As the rotating hub 21 is provided with openings or ports 77 communicating, at times, in the rotation of the parts, with openings or ports 78 in the tapered part of said stationary sleeve 56; these parts constituting an exhaust valve, and a close running fit between said rotating and stationary parts is effected by the adjustment afforded by the nuts 61 and the walls of the recesses in which said nuts are located.

The interior peripheral wall of the rotary cylinder 17 is recessed to afford pockets 73 which are somewhat wider than the thickness of the rotary disk 20, and the latter is preferably recessed or chamfered off at its periphery at 74 to a circumferential extent approximately equal to the circumferential extent of the pockets 73; the latter being divided by ribs 75 which afford bearings for the packing segments carried by said disk. The pockets 73 are formed in those portions of the rotary cylinder 17 which afford the primary compression chambers within said cylinder, and thus provide a communication between said primary compression chambers and the adjacently-located explosion chambers, so as to afford, at times, communication between said compression and explosion chambers. In the operation of the engine and just before communication is established between the said compression and explosion chambers by virtue of the pockets 73 and the chamfered off or recessed portion 74 on the rotary disk, communication is established between the explosion chambers and the exhaust passage; and as the parts come into such position as to establish communication between the compression and explosion chambers, through the medium of the pockets 73, the gas in the primary compression chambers will rush into the explosion chambers and thus force out the burned gases from the latter into the exhaust passage, and in the continued revolution of the engine the gas now in the explosion chambers will next be properly compressed before being exploded.

The two explosion chambers within the cylinder 17 and in both of which the charges are simultaneously exploded, communicate with each other through the exhaust passages 55, so that should the charge in one chamber fail to be ignited it will receive ignition from the other chamber through the exhaust passages. Also the primary compression chambers are connected with each other, so as to receive balanced charges, through the supply passages 48 in the spherical hub portion of the rotary disk.

For the purpose of cooling the rotating sleeve shaft 22 of the rotary disk 20 and the bearings of said shaft,

the standard 15 is provided with openings 62 and the end plate 37 of the said standard is also provided with openings 63, the said openings communicating with an annular chamber 64 between the stationary exhaust sleeve 56 and the rotary sleeve 22, the said annular chamber thus somewhat separating the exhaust sleeve 56, which becomes heated from the products of combustion passing through the same, from the surrounding sleeve 22.

To provide for proper lubrication of the interior wall of the rotary cylinder 17 and against which the periphery of the rotary disk rubs as it changes its position relative to the said cylinder as the parts rotate together, as also to provide for a proper lubrication of the external and internal bearings of the spherical hub 21 of the said rotating disk, oil is introduced through a duct 65 into a chamber 66 with which longitudinal oil passages 67 in the said hub come into register as the said hub rotates; said oil passages 67 communicating by ducts 68 with the periphery of the rotary disk, and also by ducts 69 with the internal bearing of the said spherical hub on the enlarged tapered portion of the exhaust sleeve 56. Oil is forced outward centrifugally through the duct 68. The exterior bearing of the hub 21 of the rotary disk in the rotary cylinder is made tight by suitable packing rings or segments 70.

In the operation of the engine herein illustrated, acting as a two-cycle internal-combustion engine, the explosive mixture of air and gas enters the chambers of the rotating cylinder through the passageways herein described, and being ignited at proper intervals by a suitable sparking apparatus, not forming a part of the present invention, power is developed within said cylinder by side pressure on the rotary disk and pressure in the direction of rotation of said disk on the division plates 24 hereinbefore referred to; said division plates dividing each of the two chambers shown in Fig. 1 formed by the rotary disk into two other chambers, so that there will be corresponding and opposing compression chambers and explosion chambers. The rotary disk and rotary cylinder are so connected that they must rotate together, and the power thus developed is communicated from the rotary cylinder through the sleeve 16 to the shaft 18 from whence the power is taken.

The igniting mechanism will preferably be so timed that ignition of the charges in the explosion chambers will take effect at what may be termed the "dead points" in the rotation of the cylinder 17 and the rotary disk 20 connected with said cylinder through the division plates 24; such "dead points" being the positions in which equal surfaces on said plates are presented or exposed at the opposite ends of the explosion chambers formed by said plates and the rotary disk. The power resulting from the combustion of the explosive gaseous mixture and developed, subsequent to ignition, is thus exerted by pressure on a rapidly increasing major surface on a division plate at the forward end of each explosion chamber, such power or pressure being less and less resisted by a rapidly diminishing minor surface on a division plate at the rear end of each explosion chamber as the connected cylinder and rotary disk revolve together, and as the said disk changes its lateral position relative to said cylinder owing to the inclination of its axis relative to the axis of said cylinder.

Having thus described our invention we claim and desire to secure by Letters Patent:

1. In a rotary engine, the combination with a rotary cylinder, of a rotary disk within the same, and connected to said cylinder so as to rotate therewith, said rotary disk having extending therefrom and rigid therewith a shaft forming an axis of said disk and which shaft is inclined relative to the axis of rotation of said cylinder.

2. In a rotary engine, the combination with a rotary cylinder, of a rotary disk within the same and connected to said cylinder so as to rotate therewith, said rotary disk having extending therefrom and rigid therewith a shaft forming an axis of said disk and which shaft is inclined relative to the axis of rotation of said cylinder, said cylinder having a second shaft rigid therewith and from which power is taken.

3. In a rotary engine, the combination with a rotary cylinder, of a rotary disk within the same, said rotary disk having extending therefrom and rigid therewith a shaft forming an axis of said disk and which shaft is inclined relative to the axis of rotation of said cylinder, and division plates rotatively connecting said cylinder and disk and forming, with said disk, chambers or compartments within said cylinder.

4. In a rotary engine, the combination with a rotary cylinder, of a rotary disk within the same and having its axis of rotation inclined relative to the axis of rotation of said cylinder, and radially-disposed division plates rotatably connecting said cylinder and disk.

5. In a rotary engine, the combination with a rotary cylinder, of a rotary disk within the same and having its axis of rotation inclined relative to the axis of rotation of said cylinder, radially-disposed division-plates rotatably connecting said cylinder and disk, and packing-carrying shoes connected with said disk and disposed on opposite sides of said division plates.

6. In a rotary engine, the combination with a rotary cylinder, of a rotary disk within the same and having its axis of rotation inclined relative to the axis of rotation of said cylinder, radially-disposed division-plates rotatably connecting said cylinder and disk, packing-carrying shoes connected with said disk and disposed on opposite sides of said division plates, said shoes being outwardly-tapered, and holders, secured to said disk, by which said shoes are carried.

7. In a rotary engine, the combination with a rotary cylinder and a sleeve or hollow shaft rigid therewith and which serves as an inlet passage communicating with the chamber of said cylinder, of a rotary disk within said cylinder and rotatably connected therewith, said disk being provided with a sleeve or hollow shaft which is inclined relative to the axis of rotation of said cylinder, and a stationary sleeve within the said sleeve or hollow shaft of said disk and the chamber of which stationary sleeve serves as an exhaust passage communicating with the chamber of said cylinder and with an exhaust outlet.

8. In a rotary engine, the combination with a rotary cylinder and a sleeve or hollow shaft rigid therewith and which serves as an inlet passage communicating with the chamber of said cylinder, of a rotary disk within said cylinder and rotatably connected therewith, said disk being provided with a sleeve or hollow shaft which is inclined relative to the axis of rotation of said cylinder, a stationary sleeve within the said sleeve or hollow shaft of said disk and the chamber of which stationary sleeve serves as an exhaust passage communicating with the chamber of said cylinder and with an exhaust outlet, and means for admitting air to an annular chamber formed between the sleeve of the said disk and said stationary sleeve, for the purpose of keeping the parts cool.

9. In a rotary engine, the combination with a rotary cylinder, of a disk within said cylinder and rotatively connected therewith, said disk having its axis of rotation inclined relative to the axis of rotation of said cylinder, packing segments carried by said disk, and means for forcing the said segments yieldingly outward against the interior peripheral wall of said cylinder.

10. In a rotary engine, the combination with a rotary cylinder, of a rotary disk arranged within said cylinder and rotatively connected therewith and having its axis

inclined relative to the axis of rotation of said cylinder, and means for centrifugally feeding a lubricant to the periphery of said disk.

11. In a rotary engine, the combination with a rotary cylinder, of a rotary disk within the same and having its axis of rotation inclined relative to the axis of rotation of said cylinder, said disk having a spherical hub fitting in bearings in said cylinder, of means for feeding a lubricant to the bearings of said hub and to the periphery of said disk.

12. In a rotary engine, the combination with a rotary cylinder, of a rotary disk located within said cylinder and having its axis of rotation at an angle to the axis of rotation of said cylinder, said disk having a spherical hub portion fitting in bearings in said cylinder and provided with openings or ports to form a valve, and a stationary exhaust sleeve fitting said spherical hub and having openings or ports which communicate, at times, with the openings or ports in the said hub.

13. In a rotary engine, the combination with a rotary cylinder, of a rotary disk located within said cylinder and having its axis of rotation at an angle to the axis of rotation of said cylinder, said disk having a spherical hub portion fitting in bearings in said cylinder and provided with openings or ports to form a valve, a stationary exhaust sleeve fitting said spherical hub and having openings or ports which communicate, at times, with the openings or ports in the said hub, and means for adjusting said sleeve within the said hub to effect a close running fit between the rotary and stationary faces of said parts.

14. In a rotary engine, the combination with a rotating cylinder, of a rotary disk located within said cylinder and having its axis of rotation inclined relative to the axis of rotation of said cylinder, and radially-disposed division plates dividing the chamber of said cylinder and serving to form, with said disks, two primary compression and two explosion chambers within said cylinder, the latter being provided at its interior peripheral wall with pockets to afford communication, at times, outside the periphery of said disk, between the said primary compression chambers and said explosion chambers.

15. In a rotary engine, the combination with a rotating cylinder, of a rotary disk located within said cylinder and having its axis of rotation inclined relative to the axis of rotation of said cylinder, radially-disposed division plates dividing the chamber of said cylinder and serving to form, with said disks, two primary compression and two explosion chambers within said cylinder, and means for affording communication between said primary compression chambers and said explosion chambers at intervals after explosions have occurred and when said explosion chambers are open to the exhaust.

16. In a rotary engine, the combination with a rotating cylinder, of a rotary disk located within said cylinder and having its axis of rotation inclined relative to the axis of rotation of said cylinder, radially-disposed division plates dividing the chamber of said cylinder and serving to form, with said disks, two primary compression and two explosion chambers within said cylinder, and passageways through which communication is afforded between said explosion chambers, so that the ignition of a charge in one of said chambers will effect the ignition of a charge in the other.

17. In a rotary engine, the combination with a rotary cylinder, of a rotary disk within and rotatively connected with said cylinder and having its axis of rotation inclined relative to the axis of rotation of said cylinder, the latter being provided with a sleeve or hollow shaft having openings or ports, of a normally stationary inlet valve-ring encircling said sleeve and provided with openings or ports and with two separated stop-lugs, and a stationary stop pin or projection to engage one or the other of said stop-lugs to hold said ring stationary in one or the other of two positions, for forward or reverse running of the engine.

18. In a rotary engine, the combination with a rotary cylinder, of radially disposed division plates fixed to said cylinder and dividing the interior of the same into radial chambers, of a rotating disk within said cylinder and having its axis of rotation inclined relative to the axis of rotation of said cylinder, said division plates extending through said disk so as to rotatively connect the latter with said cylinder.

19. In a rotary engine, the combination with a rotary cylinder, of radially-disposed division plates fixed to said cylinder and dividing the interior of the same into radial chambers, of a rotating disk within said cylinder and having its axis of rotation inclined relative to the axis of rotation of said cylinder, said division plates extending through said disk so as to rotatively connect the latter with said cylinder, and packing-carrying shoes disposed on opposite sides of said division plates.

20. In a rotary engine, the combination with a rotary cylinder, of radially disposed division plates fixed to said cylinder and dividing the interior of the same into radial chambers, of a rotating disk within said cylinder and having its axis of rotation inclined relative to the axis of rotation of said cylinder, said division plates extending through said disk so as to rotatively connect the latter with said cylinder, packing segments in the peripheral face of said disk, means for forcing the said segments yieldingly outward against the interior wall of the said cylinder, and means for yieldingly forcing said segments endwise towards said division-plates.

21. In a rotary engine, the combination with a rotary disk provided at its periphery with grooves, of a grooved block or blocks recessed into the periphery of said disk and provided with grooves registering with the grooves in said disk, packing strips received in the said grooves of said disk and overlapping the grooves in said block or blocks, and springs received in said block or blocks for acting on said packing strips.

In testimony whereof we affix our signatures, in presence of two witnesses.

RALPH H. HEBERLING.
WILLIAM L. HEBERLING.

Witnesses:
ETHLEEN E. SHEETS,
LOUIS O. LEHMAN.