W. G. MACOMBER.

ROTARY ENGINE.

APPLICATION FILED APR. 27, 1915.

1,204,892.

Patented Nov. 14, 1916.

3 SHEETS—SHEET 1.

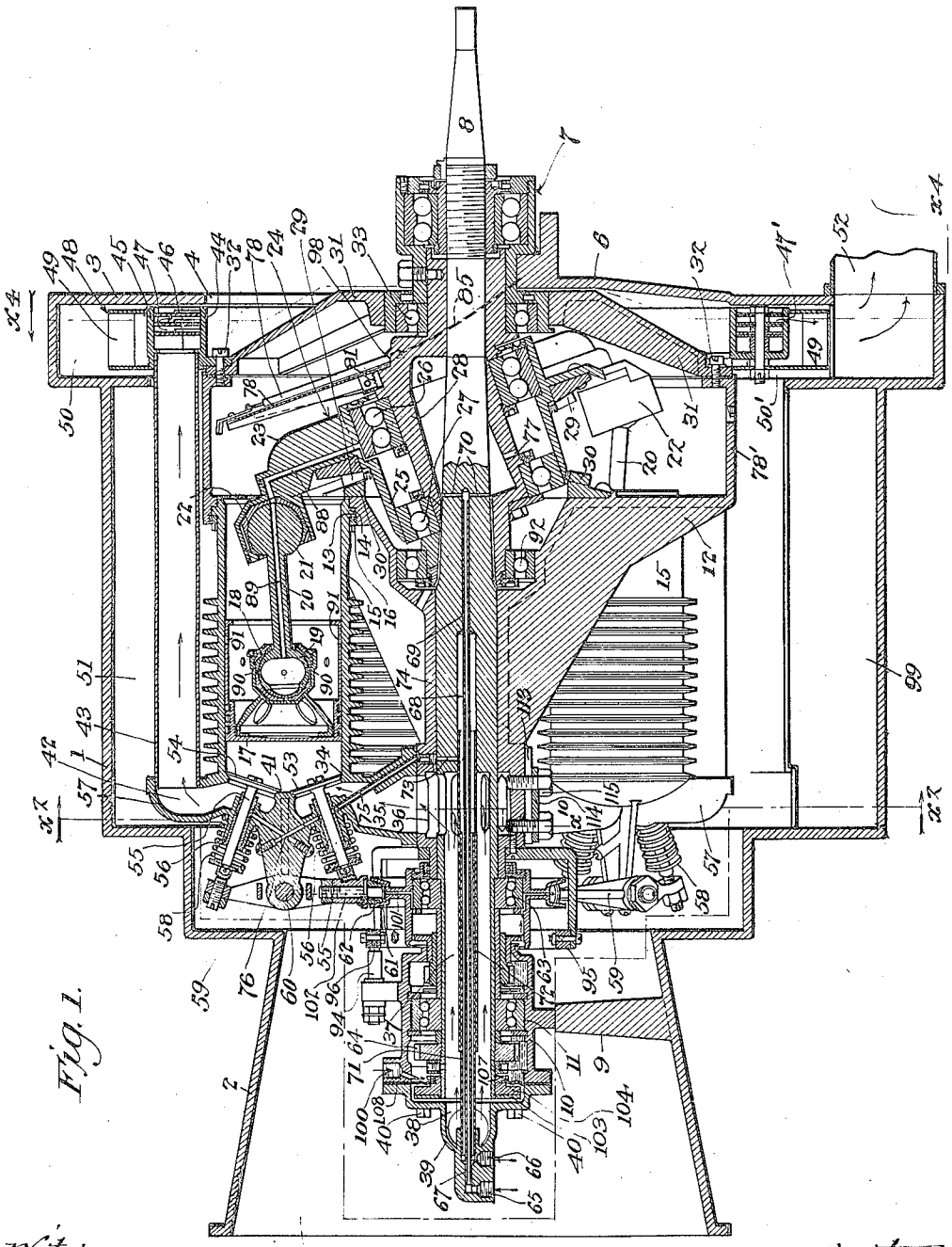

Fig. 1.

Witnesses:
Lulu A. Alter.
Sally Russo

Inventor:
Walter G. Macomber.
By Frederick P. Fish
Attorney

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3 SHEETS—SHEET 2.

Fig. 7.

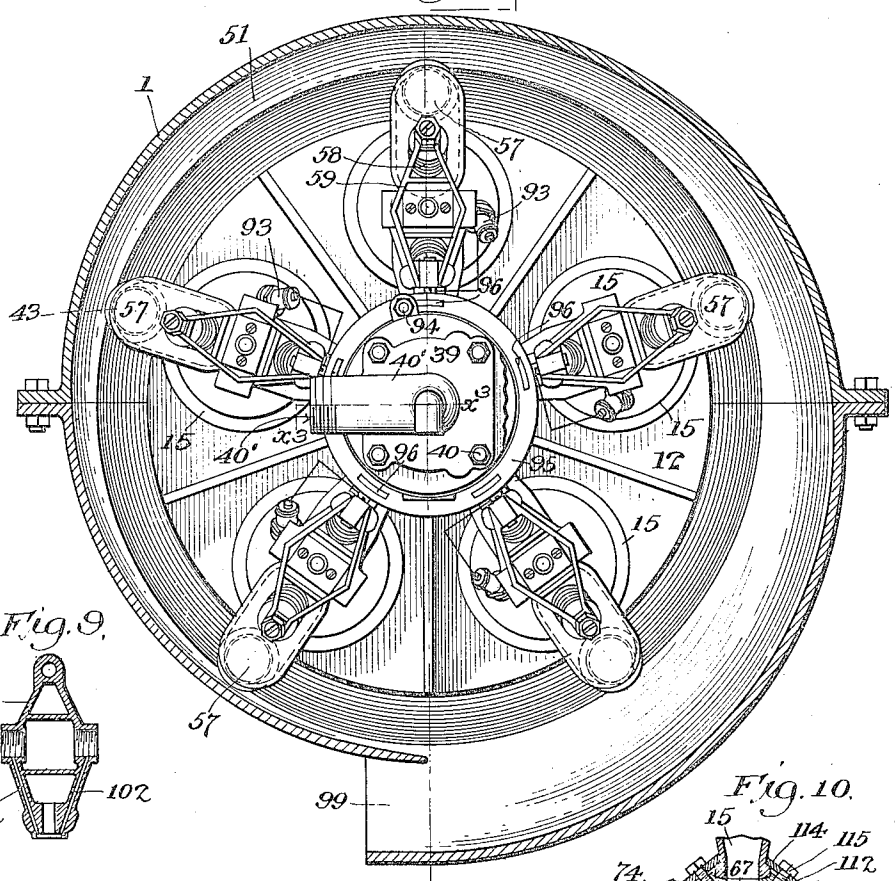


Fig. 9.

Fig. 10.

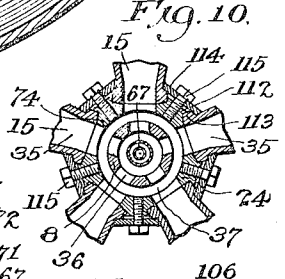


Fig. 3.

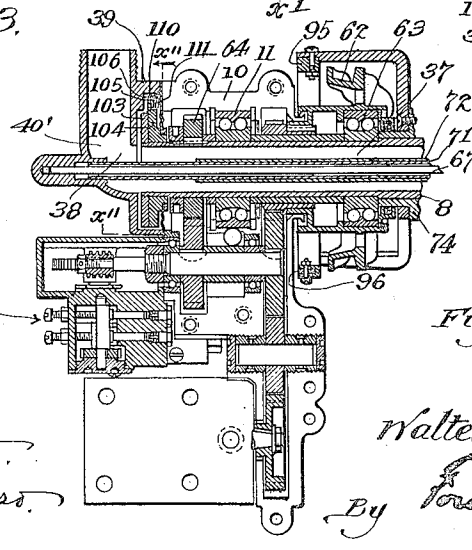
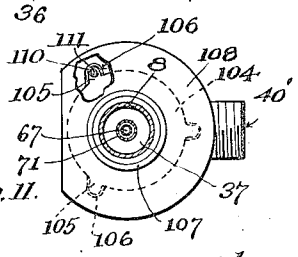


Fig. 11.



Witnesses:

Lillie A. Allen.

Sally Fuss.

Inventor:

Walter G. Macomber.

By Frederick P. Fish.

Attorney.

W. G. MACOMBER.

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3 SHEETS—SHEET 3.

Fig. 4.

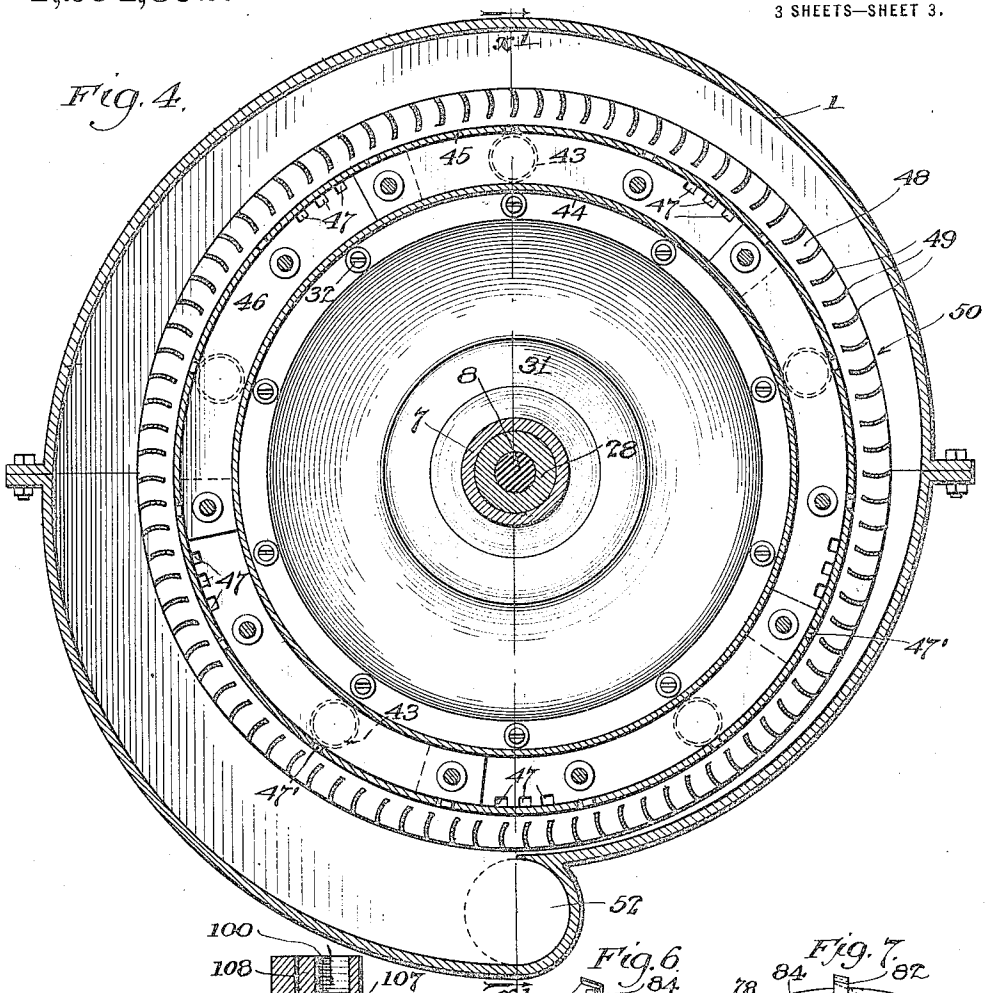


Fig. 5.

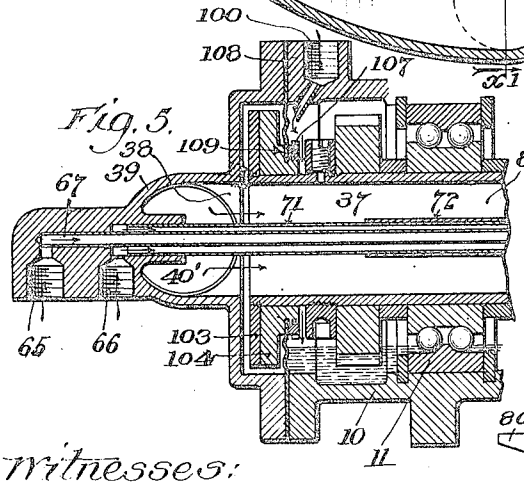


Fig. 6.

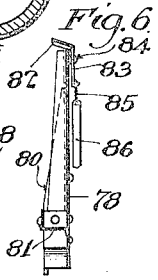


Fig. 7.

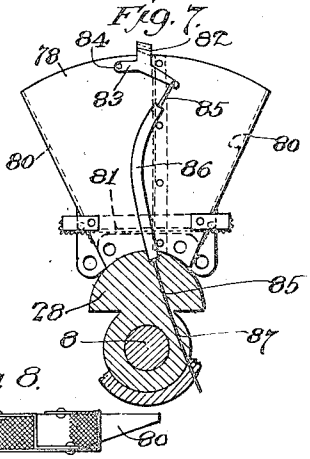
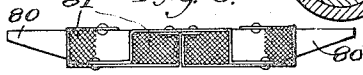


Fig. 8.



Witnesses:

Otto A. Miller.

Sally Russo

Inventor:

Walter G. Macomber.

By Packard & Packard

Attorneys.

UNITED STATES PATENT OFFICE.

WALTER G. MACOMBER, OF LOS ANGELES, CALIFORNIA, ASSIGNOR TO MACOMBER MOTORS COMPANY, OF LOS ANGELES, CALIFORNIA, A CORPORATION OF CALIFORNIA.

ROTARY ENGINE.

1,204,892. Specification of Letters Patent. Patented Nov. 14, 1916.

Application filed April 27, 1915. Serial No. 24,196.

To all whom it may concern:

Be it known that I, WALTER G. MACOMBER, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented a new and useful Rotary Engine, of which the following is a specification.

This invention relates to rotary engines of the type shown in my prior Patents Numbers 893,181, July 14, 1908, 933,316, September 7, 1909, and 1,042,018, October 22, 1912, wherein the cylinders are arranged with their axes parallel with each other and are rigidly mounted relative to each other and revolve bodily around a common axis, the rotation of the cylinders being in a plane transverse to their longitudinal axes.

In said prior patents and in this present invention there are provided two rotating elements having their axes of rotation intersecting at an angle, one of the elements carrying cylinders having pistons which are connected with the other rotating element. In said prior patents there is provided a stroke plate connected with the pistons and adapted to be arranged at an angle to the plane of rotation of the cylinders and rotating with them, whereby the resistance offered by the stroke plate causes the ignited gas behind one of the pistons to react against the cylinder and cause the cylinder to move in the line of least resistance, which is in its regular plane of rotation, the relative reciprocatory movement of the pistons and their cylinders being accomplished by the angular movement of the stroke plate. In said prior patents the angular thrust of the thrust plate was transmitted directly to the shaft, and an object of this invention is to eliminate said direct thrust on the shaft so as to insure against breakage of the shaft.

Another object of this invention is to make provision for thorough lubrication of the friction surfaces and I accomplish this by a construction producing a combined centrifugal and gravity oil feed.

The accompanying drawings illustrate the invention.

Figure 1 is a longitudinal mid section on line indicated by x^1—x^1, Figs. 2 and 4, of an engine embodying the invention. Fig. 2 is a front end elevation partly in section on irregular line indicated by x^2—x^2, Fig. 1, some of the parts shown in Fig. 3 being omitted for clearness of illustration. Fig. 3 is a fragmental plan section on line indicated by x^3—x^3, Fig. 2. Fig. 4 is a section on the irregular line indicated by x^4—x^4, Fig. 1. Fig. 5 is a sectional view of the parts shown at the left in Fig. 1 illustrating the sealing device. Fig. 6 is an edge view of some of the parts shown in Fig. 7. Fig. 7 is an enlarged detail of the means to pick up the oil. Fig. 8 is a plan of the oil strainer shown in Fig. 1. Fig. 9 is a sectional elevation of one of the walking beams. Fig. 10 is a cross section on line indicated by x^{10}—x^{10}, Fig. 1. Fig. 11 is a fragmental elevation partly in section on line indicated by x^{11}—x^{11}, Fig. 3, the parts being turned ninety degrees from the positions shown in said Fig. 3.

There is provided a housing having a spirally curved wall 1 and a forwardly outwardly expanding wall 2, forming a funnel and an end wall 3 provided with an opening 4, the end of the funnel being open at 5.

The end wall 3 extends radially inward from its periphery to form a standard 6 which carries an anti-friction bearing 7 in which is journaled one end of a driven shaft 8; and the funnel 2 is provided in its interior with a standard 9 extending radially inward from the inner periphery of the funnel to support a gear case 10 having an anti-friction bearing 11 to journal the opposite end of said shaft.

The shaft 8 is provided with a cylinder carrier 12 provided with annular grooves 13 to receive annular flanges 14 on the rear ends of cylinders 15, there being bushings 16 screw-threaded into the grooves and against the flanges to hold said cylinders in place.

The cylinders 15 are provided with pistons 17 working therein and said pistons are provided with spherical sockets 18 to receive the hollow balls 19 on the inner ends of pitmen 20 which are provided at their outer ends with solid balls 21 engaging spherical sockets 22 in the outer ends of arms 23 of a thrust or stroke member 24. The stroke member 24 is not rotatably mounted on the shaft as in the hereinbefore mentioned patents, but is rotatably mounted as follows:

The stroke member 24 is axially elongated to form an angle sleeve 25, said sleeve having an anti-friction bearing 26 adjacent

the arms 23, and also having an anti-friction bearing 27 at the forward end of said sleeve, said bearings journaling the thrust member on a tubular angle extension 28 of the standard 6.

It is noted that the balls and sockets 21 and 22 connecting the pitmen 20 to the stroke member 24 are in a plane extending between the bearings 26, 27. The advantage of this construction is that thereby the strains are distributed to the maximum and, as is clear, there is no bending effect on the shaft 8 which passes through the stationarily mounted tubular extension 28 for delivery of power.

The stroke member 24 is provided with a bevel gear 29 designed to engage a bevel gear 30 on the rear end of the cylinder carrier 12, the object of the bevel gears and bearings 26, 27 being to rotatably connect the stroke member indirectly to the shaft through the cylinder carrier so that the strains will be directed onto the tubular extension 28 and thence to the standard 6 and housing, and so that the rotary motion of the stroke member will be transmitted to the shaft with minimum deflecting effect on the shaft.

The gear 29 rotates free from the power delivering shaft 8 and functions only to maintain synchronous turning of the cylinder carrier 12 and stroke member 24 and does not function to turn said shaft.

From the foregoing it is clear that the in and out strokes of the pistons 17 will cause oscillation of the thrust member 24 and that said thrust member will be caused to move in the direction of least resistance, which is around the axis of the shaft 8; and it will further be seen that the shocks produced by successive explosions against the pistons will not be transmitted directly from the thrust member to the shaft, but will be transmitted thereto through the anti-friction bearings 26, 27 to the tubular extension 28 and through the gears 29, 30 to the cylinder carrier 12.

The cylinder carrier 12 is provided with a rear cylinder head 31 fastened by bolts 32 to said carrier and is provided with an anti-friction bearing 33 to journal said head on the standard 6.

Explosive mixture is admitted to the cylinders through inlet ports 34 communicating through passages 35 and ports 36 in the cylinder carrier and shaft to a bore 37 which extends axially in the shaft and which communicates at its front end with a chamber 38 in a cap 39 fastened by bolts 40 or the like to the gear case 10, said cap 39 being provided with an intake elbow 40′ communicating with the chamber 38 and leading from a suitable source of explosive mixture supply, not shown, but well understood in the art.

Burnt gases are exhausted from the cylinders through exhaust ports 41 communicating through passages 42 with the interior of longitudinally extending tubes 43, which exhaust into an annular rotating muffler formed of inner and outer cylindrical walls 44, 45 and radially arranged spaced apart muffle plates 46, there being orifices 47 in the muffle plates to allow the exhaust gases to pass from space to space between said plates. The outer wall 45 is provided with orifices 47′.

The muffler wall 45 is provided with an annular fan 48 having radially extending blades 49 curved in their radial traces, said fan rotating in a fan chamber 50 at one end of the housing.

The fan chamber 50 communicates with the atmosphere through the opening 4 of the housing so that when the fan 48 is in operation cool air will be sucked in through said opening and through the passage 50′ to the fan 48 and will exhaust with the burnt products of combustion through the outlet 52 of the fan chamber.

Each intake port 34 and each exhaust port 41 is controlled by intake and exhaust valve plugs 53, 54 respectively, the stems 55 of said valve plugs sliding in bearings 56 of a front cylinder head 57 and being held in closed position and being actuated to close the intake and exhaust ports 34, 41 by coil springs 58 and being alternatively actuated to open said ports by reason of their engaging the opposite ends of walking beams 59 pivoted at 60 to the front cylinder head.

The walking beams 59 are provided at their inner ends with followers 61 engaging the spirally grooved cam 62 which is mounted by an anti-friction bearing 63 in rotatable relation to the shaft 8 and which is so constructed and actuated by a train of gears 64 operated by the driven shaft 8 as to open the valves 53, 54 at appropriate times in the cycle for inspiration and exhaust in a manner well understood in the art.

The cap 39 is provided with two oil feed ports 65, 66, the port 65 communicating with the rear end of an inner stationary tube 67 having its rear end inserted through a bore 68 into a longitudinal bore 69 provided in the shaft 8, said bore 69 having radially extending outlet vents 70 extending to the periphery of the shaft. The port 66 communicates through an intermediate stationary tube 71, concentric with, surrounding and spaced apart from the inner tube 67, with an outer tube 72 rotating with the shaft 8, said outer tube at its front end communicating with the bore 68, there being vents 73 extending radially from the interior of the tube through the shaft and through the hub 74 of the cylinder carrier. Said vents 73 communicate through tubes 75 with the bearings 56 of the inlet valves 34 and thence

by ducts 76 with the bearings 56 of the exhaust valves 54, thus to lubricate said valve bearings.

When the operating parts are rotating, oil will pass from the outlet vents 70 to the interior of the tubular extension 28 and will drain from said extension through vent 77 to the interior of the sleeve 25 and will be thrown by centrifugal force outward and pass through the bearing 27 and between the cylinder carrier and stroke member 24 and outward to the cylindrical outer wall 78′ of the cylinder carrier.

I provide means to pick up the oil from adjacent the cylindrical wall 78′ and feed the same by gravity radially inward toward the axis of the shaft, so that said oil may be further used for lubricating purposes, and said means will now be described.

The tubular extension is provided with a stationary fan-shaped collector plate 78, see Fig. 7, having flanged edges 80 and said plate is provided at its inner end with a strainer 81 clearly shown in Fig. 8. The peripheral portion of the plate 78 is provided with a spoon 82 curved over the peripheral margin of the plate and having an arm 83 pivoted at one end at 84 to said plate, the other end of the arm being attached to an operating device such as a wire 85 extending through a guide 86 on the plate and through an orifice 87 which extends to the outer face of the standard 6 so that the spoon can be manipulated to take more or less of the oil from the cylindrical wall 78′ by moving the spoon toward or from said wall.

Oil caught by the spoon 82 and plate 78 gravitates downward through the strainer 81 and so into the interior of the sleeve 25 whence it follows the course hereinbefore outlined until it again reaches the cylindrical wall 78′, so as to be used over and over again, fresh oil always being supplied as needed through the tube 69.

Some of the oil is impelled by centrifugal force from the interior of the sleeve 25 through ducts 88 in the stroke member arms 23 to the sockets 22 to lubricate said sockets, and through ducts 89 in the pitmen 20 to the interior of the hollow balls 19 and thence through vents 90 to the sockets 18 to lubricate said sockets 18.

Oil passes from the sockets 18 to the peripheries of the piston heads and thence through vents 91 to lubricate the friction surfaces of the pistons and cylinders.

It is noted that though centrifugal force will impell the oil only to the cylinder portions most remote from the shaft 8, yet, owing to the universal ball and socket connections between the pistons 17 and stroke member and to the peculiar motion of the stroke member, the balls 21 will turn in the sockets 22 and the balls 19 will turn in the sockets 18 and the pistons will turn in their respective cylinders 15 when the engine is in operation.

The hub 74 is provided with an antifriction bearing 92 to journal said hub on the front end of the tubular extension 28.

The cylinders 15 are provided with igniters in the form of spark plugs 93 and a suitable distributer is provided comprising in this instance a stationary terminal 94 and a rotating element 95 mounted on the sleeve 74, said rotating element having terminal contacts 96, one for each cylinder.

The operation of the above described engine is as follows: The operator will turn the shaft 8 by hand or cause the same to be turned by suitable power as, for instance, power derived from a so-termed self-starter, not shown, thus initially compressing a charge of combustible fuel introduced into one of the cylinders 15 through its intake port 34. Then the distributer 94, 95 will operate in the well known manner of distributers to close an electric circuit and energize the appropriate igniter 93, and the resulting explosion of the charge will drive the piston 17 of said cylinder rearward to oscillate the stroke member 23 and through the gear wheels 29, 30 cause rotation of the cylinders and cylinder carrier and shaft. This compresses another charge in another of the cylinders 15 and said charge is in turn ignited and the engine continues in operation as long as fuel and electric current are supplied thereto. Lubricant is supplied to the oil inlets 65, 66 by a suitable pump indicated at 97 and oil flows through the tube 67 into the bore 69, thence through vents 70 into the interior of the tubular extension 28, thence through vent 77 into the interior of the sleeve 25 to lubricate the bearing 27. Some of said oil is forced by the centrifugal action outward through ducts 88 to the sockets 22 and some of said oil passes through the ducts 89 into the hollow balls 19 and thence through vents 90 to the sockets 18. Oil issuing from said sockets 18 passes through vents 91 to the interior of cylinders 15 and thence to the cylindrical chamber inside of the wall 78′ of the cylinder carrier. The oil thus passed to said chamber is caught by the spoon 82 and plate 78 and gravitates downward through the strainer 81 to the annular drip 98 of the tubular extension 28 and into the interior of said tubular extension, from whence the oil may circulate in the manner described above so as to be used over and over again. Oil passes from the inlet 66 through the concentric tubes 71, 72 and through vents 73 and tubes 75 to the inlet valve bearings 56 thence by ducts 76 to the exhaust valve bearings 56, thus lubricating said bearings. The peculiar motion given the stroke member 23 causes the pitmen 20 to rotate about their

axes and thus, through their frictional engagement with the sockets 18, cause the pistons 17 to rotate about their axes thus maximizing the lubrication of the pitman connections and of the pistons and cylinders.

The exhaust gases pass from the cylinders 15 through the exhaust ports 41 and thence through tubes 43 to the spaces between the muffle plates 46 and through the orifices 47' to the fan 48 and are blown by said fan out through the outlet 52 to the atmosphere.

It is noted that atmospheric air is sucked into the chamber 51 around the rotating cylinders, said air being drawn in through the opening 5 of the funnel and being expelled from the chamber 51 through outlet 99 of said chamber to the atmosphere, so as to prevent overheating of the engine.

The gear case 10 is provided with an inlet 100 for oil to lubricate the gear train 64 and bearings 11, 63. Oil passes from the gear case 10 to the interior of the hub of the cam 62, thence radially by duct 101 in the cam to the groove of the cam, and oil passes from said groove through ducts 102 in the walking beams 59 to the pivots 60 to lubricate the same.

The shaft 8 is provided at its front end with a rotating disk 103 screw threaded thereon and turning therewith and fitting closely against a disk 104 which is shiftably mounted on the shaft and which has ears 105 seated in recesses 106 in the cap 39 so that said disk 104 is non-rotatable but is shiftable axially.

The disk 104 is provided with a collar 107 screw threaded thereon against the inner margin of a flexible diaphragm 108 of leather or the like which is thus held tightly seated against a shoulder 109 of the disk 104, see Fig. 5. The outer margin of the diaphragm 108 forms a gasket for the joint between the gear case 10 and cap 39 and the diaphragm forms a flexible seal between the chamber 38 and gear case so that air extraneous to that introduced with the fuel cannot enter said chamber. The disk 104 is provided with spring seats 110 to accommodate coil springs 111 which thrust against the diaphragm 108 and thereby force the disk 104 against the disk 103 so as to prevent leakage of air between said disks from the gear case 10 to the chamber 38.

It is noted that the greater the degree of suction or partial vacuum produced under operating conditions in the bore 37 and chamber 38, the tighter will be the joint between the disks 103, 104 owing to the suction acting on the diaphragm to draw said diaphragm and the disk 104 forward toward the disk 103.

An important feature of this invention is the provision of sliding connections between the front ends of the cylinders 15 and the hub 74 of the cylinder carrier so that elongation of the cylinders relative to the cylinder carrier and shaft can readily occur without disrupting or loosening the connections which are constructed as follows.

The hub 74 is provided with longitudinal guides in the form of splineways 112 for splines 113 of the cylinders 15, said splines in the instance shown being integral with the cylinders though not necessarily so. The splines form laterally projecting flanges which are engaged by clips 114 fastened in place by bolts 115 extending through the clips and into the hub 24. When the cylinders expand and contract, the splines 113 slide in the splineways 112, but said splines and splineways prevent relative circumferential movement between the cylinders and cylinder carrier.

What I claim is:

1. A rotary engine comprising a shaft, a cylinder carrier to turn said shaft, cylinders on the cylinder carrier, a stationarily mounted member adjacent one end of the cylinder carrier, a portion of said member extending at an angle relative to the axis of the shaft, a stroke member having bearings at the forward and rear ends of said angular portion of the stationarily mounted member, pistons in the cylinders, pitmen having universal connections with the pistons respectively and having other universal connections with the stroke member, said other universal connections being in a plane extending between the forward and rear bearings of the stroke member, a gear on the cylinder carrier, and a gear on the stroke member meshing with the gear on the cylinder carrier.

2. A rotary engine comprising a shaft, a cylinder carrier fixed to the shaft, cylinders secured to the carrier with their axes parallel to the shaft, a standard provided with a tubular extension through which said shaft extends, a stroke member journaled on the extension, pistons working in the cylinders, pitmen having universal connections with the stroke member and pistons, a bevel gear on the cylinder carrier, and a bevel gear on the stroke member engaging the bevel gear on the cylinder carrier.

3. A rotary engine comprising a shaft, a cylinder carrier fixed to the shaft, cylinders secured to the carrier with their axes parallel to the shaft, a standard provided with a tubular extension through which said shaft extends, a stroke member having a sleeve, bearings at both ends of the sleeve to journal the sleeve on the tubular extension, pistons working in the cylinders, pitmen having universal connections with the stroke member and pistons, a bevel gear on the cylinder carrier, and a bevel gear on the stroke member engaging the bevel gear on the cylinder carrier.

4. A rotary engine comprising a shaft, a cylinder carrier fixed to the shaft, cylin-

ders secured to the carrier with their axes parallel to the shaft, a standard provided with a tubular extension through which said shaft extends at an angle to the axis thereof, a stroke member journaled on the extension with its axis of rotation corresponding in angle to the axis of the tubular extension, pistons working in the cylinders, pitmen having universal connections with the stroke member and pistons, a head fastened to the cylinder carrier and journaled on the standard, a bevel gear on the cylinder carrier, and a bevel gear on the stroke member engaging the bevel gear on the cylinder carrier.

5. A rotary engine comprising a shaft having a longitudinal bore and a vent extending from said bore to the periphery of the shaft, a support having a tubular extension to receive lubricant from the vent and having a vent to drain the lubricant from the interior of said extension, a stroke member having a sleeve surrounding and journaled on the extension and provided with sockets, there being ducts extending from the interior of the sleeve to said sockets, cylinders mounted to rotate with the shaft, pistons in the cylinders provided with sockets, and pitmen having hollow balls engaging the piston sockets and having ducts extending from the interior of said balls to the interior of the sockets of the stroke member and said balls having vents extending from their interior to the interior of said sockets.

6. A rotary engine comprising a shaft, a chambered cylinder carrier, cylinders fastened to the cylinder carrier and communicating with the carrier chamber, pistons working in the cylinders, means reciprocatively connecting the pistons to the shaft to turn said shaft and provided with lubrication ducts to carry lubricant impelled outward by centrifugal force to the cylinders, and means in the carrier chamber to return the lubricant by gravity toward the shaft.

7. A rotary engine comprising a shaft, a cylinder carrier to turn said shaft, a cylinder fastened to the cylinder carrier, a piston working in the cylinder, means operatively connecting the piston to the cylinder carrier and operating by centrifugal action to feed lubricant to the cylinder, and stationary means acting to return the lubricant issuing from the cylinder toward the shaft.

8. A rotary engine comprising a shaft, a cylinder carrier fixed to the shaft and having a cylindrical chamber, a cylinder fastened to the cylinder carrier and communicating with said cylindrical chamber, a piston working in the cylinder and operating to turn the cylinder carrier, and a stationary member in the cylindrical chamber designed to collect lubricant from the peripheral portion of said chamber and allow said lubricant to flow by gravity toward said shaft.

9. A rotary engine comprising a shaft having a longitudinal bore and vents from said bore to the periphery of the shaft, a cylinder carrier, a cylinder carried by said cylinder carrier, a valve for the cylinder having a stem, a bearing for said stem, a tube connecting said bearing to one of said vents, a stroke member around the other vent, and a universal connection between said stroke member and piston.

10. A rotary engine comprising a shaft having a longitudinal bore and vents from said bore to the periphery of the shaft, a cylinder carrier, a cylinder carried by said cylinder carrier, a valve for the cylinder having a stem, a bearing for said stem, a tube connecting said bearing to one of said vents, a stroke member around the other vent, a universal connection between said stroke member and piston, and concentric spaced apart tubes in said shaft bore to feed lubricant to the vents respectively.

11. A rotary engine comprising a housing having a fan chamber and open at both ends, a shaft rotatively mounted in said housing, a cylinder carrier turning with the shaft, a head for the cylinder carrier, cylinders fastened to the cylinder carrier, pistons in the cylinders and having universal connections with the cylinder carrier, fan blades rotating in the fan chamber, and tubes connecting the fan chamber with the cylinders.

12. A rotary engine comprising a shaft, a chambered cylinder carrier on the shaft, cylinders fastened to the cylinder carrier and communicating with the carrier chamber, a standard having a cylindrical extension, a stroke member journaled on the cylindrical extension, pistons in the cylinders having universal connections with the stroke member, and a plate mounted on the cylindrical extension and having its peripheral margin adjacent the wall of the carrier chamber.

13. A rotary engine comprising a shaft, a chambered cylinder carrier on the shaft, cylinders fastened to the cylinder carrier and communicating with the carrier chamber, a standard having a cylindrical extension provided with a vent in its lower side, a stroke member journaled on the cylindrical extension, pistons in the cylinders having universal connections with the stroke member, a plate mounted on the cylindrical extension and having its peripheral margin adjacent the wall of the carrier chamber, and a strainer to strain the oil running down said plate.

14. A rotary engine comprising a shaft, a chambered cylinder carrier on the shaft,

cylinders fastened to the cylinder carrier and communicating with the carrier chamber, a standard having a cylindrical extension provided with a vent in its lower side, a stroke member journaled on the cylindrical extension, pistons in the cylinders having universal connections with the stroke member, a plate mounted on the cylindrical extension, and a spoon extending from said plate toward the wall of the carrier chamber.

15. A rotary engine comprising a shaft, a chambered cylinder carrier on the shaft, cylinders fastened to the cylinder carrier and communicating with the carrier chamber, a standard having a cylindrical extension provided with a vent in its lower side, a stroke member journaled on the standard, pistons in the cylinders having universal connections with the stroke member, a plate mounted on the cylindrical extension, a spoon shiftably mounted on the plate, and means to shift said spoon toward and from the wall of the carrier chamber.

16. A rotary engine comprising a shaft, a chambered cylinder carrier on the shaft, cylinders fastened to the cylinder carrier and communicating with the carrier chamber, a standard having a cylindrical extension provided with a vent in its lower side, a stroke member journaled on the standard, pistons in the cylinders having universal connections with the stroke member, a plate mounted on the cylindrical extension, a spoon shiftably mounted on the plate, and a wire fastened to the spoon and extending through the standard to shift said spoon.

17. A rotary engine comprising a shaft, a cylinder carrier to turn said shaft, cylinders on the cylinder carrier, a stationarily mounted member adjacent one end of the cylinder carrier having a portion extending at an angle relative to the axis of the shaft, a stroke member having bearings at the forward and rear ends of the angular portion of said member, pistons in the cylinders, pitmen having universal connections with the pistons respectively and having other universal connections with the stroke member, said other universal connections being in a plane passing between said forward and rear bearings of the stroke member, gears connecting the cylinder carrier and stroke member for synchronous rotation, and a bearing for the cylinder carrier at the forward end of the stationary member.

18. A rotary engine comprising a shaft, a cylinder carrier mounted on the shaft, a cylinder fixed at one end to the cylinder carrier with its axis parallel to the shaft and having a sliding connection with the shaft at its opposite end, a piston in the cylinder, and means operated by movement of the piston to turn the cylinder carrier.

19. A rotary engine comprising a shaft, cylinders rotating about the axis of said shaft, pistons in the cylinders, connections between the pistons and shaft to turn said shaft, means to supply oil to the cylinders, and a stationarily mounted element adjacent one end of the cylinders for catching oil issuing from said cylinders and allowing said oil to gravitate toward the axis of the shaft.

20. A rotary engine comprising a shaft, a stationarily mounted tubular extension around the shaft provided with a vent, means to supply oil to the tubular extension, a sleeve around the tubular extension and journaled thereon, cylinders mounted to turn with the shaft, pistons in the cylinders, means operatively connecting the pistons to the sleeve and adapted to feed oil from the interior of the sleeve to the pistons, and a plate mounted on the tubular extension and extending outward toward the path of travel of the cylinders.

21. A rotary engine comprising a standard having a forwardly extending stationary tubular member, a shaft extending through said stationary tubular member and journaled in said standard, a cylinder carrier to turn said shaft provided with a bearing on the forward end of said tubular member, cylinders on the cylinder carrier, the rear portion of the tubular member being at an angle relative to the axis of the shaft, a stroke member having bearings at both ends of the angular portion of the tubular member, pistons in the cylinders, pitmen having universal connections with the pistons respectively and having other universal connections with the stroke member, said other universal connections being in a plane passing between said forward and rear bearings of the stroke member, gears connecting the cylinder carrier and stroke member for synchronous rotation, and a bearing for the cylinder carrier at the forward end of the stationary member.

In testimony whereof, I have hereunto set my hand, at Los Angeles, California, this 20th day of April, 1915.

WALTER G. MACOMBER.