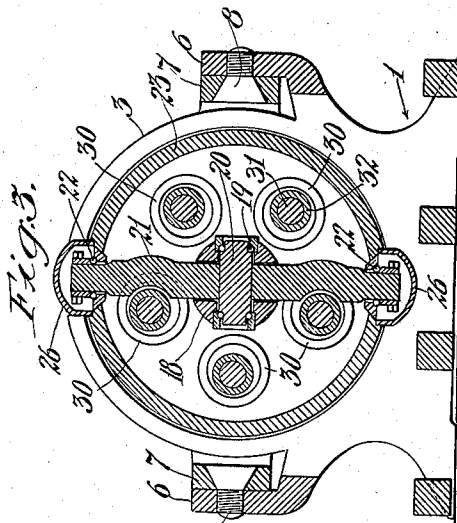
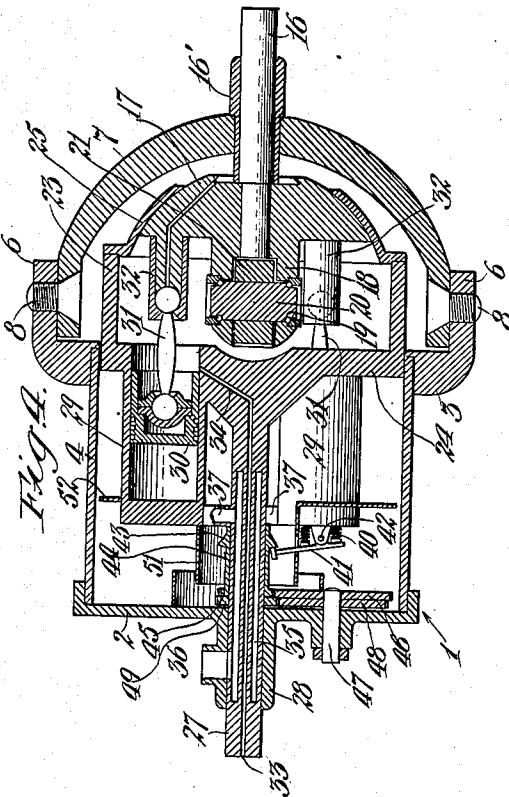
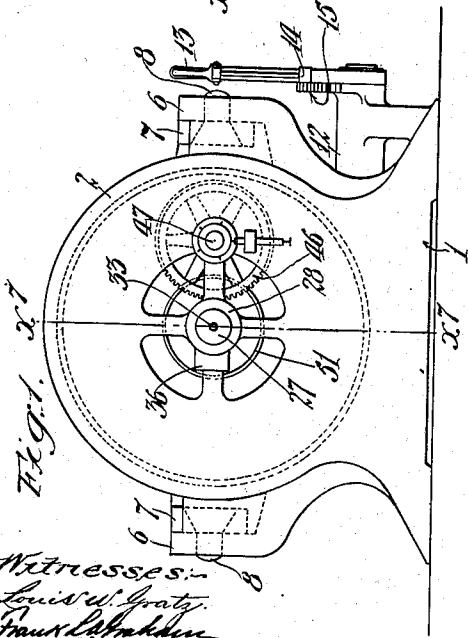
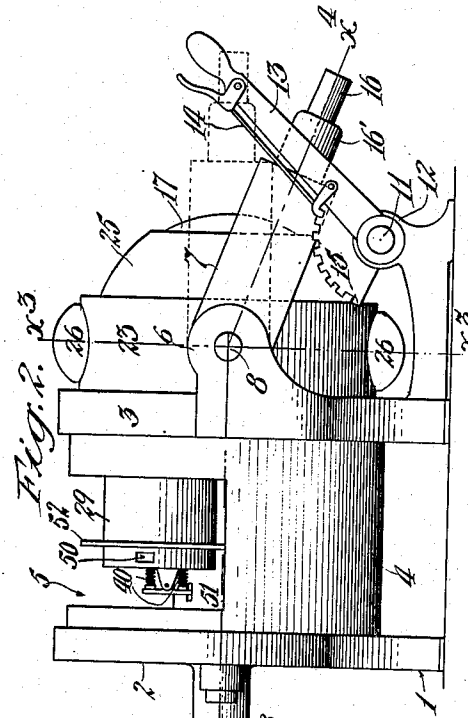


W. G. MACOMBER.
INTERNAL COMBUSTION ROTARY ENGINE.
APPLICATION FILED SEPT. 2, 1908.

933,316.

Patented Sept. 7, 1909.
2 SHEETS—SHEET 1.



Witnesses:
Louis W. Grady,
Paul L. Hadden

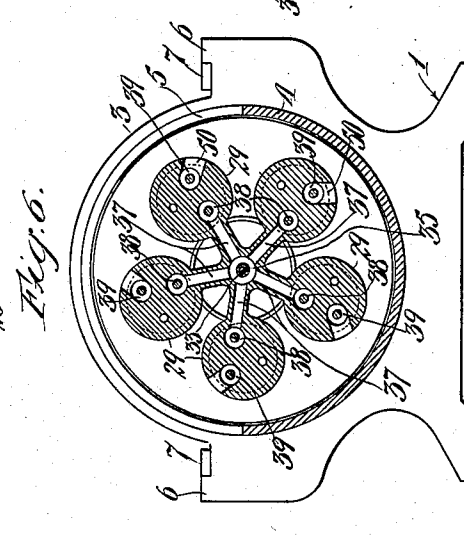
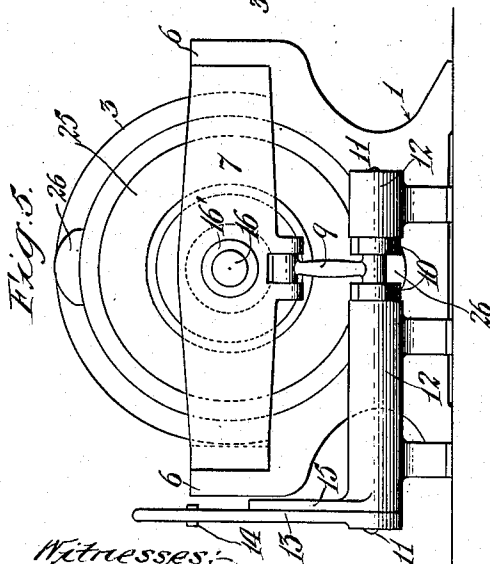
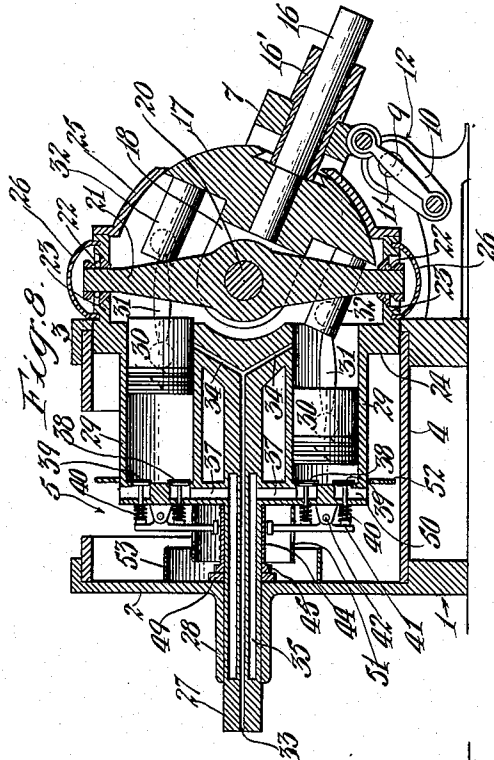
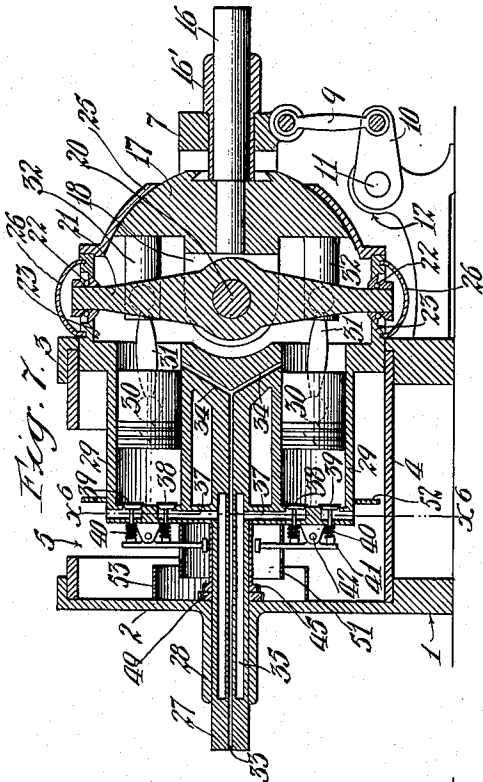
Inventor
Walter G. Macomber
by Samuel L. Hadden

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2 SHEETS—SHEET 2.



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UNITED STATES PATENT OFFICE.

WALTER G. MACOMBER, OF JOHANNESBURG, CALIFORNIA.

INTERNAL-COMBUSTION ROTARY ENGINE.

933,316.

Specification of Letters Patent.

Patented Sept. 7, 1909.

Application filed September 2, 1908. Serial No. 451,392.

To all whom it may concern:

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

This invention relates to a rotary engine in which a plurality of cylinders, each having a reciprocating piston, are caused to rotate bodily in a plane at right angles to the direction of piston movement. The power from the pistons is applied to a rotating element which is adapted to rotate in a plane at an angle to the plane of rotation of the cylinders. This engine is of a type shown in a previous patent of mine, #893,181, July 14, 1908.

The present engine differs from the former in that the present engine is an internal combustion engine, and one of the main objects of the present invention is to adjust the plane of rotation of the rotary element above referred to, to various angles and thereby regulate the length of stroke of the pistons. This will enable the compression in the cylinders to be varied. For example, if a high power is required the stroke may be adjusted to give a high compression. If a low power is required, or if the engine is running idle, then a very short stroke or low compression, which is advisable under such conditions, may be obtained.

Another object of the invention is to provide for thorough lubrication of all moving parts.

Another object is to provide for cooling the cylinders by air.

Referring to the drawings:—Figure 1 is an end elevation of the engine, showing the engine so adjusted that there is no stroke. Fig. 2 is a side elevation of the engine. Fig. 3 is a section on line x^3-x^3 Fig. 2. Fig. 4 is a horizontal section taken longitudinally through the engine on line x^4-x^4 Fig. 2. Fig. 5 is an elevation showing the opposite end from that shown in Fig. 1. Fig. 6 is a cross section on line x^6-x^6 Fig. 7. Fig. 7 is a vertical longitudinal section on line x^7-x^7 Fig. 1. Fig. 8 is a view similar to Fig. 7, showing the engine adjusted for maximum stroke.

1 designates the frame of the engine having at the rear or intake end a stationary plate 2.

3 is a ring located at the intermediate part

of the frame, and the ring 3 and disk 2 support a shell 4, which as clearly shown in Fig. 2 is cut out at the top as at 5, forming an opening through which the exhaust gases together with the cooling air pass to the atmosphere, as will be explained. The ring 3 is formed with two ears 6 to which the yoke 7 is pivoted by means of screws 8. As clearly shown in Fig. 5, a link 9 is pivoted to the yoke 7 and connects with two arms 10, as shown in Fig. 7, which project from a shaft 11 mounted in a journal bearing 12 formed on the frame. A hand lever 13 is secured to the shaft 11 and has a latch mechanism 14 which coacts with a notched sector 15 to hold the hand lever in the position set. By operating the hand lever 13 the yoke 7 may be adjusted into various positions.

The yoke 7 has an inserted bushing 16 which forms a journal bearing for a driven shaft 16. Secured to the rear end of the shaft 16 is a disk 17 which I term a "stroke plate" as its angular position determines the stroke of the pistons. The stroke plate 17 has a central rearwardly extending slotted boss 18, which is pivoted by means of ball bearings 19 to a cross-pin 20, which cross-pin extends through a swivel bar 21. The latter being journaled at each end by ball bearings 22 to a flange 23 which forms a part of and projects from a cylinder carrier 24.

The cylinder carrier 24 is provided at its forward end with a bowl-shaped guard 25 which extends partially over the stroke plate 17 and incloses the crank chamber, which chamber is formed by the flange 23, end of the cylinder carrier 24, and stroke plate 17, the purpose of the guard 25 being to retain oil in the crank chamber. The oil is thrown to the outer portion of the crank chamber by centrifugal force when the engine is in motion, and is caused by the movement of the stroke plate 17 to splash over all the parts inclosed in the crank chamber. The stroke plate has a wobble motion as it operates which causes this action. In order to protect the bearings 22 of the swivel bar 21, caps 26 are attached to the flange 23, as shown in Figs. 2 and 3.

The front end of the cylinder carrier is supported by the swivel bar 21 which in turn is supported by the cross-pin 20, ball bearings 19 and stroke plate 17 on shaft 16. The rear end of the cylinder carrier is supported by a shaft 27, which, as clearly shown in Fig. 8, extends rearwardly through the cen-

ter of the cylinder carrier, and is rotatively mounted in a journal bearing 28 formed on the rear stationary plate 2. The cylinder carrier 24 is formed in the present embodiment with five cylinders 29, all of which are similar in construction, each having a piston 30 therein, and each piston being connected by a connecting rod 31 with a post 32 extending rearwardly from the stroke plate 17. Each connecting rod 31 has a ball joint connection at both its ends so that universal movement is permitted between each connecting rod, piston, and post 32. The shaft 27 has a central oil hole 33 which has branches 34 leading to the respective cylinders 29 for lubricating them. An annular chamber 35 is formed around the oil passage 33, the chamber 35 constituting a gas intake chamber, to which fuel is admitted through an inlet 36.

Passages 37 lead from the gas chamber 35 to the respective cylinders 29, as clearly shown in Figs. 6, 7 and 8. In the head of each cylinder is an inlet valve 38, and an exhaust valve 39, which valves are closed by springs 40. The valves are opened at the proper time by means of levers 41 pivoted at 42, the respective levers being operated by a cam 43 arranged on a sleeve 44 which has a pinion 45 meshing with a gear 46 journaled on a pin 47. Fixed with the gear 46 is another gear 48 which meshes with a pinion 49 secured to the shaft 27. The gears are so proportioned and the cam is so designed that the inlet and exhaust valves are properly operated as the shaft 27 rotates. Each exhaust valve 39 discharges through the passage 50 directly to the atmosphere, as clearly shown in Fig. 2, the exhaust gases passing from the shell 4 out through the opening 5. An air pipe 51 is secured to the cylinder carrier 24 and rotates therewith.

52 is a partition fastened to and revolving with the cylinders, being located at the front end of the pipe 51.

53 is a large pipe surrounding the pipe 51 and secured to the stationary plate 2 which latter has openings opposite the pipe 53 as shown in Fig. 1.

When the engine is in motion and the exhaust gases are leaving the cylinders a current of air is caused to flow through the outer part of pipe 53, thence against the cylinder heads and then out through the opening 5. The rotating valve stems also tend to cause the air to flow outwardly over the cylinder heads. The partition 52 compels a portion of the air entering through pipe 53 to be sucked by the rotation of the cylinders, through pipe 51 and thence outwardly around the cylinders. The air is thrown centrifugally outward by the rotating cylinders and is forced into contact with the entire outer surface of each cylinder before it escapes through the opening 5, and thus the

cylinders are kept sufficiently cool without the use of water.

By throwing the hand lever 13 into the position substantially as shown in Fig. 2, the stroke plate 17 is adjusted to an angle with the cylinder carrier so that, as the pistons reciprocate, they impart a rotating motion to the stroke plate, and the latter drives the shaft 16. As the stroke plate 17 is thus caused to rotate it rotates the swivel bar 21 bodily, and the latter rotates the cylinder carrier 24 so that the respective cylinders rotate synchronously with and are always substantially in line with their respective posts 32. The swivel bar 21 is adapted to rotate axially in its bearings 22 the necessary amount required, which is necessitated by the angularity of its bodily plane of rotation to the plane of rotation of shaft 16. The cross-pin 21 also permits the necessary swinging action of the stroke plate 17 with respect to the fixed plane of rotation of the swivel bar 21. This construction affords a universal joint which insures that all parts will revolve in perfect unison.

By adjusting the stroke plate 17 into a position near to right angles with the line of the piston travel, the length of stroke of the pistons will be shortened on account of the reduced amount of wobble action of the stroke plate. This will produce less compression. If the stroke plate 17 be adjusted at right angles to the line of piston travel then the pistons will have no stroke and the engine must stop. By adjusting the stroke plate 17 so that a very short stroke is permitted, starting or cranking of the engine is greatly facilitated on account of the extremely low compression. Another advantage of this adjustment is that it is a very easy matter to start the machine without cranking. For example, after the engine has stopped, place the hand lever in neutral position which will reduce the pressure of gas to nearly atmospheric pressure so that leakage past the piston is minimized. Then the engine may be started by throwing the lever 13 to the high compression point and by producing the spark in the cylinder so that the gas therein will be exploded and operate the pistons.

What I claim is:—

1. A rotary machine comprising a plurality of cylinders mounted to rotate bodily transversely to their bores, reciprocating pistons in the cylinders, a rotating element connected with the pistons and rotating in a plane at an angle to the plane of rotation of the cylinders, a shaft supporting said rotating element, and means for adjusting the shaft to vary the plane of rotation of said element.

2. A rotary machine comprising a rotatable cylinder carrier, a plurality of cylinders thereon, pistons in the cylinders having

a travel at right angles to the plane of rotation of the cylinders, a cross bar connected to the cylinder carrier and rotating bodily therewith and being mounted to have an axial motion with respect to the cylinder carrier, a stroke plate mounted to rotate in a plane parallel with or angular to the plane of rotation of the cylinders, said pistons being connected with said stroke plate, and means forming a pivotal connection between said stroke plate and said cross bar.

3. A rotary machine comprising a plurality of cylinders mounted to rotate in a plane at right angles to their bores, reciprocating pistons in the cylinders, a rotating device connected with the pistons, a shaft supporting said rotating device, and means for tilting said shaft to cause said device to assume a plane parallel with the plane of rotation of the cylinders or to be adjusted to various angles with respect to the plane of rotation of the cylinders.

4. A rotary machine comprising a plurality of cylinders mounted to rotate in a plane at right angles to their bores, reciprocating pistons in the cylinders, a rotating device connected with the pistons and adapted to assume a plane parallel with the plane of rotation of the cylinders or to be adjusted to various angles with respect to the plane of rotation of the cylinders, a frame in which said cylinders rotate, a yoke pivoted to said frame, a shaft journaled in said yoke and supporting said rotating device, and means for tilting said yoke to vary the plane of rotation of said rotating device.

5. A rotary machine comprising a plurality of cylinders adapted to rotate in a plane transversely to their bores, reciprocating pistons in the cylinders, a frame in which said cylinders rotate, a yoke pivoted to said frame, a shaft mounted in said yoke, a stroke plate secured to said shaft, the respective pistons being connected to the stroke plate at substantially equal distances apart, an adjusting shaft, an arm thereon, a link connecting said arm with said yoke, a hand lever on said adjusting shaft, and latch mechanism for retaining said hand lever in various positions.

6. A rotary machine comprising a plurality of cylinders mounted to rotate in a plane transversely of their bores, pistons in the cylinders, a cross bar swiveled to said rotating cylinders and extending diametrically across the axis of rotation of the cylinders, a cross pin intersecting the longitudinal axis of said cross bar and also intersecting the axis of rotation of the cylinders, a stroke plate connected to said cross pin and connected with the respective pistons, and means for adjusting the stroke plate in an arc of which said cross pin is the center.

7. A rotary machine comprising a cylinder carrier, cylinders formed thereon, a

shaft supporting the carrier and extending parallel with the bores of said cylinders, reciprocating pistons in said cylinders, a rotating device adapted to rotate in a plane at an angle to the stroke of said pistons and connected with said pistons, said shaft having a longitudinal oil hole with branches extending to the respective cylinders, and having an annular gas inlet chamber formed around the oil hole with passages leading from the gas inlet chamber to the respective cylinders, and gas outlet passages leading from the respective cylinders in a general direction away from the center of rotation of the cylinders.

8. A rotary machine comprising a plurality of cylinders mounted to rotate in a plane transversely of their bores, reciprocating pistons in the cylinders, a cylinder carrier supporting said cylinders and having a flange extending beyond the cylinders, a stroke plate mounted to rotate in various positions angularly to the line of travel to said pistons, said stroke plate having a convex face concentric with the axis of rotation and adjustment of said stroke plate, and a guard extending from said flange and meeting the convex surface of the stroke plate.

9. A rotary machine comprising a plurality of cylinders mounted to rotate in a plane transversely of their bores, reciprocating pistons in the cylinders, a cylinder carrier supporting said cylinders and having a flange extending beyond the cylinders, a stroke plate mounted to rotate in various positions angularly to the line of travel to said pistons, said stroke plate having a convex face concentric with the axis of rotation and adjustment of said stroke plate, a guard extending from said flange and meeting the convex surface of the stroke plate, a cross bar swiveled in said flange, and a cross pin connecting said cross bar and said stroke plate.

10. A rotary machine comprising a plurality of cylinders mounted to rotate in a plane transversely of their bores, reciprocating pistons in the cylinders, a cylinder carrier supporting said cylinders and having a flange extending beyond the cylinders, a stroke plate mounted to rotate in various positions angularly to the line of travel to said pistons, said stroke plate having a convex face concentric with the axis of rotation and adjustment of said stroke plate, a guard extending from said flange and meeting the convex surface of the stroke plate, a cross bar swiveled with ball bearings in said flange, a cross pin connecting said cross bar and said stroke plate, and caps on said flange covering said ball bearings.

11. A rotary machine comprising a plurality of cylinders mounted to rotate in a plane transversely of their bores, reciprocating pistons in the cylinders, a cylinder carrier

supporting said cylinders and having a flange extending beyond the cylinders, a stroke plate mounted to rotate in various positions angularly to the line of travel of said
 5 pistons, said stroke plate having a convex face concentric with the axis of rotation and adjustment of said stroke plate, a guard extending from said flange and meeting the
 10 convex surface of the stroke plate, a cross bar swiveled with ball bearings in said flange, a cross pin connecting said cross bar and said stroke plate, and caps on said flange covering said ball bearings, said guard and
 15 said flange forming an inclosed crank chamber which communicates with said cylinders.

12. A rotary machine comprising a plurality of cylinders mounted to rotate in a plane transversely of their bores, reciprocating
 20 pistons in the cylinders, a cylinder carrier supporting said cylinders and having a flange extending beyond the cylinders, a stroke plate mounted to rotate in various positions angularly to the line of travel of said
 25 pistons, said stroke plate having a convex face concentric with the axis of rotation and adjustment of said stroke plate, a guard extending from said flange and meeting the convex surface of the stroke plate, a cross
 30 bar swiveled with ball bearings in said flange, a cross pin connecting said cross bar and said stroke plate, and caps on said flange covering said ball bearings, said guard and said flange forming an inclosed crank chamber
 35 which communicates with said cylinders, the connection between said pistons and said stroke plate comprising connecting rods having ball joints at each end, said stroke plate having a series of oil passages extending to the
 40 adjacent ball joints of the connecting rods.

13. A rotary machine comprising a plurality of cylinders mounted to rotate in a plane transversely to their bores, reciprocating
 45 pistons in the cylinders, a cylinder carrier supporting said cylinders and having a flange extending beyond the cylinders, a stroke plate mounted to rotate in various positions angularly to the line of travel of
 50 said pistons, said stroke plate having a convex face concentric with the axis of rotation and adjustment of said stroke plate, a guard extending from said flange and meeting the convex surface of the stroke
 55 plate, a cross bar swiveled with ball bearings in said flange, a cross pin connecting said cross bar and said stroke plate, and caps on said flange covering said ball bearings, said guard and said flange forming an inclosed
 60 crank chamber which communicates with said cylinders, the connection between said pistons and said stroke plate comprising connecting rods having ball joints at each end, said stroke plate having a series of oil
 65 passages extending to the adjacent ball joints

of the connecting rods, said stroke plate having an annular under cut oil retaining groove with which said oil passages communicate.

14. A rotary machine comprising a cylinder carrier, cylinders formed thereon with
 70 air spaces in the cylinder carrier between the cylinders, reciprocating pistons in the cylinders, a stroke plate mounted to rotate angularly to the plane of rotation of the
 75 cylinders and connected with the respective pistons, a stationary shell surrounding said cylinders and having an opening for the exhaust of gas discharged from the cylinders.

15. A rotary machine comprising a cylinder carrier, cylinders formed thereon with
 80 air spaces in the cylinder carrier between the cylinders, reciprocating pistons in the cylinders, a stroke plate mounted to rotate angularly to the plane of rotation of the
 85 cylinders and connected with the respective pistons, a stationary shell surrounding said cylinders and having an opening for the exhaust of gas discharged from the cylinders, a rear plate in which the rear end of
 90 said shell is mounted, said rear plate having central air inlets, and a tube secured to said plate inside said shell for conducting air against the heads of the cylinders.

16. A rotary machine comprising a cylinder carrier, cylinders formed thereon with
 100 air spaces in the cylinder carrier between the cylinders, reciprocating pistons in the cylinders, a stroke plate mounted to rotate angularly to the plane of rotation of the cylinders and connected with the respective
 105 pistons, a stationary shell surrounding said cylinders and having an opening for the exhaust of gas discharged from the cylinders, a rear plate in which the rear end of said shell is mounted, said rear plate having central air inlets, a tube secured to said
 110 plate inside said shell for conducting air against the heads of the cylinders, and a tube extending rearwardly from said cylinder carrier for conducting air to the central space between said cylinders.

17. A rotary machine comprising a plurality of cylinders mounted to rotate bodily
 115 transversely to their bores, reciprocating pistons in the cylinders, a rotating element connected with the pistons and rotating in a plane at an angle to the plane of rotation of the cylinders, means for adjusting the
 120 plane of rotation of said element, means for conducting fuel to said cylinders, valves for controlling said fuel inlets, valves for controlling the exhaust of gas from the cylinders, a lever on each cylinder for operating
 125 the associated valves, a cam for operating said levers, and means for driving said cam at a different speed from that of the cylinders.

18. A rotary machine comprising a plu- 130

5 rality of cylinders mounted to rotate bodily
 transversely to their bores, reciprocating
 pistons in the cylinders, a rotating element
 connected with the pistons and rotating in
 10 a plane at an angle to the plane of rotation
 of the cylinders, means for adjusting the
 plane of rotation of said element, a cylinder
 carrier supporting said cylinders, a shaft
 supporting the cylinder carrier and having
 15 an annular gas chamber, passages extending
 from said gas chamber to said cylinders,
 valve rotating mechanism rotating with
 the cylinders for controlling the inlet of
 fuel and exhaust from said cylinders, and a
 20 cam operated at a different speed than the
 shaft for operating the valve mechanism
 as the latter travels around the cam.

25 19. A rotary machine comprising a plu-
 rality of cylinders mounted to rotate bodily
 transversely to their bores, reciprocating pis-
 tons in the cylinders, a rotating element
 connected with the pistons and rotating in
 a plane at an angle to the plane of rotation
 30 of the cylinders, means for adjusting the
 plane of rotation of said element, a cylinder
 carrier supporting said cylinders, a shaft
 supporting the cylinder carrier and having
 an annular gas chamber, passages extending
 from said gas chamber to said cylinders,
 35 levers pivoted on the respective cylinders, a
 sleeve on said shaft, a cam on said sleeve
 adapted to actuate said levers, and means
 for driving said cam at a different speed
 from said shaft.

40 20. A rotary machine comprising a plu-
 rality of cylinders mounted to rotate bodily
 transversely to their bores, reciprocating pis-
 tons in the cylinders, a rotating element
 connected with the pistons and rotating in
 a plane at an angle to the plane of rotation
 45 of the cylinders, means for adjusting the
 plane of rotation of said element, a cylinder
 carrier supporting said cylinders, a shaft
 supporting the cylinder carrier and having
 an annular gas chamber, passages extending
 from said gas chamber to said cylinders,
 50 levers pivoted on the respective cylinders, a
 sleeve on said shaft, and a cam on said
 sleeve adapted to actuate said levers, a pin-
 ion on said sleeve, an idle gear meshing with
 said pinion, a second gear fastened to said
 idle gear, said second gear meshing with a

second pinion, said second pinion being se-
 cured to said shaft, said gears being so pro-
 55 portioned that the sleeve and cam are driven
 at a different speed from said shaft.

21. A rotary machine comprising a plu-
 rality of cylinders mounted to rotate bodily
 transversely to their bores, reciprocating pis-
 tons in the cylinders, a rotating element 60
 connected with the pistons and rotating in
 a plane at an angle to the plane of rotation
 of the cylinders, means for adjusting the
 plane of rotation of said element, a cylinder
 carrier supporting said cylinders, a shaft 65
 supporting the cylinder carrier and having
 an annular gas chamber, passages extending
 from said gas chamber to said cylinders,
 and valve mechanism for controlling the in-
 let of fuel and exhaust from said cylinders, 70
 said shaft having a central oil passage
 which passes through said gas passage but
 does not communicate therewith, said oil
 passage having branches extending to the
 75 respective cylinders.

22. A rotating machine comprising a cyl-
 80 inder carrier, cylinders formed thereon with
 air spaces in the cylinder carrier between
 the cylinders, reciprocating pistons in the
 cylinders, a stroke plate mounted to rotate
 angularly to the plane of rotation of the
 cylinders and connected with the respective
 pistons, a stationary shell surrounding said
 cylinders and having an opening for the
 85 exhaust of gas discharged from the cylin-
 ders, a rear plate in which the rear end of
 said shell is mounted, said rear plate having
 central air inlets, a tube secured to said
 plate inside said shell for conducting air
 against the heads of the cylinders, a tube 90
 extending rearwardly from said cylinder
 carrier for conducting air to the central
 space between said cylinders, and a partition
 secured to the cylinders and rotating there-
 95 with, said partition extending nearly to the
 inner face of the stationary shell which in-
 closes the cylinders.

In testimony whereof, I have hereunto set
 my hand at Los Angeles, California, this
 26th day of Aug. 1908.

WALTER G. MACOMBER.

In presence of—

HOWARD BLAND,
 E. E. TEAGLE.