B. M. DUTTON & F. L. JOBSON.

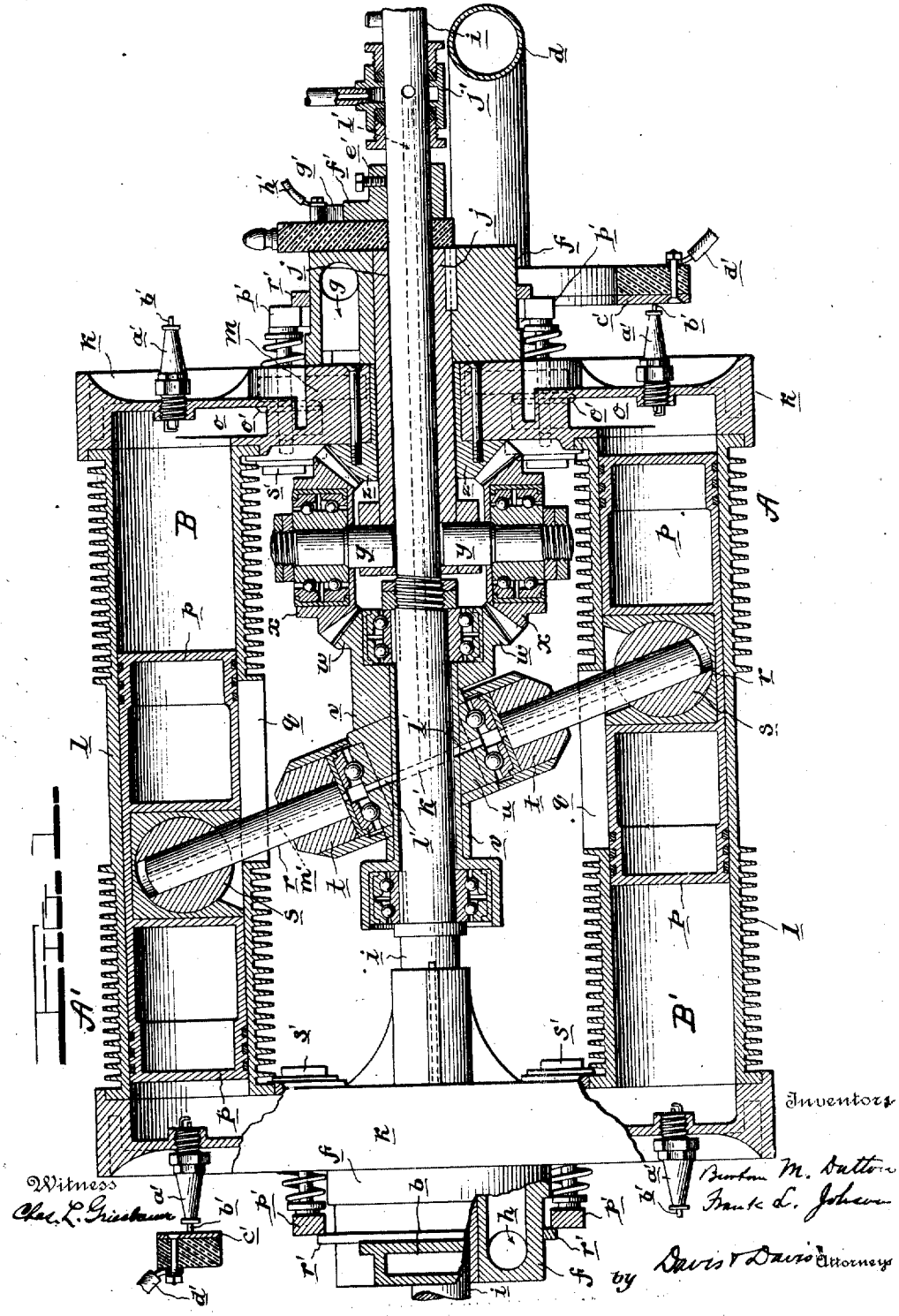
ROTARY INTERNAL COMBUSTION ENGINE.

APPLICATION FILED APR. 8, 1916.

1,228,101.

Patented May 29, 1917.

4 SHEETS—SHEET 1.



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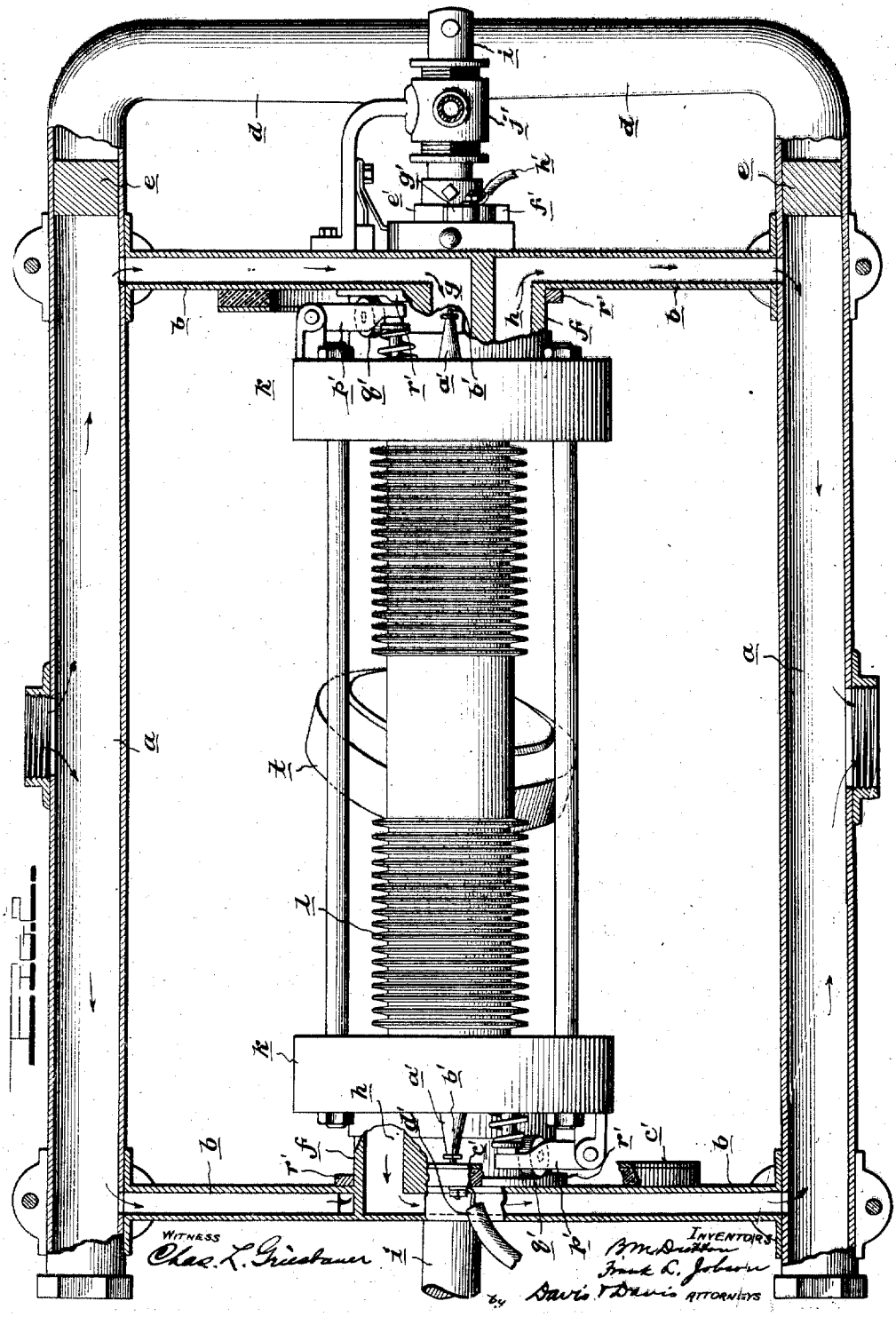

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Fig. 3.

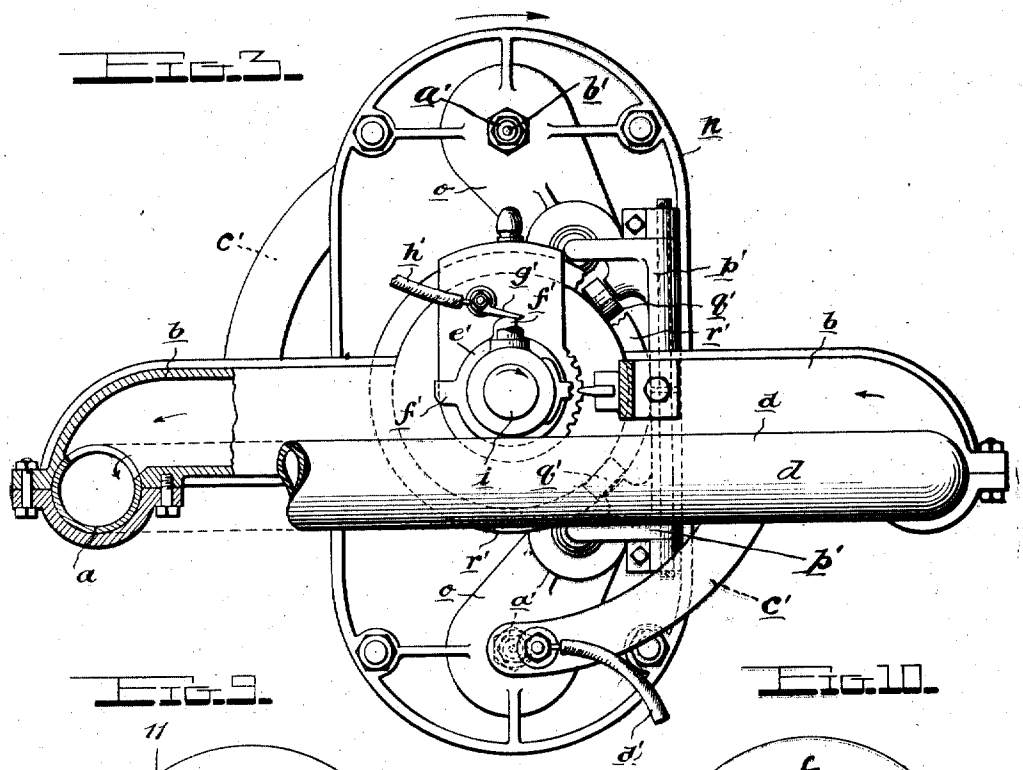


Fig. 9.

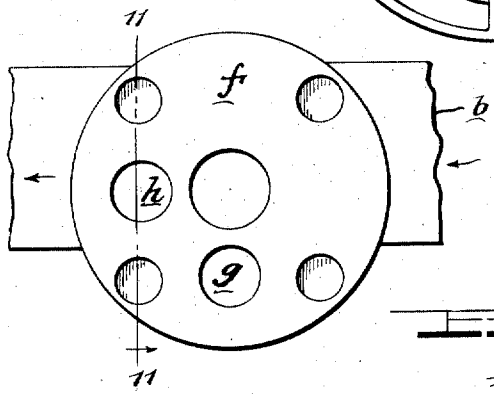


Fig. 10.

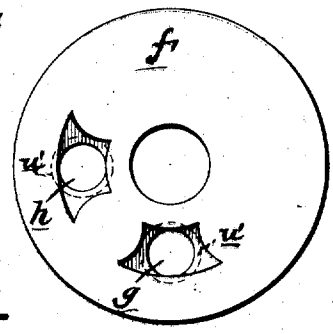
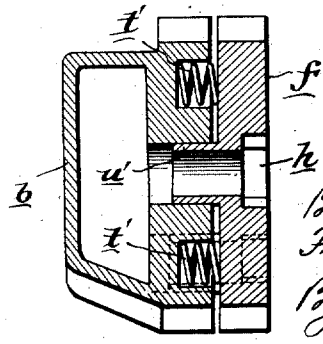


Fig. 11.



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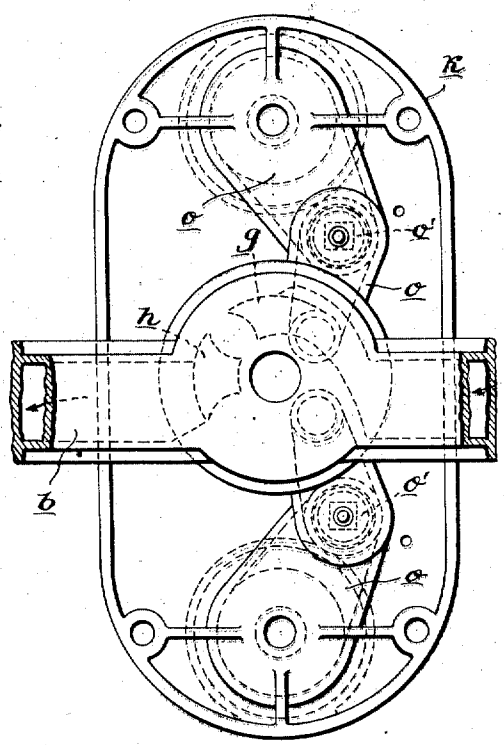
4 SHEETS—SHEET 4.

FIG. 4.

FIG. 5.



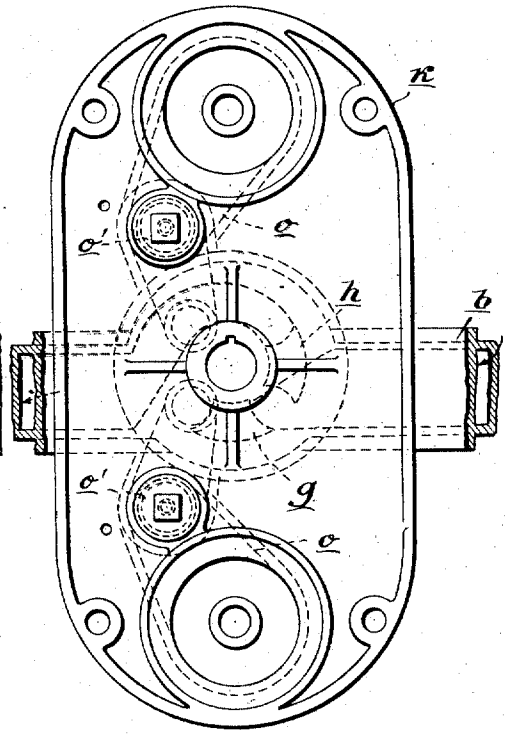


FIG. 6.

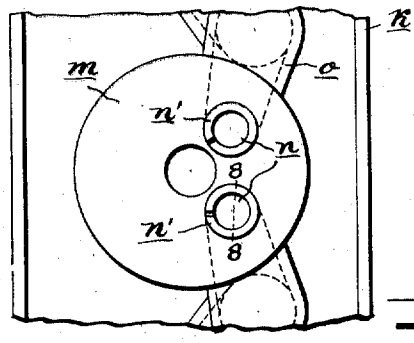


FIG. 7.

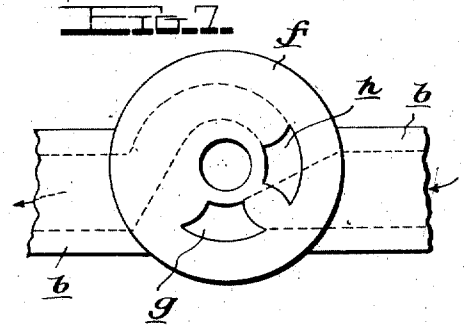
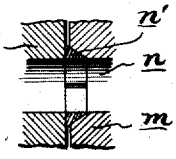


FIG. 8.



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UNITED STATES PATENT OFFICE.

BURTON M. DUTTON, OF ABINGDON, AND FRANK L. JOBSON, OF RICHMOND, VIRGINIA, ASSIGNORS OF ONE-FOURTH TO JAMES H. McEVOY, OF RICHMOND, VIRGINIA.

ROTARY INTERNAL-COMBUSTION ENGINE.

1,228,101. Specification of Letters Patent. Patented May 29, 1917.

Application filed April 8, 1916. Serial No. 89,821.

To all whom it may concern:

Be it known that we, BURTON M. DUTTON and FRANK L. JOBSON, citizens of the United States of America, and residents, respectively, of Abingdon, county of Washington, State of Virginia, and Richmond, county of Henrico, State of Virginia, have invented certain new and useful Improvements in Rotary Internal-Combustion Engines, of which the following is a full and clear specification.

This invention has relation to that type of rotary engines in which a plurality of cylinders are arranged parallel to the power shaft and caused to bodily rotate around the shaft, and the object of this invention is to improve and simplify this type of engine and to provide a true four-cycle engine in which motor action is secured at each unit once in each revolution, as more fully hereinafter set forth. This invention has other objects which will hereinafter appear in the course of the specification.

In the drawings—

Figure 1 is a view partly in side elevation and partly in vertical longitudinal section of one embodiment of our invention;

Fig. 2 is a plan view thereof, partly in horizontal section;

Fig. 3 is a view looking at the forward end of the engine, part of the frame being broken away;

Fig. 4 is a fragmentary view of the forward end of the engine, the shaft and other parts being removed for the purpose of better showing the arrangement of ports and passages;

Fig. 5 is a view of the inner face of the rear head of the cylinder structure;

Figs. 6, 7 and 8 are detail views hereinafter more fully explained; and

Figs. 9, 10 and 11 other detail views hereinafter described in detail.

The base or frame of our engine consists of a pair of side bars *a* and a pair of end bars *b* rigidly connected to form a rectangular frame. These bars are desirably made hollow to enable them to be utilized as inlet and exhaust manifolds. The arrows in Fig. 2 show the manner in which the incoming fuel is distributed to the engine and the manner in which the exhaust products are discharged through the hollow frame bars. An additional cross bar *d* is employed at one or both ends of the frame for additional strength, and when these additional cross bars are employed, it is desirable that plugs *e* be employed to close them against entrance of fuel and products of combustion.

Attached rigidly to each of the cross bars of the frame is a circular abutment *f*, in each of which is formed an inlet port *g* and an outlet port *h*. These two abutments face each other and their circular faces are machined or ground off smooth. The power shaft *i* extends centrally through these abutments and is supported thereon, directly at the rear end of the engine and indirectly, through the medium of a sleeve *j*, at the forward end of the engine, the sleeve being keyed to the abutment *f* through which it centrally extends.

Mounted so as to rotate with the shaft is a pair of double cylinder heads *k* extending radially with respect to the shaft and having affixed to their outer ends a pair of double cylinders *l* lying parallel to the shaft. The rear head *k* is keyed to the shaft, but the forward head is not connected to the shaft, being rotatively supported on the aforesaid stationary sleeve *j*. Formed on the outer face of each head, centrally thereof, is an outwardly-extending circular boss *m*, which is machined and polished off so as to have a practically gas-tight fit against the inner face of the adjacent abutment *f*. In the face of each of these bosses are formed two ports *n*, each of which ports connects with a passage *o* formed in the head and communicating with the compression space of the adjacent end of one of the cylinders.

In each of the cylinders is slidably mounted a double piston, *i. e.*, a piston structure having a piston *p* at each end, so as to thereby provide for four motor units, two in each cylinder. Each of the cylinders is provided midway its length, in its inner side, with a longitudinal slot *q*, through which, radially, extends a rod *r*. The outer end of each of these rods has a sliding connection with a disk or cylinder *s* mounted rotatively in the piston member, each rod *r* being thereby connected to the piston structure by what is practically a universal joint. The inner ends of the rods *r* are rigidly con-

nected by a ring yoke t which surrounds and is journaled upon the periphery of a wabbler-head u carried by a sleeve v and having its axis divergent to the axis of the power shaft. The sleeve v is journaled on the shaft and is free to rotate independently thereof. At one end, the sleeve is provided with a bevel gear w, which meshes with two diametrically opposite idle bevel gears x journaled on radial pins y supported rigidly on the inner end of stationary sleeve j. These gears x also mesh with a bevel gear z affixed to the inner face of the front head of the cylinder structure.

For ignition purposes, each cylinder head is provided with a spark plug a' so located that its terminal b' wipes a stationary contact plate c' mounted on the frame and connected to the high-tension conductor d' of the usual ignition system. The current is timed or commuted by the commutator e' affixed to the power shaft and provided with two contact points f' set at quadrature and adapted to touch at the proper times a spring g' connected to the low-tension circuit h'. When the commutator point is in contact with the brush, a current flows in the low-tension circuit and this produces a current in the spark coil (not shown) in the usual way, and, as is seen, no wiring is connected to the spark plugs; they get current by a wiping contact with the plates c' at the proper time to give high-tension current to the spark plugs.

Oiling of the cylinders is effected by passing oil in through a bore i' in the power shaft, oil being introduced into this bore at the forward end of the shaft by means of a gland j'. This bore connects with a transfer hole k' formed in the shaft coincident with holes l' formed in the sleeve and the wabbler-head, these holes extending to the periphery of the wabbler-head and thus communicating with the bearing between the wabbler-head and the ring yoke. By forcing oil in through these passages i', k' and l', it will be seen that the yoke bearing as well as the bearings of the sleeve will be kept thoroughly lubricated. By providing each of the bars r with a bore m', the oil may be transmitted not only to the universal joint between this rod and the double piston, but also to the cylinders, and it will be seen that centrifugal action will aid in carrying the oil to the cylinders and the rod bearings in the piston.

The relative arrangement of ports g, h and n is such that during each rotation each port n will communicate with its adjacent inlet port g during intake of fuel, be closed by the solid face of the abutment f during compression and explosion, and then open into the adjacent outlet port h during the exhaust stroke. It will be observed that the abutments f and bosses m, whose faces are polished to nicely fit against each other, are thus made to serve virtually as the valves of the engine. If it is desired or is necessary to have a joint more nearly gas-tight than is afforded by the smooth face of the parts m and n, we may employ expansible packing rings n', as shown in Fig. 8, these rings being confined in a groove formed around the port n. These rings are normally expansible circumferentially and are beveled to fit against correspondingly beveled faces on the boss, so that they normally press against the polished face of the abutment f and thus form a more nearly gas-tight joint around port n.

In addition to the cut-off arrangement afforded at the boss and abutment ports, in some types of engines it will be desirable to provide a puppet valve o' in each of the combined inlet and outlet passages o, this valve being adapted to open inwardly and to be kept normally closed by the usual coil spring. The stem of each valve extends out through the outer face of the cylinder head, and, to actuate each valve, we provide a rocking tappet p' mounted on the outer face of the head and provided with a roller q' positioned to run upon a cam track r' affixed to the frame of the engine, the operating face of this cam being shaped to hold each valve open during intake and exhaust and to permit it to close during compression and explosion strokes. It will be thus observed that our construction lends itself nicely to the use of but one valve for each motor unit, this valve serving the function both of an exhaust valve and an inlet valve. In our construction it will be a simple matter to render each one of these valves removable for cleaning and repairing and for regrinding of the valve seat. This ready removability of the valve is obtained by inserting in the inner face of the cylinder head a removable plug s'.

It will be understood that any suitable means may be provided to compensate for expansion and contraction of the cylinder structure and thus maintain gas-tight joints between the faces of the abutments and the bosses. In some cases, the expansible washers we have described may not be sufficient, and in such cases we may employ a two-part abutment as shown in Figs. 9, 10 and 11, spiral springs t' being employed to press the inner section of the abutment against the boss. This movable section of the abutment is provided with tubes u' which slide in passages formed in the stationary section, as shown. It will be observed that with this construction a sufficient compensating action is obtained to take care of expansion, contraction and wear of the parts.

In operation, the cylinder structure rotates clockwise, and, by reason of the bevel gearing arrangement described, the wabbler-head will be caused to rotate anti-clock-

wise. This occasions double-quick piston travel, carrying each motor unit through four cycles, induction, compression, explosion, and exhaust, at each revolution of the cylinder structure; in other words, while the cylinders and their members rotate bodily through one-quarter revolution in one direction, the wabbler-head member rotates one-quarter in the other direction, the two together comprising a one-half rotation, thus giving to the pistons their full travel four times in each revolution of the cylinders. This action makes possible the valve action herein described. It will be observed that the two rods *r* and the connecting yoke form together a double lever and that, as the ends of this lever are forced backwardly or forwardly by the explosions, the yoke member exerts what is practically a screw-like action upon the wabbler-head, thus tending to rotate the wabbler-head in one direction and the yoke member in the opposite direction.

To more specifically follow the valve action, we may designate the motor units in Fig. 1 as A, A′, B, B′. The unit A is firing and it will be seen that it may advance one-quarter clockwise before its cylinder port *n* will open into the exhaust port in the abutment, so that, through this part of the cycle, solid surface is presented to the cylinder port by the boss face, thus preventing leakage. When the exhaust port is reached, exhaust begins and continues through the next quarter, and, at the end of this quarter, the cylinder port passes to solid surface again for a moment and then begins to register with the inlet port in the boss. Induction now ensues throughout this quarter, and at its end solid surface is again reached on the boss face, and the piston begins to compress the new charge. At the end of this quarter, compression is completed and the firing point again reached. At this point, the cylinder port of unit B has just passed over the inlet port and is ready to begin compression, so that, when its cylinder makes a quarter turn, its compression will be completed and it will fire. It will be noted that this port is advanced one-eighth, while the one just dealt with is retarded one-eighth, so that the cylinder ports shall be in quadrature relation and thus be served from one set of ports in the abutment without interference. While this action is taking place in the front units A and B, similar action is taking place in the rear motor units A′ and B′, the port arrangement being such that the units A, A′ are companion units, and the units B, B′ companion units. Thus ignition will take place simultaneously in units A and A′ and also simultaneously in units B and B′. Simultaneous firing of diagonally opposite motor units tends to neutralize end thrust and make the engine a well balanced and self-contained unit on the shaft. However, if desired, the motor units may be fired in sequence by simply turning the rear or the front cylinder head half about, to thus place all the cylinder ports on the same side of the shaft, or the same effect may be secured by turning one of the abutments half about.

It will be observed that the construction illustrated and described may be materially departed from without departing from our invention as expressed in the claims. For instance, we do not confine ourselves to the use of a reversely rotating wabbler member, as it is obvious that the usual four-cycle functioning of the engine may be secured by rigidly holding the wabbler member against turning, say, by securing it to an extension of the stationary sleeve *j*, thereby doing away with the gears. The same effect would be obtained by having the wabbler-head affixed to the shaft, but in this case the shaft would have to be held stationary and the cylinders revolved, or vice versa. Furthermore, we are not confined to use of the valve and port mechanism herein described with the reversely rotatable or double-quick action illustrated, for it is obvious that by interposing a rotatable member carrying the inlet and exhaust port, timed by the usual reduction gear, a true four-cycle engine could be served.

Having thus described our invention, what we claim is:

1. In an engine of the class set forth, a power shaft, two structures rotatable relatively on an axis concentric with said shaft, the outer structure embodying a pair of oppositely disposed double cylinders, a double piston working in each cylinder, and heads for said cylinders, said heads being provided with inlet and outlet passages and ports, means whereby the reciprocation of said pistons causes relative rotation of said structures, and means controlling said ports embodying abutments provided each with an inlet and an outlet port and members surrounding these ports and normally pressing against the adjacent cylinder head and abutment face.

2. In an engine of the class set forth, a power shaft, a rotatable structure mounted concentric therewith and comprising a plurality of double cylinders parallel to the power shaft, heads connecting the cylinders and provided with inlet and outlet ports and passages, a double piston working in each cylinder, a wabbler-head-carrying member mounted concentrically with respect to said shaft, said wabbler-head having its axis divergent to the axis of the shaft, a ring yoke embracing the wabbler-head and provided with means having connection with said pistons, and means controlling said ports embodying abutments provided each with an inlet port and an outlet port and a normally-

expansible beveled packing ring surrounding each of said ports and normally bearing both against the abutment face and the adjacent cylinder head.

3. In an engine of the class set forth, a power shaft, a rotatable structure mounted concentric therewith and comprising a plurality of double cylinders parallel to the power shaft, heads connecting the cylinders and provided with inlet and outlet ports and passages, a double piston working in each cylinder, a wabbler-head-carrying member mounted concentrically with respect to said shaft, said wabbler-head having its axis divergent to the axis of the shaft, a ring yoke embracing the wabbley-head and provided with rods having connection with said pistons, and means whereby the rotation of the outer structure causes the wabbler-head-carrying member to rotate in a reverse direction.

4. In an engine of the class set forth, a power shaft, a rotatable structure mounted concentric therewith and comprising a plurality of double cylinders parallel to the power shaft, heads connecting the cylinders and provided with inlet and outlet ports and passages, a double piston working in each cylinder, a wabbler-head-carrying member mounted concentrically with respect to said shaft, said wabbler-head having its axis divergent to the axis of the shaft, a ring yoke embracing the wabbler-head and provided with rods having connection with said pistons, and means whereby the rotation of the outer structure causes the wabbler-head-carrying member to rotate in a reverse direction, said means embodying a gear on one of the heads, a gear on the wabbler-head-carrying member and a pair of transmitting gears.

5. In an engine of the class set forth, a power shaft, a rotatable structure embodying cylinders and pistons and cylinder heads, the latter having ports and passages, a wabbler-head having its axis divergent to the axis of the shaft, means whereby the reciprocation of the pistons tends to rotate the wabbler-head in one direction and the rotating structure in the opposite direction, and gearing connecting the wabbler-head to one of the heads to positively assist said tendency to rotate in opposite directions.

6. In a four-cycle engine of the class set forth, a power shaft, a structure rotatable on an axis concentric therewith and embodying two double parallel cylinders, heads for the cylinders provided each with a combined inlet and outlet passage for each cylinder, the ports of these passages being both on one side of the center of rotation, one being in advanced and the other in retarded position, means whereby the reciprocation of the pistons tends to rotate said structure, an abutment adjacent the outer face of each cylinder head and provided with an inlet port and an outlet port at the side facing the cylinder head, for the purposes set forth.

7. In a four-cycle engine of the class set forth, a power shaft, a structure rotatable on an axis concentric therewith and embodying two double parallel cylinders, heads for the cylinders provided each with a combined inlet and outlet passage for each cylinder, the ports of these passages being both at one side of the center of rotation, means whereby the reciprocation of the pistons tends to rotate said structure, an abutment adjacent the outer face of each cylinder head and provided with an inlet port and an outlet port at the side facing the cylinder head, resilient means being provided for maintaining a gas-tight joint between the abutting faces of the abutments and the cylinder heads.

8. In a four-cycle engine of the class set forth, a power shaft, a structure rotatable on an axis concentric therewith and embodying two double parallel cylinders, heads for the cylinders provided each with a combined inlet and outlet passage for each cylinder, the ports of these passages being both at one side of the center of rotation, means whereby the reciprocation of the pistons tends to rotate said structure, an abutment adjacent the outer face of each cylinder head and provided with an inlet port and an outlet port at the side facing the cylinder head, a valve in each of said combined inlet and outlet passages, and means operable by the rotation of said structure to open these valves during exhaust and inlet.

9. In an engine of the class set forth, a power shaft, a rotatable structure rigidly attached thereto and consisting of a pair of double cylinder heads, each having a pair of combined inlet and outlet passages, double cylinders arranged parallel to the shaft, a double piston working in each cylinder, a sleeve journaled on the shaft and carrying a wabbler-head whose axis is divergent to the shaft, a ring yoke surrounding the wabbler-head and journaled thereon and carrying radial rods whose outer ends connect the two said double pistons, and gearing between the wabbler-head carrying sleeve and one of the heads to positively rotate the sleeve in the opposite direction to the cylinders.

10. In an engine of the class set forth, a frame carrying a pair of abutments, each having an inlet and an outlet passage, a shaft extending through said abutments and carrying a rotatable structure embodying parallel pistons, cylinder heads having ports and passages and double pistons working in the cylinders, a stationary sleeve affixed to one of the abutments and extending through the adjacent head and carrying radial pins at its inner end, a gear journaled on each pin, a gear affixed to the adjacent head and meshing with said gears, another gear mesh-

ing with said gears and carried by a rotatable member, and means whereby reciprocation of the pistons tends to rotate said member in a direction opposite to the rotation of the cylinders.

11. In an engine of the class set forth, a power shaft provided with a longitudinal and transverse bore and means for supplying oil thereto, relatively rotatable structures mounted concentric with the shaft, one of said structures embodying bodily rotatable double cylinders and double pistons working therein and radial rods connected to the pistons, each being bored longitudinally, the other of said structures being provided with an oil passage connecting the transverse passage in the shaft to the bores in the rods, for the purpose set forth.

12. In a four-cycle engine of the class set forth, a power shaft, a structure rotatable on an axis concentric therewith and embodying two double parallel cylinders, heads for the cylinders provided each with a combined inlet and outlet passage for each cylinder, the ports of these passages being both at one side of the center of rotation, means whereby the reciprocation of the pistons tends to rotate said structure, an abutment adjacent the outer face of each cylinder head and provided with an inlet port and an outlet port at the side facing the cylinder head, a valve in each of said combined inlet and outlet passages, means operable by the rotation of said structure to open these valves during exhaust and inlet, the inner face of each head being provided with openings in alinement with the said valves, and a plug for each of these openings, these plugs being movable to enable the valves to be removed when it is desired to operate the engine without these valves.

In testimony whereof we hereunto affix our signatures.

BURTON M. DUTTON.
FRANK L. JOBSON.