May 17, 1938. J. O. HEINZE 2,117,662

ENGINE ASSEMBLY

Filed Jan. 23, 1936 3 Sheets-Sheet 1

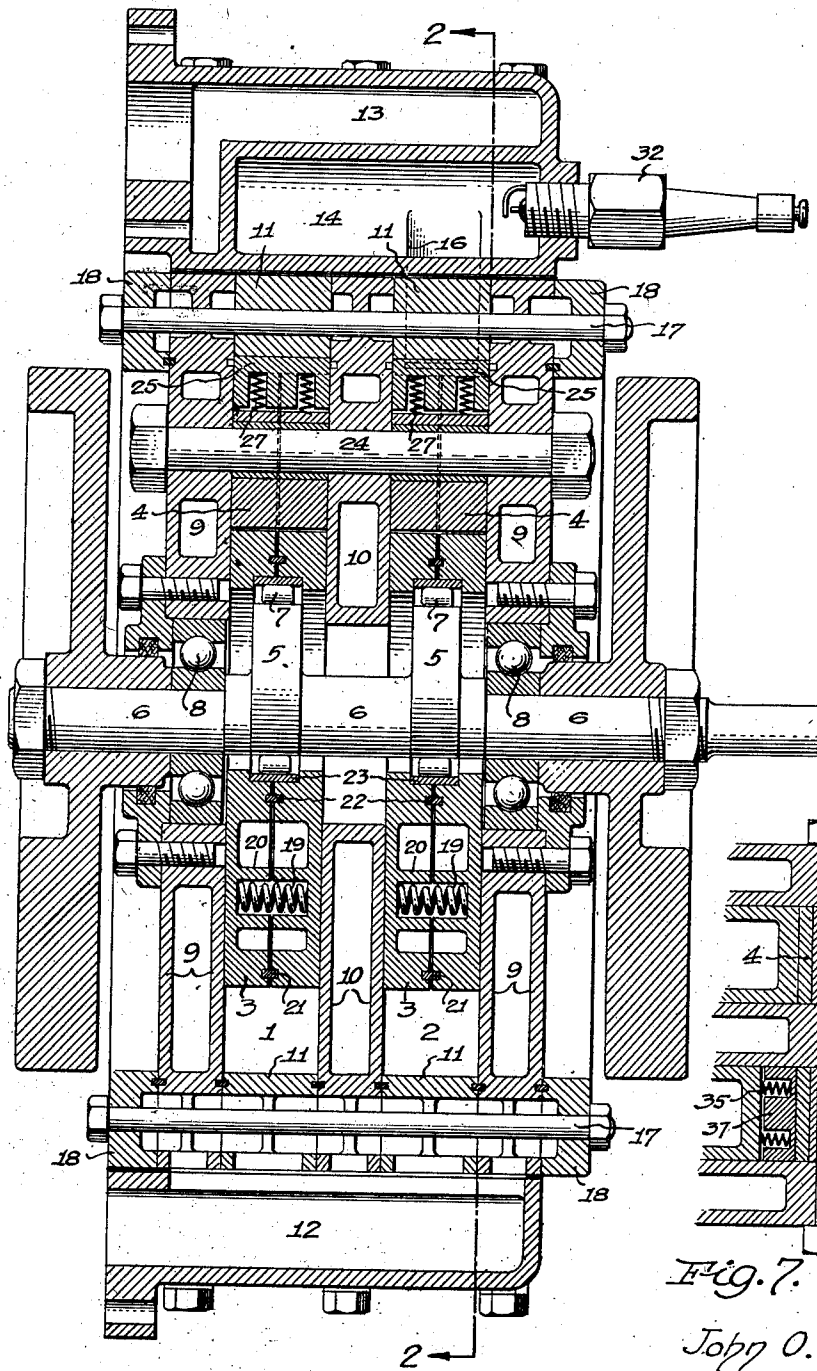

Fig. 1.

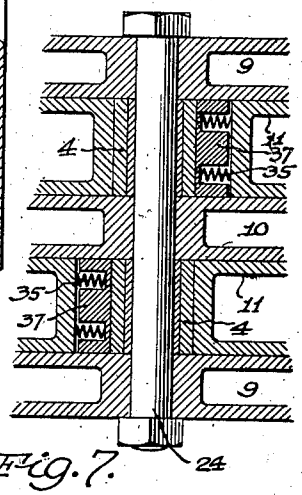

Fig. 7.

INVENTOR

John O. Heinze,

BY

ATTORNEYS

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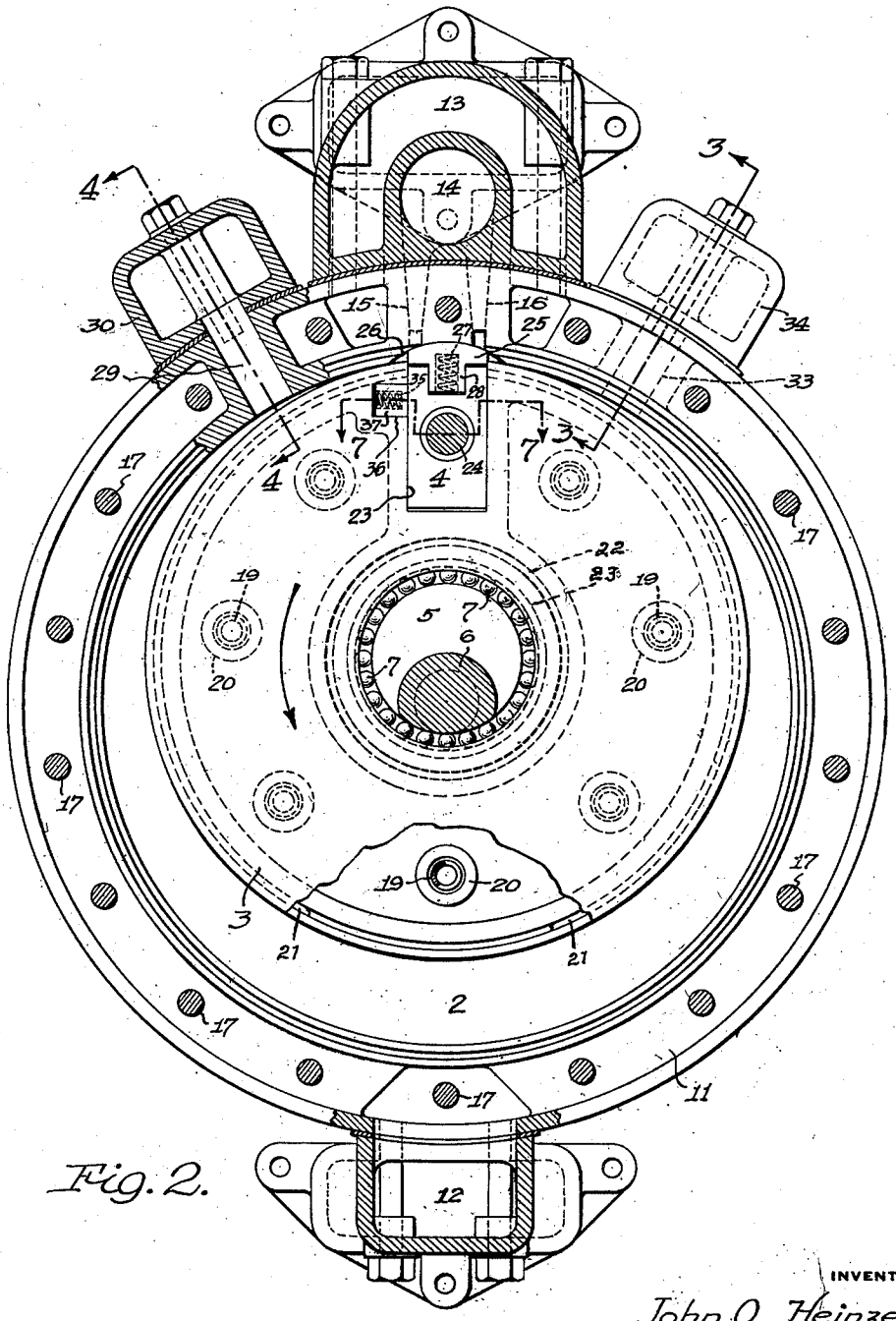

Fig. 2.

INVENTOR

John O. Heinze,

BY

ATTORNEYS

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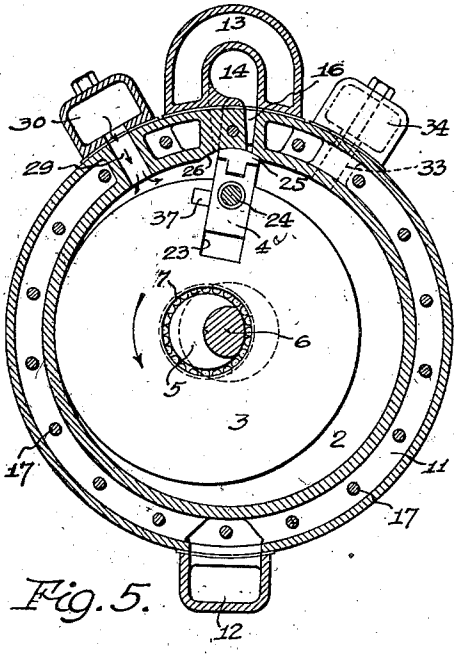

Fig. 5.

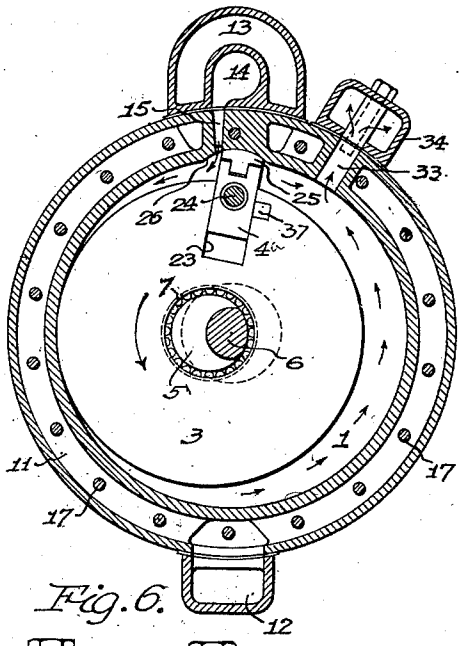

Fig. 6.

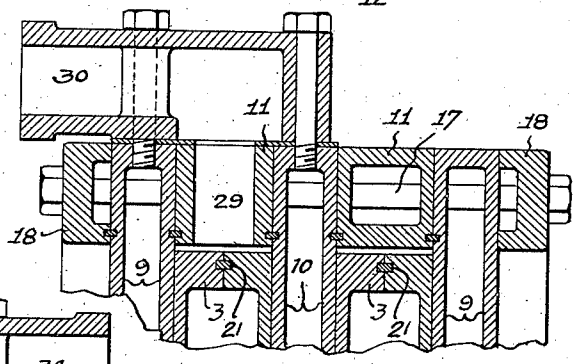

Fig. 4.

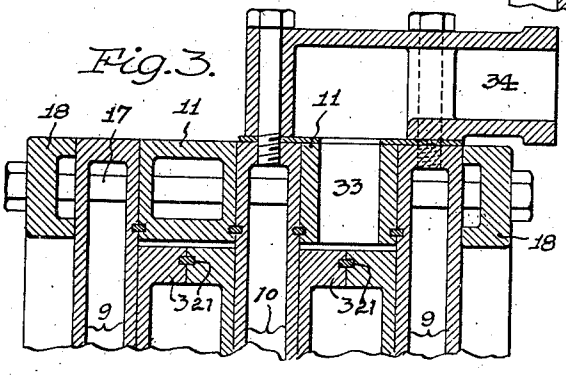

Fig. 3.

INVENTOR

John O. Heinze,

BY

ATTORNEYS

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UNITED STATES PATENT OFFICE

2,117,662

ENGINE ASSEMBLY

John O. Heinze, Detroit, Mich., assignor to Heinze Development Company, Detroit, Mich., a corporation of Michigan

Application January 23, 1936, Serial No. 60,365

4 Claims. (Cl. 123—8)

This invention relates to an internal combustion engine of the eccentric piston type, and its object is to simplify, perfect and reduce the cost of manufacture of motors and compressors of this type, and to combine such a compressor and motor in a single unit to provide a perfected internal combustion engine.

A further object is to provide a construction wherein an abutment member for separating the space at one side of the piston from that at the opposite side, also serves as a valve moved by eccentric motion of the piston to open and close a port in the cylinder wall during one-half of each stroke of the piston.

It is also an object to prevent leakage past the abutment within its slot in the piston, by providing means for exerting a constant force to hold said piston with the face of a side wall of its slot in firm contact with the side face of the abutment therein and which face is opposed to pressure within the cylinder, and to prevent leakage past the ends of the piston, by providing means for yieldingly expanding the piston in the direction of its length to hold its end walls in face contact with the end walls of its cylinder.

It is also an object to provide certain other new and useful features in the construction and arrangement of parts, all as hereinafter more fully described, reference being had to the accompanying drawings, wherein—

Figure 1 is an axial longitudinal section through an internal combustion engine illustrative of an embodiment of the present invention;

Fig. 2 is a transverse section substantially upon the line 2—2 of Fig. 1;

Fig. 3 is a sectional detail substantially upon the line 3—3 of Fig. 2;

Fig. 4 is a similar section upon the line 4—4 of Fig. 2;

Figs. 5 and 6 are transverse sections through compressor and motor respectively, and illustrative of the operation and relative positions of the pistons and valvular abutments therein; and

Fig. 7 is a sectional detail substantially upon the line 7—7 of Fig. 2.

The structure as shown in the accompanying drawings, is an internal combustion engine comprising a motor and a compressor for compressing and supplying combustible charges to the motor, and the structure as shown, comprises an annular motor cylinder indicated as a whole by the numeral 1 and an annular compressor cylinder indicated as a whole by the numeral 2 with a circular piston 3 in each cylinder anchored therein for eccentric movement, by an abutment member or block 4 dividing the crescent shaped space between the periphery of each piston and cylinder wall, each piston being mounted upon an eccentric 5 formed integral with a shaft 6 extending axially through the two cylinders with an anti-friction bearing 7 interposed between the periphery of each eccentric and piston and the end portions of said shaft being mounted in ball bearings 8 in the end walls of the cylinders, which walls 9 form a part of the casing of the structure and the end walls of the two cylinders 1 and 2. A corresponding single intermediate wall 10 forms the inner end walls of the cylinders and interposed between the peripheral portions of these walls 9 and 10, are annular members 11 which form the peripheral walls of said cylinders, all of said walls being formed hollow to provide water cooling spaces, all in communication with a water inlet manifold 12 secured to and extending across the lower side of said cylinders. A water outlet manifold 13 extends across the upper side of said cylinders in open communication with said hollow walls, and formed integral with this manifold 13, interiorly thereof, is a combustion chamber 14 with the water space of said manifold partly surrounding said chamber which chamber is in communication through a passage 15, with the interior of cylinder 1 and through a passage 16 with the interior of the cylinder 2. The two wall members 9 and the wall member 10 are secured together with the annular walls or members 11 interposed, by means of bolts 17 passing through the peripheral portions of these walls and through clamping rings 18 secured by said bolts against the outer faces of said walls 9. The cylinders 1 and 2 are thus formed by the several separate sections 9, 10 and 11 which are drawn into firm contact with each other, by said bolts, and in the manufacture of the engine, the end faces of the walls 9 and 10 may be ground perfectly flat before assembly, as may also the end faces of the pistons so that said pistons will contact over their entire end areas with the faces of the cylinder end walls, leakage past the ends of the pistons being thus avoided by maintaining firm contact of these faces of the piston ends with these ground faces of the cylinder walls, by dividing each piston intermediate its end faces, into two parts or halves and interposing coiled springs 19 between said halves within hollow bosses 20 on each half within the hollow or internal cavity with which each half of the piston is formed with these cavities open toward each other.

The springs 19 thus exert a force to spread the two halves of each piston apart and thus yieldingly

hold their end faces in close contact with the faces of the end walls of their cylinders, and to prevent leakage from each cylinder through the peripheral slot or space between the two halves of each piston, said halves may be formed with opposed grooves in the opposed faces of the peripheral walls of these halves to receive a packing ring 21, and in a like manner, each piston is formed with opposed grooves in opposed faces of the inner walls of the piston halves to receive a packing ring 22, and seated upon these walls and extending across the split between said halves, is a hardened ring 23' upon which the rollers of the bearings 7 run. Leakage from the combustion space of the motor and the compression space of the compressor is thus prevented from passing through each piston between the opposed faces of its halves and at the same time leakage between the ends of each piston and the end walls of the cylinders is effectually prevented by the firm contact maintained by the springs 19, between the ground end faces of the pistons and faces of the end walls of the cylinders.

To anchor each piston within its cylinder for eccentric movement therein, the abutment member or block 4 for each piston which is disposed within a radial slot 23 in said piston, is pivoted for swinging movement upon a pivot bolt or shaft 24 extending through openings in the wall members 9 and 10 and through a longitudinal opening in each block 4 located intermediate the inner and outer sides of each block, said pivot bolt being located well within the circle of the periphery of each piston, said pivot bolt 24 being rigidly held against rotation and secured to said walls by means of a nut or nuts on its projecting end or ends, said pivot bolt thus also serving to assist in securing said walls together. Each block 4 is of the same length as the thickness of the piston so that the end surfaces of the block will abut and slide upon the inner surfaces of the end walls of the cylinder, and the pivot bolt or shaft 24 of each block is so located that the outer end or side of the block, to which is applied a shoe 25, will extend far enough to seat said shoe within a notch or groove 26 formed in the inner surface of the peripheral wall of the cylinder, the surface of this groove 26 being curved concentrically with the axis of the pivot bolt 24 so that as the block swings upon said pivot, the shoe will ride in contact with the curved surface of the groove 26 and maintain contact therewith to prevent leakage between said shoe and curved surface, said shoe being urged into seating contact therewith by means of springs 27, each within a bore in a rib 28 on the shoe which rib fits closely within a longitudinal groove in the outer side of the block.

The port or passage 15 which affords communication between the interior of the cylinder 1 and the combustion chamber 14, opens through the curved surface of the groove 26, and in a like manner the passage 16 affording communication between the cylinder of the compressor 2 and said chamber 14 also opens through said curved surface of said groove. Therefore as each block 4 is swung upon its pivot by the eccentric movement of its piston, communication between the interior of each cylinder and the combustion chamber will be opened and closed during each half stroke of each piston, the port 15 opening through said curved surface at one side of the vertical plane of the pivotal axis of said block and the other port 16 opening through said surface at the opposite side of said plane, both ports being closed when the pistons are at the upper ends of their strokes as shown in Fig. 2.

As shown in Fig. 2 the compressor cylinder is formed with an inlet passage 29 at a distance from the port 16 in the direction of rotation of the piston, and this passage 29 is in open communication with a short intake manifold 30 to which a carburetor or other device (not shown) is attached for supplying a combustible mixture of fuel and air to the compressor cylinder, this intake passage being open at all times as it is located laterally from the point of contact of the piston with the cylinder wall when the piston is at the upper end of its stroke, and therefore mixture will be drawn in through this passage until the piston reaches the lower end of its stroke where it will be trapped within the cylinder and compressed by further movement of the piston until the piston reaches substantially its three-quarter position, at which time the passage 16 leading to the combustion chamber 14 will be opened and this compressed charge will be forced into said chamber. As shown in Fig. 1, a spark plug 32 is inserted within an opening in one end of this chamber 14 and the charge which is compressed within this chamber will be fired at the proper time or approximately when the passage 15 leading from this chamber to the motor cylinder is opened to discharge the gases under high compression within the combustion chamber, into the motor cylinder, and when the motor piston has reached the position shown in Fig. 6 the full force of the explosion of gases will be applied to the piston of that cylinder, swinging the piston upon its pivot shaft 24, and thereafter the passage 15, is closed by the valvular abutment of said piston, allowing the highly compressed charge to act upon the piston expansively until near the end of its stroke when the port 33 will be opened and permit the exhaust gases to pass freely out, this port remaining open during substantially the remainder of the stroke so that all of the burned gases expanded to nearly atmospheric pressure will be expelled through the short exhaust manifold 34.

In order to prevent leakage between the abutment blocks 4 and the side wall of each piston slot 23 within which the blocks are located, a longitudinal groove 36 is provided in one wall of each piston slot 23 to receive a bar 37 formed with recesses to receive coiled springs 35 which act between said bar and bottom of said groove 36 to press said bar against the side of the block 4 and move the piston to bring the side of its slot 23 opposite that at which said springs are located, into firm even contact with that side of the abutment block, said springs for so moving the compressor piston, being located at the forward side of said abutment block in the direction of rotation of the piston as indicated in Fig. 2, to make a tight joint between the block and wall of the piston slot at the compression side of the piston, and said springs 35 for moving the motor piston are located at the rearward side of its block, in the direction of rotation of the piston, so that the gases under high compression at the compression side of the piston will be prevented from leaking past the abutment block.

With the present arrangement of pivoted abutment members, the outer side of each serves as a valve and the movement of the piston to which it is applied serves to move the valve to close and open the cylinder port in proper timed rela-

tion to the movement of the piston, thus obviating the necessity for complicated valve structures separate from said abutments and means for operating such valves in proper timed relation to piston movements. Further the arrangement provides for a sliding valve member which is continuously held to its seat, thus avoiding leakage due to improper seating caused by wear, and this valve member or shoe 25 carried by the abutment is held yieldingly against its seat so that wear will cause better seating rather than otherwise. In this arrangement of valvular abutment, the abutment itself, oscillates upon its anchoring pivot with the movements of the piston and its pivot also provides an anchor for the piston upon which the piston oscillates as it slides upon said abutment. A very strong and easily machined and assembled abutment structure is thus secured and leakage past the abutment through the abutment slot in the piston is obviated by the simple expedient of providing springs carried by the piston for moving the piston relative to the abutment and holding the side wall of the piston slot in firm contact with the adjacent side of said abutment.

Further, leakage past the ends of the piston is prevented by grinding said end surfaces to contact throughout their area, the similarly ground surfaces of the cylinder end walls, and such contact is insured by making the piston expansible in the direction of its length.

Obviously advantages of the particular construction and arrangement shown, may be secured by the employment of modified constructions without departing from the spirit of the present invention, and such modifications are contemplated as falling within the scope of the appended claims.

Having thus fully described my invention what I claim is:

1. The combination with a power cylinder and a compression cylinder each having a port opening through the peripheral wall thereof, and a piston eccentrically supported in each of said cylinders and each piston having a radial slot therein opening through the periphery thereof; of an abutment member in said slot of each piston with a portion of each abutment projecting from the open side of said slot to engage the peripheral wall of its cylinder and open and close said ports, a combustion chamber with passages in open communication with said chamber at one end and communicating at their opposite ends through said ports with said cylinders, and means mounted in the end walls of the cylinders and passing through said slots in said pistons for pivotally supporting said abutment members inwardly from said peripheral wall of each piston to swing upon said pivot means with the eccentric movement of said pistons and move the projecting portion of one of said abutment members in contact with said peripheral wall of its cylinder to uncover said port at one side of said abutment and afford free passage through one of said passages for products of combustion from said chamber into said power cylinder upon movement in one direction of said abutment with said power piston in said cylinder and to uncover said port at the other side of said abutment in the compressor cylinder and afford free passage of compressed air from said compressor cylinder through the other passage into said combustion chamber in timed relation to the opening of the passage from said chamber into said power cylinder.

2. The combination as characterized in claim 1 and further characterized by a shoe on said projecting portion of each abutment to yieldingly engage said walls of said cylinders.

3. The combination as characterized in claim 1 and further characterized by each cylinder being formed with a groove in its peripheral wall formed concentric in cross section with the pivotal support for the abutment within said radial slot of said piston in said cylinder, each of said abutments being pivotally supported within the slot of its piston upon a pivot bolt supported by said cylinder end walls and positioned within said slot inwardly of the periphery of said piston, a shoe mounted upon the projecting portion of each abutment member, and yieldable means to press each of said shoes into contact with the curved surfaces of said grooves in said cylinder walls.

4. In an engine assembly comprising a motor cylinder and a compressor cylinder, said cylinders being formed by hollow circular end walls, an intermediate hollow circular wall and annular members between said end and intermediate walls and forming the peripheral walls of said cylinders, said walls and members being secured together by through bolts adjacent the peripheries of said walls; a water manifold secured to said cylinders in communication with said hollow walls and formed with an interior combustion chamber having passages affording communication between said chamber and said cylinders; a shaft mounted axially of said cylinders; an eccentric in each cylinder upon said shaft with said eccentrics extending laterally in the same direction from said shaft; a piston of circular form mounted upon each eccentric in each cylinder and each piston formed with a radial slot opening through its periphery; an abutment member in said slot of each piston with its outer end in contact with the peripheral wall of each of said cylinders, a pivot bolt mounted in the end walls of said cylinders and extending through said abutment member within said slots to pivotally support said abutment members, said cylinder walls being formed with ports through which said passages open opposite said outer ends of said abutments to be opened and closed, one in timed relation to the other, by swinging movements of said abutments upon their pivotal supports with the movements of said pistons; and an intake manifold in open communication with said compressor cylinder at the intake side thereof at one side of said chamber and an exhaust manifold in open communication with said motor cylinder at the exhaust side thereof and at the opposite side of said chamber.

JOHN O. HEINZE.