No. 721,932. PATENTED MAR. 3, 1903.

T. BARROW.

OSCILLATING ENGINE.

APPLICATION FILED OCT. 19, 1901.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1,

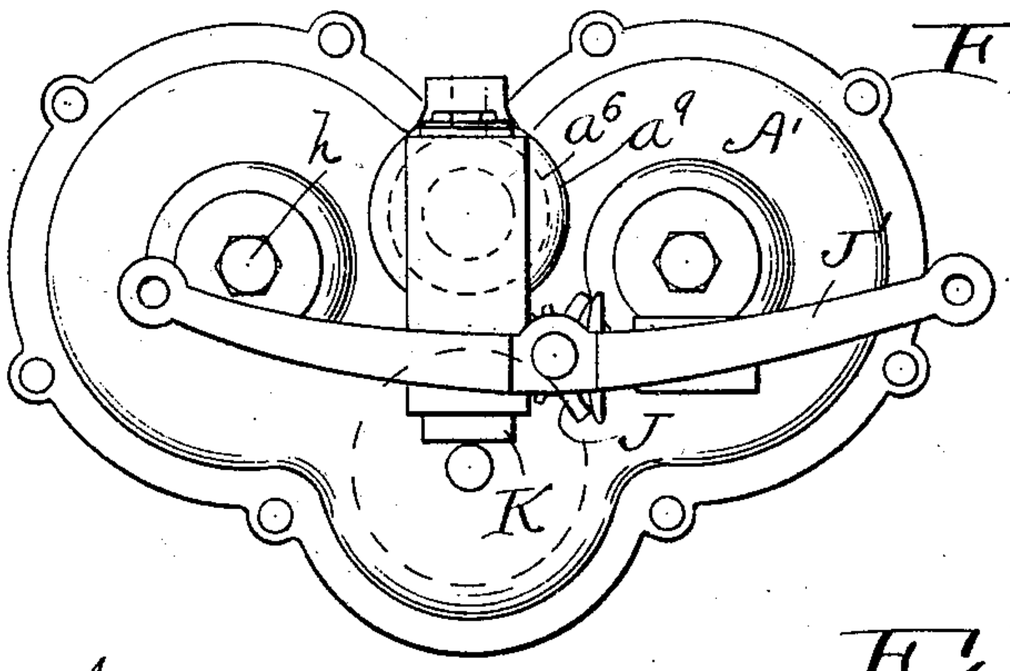


Fig. 2,

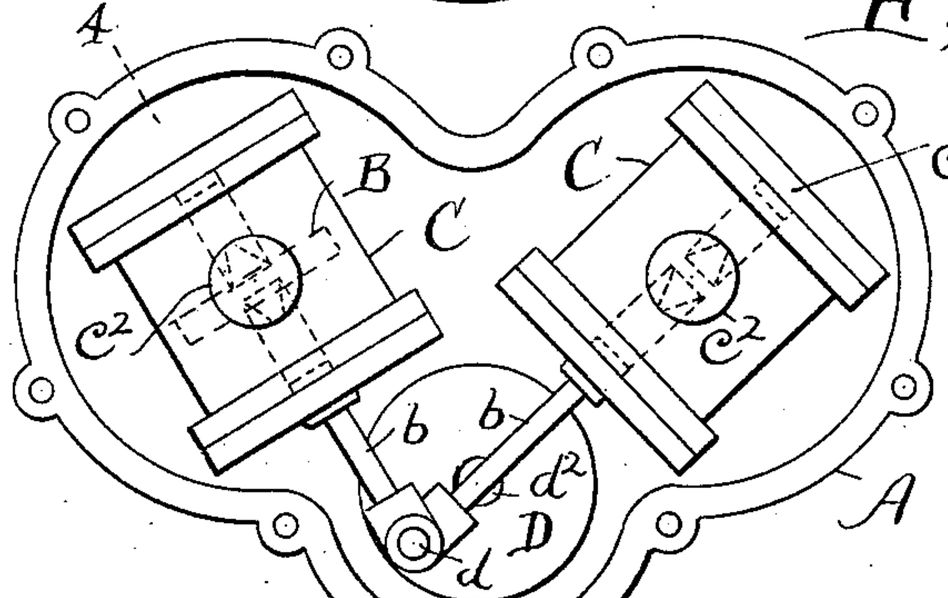


Fig. 3,

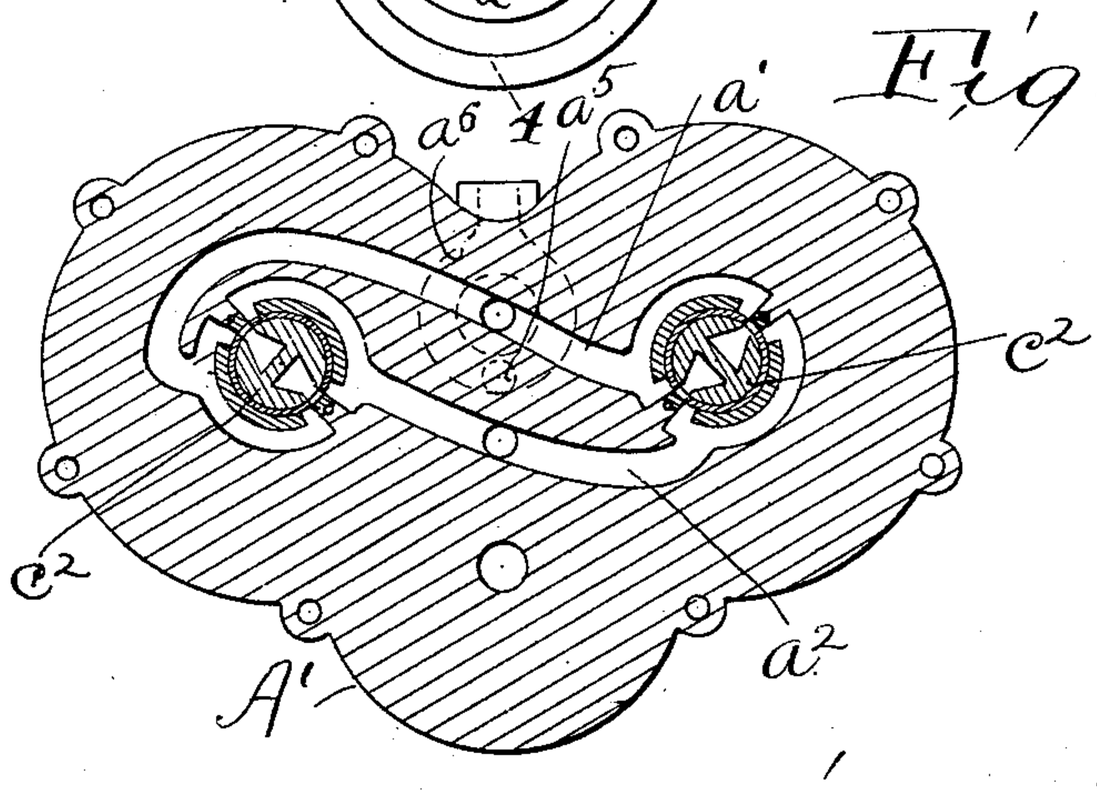
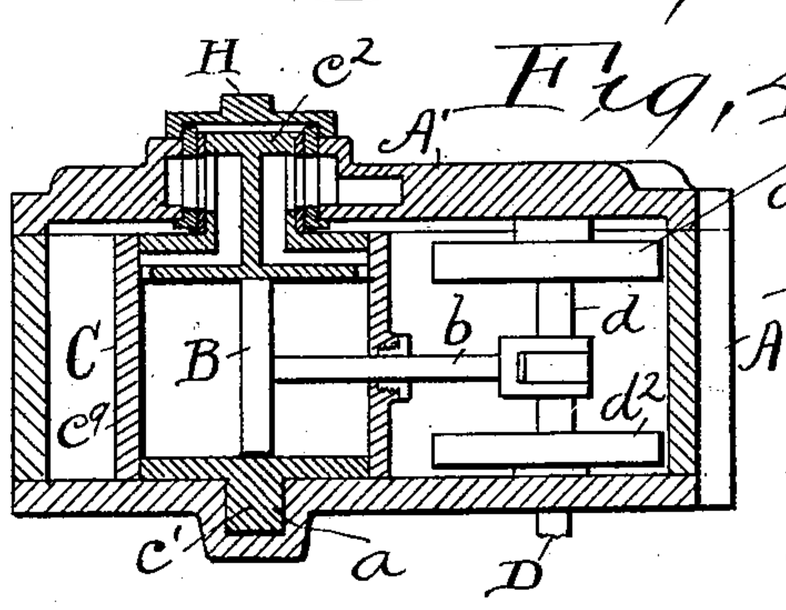


Fig. 4,



Witnesses
E. B. Gilchrist
H. M. Wise.

Inventor,
Thomas Barrow,
By his Attorneys,
Thurston & Bates.

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NO MODEL. 2 SHEETS—SHEET 2.

Fig. 5,

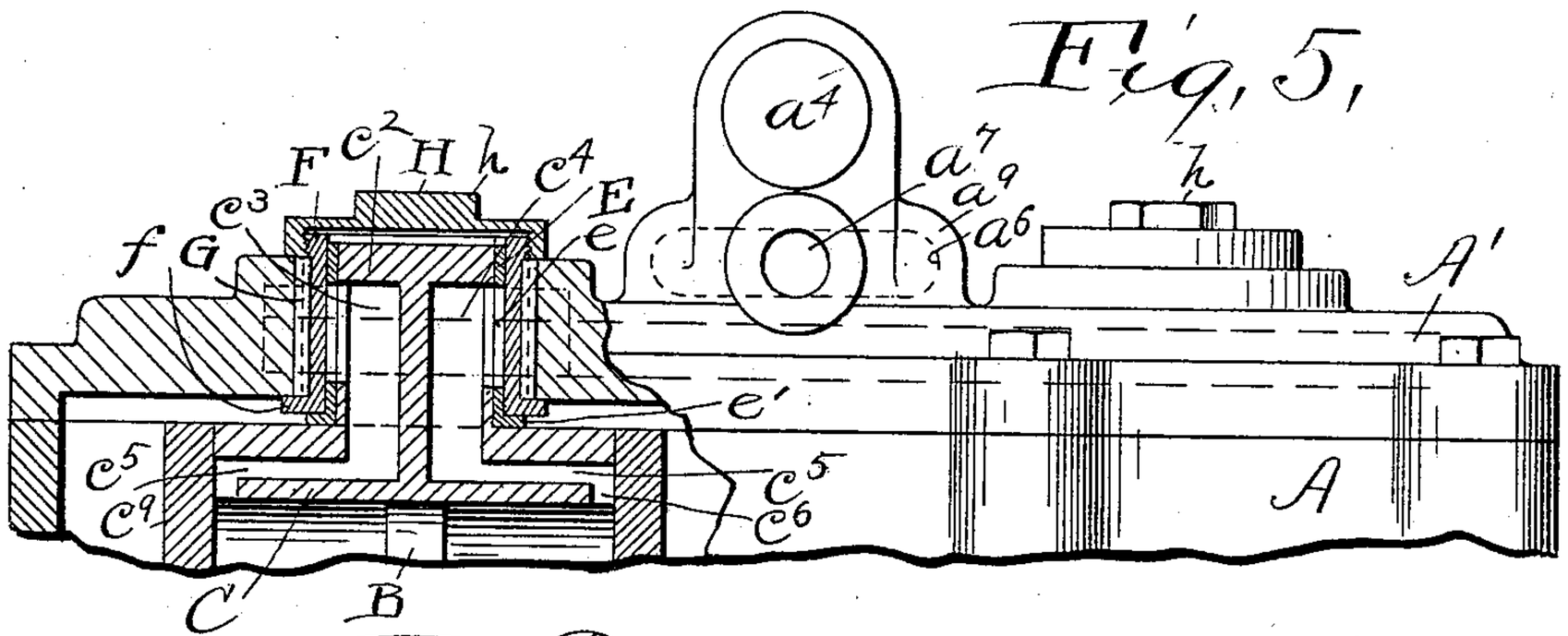


Fig. 6,

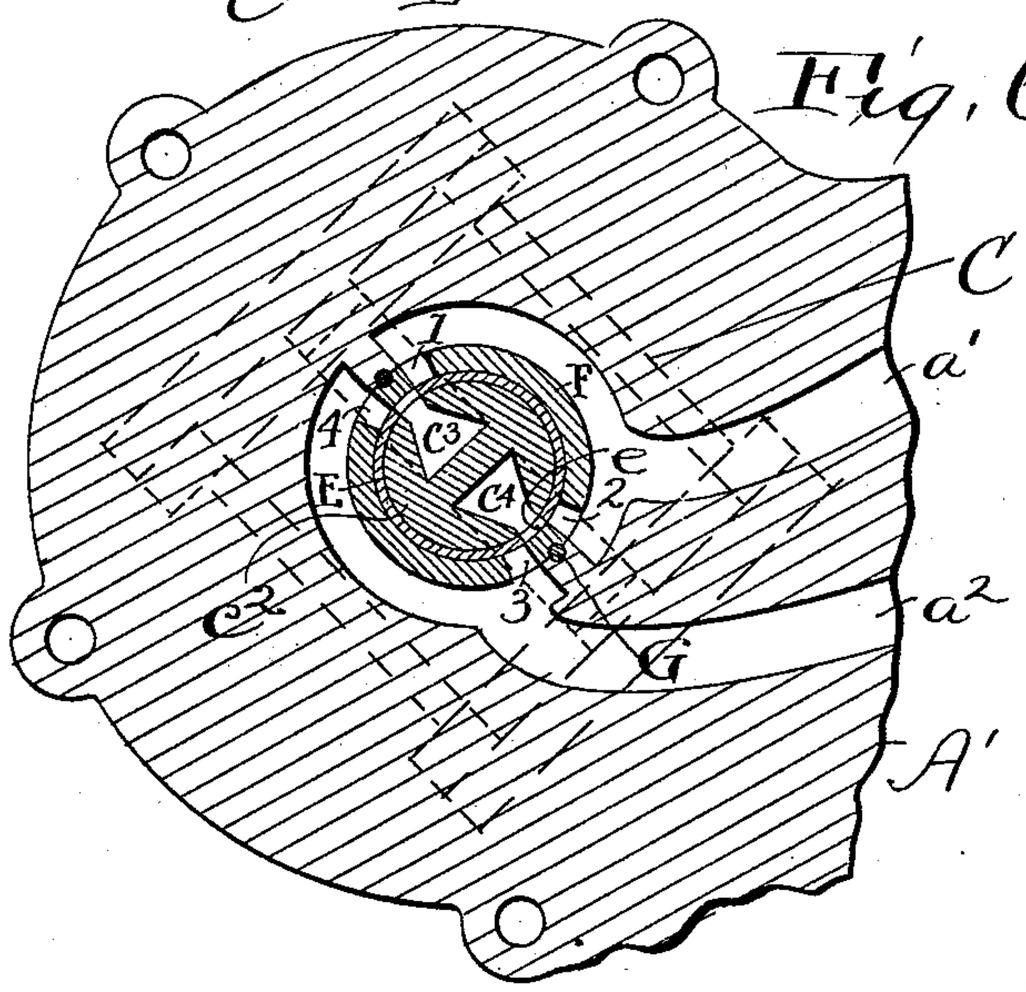


Fig. 7,

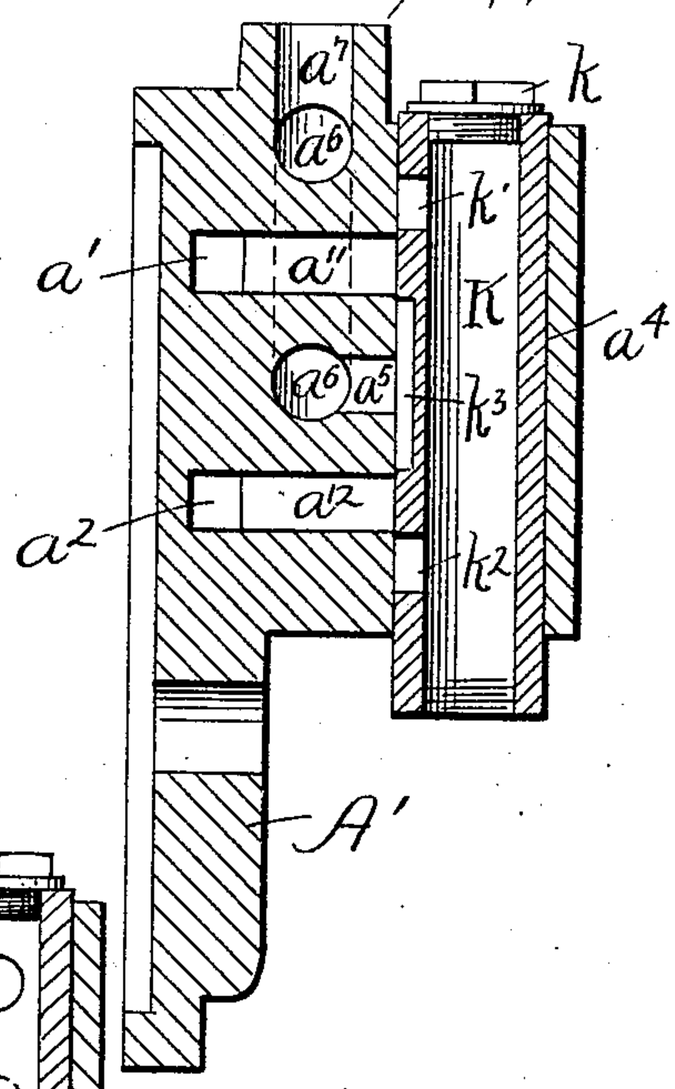


Fig. 9,

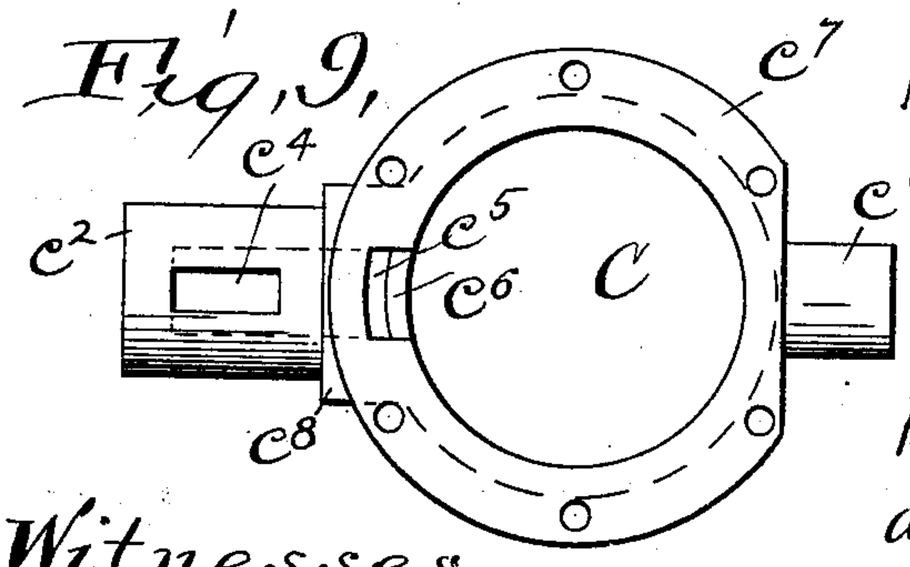
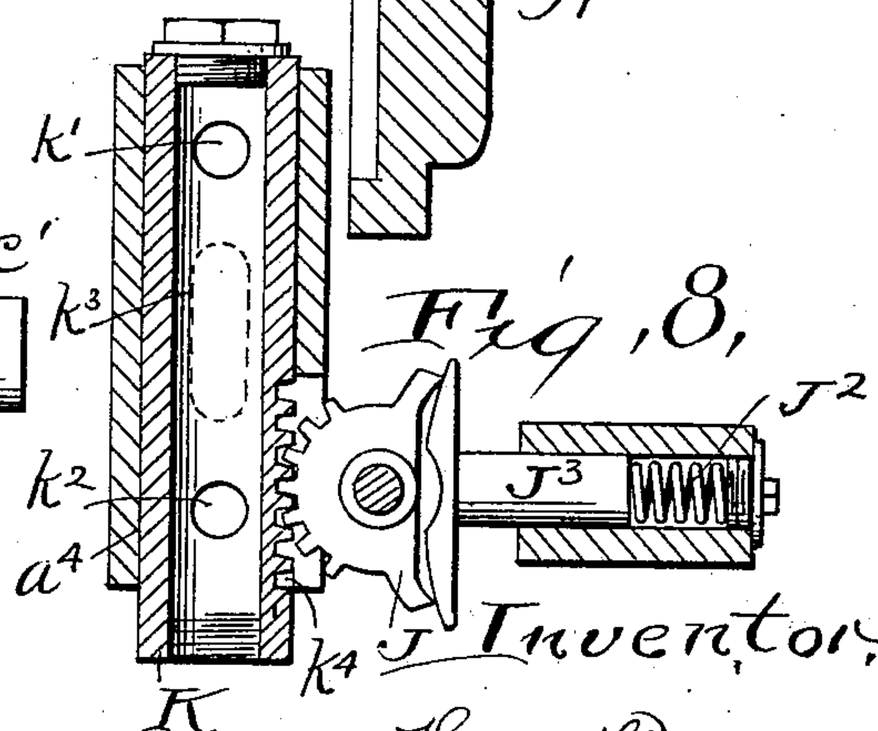


Fig. 8,



Witnesses,
E. B. Gilchrist
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UNITED STATES PATENT OFFICE.

THOMAS BARROW, OF CLEVELAND, OHIO, ASSIGNOR, BY MESNE ASSIGNMENTS, TO CHICAGO PNEUMATIC TOOL COMPANY, A CORPORATION OF NEW JERSEY.

OSCILLATING ENGINE.

SPECIFICATION forming part of Letters Patent No. 721,932, dated March 3, 1903.

Application filed October 19, 1901. Serial No. 79,273. (No model.)

To all whom it may concern:

Be it known that I, THOMAS BARROW, a subject of the King of England, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Oscillating Engines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

Oscillating engines have been found very convenient for small individual installations on account of their compactness; but there is always difficulty in keeping the admission-ports sufficiently packed to prevent leakage.

In the present invention I have provided within a casing a pair of oscillating cylinders trunnioned in the back of the casing and the cover therefor and receiving their operating fluid through passages in the cover communicating with openings into the periphery of the trunnion. To do this I have provided a peculiar system of passages in the cover with which the trunnion-openings directly communicate and a peculiar arrangement of those trunnion-openings, as hereinafter explained. I have also provided a system of bushings enabling both the cover and cylinder to be simple castings with only approximately accurate ports. These bushings, moreover, provide better wearing-surfaces and if worn may be replaced. These and other features preventing leakage and improving the construction are hereinafter more fully explained. The invention may be most conveniently summarized as consisting of the combinations of parts hereinafter described, and definitely set out in the claims.

In the drawings, Figure 1 is a front elevation of my improved engine wherein there are two cylinders having their pistons taking onto a single crank. Fig. 2 is front elevation of the same with the cover-plate removed. Fig. 3 is a vertical section through the cover-plate looking toward the front. Fig. 4 is a transverse section of the engine, being on the line 4 4 of Fig. 2. Fig. 5 is a plan of the engine, sectional through one of the trunnions. Fig. 6 is a vertical section through the cover-plate looking toward the cylinder. Fig. 7 is a vertical central section through the valve and cover-plate. Fig. 8 is a vertical central section through the valve parallel with the cover-plate. Fig. 9 is an end view of one of the cylinders.

Referring to the drawings by letters, A represents a box having a cover-plate A′. Within the casing thus provided are the two oscillating cylinders C, the pistons B of which have piston-rods *b*, taking onto the single crank-pin *d* on the disk cranks d' d^2, the latter of which is secured on the crank-shaft D. On the side of the cylinders, at the back of the casing, the cylinders have solid trunnions c', taking into recesses *a* in the casing. At the opposite side the trunnions c^2 have extending into them a pair of diametrically opposite openings c^3 c^4, which lead inward from the peripheral surface and downward to longitudinal passages c^5, leading to the ends of the cylinder-body, partly within a boss c^8 on that side of the cylinder. At the ends of the body recesses c^6 lead from the passages c^5 to the interior, and thus complete those passages when the cylinder-heads c^9 are secured to the flanged ends c^7 of the body. Now if operating fluid—compressed air, for example—be admitted alternately to one of the openings c^3 or c^4 and the other be coupled with the exhaust the piston B will be reciprocated and the crank-shaft rotated. The operating fluid is conveyed to and from the trunnions c^2 by passages within the cover-plate A′. There are two of these passages a' and a^2, each of which leads from the valve-seat a^4 of the reversing-valve hereinafter described, to four ports, two associated with each cylinder. These four port-openings are designated in Fig. 6 as 1, 2, 3, and 4. Ports 1 and 2 are in communication with the passage a' and ports 3 and 4 with the passages a^2. Ports 1 and 3 are diametrically opposite and likewise ports 2 and 4, so that when the engine is receiving fluid from the passage a' through port 1 it is discharging it from the opposite side of the piston through port 3 into the passage a^2. The swinging of the engine on its trunnion as the forward end of the piston-rod travels around the crank-circle brings the ports c^3 and c^4 alternately into

engagement with the ports 1 and 4 and the ports 2 and 3, respectively, thus causing the continuous driving of the engine, the piston going in one direction when the ports 1 and 3 are in communication with the trunnion-ports and the other when ports 4 and 2 are in communication. If the connection of the passages a' and a^2 with the admission and exhaust is reversed at the reversing-valve, the direction of rotation of the engine is thereby reversed. Now in order to make a good wearing-surface between the trunnion c^2 and the cover-plate I provide two bushings. One of these, E, is a tube having an inner flange e'. It is forced onto the trunnion c^2 and has openings e alining with the openings c^3 c^4. This bushing E is preferably made of steel and has the ports e accurately machined through it, which may be very conveniently done. The passages c^3 c^4, as will be seen from the drawings, flare as they extend toward the center of the trunnion. This is accomplished simply by coring the casing, and no great accuracy is required, owing to the bushing E.

Coöperating with the bushing E is the bushing F, preferably of bronze. This bushing has a shoulder or flange f, and it is driven into the cover A'. The four port-openings 1, 2, 3, and 4 are made by this bushing only, which much simplifies the coring of the passages a' a^2. To prevent leakage of the operating fluid under pressure from one of the passages a' or a^2 into the other around the periphery of the bushing F, I insert a pair of plugs G, of Babbitt or other suitable material, extending along the line of engagement between the bushing F and the cover. These plugs are thus between the ports 1 and 4 and 2 and 3, as shown, and being of greater length than the distance across the passages a' or a^2 effectually prevent leakage from one of these passages to the other. A cap H, having a hexagon head h and an internal thread, screws onto the threaded projecting end of the bushing F, and thus neatly covers the end of the trunnion. The removal of this cap allows the trunnion to be oiled as desired.

The employment of the bushings E and F, first, allows them to be made of steel and bronze, respectively, so that the abrasive effect is slight, while the cover-plate and the cylinder may be made of much cheaper cast-iron; second, it allows the ports e and 1, 2, 3, and 4 to be much more conveniently, accurately, and cheaply made than would be the case if they were made directly into castings, and, third, when these bushings do become worn the bushing F may be conveniently forced out of the cover and replaced by a new one of slightly-smaller bore.

The passages a' and a^2 lead to ports a^{11} a^{12} in a valve-seat a^4, which is shown as tubular. At the seat, intermediate of the ports formed by these passages, is an exhaust-port a^5, communicating with an annular exhaust-passage a^6, which is within a boss a^9 on the cover-plate and loops around the passage a^{11}, joining the final exhaust-passage a^7. This annular arrangement of the exhaust-passage is very convenient, allowing the port-passages a^{11} and a^{12} to be straight recesses reamed to the desired size and leading from the valve-seat to the cylinder-passages a' a^2.

The valve is designated K. It is shown as tubular and filling the valve-seat a^4, being plugged at the upper end by the plug k and receiving the operating fluid through an opening in the lower end. Drilled openings k' and k^2 are adapted by the movement of the valve to aline with the ports a^{11} and a^{12}, respectively, allowing operating fluid to be admitted from the valve thereto, while simultaneously the recess k^3 in the outer surface of the valve couples the port a^{12} or a^{11}, as the case may be, with the exhaust-port a^5. The valve is shown as operated by a toothed segment J, having teeth meshing with teeth k^4 in the side of the valve and itself oscillated by a lever J', rigidly secured to it. A spring J^2 maintains a plunger J^3 pressed against separated toes on opposite sides of the segment J, giving that segment, and hence the valve, a tendency to return to its intermediate or off position when displaced in either direction. The valve here shown and the method of operating it are not a part of the present invention, however, being covered by my prior patent, No. 673,573, of May 7, 1901.

Having described my invention, I claim—

1. In an oscillating engine, in combination, a casing including a cover-plate, an oscillating cylinder therein, a rigid trunnion projecting from the middle of the cylinder side and having ports in its periphery communicating by passage-ways through it with the opposite ends of the cylinder, said trunnion extending into an opening in the cover-plate, and passages in the cover-plate leading from such opening, substantially as described.

2. In an oscillating engine, in combination, a casing including a cover-plate, an oscillating cylinder therein having a rigid trunnion projecting into an opening in the cover-plate, ports in the periphery of said trunnion, a valve-seat on the outer side of the cover, and a reversing-valve occupying such seat, there being passages within the cover parallel with the surface thereof and intercepted by said trunnion and openings at right angles to the cover leading from the valve-seat to said passages, substantially as described.

3. In an oscillating engine, in combination, a casing, an oscillating cylinder therein having a rigid trunnion on one side thereof projecting into an opening in the casing, there being ports in the periphery of said trunnion within the opening, and passages within the casing leading from said ports, and a pair of coöperating bushings carrying port-openings one of said bushings surrounding the trunnion and rigid with it and the other rigid with the casing, substantially as described.

4. In an oscillating engine, in combination, a casing including a cover-plate, an oscillat-

ing cylinder therein having a rigid trunnion on one side thereof and projecting into an opening in the cover-plate, there being ports in the periphery of said trunnion, and passages within the cover-plate leading from said ports, a bushing having ports and surrounding said trunnion and occupying the recess in said cover, said bushing extending outward beyond the cover, and a cap threaded to said bushing on the outer side of the cover, substantially as described.

5. In an oscillating engine, in combination, a casing, an oscillating cylinder therein having a rigid trunnion projecting into an opening in the casing, there being ports in the periphery of said trunnion and passages within the casing leading from said ports, and a bushing having ports and surrounding the trunnion and rigidly occupying the recess in the casing, and plugs at the junction-line of said bushing and recess preventing leakage from one passage to the other, substantially as described.

6. In an oscillating engine, in combination, a casing carrying a pair of passages for the operating fluid, said two passages leading to a recess in the casing, a bushing occupying said recess and having four ports wholly within said recess, two of said ports communicating with one passage and the other two with the other passage, said passages being disconnected between said ports by reason of the casing there engaging the bushing, and plugs at such engaging line of the casing of the bushing preventing leakage, substantially as described.

7. In an oscillating engine, the combination of a casing including a cover, there being a pair of passages a', a^2 in the cover thereof leading to a recess, a cylinder having a trunnion extending into said recess, a bushing surrounding the trunnion within the recess and snugly engaging the casing-cover, said bushing having four openings, 1, 2, 3 and 4, 1 and 3 being diametrically opposite and 2 and 4 diametrically opposite, the openings 1 and 2 communicating with one passage and the openings 3 and 4 communicating with the other, said passages a' a^2 extending in an arc shape to connect the consecutive ports 1 and 2 and 3 and 4 respectively, the casing-cover having a projection between the ports 1 and 4 and another projection between the ports 2 and 3 which projections engage with the bushing at these points, and plugs G interrupting the junction-line between these projections and the bushing, substantially as described.

8. An oscillating cylinder having a rigid trunnion projecting from the side of its outer surface, said trunnion having a pair of openings on diametrically opposite sides of its periphery, which openings flare as they extend inward but are separated by a partition of the trunnion and then lead inward along the cylinder terminating near opposite ends thereof, combined with the casing which said cylinder occupies and which has opposite ways adapted to communicate with said openings in the trunnion, substantially as described.

9. In an oscillating engine, the combination of a casing including a cover-plate, there being a pair of passages in the cover-plate leading to a recess, a cylinder, a trunnion rigid with the cylinder extending from the middle of the side thereof into said recess, said trunnion having ports in its periphery, passages within said trunnion and the wall of the cylinder leading from said ports to opposite ends of the cylinder, a valve-casing on said cover-plate having openings communicating with said passages in the cover-plate, and a valve within said casing for controlling the admission of operating fluid to said openings, substantially as described.

In testimony whereof I hereunto affix my signature in the presence of two witnesses.

THOMAS BARROW.

Witnesses:
ALBERT H. BATES,
H. M. WISE.