F. H. TREAT.

EXPLOSIVE ENGINE.

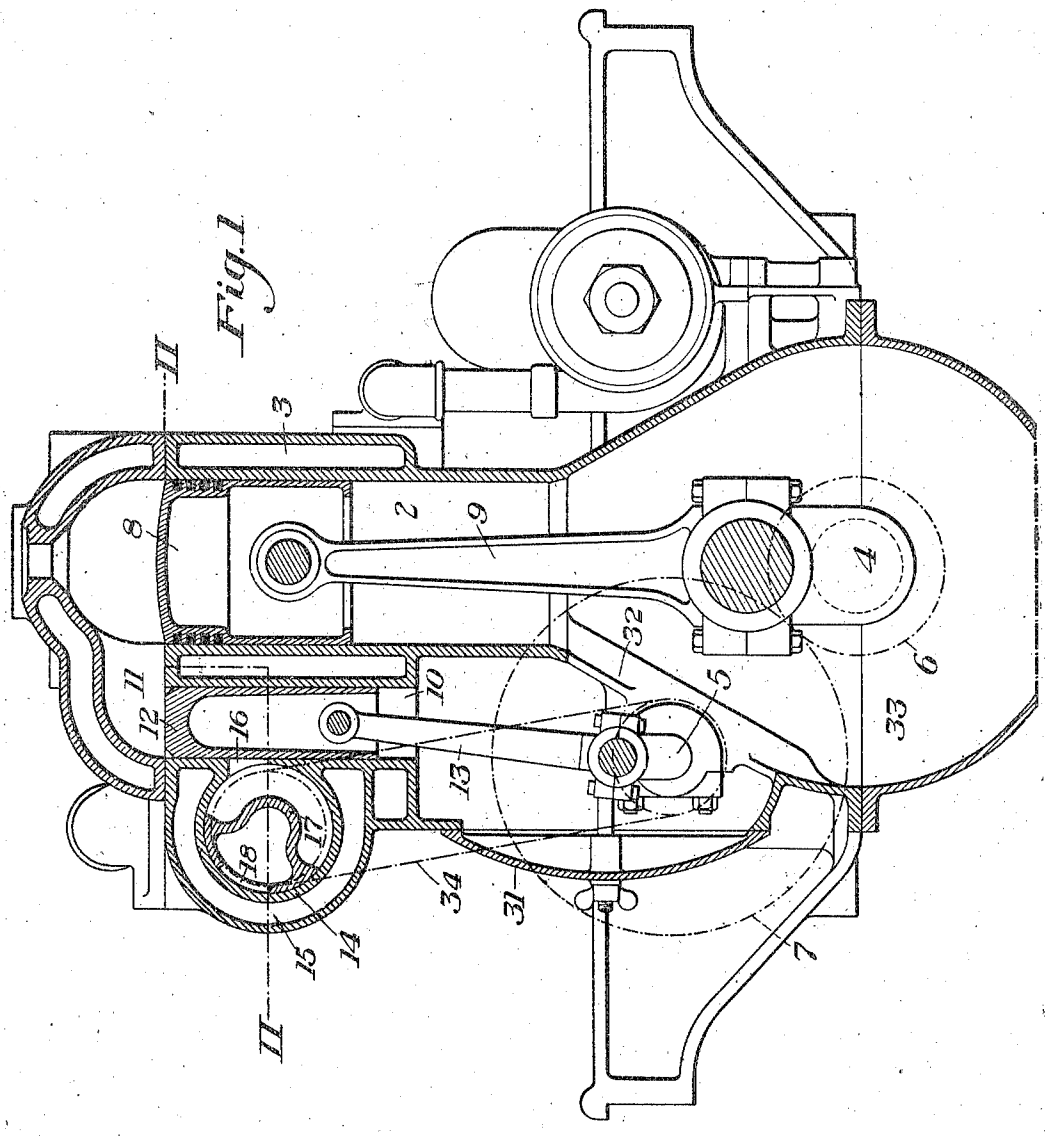
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1,290,413.

Patented Jan. 7, 1919.

5 SHEETS—SHEET 1.

Fig. 1



WITNESSES

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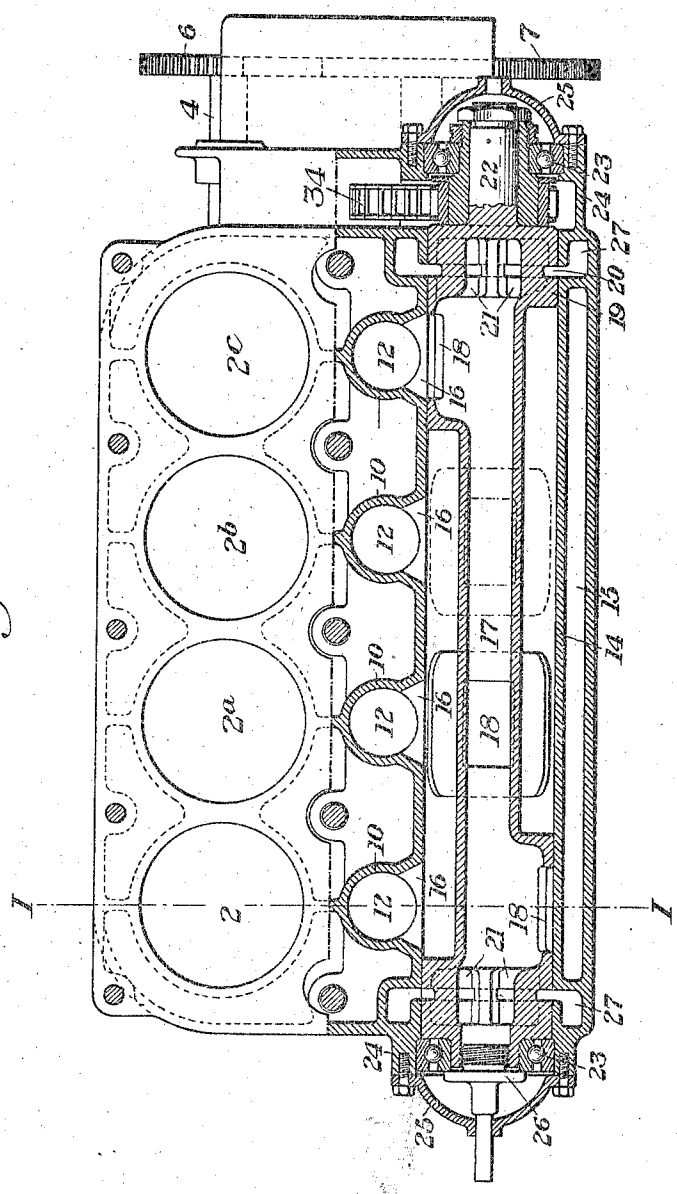
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5 SHEETS—SHEET 2.

Fig. 2.



WITNESSES

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5 SHEETS—SHEET 3.

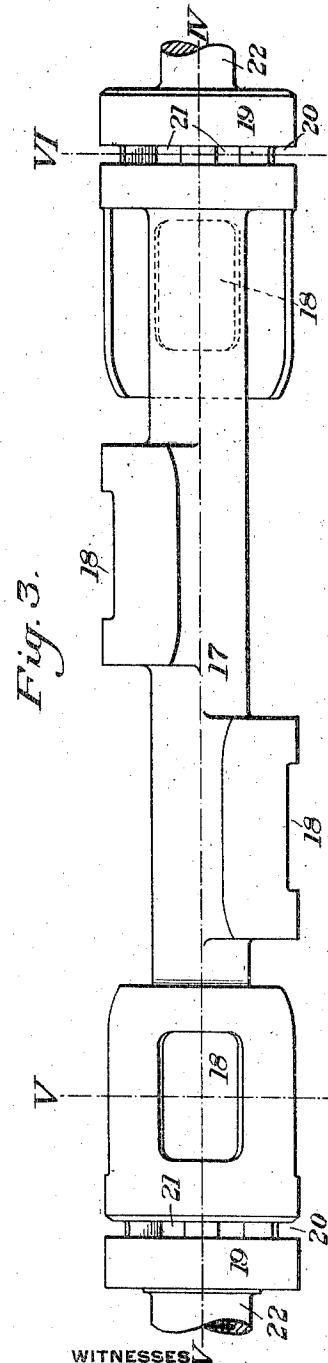


Fig. 3.

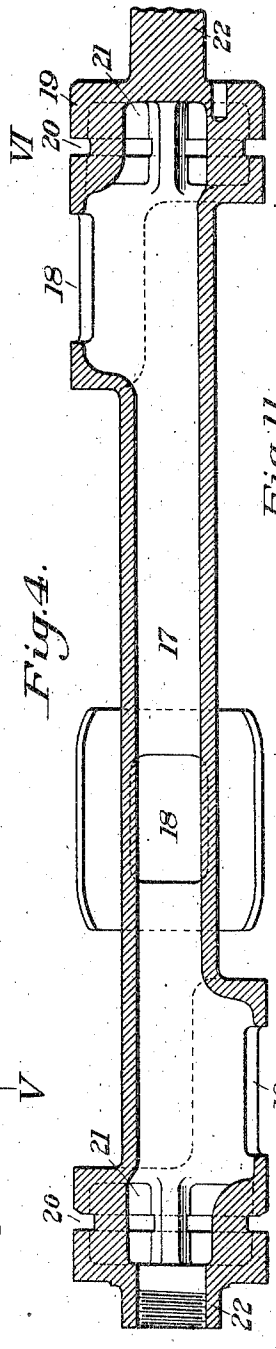


Fig. 4.

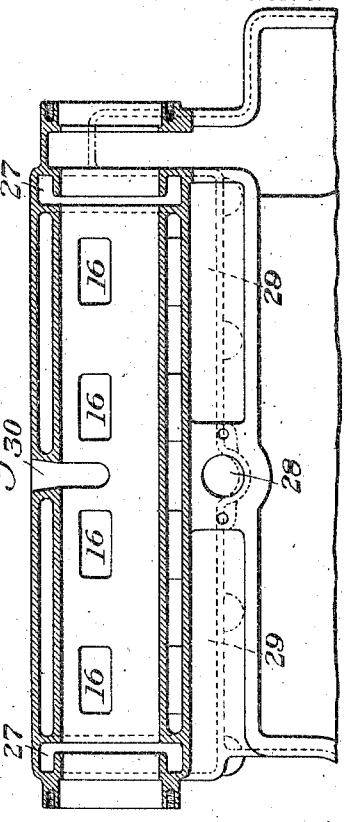


Fig. 11.

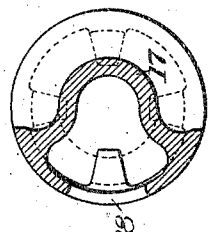


Fig. 5.

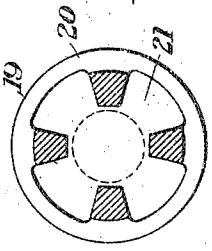


Fig. 6.

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5 SHEETS—SHEET 4.

Fig 10.

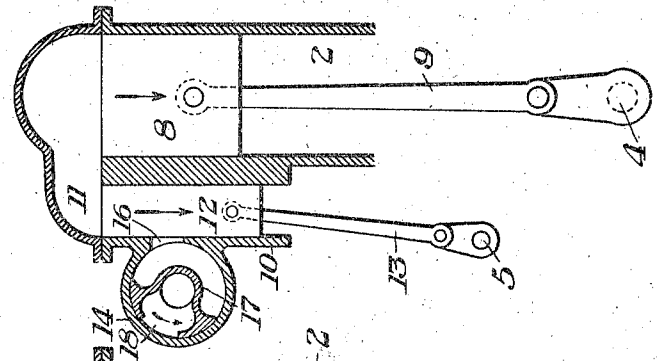


Fig. 9.

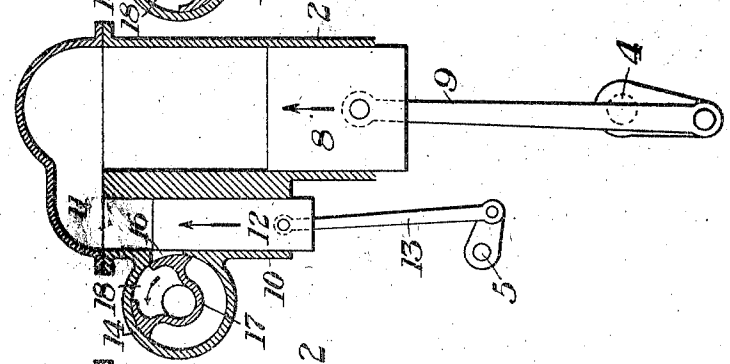


Fig. 8.

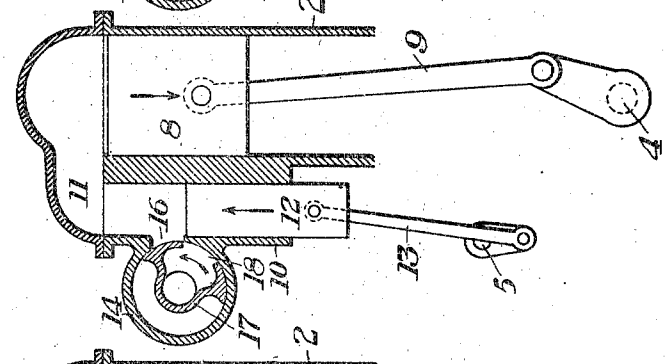
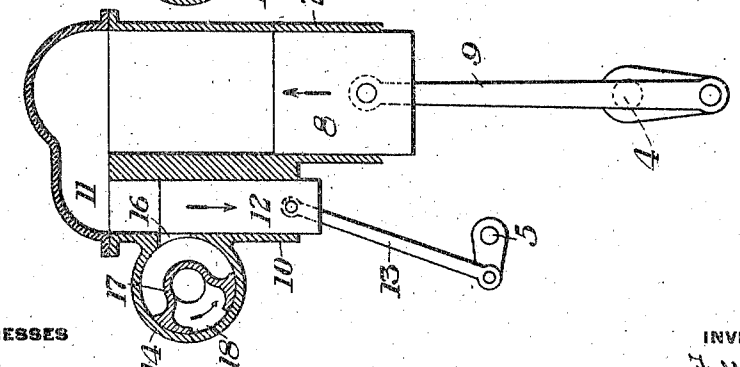


Fig 7



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5 SHEETS—SHEET 5.

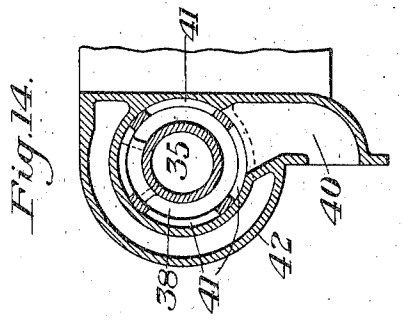


Fig. 14.

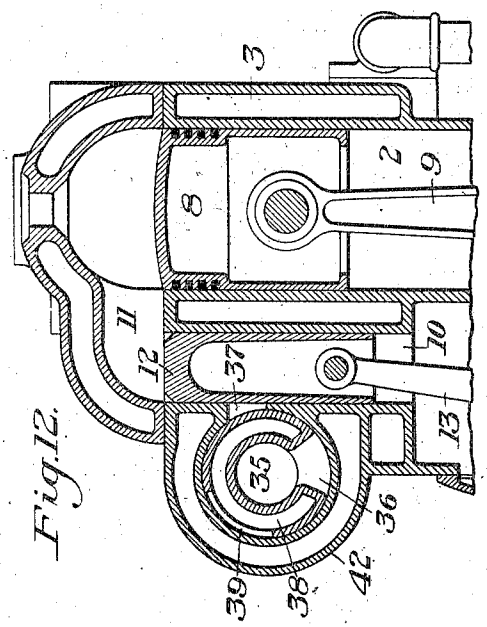


Fig. 12.

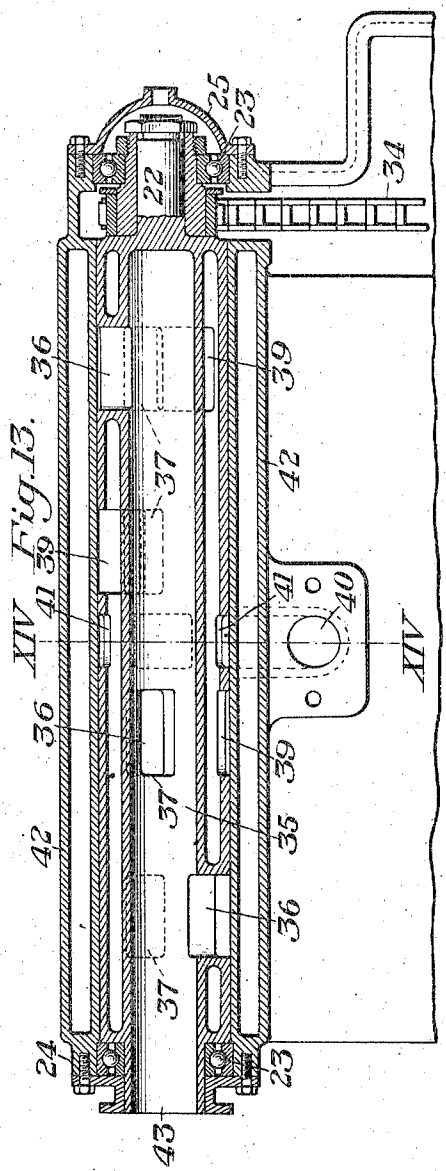


Fig. 13.

WITNESSES

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UNITED STATES PATENT OFFICE.

FRANCIS H. TREAT, OF CLEVELAND, OHIO.

EXPLOSIVE-ENGINE.

1,290,413. Specification of Letters Patent. Patented Jan. 7, 1919.

Application filed February 15, 1915. Serial No. 8,134.

To all whom it may concern:

Be it known that I, FRANCIS H. TREAT, a citizen of the United States, residing at Cleveland, Cuyahoga county, Ohio, have invented a new and useful Improvement in Explosive-Engines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a transverse vertical section of an engine embodying my invention, the plane of section being taken on the line I—I of Fig. 2.

Fig. 2 is a section on the irregular line II—II of Fig. 1, with some of the parts below the plane of section omitted.

Fig. 3 is a plan view of the rotary valve with its journal portions broken away.

Fig. 4 is a section on the line IV—IV of Fig. 3.

Figs. 5 and 6 are sections taken, respectively, on the lines V—V and VI—VI of Fig. 3.

Figs. 7, 8, 9 and 10 are diagrams showing four different positions of the valves relatively to one of the main pistons.

Fig. 11 is a longitudinal sectional view through the valve casing.

Fig. 12 is a sectional view similar to a portion of Fig. 1, but showing a modified constructon of the rotary valve.

Fig. 13 is a longitudinal section of the rotary valve of Fig. 12 and of its casing, and

Fig. 14 is a cross section on the line XIV—XIV of Fig. 13.

My invention has relation to explosive-engines of the general type described and claimed in my Patent No. 938,401 of October 26, 1909, in which a piston valve is employed to control a combined inlet and exhaust passage for the engine cylinder.

The present invention is designed to improve and simplify the valve mechanism whereby the engine is more particularly adapted for use on vehicles.

In accordance with my present invention the auxiliary cylinder, and the piston valve working in said cylinder and connected to the half-speed shaft, instead of being arranged at the end of the main cylinder, are arranged parallel with the axis of the main cylinder. I also provide in combination and coöperation with this piston valve a single auxiliary inlet and exhaust control valve, preferably of the rotary type, and which is common to a plurality of cylinders. I also so arrange the valve mechanism that the parts can be kept thoroughly and efficiently lubricated by a splash action in the main crank case.

My invention will be best understood by reference to the accompanying drawings, in which I have shown a preferred embodiment thereof and which will now be described, it being premised, however, that various changes can be made in the details of construction and arrangement of the parts without departing from the spirit and scope of my invention, as defined in the appended claims.

In these drawings I have shown my invention as applied to a multiple-cylinder engine having the four cylinders 2, 2^a, 2^b and 2^c. These cylinders are shown as provided with the usual water jackets 3. 4 is a main crank shaft of the engine and 5 a half-speed shaft which may be driven from a shaft 4 in any suitable manner, as by means of the gears 6 and 7 (shown in dotted lines in Fig. 1 and also shown in Fig. 2). 8 designates the main piston in the cylinder 2 and 9 its rod or pitman connecting it with the shaft 4. 10 designates the auxiliary cylinders which, as above stated, are placed parallel to the axis of the main cylinders, there being one of these auxiliary cylinders for each main cylinder. Each auxiliary cylinder communicates with the explosion chamber of the adjacent main cylinder by the passage 11. 12 designates the piston valve in one of the cylinders 10; and 13 its rod or pitman connecting it with a crank of the half-speed shaft 5.

14 designates a valve casing of general cylindrical form, preferably water jacketed, as indicated at 15, and which communicates with each auxiliary cylinder 10 by means of a port 16 at one side thereof. The rotary valve which works in the casing 14 is common to all four cylinders and consists of a hollow body portion 17 having the four ports 18 at equidistant intervals along its length and having their centers 90° apart circumferentially. Each end portion of this valve has a head 19 of cylindrical form; and in each of these heads is a circumferential groove 20 which comunicates with the interior of the hollow valve by a plurality of radial ports 21. Each end of the valve has

a journal extension 22 which is preferably mounted on ball bearings 23 in the casing portions 24, access to these bearings being had by the removable caps 25. The hollow end of the valve body is shown as closed by a screw plug 26. The valve casing 14 has a chamber 27 surrounding and in communication with each of the grooves 20. The explosive mixture is conducted into these chambers 27 from an inlet connection 28, which has a branch port 29 leading to each chamber 27. The valve casing 14 also has an exhaust port 30.

31 is a crank casing inclosing the half-speed shaft 5 and communicating at 32 with the main crank shaft casing 33. The opening at 32 is a large opening and sufficient lubricant will be splashed up through this opening from the main crank casing to keep the piston valve 12 and its cylinder thoroughly lubricated at all times. Some of this lubricant will also find its way into the bearings of the rotary valve.

The rotary valve may be driven in various ways, as by a chain connection 34 from the half-speed shaft 5 (see Figs. 1 and 2).

The operation is as follows:

The explosive mixture entering into the end chambers 27 of the rotary casing passes freely at all times into the interior of the rotary valve through the radial ports 21; and is discharged from this valve into the respective engine cylinders under control of the said valve and of the piston valve 12. The exhaust from the engine cylinders, under control of the rotary valve and the valves 12 passes out into the interior of the valve casing 14 into the space therein surrounding the rotary valve, and thence to the exhaust opening 30. The operation in each complete cycle for each cylinder will be best understood by reference to Figs. 7, 8, 9 and 10. Fig. 7 shows the parts in the position they occupy at the end of the explosive stroke and when the main piston 8 is substantially on or passing dead center. At this time, the auxiliary piston 12 of this cylinder is moving downwardly and is just about to uncover the port 16 leading into the valve casing 14; so that during the next instroke of the piston 8, the port 16 will be open for exhaust. At this time, the rotary valve is in position where its inlet port is cut off by the valve casing, as shown.

Fig. 8 represents the position of the parts at the end of the exhaust stroke and just as the main piston 8 is passing its in-center. At this time the piston valve 12 is moving in the reverse direction with the port 16 wide open and the inlet port 18 of the rotary valve just coming into register with said port 16.

Fig. 9 shows the position of the parts as the piston is passing its out-center after completing the inlet stroke. At this time, the inlet port 18 of the rotary valve is closed off and the piston valve is just about to close the port 16.

Fig. 10 shows the positions of the parts at the time of the explosion. At this time the piston valve is at the maximum of its out-stroke, completely closing the port 16 with a considerable overlap and its rod 13 being on dead center. This piston valve is, therefore, in its most effective position to receive in an endwise direction the force of the explosion.

In Figs. 12, 13 and 14, I have shown a modified construction of the rotary valve and its casing.

In the construction shown in these figures, the valve is provided with a central exhaust chamber 35 having a plurality of peripheral ports 36, the centers of which are approximately 90° apart and which are adapted to be successively brought into register with the ports 37 leading into the auxiliary cylinder. The valve also has a surrounding chamber 38 for the explosive mixture, with peripheral ports 39 also having their centers 90° apart and arranged to be successively brought into register with the ports 37 of the auxiliary cylinders. The explosive mixture is supplied to the chamber 38 from the admission chamber 40 through the peripheral admission ports 41, the chamber 40 opening through the water-jacketed casing 42. The explosive fluid flows into the chamber 38 which is kept constantly filled with the mixture and from thence into the respective cylinders at proper times. The exhaust in the cylinders goes through the ports 36 into the central chamber 35 and may be let off through a suitable connection with one end of the valve, at 43 (Fig. 13).

My invention provides a very simple and efficient valve mechanism for a multiple-cylinder four cycle engine. The piston valves receive the full force of the explosions, thus entirely relieving the rotary valve which has only to do with very light pressures and can be fitted to rotate freely in its end bearings. The piston valves also initially control the points of cut-off and exhaust. The entire construction is a simple and compact one well adapted to portable engines.

I claim:

1. In an explosive engine of the four-cycle type, a cylinder having an explosion chamber, a piston in said cylinder, presenting its end surface to the explosion chamber, an auxiliary cylinder forming an end connection with said explosion chamber so as to constitute a combined inlet and exhaust port leading therefrom, a combined inlet and exhaust port leading from one side of the auxiliary cylinder, and to a rotary valve chamber, said port extending transversely a distance of less than one-half the circum-

ference of the auxiliary cylinder, a piston in said auxiliary cylinder, also presenting its end surface to the explosion chamber, and having actuating connection arranged to move it to a position in which it will seal said port and the explosion chamber during the compression and the explosion periods, and a single rotary valve, in said rotary valve chamber, having separate inlet and exhaust ports, and a rotating connection whereby said ports will be alternately brought into registry with the aforesaid combined inlet and exhaust port each during the corresponding periods of the four stroke cycle, substantially as described.

2. In an explosive engine of the four-cycle type, a cylinder having a single combined inlet and exhaust port leading into its explosion chamber, a piston therein, an auxiliary cylinder at one side of the main cylinder and having its axis extending in the same general direction as the axis of the main cylinder and with an end of which the said port connects, a piston in said auxiliary cylinder, the last named piston having actuating connections arranged to move it to a position in which its end surface will seal the said port and explosion chamber during the compression and explosion periods of the engine, a combined inlet and exhaust port leading from one side of the auxiliary cylinder, and a single rotary valve controlling said port and having inlet and exhaust ports, said port extending transversely a distance less than one-half the circumference of the auxiliary piston, substantially as described.

3. In an explosive engine of the four-cycle type, a cylinder having a single combined inlet and exhaust port leading into its explosion chamber, a piston therein, an auxiliary cylinder at one side of the main cylinder and having its axis extending in the same general direction as the axis of the main cylinder and with an end of which the said port connects, a piston in said auxiliary cylinder, the last named piston having actuating connections arranged to move it to a position in which its end surface will seal the said port and explosion chamber during the compression and explosion periods of the engine, a combined inlet and exhaust port leading from one side of the auxiliary cylinder, and a single rotary valve controlling said port and having inlet and exhaust ports, said auxiliary cylinder being open at its inner end and communicating through a closure with the lubricant chamber of the crank case of the main cylinder, substantially as described.

In testimony whereof, I have hereunto set my hand.

FRANCIS H. TREAT.

Witnesses:
HARRY R. TEMPLETON,
KENNETH R. KING.