No. 890,532. PATENTED JUNE 9, 1908.

A. P. SCHMUCKER.

EXPLOSIVE ENGINE.

APPLICATION FILED JAN. 14, 1905.

4 SHEETS—SHEET 1.

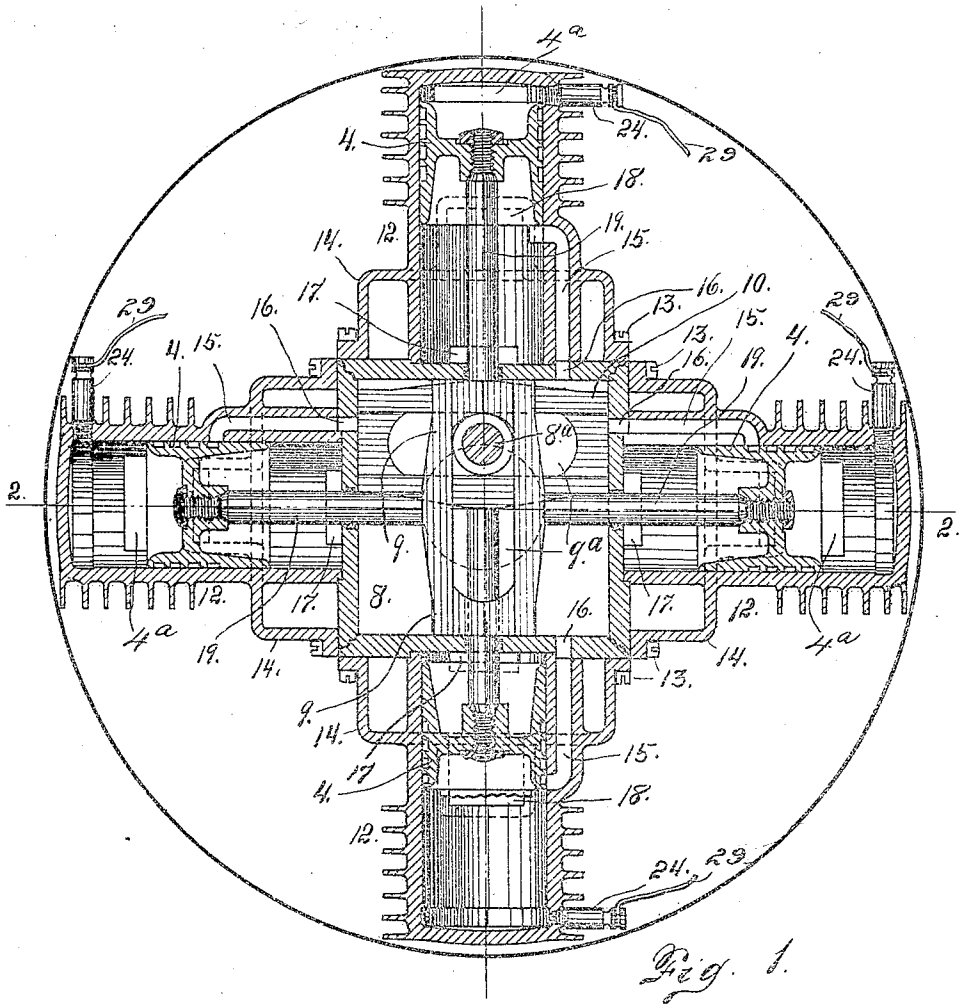


Fig. 1.

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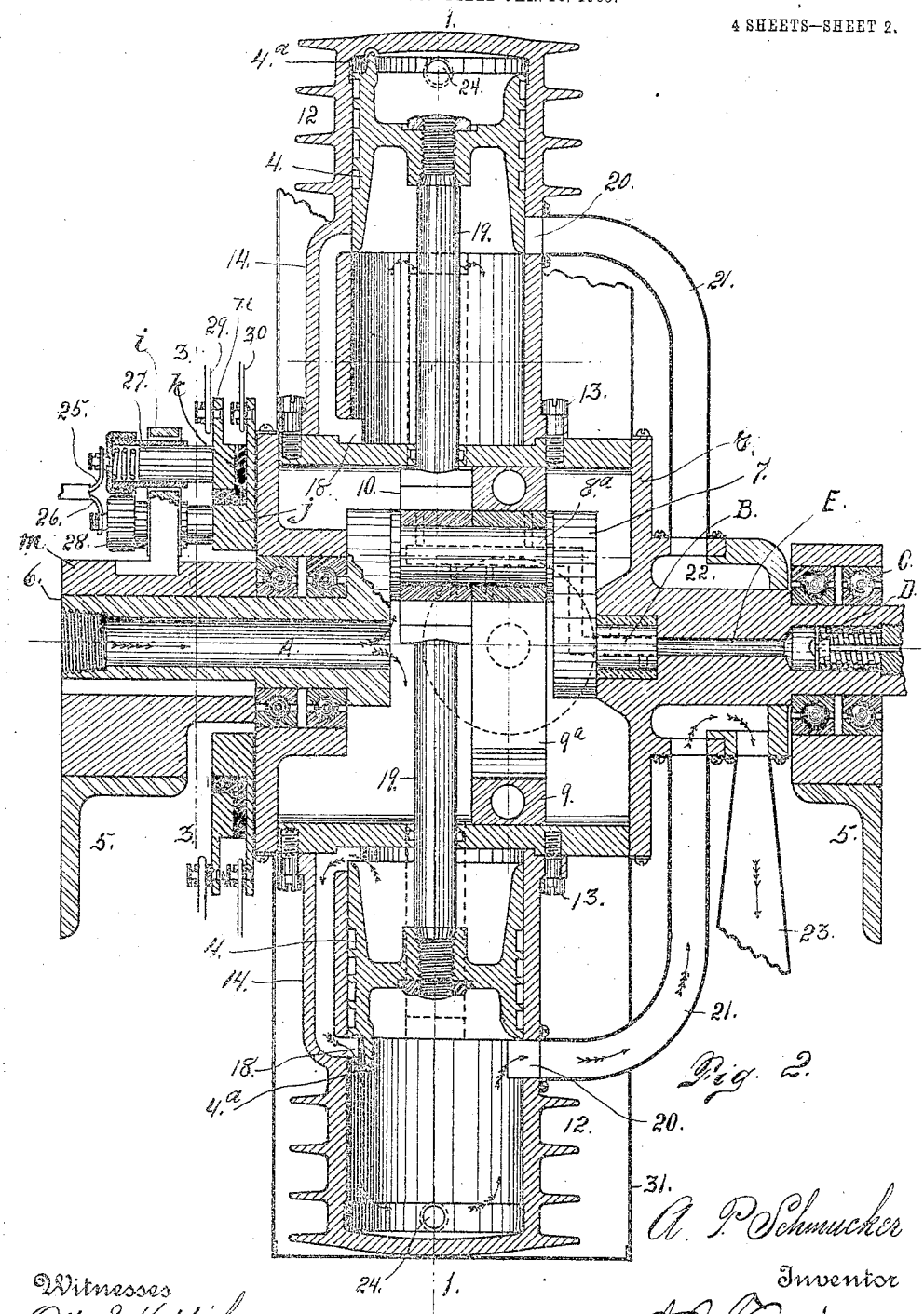


Fig. 2.

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4 SHEETS—SHEET 3.

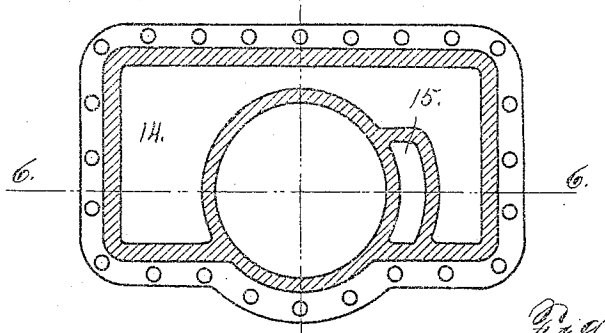


Fig. 5.

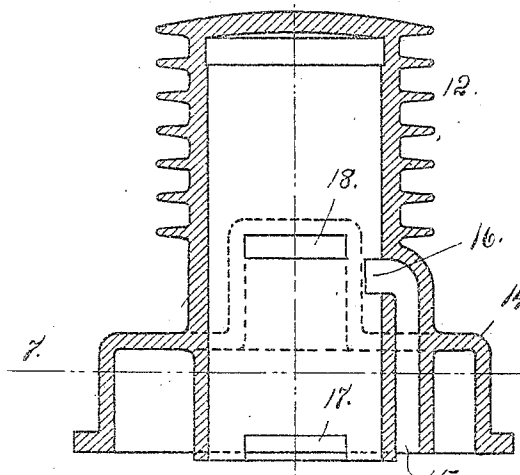


Fig. 4.

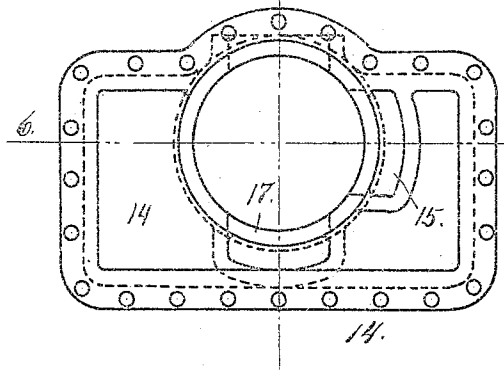


Fig. 3.

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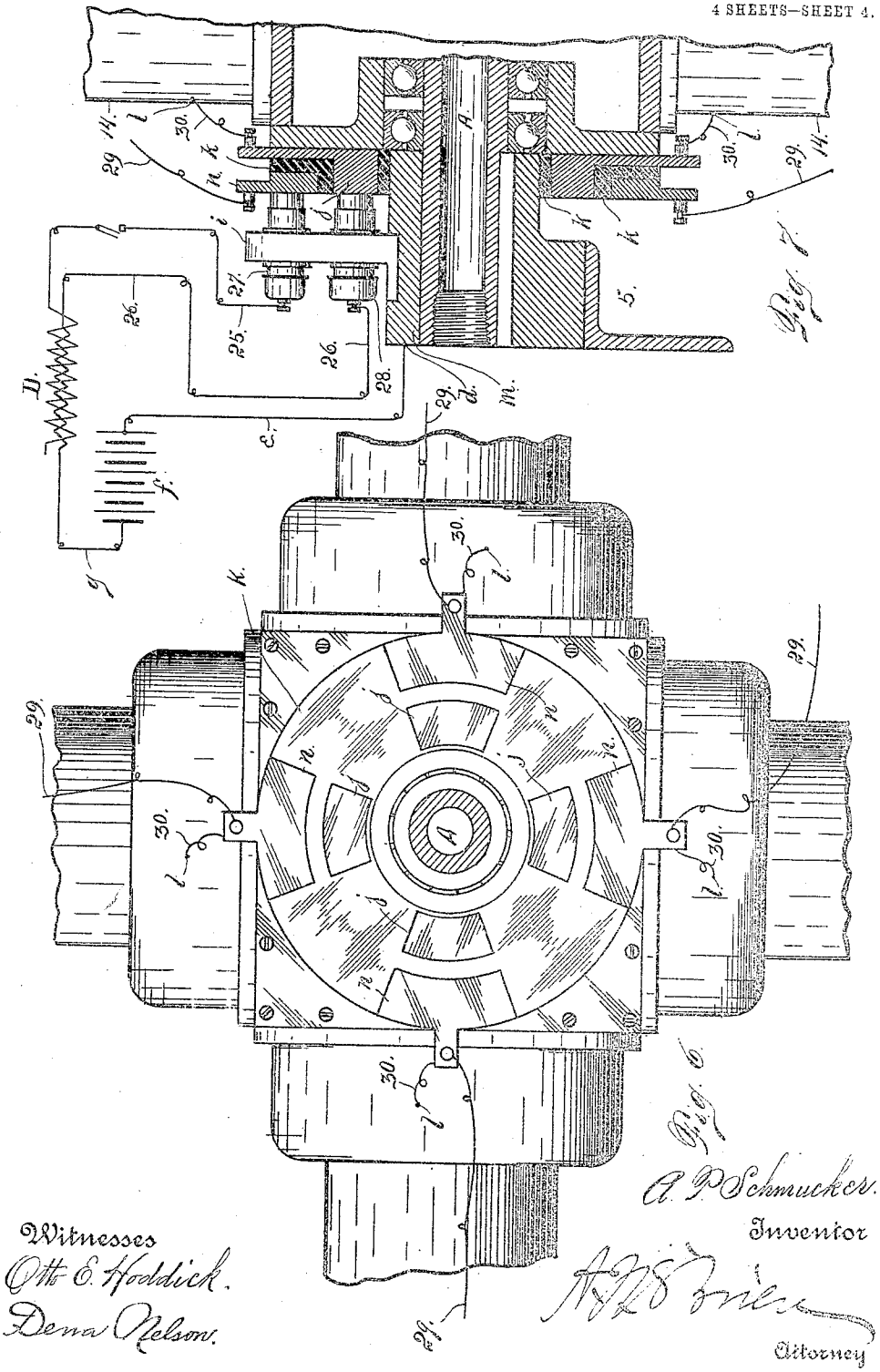
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4 SHEETS—SHEET 4.



Witnesses
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Dena Nelson.

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UNITED STATES PATENT OFFICE.

ALFRED P. SCHMUCKER, OF DENVER, COLORADO.

EXPLOSIVE-ENGINE.

No. 890,532. Specification of Letters Patent. Patented June 9, 1908.

Application filed January 14, 1905. Serial No. 241,119.

To all whom it may concern:

Be it known that I, ALFRED P. SCHMUCKER, a citizen of the United States, residing in the city and county of Denver and State of Colorado, have invented certain new and useful Improvements in Explosive-Engines; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

My invention relates to explosive engines and consists of a multiple cylinder two cycle construction, each cylinder having an auxiliary chamber communicating therewith, in which the explosive mixture is compressed. The gas or explosive fluid, is introduced to the crank chamber and when any piston is at its outward limit of movement, the said fluid escapes from the crank chamber into the cylinder in the rear of the piston, and also enters the auxiliary chamber through a port at the inner extremity of the cylinder. During the return stroke of the piston, the explosive fluid is compressed in the inner extremity of the cylinder and in the auxiliary chamber, and when the piston reaches its inward limit of movement, a port leading from the auxiliary chamber is uncovered whereby the compressed fluid is allowed to enter the cylinder forward or outside of the piston. Then during the outward movement of the piston the last named port is closed and the explosive mixture compressed in the outer extremity of the cylinder where the explosion takes place through the instrumentality of suitable sparking mechanism. In the construction herein shown and described, it is intended that the cylinder and crank chamber with which they are connected shall rotate around a stationary crank shaft, though it must be understood that the cylinders may be stationary whereby the crank shaft is caused to rotate, if desired.

Having briefly outlined my improved construction as well as the function it is intended to perform, I will proceed to describe the same in detail reference being made to the accompanying drawing in which is illustrated an embodiment thereof.

In this drawing, Figure 1 is a vertical section taken through a four cylinder engine of my improved construction. This section is taken approximately on the line 1—1 of Fig. 2. Fig. 2 is an enlarged section taken through the engine at right angles to Fig. 1. The section line of Fig. 2 is indicated by line 2—2 Fig. 1. Fig. 3 is an inner end view of a cylinder and an auxiliary chamber shown on a larger scale than in Fig. 1. Fig. 4 is a section taken on the line 6—6 Figs. 3 and 5. Fig. 5 is a section taken on the line 7—7 Fig. 4. Fig. 6 is a fragmentary detail view of the engine as it would appear from a point at the left of Fig. 2 looking at said figure toward the right, the brushes, however, being removed to better illustrate the contact plates engaged by them. Fig. 7 is a fragmentary sectional view similar to the left hand part of Fig. 2, a source of electricity, and an induction coil and the circuit wires, however, being shown.

The same reference characters indicate the same parts in all the views.

Let the numeral 5 designate a suitable frame or support, in which is mounted a shaft 6 having a crank 7 located in a crank chamber 8 in which are located two slotted yokes 9 and 10 occupying positions at right angles to each other and in different planes. The crank pin 8^a of the crank shaft, passes through the slots of the yokes, the said slots occupying positions at right angles to each other and being designated by the reference character 9^a in each case. This crank chamber as shown in the drawing is square and the yoke extremities engage its opposite sides, the said yokes being disposed as heretofore explained. Respectively connected with the four sides of the crank chamber, are four cylinders 12, the cylinders being secured to the chamber by suitable fastening devices as screws 13. Each cylinder is provided with an auxiliary chamber 14 the said chamber being formed integral with the cylinder as shown in the drawing.

Each cylinder is provided with a passage 15 registering with a port 16 in the crank chamber. This passage 15 leads outwardly from the crank chamber, its outer extremity communicating with the cylinder at a point immediately in the rear of the piston 4 when the latter is at its outward limit of movement, whereby the gas or other explosive

fluid is allowed to enter the cylinder in the rear of the piston when the latter is in the position stated. As soon, however, as the piston begins its return or inward movement, the passage 15 is cut off from communication with the cylinder and this condition continues until the piston has again reached its outward limit of movement. The auxiliary chamber 14 communicates with the cylinder by two ports designated 17 and 18, respectively. The port 17 is the innermost port being located adjacent the crank chamber, and is partly open even when the piston is at its inward limit of movement, whereby the explosive mixture is compressed in the auxiliary chamber and the inner extremity of the cylinder during the inward movement of any piston, and while the cylinder is cut off from communication with the crank chamber. The port 18 forms a communication between the auxiliary chamber and the cylinder when the piston is at its inward limit of movement, whereby the compressed explosive mixture is allowed to escape from the auxiliary chamber into the outer extremity of the cylinder, in front of the piston whereby it is compressed as the latter moves outwardly and closes the port 18, the compression continuing until the cylinder reaches its outward limit of movement and the explosion takes place through the instrumentality of suitable devices.

The two pistons of each pair of oppositely-disposed cylinders, are connected with the opposite sides of a yoke 9 by piston stems 19 which are rigidly connected both with the pistons and the yoke.

The explosive fluid is introduced into the crank chamber through a longitudinal passage A formed in the crank shaft 6. The opposite extremity of the crank shaft is provided with a longitudinal passage B through which oil or other lubricating material is introduced to the bearing parts from a duct E formed in the crank chamber casing and communicating with a chamber C in which is located a spring-actuated piston D whereby the oil is automatically forced through the duct E.

When the machine is in operation the crank chamber and the cylinders rotate on the crank shaft, the structure being provided with suitable ball bearings to diminish friction.

Each cylinder is provided with an exhaust port 20 located immediately beyond the piston when the latter is at its inward limit of movement. An exhaust passage 21 registers at one extremity with the port 20, its opposite extremity communicating with an exhaust chamber 22 formed in the crank chamber casing but having no communication with the crank chamber. All four cylinders are connected with the same exhaust chamber, and the exhaust escapes from the said chamber through an exhaust outlet or conduit 23.

The outer extremity of each cylinder is provided with a sparking plug 24 which may be suitably connected with an electrical circuit for producing a spark in the outer extremity of each cylinder at or approximately at the moment of greatest compression or when the piston has reached its outward limit of movement. The engine is equipped with suitable means for automatically producing a spark in the extremity of each cylinder at the proper instant but this mechanism will not be described in detail. By referring, however, to Fig. 2 it will be observed that two conductors 25 and 26 are respectively connected with metal contacts or brushes 27 and 28, whereby as the cylinders and crank chamber rotate, the circuits are closed through the instrumentality of conductors 29 and 30.

The sparking mechanism will now be explained more in detail, special reference being made to Figs. 6 and 7. Starting at the batteries *f*, the low tension current is conducted by the wire *g* to the inner or low tension coil of the induction coil D, then through the low tension coil into the wire 26 which conducts the low tension current to the brush 28. The brush 28 is properly insulated to keep the current from being conducted to the arm or brush holder *i*. As the engine rotates, the brush 28 comes in contact with the contact plate *j*, which is set into a piece of insulating material *k* in order to insulate the plates *j* and *n* from each other. The plate *j* being in contact with the engine frame, the current passing through this plate will be grounded as a matter of course. In order to make this fact more clear, the plate *j* is shown connected with the engine frame by a wire 30 at a point *l* (see Figs. 6 and 7). By virtue of this construction and arrangement, at intervals controlled by the rotation of the engine, the current goes through the engine. The wire *e* which is grounded to the engine at a point *d*, then conducts the current back to batteries *f* making a complete low tension circuit.

The high tension current starts in the induction coil D caused by the induction of the current from the inner coil or the low tension coil to the outer coil or the high tension coil. The wire 25 being connected to the high tension coil conducts the high tension current to brush 27. The brush 27 is properly insulated to keep the current from being conducted to anything other than the high tension contact plates *n*. The contact plates *n* being set in the insulating disk or plate *k*, rotate with the engine, causing a contact between the brush 27 and one of the contact plates *n*. The wire 29 conducts the

high tension current to a jump spark plug 24, (see Figs. 1 and 2) which is in turn grounded to the engine.

When any piston reaches the outer end or approximately the outer end of every stroke and has the mixture under pressure, it is the proper time for the explosion to occur in the outer end of the cylinder. When the piston is in the above position, the brush 28 or the low tension brush is in contact with the low tension contact plate *j* which is grounded to the engine. At the same time the high tension brush 27 is in contact with a high tension contact plate *n* which is connected to the jump spark plug 24 in the cylinder in which the explosion is to occur. Then when the brushes 27 and 28 are in contact with their respective contact plates, a complete circuit is formed; and when brushes 27 and 28 reach their respective contact plates *n* and *j*, a spark is made in the explosion chamber of the cylinder by means of the jump spark plug.

From the foregoing description the use and operation of my improved engine will be readily understood. Assuming that the crank shaft is stationary, as the explosions occur in the cylinders, the latter together with the crank chamber are caused to rotate around the crank shaft. As each two opposite pistons are connected with the same yoke, these pistons are alternately at their inner and outer limits of movement. In other words the explosions take place alternately in each pair of oppositely disposed cylinders; and when one piston of each pair is at its outward limit of movement and the other piston at its inward limit of movement, the two pistons of the other cylinders are centrally located in their cylinders one moving outwardly and the other inwardly (see Fig. 1 of the drawing).

By the use of the auxiliary chambers connected with the cylinders as aforesaid, an important function is subserved, since it allows the making of the cylinders of much less length, whereby an engine of a given power may be constructed of comparatively small size.

As any piston moves outwardly it produces suction behind it or between itself and the crank chamber and within the auxiliary chamber whereby the explosive mixture is drawn from the crank chamber through the passage 15 into the cylinder behind the piston and into the auxiliary chamber, as soon as the piston reaches its outward limit of movement, at which time the outer extremity of the passage 15 is uncovered by the piston. At this time the port 18 communicating with the auxiliary chamber is closed. Now as the piston begins its inward movement, it immediately cuts off the passage 15 from communication with the cylinder, and then compresses the explosive mixture in the rear extremity of the cylinder and the auxiliary chamber, and as soon as the piston reaches its inward limit of movement, this compressed explosive mixture enters the cylinder forward of the piston by way of the port 18 as heretofore explained. Also as soon as the piston reaches its inward limit of movement, the exhaust from the cylinder takes place through the passage 21, the said passage and its port 20 being comparatively large whereby the exhaust takes place rapidly, as the explosive mixture enters the cylinder from the auxiliary chamber by way of the port 18. This is a two-cycle engine, that is to say an explosion occurs in each cylinder for every complete revolution; and there being four cylinders there will of course be four explosions every time the engine makes a complete revolution.

Attention is called to the fact that the outer extremity of each piston is provided with a projection 4^a forming a sort of baffle plate adapted to direct the explosive mixture toward the outer end of the cylinder as it enters the cylinder from the auxiliary chamber, whereby the said mixture has a tendency to clean out the cylinder or drive out the products of combustion resulting from the explosion immediately preceding. The direction of the gas as it enters the cylinder under the circumstances stated, is indicated by the arrows in Fig. 2. This action of the gas entering the cylinder aids in obtaining a thorough exhaust.

Having thus described my invention, what I claim is:

1. In an explosive engine, the combination of a common crank chamber, a charge inlet therefor, a number of cylinders connected therewith, each cylinder having an auxiliary chamber provided with two ports communicating with the cylinder, one port being at the inner extremity of the cylinder and the other in position to be uncovered when the piston is at its inward limit of movement, for the escape of the explosive mixture into the outer extremity of the cylinder, the said mixture having been compressed in the auxiliary chamber during the inward movement of the piston.

2. In a multiple cylinder two-cycle explosive engine, the combination of the common crank chamber, a charge inlet therefor, cylinders connected therewith, each cylinder having an auxiliary chamber communicating with the cylinder by two separated ports, one port being at the inner extremity of the cylinder and open to allow the explosive mixture to be compressed in the auxiliary chamber during the inward movement of the piston, and the other in position to be uncovered when the piston is at or approximately at its inward limit of movement, the

cylinder communicating with the crank chamber by a suitable passage when the piston is at its outer limit of movement, the said passage being closed at its cylinder end as the piston begins its inward stroke, each cylinder being also provided with an exhaust passage open when the piston is at its inward limit of movement, but closed by the piston when the latter begins its outward stroke.

3. In an explosive engine, the combination of a common crank chamber, a charge inlet therefor, a crank shaft passing through said chamber, two slotted yokes located in the chamber and disposed at right angles to each other, the crank of the shaft engaging the slots of both yokes, four cylinders connected with the opposite sides of the crank chamber, and pistons in the cylinders, the stems of the two pistons in each pair of oppositely located cylinders, being rigidly connected with one of the yokes, each cylinder having an auxiliary chamber provided with ports in communication with the respective ends of its cylinder, the inner port being open to allow the explosive mixture to be compressed in the auxiliary chamber during the inward stroke of the piston, the outer port being closed until the piston has completed or approximately completed its inward stroke, the crank chamber having a passage communicating with the cylinder when the piston is at its outward limit of movement, the said passage being cut off from the cylinder at all other times.

4. In an explosive engine, the combination of a common crank chamber, a charge inlet therefor, a number of cylinders mounted thereon, pistons in the cylinders, each cylinder having an auxiliary chamber communicating with the cylinder by inner and outer ports, the outer ports being controlled by the pistons, the last named ports being closed except when the pistons are at or approximately at their inner limit of movement, the inner port being in communication with the cylinder to allow the explosive mixture to be compressed therein during the inward movement of the piston, each cylinder having a passage communicating with the crank chamber when the piston is at its outward limit of movement, and an exhaust passage open when the piston is at or approximately at its inward limit of movement, the arrangement being such that an explosion occurs in each cylinder during each revolution.

5. In an explosive engine, the combination of a crank chamber, a charge inlet therefor, a cylinder connected therewith and having an auxiliary chamber provided with two ports communicating with the cylinder, one port being at the inner extremity of the cylinder and the other in position to be uncovered when the piston is at or approximately at its inward limit of movement, for the escape of the explosive mixture into the outer extremity of the cylinder, the said mixture being compressed in the auxiliary chamber during the inward movement of the piston, the crank chamber being in communication with the cylinder when the piston is at or approximately at its outward limit of movement, the cylinder, however, being at all other times cut off from the crank chamber.

6. An explosive engine having a crank chamber, a charge inlet therefor, a cylinder provided with an auxiliary chamber in communication with the cylinder to allow the explosive mixture to be compressed in the auxiliary chamber at each inward stroke of the piston, the cylinder being in communication with the crank chamber when the piston is at or approximately at its outward limit of movement, the cylinder, however, being cut off from the crank chamber at all other times.

7. An explosive engine provided with a common crank chamber, a charge inlet therefor, a number of cylinders each being provided with an auxiliary chamber in connection with the cylinder to allow the explosive mixture to be compressed in the auxiliary chamber during the inward movement of the piston, the auxiliary chamber being open to allow the compressed fluid to enter the cylinder at the outer extremity of the piston when the latter is at its inward limit of movement.

8. An explosive engine provided with a common crank chamber, a charge inlet therefor, and a number of cylinders disposed about the crank chamber, each cylinder being in communication with the crank chamber to receive a supply of explosive mixture when its piston is at its outward limit of movement, but cut off therefrom at all other times, each cylinder having an auxiliary chamber, the latter having inner and outer ports communicating with the cylinder, the inner port being open to allow the explosive mixture to enter the auxiliary chamber from the cylinder and be compressed therein during the inward travel of the piston; and the outer port being open to allow the compressed mixture to enter the cylinder at the outer extremity of the piston when the latter is at its inward limit of movement, the said outer port being at all other times cut off from communication with the cylinder.

9. A two cycle explosive engine composed of a common crank chamber, a charge inlet therefor, cylinders disposed about the chamber, the chamber and cylinders being mounted to rotate, the explosions occurring in the several cylinders successively, there being an explosion in each cylinder during every revolution of the engine, the cylinders being respectively provided with auxiliary chambers in which the explosive mixture is compressed.

as the pistons move inwardly, the auxiliary chambers being in communication with the respective cylinders at the outer extremities of the pistons when the latter are at their inward limit of movement, but cut off therefrom at all other times, each cylinder being in communication with the crank chamber at the inner extremity of its piston when the latter is at its outward limit of movement, and means for maintaining a supply of explosive mixture in the crank chamber.

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

ALFRED P. SCHMUCKER.

Witnesses:
DENA NELSON,
A. J. O'BRIEN.