G. J. ALTHAM.

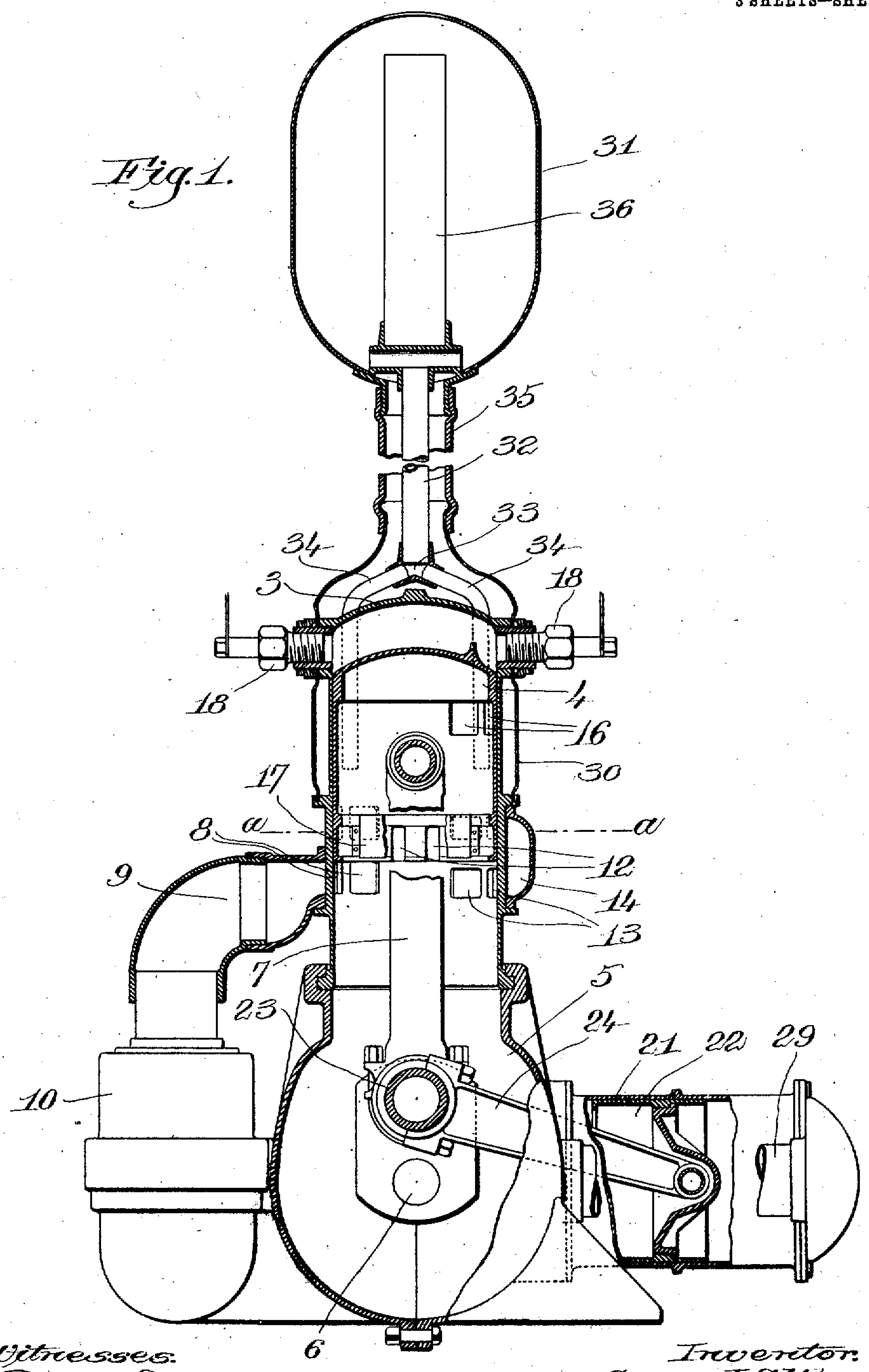
INTERNAL COMBUSTION ENGINE.

APPLICATION FILED MAR. 28, 1907.

962,110. Patented June 21, 1910.

3 SHEETS—SHEET 1.

Fig. 1.



Witnesses:
Thomas J. Drummond
Joseph M. Ward.

Inventor:
George J. Altham,
by Emery & Gregory Attys.

G. J. ALTHAM.

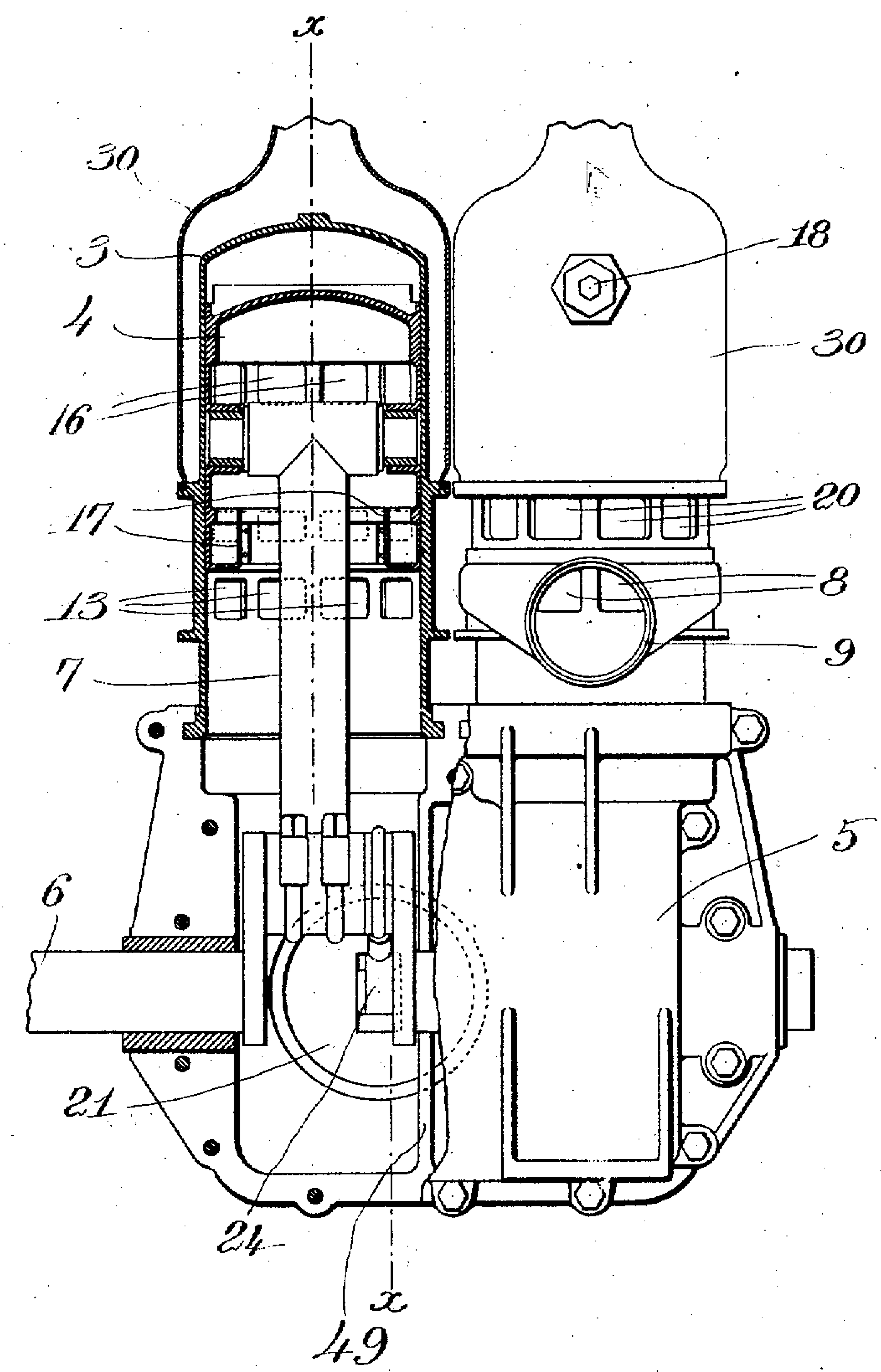
INTERNAL COMBUSTION ENGINE.

APPLICATION FILED MAR. 28, 1907.

962,110. Patented June 21, 1910.

3 SHEETS—SHEET 2.

Fig. 2.



Witnesses
Thomas J. Drummond
Joseph M. Ward.

Inventor.
George J. Altham,
by Emery, Booth, Gregory attys.

962,110. **Patented June 21, 1910.**

Fig. 3.

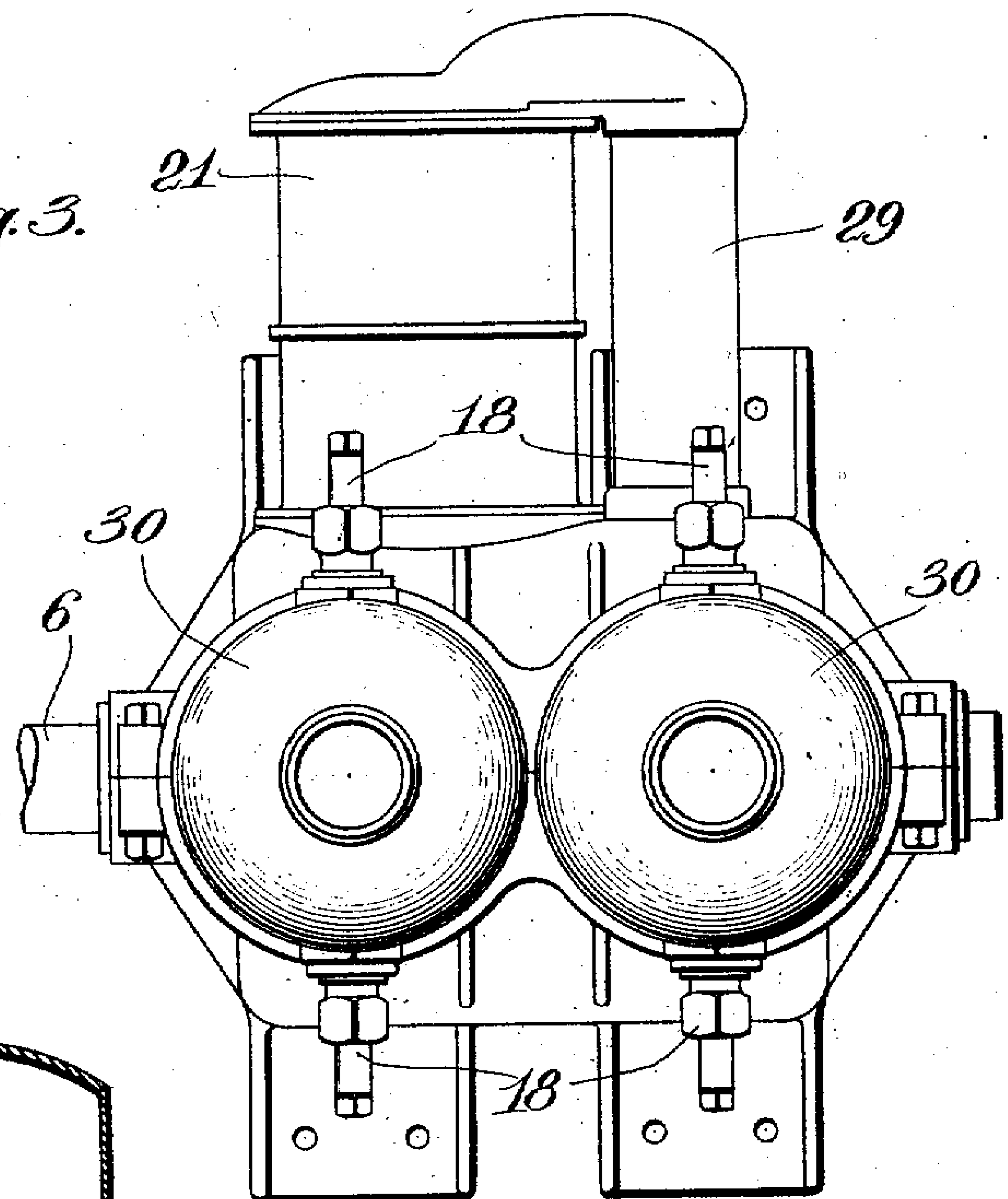


Fig. 5.

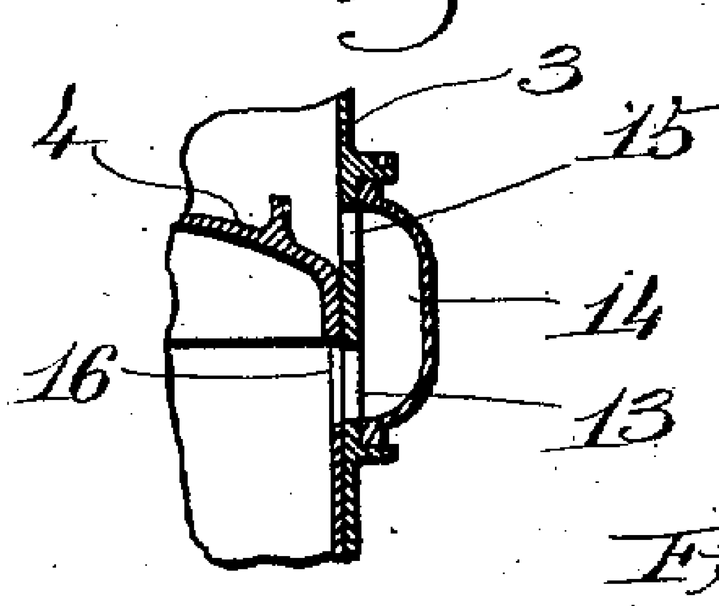


Fig. 6.

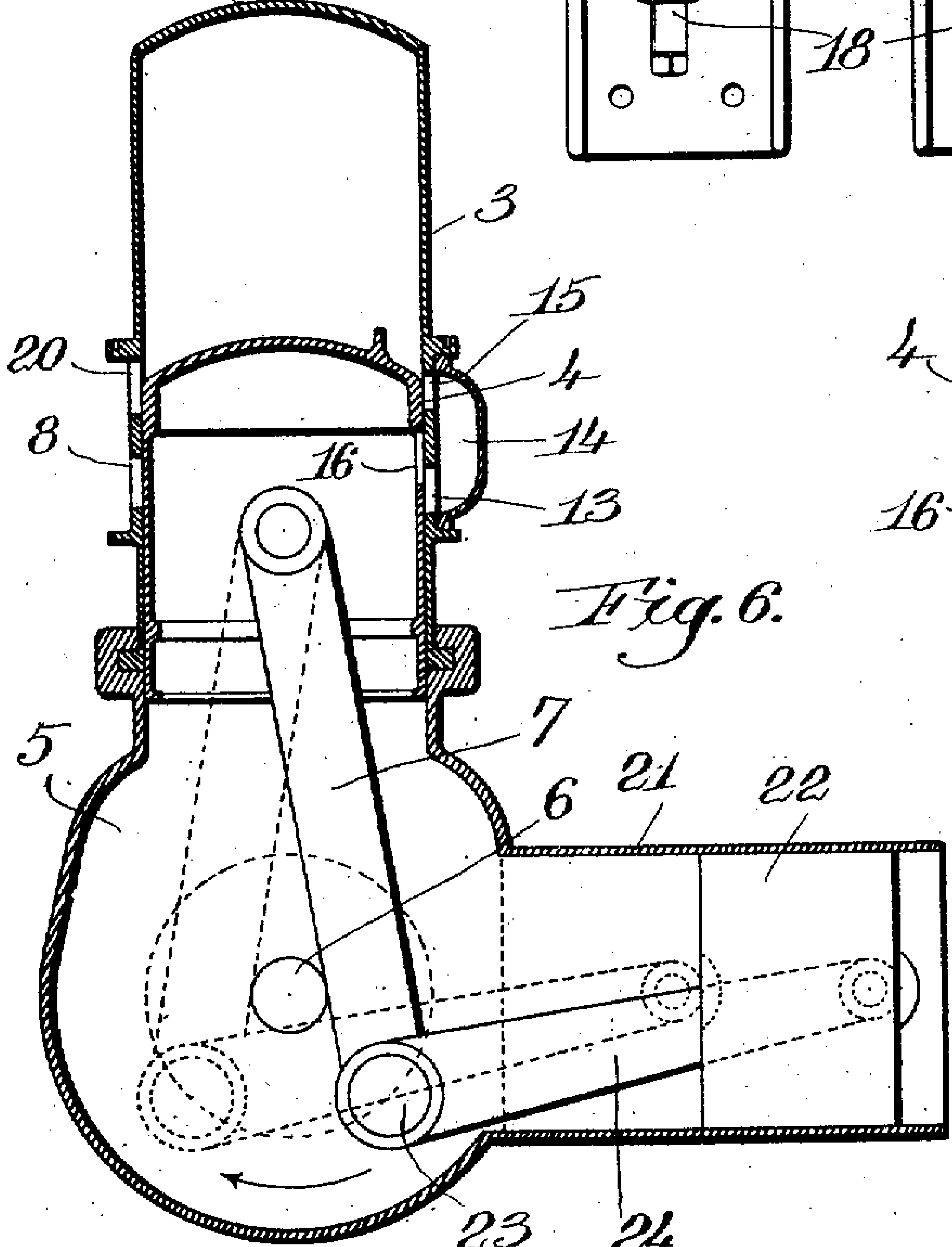
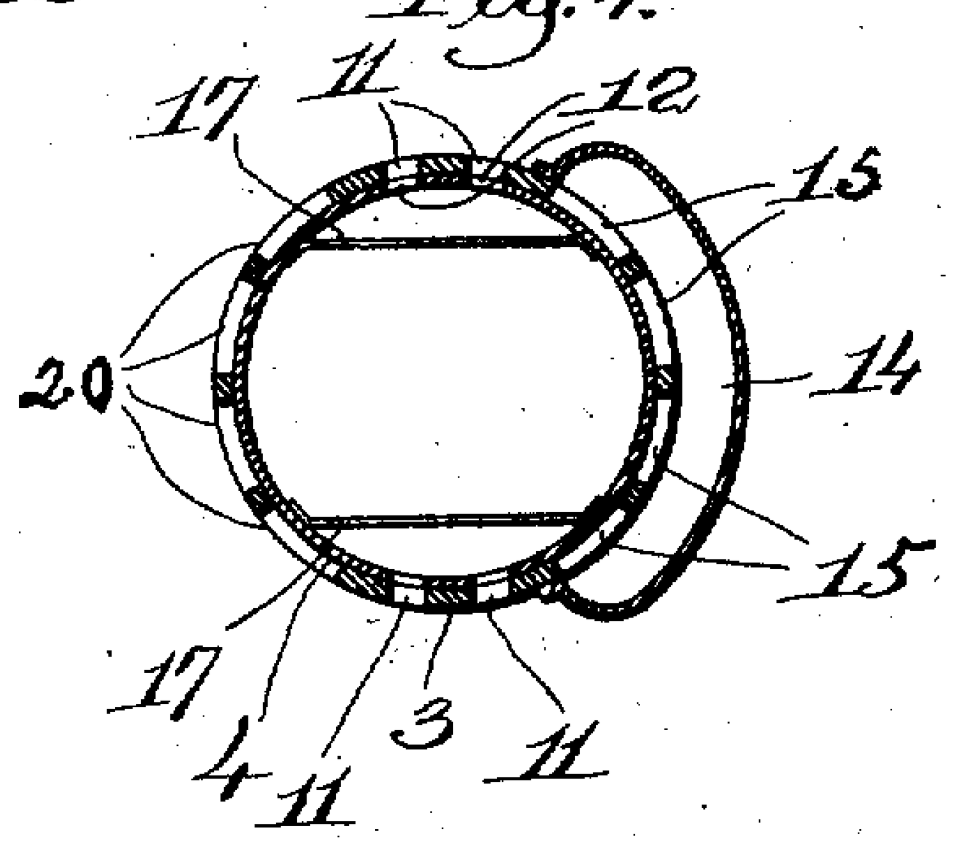


Fig. 4.



Witnesses.
Thomas J. Drummond.
Joseph M. Ward.

Inventor.
George J. Altham,
by Crosby & Gregory, attys.

UNITED STATES PATENT OFFICE.

GEORGE JOHN ALTHAM, OF FALL RIVER, MASSACHUSETTS.

INTERNAL-COMBUSTION ENGINE.

962,110. Specification of Letters Patent. Patented June 21, 1910.

Application filed March 28, 1907. Serial No. 364,980.

To all whom it may concern:

Be it known that I, GEORGE J. ALTHAM, a citizen of the United States, residing at Fall River, county of Bristol, State of Massachusetts, have invented an Improvement in Internal-Combustion Engines, of which the following description, in connection with the accompanying drawing, is a specification, like numerals on the drawing representing like parts.

This invention relates to internal combustion engines, and especially to engines of the two-cycle type.

Two-cycle internal combustion engines are usually constructed so that during the outward movement of the piston a charge of air and gas is drawn into the crank case, which charge is compressed more or less during the power stroke, and at the end of the power stroke suitable ports are opened to permit said charge to be transferred to the working end of the cylinder. It is rather difficult, however, with this construction to handle a sufficiently large volume of gas at each stroke of the engine to get a good explosive mixture at the time of ignition, and it is one of the objects of my invention to provide means whereby an increased volume of gas and air can be thus handled at each stroke of the engine thereby securing a much better explosive mixture and more economy in the operation of the engine. In the present embodiment of my invention I accomplish this by making the crank case of variable volume and providing means for increasing the volume thereof when the power piston is at the outer end of its stroke and when the inlet ports to the crank case are open whereby an increased volume of air and gas may be drawn into the crank case. This mechanism also operates to reduce the volume of the crank case at the end of the power stroke thereby assisting materially in transmitting the charge from the crank case to the working end of the cylinder without the necessity of putting the charge in the crank case under any considerable pressure.

I will first describe one embodiment of my invention and then point out the novel features thereof in the appended claims.

In the drawings, Figure 1 is a vertical section on the line *x—x*, Fig. 2, showing one embodiment of my invention; Fig. 2 is a side view of an engine embodying my invention showing one of the cylinders in section at right angles to the section in Fig. 1; Fig. 3 is a top plan view; Fig. 4 is a section on the line *a—a*, Fig. 1; Fig. 5 is a detail showing the piston at the end of the power stroke; Fig. 6 is a diagram view.

I have merely for the sake of illustration shown herein a two-cylinder engine, although I wish it understood that my invention is not limited to a two-cylinder engine, but may be embodied in a single-cylinder engine.

The two cylinders and their ports are alike, and so a description of one will suffice for both.

3 is the cylinder within which the piston 4 works as usual. The lower end of the cylinder communicates with the crank case 5 and the piston 4 is shown as connected to the crank shaft 6 by means of the pitman 7. These parts may be of any suitable or usual construction except in the particulars hereinafter described. The cylinder is provided on one side with the inlet ports 8 which communicate by means of a connection 9 with a carburetor 10 of any suitable or usual pattern, and the inlet ports 8 are controlled by the piston and are so arranged that when the piston is in its extreme upper position, as shown in Fig. 1, said ports are uncovered. The cylinder also has therein air-inlet ports 11, two such ports being shown on each side of the cylinder which are also controlled by the piston, and the piston 4 has therein other inlet ports 12 which are adapted to register with the air inlet ports 11 when the piston is elevated, as seen in Fig. 1 so that the ports 8 and 11 are opened simultaneously. Although I have shown these air inlet ports 11 and 12 on both sides of the piston and cylinder, such construction is not essential. The cylinder is also provided with outlet ports 13 which lead to the transfer chamber 14 and with other ports 15 also communicating with the transfer chamber 14, and the piston 4 is provided with outlet ports 16 situated to register with the outlet ports 13 at the end of the power stroke.

Situated in front of the ports 12 are deflectors 17 which serve to deflect the air as it enters the cylinder upwardly to the upper part of the piston, and as a result when the charges of air and of explosive mixture have been drawn into the cylinder, the air will be situated at the upper part of the piston, while the explosive mixture drawn from the carbureter will be located in the lower part of the cylinder and in the crank case. Of course, these charges will mix together somewhat at a point between the upper and lower ends of the cylinder, but the upper end of the piston will contain the air and the lower end of the cylinder and the crank case the explosive charge.

Two-cycle engines are usually so constructed that the explosive charge is first drawn into the crank case when the piston is at the upper end of the stroke and then is transferred to the working end of the cylinder when the piston is at the end of the power stroke. It is difficult, however, with the engines as usually made, to handle a sufficiently large volume of explosive charge at each stroke to make a good explosive mixture in the working end of the power cylinder at the time of ignition. I have aimed to overcome this difficulty by providing means for increasing the volume of the crank case at the time when the explosive charge is drawn into it whereby a larger charge may be thus drawn into the crank case, and I also propose to reduce or decrease the volume of the crank case when the piston is at the end of the power stroke thereby to assist the transfer of the charge to the working end of the cylinder, and to accomplish this transfer without unduly compressing the charge in the crank case.

In the present embodiment of my invention the crank case has connected therewith a chamber 21 in the form of a cylinder within which operates a displacer piston 22. This piston may be operated in any suitable way, but for the sake of convenience I have shown it as connected to the crank 23 on the crank shaft 6 by means of a pitman 24.

Referring to Fig. 1 it will be seen that when the power piston 4 is at the end of its outward stroke, the displacer piston 22 will be at the inner end of its stroke and that while the power piston remains substantially stationary at the outer end of its stroke with the air inlet ports 11, 12 open and the inlet ports 8 also open, the displacer piston 22 has its maximum backward movement, thereby materially increasing the volume of the crank case, this being due to the fact that the power cylinder and the cylinder 21 are arranged at right angles to each other with their pistons both connected to the same crank. Furthermore it will be seen that while the power piston is descending and having its maximum movement, the displacer piston has comparatively little movement, and when the power piston has reached the end of its power stroke, as seen in Fig. 6, and the crank is passing the dead center the displacer piston 22 has its maximum inward movement, as shown from full to dotted lines Fig. 6. The volume of the crank case is, therefore, materially increased when the power piston is at the upper end of its stroke and when the inlet ports to the crank case are open for the admission of air and gas, and when the piston is at the end of its power stroke and the ports leading to the transfer chamber 14 are open, the volume of the crank case is materially decreased. The result of this construction is that when the power piston is at the outer end of its stroke and the inlet ports 11, 12 and 8 to the crank case are open a charge of air and a charge of explosive mixture from the carbureter will be drawn into the crank case beneath the piston both by the suction caused by the outward movement of the piston, as usual, and also by added suction caused by the outward movement of the displacer piston. In an ordinary two-cycle engine, the suction created in the crank case by the outward movement of the power piston alone is relied upon to draw the explosive charge into the crank case, and this is usually not sufficient to permit a proper volume of explosive charge to be handled.

With my invention by increasing the volume of the crank case when the inlet ports thereto are open, a larger volume of air and gas is drawn into the crank case than is possible with the old construction, and furthermore by the inward movement of displacer piston 22 when the power piston is at the end of its power stroke, as shown in Fig. 6, this larger volume may be transferred to the working end of the cylinder without increasing to any extent the pressure to which the charge in the crank case is subjected during the power stroke of the piston. As stated above, it will be noted that the air which is drawn through the ports 11 and 12 will be deflected by the deflector 17 to the upper part of the piston. The result of this construction is that when the power piston has reached the outer limit of its stroke and the air and gas inlet ports are open to the crank case, the air which is drawn inwardly through the ports 11, 12 is deflected by the deflector 17 to the upper part of the piston, while the explosive charge drawn in through the ports 8 remains at the lower part of the cylinder and within the crank case. When the piston has completed its power stroke and the ports 16 therein come in register with the ports leading to the transfer chamber 14, the air which is in the upper part of the piston is first transferred to the cylinder and subsequently the explosive charge is transferred. The result of this is that the charge of air which is drawn in through the ports 11 and 12 is used to scavenge the cylinder, and therefore no gas is wasted to perform this operation. Any air which remains in the cylinder after the exhaust ports are closed and after the scavenging operation will, of course, mingle with the explosive charge admitted.

Where a double-cylinder engine is used I may if desired connect the crank cases of both cylinders to the same compensating cylinder 21, one crank case communicating with one end of the cylinder and the other crank case with the other end thereof. In this case, the cranks of the two power pistons would be arranged 180° apart and the movement of the compensating piston 22 would accommodate both of the main cylinders. As shown in Fig. 3, the outer end of the compensating cylinder 21 is connected by a duct or by-pass 29 with the crank case of the other power cylinder, and in this way one compensating cylinder will answer for two power cylinders.

Where two cylinders are used side by side, as shown in the drawings, I propose to separate the crank case chambers of the two cylinders by means of a suitable partition 49, through which the crank shaft passes.

18 designates the usual sparking plugs by means of which the charge is ignited at the proper time.

I have shown the cylinder as provided with the jacket 30 which communicates with a chamber 31 above the engine and adapted to receive water.

32 is a down-take which communicates with the lower end of the chamber and terminates in a plurality of distributing pipes 34 within the jacket.

35 is an up-take communicating with the jacket and with the delivery-pipe 36.

The water from the chamber passes down through the down-take 32 into the jacket and up through the up-take 35 to the delivery-pipe 36, and in this way sufficiently rapid circulation of water may be established to keep the cylinder cool. Any other suitable way of cooling the cylinder may be employed, however, without departing from my invention.

The particular manner herein described of varying the volume of the crank case chamber at the proper time is not essential to my invention and the construction may, therefore, be varied in many matters of detail without departing from the invention described in the appended claims.

Having described my invention what I claim as new and desire to secure by Letters Patent is:—

1. In a two-cycle internal combustion engine, the combination with a cylinder having an air inlet port for the admission of air and a separate inlet port for an explosive charge situated below the air inlet port, of a piston in the cylinder which by its movement opens said ports simultaneously to admit both air and an explosive charge to the cylinder below the piston, said cylinder having another port and the piston also having a port which registers with said other port when the piston at the end of its power stroke whereby first the air and then the explosive charge are transferred to the working end of the cylinder.

2. In a two-cycle internal combustion engine, the combination with a cylinder having separate ports for the admission of air and an explosive charge, of a piston in the cylinder which by its movement opens said ports simultaneously to admit both air and an explosive charge to the cylinder below the piston, a deflector to deflect the air into a separate part of the cylinder from that in which the explosive charge is admitted, and means to transfer first the air and then the explosive charge to the working end of the cylinder at the end of the power stroke.

3. In an internal combustion engine, the combination with a cylinder and piston therein, of a crank case having a variable volume connected to one end of the cylinder, means to admit an explosive charge to the crank case while the piston is at one end of its stroke, and other means to increase materially the volume of said crank case while the charge is being admitted thereto.

4. In an internal combustion engine, the combination with a cylinder and a piston therein, of a crank case communicating with the cylinder, an expansible and contractible chamber communicating with said crank case, said cylinder having a port to admit an explosive charge to the crank case, which port is positioned to be opened by the piston when the latter is at the end of its return stroke, and means to increase the volume of said chamber during the entire time that the inlet port is uncovered.

5. In an internal combustion engine, the combination with a cylinder and a piston therein, of a crank case connected with the cylinder, said cylinder having an inlet port leading to the crank case to admit an explosive charge thereto, which inlet port is controlled by the piston, and means other than the piston to produce a suction in the crank case while the inlet port is uncovered by the piston whereby an explosive charge is drawn into the crank case chamber.

6. In an internal combustion engine, the combination with a cylinder and a piston therein, of a crank case having a variable volume connected to one end of the cylinder, means to admit an explosive charge to the crank case, and means other than the piston to increase the volume of the crank case while the piston is completing its return stroke and is commencing its power stroke.

7. In an internal combustion engine, the combination with a cylinder and a piston therein, of a crank case having a variable volume connected to one end of the cylinder, said cylinder having an inlet port to admit an explosive charge to the crank case which inlet port is uncovered by the piston when the latter is at the end of its outward stroke,

and means other than the piston to increase the volume of the crank case during the entire time when said inlet port is opened.

8. In a two-cycle combustion engine, the combination with a cylinder and a piston therein, of a crank case connected to the cylinder, means to admit air and an explosive charge separately to the crank case, means separate from the piston to increase the volume of the crank case chamber when said air and explosive charge are being admitted thereto, and means to transfer said air and explosive charge to the cylinder at the end of the power stroke.

9. In an internal combustion engine, the combination with a cylinder and a power piston therein, of a crank case chamber communicating with one end of the cylinder, means to adjust an explosive charge to the crank case chamber, a transfer chamber by which the charge can be transferred from the crank case chamber to the working end of the power cylinder, an auxiliary cylinder communicating with the crank case chamber, an auxiliary piston within the auxiliary cylinder, and means actuated by the power piston to give the auxiliary piston its maximum movement in each direction at a period of time different from that in which the power piston has its maximum movement.

10. In an internal combustion engine, the combination with a power cylinder and a power piston therein, of a crank case connected to one end of said cylinder, means to admit an explosive charge to the crank case, an auxiliary cylinder connected to the crank case, a displacer piston therein, and means actuated by the power piston for giving the auxiliary piston its maximum movement at a period of time when the power piston has its minimum movement.

11. In an internal combustion engine, the combination with a power cylinder and a power piston therein, of a crank case having communication with the working end of the cylinder, an auxiliary cylinder communicating with the crank case, and a displacer piston in said auxiliary cylinder, means to admit an explosive charge to the crank case and means to move the displacer piston forward while the power piston is completing its power stroke and beginning its return stroke, thereby to transfer the explosive charge from the crank case to the working end of the cylinder.

12. In an internal combustion engine, the combination with two power cylinders, of a power piston in each cylinder, a closed crank case connected with each cylinder, means to admit an explosive charge to each crank case, an auxiliary cylinder communicating with both crank cases, and a piston therein operated by one of the power pistons.

13. In an internal combustion engine, the combination with a power cylinder and a power piston therein, of a closed crank case connected to said cylinder, means to admit an explosive charge to the crank case, said cylinder having a transfer passage to permit the charge to be transferred to the working end thereof, an auxiliary cylinder communicating with said crank case, a displacer piston in said auxiliary cylinder, and means connecting said displacer piston and the power piston so that one has its maximum movement while the other is approaching the end of its stroke and beginning its return stroke.

14. In an internal combustion engine, the combination with a power cylinder and a power piston therein, of a closed crank case connected to said cylinder, an auxiliary cylinder communicating with the crank case, a displacer piston in said auxiliary cylinder, said power cylinder having a port leading to the crank case chamber for the admission of an explosive charge and a transfer passage connecting the crank case chamber with the working end of said power cylinder, said displacer piston and power piston being connected so that one has its maximum movement while the other is approaching the end of its stroke and beginning its movement in the opposite direction.

15. In an internal combustion engine, the combination with a power cylinder and a power piston therein, of a closed crank case connected to said cylinder, an auxiliary cylinder communicating with the crank case and arranged at right angles to the power cylinder, a displacer piston in said auxiliary cylinder, and a crank shaft to which both pistons are connected, said power cylinder having a port to admit an explosive charge to the crank case chamber, and a transfer passage to permit said charge to be transferred from said chamber to the working end of the cylinder.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

GEORGE JOHN ALTHAM.

Witnesses:

Louis C. Smith,

Bertha F. Heuser.

Correction in Letters Patent No. 962,110.

It is hereby certified that in Letters Patent No. 962,110, granted June 21, 1910, upon the application of George John Altham, of Fall River, Massachusetts, for an improvement in "Internal-Combustion Engines," an error appears in the printed specification requiring correction as follows: Page 4, line 19, the word "adjust" should read *admit;* and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 19th day of July, A. D., 1910.

[SEAL.]

F. A. TENNANT,

Acting Commissioner of Patents.