

L. F. HELLMANN.
 INTERNAL COMBUSTION ENGINE.
 APPLICATION FILED MAY 15, 1911.

1,029,929.

Patented June 18, 1912.

3 SHEETS—SHEET 1.

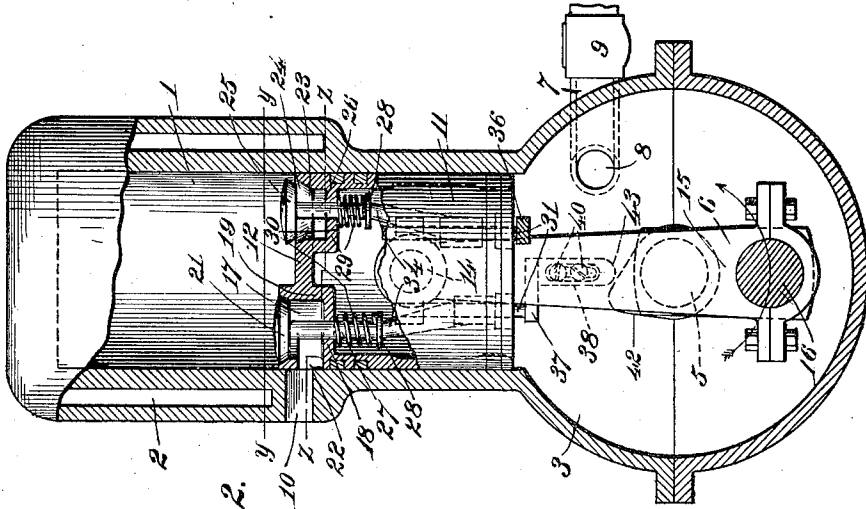


Fig. 2.

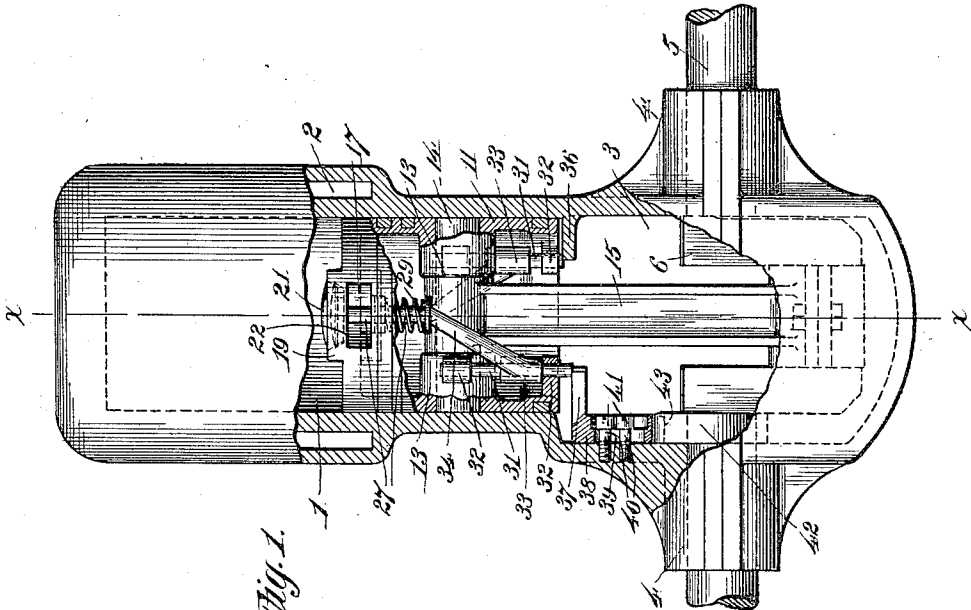


Fig. 1.

Witnesses

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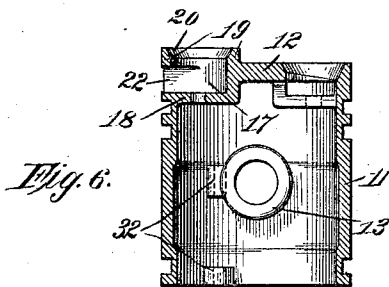
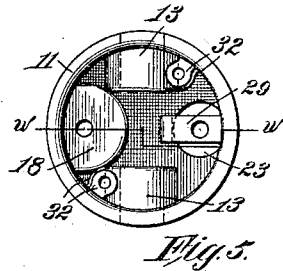
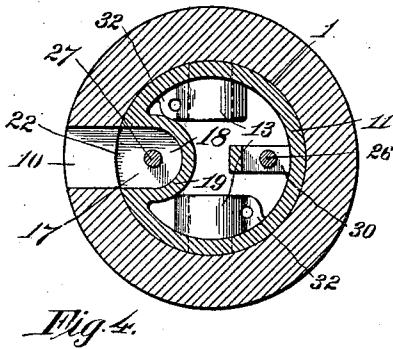
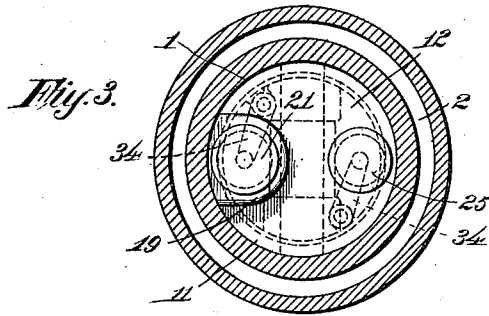
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3 SHEETS-SHEET 2.



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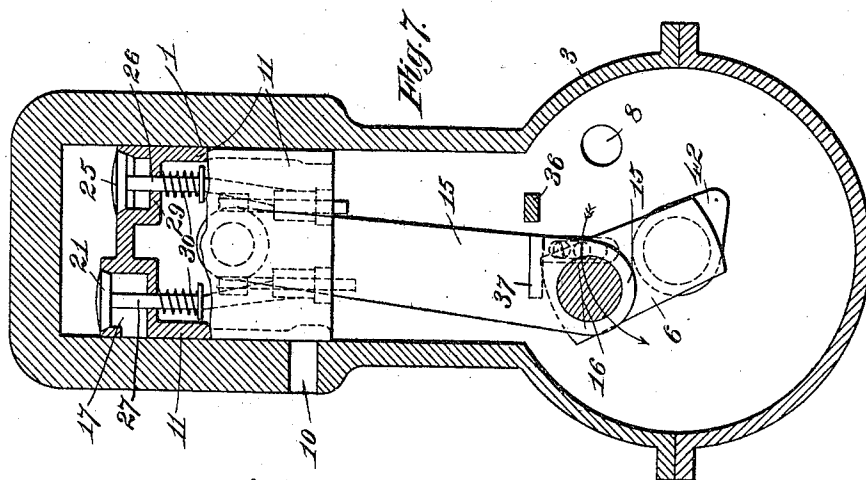
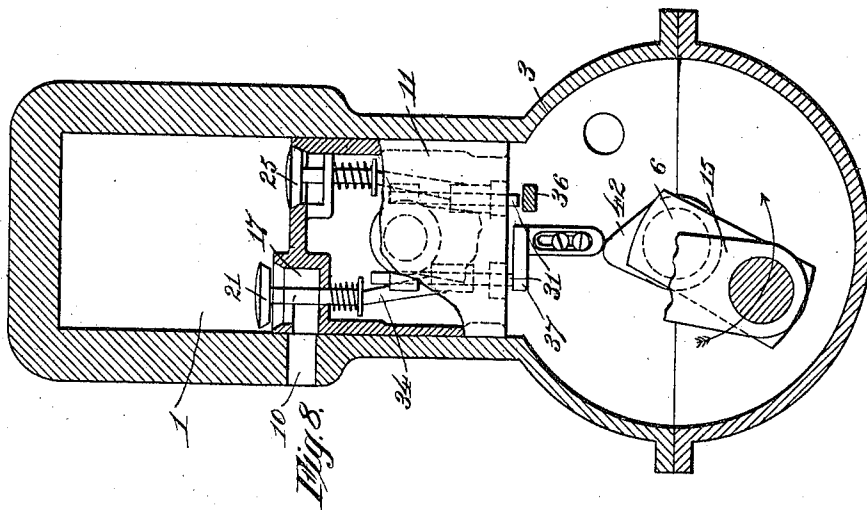
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3 SHEETS—SHEET 3.



Witnesses

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UNITED STATES PATENT OFFICE.

LUI F. HELLMANN, OF INDIANAPOLIS, INDIANA.

INTERNAL-COMBUSTION ENGINE.

1,029,929.

Specification of Letters Patent.

Patented June 18, 1912.

Application filed May 15, 1911. Serial No. 627,095.

To all whom it may concern:

Be it known that I, LUI F. HELLMANN, a citizen of the United States, residing at Indianapolis, county of Marion, and State of Indiana, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

My invention relates to internal combustion engines and particularly to that type thereof known as two-cycle engines.

The object of my invention is to provide a two-cycle internal combustion engine which shall be of greater power for its size than other engines of its class which have heretofore been devised.

A further object of my invention is to provide an engine of the class mentioned which shall be of such construction as to eliminate all danger of back fire or preignition in the crank case.

A further object of my invention is to provide an engine of the two-cycle type which shall not waste a portion of the explosive mixture, as is common to engines of this class, to the end that more work may be accomplished with a given amount of fuel.

Other objects will appear hereinafter. With these objects in view my invention consists generally in a two-cycle engine comprising a cylinder, piston, inclosed crank case and crank shaft, the cylinder being provided with an exhaust port which is at all times covered by the piston and the crank case being provided with an inlet port and a check valve adjacent the inlet port, in combination with an exhaust passage way extending through the top of the piston and through one side thereof to register at times with the exhaust port, a second passage way through the top of the piston communicating with the crank case, valves normally closing said passage ways and means for operating said valves whereby the exhaust valve is opened as the piston reaches a point near the downward limit of the stroke and closed before it completes said stroke to create a partial vacuum in the cylinder, and whereby the inlet valve is opened after the closing of the exhaust valve and closed at the beginning of the return stroke.

My invention further consists in various details of construction and arrangements of parts all as will be fully described herein-

after and particularly pointed out in the claims.

My invention will be more readily understood by reference to the accompanying drawings forming a part of this specification and in which—

Figure 1 is a vertical section through an internal combustion engine embodying my invention in its preferred form, portions of the device being shown in elevation, Fig. 2 is a vertical section on substantially the line $x-x$ of Fig. 1, Fig. 3 is a horizontal section on the line $y-y$ of Fig. 2, Fig. 4 is a similar section taken on the line $z-z$ of Fig. 2, Fig. 5 is a bottom plan view of the piston with the valves and valve operating mechanism removed, Fig. 6 is a vertical section through the piston on the line $w-w$ of Fig. 5, Fig. 7 is a vertical section in diagram, similar to Fig. 2, and illustrating the piston at the first part of the down stroke, and Fig. 8 is a similar view illustrating the piston nearing the downward limit of its stroke just prior to closing the exhaust valve and opening the inlet valve.

Referring now to the drawings 1 indicates the cylinder of the engine which is provided with suitable cooling means such as a water jacket 2. At the lower end of the cylinder 1 is a crank case 3 provided with suitable bearings 4 for the crank shaft.

5 indicates the crank shaft and 6 the crank.

7 indicates a supply pipe for the explosive mixture leading from the carbureter and communicating with the crank case through an aperture 8 in the crank case, and provided with a check valve 9 to prevent backward flow of gas through said pipe. The crank case is tightly closed except for said supply inlet or aperture 8.

10 indicates an exhaust port formed in the side of the cylinder 1.

11 indicates the piston which comprises a hollow cylindrical member open at the bottom and closed at the top by a horizontal top or upper end 12. The piston is provided with a pair of inwardly extending bosses for the wrist pin 14 upon which is mounted a connecting rod 15, the other end of which is connected to the crank pin 16.

The piston is provided with an exhaust chamber or passage way 17 defined by a horizontal bottom wall 18 and vertical walls 19, the latter being extended upwardly

above the top 12 and formed with a valve seat 20 for the exhaust valve 21. The chambers 17 opens through the side of the piston below the valve seat as at 22, to communicate with the exhaust port 10 when the piston is in proper position. The parts are so proportioned and arranged that the exhaust port is always covered by the piston and never opens directly into the cylinder.

By extending the walls 19 of the exhaust chamber above the top 12 the chamber may be made of sufficient size and not extend to any great extent within the piston. The top 12 of the piston is also provided with an inlet port 23 having a valve seat 24 for the inlet valve 25. The inlet and exhaust valves are provided with valve stems 26 and 27 respectively which extend downwardly into the piston and upon their lower end are provided collars or other suitable members 28.

29 indicates a guide for the inlet valve stem arranged below the port 23. Interposed between the members 28 and the guide 29 and the bottom 18 of the exhaust chamber are springs 30 which normally tend to maintain the valves in closed position.

31 indicates a pair of vertically disposed rods mounted for reciprocation in the piston and having their lower ends projecting below the lower end of the piston. The rods are mounted in lugs 32 formed on the walls of the piston and on the bosses 13. Fixed to the rods 31 are sleeves 33 and upon the sleeves are upwardly projecting angularly disposed arms 34 which engage the lower ends of the respective valve stems 26 and 27. It is obvious that by pushing upwardly on the rods 31 that the valves will be opened.

I accomplish the opening of the valves by providing suitable members in the path of the rods against which the lower ends of said rods abut as the piston is reciprocated.

In carrying out my invention I provide means whereby the exhaust valve is opened after the piston has completed a greater portion of its downward or power stroke and is closed before the piston reaches lowermost position, whereby a slight vacuum is created within the cylinder; and also provide means whereby the inlet valve is opened after the exhaust valve is closed. As the valves are opened by means of abutment members arranged in the path of travel of the rods 31, it is evident that the abutment member which controls the operation of the exhaust valve must be movable in order to permit closing of the exhaust valve before the end of the stroke and the opening of the inlet valve.

36 indicates the abutment member which controls the operation of the inlet valve. This comprises an arm or lug which may be cast integrally with the crank casing as indicated at Fig. 1.

37 indicates the abutment member for op-

erating the exhaust valve. This comprises a substantially horizontal arm formed on a slide 38, mounted for vertical reciprocation on the side of the crank casing opposite that from which the member 36 projects.

Various ways may be employed for slidably mounting the slide 38 on the casing 3, but I find that illustrated in the drawings to be both simple and efficient. As shown therein the slide is provided with a vertically disposed slot 39 and a pair of screws 40 extend through said slot and are capped into the casing as shown clearly in Fig. 1. The screws are provided with heads 41 which are countersunk in the slot as illustrated. Mounted upon the shaft 5 below the member 38, said member being preferably arranged directly above the shaft, is a cam 42 which engages the well rounded lower end 43 of the member 38 at each revolution of the shaft. The cam is so proportioned and timed that it will raise the abutment member 37 at the proper time to open the exhaust valve and to release the same to permit closing of the valve before the end of the stroke.

The operation of the device is as follows:—It is to be understood that with each upward or return stroke of the piston the gas or explosive mixture is drawn into the crank casing through the pipe 7 and inlet 8 and that with the power stroke the valve 9 closes to prevent the backward flow of the gas toward the carbureter. Assuming that the charge in the cylinder has just been exploded and the piston is beginning its downward or power stroke, the parts will be in the positions shown in Fig. 7. Both of the valves 21 and 25 are closed and the piston will continue to descend under the force of the expanding gases until the greater portion of the power stroke has been traversed. The cam 42 then raises the member 38 causing the abutment member 37 to rise into the path of the end of the rod 31 controlling the exhaust valve. By this time the opening 22 of the exhaust chamber has begun to register with the exhaust port 10, and as downward movement of the exhaust valve is momentarily checked by the cam, continued downward movement opens the exhaust and permits the escape of the expanded gases. Further movement of the cam then permits the slide 38 to drop and the spring 29 immediately seats the exhaust valve, closing the exhaust before the end of the stroke is reached. Further downward movement of the piston to complete the stroke creates a partial vacuum within the cylinder and also causes the end of the rod 31 which controls the inlet port, to engage the fixed abutment member 36 thereby opening the inlet valve. The downward stroke of the piston compresses the fuel or gas within the crank casing, the valve 9 being closed, and as soon as the inlet valve 25

is opened a fresh charge rushes into the cylinder. It is obvious that the charging of the cylinder is greatly augmented by the partial vacuum created in the cylinder by closing the exhaust valve before the end of the power stroke, and by the compression of the gas in the crank case. As soon as the piston begins its return stroke the inlet valve closes and the fresh charge is compressed in the upper end of the cylinder as the piston rises. Also with the return stroke a fresh supply of gas is drawn into the crank casing. As the exhaust is completed prior to the opening of the inlet valve the cylinder is sufficiently scavenged prior to the admission of fresh gas so that there is no danger of back fire or preignition, and further as the exhaust is always closed before opening the inlet, there is no waste of fuel as is common with many engines of this type.

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, a cylinder having an exhaust port and an inclosed crank case, in combination with a piston in said cylinder covering said exhaust port at all times, said piston being provided with an exhaust passage way opening through the top and one side thereof whereby communication may be established between said cylinder and said exhaust port, an exhaust valve controlling said passage way, an inlet port formed in said piston whereby communication may be established between said cylinder and said crank casing, an inlet valve controlling said port, means for opening said exhaust port toward the end of the power stroke and for closing the same before the end of the power stroke is reached and means for opening said inlet valve after said exhaust valve is closed, substantially as described.

2. In a two-cycle internal combustion engine, a cylinder having an exhaust port and an inclosed crank case, a fuel supply pipe leading to said case, a check valve in said pipe, a piston in said cylinder, said piston being provided with an exhaust passage way

extending through the top and one side thereof adapted to form a communication between said cylinder and said exhaust port, and also with an inlet port adapted to form a communication between said cylinder and said crank case, an exhaust valve controlling said exhaust passage way, an inlet valve controlling said inlet port, depending valve stems on said valves and reciprocating members engaging said valve stems to operate said valves, and means for actuating said reciprocating members whereby the exhaust valve is opened toward the end of the power stroke and closed before reaching the end of said stroke to scavenge the cylinder and create a partial vacuum therein and whereby said inlet valve is opened after said exhaust valve is closed, substantially as described.

3. In a two-cycle internal combustion engine a cylinder provided with an exhaust port and an inclosed crank case, in combination with a fuel supply pipe leading to said case, a check valve in said pipe, a piston in said cylinder provided with an exhaust passage way adapted to form a communication between said cylinder and said exhaust port, said piston being also provided with an inlet port adapted to form a communication between said cylinder and said crank case, an exhaust valve controlling said exhaust passage way and an inlet valve controlling said inlet port, a pair of vertically disposed rods mounted in said piston for vertical reciprocation, depending valve stems on said valves, means on said rods for engaging said valve stems, a fixed abutment for the rod controlling the inlet valve, a reciprocating abutment for engaging the rod controlling the exhaust valve and means for reciprocating the last mentioned abutment, substantially as described.

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

LUI F. HELLMANN.

Witnesses:

WILLIAM M. HOUZE,
WESLEY HAUFLE.