C. A. SULLIVAN & J. W. POTTER.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED MAR. 4, 1910.

1,011,875. Patented Dec. 12, 1911.

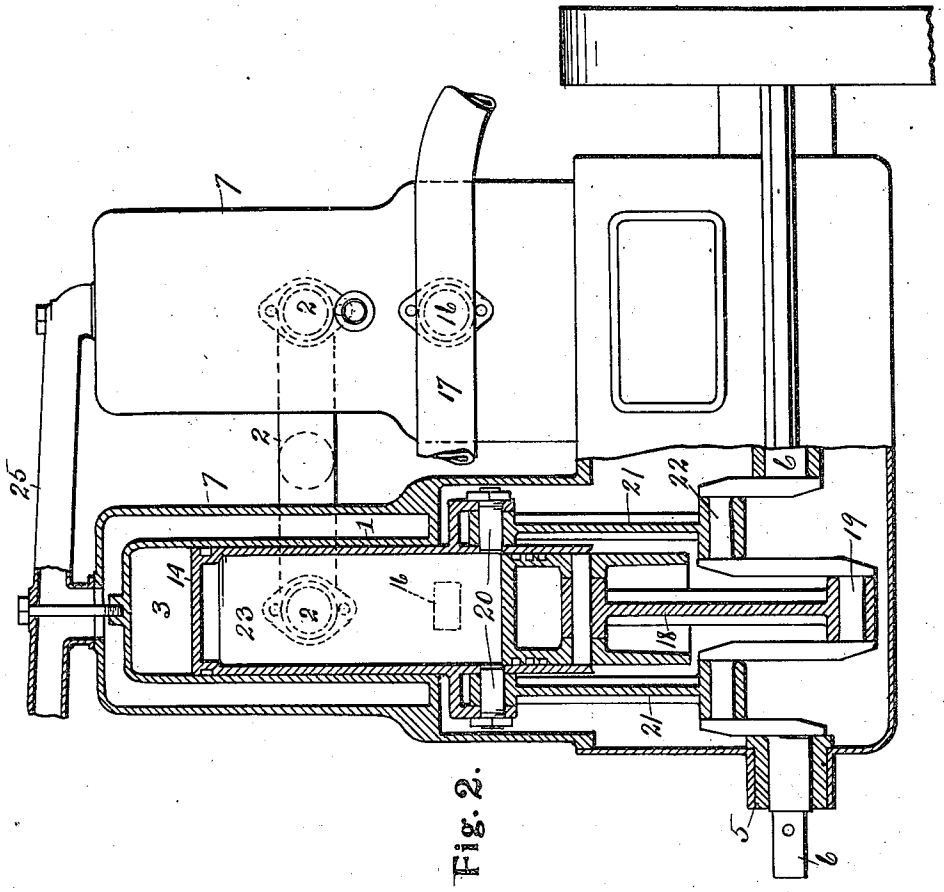

Fig. 2.

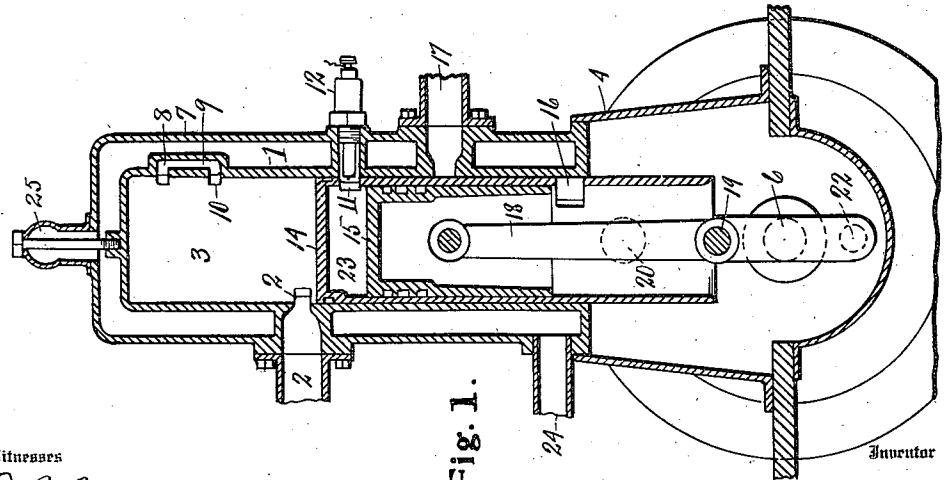

Fig. 1.

Witnesses

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UNITED STATES PATENT OFFICE.

CHARLES A. SULLIVAN, OF WINDSOR, ONTARIO, CANADA, AND JAMES W. POTTER, OF DETROIT, MICHIGAN, ASSIGNORS OF ONE-FOURTH TO EDWARD J. WOODISON AND ONE-FOURTH TO CHARLES L. ACKERSON, BOTH OF DETROIT, MICHIGAN.

INTERNAL-COMBUSTION ENGINE.

1,011,875. Specification of Letters Patent. Patented Dec. 12, 1911.

Application filed March 4, 1910. Serial No. 547,191.

To all whom it may concern:

Be it known that we, CHARLES A. SULLIVAN and JAMES W. POTTER, citizens of the United States, residing at Windsor, Ontario, Canada, and Detroit, county of Wayne, State of Michigan, have invented a certain new and useful Improvement in Internal-Combustion Engines, and declare the following to be a full, clear, and exact description of the same, such as will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawings, which form a part of this specification.

This invention relates to internal combustion engines.

It has for its object an improved internal combustion engine.

In the drawings:—Figure 1, is a vertical section transverse the shaft. Fig. 2, is a vertical section along the axis of the shaft, and an elevation of a companion engine.

The engine consists essentially of a cylinder properly water-jacketed in which reciprocates an intermediate member which acts as a piston with respect to this cylinder, and is provided with piston rod connections to the crank shaft; this member is hollow and acts as a cylinder with respect to an internal piston which is provided with a rod connection to the same crank shaft.

In the drawings, 1 indicates the external cylinder provided with an intake passage 2 which opens into the first chamber 3 near that end of the chamber which lies toward the shaft. This cylinder is bolted or otherwise secured to a casing 4 that supports the bearings 5 of a shaft 6, and it is provided with suitable water jacket casings 7 and with a transfer passage 8 leading from chamber 3 through a by pass 9 to a port 10 that at times registers with a port 11 in the intermediate member. It is also provided with an opening for a spark plug 12 properly located to register with the port 11 in the intermediate member at a time when the crank is in proper position for an explosive impulse. The intermediate member 14 reciprocates in the external cylinder as a piston and is bored and arranged to act as a cylinder with respect to an internal piston 15. It is provided with port 11, that serves both for intake and for firing, and with exhaust port 16 that at the proper time registers with a passage 17 through the walls of the external cylinder. Within the intermediate member 14 reciprocates a piston 15 to which is pivoted connecting crank rod 18 that engages with a wrist pin 19 of the crank. The intermediate member is provided with trunnions 20 from which crank rods 21 connect to wrist pins 22 on the shaft 6. An explosive mixture is drawn into the chamber 3 when the various parts are in the relation shown in Fig. 1 and fills that chamber at atmospheric pressure. The member 14 and the piston 15 next spread to the position shown in Fig. 2, the member 14 covers the intake port of passage 2, and the charge in the chamber 3 compressed during the first part of the movement is transferred to the chamber 23 during the latter part of the movement through the by-pass 9, the port 11 of the intermediate member registering with the port 10 of the by-pass. At the completion of the revolution the mixture now in the chamber 23 is compressed and the parts take the position shown in Fig. 1, at which time the charge is exploded; the spark which produces the explosion is at the terminal of spark plug 12 which engages through the walls of the outer cylinder, and at the proper time of movement of the several parts the opening 11 of the intermediate cylinder is properly located with reference to the spark plug for the firing of the charge which is held in the chamber 23. The outer cylinder is cooled by water which circulates through the hollow walls of this member and is introduced through the conducting pipe 24 into the cylinder and is drawn off through pipes 25. It has not been thought necessary to show either the supply tank or the discharge tank which may be the same tank; or to show the system of check valves which would naturally be used.

What we claim is:—

1. An internal combustion engine, having in combination a fixed cylinder, a piston, a member intermediate said cylinder and piston, arranged to act as a piston with respect to said fixed cylinder, and as a cylinder with respect to said first-mentioned piston, a crank shaft, pitman connections between said crank shaft and intermediate member and piston adapted to cause the same to alternately approach and separate, said fixed cylinder having a fuel inlet port un-

covered by said intermediate member near the limit of its outward stroke, a by-pass in said fixed cylinder having an opening into the clearance space thereof, and another opening adapted to register with the clearance space of the intermediate member when the intermediate member is reaching the limit of its compression stroke in the fixed cylinder, said by-pass adapted to transfer fuel through the chamber of the fixed cylinder to the chamber of the intermediate member, said intermediate member also provided with a port leading from its clearance space, and adapted to register with said last-mentioned opening of said by-pass, thereby establishing communication therethrough between said fixed cylinder and intermediate member, and a firing plug introduced through the walls of the fixed cylinder, with which the said port of the intermediate member is adapted to register when the piston and intermediate member are near their closest condition of approach, substantially as described.

2. An internal combustion engine, having in combination a fixed cylinder, a piston, a member intermediate said cylinder and piston, arranged to act as a piston with respect to said fixed cylinder, and as a cylinder with respect to said first-mentioned piston, a crank shaft, pitman connections between said crank shaft and intermediate member, pitman connections between said crank shaft and said piston, the same being arranged diametrically opposite each other with respect to said crank shaft, the said fixed cylinder being provided with a fuel inlet port uncovered by said intermediate member near the limit of its outward stroke, a by-pass in said fixed cylinder having an opening adapted to register with the clearance space of the intermediate member when the same is reaching the limit of its compression stroke in the fixed cylinder, said by-pass adapted to transfer fuel from the chamber of the fixed cylinder into the chamber of the intermediate member, the intermediate member having a port, leading from its clearance space, adapted to register with said opening of said by-pass and to establish communication therethrough between said fixed cylinder and the intermediate member, and a firing plug introduced through the walls of the fixed cylinder, with which the said port of the intermediate member is adapted to register when the piston and intermediate member are near their closest condition of approach, substantially as described.

3. An internal combustion engine, having in combination a fixed cylinder, a crank shaft, a piston having pitman connections to said crank shaft, a member intermediate the cylinder and piston, adapted to act as a piston with respect to said fixed cylinder, and as a cylinder with respect to said piston, the said intermediate member being provided with a port leading from its clearance space, pitman connections from said intermediate member to said crank shaft, adapted, with said first-mentioned pitman connections to cause the piston and intermediate member to alternately approach and separate, said fixed cylinder having a fuel inlet port uncovered by the intermediate member near the limit of its outward stroke, a by-pass leading from the clearance space in the fixed cylinder through the walls and returning into the cylinder at a point adapted to register with the said port leading from the clearance space of the intermediate member when the same is near the end of its compression stroke in the fixed cylinder, said by-pass being adapted to transfer fuel from the chamber of the fixed cylinder into the chamber of the intermediate member, and an ignition device introduced through the walls of said fixed cylinder, and adapted to register with said port in the intermediate member, when the piston and intermediate member are near their closest condition of approach, substantially as described.

In testimony whereof, we sign this specification in the presence of two witnesses.

CHARLES A. SULLIVAN.
JAMES W. POTTER.

Witnesses:
CHARLES F. BURTON,
VIRGINIA C. SPRATT.