A. P. BRUSH.

INTERNAL COMBUSTION ENGINE AND METHOD OF OPERATING THE SAME.

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Fig. 1

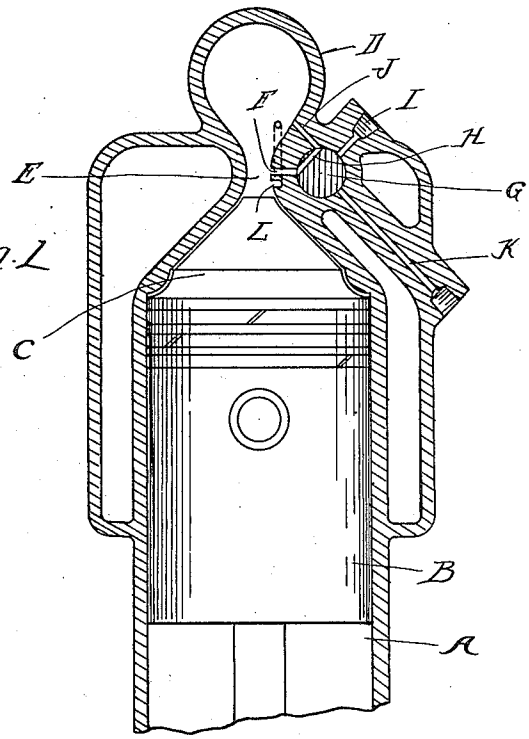
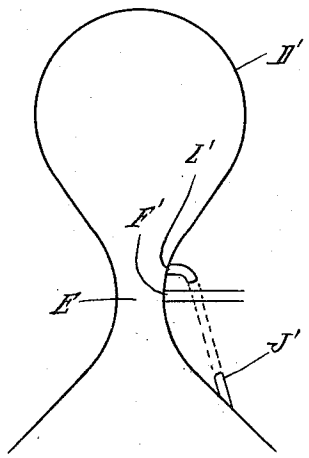


Fig. 2.



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UNITED STATES PATENT OFFICE.

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INTERNAL-COMBUSTION ENGINE AND METHOD OF OPERATING THE SAME.

Application filed March 14, 1919. Serial No. 282,581.

To all whom it may concern:

Be it known that I, ALANSON P. BRUSH, a citizen of the United States of America, residing at Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Internal-Combustion Engines and Methods of Operating the Same, of which the following is a specification, reference being had therein to the accompanying drawings.

The invention relates to internal combustion engines of the type in which the air and fuel are separately introduced into the cylinder, and it is the object of the invention to obtain a more thorough commingling of the elements in advance of combustion. The invention is particularly applicable to the Diesel or slow combustion type of engines, but it may also be used with the explosion type.

In the type of engines to which my invention is applied the cylinder first receives a volume of air which is compressed in the upward stroke of the piston, while the fuel is usually injected into the compressed air by external force. With my improvement the fuel may be introduced by differential pressure incident to the compression of the air and without external force other than that required for separating a measured charge. Another feature of my improvement is the thorough commingling of the fuel with the air in advance of combustion, which also is accomplished by differential pressure and the velocity of the moving air through a constricted passage. Both of these effects may be produced by expelling the air from the cylinder through a contracted passage into a compression chamber and returning the air through this passage upon the forward stroke of the piston. The fuel is introduced into the restricted passage by the velocity of the air current passing therethrough, which also effects a thorough commingling. Furthermore, the higher pressure which is present in the compression chamber or in the cylinder may be utilized to propel the fuel through its introduction port and clearing the same from any remnant.

In the drawings:

Figure 1 is a central longitudinal section through an external combustion engine embodying my invention;

Figure 2 is an enlarged diagram of a slightly modified construction.

A is the cylinder of an internal combustion engine, B is the piston having its upper end portion C fashioned to closely fit the upper end of the cylinder to reduce the clearance to the minimum. D is a compression chamber which is connected to the cylinder by a constricted throat E. This is preferably of substantially venturi form, the flaring ends gradually merging into the cylinder and compression chamber D. F is a port or passage for the introduction of the fuel communicating with the throat E preferably at the point where there is the greatest reduction of pressure incident to the velocity of the air current. The port F is in communication with a fuel supply, and to measure the charge there is provided a rotary charging device G or other equivalent means. As specifically shown, this charging device is provided with a passage H of sufficient capacity to hold the maximum charge, said passage being alternately registered with a supply port I and the discharge port F. In addition to these ports there is provided a port J leading from the compression chamber D into registration with one end af the passage H when the opposite end of the latter is in registration with the port F. A port or passage K is further provided which is positioned to register with one end of the passage H when the opposite end is in registration with the supply port I, thereby permitting the expellation of the entrapped air.

With the construction as thus far described, in operation the air which is introduced into the cylinder through any suitable inlet ports (not shown) is compressed during the upward stroke of the piston and is forced through the throat E into the chamber D. During this movement the passage H is registered with the ports I and K so that a quantity of fuel may be introduced therein. During the return stroke of the piston the passage H is moved into registration with the ports J and F, and by reason of the differential pressure incident to the high velocity of the air through the passage E, all of the fuel will be swept from the passage H and into the moving air current. This will cause a thorough commingling of the air and fuel so that combustion may occur in the engine cylinder.

To prevent the liquid fuel from following down the side wall of the passage E upon leaving the port F, a port L is ar-

ranged just below the port F and is connected at its opposite end to the chamber D. This causes the blowing of a current of air out from the port L, dislodging any fuel that might otherwise cling to the side wall of the passage.

The operation as above described is where the engine is of a slow burning type, the commingled fuel and air being automatically ignited upon entering the cylinder. It is obvious, however, that the commingling could be effected upon the opposite stroke or during movement of air through the passage E into the chamber D.

Such a construction is illustrated in Figure 2 of the drawings, which represents an explosion type of engine, in which D′ is a chamber of relatively large content. F′ is a port through which the fuel is introduced from any suitable source and by any suitable means, and L′ is a port above the port F′ connected by a passage J′ with the cylinder below the restricted passage E. With this construction the liquid fuel will be drawn in and commingled with the compressed air as it is forced upward from the cylinder into the chamber D′ and at the proper time the compressed charge is ignited either automatically or by a timed igniter. Air is also blown from the port L′ to break the flow of liquid along the surface of the passage and to compel it to pass into the center of the air current.

What I claim as my invention is:

1. An internal combustion engine, comprising a cylinder, a compression chamber and a constricted passage forming the primary connection between the same, and means for introducing the fuel into the constricted passage operated by differential pressure of the compressed air in said passage, and in one of the spaces connected by said passage.

2. An internal combustion engine, comprising a cylinder, a compression chamber and a constantly open constricted passage connecting the same, a piston having slight clearance in said cylinder to expel the air therefrom into the compression chamber, a port or passage having one end connecting with said constricted passage and the opposite end with said compression chamber, and means for introducing fuel into said port or passage whereby differential air pressure will sweep said fuel into the high velocity air current.

3. An internal combustion engine, comprising a cylinder, a compression chamber and a constantly open constricted passage, being of substantially venturi form, a passage having one end thereof connecting with said compression chamber and the opposite end to the venturi passage, a piston within said cylinder for expelling the air therefrom into said compression chamber, and means operating during the suction stroke of the piston for introducing fuel into said last-mentioned passage, whereby the same is swept into the air current by differential pressure.

4. An internal combustion engine, comprising a cylinder, a compression chamber and a constantly open constricted passage connecting the same and having a substantially venturi form, a port connecting with said constricted passage, a port connecting with the compression chamber, and means having a fuel holding passage for registering the same to connect said ports, whereby the fuel is swept into the air current by differential air pressure.

5. An internal combustion engine, comprising a cylinder, a compression chamber, a constantly open constricted passage connecting the same, a port connected with said constricted passage through which liquid is introduced, and means adjacent to said port for breaking the flow of liquid along the wall of the passage.

6. An internal combustion engine, comprising a cylinder, a compression chamber, a constantly open constricted passage connecting the same, a port connected with said constricted passage through which liquid fuel is introduced, and means for ejecting air adjacent to said port to break the flow of liquid along the wall of the passage.

7. An internal combustion engine, comprising a cylinder, a compression chamber, a constantly open constricted passage connecting the same, a port connected with said constricted passage through which liquid fuel is introduced, and a port adjacent to said first-mentioned port communicating with a chamber on one side of said constricted passage, whereby a flow of air from the last-mentioned port is introduced to break the flow of liquid from the first-mentioned port along the wall of the passage.

8. An internal combustion engine comprising a cylinder, a compression chamber, and a constricted port connecting the same, a fuel feed passage, and means for establishing the extremities of said passage respectively in communication with said compression chamber and constricted port or in communication respectively with a liquid fuel supply and a vent opening.

9. An internal combustion engine comprising a cylinder, a compression chamber and a constricted port connecting the same, a rotative member formed with a fuel feed passage and means establishing said fuel passage in communication in one position of said rotative member with said constricted port and said compression chamber and in another position of the rotative member in communication with a source of liquid fuel and a vent opening.

10. An internal combustion engine com-

prising a cylinder, a compression chamber and a constricted port connecting the same, passages in constant communication respectively with said compression chamber and port, and a member formed with a third passage establishing communication between the two first mentioned passages in one position of said member and between a liquid supply source and vent opening in another position of said member.

11. An internal combustion engine, comprising two chambers respectively having the nature of a cylinder and a compression chamber, connected by a constantly open constricted passage forming the pimary connections between said cylinder and passage, and a fuel feed passage discharging into said constricted passage and having a connection to one of said chambers, whereby a charge of fuel is adapted to be ejected from said fuel feed passage by differential pressures in the chamber and constricted passages with which the ends of said fuel feed passage connects.

In testimony whereof I affix my signature.

ALANSON P. BRUSH.