Feb. 19, 1929. 1,702,875

E. C. MAGDEBURGER

INTERNAL COMBUSTION ENGINE

Filed Nov. 21, 1927 2 Sheets-Sheet 1

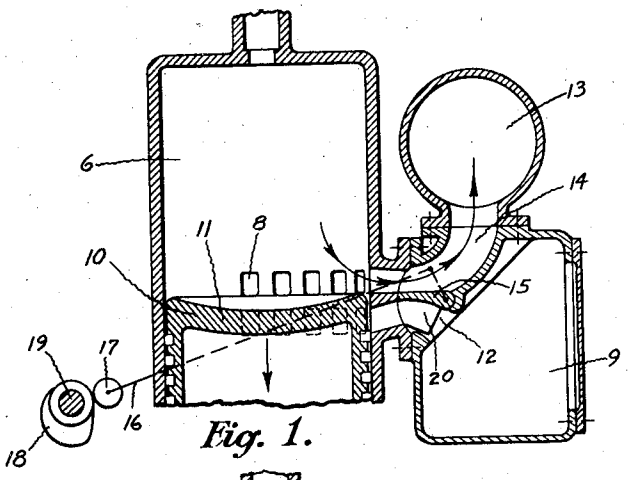


Fig. 1.

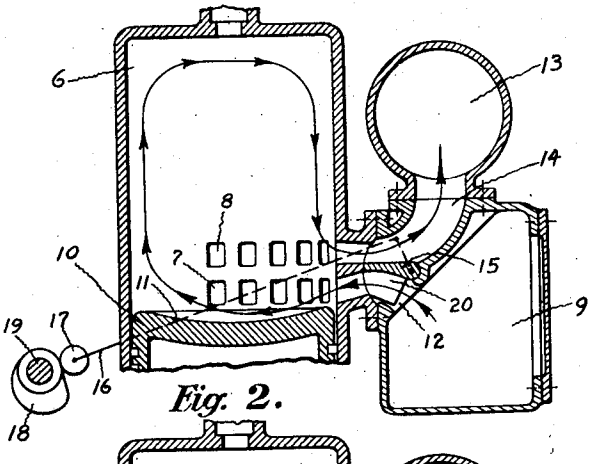


Fig. 2.

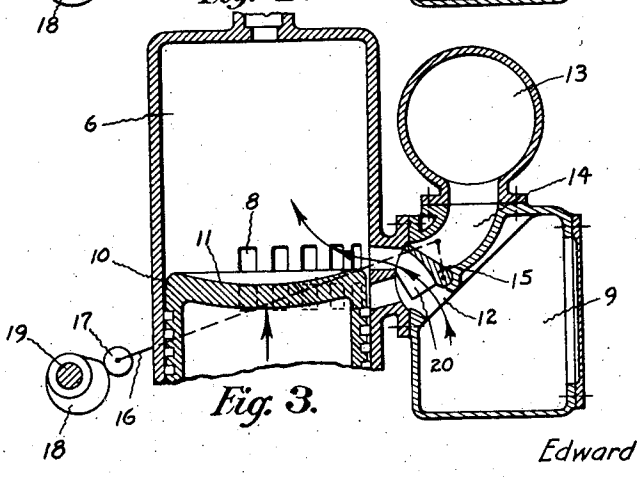


Fig. 3.

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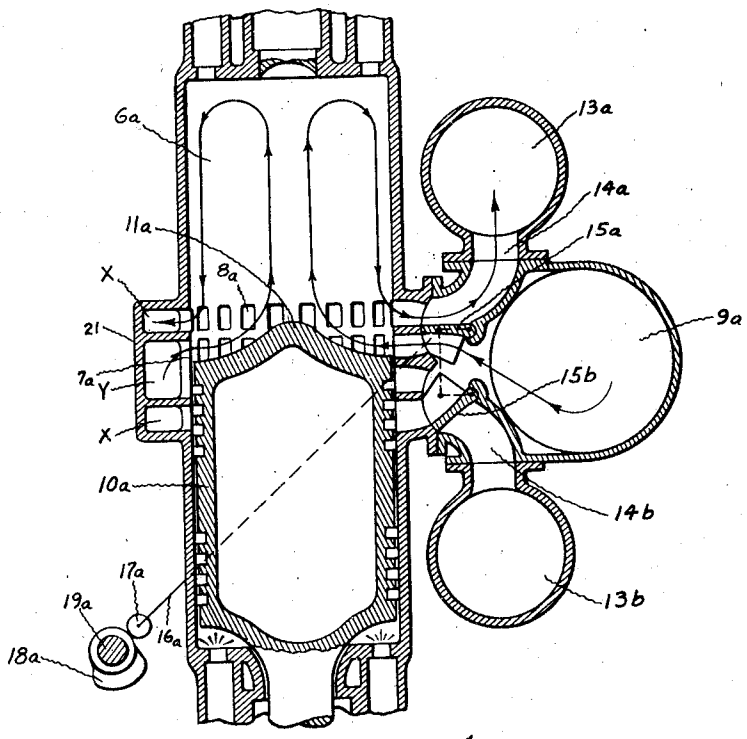


Fig. 4.

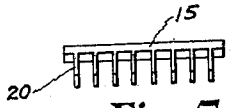


Fig. 5.

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Patented Feb. 19, 1929. 1,702,875

UNITED STATES PATENT OFFICE.

EDWARD C. MAGDEBURGER, OF WASHINGTON, DISTRICT OF COLUMBIA.

INTERNAL-COMBUSTION ENGINE.

Application filed November 21, 1927. Serial No. 234,801.

My invention relates broadly to internal combustion engines and more particularly to a scavenging system for the two cycle type thereof.

An object of my invention is to increase the efficiency of the engine by providing a scavenging system whereby a greater weight of air than heretofore will be available in the charge, thereby increasing the amount of oil that can be burned efficiently.

A further object of the invention is to provide a scavenging system that will produce a lower temperature of cylinder charge at the beginning of compression, and that will allow a greater amount of scavenging fluid to pass over the crown of the piston than is accomplished in the present types of scavenging.

With the above and other objects in view the invention consists in the construction, combination and arrangement of parts as will be hereinafter more fully described.

Reference is to be had to the accompanying drawings, in which like reference characters indicate corresponding parts throughout the several views, and in which

Figure 1 is a sectional view of that portion of an internal combustion engine comprehending my invention showing the piston in its exhaust position.

Figure 2 is a similar view showing the piston in its scavenging position,

Figure 3 is a similar view showing the piston in its supercharging position,

Figure 4 is a similar view showing the arrangement of parts for a double acting cylinder, and

Figure 5 is a front view looking from the interior of the cylinder of the director valve used in my invention.

In scavenging systems now used in two representative two cycle oil engines, one a large double acting engine and the other a high speed automotive engine, a double row of ports operated by the piston itself are employed. In such construction the scavenging fluid issuing from the lower or scavenging ports impinges on the crown of the piston which causes it to change its direction to axial toward the cylinder head, where it again turns and, following the cylinder wall, reaches the upper or exhaust ports, thus completing a loop. The former of the above types of engines has ports only about one half of the cylinder circumference, utilizing the opposite side of the cylinder wall to further direct the scavenging fluid; while the latter type has ports all around the cylinder and largely depends upon the piston for directing the flow of scavenging fluid, the process being assisted by the impingement of the individual streams of fluid. Such types of scavenging have one inherent disadvantage. The admission of scavenging fluid, a large part of which constitutes the fresh air charge of the cylinder for the next operating cycle, ceases when the piston passes the upper edge of the scavenging ports, and before compression of the charge can begin a part of it has been expelled into the open exhaust ports by the moving piston. Hence, the weight of air available for combustion is that which will occupy the cylinder volume above the upper edge of the exhaust port at a pressure but very little exceeding the pressure in the exhaust header which is equal to atmospheric pressure. In a high speed type of engine the scavenging air pressure is usually not less than five to seven pounds per square inch, and such useless loss of scavenging air as referred to above affects considerably the engine efficiency as measured by fuel consumption per B. H. P.-hour. Also it affects adversely the engine weight per B. H. P., since the mean effective pressure that can be developed within the cylinder must be proportional to the weight of air available in the cylinder, other conditions being equal.

My improved scavenging system consists of making a portion of the wall separating the exhaust and scavenging ducts leading to the cylinder movable by pivoting it at the end farthest from the cylinder. This will in no way adversely affect the exhaust of gases by excess pressure, nor the normal scavenging or blowing out of the remaining gases by means of scavenging air, but as soon as this is completed, the piston will close the scavenging ports, and coincident therewith the above referred to portion of wall is moved on its pivot, shutting off the exhaust header from the cylinder and connecting the latter by means of upper ports to the scavenging air receiver. In this manner scavenging air can flow into the cylinder without any chance of escape into an exhaust header until the pressure in the cylinder becomes equal to scavenging air pressure and compression can begin with the closing of the upper ports by the piston as usual with the important difference, however, that more air by weight will fill the cylinder and hence more oil can be

burned effectively. Thus a smaller cylinder will suffice for a given power with consequent lighter weight of engine. Other incidental advantages are secured, such as lower temperature of cylinder charge at the beginning of compression, thus further increasing the weight of air in the charge. More efficient combustion with reduced temperatures at the opening of the exhaust ports; which latter are furthermore cooled by scavenging air during supercharging, is obtained. All of which reduces the dangers from heat stresses in the exhaust port bridges.

Referring more particularly to the drawings, 6 indicates a cylinder of an internal combustion engine provided with a plurality of inlet ports 7 and exhaust ports 8 arranged circumferentially thereabout. Scavenging fluid is admitted into the cylinder from a conveniently located air receiver 9 through the ports 7 and in making its course within the cylinder, it drives out the exhaust gases through the ports 8. A piston 10, which may be provided with a concave crown 11, Figs. 1 to 3, or one that is convex 11^a, Fig. 4, is operable in the cylinder to open and close the ports. The scavenging fluid is led from the air receiver to the ports 7 through a duct 12, and the exhaust gases upon passing through the exhaust ports 8, enter an exhaust header 13 by a duct 14, from there to be discharged into the atmosphere in the usual manner. A portion 15 of the dividing wall between the ducts adjacent to the cylinder is pivotally mounted at its end most remote from the cylinder, and is so arranged that at certain positions of the piston duct 12 is connected with ports 7 and duct 14 is connected with ports 8, while at other times both ports 7 and 8 are connected with the air receiver 9. This movable portion of the wall is what I term a director valve 15. Movement is imparted to the director valve through a push rod 16. One end of the push rod 16 is connected to the director valve 15, and the other end has a roller 17 engaging with a cam 18 mounted on any suitable revolving shaft 19.

It is not necessary that the director valve have a tight fit in the housing as a slight leakage of scavenging air around it will assist in keeping it cool without lubrication other than in the journals of its pivots. The valve may, also, be provided with ribs 20, see Fig. 5, on the scavenging side which will not only help in cooling it, but which will also direct the individual streams of scavenging fluid towards the ports in the cylinder. These ribs may be formed integral with or attached to the wall portion in any desired manner.

In Fig. 4 is shown my scavenging system applied to a double acting engine, wherein parts corresponding to those in Figs. 1 to 3 are designated with like reference characters, except that "a" is added. In this type it may be desirable to have the ports extend completely around the cylinder, instead of only partially, as shown in the single acting engine above described. In which case it will be necessary to provide a means to conduct the fluid, both entering and exhaust, to or from the respective receivers. For this purpose I have provided the member 21, that is divided into three chambers or compartments, those indicated X being for the exhaust and the one indicated Y being for the entering fluid. Although there is shown in this figure but one set of ports, it will be understood that there is also a second set of ports, as is customary in double acting engines. To properly control the fluid there must therefore be two director valves, one for each set. These valves I have designated 15^a and 15^b, and they are so connected that they operate complementarily, that is to say, as valve 15^a is moved from the position illustrated so that the duct 14^a is closed to the escape of exhaust gases, valve 15^b is automatically moved, opening duct 14^b, and vice versa. Any suitable connection between the two valves may be used for this purpose, but it is to be understood that the two will move simultaneously, movement being imparted thereto by a cam 18^a mounted on a shaft 19^a. The detail construction of each of the valves is similar to that heretofore described. It will also be noted that in this type of cylinder both sets of inlet ports are fed from one air receptacle 9^a, while each set of exhaust ports is provided with an exhaust header 13^a and 13^b, respectively.

As the operation of the device will be obvious to one skilled in the art, it is thought not necessary to give an explanation thereof. It will be understood, however, that the above description and accompanying drawings comprehend only the general and preferred embodiment of my invention and that various minor changes in details of construction, proportion, and arrangement of parts may be made within the scope of the appended claims and without sacrificing any of the advantages of my invention.

Having described my invention, what I claim as new is:

1. In an internal combustion engine, in combination with a cylinder, a scavenging system including a scavenging fluid source, a passageway for conveying the scavenging fluid to the cylinder, a passageway for conveying the exhaust gases from the cylinder, and a director valve in the dividing wall between the passageways adapted to permit communication between said source and both of said passageways simultaneously while at the same time closing one of the passageways to the escape of exhaust gases.

2. In an internal combustion engine, in combination with a cylinder, a scavenging system including a scavenging fluid source,

a passageway for conveying the scavenging fluid to the cylinder, a passageway for conveying the exhaust gases from the cylinder, a dividing wall between said passageways, a portion of the wall being pivoted to provide a director valve, and means for imparting movement to the valve.

3. In an internal combustion engine, in combination with a cylinder, a scavenging system including a scavenging fluid source, a passageway for conveying the scavenging fluid to the cylinder, a passageway for conveying the exhaust gases from the cylinder, a dividing wall between the passageways, a portion of the wall being pivoted to provide a director valve, ribs formed on the scavenging side of the valve, and means for operating the valve.

4. In an internal combustion engine, in combination with a cylinder, a scavenging system including a scavenging fluid source, a passageway for conveying the scavenging fluid to the cylinder, a passageway for conveying the exhaust gases from the cylinder, a dividing wall between the passageways, a portion of the wall being pivoted to provide a director valve, channels formed on the scavenging side of the valve, and means for operating the valve.

5. In a double acting combustion engine, in combination with a cylinder having a plurality of sets of inlet and exhaust ports, a scavenging system including a single scavenging fluid source, a plurality of passageways leading from the source to the inlet ports, a plurality of passageways leading from the exhaust ports to separate exhaust headers, connected valves for controlling the escape of the exhaust gases, said valves being pivoted in and when closed forming a part of certain of the walls forming the passageways, and means for operating the valves simultaneously.

6. In a double acting internal combustion engine, in combination with a cylinder having a plurality of inlet and exhaust ports, a scavenging system including a single scavenging fluid source, a plurality of passageways leading from the source to the inlet ports, a plurality of passageways leading from the exhaust ports to separate exhaust headers, means pivoted to and when closed forming a part of the walls of said passageways for closing one of said exhaust passageways while simultaneously opening the other of the exhaust passageways, at the same time leaving both of the inlet passageways open, and means for operating the first said means.

EDWARD C. MAGDEBURGER.