J. A. SEYMOUR.

INTERNAL COMBUSTION MOTOR.

APPLICATION FILED APR. 4, 1913.

1,175,017. Patented Mar. 14, 1916.

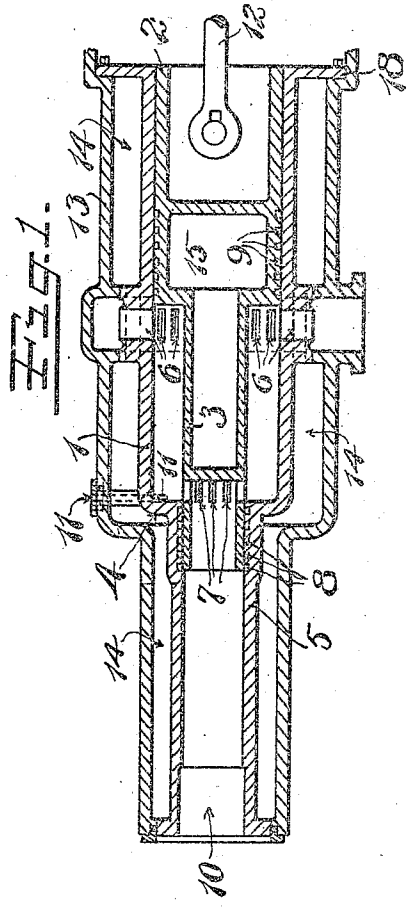


Fig. 1.

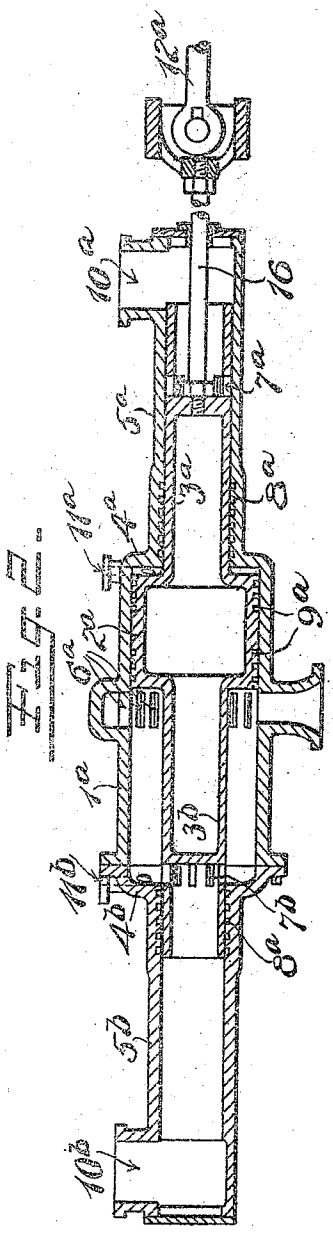


Fig. 2.

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INTERNAL-COMBUSTION MOTOR.

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To all whom it may concern:

Be it known that I, JAMES ALWARD SEYMOUR, a citizen of the United States, residing at Auburn, Cayuga county, New York, have invented certain new and useful Improvements in Internal-Combustion Motors, of which the following is a full, clear, and exact description.

My invention relates to internal combustion motors of the two-stroke cycle type and of the high compression variety or so-called "Diesel" type, in which type air alone is compressed and fuel injection begins at or about the end of the compression stroke, and is preferably ignited by compression, the injection of fuel being continued at such a rate as to burn at substantially constant pressure throughout such a portion of the working stroke as desired.

Among the main objects of my invention are simplicity of construction, involving the doing away with many working parts heretofore commonly used in motors of the high compression two-stroke cycle variety; securing efficient scavenging; reducing to a minimum the liability of warping or cracking from internal stresses due to the great differences in temperature in the various parts incidental to the operation of the motor; and an arrangement which makes it possible to water jacket the various parts when desirable without sacrificing the last named advantage.

In the accompanying drawings, Figure 1 is a central longitudinal section conventionally showing such parts of the motor as are essential to a full understanding of my invention as applied to a single acting motor. Fig. 2 is a similar view of my invention as applied to a double acting motor.

Referring to Fig. 1, 1 represents the cylinder. The piston employed is of the differential type in which 2 represents the working head. 3 is a tubular extension from the working head 2. 4 represents the head of the cylinder, the same having a passage in which the extension 3 works. Surrounding the passage in the head 4 is an extension 5 of suitable length to permit the piston extension 3 to reciprocate therein its full stroke. 6—6 are exhaust ports in the cylinder wall 1. 7—7 are air inlet ports in the piston extension 3. The extension 3 is of such length that when the piston is at the end of its power stroke, the said extension 3 will still be properly guided in the passage in the cylinder head. Suitable packing rings 8—8 are provided for the extension 3, the grooves for the packing rings being formed in the cylinder head or in its extension as shown. 9—9 are packing rings for the piston head 2, the grooves therefor being formed in said piston head, as shown in the drawings. 10 is an air inlet which opens into the extension 5, said pipe being arranged to conduct air under pressure from a suitable source of supply (not shown) into said extension. 11 is a fuel injection passage opening into the cylinder 1 at or near the cylinder head 4, said passage being in communication with a suitable fuel supply means arranged to inject the fuel under pressure into the cylinder beginning at or near the end of the compression stroke of the piston. One or more of these fuel injection inlets 11 may be provided, it being preferable that the same should enter the cylinder more or less tangentially.

The arrangement of the exhaust ports 6 and inlet ports 7 is such that the exhaust ports will open near the end of the power stroke of the piston in advance of the opening of the inlet ports, whereby the terminal pressure within the cylinder will drop to approximately atmospheric pressure by the time the inlet ports 7 begin to open, whereby air entering through the pipe 10 at comparatively low pressure may readily and effectively expel the burnt or inert gases contained within the cylinder. By preference the volume of air forced into the cylinder incidental to each scavenging process is somewhat in excess of the capacity of the cylinder to guarantee complete scavenging. Any suitable connection may be provided between the piston and the crank shaft (not shown), for example, an ordinary connecting rod, as indicated at 12. 13 represents a jacket wall for the cylinder water jacket space 14. 15 represents a water jacket space in the piston. Any usual means may be employed to maintain water circulation through said jacket spaces.

In Fig. 2, I have shown a double-acting motor constructed to embody the features of invention described in connection with Fig. 1 and in which 1^a represents the cylinder. 6^a—6^a represent the exhaust ports arranged substantially midway in the length of said cylinder. 4^a—4^b represent the cylinder heads, each having a passage designed to receive respectively the oppositely extend-

ing piston extensions 3^a—3^b. 11^a—11^b represent the fuel injection inlets at opposite ends of the cylinder 1^a. 5^a—5^b represent the cylinder head extensions. In this form of motor, means must be provided to permit the piston to be inserted or removed from the cylinder. One effective means may comprise forming one of the cylinder heads, for example 4^a, separately from the side wall of the cylinder and bolting the same to a flange on the cylinder wall, as shown. 10^a—10^b represent the air inlet passages which correspond in function to the air inlet passage described in connection with Fig. 1. To connect the piston with the motor crank shaft (not shown), I may connect a piston rod 16 to one of the piston extensions, for example, 3^a, said rod passing through a suitable stuffing box in the end of the cylinder head extension 5^a, as shown, whereby the usual connecting rod 12^a might be connected to the exposed end of said piston rod. One of the advantages of this double acting type of motor is that the stuffing box for the piston rod is moved from the zone of high pressure and hot gases. It will be understood that the various parts of the motor shown in Fig. 2 may be water-jacketed if desired.

The proposed arrangement gives unusual freedom from valves, ribs, or other connection, where water jackets are used between the outer water jacket wall, and the wall of the cylinder, so that the latter is free to expand in any direction at the points where it becomes hot, without causing internal stresses, or distortion, due to differences in expansion in the walls of cylinder and jackets. It should be understood that where the point of anchorage connection between cylinder and jacket walls occurs remote from the fuel injection passages, as at 18, Fig. 1, the latter, by reason of their comparatively small size, are easily made flexible to avoid danger of breakage, thus permitting expansion and contraction of the parts to occur freely.

In operation, it will be observed that the exhaust ports open in advance of the inlet ports 7, whereby the pressure within the cylinder may very materially drop, and preferably to a point relatively near atmosphere, before the inlet ports open, so that the scavenging air may be effectively introduced at low pressure. It will be apparent that this is very important in the motor illustrated and described herein, because it operates on the high compression, or Diesel, principle. It is apparent that if the exhaust ports and inlet ports opened simultaneously, the pressure within the cylinder would be so great under normal working loads that it would require very heavy pressure on the scavenging air to effect the scavenging of the cylinder or cylinders. Furthermore, if the pressure of the gases in the cylinder is higher than that of the scavenging air when the inlet ports 7 open, a temporary back flow of the gases into the cylinder extension will take place, substantially retarding the actual commencement of the scavenging within the cylinder by the time taken to drive back the inert gases in the cylinder extension, and thereby materially lowering the efficiency of the scavenging operation.

It should be understood that the drawings submitted herewith are illustrative rather than definitive, and that I may make changes in proportions and arrangements so long as the essential features herein described are maintained.

I have made no effort to show the means for feeding fuel into the cylinder through the fuel injection passage or passages, or for forcing air into the cylinder extension or extensions, since such a means may be constructed in a great variety of ways, no particular novelty of construction therefor being claimed herein. In this motor, as in all motors of the Diesel type, the fuel may be injected at any time and maintained for any desired period, thereby differing from the ordinary so-called explosion motor, in which an explosive mixture of gas is first compressed and then ignited.

What I claim is:

In an internal combustion motor of the high compression, or Diesel, type, a cylinder having an extension at one end of smaller diameter, in combination, a piston arranged to reciprocate in said cylinder and having a hollow extension arranged to reciprocate in the extension of the cylinder, a fuel injection inlet at one end of said cylinder adjacent to said extension of smaller diameter, a low pressure air inlet leading into the cylinder extension, an inlet port in the hollow piston extension arranged to put the interior of said cylinder extension into communication with the interior of the cylinder through the piston extension when the piston is approaching the end of its working stroke, an exhaust port in the wall of the cylinder at the end opposite the fuel injection inlet and arranged to be uncovered by the piston as the latter approaches the end of its working stroke, said exhaust outlet being so arranged that it will be opened by said piston in advance of the opening of the air inlet port in the piston extension.

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