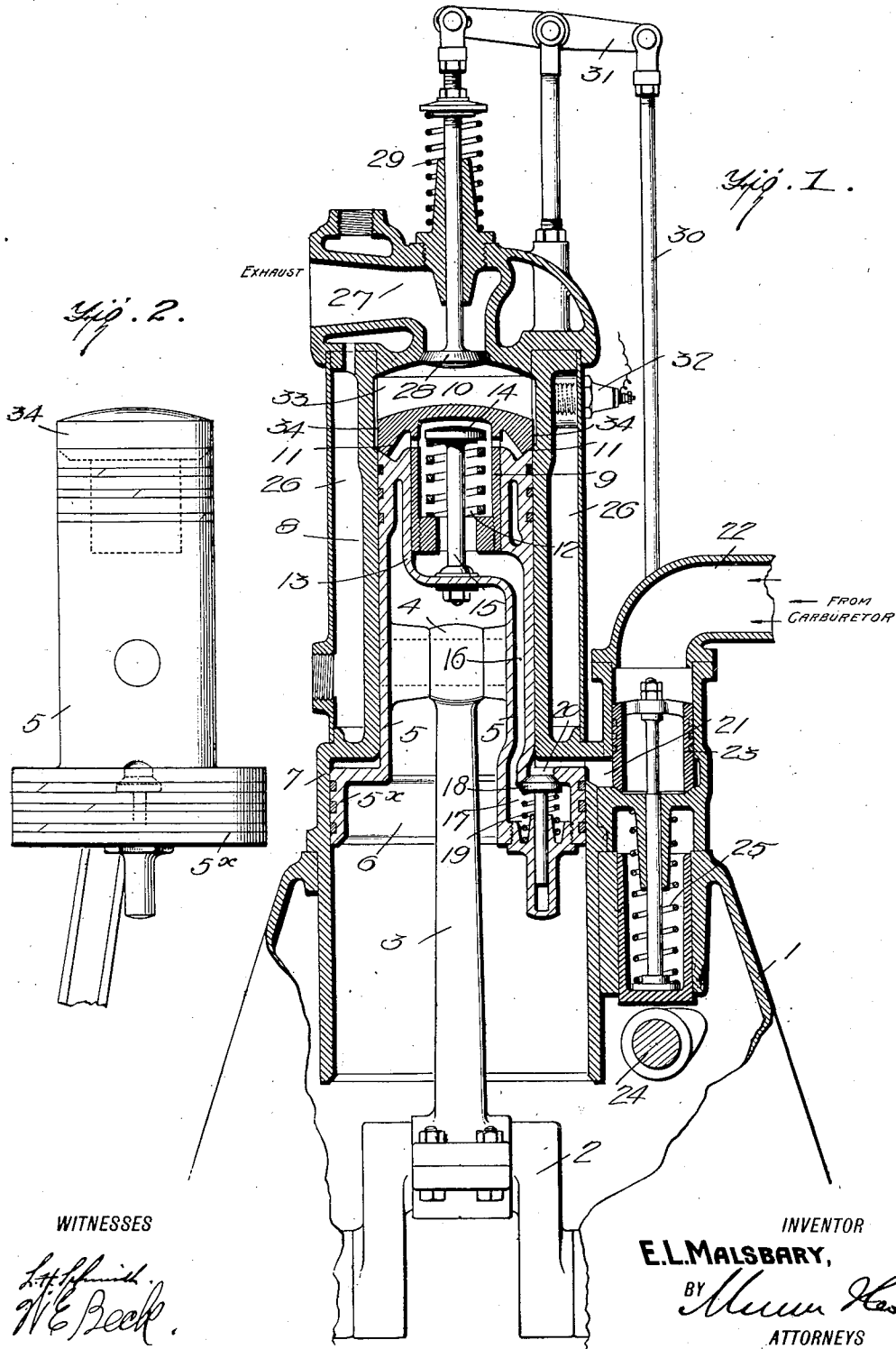


E. L. MALSARY.
INTERNAL COMBUSTION ENGINE.
APPLICATION FILED JUNE 14, 1917.

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UNITED STATES PATENT OFFICE.

EDWARD LEIGH MALSARY, OF RENO, NEVADA.

INTERNAL-COMBUSTION ENGINE.

1,386,129.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, EDWARD LEIGH MALSARY, a citizen of the United States, and a resident of Reno, in the county of Washoe and State of Nevada, have invented a new and useful Improvement in Internal-Combustion Engines, of which the following is a specification.

My invention relates to improvements in internal combustion engines and it consists in the combinations, constructions and arrangements herein described and claimed.

An object of my invention is to provide an engine of the two-cycle type which is scavenged as completely as an engine or motor of the four-cycle type.

A further object of my invention is to provide a device of the type described in which the explosive charge is forced through the hottest part of the motor, thereby not only rendering the fuel more easily ignited and consumed but also tending to cool the engine.

A further object of my invention is to provide an engine in which the use of ports such as those ordinarily used in two-cycle engines is dispensed with.

Other objects and advantages will appear in the following specification and the novel features of the invention will be particularly pointed out in the appended claims.

My invention is illustrated in the accompanying drawings, forming part of this application, in which—

Figure 1 is a central vertical section through the device,

Fig. 2 is a side view of the piston.

In carrying out my invention I provide a crank case 1 containing the usual crank 2 to which is attached the pitman 3. The latter is secured at 4 to a wrist pin which is firmly secured to the walls of the reduced portion of the piston 5. This reduced portion is connected with an enlarged portion 6.

The casing 7 of the engine has a reduced portion 8 in which the reduced portion 5 of the piston moves. The top part of the piston member 5 is cored out to receive the slidable sleeve 9 which is connected with a valve 10. The valve 10 is equal in diameter to the explosion piston 5 with a sliding fit in the bore of the explosion cylinder, and is practically the head of the piston. This valve is spaced apart from the piston portion 5 and has a seat 11 near its outer edge. It should be observed particularly that the

seat 11 includes the upwardly inclined surface which leads to the interior surface of the cylinder. This inclination directs the gas upwardly when released under pressure. The valve is normally held on the seat by means of a spring 12, one end of which bears on a nut 13 which is screwed to the sleeve 9, the other end bearing on a head 14 which is fastened to a stem 15 secured to the piston member 5. A by-pass 16 leads from the space within the sleeve 9 to a valve chamber 17 in which is disposed a valve 18 which is held by a spring 19 normally on its seat. This valve 18 covers a port 20 leading to an annular chamber 21.

The intake pipe is shown at 22. Communication between the intake pipe 22 and the annular chamber 21 is controlled by a sleeve valve 23 which is operated by a cam 24, a spring 25 being provided for normally holding the valve in closed position. At 26 I have shown a water jacket for the engine.

The top of the engine comprises an exhaust passage 27 which is controlled by the valve 28 manipulated by a valve rod which is normally closed by a spring 29, but which may be opened by the rod 30 acting through a lever 31. A spark plug 32 is provided for igniting the charge.

From the foregoing description of the various parts of the device, the operation thereof may be readily understood.

Let us assume that the device is in the position shown in Fig. 1 and that a charge has just been exploded. It will drive the piston downwardly and the chamber 21 will then increase in volume. At the first downward movement of the piston the valve 23 is opened by the cam 24 so that the fuel is drawn in from the intake pipe 22 into the chamber 21. At or near the limit of the downward stroke of the piston the valve 23 is closed, thus trapping the fuel in the chamber 21. On the return or upstroke of the piston the exhaust valve 28 is opened and valve 18 is forced open by the pressure created in the chamber 21, and the gas is forced through the by-pass 16, into the interior of the sleeve 9. Here it meets the valve 10 and lifts it from its seat permitting the gas to enter the explosion chamber 33 through the grooves 34 at the sides of the valve 10. This incoming gas is already compressed and ready to fire. When the piston reaches the proper point ignition will take place and drive the piston forwardly again. It will

thus be seen that several advantages are accomplished. In the first place, the entrance and exit of the gases are controlled by valves, thus eliminating the ports which are ordinarily used in two-cycle engines. The cylinder is scavenged in a similar manner to that of a four-cycle engine. The incoming charge is brought into close contact with the hottest part of the engine thereby cooling the engine and also heating the charge. Inasmuch as one of the disadvantages ordinarily experienced with two-cycle engines is the fact that they tend to heat up quickly and are ordinarily not thoroughly scavenged of the spent charge, it will be readily seen that in this device I have overcome these objections without sacrificing the power which is obtained in an engine of the two-cycle type.

I claim:—

1. In an internal combustion engine, a cylinder having a bore of two diameters providing a compression and an explosion chamber, a piston having lower and upper portions different in diameter to fit the corresponding compression and explosion chambers, a by-pass in the piston leading from the compression to the explosion chamber, a valve in the lower end of the by-pass, having a spring arranged to keep the valve closed for a predetermined time and until overpowered by the pressure in the compression chamber, and a valve mounted in the upper end of the by-pass and operating in the head of the explosion cylinder practically forming the head of the piston.

2. In an internal combustion engine, a cylinder having a bore of two diameters providing a compression and an explosion chamber, the explosion chamber having a plurality of gas grooves, a piston having lower and upper portions different in diameter to fit the corresponding compression and explosion chambers, a by-pass in the piston leading from the compression to the explosion chamber, a valve in the lower end of the by-pass, having a spring normally keeping the valve closed but being overcome by the increasing pressure in the compression chamber on the upstroke of the piston, and a valve mounted in the upper end of the by-pass with a seat on the piston and having a head operating in the bore of the explosion cylinder practically forming the head of the piston, said valve opening under gas pressure in the by-pass, and permitting the gas to pass into the explosion chamber through the gas grooves upon reaching them.

3. In an internal combustion engine, a cylinder having a bore of two diameters providing a compression and an explosion chamber, the explosion chamber having a plurality of gas grooves, a piston having lower and upper portions different in diameter to fit the corresponding compression and explosion chambers, a by-pass in the piston

leading from the compression to the explosion chamber, a valve in the lower end of the by-pass, having a spring normally keeping the valve closed but being overcome by the increasing pressure in the compression chamber on the upstroke of the piston, a valve mounted in the upper end of the by-pass and having a head operating in the bore of the explosion cylinder practically forming the head of the piston, said valve opening under gas pressure in the by-pass and permitting the gas to pass into the explosion chamber through the gas grooves upon reaching them, and a seat on the end of the piston, with an upwardly inclined wall leading to the gas grooves, to direct the gas toward the grooves when the valve unseats.

4. The combination in an internal combustion engine, of a cylinder with a bore of two diameters providing a compression chamber and an explosion chamber, the explosion chamber wall having a plurality of grooves, a gas inlet valve for the compression chamber, an exhaust valve for the explosion chamber, cam actuated means for operating said valves in succession, a two-diameter piston fitting in the respective chambers, a valve-controlled compressed gas by-pass in the piston leading from the compression to the explosion chamber, and a valve mounted on top of the explosion piston and controlling the discharge of the compressed gas from the by-pass to the explosion chamber through the grooves, said valve being equal in diameter to the explosion piston and practically forming the piston head.

5. A two-cycle internal combustion engine comprising an outer cylindrical casing having a reduced portion, a piston having a body portion arranged to engage the interior of said outer casing and a reduced portion arranged to engage the interior of the reduced portion of said casing, an annular compression chamber between the junction of the reduced portion of the casing with the main cylindrical portion and the reduced portion of the piston with its main cylindrical portion, a valve carried at the end of the reduced portion of the piston, said valve having a chamber, a by-pass between said valve chamber and said compression chamber, a valve for controlling the entrance of fuel into said compression chamber, a check valve between said compression chamber and said by-pass, spring means carried by the reduced portion of the piston for pressing the valve carried by said reduced portion against its seat, and grooves in the walls of the reduced portion of the casing for permitting the passage of gas when the piston valve is unseated.

6. Instrumentalities embodied in a two-cycle internal combustion engine for scav-

enging the cylinder of a previously burnt charge before introducing a fresh charge, comprising a cylinder with a plurality of gas grooves near the top and an exhaust valve, a piston operating in the cylinder and having a gas trap with a check-valve-controlled compressed gas inlet, and a normally spring-seated valve in the top of the piston of the same diameter as that of the piston, to hold the compressed gas in the gas trap whether the valve is seated or unseated until the gas grooves are reached, and the exhaust gas is substantially completely forced out of the exhaust valve on the inward stroke of the piston.

7. Means in an internal combustion engine, for introducing into the explosion chamber a compressed charge of gas equal to or greater in volume than the piston displacement of said chamber, and completely scavenging the explosion chamber during the act of compressing the gas; consisting of a piston having piston heads of different diameters with a gas trap extending from the lower to the upper piston head, a spring seated valve controlling the entrance to the gas trap in the lower piston head, a spring seated valve controlling the exit of the gas trap at the upper piston head and being the same in diameter as the piston head, a cylinder for the piston, of different diameters to correspond to the piston heads, the upper cylinder having gas grooves at the top to enable the transference of the compressed gas in the trap to the combustion chamber upon the prior expulsion of all burnt gas, a gas inlet joined to the lower cylinder, including a valve chamber with a short passage leading to the cylinder, and a tubular inlet valve operating in said chamber producing a wide gas passage in the valve chamber when opened, and shutting off the valve chamber when closed, causing substantially all of the gas to enter the gas trap.

8. The combination of a piston having a by-pass terminating in an enlarged chamber at the top, a stem fixed in the chamber, a false piston head arranged to act as a valve, having a sleeve portion slidable in the chamber and provided with gas outlet ports, and resilient means interposed between said stem and a portion of said sleeve to normally hold the false head against the piston.

9. An internal combustion engine, comprising in combination a cylinder having two portions of unequal internal diameter, a power piston having two portions of unequal external diameter and arranged to reciprocate in said cylinder, said cylinder having an intake port communicating with that portion thereof which has the larger diameter and a combustion chamber communicating with that portion thereof which has the smaller diameter, that portion of said piston

which has the smaller diameter having a passageway therethrough, and a sub-piston arranged to close said passageway during the power stroke.

10. An internal combustion engine, comprising in combination a cylinder having two portions of unequal internal diameter, and a power piston having two portions of unequal external diameter and arranged to reciprocate in said cylinder, said cylinder having an intake port communicating with that portion thereof which has the larger diameter, the end of that portion of said cylinder which is of the smaller diameter being provided with a fuel conducting passage, a combustion chamber communicating with that portion thereof which has the smaller diameter, that portion of said piston which has the smaller diameter having a passageway therethrough, and a sub-piston arranged to close said passageway during the power stroke.

11. An internal combustion engine, comprising in combination a cylinder having two portions of unequal internal diameter, a power piston having two portions of unequal external diameter and arranged to reciprocate in said cylinder, said cylinder having an intake port communicating with that portion thereof which has the larger diameter and a combustion chamber communicating with that portion thereof which has the smaller diameter, that portion of said piston which has the smaller diameter having a passageway therethrough, a sub-piston arranged between said power piston and said combustion chamber, and spring means for holding said sub-piston on said power piston during the power stroke.

12. An internal combustion engine, comprising in combination a cylinder having a combustion chamber, means whereby a charge of fuel and air is drawn into said cylinder, means whereby said charge is forced under pressure into said combustion chamber in the form of a hollow cylinder, the walls of which are sufficiently thin to effect such a thorough mixing of said charge that, substantially, combustion will result on ignition, a valveless sub-piston for preventing said charge from commingling with the burned gases of the previous explosion, and means for controlling said sub-piston.

13. An internal combustion engine, comprising in combination a cylinder having a combustion chamber, means whereby a charge of fuel and air is drawn into said cylinder, means whereby said charge is forced under pressure into said combustion chamber in a thin annular sheet, a valveless sub-piston for preventing said charge from commingling with the burned gases of the previous explosion, and means for controlling said sub-piston.

14. An internal combustion engine, com-

prising in combination a cylinder terminating in a combustion chamber, the combustion chamber end of said cylinder being counterbored; a power piston arranged to reciprocate in said cylinder, and a sub-piston located between said power piston and said combustion chamber, the area between the peripheral surface of said sub-piston and the wall of the counterbored portion of the cylinder being so small that a charge of fuel and air may be forced therethrough into the combustion chamber in an annular sheet sufficiently thin to effect such a thorough mixing of said charge that substantially complete combustion will result on ignition, and means for controlling said sub-piston.

15. An internal combustion engine, comprising in combination a cylinder terminating in a combustion chamber, the combustion chamber end of said cylinder being counterbored; a power piston arranged to reciprocate in said cylinder, a sub-piston located between said power piston and said combustion chamber, and mechanical means for controlling said sub-piston.

16. An internal combustion engine, comprising in combination a cylinder terminating in a combustion chamber, the combustion

chamber end of said cylinder being counterbored; a power piston arranged to reciprocate in said cylinder, a sub-piston located between said power piston and said combustion chamber, and spring means for controlling said sub-piston.

17. An internal combustion engine, comprising in combination a cylinder terminating in a combustion chamber, the combustion chamber end of said cylinder being counterbored, the bottom of the counter-bore being beveled inwardly; a power piston arranged to reciprocate in said cylinder, a sub-piston located between said power piston and said combustion chamber, the area between the peripheral surface of said sub-piston and the wall of the counter-bored portion of the cylinder being so small that a charge of fuel and air may be forced therethrough into the combustion chamber in an annular sheet sufficiently thin to effect such a thorough mixing of said charge that substantially complete combustion will result on ignition, and means for controlling said sub-piston.

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Witnesses:

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