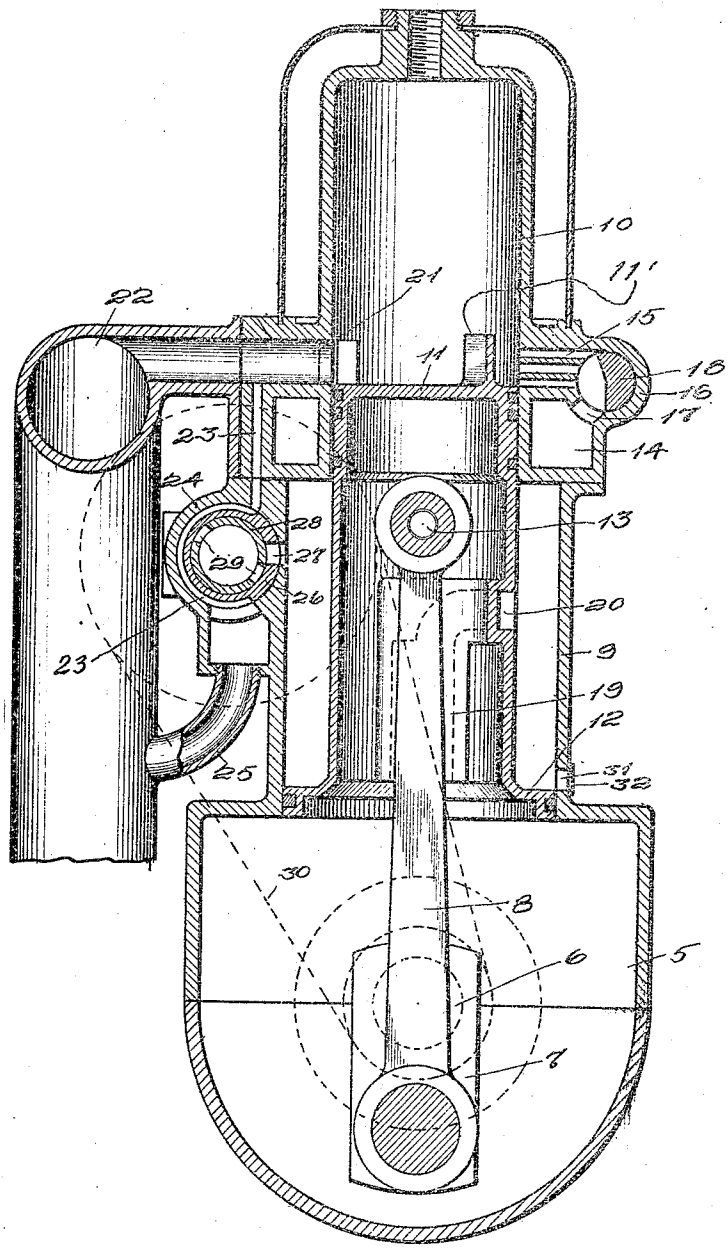
C. M. LEECH.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED MAR. 12, 1914. RENEWED APR. 3, 1916.

1,182,494. Patented May 9, 1916.



Witnesses

Inventor

Charles M. Leech,

By C. H. Parker

Attorneys

UNITED STATES PATENT OFFICE.

CHARLES M. LEECH, OF LIMA, OHIO.

INTERNAL-COMBUSTION ENGINE.

1,182,494. Specification of Letters Patent. Patented May 9, 1916.

Application filed March 12, 1914, Serial No. 824,164. Renewed April 3, 1916. Serial No. 88,703.

To all whom it may concern:

Be it known that I, CHARLES M. LEECH, a citizen of the United States, residing at Lima, in the county of Allen and State of Ohio, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

My invention relates to improvements in internal combustion engines of the two cycle or four cycle type having means to heat and compress the charge of gas prior to its introduction into the explosion cylinder.

An important object of the invention is to provide means for utilizing the exhaust or products of combustion passing from the explosion cylinder, to heat the incoming charge passing through the movable or rotatable distributing valve, prior to its introduction into the pumping chamber, to be supplied thereby to the explosion cylinder.

A further object of the invention is to provide a novel form of charge or gas pumping or compression means, dispensing with crank case compression, and at the same time simplifying the construction of the engine.

A further object of the invention is to provide means for introducing a separate supply of fresh air into the pumping cylinder, to properly dilute the previously mixed gas or charge supplied thereto from the carbureter, such introduction of fresh air preferably taking place when the pumping piston nears the lower end of its down stroke.

A further object of the invention is to provide an engine of the above mentioned character, which is simple in construction, inexpensive to manufacture, strong, durable, and convenient in use.

Other objects and advantages of the invention will be apparent during the course of the following description.

In the accompanying drawings forming a part of this specification and in which numerals are employed to designate the several parts throughout the same, the figure is a central longitudinal sectional view through an engine embodying my invention.

In the drawings, wherein for the purpose of illustration is shown a preferred embodiment of my invention, the numeral 5 designates a crank case, within which is rotatably mounted a crank shaft 6, provided with a crank 7, having pivotal connection with an upstanding pitman 8. Formed upon the upper end of the crank case 5 is a lower pumping cylinder 9, upon the upper end of which is formed an explosion cylinder 10, the explosion cylinder, preferably having a smaller diameter than the pumping cylinder, as shown. Mounted to reciprocate within the explosion cylinder 10 is a preferably tubular operating piston 11, upon the lower end of which is formed a laterally extending pumping piston 12, of greater diameter and reciprocating within the pumping cylinder 9, as shown. The pitman 8 extends into the piston 11 and is pivotally connected therewith, as shown at 13.

Preferably interposed between the pumping cylinder 9 and the explosion cylinder 10 is a preferably annular compression chamber 14, forming in effect a downward continuation of the explosion cylinder 10, as shown. It is obvious that the location of this compression chamber 14 is such that it will receive heat from the explosion cylinder, whereby the incoming charge will be thoroughly heated before entering the explosion cylinder. Port or ports 15, lead at their outer ends into a valve casing 16, having communication with the chamber 14 through a port 17. The port or ports 15 are also in communication with the lower end of the cylinder 10. A valve 18 is mounted to turn or rock within the valve casing 16, to cover a selected number of the ports 15, when it is desired to reduce or throttle the charge supplied to the explosion cylinder 10, the ports 15 leading into the lower end thereof, as shown.

The operating piston 11 is provided at its lower end with a longitudinally extending exterior port or pocket 19, adapted, when the operating piston is in its lower position, to be in free communication with the interior of the pumping cylinder 9. The exterior port 19 has its upper end in the form of a transverse or horizontal portion 20, adapted when the operating piston 11 moves upwardly sufficiently, for registration with the port 15. In this manner, upon the up-stroke of the operating and pumping pistons, the charge compressed in the pumping cylinder 9 will pass through the exterior port 19, ports 15, valve casing 16, and into the compression chamber 14, and remain therein until the operating piston has again traveled downwardly whereby its upper end uncovers the ports 15, at which time the charge within the compression chamber 14 will pass into the explosion cyl-

inder 10, behind the deflector 11'. This deflector causes the incoming charge to travel upwardly into the explosion cylinder, for properly expelling the products of combustion from the previous explosive charge.

The explosion cylinder 10 is provided near its lower end and preferably diametrically opposite the parts 15 with an exhaust port 21, formed through the annular compression chamber 14, as shown. This exhaust port discharges into an exhaust pipe 22, as shown. An auxiliary passage or port 23 is in free communication with the exhaust port 21, and serves to conduct a portion of the heated gases or products of combustion into and through a distributing valve casing 24, as shown. The exhaust passes through the valve casing 24, finally discharges through a pipe 25 and is conducted thereby to the pipe 22. Arranged within the valve casing 24 is a tubular sleeve or bushing 26, provided with a port 27, in communication with the interior of the pumping cylinder 9, near and spaced a substantial distance from the upper end thereof. Rotatably mounted within the tubular sleeve or bushing 26 is a rotatable tubular distributing valve 28, provided with preferably diametrically oppositely arranged exhaust ports 29, adapted for registration with the port 27. The valve 28 is driven, by and at one-half of the speed of rotation of, the crank shaft 6 through the medium of driving connecting means 30, of any well known or preferred type. One port 29 is brought into registration with the port 27 upon each down stroke of the piston 11, preferably when the same has about half way completed the down stroke. It is to be understood that a previously formed charge of gas is supplied to the tubular rotatable valve 28, from a carbureter of any well known or preferred type, such carbureter being connected with the tubular valve by any suitable means.

From the foregoing it is obvious that the rotatable valve 28 controls the passage of the gas or explosive charge into the pumping cylinder 9, and that such gas is heated before entering the pumping cylinder, by the products of combustion or exhaust from the explosion cylinder circulating through the port 23 in proximity to the rotatable valve 28.

In order that fresh or cool air may be supplied to the gas or explosive charge fed into the pumping cylinder 9, before such charge is finally supplied to the explosion cylinder, I provide the pumping cylinder at its lower end with an air inlet port 31, preferably spanned by a section of wire fabric 32, or the like. The air inlet port 31 is not uncovered for the purpose of supplying air into the pumping cylinder 9 above the pumping piston 12, until said pumping piston has reached the end of its down stroke.

The operation of the engine is as follows: Upon the down stroke of the operating and pumping pistons, and when the same has about one-half way completed such down stroke, port 29 is brought into registration with port 27, whereby the gas or explosive charge is fed or sucked into the pumping cylinder 9 above the pumping piston 12. This action continues until the pistons reach the end of their down stroke, whereby pumping piston 12 will uncover the air inlet 31, such air passing inwardly to mix with the gas in the pumping cylinder 9, due to the presence of a more or less degree of vacuum within the pumping cylinder. When the operating piston 11 reaches the end of its down stroke, as above stated, the products of combustion from the previously fired charge, pass through exhaust port 21 into exhaust pipe 22, some of this heated gas or products of combustion also passing through the auxiliary exhaust port 23, to travel in proximity to the rotatable tubular distributing valve 28, to heat the same and the charge of gas supplied thereto, whereby the gas is heated before entering the pumping cylinder, as hereinabove described. The gas previously fed to the compression chamber 14 now passes through ports 15 and associated elements into the lower end of the explosion cylinder 10, the same passing upwardly therein by virtue of the deflector 11', thus aiding in expelling the products of combustion of the previously explosive charge. Upon the up stroke of the operating and pumping pistons, the gas and air contained within the pumping cylinder 9 is suitably compressed within the cylinder 9, and when the upper portion 20 of the exterior port 19 moves into registration with ports 15, such gas and air pass into the compression chamber 14, as is obvious. Upon the down stroke of the pistons the foregoing operation is repeated.

While I have shown and described my invention as applied to or embodied in a two cycle engine, I wish it distinctly understood that the invention is in no sense restricted to this use, as the same may be advantageously practised in connection with a four cycle engine.

It is to be understood that the form of my invention herewith shown and described is to be taken as a preferred example of the same, and that various changes in the shape, size and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the subjoined claims.

Having described my invention, I claim:—

1. In an engine of the character described, an explosion cylinder provided with an inlet port and a permanently unobstructed exhaust port, a working piston mounted to reciprocate within the explosion cylinder to

uncover the ports upon the down stroke thereof, a pumping cylinder arranged below the explosion cylinder, a compression chamber interposed between the explosion cylinder and pumping cylinder, means of communication between the compression chamber and inlet port, a pumping piston carried by the working piston and operating within the pumping cylinder, said working piston being provided near and above the pumping piston with a longitudinal exterior pocket adapted for registration with the inlet port, a valve casing formed upon the pumping cylinder near and below the compression chamber and having a main cylindrical opening and an auxiliary exhaust port having no communication with the main cylindrical opening and communicating with the exhaust port of the explosion cylinder, the main cylindrical opening of the valve casing having means of communication with the pumping cylinder, and a rotatable valve mounted within the valve casing to control the passage of gas through the means of communication between the valve casing and pumping cylinder.

2. In an engine of the character described, an explosion cylinder provided with an inlet port and a permanently unobstructed exhaust port, a piston mounted to reciprocate within the explosion cylinder, apparatus to supply gas to the inlet port, a valve casing connected with the apparatus, having communication therewith, and spaced a substantial distance from the permanently unobstructed exhaust port with an auxiliary exhaust port formed therethrough having no communication with the main opening of the valve casing and communicating with the exhaust port, and a movable valve mounted within the main opening of the valve casing to control the passage of gas therefrom.

3. In apparatus of the character described, an explosion cylinder provided with an inlet port and an exhaust port, a working piston mounted to reciprocate within the explosion cylinder, a compression chamber having communication with the inlet port, a movable valve to control such communication to increase and reduce the volume of gas passing to and from the compression chamber through the inlet port, a pumping cylinder, a pumping piston connected with the working piston and operating within the pumping cylinder, and said working piston, being provided near and above the pumping piston with a longitudinal exterior pocket adapted to communicate with the inlet port.

4. In an engine of the character described, an explosion cylinder provided with inlet and exhaust ports, a working piston mounted to reciprocate within the explosion cylinder and provided in its lower portion with an exterior longitudinal pocket adapted to communicate with the inlet port, a pumping cylinder, a pumping piston connected with the working piston and operating within the pumping cylinder, an annular compression chamber surrounding the lower portion of the explosion cylinder beneath and in proximity to the inlet and exhaust ports and having means of communication with the inlet port, and a movable valve for controlling the means of communication between the annular compression chamber and the inlet port to increase and reduce the volume of gas passing to and from the compression chamber through the inlet port.

In testimony whereof I affix my signature in presence of two witnesses.

CHARLES M. LEECH.

Witnesses:

J. M. MATCHETTE,

CLARENCE C. MILLER.