E. EASTHOPE, Jr.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED SEPT. 23, 1909.

976,858. Patented Nov. 29, 1910.

Fig. 2.

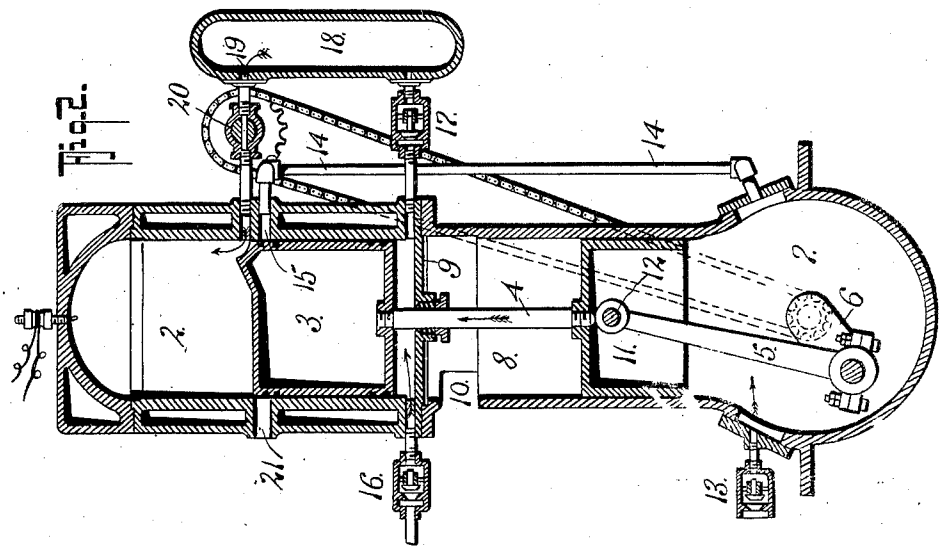
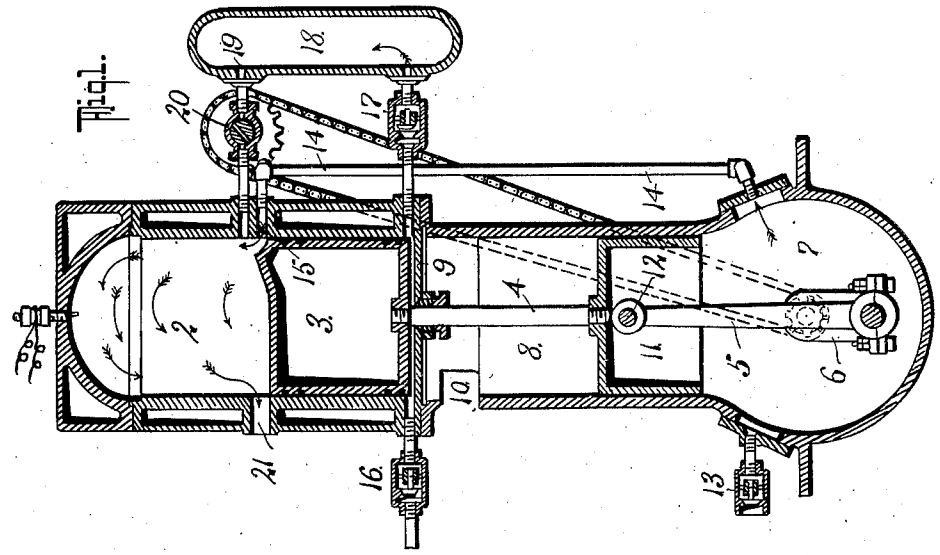


Fig. 1.



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INTERNAL-COMBUSTION ENGINE.

976,858. Specification of Letters Patent. Patented Nov. 29, 1910.

Application filed September 23, 1909. Serial No. 519,129.

To all whom it may concern:

Be it known that I, ERNEST EASTHOPE, Jr., a citizen of the Dominion of Canada, residing at Vancouver, in the Province of British Columbia, Canada, have invented a new and useful Internal-Combustion Engine, of which the following is a specification.

This invention relates to an internal combustion engine of the two cycle type in which by the adoption of certain novel features in the construction and arrangement of the several parts of the engine I attain a more efficient scavenging from the cylinder of the residual inert products of the last explosion, a more direct and immediate introduction of the fresh charge of gas and air, an air cushion absorption of the momentum of the piston during the downstroke, and in these improvements the disposition of the pistons in relation to the connecting rod pin such that the piston bearing on which is imposed the greater part of the thrust due to the angularity of the connecting rod is removed some distance from the explosion cylinder so that its lubricant is not exposed to the excessive heat thereof.

The invention is particularly described in the following specification, reference being made to the drawings by which it is accompanied, in which:

Figure 1 is a vertical section through an internal combustion engine of the two cycle class having a closed crank chamber showing the piston at the bottom of its stroke in which position it has exhausted the products of the explosion and has uncovered the port to admit a scavenging charge of compressed air through the cylinder, and Fig. 2 shows a similar view of the same engine wherein the piston has commenced the upward stroke and has closed the scavenging port and the valve is opened to admit the explosive charge to be compressed during the upstroke for the next explosion.

In these drawings 2 represents the explosion cylinder and 3 its piston, connected by a piston rod 4 and connecting rod 5 to the crank 6. The crank rotates in a closed crank chamber 7 between which and the explosion cylinder 2 is a supplementary air compression cylinder 8 in connection with the crank chamber 7 and separated from the explosion cylinder 2 by a partition 9 through which the piston rod 4 is gland-packed, access to which gland is provided by an opening 10 in the wall of the cylinder. Within the supplementary cylinder 8 is a piston 11 which is secured on the piston rod 4 and in which is the pin 12 of the connecting rod 5. The crank chamber 7 is furnished with a suction valve 13 from the external air and the indrawn air is delivered during the downstroke through a passage 14 uncovered by the piston 3 when at the bottom of its stroke. Into the lower end of the explosion cylinder 2 and below its piston 3, air or gas and air is drawn through a suction valve 16 and this air or gas is compressed during the downstroke of the engine and is delivered through a check valve 17 into a compression chamber 18 from which a passage 19 delivers through a valve 20 controlled from the crank shaft into the explosion cylinder 2 through a port above but closely adjacent to the scavenging port 15. The valve 20 may be operated in any manner from the crank shaft of the engine so that it will be opened to admit the compressed gas and air just after the piston has commenced its upstroke and as it is closing the scavenging port 15. In the drawing this valve is shown as having a through port and rotatable by a chain gear from the crank shaft at half its speed which will give an admission for each revolution. The suction valve 16 may draw from the carbureter or if thought advisable the carbureter may be introduced in the connection from the bottom of the cylinder 2 to the compression chamber 18.

In the operation of the engine the downstroke of the piston 3 under the force of the explosion compresses between that piston and the cylinder end 9 the gas and air or air alone according to the location of the carbureter, drawn in through the suction 16 during the upstroke and delivers it through the check valve 17 into the compression chamber 18. In the same movement the lower piston 11 compresses within the crank chamber 7 the charge of air drawn in through the suction valve 13. As the piston 3 reaches the lower end of its movement its upper edge first uncovers the exhaust port 21 and later after the products of the explosion have to a large extent escaped, the piston uncovers the port 15 and the air compressed in the crank chamber 7 scavenges from the cylinder, as indicated by the arrows in Fig. 1 the residuum of the inert gas. Thereafter as the piston moves up and is about to close or has closed the scavenging port 15 and the exhaust port 21, the valve 20 commences to

open to deliver the charge of gas and air from the compression chamber 18 for the next explosion which gas and air being under compression will flow rapidly in and fill the cylinder mixing with the scavenging air left therein instead of with an exhausted gas as is usual. This charge is compressed in the upper end of the explosion cylinder to be ignited in the usual manner when the piston is at the upper end.

It must be noted as an important feature of this invention that the momentum of the downwardly moving piston is absorbed not only by the compression of the air in the crank chamber 7 which alone would not be particularly effective for that object as the pressure in the crank chamber is released before the piston reaches the bottom of its stroke or as soon as it begins to uncover the port 15, but the downward movement of the piston 3 is also checked by the ample area of its under side compressing the gas and air or air into the compression chamber 18 and this compression acts to retard the piston to the full end of the stroke. It will be noticed further as an advantageous incidental feature that the angular thrust of the connecting rod does not come upon the explosion piston 3 which owing to its heat cannot be efficiently lubricated to withstand that lateral pressure, but upon the piston 11 which being separated from the explosion cylinder and exposed to a continual inflow of external air is comparatively cool.

I am aware that prior to my invention attempts have been made to scavenge the explosion cylinder with pure air prior to the admission of the next charge but in all with which I am acquainted these attempts have been ineffective in that the scavenging charge has been unable to pass through a considerable volume of port passages in which inert gas was pocketed so that the incoming charge has been more or less diluted.

Having now particularly described my invention and the manner of its operation, I hereby declare that what I claim as new and desire to be protected in by Letters Patent, is:

1. An explosion engine comprising a working cylinder inclosing an explosion chamber, a working piston operating in said cylinder, a piston rod connected with said piston and projecting through the end of said cylinder, a crank case having an upwardly projected cylinder portion to which said working cylinder is secured and into which said piston rod projects, a supplemental piston in said crank case cylinder portion connected to said piston rod, said crank case cylinder portion having an opening above said supplemental piston to effect communication with the atmosphere, a valved air inlet to said crank case, a crank shaft having a crank working in said crank case, a connecting rod between said supplemental piston and said crank, said working cylinder having an air inlet port, said working cylinder having an exhaust port opposite said inlet port, a pipe connection between said air inlet port of said working cylinder and said crank case, a working agent inlet port for the working chamber of said working cylinder, said working cylinder also inclosing a pumping chamber, in which said working piston compresses working agent, a valved intake port to said pumping chamber and a valved outlet port for said pumping chamber, a reservoir connected with said valved outlet port of said pumping chamber, a connection between said working agent inlet port of said working chamber and said reservoir, a valve in said connection, and means connecting said valve with the crank shaft to operate the same.

2. In an internal combustion engine, a crank case having an upwardly projected cylinder portion, a piston operating in said upwardly projected cylinder portion, a crank shaft having a crank operating in said crank case, a valved intake for said crank case, a connecting rod between said piston and said crank, a working cylinder supported on and above said cylinder portion of said crank case, said cylinder portion of said crank case above said piston having an aperture to maintain atmospheric pressure within said crank case cylinder portion above said piston, a working piston in said working cylinder dividing the same into a working chamber and a pumping chamber, a connection between said working piston and said first named piston, an exhaust port for said working chamber, a piston controlled air inlet port for said working chamber, pipe connections between said air inlet port and said crank case, a valved intake for the pumping chamber of said working cylinder and a valved outlet from said pumping chamber, said working cylinder having a piston controlled working agent inlet for said working chamber in communication with said valved outlet of said pumping chamber, and a mechanically controlled valve for controlling the passage of working agent into said working chamber of said working cylinder, and means for operating said last named valve from said crank shaft.

3. An internal combustion engine comprising a crank case having a projecting cylinder portion open at one end, a closed ended working cylinder secured to said cylinder portion to close the other end thereof, said crank case cylinder portion having an aperture to effect atmospheric pressure within said cylinder portion, a piston within said cylinder portion below said aperture, a crank shaft having a crank working in said crank case, a connecting rod between said

piston and said crank, a valved intake to said crank case, a working piston operating in said working cylinder and dividing it into a working chamber and a pumping chamber and a connection between said working piston and said piston in the crank case cylinder, said working cylinder having a piston controlled exhaust port and having a piston controlled air inlet port and having a piston controlled working agent inlet port, pipe connections between said air inlet port and said crank case, a reservoir, a valved pipe connection between said pumping chamber and said reservoir, a pipe connection between said reservoir and said working agent inlet port to said working chamber, a rotary valve in said last named pipe connection, and transmission gearing between said rotary valve and said crank shaft.

4. In a gas engine, an explosion cylinder and its working piston, a closed crank chamber, a supplementary air compression cylinder in direct communication with the crank chamber but separated from direct communication with the explosion cylinder, a piston in said supplementary cylinder, a rod connecting said pistons together, a crank operating in said crank chamber, a connecting rod between said crank and said supplementary cylinder piston, a suction valve leading into the crank chamber, said explosion cylinder having a port which is uncovered by the working piston when at the lower extremity of its stroke, means for delivering compressed air from said crank chamber into the explosion cylinder through said port, a suction valve connected to lead into the lower end of the explosion cylinder beneath its piston, a reservoir, a duct between the lower end of the explosion cylinder and said reservoir, a check valve in said duct, a valve controlled duct between said reservoir and said explosion cylinder, said explosion cylinder having a port adjacent to the port that is in communication with the crank chamber with which port said valve controlled duct communicates and means operated from the crank shaft for operating the valve in said valve controlled duct.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ERNEST EASTHOPE, Jr.

Witnesses:

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ALEXANDER SMITH.