W. M. APPLETON.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED MAY 13, 1909.

939,376. Patented Nov. 9, 1909.

FIG. 3.

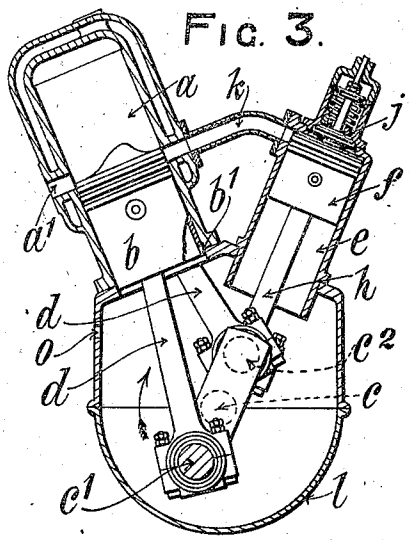


FIG. 4.

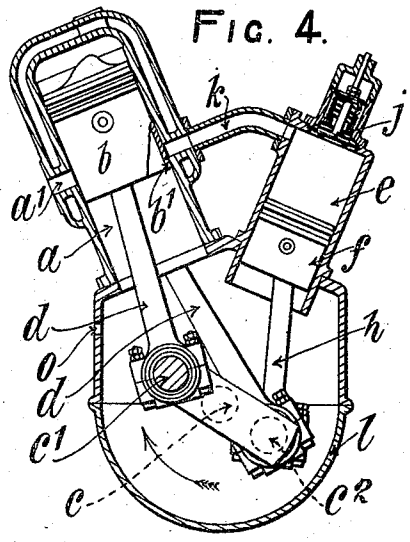


FIG. 2.

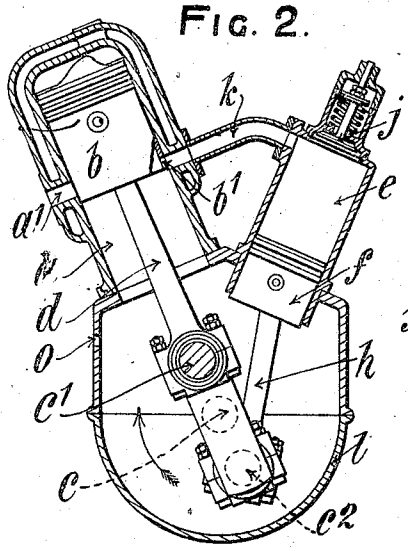
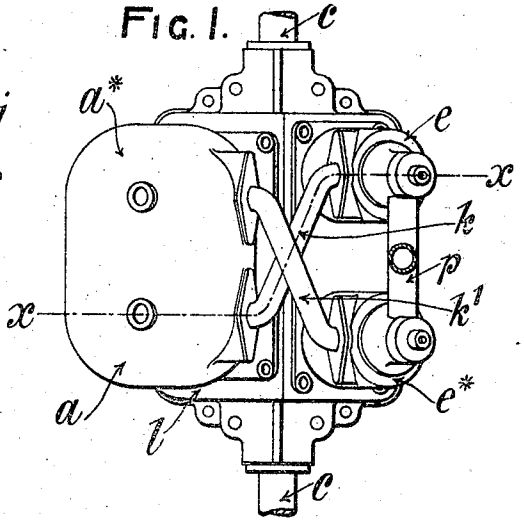


FIG. 1.



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INTERNAL-COMBUSTION ENGINE.

939,376. Specification of Letters Patent. Patented Nov. 9, 1909.

Application filed May 13, 1909. Serial No. 495,783.

To all whom it may concern:

Be it known that I, WILLIAM MORTEN APPLETON, a subject of the King of Great Britain and Ireland, and residing at Hill Road, Weston-super-Mare, in the county of Somerset, England, engineer, have invented a new and useful Improvement in Internal-Combustion Engines, of which the following is a full and complete specification.

This invention relates to internal combustion engines of the two-cycle type in which each power cylinder has a displacer cylinder, and it has for its object to pass into the power cylinders a charge of air in advance of the charge of explosive mixture so as to effectually scavenge said cylinders of the exhaust gases without the loss of any of the explosive mixture, thereby materially increasing the efficiency of the engine.

A further object is to simplify the construction by reducing the number of working parts which also tends to lessen the cost of production.

I attain this end by the construction illustrated in the accompanying drawing in which:—

Figure 1 is a view in plan showing the relative positions of the power and displacer cylinders, Fig. 2 is a view in sectional elevation on line x x of Fig. 1 showing the piston of one of the power cylinders at the commencement of its working stroke and the piston of its displacer cylinder approaching the end of its suction stroke. Fig. 3 is a similar view showing the piston of one of the power cylinders just after the commencement of the return stroke and the piston of its displacer cylinder at the end of its discharging stroke, and Fig. 4 is a similar view showing the piston of one of the power cylinders approaching the end of its return stroke and the piston of its displacer cylinder approaching the completion of its suction stroke.

Throughout the views similar parts are marked with like letters of reference.

According to the present invention, the engine consists of two pairs of power and displacer cylinders or of multiples of said pairs.

The working cylinders a and a^x are located on one side of the crank-shaft c and the displacer cylinders e and e^x on the other side thereof. The crank-shaft c has two crank-pins c^1 and c^2 which are set at an angle of 180° to one another. To the crank-pin c^1 are coupled both the connecting rod d of the piston b of the power cylinder a and the connecting rod of the piston of the displacer cylinder e^x, and to the crank-pin c^2 are coupled the connecting rod d of the piston b of the power cylinder a^x and the connecting rod h of the piston f of the displacer cylinder e. In the heads of the displacer cylinders are admission valves j putting a common induction pipe p into communication with said cylinders, and in the front ends of the power cylinders are exhaust ports a^1 adapted to be covered and uncovered by the pistons of said cylinders.

The back of the displacer cylinder of each pair of cylinders is in communication with the power cylinder of the other pair by means of a suitable pipe or passage, that is to say, the back end of the displacer cylinder e is in communication with the front end of the power cylinder a by means of the pipe k and the back end of the displacer cylinder e^x is in communication with the forward end of the power cylinder a^x by means of the pipe k^1. The openings of the pipes k and k^1 into the power cylinders are covered and uncovered by the pistons of the power cylinders, but the openings of said pipes into the displacer cylinders are neither covered nor uncovered by the pistons of said cylinders. The openings of the pipes k and k^1 into the power cylinders are so located that they are uncovered by the pistons of said cylinders just before they reach the ends of their working strokes and are closed by said pistons at the commencement of their return strokes. Said openings are also opened by the front ends of the pistons of the power cylinders as they approach the ends of their return strokes which puts the displacer cylinders respectively in communication with the front ends of the power cylinders which are open to the atmosphere through the hole o in the crank-chamber l. As the front ends of the pistons b do not clear the orifices of the passages k and k^1 when they are at the ends of their return strokes a gap or recess b^1 is cut or formed in the front edge of each piston for the purpose of opening said passage completely to the front ends of the power cylinders.

The displacer cylinders are set at such an angle with the power cylinders that the piston of each displacer cylinder is moving on its suction stroke during the whole of the time the passage between said cylinder and

its power cylinder is open to the atmosphere through the front end of said power cylinder, so that during the latter part of the suction stroke of the piston of the displacer cylinder air is drawn into said cylinder through said passage, the front end of the power cylinder, the crank chamber, and the hole or aperture therein.

The cycle of operations is as follows: Commencing with the working stroke of one of the power cylinders the piston of said cylinder first closes the passage between said cylinder and its displacer cylinder to the front end of the power cylinder and then as said piston approaches the end of its working stroke it first uncovers the exhaust port and subsequently opens the passage between the two cylinders to the back end of the power cylinder. On the return stroke of the piston of the power cylinder it first closes the passage between the two cylinders, next closes the exhaust port, and as it reaches the end of said stroke it opens the passage between the two cylinders to the atmosphere through the front end of the power cylinder. At the end of the return stroke and the commencement of the working stroke of the piston of the power cylinder the piston of its displacer cylinder is reaching the end of its outer or suction stroke and draws air into said displacer cylinder through the front end of the power cylinder until the passage between the two cylinders is closed by the piston of the power cylinder. During the remainder of the working stroke of the piston of the power cylinder the piston of its displacer cylinder is making its return or discharging stroke which operates to compress the gaseous mixture and the air in said cylinder until the passage between the two cylinders is opened by the piston of the power cylinder, which allows first the air and then the gaseous mixture to flow into the power cylinder. The air operates to scavenge said cylinder and passes out by the exhaust port until said port is closed by the piston of said cylinder on its return stroke. During the return stroke of the piston of the power cylinder when the passage between the two cylinders is closed the piston of the displacer cylinder is on its suction stroke drawing in gaseous mixture through the admission valve until said piston opens the passage between the two cylinders and puts the displacer cylinder into communication with the atmosphere through the front end of the power cylinder, when the admission valve closes and air only is drawn into the displacer cylinder as before described. The working stroke of the piston of the other power cylinder commences when the piston of the first-named power cylinder is commencing its return stroke and the cycle of operations is the same as in the first-named power cylinder and its displacer cylinder.

What I claim and desire to secure by Letters Patent is:—

In a two-cycle internal combustion engine, the combination of two pairs of cylinders each pair comprising a power cylinder and a displacer cylinder, the front ends of the power cylinders being open to the atmosphere, a two-throw crank-shaft the crank-pins of which are at an angle of 180° to each other, pistons in said cylinders, connecting rods for coupling the pistons to the crank-pins of the crank-shaft, the pistons of one power cylinder and one displacer cylinder being coupled to the same crank-pin, valves for the admission of the explosive mixture to the displacer cylinders, exhaust ports in the forward ends of the power cylinders which are opened and closed by the pistons of said cylinders, and a pipe or passage connecting the back end of each of the displacer cylinders with the forward end of the power cylinder of the other pair, said passages being so located that they are uncovered by the pistons in the power cylinders as said pistons approach the ends of both of their strokes whereby each displacer cylinder is placed alternately in communication with the back end of its power cylinder and with the atmosphere through the front end of said cylinder. the cylinders of each pair being set at such an angle to one another that the piston of each displacer cylinder is moving on its suction stroke during the whole of the time the passage between said cylinder and its power cylinder is in communication with the atmosphere through the front end of said power cylinder, as set forth.

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

WILLIAM MORTEN APPLETON.

Witnesses:
WILLIAM H. COLE,
EFFIE JOSEPHINE FUSSELL.