W. M. APPLETON.

INTERNAL COMBUSTION ENGINE.

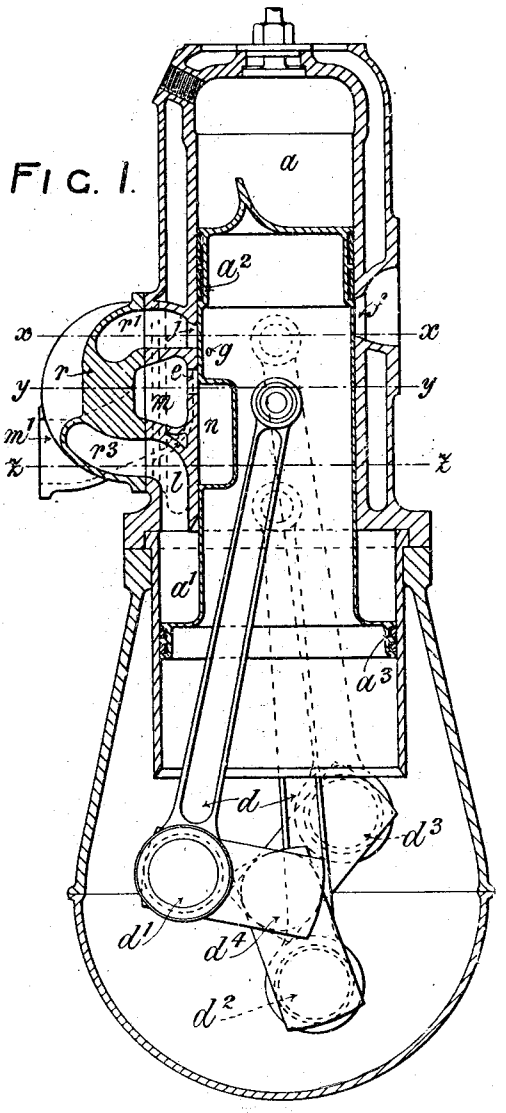
APPLICATION FILED MAY 25, 1912.

1,051,537.

Patented Jan. 28, 1913.

2 SHEETS—SHEET 1.

FIG. 1.



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2 SHEETS—SHEET 2.

FIG. 3.

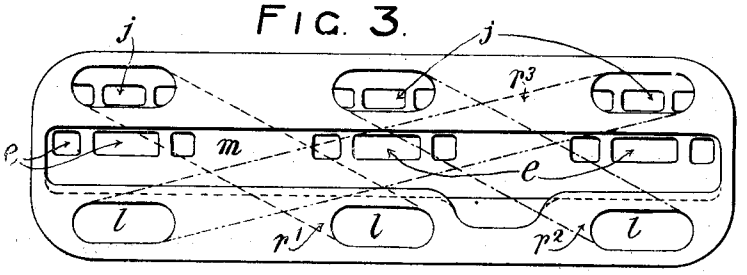


FIG. 2.

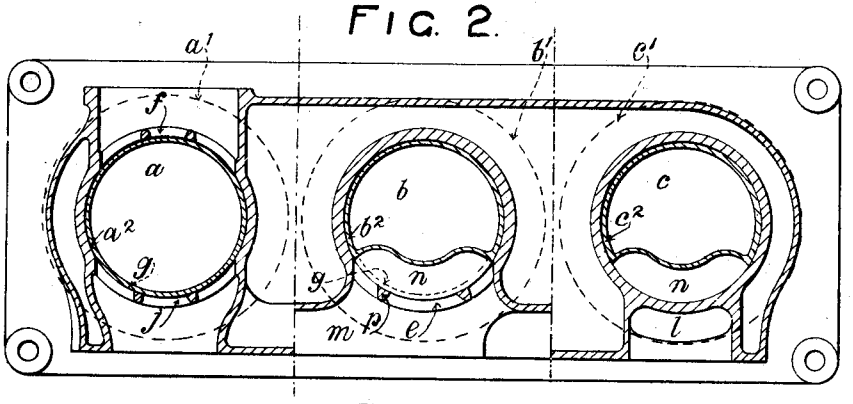
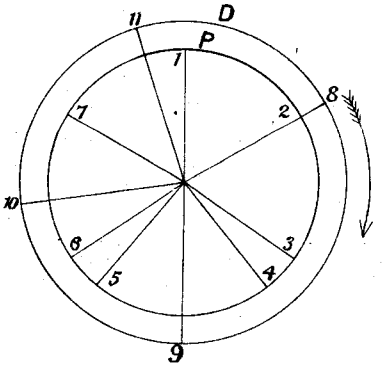


FIG. 4.



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INTERNAL-COMBUSTION ENGINE.

1,051,537. Specification of Letters Patent. Patented Jan. 28, 1913.

Application filed May 25, 1912. Serial No. 699,720.

To all whom it may concern:

Be it known that I, WILLIAM MORTEN APPLETON, a subject of the King of Great Britain and Ireland, residing at Tyn-y-Coed, Hill Road, Weston-super-Mare, in the county of Somerset, England, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a specification, reference being had therein to the accompanying drawing.

This invention relates to internal combustion engines of the two-cycle type in which three pairs of cylinders or multiples thereof are employed, the units of each pair being of different diameters and arranged tandem fashion, one cylinder of each pair being a displacer cylinder and the other a power cylinder, and in which the pistons of the power cylinders only function as distributing valves, and it has for its object simplifying the construction of this type of engine, which end I attain by a certain disposition and arrangement of the inlet and distribution ports hereinafter particularly specified.

In the accompanying drawings which illustrate this invention:—Figure 1 is a view in sectional side elevation through one of the compound cylinders, Fig. 2 is a three-part sectional plan on lines $w\ w$ $y\ y$ and $z\ z$, Fig. 1. Fig. 3 is a diagrammatic view in elevation showing the various ports and their means of inter-communication, and Fig. 4 is a diagram showing the cycle of operations in each of the cylinders.

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

The three compound cylinders a a^1, b b^1 and c c^1 are arranged side by side in close proximity to one another, and the compound piston a^2 a^3, and similar pistons in the cylinders b b^1 and c c^1 denoted by the character b^2 and c^2 are coupled by suitable connecting rods d to the crank-pins d^1 d^2 and d^3 of a three-throw crank-shaft d^4, said cranks being set at an angle of 120° to one another. The smaller cylinders a b and c are the power cylinders and the larger one a^1 b^1 and c^1 the displacer cylinders. In each of the power cylinders a b and c is an admission or inlet port e, an exhaust port f, and a by-port j. The inlet ports e are so located that they are never uncovered by the power pistons and each opens into a common chamber m which is in communication by a passage m^1 with the carbureter or other source of fuel supply. The exhaust ports f and the by-ports j are so located that they are both uncovered by the power pistons as they approach the ends of their working strokes, the former slighly in advance of the latter. In each of the displacer cylinders a^1 b^1 and c^1 is a distribution port l which is always open and is not controlled by the piston of said cylinder. In each of the power pistons a^2 b^2 and c^2 is a recess n which is of such a shape and is so located that it puts the inlet port e and the by-port j into communication at and during a predetermined part of the cycle of the engine. The by-ports j of the three power cylinders are connected with the distribution ports l of the displacer cylinders by passages r^1 r^2 and r^3. These passages are preferably formed in a single piece or casing r adapted to be fixed over the ports j e and l of all the cylinders, as shown in Fig. 1 of the accompanying drawing.

In action the displacer cylinder of each pair of the three cylinders draws in its charge of gaseous mixture through its distribution port l, one of the passages r r^1 or r^2, the by-port j of the power cylinder of one of the other pairs, the recess n in the piston of said other power cylinder, and the inlet port e of said other power cylinder, and delivers the gaseous mixture into the combustion space of the power cylinder of the same pair through the by-port j of same power cylinder.

The cycle of operations is shown diagrammatically in Fig. 4. The inner circle marked P refers to the power cylinder and the outer circle marked D refers to the displacer cylinder. The cycle of operations in each of the power cylinders is as follows:—From 1 to 3 represents the firing or power part of the stroke of the power piston. At 3 the exhaust port is opened by the piston. At 4 the by-port is opened by the piston, thereby admitting a charge from the displacer cylinder of one of the other pairs. At 5 said by-port is closed by the piston. At 6 the exhaust port is closed by the piston, and from 6 to 1 the charge is compressed. At 2 the communication between the inlet port and the by-port through the recess in the piston is cut off, and at 7 said communication is restored. The simultaneous cycle of operations in each of the displacer cylinders is as follows:—From 8 to 9 the charge is being drawn in through the distribution port and the inlet and by-ports of the power cyl-

inder of one of the other pairs. From 9 to 10 said charge is being compressed. From 10 to 11 said compressed charge is passing into the power cylinder of one of the other pairs through its own distribution port and the by-port of said power cylinder, and from 11 to 8 a vacuum is being produced preparatory to drawing in another charge.

When the engine is designed to have its power cylinders scavenged by air, an air port *g* is formed in the wall of each of the power pistons, said port being so located as to put the by-port *j* into communication with the atmosphere through the compound piston and the crank-chamber—which is open to the atmosphere—during both the up and down strokes of the power piston so that air is drawn into the displacer cylinders both before and after the explosive mixture. To prevent the air port *g* opening to the admission or inlet port *e* when it passes over it, said port is provided with a bridge piece *p* over which said port passes as shown in Fig. 2.

When it is inconvenient to place the carbureter on the same side of the engine as the group of ports the connecting passage m^1 to the admission or inlet chamber *m* may be carried around one of the cylinders or between two of said cylinders when the design will permit of same.

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

1. In an internal combustion engine of the two-cycle type, the combination of three pairs of cylinders, one of each pair being a power cylinder and the other a displacer cylinder, compound pistons working in said cylinders, an inlet port in each power cylinder, a by-port in each power cylinder, an exhaust port in each power cylinder, a distribution port in each displacer cylinder, a recess in each of the power pistons adapted to put the inlet port into communication with the by-port, a common passage connecting the inlet ports of all the power cylinders, and distribution passages connecting the by-ports of the power cylinders with the distribution ports of the displacer cylinders, as set forth.

2. In an internal combustion engine of the two-cycle type, the combination of three pairs of cylinders, each pair being arranged tandem fashion and one of each pair being a power cylinder and the other a displacer cylinder, compound pistons working in said cylinders, an inlet port in each power cylinder, a by-port in each power cylinder, a recess in each power piston adapted to put the inlet and by-ports into communication during a predetermined part of the stroke of said piston, an exhaust port in each power cylinder, a distribution port in each displacer cylinder, a common passage connecting the inlet ports, and three distribution passages each connecting the by-port of the power cylinder of one pair and the distribution port of the displacer cylinder of one of the other pairs, all said passages being formed in a single piece or casting.

3. In an internal combustion engine of the two-cycle type, the combination of three pairs of cylinders, one of each pair being a power cylinder and the other a displacer cylinder, compound pistons working in said cylinders, a crank chamber open to the atmosphere, an inlet port in each power cylinder, a by-port in each power cylinder, a recess in each power piston adapted to put the inlet port and by-port into communication during a predetermined part of the stroke of said piston, an exhaust port in each power cylinder, an air port in each power cylinder which at a predetermined part of the stroke of said piston puts the by-port into communication with the atmosphere through the compound piston and the crank-chamber, a distribution port in each displacer cylinder, a passage common to the three inlet ports, and distribution passages each connecting the by-port of the power cylinder of one pair and the distribution port of the displacer cylinder of another pair, as set forth.

4. In an internal combustion engine of the two-cycle type, the combination of a series of compound single-acting cylinders, one of each pair being the power part and the other the displacer part, a crank-chamber open to the atmosphere on which said cylinders are mounted, compound pistons working in said cylinders, an inlet port in each power part, a by-port in each power part, a recess in each power piston adapted to put the inlet and by-ports into communication during a predetermined part of the stroke of said piston, an exhaust port in each power part, an air port in each power part adapted at a predetermined part of the stroke of said piston to put the by-port into communication with the atmosphere through the crank-chamber, a distribution port in each displacer part, a passage connecting the inlet ports, and distribution passages connecting the by-ports of the power parts of the compound cylinders with the distribution ports of the displacer parts of the other cylinders, as set forth.

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

WILLIAM MORTEN APPLETON.

Witnesses:
E. J. BUSSELL,
E. E. TYLER.