L. B. STEDMAN.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED JUNE 26, 1914.

1,170,783.

Patented Feb. 8, 1916.

2 SHEETS—SHEET 1.

Fig. 1.

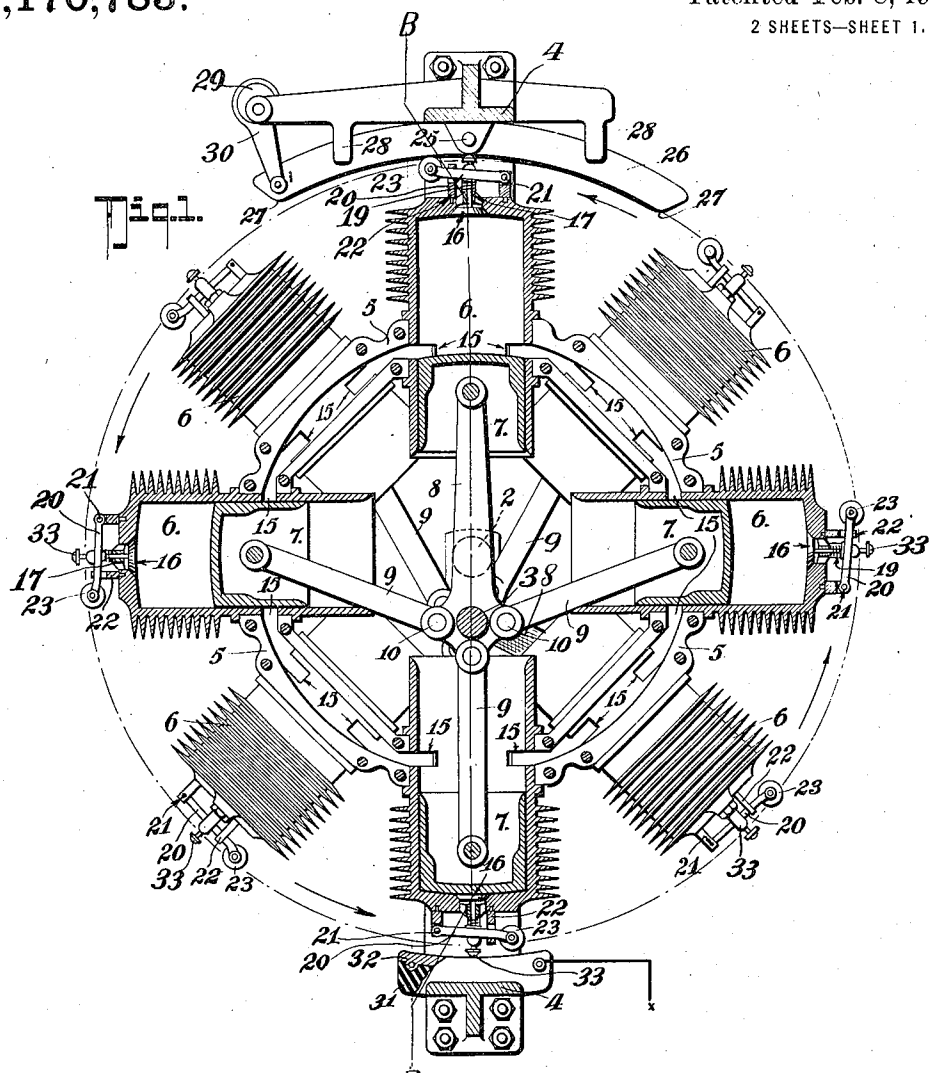
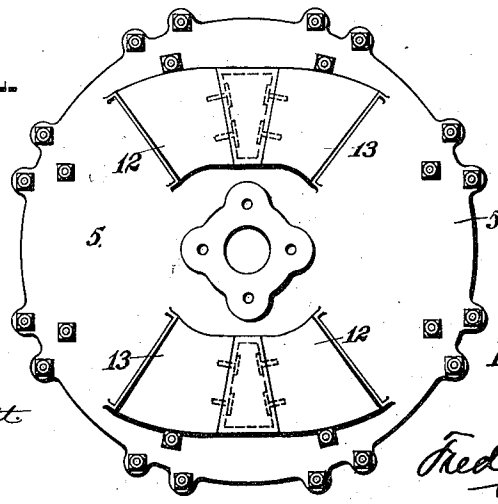


Fig. 2.



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2 SHEETS—SHEET 2.

Fig. 4.

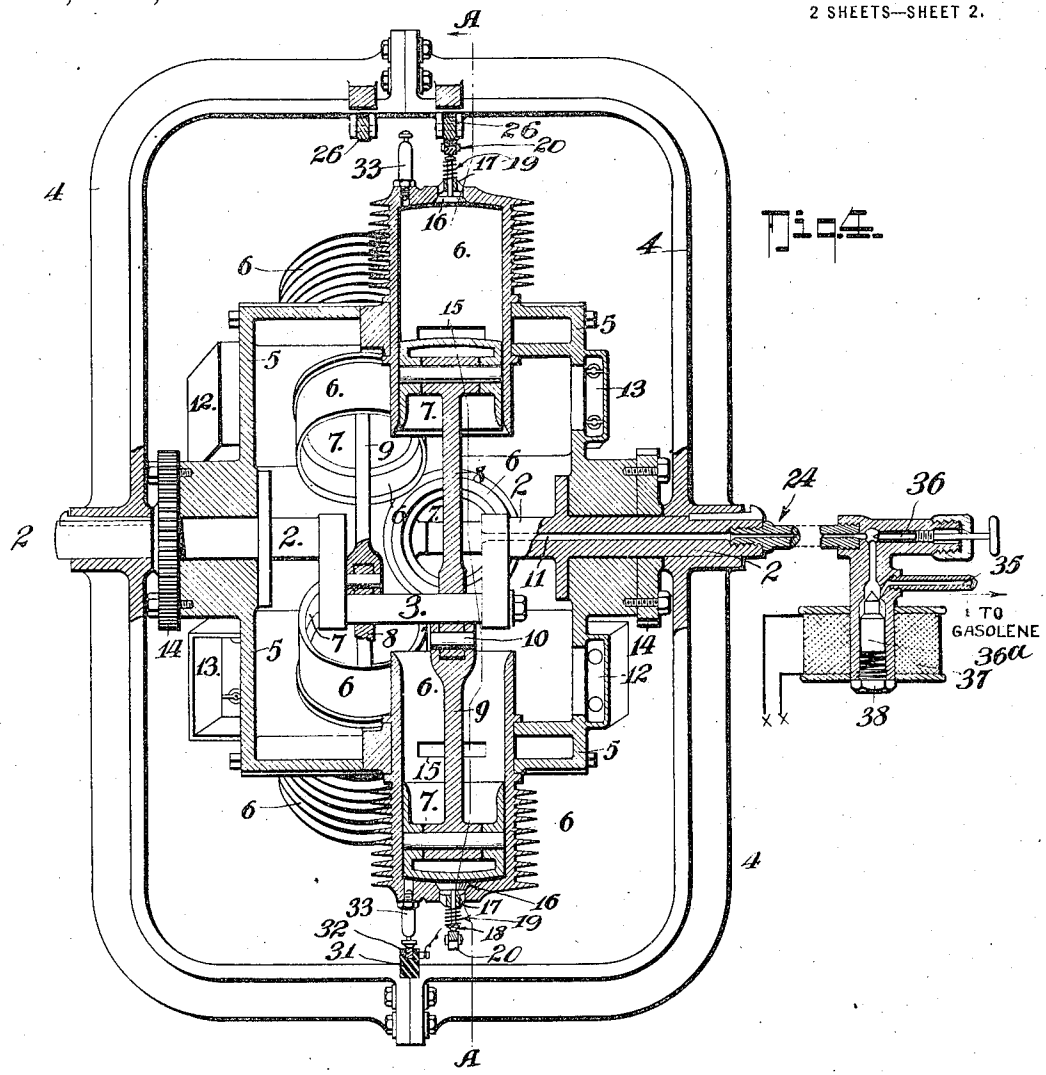
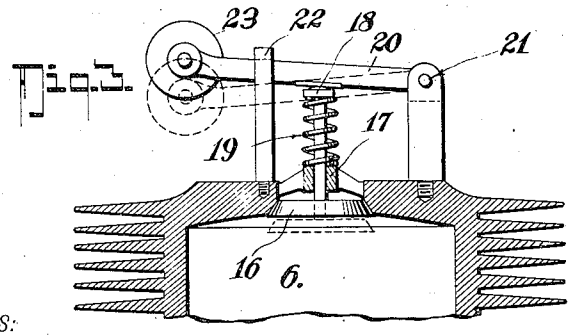


Fig. 5.



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INTERNAL-COMBUSTION ENGINE.

1,170,783. Specification of Letters Patent. Patented Feb. 8, 1916.

Application filed June 26, 1914. Serial No. 847,450.

To all whom it may concern:

Be it known that I, LEONARD B. STEDMAN, a citizen of the Dominion of Canada, residing at Victoria, in the Province of British Columbia, Canada, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

This invention relates to a two cycle internal combustion engine wherein a series of cylinders are radially disposed around the circumference of a cylindrical casing which with the cylinders is rotatable on a fixed shaft having a crank pin to which the pistons of the several cylinders are connected. Gaseous fuel is delivered into the casing where it is mixed with a supply of air sufficient to make an explosive mixture and is admitted to the several cylinders through ports which are uncovered by the movement of their pistons. The charge of each cylinder is compressed by its piston during rotation of it around the fixed crank pin and is ignited, the pressure of the explosion exerting its effort on the fixed crank pin to rotate the engine and its cylinders.

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 cross section on the line A—A in Fig. 4. Fig. 2 is an end view of the casing showing the air supply scoops. Fig. 3 is an enlarged detail of the exhaust valve operating mechanism, and Fig. 4 is a vertical section on the line B—B in Fig. 1.

In these drawings 2, 3 represents a crank shaft which is secured in any suitable manner against rotation to an open frame 4 which forms the fixed frame of the engine. On the concentric portion 2 of this shaft is mounted to rotate within the frame 4, a hollow cylindrical casing 5 having a series of cylinders 6 secured to its outer circumference at equal angular distances apart to radially project partially within and partially without the casing. These cylinders are arranged in two groups on adjacent parallel planes, the cylinders of one group being staggered in relation to those of the other. The pistons 7 of these cylinders are connected by rods 8 or 9, (see Fig. 1), to the crank pin 3 of the shaft 2, the piston of one cylinder of each group being directly connected by a master rod 8 while those 9 of the other cylinders of each group are connected at 10 to the master rod 8.

Gaseous fuel is delivered under pressure into the casing 5 through an axial bore 11 in the crank shaft 2 and the amount of fuel admitted is automatically regulated to the speed of the engine in a manner to be described later. The required air to form an explosive mixture with this gaseous fuel is delivered within the casing 5 by the rotation of the engine through inclined scoop vanes 12, 13 on each side of the casing, 12 being for rotation in one direction and 13 for rotation in the opposite direction. The delivery inlet or inlets of each scoop are provided with a check valve or valves opening inward. The explosive mixture of gas and air is admitted from the casing 5 to each cylinder 6, as required, through a port or ports 15 in the wall of the cylinder within the casing, which ports are uncovered by the piston of each cylinder at the inner limit of the piston's movement.

The products of combustion are exhausted through a mushroom valve 16 seating outward in each cylinder end. The stem of each exhaust valve 16, (see Fig. 3), is movable through a bearing 17 which is wing-supported in the end of the cylinder, or in a valve seat cage secured therein, and between the outer end of the bearing 17 and a cap 18 secured on the end of the valve stem, is a spring 19 which will hold the valve closed while the engine is starting. Each cylinder exhaust valve is mechanically opened by the following device: Pivotally mounted at 21 on the end of each cylinder is a short lever 20, the free end of which is vertically movable in a supporting guide 22 and is furnished with a roller wheel 23 rotatable in the plane of rotation of the engine. Mounted on a pin 25 within the fixed frame 4 of the engine is a bar 26, one end of which bar is connected by a rod 30 to an eccentric 29 which is rotatably mounted on a bracket projecting from the frame 4. The inner edge of this bar from adjacent the fulcrum pin to each end is curved so that when either end is projected into the path of the roller

wheel 23 engagement of that wheel will open the exhaust valve and at the proper place will allow it to close again. With this arrangement the bar may be tilted by the throw of the eccentric to project either end of it within the concentric circle of the path of the roller wheels 23 and to withdraw the other end without that concentric circle. As each cylinder in succession, during rotation of the engine, reaches this bar, the roller 23 is engaged by the inwardly projected end 27 and the lever 20 is moved in to open the exhaust valve, and as the roller passes under the fulcrum pin 25 of the bar the valve is allowed to close. The length of the bar 26 is such that it extends on each side of the fulcrum pin 25 a sufficient distance to open the exhaust valve 16 of each cylinder before the piston of that cylinder uncovers its admission ports 15. As either end of the bar 26 may be projected within the concentric path of the exhaust valve operating rollers 23, the direction of rotation of the engine may be reversed. Diametrically opposite to the fulcrum pin 25 of the exhaust opening bar, but located in a different plane, is secured on suitable insulation 31 a contact 32 which is concentric to the ignition circuit of the engine. The ignition plug 33 of each cylinder as it comes around engages this fixed contact 32 and connects it in the ignition circuit. The two groups of cylinders are brought as close as practicable to one another and their exhaust valves and ignition are operable in the same manner.

On referring to Fig. 1, the cylinder shown at the top of the drawing has exhausted the products of its last explosion and has received a fresh charge of the explosive mixture. Rotation of the engine in the direction of the arrow first closes the ports 15 by the outward movement of the piston 7, and the charge is compressed during movement down the left side of the circle of its movement and as it approaches the dead center at the bottom of the figure, its ignition plug 33 makes contact with the fixed ignition contact 32 and the charge is ignited when the circuit is closed by the timer, the pressure of the explosion exerting its effort to rotate the engine during movement up the right side of the engine. When the roller wheel 23 of the exhaust valve lever engages the inwardly projected end 27 of the bar 26, the exhaust valve 16 is opened and the inert products of the explosion escape direct to the atmosphere. Shortly after the exhaust has been opened, the ports 15 are uncovered by the piston and the gaseous mixture flows from the space within the casing 5 into the cylinder, following up the exhaust therefrom. This action occurs with each cylinder of each group during its rotation around the crank pin. Power may be taken from the rotating engine in any convenient manner. In the drawing a gear wheel 14 is secured on the hub of the rotating casing 5, the teeth of which wheel may mesh with those of a wheel on the shaft to which movement is to be imparted.

The gaseous fuel, which is admitted to the casing 5 through the axial bore 11, is derived from a carbureter of any approved kind located at 24 between the engine and the valve by which the liquid fuel is regulated to the carbureter. The distillate or other liquid fuel is delivered to this valve through a passage 35 and the amount is regulated by a needle valve 36. The amount is controlled to the speed requirements of the engine by a valve formed on the end of the core 36^a of a solenoid 37, the coil of which is in the ignition circuit of the engine so that as that circuit is closed to fire the charge of each cylinder, the solenoid 37 is energized and the valve 36^a is opened to allow a corresponding supply of fuel to pass to the carbureter. It should be understood that the gaseous fuel supplied from the carbureter is a rather rich mixture which is diluted by the air that is forced into the crank case by means of the air scoops to the proper mixture for ignition. Furthermore, as the engine travels faster and faster more air is admitted and the mixture correspondingly thinned to the point of greatest efficiency, the amount of air admitted into the crank case being somewhat proportional to the speed of the engine. It should also be understood that in starting the engine, the same is turned over by hand, the fuel supply being adjusted to give the proper mixture or some of the cylinders can be primed in the usual manner to begin the operation. A multiple cylinder engine is thus provided, operable on the two cycle system, that will occupy a very limited space for the power it will generate. The explosive mixture of gas and air, entering as it does at the opposite end of the cylinder to that from which the products of the last explosion are exhausted, will be drawn in by the outward rush of the exhaust and following that exhaust will do its own scavenging of the cylinder.

Although the engine is shown as having the ignition contact for each group of cylinders on the same side of the circle of rotation, and also the exhaust valve operating bar for each group on the same side of the circle of rotation, I do not desire to be confined to this arrangement as a more equable turning moment may be obtained by reversing the positions of the ignition contact and exhaust valve operating bar of one group to what they are on the other. Nor do I desire to be confined to the construction here set forth for delivering air under pressure within the cylindrical casing from which the several cylinders receive their supply

of the explosive mixture, as the same may be modified as the result of practical experiment.

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

1. In a two cycle internal combustion engine of the rotary cylinder type, the combination with the rotating cylinders and pistons, the stationary crank shaft, the connecting rods between the pistons and the crank shaft, the exhaust valves and their operating devices and the piston controlled by-pass ducts between the working chambers of the cylinders and the crank case, of means for supplying gaseous fuel to within the casing under pressure, scoops for scooping air into the crank case during rotation of the engine to act with the gaseous fuel and form the working charge, check valves for controlling the passage of air through said scoops.

2. In an internal combustion engine of the rotary cylinder two cycle type, the combination with the fixed crank shaft, the rotatable closed crank case, the cylinders, pistons, connecting rods, exhaust valves, and by-pass ducts between the crank case and the working chambers of the respective cylinders; of scoops having check valves, the opening of which is governed by the rotation of the crank case for forcing air into the crank case, and means for admitting fuel into the crank case to unite with the air and form the working charge.

3. In an internal combustion engine of the rotary cylinder two cycle type, the combination of rotating cylinders and pistons, a stationary crank shaft, connecting rods between the pistons and the crank shaft, said cylinders having piston controlled charge inlet ports in communication with the crank case, exhaust valves in the heads of said cylinders, means for opening said exhaust valves at intervals, means for passing gasolene into said crank case, air scoops on said crank case and designed to take air when said crank case is rotated in either direction, check valves for said air scoops, and means for igniting the charges in the cylinders at intervals.

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

LEONARD BROOKES STEDMAN.

Witnesses:
B. S. ODDY,
WM. CATHCART.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."