C. F. FOUNTAIN & W. A. LANGFORD.

ROTARY VALVE FOR INTERNAL COMBUSTION ENGINES.

APPLICATION FILED JUNE 29, 1915.

1,191,684.

Patented July 18, 1916.

3 SHEETS—SHEET 1.

FIG. 1.

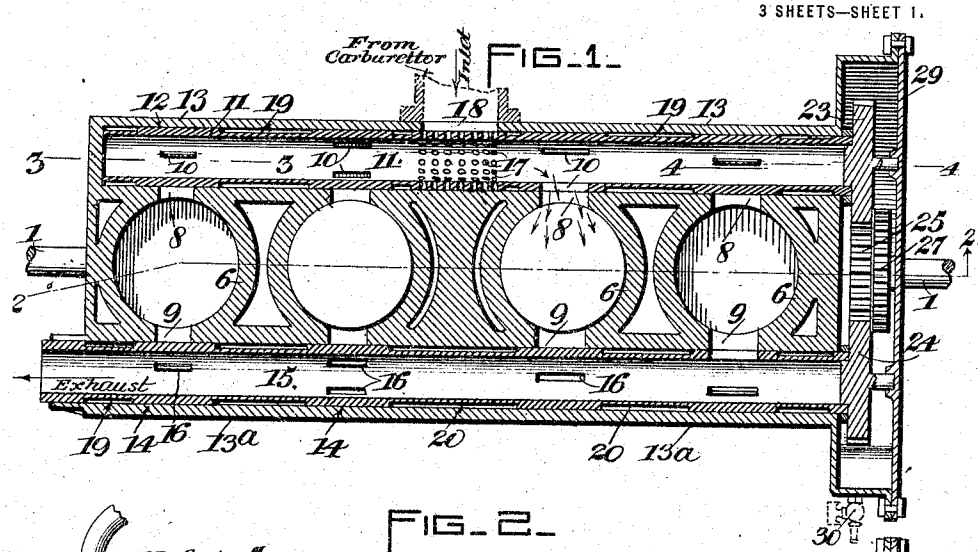


FIG. 2.

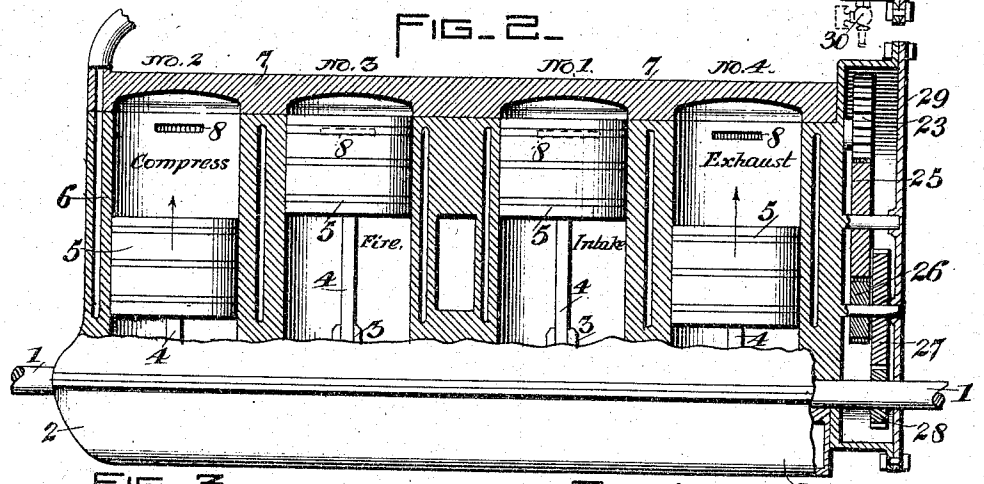


FIG. 3.

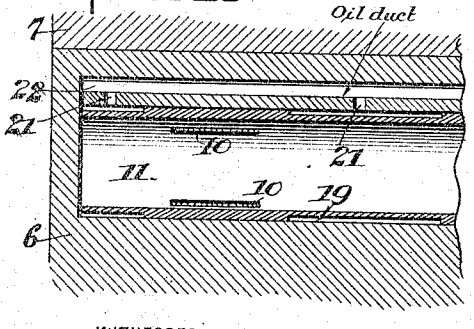
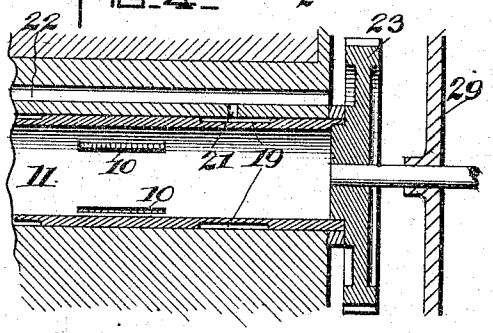


FIG. 4.



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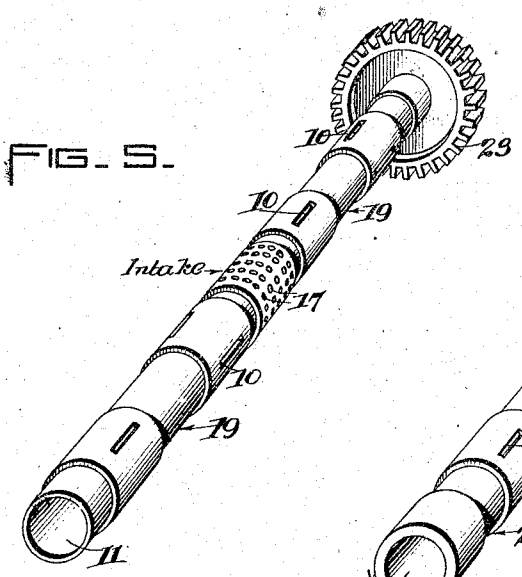
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3 SHEETS—SHEET 2.

FIG. 5.



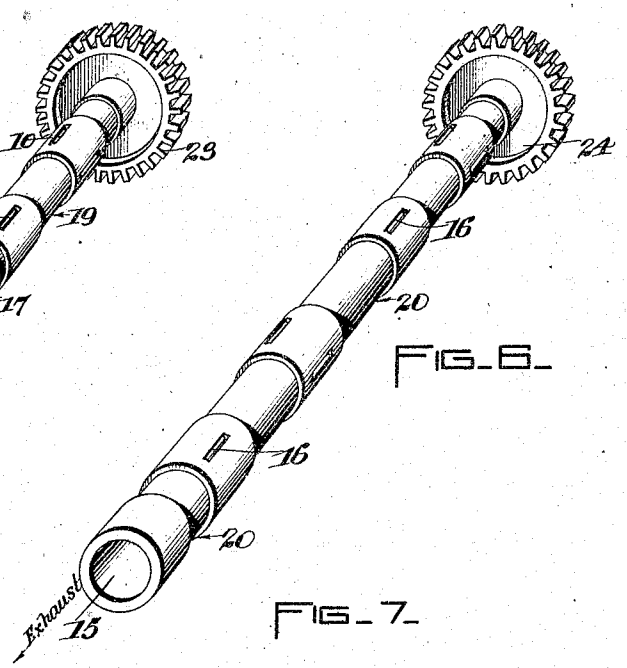
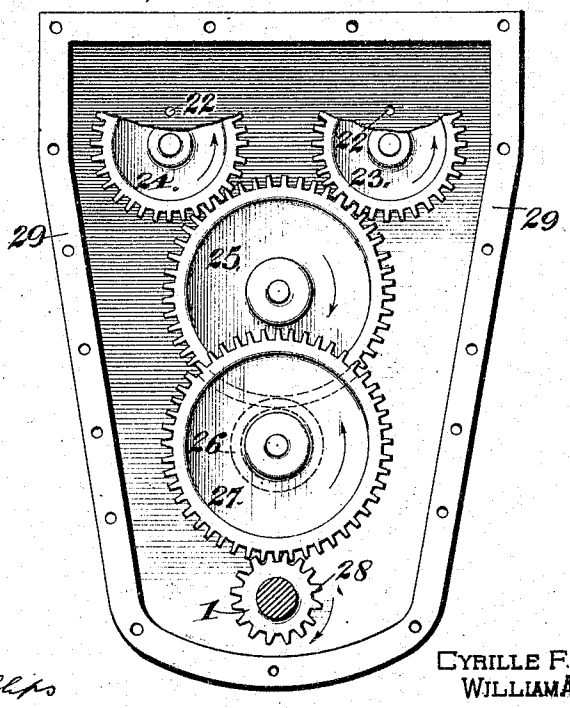


FIG. 6.

FIG. 7.



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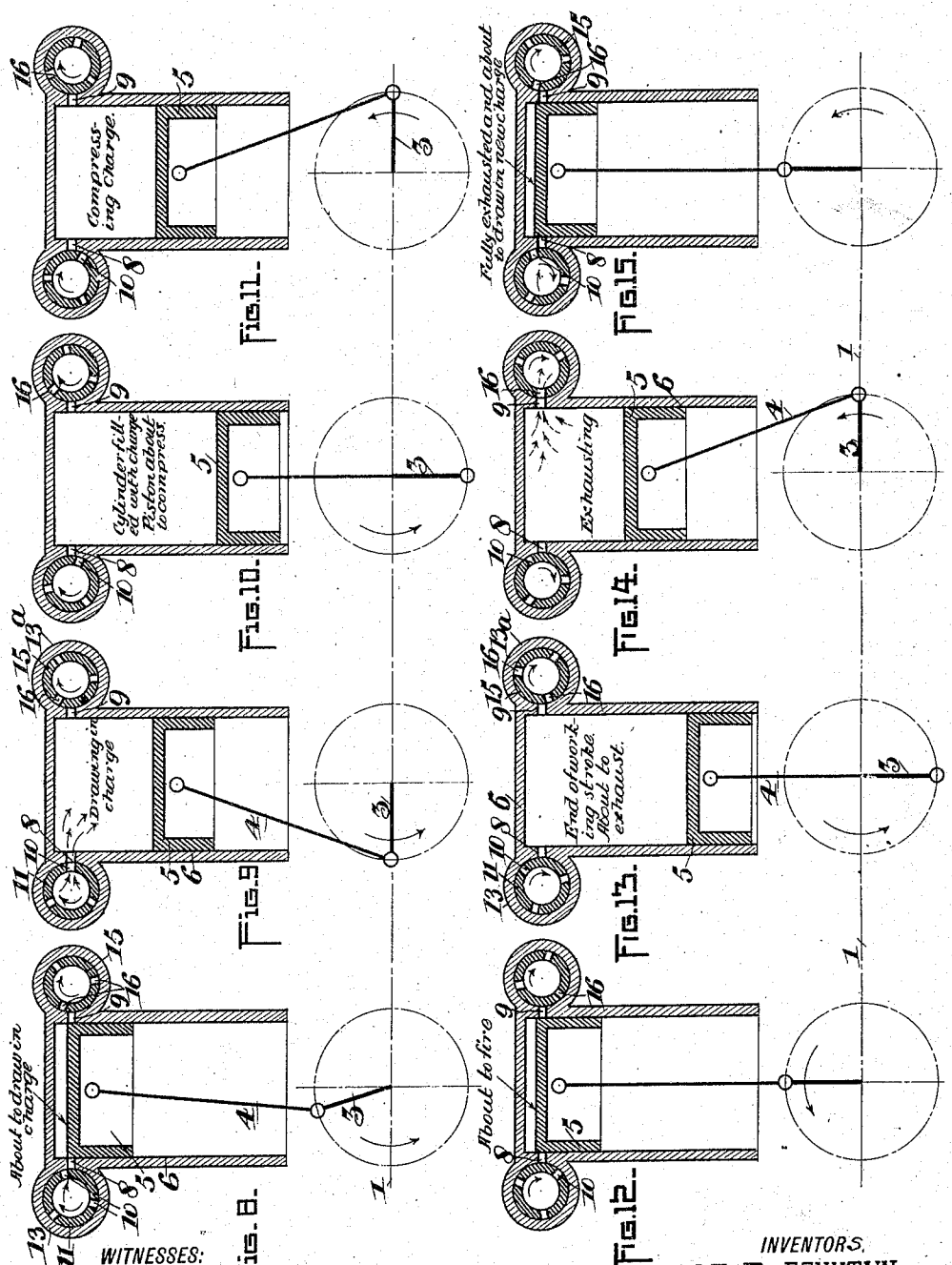
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3 SHEETS—SHEET 3.



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ROTARY VALVE FOR INTERNAL-COMBUSTION ENGINES.

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To all whom it may concern:

Be it known that we, CYRILLE FRANK FOUNTAIN and WILLIAM A. LANGFORD, both residing at Park City, in the county of Summit and State of Utah, have invented a new and useful Improvement in Rotary Valves for Internal-Combustion Engines, of which the following is a specification.

The principal object sought to be attained by our invention is to provide a coreless rotary inlet and exhaust valve for an internal combustion engine of any of the usual types, which valve shall be of such a simple construction as to materially reduce the expense of constructing the engine by eliminating the usual cam shaft, valve lift rods, puppet valves, etc.

Another object is to provide valves for the purpose set forth of a tubular shape and disposed co-extensively with the engine cylinders near their tops, the valves having elongated charge outlet openings and burnt gas inlet openings which communicate at predetermined times with similarly shaped openings in the cylinder walls at which times communication is established between the cylinder and interior of the tubular valves to either permit an inrush of a new charge or the exhaust of a burnt charge.

Another object is to construct the valve body in a peculiar manner so as to form lubricating oil retaining spaces at places intermediate of the elongated inlet and exhaust ports, these oil spaces being fed by a suitable oil duct arranged over the valve.

Another object is to construct the inlet valve with an annular perforated portion adjacent the carbureter connection so that the incoming charge may be thoroughly mixed as it passes through the perforations on its way to the engine cylinders.

Another object is to locate the valves and the elongated openings in the cylinder walls which communicate therewith, in such a position that the piston when at the limit of its compression stroke, will cover the aforesaid openings and thus shield the valve from the instantaneous high temperature of the exploded charge.

The application and use of our invention is fully described, specifically pointed out in the appended claims and illustrated in the accompanying drawings, in which—

Figure 1 is a horizontal section of a four-cylinder, four-cycle gasolene engine showing the application of our improved valves to the inlet and exhaust sides thereof. Fig. 2 is a central vertical section on line 2—2 on Fig. 1. Figs. 3 and 4 are detail sectional views on lines 3—3 and 4—4 on Fig. 1. Figs. 5 and 6 are detail perspective views of the inlet and exhaust valves respectively. Fig. 7 is an elevation of the valve operating gear train, the cover of the casing having been removed. Figs. 8, 9, 10, 11, 12, 13, 14 and 15 are diagrammatical views representing the various stages of the valves and piston of one cylinder during one complete cycle of operation.

Our invention may be embodied in any type of a gas engine requiring a charge inlet and an exhaust valve, the present showing being that of a four-cylinder, four-cycle gas engine which comprises the crank shaft 1 mounted in bearings on the crank casing 2, the crank shaft 1 having the usual cranks 3 to which the pistons 5 are connected by connecting rods 4 as shown in Fig. 2 of the drawings.

The pistons 5 reciprocate in the chambers 6 which are closed by a cap-plate 7 at the top, the chambers 6 being provided with elongated charge inlet ports 8 at one side and similar burnt charge exhaust ports 9 at the opposite side. The ports 8 register at times with elongated openings 10 in the rotary charge inlet valve 11 mounted in the bore 12 of the valve casing 13 as shown in the Fig. 8, *et seq.*, by further reference to which it will be seen that the openings 10 above referred to are arranged in a series of three for each cylinder for a purpose hereinafter explained.

Casing 13^a at the opposite side is provided with a bore 14 in which the exhaust valve 15 is rotatably mounted, the valve 15 being provided with elongated exhaust openings 16 which register at times with the ports 9 in the walls of the cylinders 6 and by referring again to Fig. 8 it will be seen that the exhaust openings 16 in the valve 15 are also arranged in a series of three for a purpose to be hereinafter explained.

Both rotary valves 11 and 15 are open at one end and by referring to Fig. 1 it will be seen that the inlet valve 11 is shorter than the exhaust valve 15, so that the valve 11 may be completely housed in its casing

13, the head of which forms an end closure therefor, while the exhaust valve 15 being greater in length extends beyond its casing 13ª and will connect directly to the exhaust pipe (not shown) in any suitable way.

At a place midway of its length, the inlet valve 11 is perforated by an annular series of openings 17 which are constantly in register with the opening 18 in the wall of the valve casing 13 which opening 18 communicates with the charge inlet pipe which in turn connects to the carbureter not shown. Since the valve 11 is perforated as described and in a zone equal in width to that of the opening 18 in the casing 13, communication is constantly had between the interior of the valve 11 and the carbureter thus keeping the gas supply constant. Again, by making the gas inlet to the valve 11 in the form of many small openings, the in-coming charge is further disintegrated, placed in a better workable condition and one of the principal objects of the invention is thus accomplished.

Arranged at intervals along both valves 11 and 15 and midway of the outlet and inlet openings 10 and 16 respectively, are annular depressions 19 and 20. Communicating with the bores 12 and 14 of the valve casings 13 and 13ª at places adjacent the depressions 19 and 20, are supplementary ducts 21, which as shown in Figs. 3 and 4 join a main duct 22 which extends the entire length of the valve and is adapted to supply a lubricant thereto. Since the valves are formed with the annular depressions as above stated, chambers are thus caused in which the lubricant is pocketed and a constant supply thereof is assured the consequently raised bearing portions in which the outlet openings 10 and inlet openings 16 in valves 11 and 15, are formed as is clearly shown in Figs. 5 and 6.

Fastened to the rotary valves 11 and 15 and forming closures for the opposite ends of the valves, are pinions 23 and 24 which are driven by a gear 25 which meshes with a pinion 26 formed integrally with a large gear 27 which gear 27 in turn meshes with a pinion 28 on the engine shaft 1 as shown in Fig. 7 thus by this arrangement of gearing the valves 11 and 15 will be rotated at a relatively low speed when the engine is in operation. The train of gears referred to is incased in a housing 29 which may be entirely filled with oil so that the gears may be constantly lubricated as well as supply lubricant to the ducts 22 before referred to, it being understood that in the event of an intended inspection of the interior of the gear housing, that the oil may first be drawn off through a cock 30 shown in dotted lines in Fig. 1.

Operation: By reference to Fig. 2 it will be seen that the cranks 3 on the crank shaft 1 are positioned on halves therefore the end pistons are at the bottom of their strokes and the intermediate pistons are at the tops of their strokes, the cycle of operation, common to the successive units numbered 1, 2, 3, and 4 being to intake, compress, fire and exhaust a previously burnt charge. The cycle of operation just described and followed by each of the units in proper sequence is also followed by each individual unit, therefore it will only be necessary to describe the cycle of operation of one unit which will be identical to all.

Attention is now directed more particularly to the diagrammatical Fig. 8 *et seq.* which are, for purpose of description, considered as being cross sections of unit number 1. In Fig. 8 the piston 5 has just uncovered the inlet port 8 on its down or suction stroke and the valve 11 has rotated to such a position where one of its series of three openings is just beginning to register with the port 8 so that a charge of gas may be drawn into the cylinder 6 while the piston is traveling to the limit of its "down" stroke as shown in Figs. 9 and 10. When at this position the cylinder is filled with gas, port 8 is just closed by the advanced rotation of valve 11 and the charge is about to be compressed.

Figs. 11 and 12 show both the inlet and exhaust ports 8 and 9 closed by their respective valves 11 and 15 and the piston having compressed the charge to the point of firing which having been done, impels the piston downwardly to the bottom of its stroke as in Fig. 13, at which position the exhaust valve has rotated to such a position as to just bring one of its series of three openings in register with the exhaust port 9. This being done and the piston now traveling upwardly, the burnt charge will be expelled through the exhaust port 9 and opening 16 to scavenge the cylinder as shown in Figs. 13, 14, and 15 during which time the inlet port 8 has remained closed.

In Fig. 15 the exhaust 16 has just severed its register with cylinder port 9, piston 5 has reached the top of its stroke and the second inlet valve opening 10 is now in such a position that when the piston starts down again, the second opening 10 will register with the port 8 and the cycle of operation just described will be repeated.

It will be now seen that the ratio between the elements in the gear train is such as to revolve the inlet and exhaust valves 11 and 15, one third of a revolution while the crank shaft makes two revolutions which comprises the complete cycle of one unit of the engine.

Since the piston 5 when at the limit of its upstroke completely covers the cylinder inlet and exhaust ports 8 and 9, the rotary

valves 11 and 15 are therefore protected from the effect of the explosion of the charge.

We claim:

1. The combination of a piston chamber having a piston, a casing arranged transversely thereof having a port in communication with the chamber the casing being open at one side and end, a tubular valve in the casing closed at one end by the wall of the casing and at the other end by a cap gear the valve having a port adapted to register with the cylinder port at times and also having a belt of minute perforations in communication with the side opening for the admission and atomization of the elements of the gaseous charge, and a driven gear for rotating the cap gear to move the valve port into registration with the cylinder port as the piston performs a suction stroke.

2. The combination of a piston chamber having a piston, a casing arranged transversely thereof having a port in communication with the chamber the casing having a side opening and an open end, a tubular valve in the casing closed at one end by the wall of the casing and at the other end by a cap gear, the valve having a port adapted to register with the cylinder port at times and also having a belt of minute perforations in communication with the side opening for the admission and atomization of the elements of the gaseous charge, a driving gear to move the valve port into registration with the cylinder port and admit a charge to the cylinder, the piston in the chamber being adapted to cover the cylinder port at the instant of the subsequent explosion of the charge.

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