Nov. 6, 1923. 1,473,077

G. L. BULL

VALVE OPERATING MECHANISM

Filed April 16, 1921

Fig. 1.

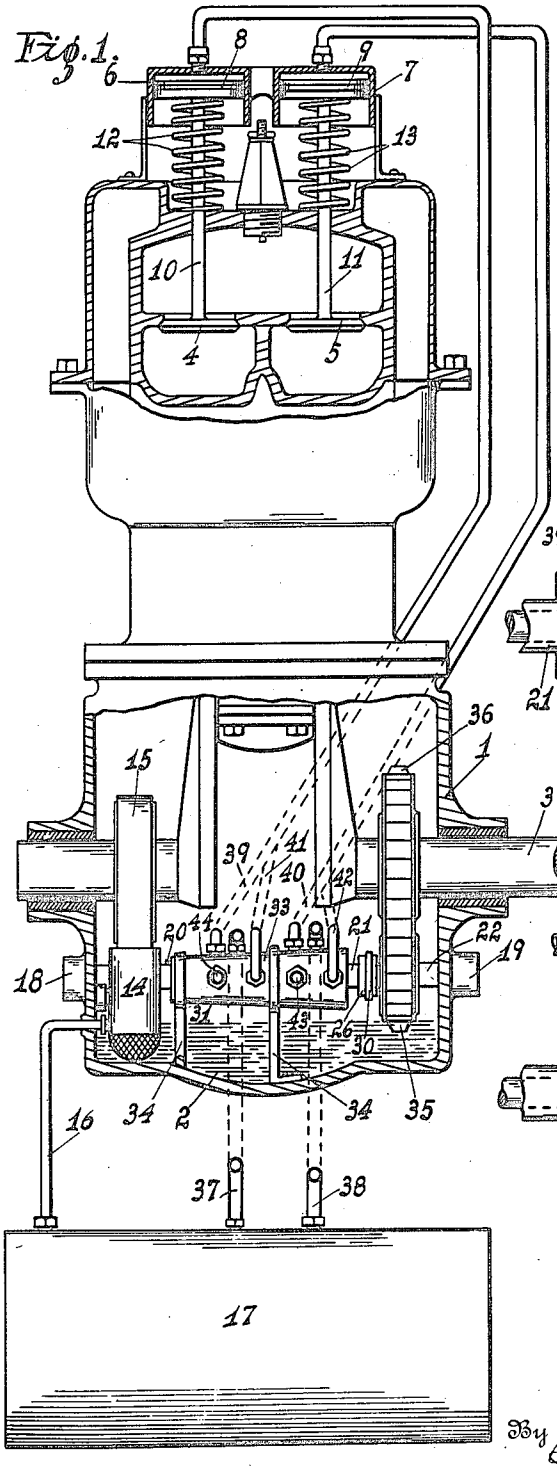


Fig. 2.

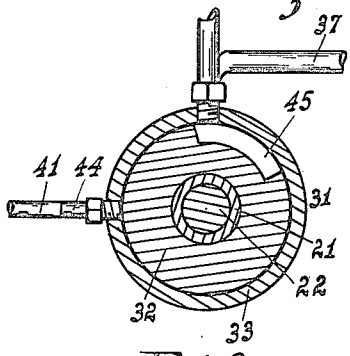


Fig. 3.

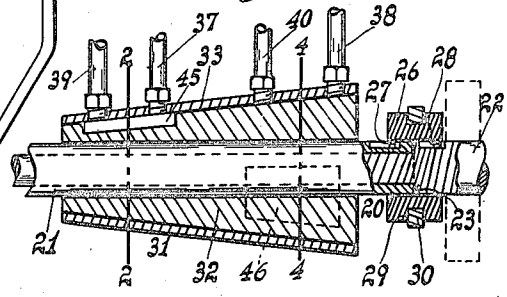


Fig. 4.

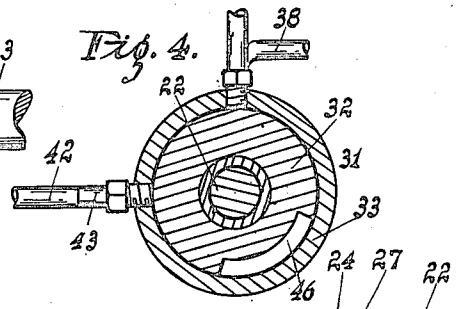
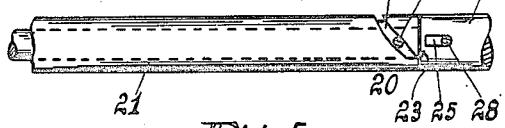


Fig. 5.



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Patented Nov. 6, 1923. 1,473,077

UNITED STATES PATENT OFFICE.

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VALVE-OPERATING MECHANISM.

Application filed April 16, 1921. Serial No. 461,796.

To all whom it may concern:

Be it known that I, GEORGE L. BULL, a citizen of the United tates, residing at Oakland, in the county of Alameda and State of California, have invented certain new and useful Improvements in Valve-Operating Mechanism, of which the following is a specification.

My invention relates to improvements in valve-operating means for internal combustion engines, and contemplates a hydraulic valve operating system particularly adapted to pump the oil in the engine crank case sump into valve-operating cylinders which operate the engine intake and exhaust valves.

Referring to the annexed drawing in which my invention is illustrated and which forms a part of this specification:

Figure 1 is a vertical section of an internal combustion engine embodying my valve operating system.

Figure 2 is a cross section of the timing valve taken on line 2—2 of Figure 3.

Figure 3 is a longitudinal section of the timing valve.

Figure 4 is a cross section of the timing valve taken on line 4—4 of Figure 3.

Figure 5 is a view of the timing valve shaft, showing the advance and retard clutch grooves in the sections thereof and the clutch pins in said grooves.

In the drawing 1 indicates the crank case; 2 the crank case sump; 3 the crank shaft; 4 the intake valve; and 5 the exhaust valve of an internal combustion engine.

In the top of the engine casing are mounted two cylinders 6 and 7 which are closed only at their upper ends. Pistons 8 and 9, which are secured to the stems 10 and 11 of the valves 4 and 5, reciprocate in the cylinders 6 and 7 respectively. Springs 12 and 13 surrounding the valve stems 10 and 11, bear at their lower ends upon the head of the engine cylinder and at their upper ends against the pistons 8 and 9 respectively. In the engine crank case 1 is mounted a pump 14 which is operated by an eccentric 15 secured on the crank shaft 3. A pipe 16 leads from said pump to a pressure tank 17. In bearings 18 and 19 in the sides of the crank case below the crank shaft 3 is journaled a shaft 20 which is made in two sections 21 and 22, the section 22 telescoping within the section 21 and having a shoulder 23 formed thereon which engages the end of the section 21. In the sections 21 and 22 at their meeting point are cam groove 24 and longitudinal groove 25 respectively. A clutch 26 surrounds the shaft 20 at the meeting point of the sections 21 and 22, from the inner surface of which clutch extends pins 27 and 28 respectively into the grooves 24 and 25. The clutch 26 has an annular groove 29 in its periphery in which fits the ring end of a lever 30. A timing valve 31 is mounted on the shaft section 21, said valve including a valve cone 32 which is secured on the section 21 and a conical valve casing 33 which surrounds said valve cone and is secured in standards 34 upstanding from the bottom of the sump 2. On the shaft section 22 within the crank case 1 is secured a pinion 35 which meshes with a gear 36 secured on the crank shaft 3 also within the crank case, whereby the shaft 20 and valve cone 32 are rotated by the crank shaft 3, the clutch 26 causing the shaft section 21 to rotate with the section 22. Pipes 37 and 38 lead from the tank 17 into the valve casing 33. Pipes 39 and 40 lead from the valve casing 33 into the upper ends of the cylinders 6 and 7 respectively. The pipes 37, 38, 39 and 40 are fitted in the valve casing 33 in longitudinal alignment. Pipes 41 and 42 lead from the pipes 39 and 40 into the valve casing 33 at points 90° from the point of connection of the pipes 37, 38, 39 and 40 with the casing. Outlet pipes 43 and 44 lead from the valve casing at points 90° from the points of connection of the pipes 37 to 40 inclusive with the valve casing. Ports 45 and 46 are provided in the periphery of the valve cone 32, the port 45 being adapted to register first with the pipes 37 and 39 and then with the pipes 41 and 44, and the port 46 being adapted to register first with the pipes 38 and 40 and then with the pipes 42 and 43.

The operation of my invention is as follows:

The rotation of the crank shaft 3 operates the pump 14 through eccentric 15 and rotates the valve cone 32 through the gear 36, pinion 35, shaft section 22, clutch 26 and shaft section 21. The pump 14 forces the oil from the sump 2 into the pressure tank 17. During the rotation of the valve cone 32 when the port 45 registers with pipes 37 and 39, oil is forced from the tank 17 through pipe 37, port 45, and pipe 39 into the upper end of cylinder 6, and opens the

intake valve 4 to admit gas into the engine cylinder. On the compression stroke of the engine the valve 4 closes and forces the piston 8 upwardly and the oil out of the cylinder 6 through pipes 39 and 41 into the port 45, which at this time registers with pipes 41 and 44, and from said port out through outlet pipe 44 back into the sump 2. On the exhaust stroke of the engine the port 46 registers with pipes 38 and 40, whereupon oil is forced from the tank 17 through pipe 38, port 46, and pipe 40 into the cylinder 7 and the exhaust valve 5 is opened to allow the products of combustion to escape. When the port 46 passes the pipes 38 and 40 and registers with the pipes 42 and 43 the exhaust valve 5 closes under the influence of its spring 13 and forces the oil out of cylinder 7 through pipes 40 and 42, ports 46 and pipe 43 into the sump 2. This completes the cycle of operations.

By shifting the clutch 26 the pin 27 engaging the slot 24 turns the shaft section 21 and valve cone 32 with relation to the section 22 and advances or retards the opening of the valves.

The lateral motion of the clutch 26 in the grooves 24 and 25, causes the section 21 to rotate and vary the timing of the valves.

Having described my invention, I claim:

1. In an internal combustion engine, the combination with the intake and exhaust valves of the engine, and hydraulic means for operating said valves said hydraulic means including a shiftable clutch.

2. In an internal combustion engine, the combination with the crank case and intake and exhaust valves of the engine, of hydraulic means for utilizing the oil in the crank case for operating said valves.

3. In combination with the intake and exhaust valves of an internal combustion engine, a piston connected to the stem of each of said valves, a cylinder in which each of said pistons reciprocates, a pressure tank, a pump for pumping liquid into said pressure tank, a valve, pipes leading from said tank into said valve, pipes leading from said valve into said cylinders respectively, exhaust pipes leading respectively from said latter pipes into said valve, outlet pipes leading from said valve into the crank case, and means for operating said valve to allow the oil to pass from said tank through the pipes leading from said tank to said valve and through the pipes leading from said valve to said cylinders to operate said intake and exhaust valve and to allow the oil to pass from said cylinders when said valves are closed, through the pipes leading into said cylinders and through said exhaust pipes and said outlet pipes.

4. In an internal combustion engine, the combination with the intake and exhaust valves of the engine, of hydraulic means for operating said valves, and means for adjusting the hydraulic means to advance or retard the opening of the valves.

5. In combination with the crank case, crank shaft, intake valve and exhaust valve of an internal combustion engine, a piston connected to the stem of each of said valves, a cylinder in which each of said pistons reciprocates, a pressure tank, a pump operated by the engine crank shaft for pumping oil from the engine crank case sump into said pressure tank, a valve shaft journaled in said crank case, a valve including a valve cone secured on said valve shaft and a valve casing surrounding said valve cone, two pipes leading from said pressure tank into said valve casing, two pipes leading from said valve casing into said cylinders respectively, exhaust pipes leading from said latter pipes respectively into said valve casing, two outlet pipes leading from said valve casing, two ports in said valve cone, a gear on the engine crank shaft, and a pinion on said valve shaft meshing with said gear for rotating said valve cone to cause one of said ports first to register with one pipe leading from said tank and one pipe leading to one of said cylinders, to admit oil into said cylinder to open the intake valve, and then to register with the exhaust pipe leading from said pipe leading from said cylinder and with one of said outlet pipes, to allow the oil to exhaust from said cylinder into the crank case, and to cause the other valve port to register, first, with the other pipe leading from said tank and the other pipe leading to the other cylinder, to admit oil to said cylinder to open said exhaust valve, and then to register with said other exhaust pipe and other outlet pipe to allow the oil to exhaust from said other cylinder into said crank case.

6. In combination with the crank case, crank shaft, intake valve and exhaust valve of an internal combustion engine, a piston connected to the stem of each of said valves, a cylinder in which each of said pistons reciprocates, a pressure tank, a pump operated by the engine crank shaft for pumping oil from the engine crank case sump into said pressure tank, a valve shaft journaled in said crank case, said valve shaft being formed in two telescoping sections, said sections being formed with a longitudinal groove and a cam groove respectively, a clutch surrounding said shaft at the joint between said sections, pins on said clutch engaging said grooves respectively, a valve including a valve cone secured on one of said shaft sections and a valve casing surrounding said cone, two pipes leading from said pressure tank into said valve casing, two pipes leading from said valve casing into said cylinders respectively, exhaust pipes leading from said latter pipes respec-

tively into said valve casing, two outlet pipes leading from said valve casing, two ports in said valve cone, a pinion on the other section of said valve shaft, and a gear on the engine crank shaft meshing with said pinion for rotating said valve cone to cause one of said ports first to register with one pipe leading from said tank and the pipe leading into the cylinder for operating the engine intake valve, and then to register with the exhaust pipe, leading from said pipe which leads to said intake valve operating cylinder, and with one of said outlet pipes, and to cause the other cone port to register first with the other pipe leading from said tank to the valve casing and the pipe leading from said casing into the engine exhaust valve operating cylinder, and then to register with the other exhaust pipe and the other outlet pipe.

7. In an internal combustion engine, the combination with the intake and exhaust valves of the engine, of hydraulic means for operating said valves, said last named means including a clutch.

8. In an internal combustion engine, the combination with the intake and exhaust valves of the engine, of hydraulic means for operating said valves, said last named means including a shaft made in two sections, one of which telescopes within the other so as to permit of relative rotation of the two sections.

9. In an internal combustion engine, the combination with the intake and exhaust valves of the engine, of hydraulic means for operating said valves, said last named means including a shaft made in two sections, one of which telescopes within the other, one section having a cam groove in its outer periphery, the other section having a longitudinal groove therein, a clutch, pins on the clutch projecting into the two grooves in the sections of the shaft so as to permit of relative rotation of the two sections, and means to operate the clutch.

10. In an internal combustion engine, the combination with the intake and exhaust valves of the engine, hydraulic means for operating said valves, said hydraulic means including a pressure tank, a pump, means to operate the pump, a pipe connecting the pump and pressure tank whereby the fluid under pressure is carried to the pressure tank, a timing valve, pipes leading from the pressure tank to the timing valve whereby the fluid is conducted from the pressure tank to the timing valve.

11. In an internal combustion engine, the combination with the intake and exhaust valves of the engine, hydraulic means for operating said valves, said hydraulic means including a pressure tank, a pump, means to operate the pump, a pipe connecting the pump and pressure tank whereby the fluid under pressure is carried to the pressure tank, a timing valve, pipes leading from the pressure tank to the timing valve whereby the fluid is conducted from the pressure tank to the timing valve, said timing valve including a valve cone having ports therein, pipes leading from the timing valve to the cylinders through which the fluid alternately flows, pipes connecting the last mentioned pipes and other ports in the timing valve through which the fluid is returned to the timing valve, a crank case sump and outlet pipes from the timing valve whereby the fluid is returned from the timing valve to the crank case sump.

In testimony whereof I affix my signature.

GEORGE L. BULL.