

March 18, 1924.

1,486,954

O. L. DUGGER

ROTARY VALVE FOR INTERNAL COMBUSTION ENGINES

Filed Aug. 9, 1920

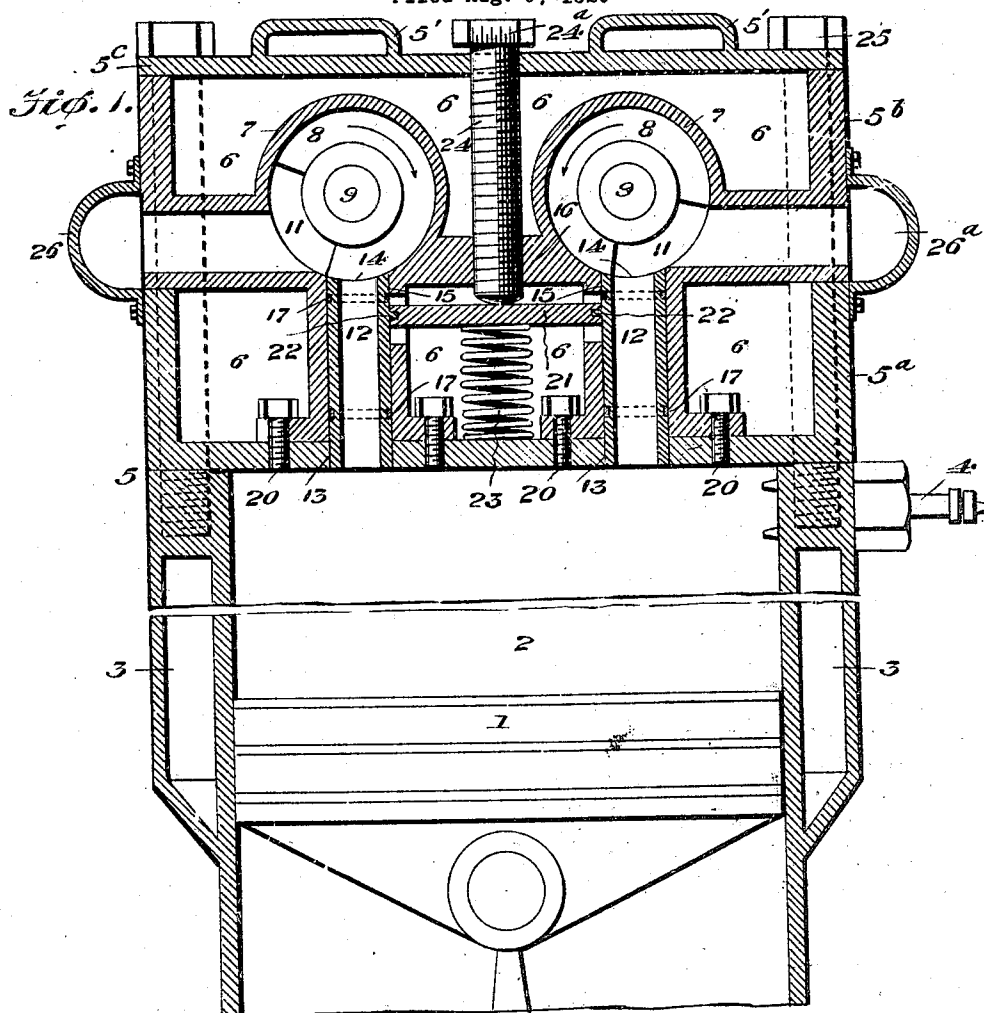


Fig. 2.

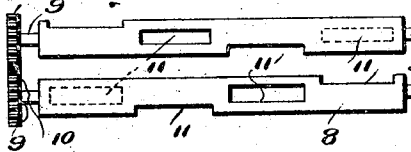
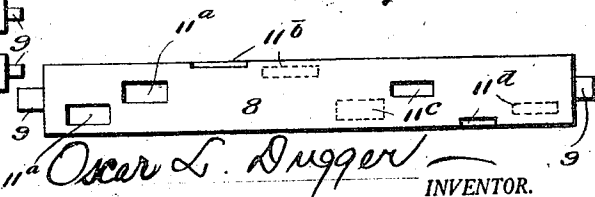


Fig. 3.



Witness
[Signature]

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UNITED STATES PATENT OFFICE.

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ROTARY VALVE FOR INTERNAL-COMBUSTION ENGINES.

Application filed August 9, 1920. Serial No. 402,370.

To all whom it may concern:

Be it known that I, OSCAR L. DUGGER, a citizen of the United States, residing at Evansville, in the county of Vanderburg and State of Indiana, have invented certain new and useful Improvements in Rotary Valves for Internal-Combustion Engines, of which the following is a specification.

This invention relates to rotary valves for internal combustion engines.

It has been proposed heretofore to provide one or more rotary valves to control the intake and exhaust from the cylinders of internal combustion engines but, as previously constructed, such valves have not been entirely satisfactory because they have been subject to the force of the explosion of the cylinder, have been difficult to pack, to keep cool, and are subject to too much friction.

My invention has for its object the provision of a rotary valve in either single or duplex form, which will be of such improved construction that it will greatly, if not entirely, overcome the foregoing defects incident to rotary valves when used on internal combustion engines, and to that end it embodies certain improvements and novel relationships and combinations of parts appearing more fully hereinafter.

In carrying out my invention, the rotary valves are mounted in and carried by the cylinder head so that the head may be removed without dismantling the valve action. Furthermore, the valves are subject to the action of the water jacket, thus insuring against too great increase in their temperature with incident warping, sticking, and allied defects. The cylinder head and the valve casings are made in sectional form and there are employed novel tubular conduits serving as ports connecting the valves and the cylinder, together with means to effectively pack the parts, and adjustable means whereby the tubular conduits which serve as ports may be set at just the right tension to avoid leakage while, at the same time, minimizing friction on the valves.

My improved valve is not affected by carbon deposits or warpage because its parts turn freely in their seats. The rotary valves

are turned by a positive valve motion without the use of springs.

I am aware that modifications may be resorted to in carrying out my invention and the disclosure of the invention, which is of a preferred embodiment thereof, is to be considered as illustrative, instead of restrictive, of the scope of the invention.

In the accompanying drawings,

Figure 1 is a vertical section through a cylinder of a four-cycle internal combustion engine equipped with my improved valve;

Fig. 2 is a detail plan view of the pair of valves shown in Fig. 1, and

Fig. 3 is a detail view of a single valve which may be employed in lieu of the pair of valves.

I have only illustrated one cylinder of the internal combustion engine to which the present valve is shown applied but it will be understood from Figure 2 that the remaining cylinders will have the same arrangement as shown in Figure 1, as the valve can be used for any number of cylinders cast en bloc.

The piston appears at 1 and the cylinder at 2, the latter having water jacket 3. The spark plug 4 is let into the side of the cylinder.

The cylinder head 5 is of special form and contains my improved valve or valves according as one or two are used.

The cylinder head 5 is hollow, as shown at 6 for the circulation of the water, water manifolds 5' being used, thereby insuring cooling of the valve or valves employed. In fact, only a very small part of the valve surface is exposed to the gases and explosion, thus overcoming a serious defect incident to the use of rotary valves for internal combustion engines. The valve casings appear at 7 and the rotary valves are shown at 8. By reference to Fig. 2 it will be seen that the valves 8 are duplex, but are so set that they will properly function as hereinafter described. Said valves are suitably journaled at their ends 9 and between cylinders where necessary and are connected by gear pinions 10 of equal diameter so that the timing of the valve is exactly correct. The

valves may be driven at one end by a gear or sprocket or any other suitable device, not shown, from the crank shaft of the engine, at one-half of the crank shaft speed. My
 5 valves 8 are each formed of a single solid piece of metal provided with pockets 11. The pockets 11 at the left hand end of Fig. 2 control the intake and exhaust of the first cylinder; the second set of pockets 11 control the second cylinder, and so on.

The valve casings 7 are in communication, at predetermined times, with the cylinder 2 through slidably mounted tubular conduits 12. These conduits serve as ports; each has
 15 one end slidable in an opening 13 in the inner end of the cylinder head 5. The other ends of the conduits 12 are concaved and bear against the valves 8, as shown at 14, and they slide loosely through openings 15 in the web 16. The conduits 12 are suitably packed as at 17. Diaphragms engaged with the conduits may be employed for packing them, if preferred.

A plate 21 which has its ends engaged
 25 with lugs 22 carried by the conduits 12, is pressed upwardly by springs 23 of which only one is shown. The springs 23 in connection with the plate 21 force the conduits 12 upwardly to cause their upper ends 14 to bear upon the valves 8. For the purpose of regulating this pressure to a nicety, so that there will be a suitably tight connection at 14, and nevertheless undue friction will be prevented, there is provided a
 30 screw or screws 24 threaded through the web 16 and the outer part of the cylinder head 5 and adjustable from the exterior of the cylinder head. A micrometer scale 24^a on the head or stem of screw 24 and markings on the cylinder head serve as an indicator.

Cap screws 25 extending down through the cylinder head 5, connect it to the cylinder 2.

45 On removing the screws 25, the entire cylinder head 5 may be taken off without distributing the valve action.

The cylinder head 5 is preferably formed in two sections:—a lower section 5^a and an upper section 5^b detachably connected together by the cap screws 20, and also fastened together by screws 25 which connect the entire cylinder head to the cylinder. There is a cap plate 5^c surmounting section
 55 5^b. The screws 25 fasten the cap plate 5^c.

The manifolds 26, 26^a, may be cast integral with, or bolted to, upper section 5^b. Manifold 26 serves for the intake and 26^a for the exhaust.

60 There is shown in Fig. 3 a single valve which may be used in lieu of the duplex valve of Figs. 1 and 2. When this valve is used, modification of the cylinder head 5 is required, but conduits such as 12 will be
 65 employed in connection therewith and there

will be used spring pressure means such as 21 and 23 and regulating means such as 24. The pockets are arranged in pairs 11^a, 11^b, 11^c, 11^d for the cylinders of the engine, the pockets of each pair being arranged one in advance of the other. To suit this arrangement two of the conduits 12 will be employed on a line with each other, one in advance of the other, to co-operate with the pair of pockets 11^a, for instance. The valve
 70 of Fig. 3 which is designated 8^a, will be positively driven by a gear or sprocket or other suitable device from the crank shaft of the engine.

Referring to Fig. 1, the right hand valve 80 8 is in position to exhaust the burnt gases, and the left hand valve 8 is closed. Assuming that the piston 1 is on its upward stroke, when it reaches the upper limit of its stroke the right hand valve 8 will have
 85 closed the conduit 12, and the left hand valve 8 will have begun to open the left hand conduit 12 which it will hold open to the intake 26 until the piston has reached the lower limit of its stroke, whereupon the
 90 left hand valve 8 will close the left hand conduit 12 and hold it closed while the piston travels up on its compression stroke, down on its firing stroke, and up on its exhaust stroke. The right hand valve 8 which
 95 controls the exhaust to 26^a remains closed during the intake stroke and the compression and firing strokes of the piston and opens again on the exhaust stroke.

What I claim is:—

100 1. The combination with a cylinder of an internal combustion engine, of a head therefor, a rotary valve in said head, a slidable conduit affording communication between the cylinder and the valve and bearing on the latter, spring-means actuating the conduit toward the valve, and means, operable from the exterior of the head, adapted for limiting the movement of said spring-means to determine the relationship of the
 105 conduit to the valve.

2. The combination with a cylinder of an internal combustion engine, of a removable head for said cylinder, a pair of rotary valves carried by said head and unitary
 115 therewith, one of said valves controlling the intake to, and the other the exhaust from, said cylinder, and slidable tubular conduits carried by the head and in communication with the cylinder, said conduits bearing
 120 against said valves, a plate for simultaneously moving said conduits, a spring co-operating with the plate to press the conduits against the valves, and a screw, operable from the exterior of the head, adapted
 125 for adjusting said plate.

3. The combination with a cylinder of an internal combustion engine, of a removable head for said cylinder, a pair of rotary
 130 valves carried by said head and unitary

therewith, one of said valves controlling the intake to, and the other the exhaust from, said cylinder, movable tubular conduits carried by said head and communicating with
5 said cylinder and in contact with said valves, means for packing said conduits, and spring-actuated means carried by the head for holding said conduits in effective position for control by said valves, and means, operable from the exterior of the head, 10 adapted for adjusting said conduits.

In testimony whereof I affix my signature.

OSCAR L. DUGGER.