Oct. 9, 1928. 1,687,473

O. L. DUGGER ET AL

ROTARY VALVE FOR EXPLOSIVE ENGINES

Filed July 31, 1926 2 Sheets-Sheet 1

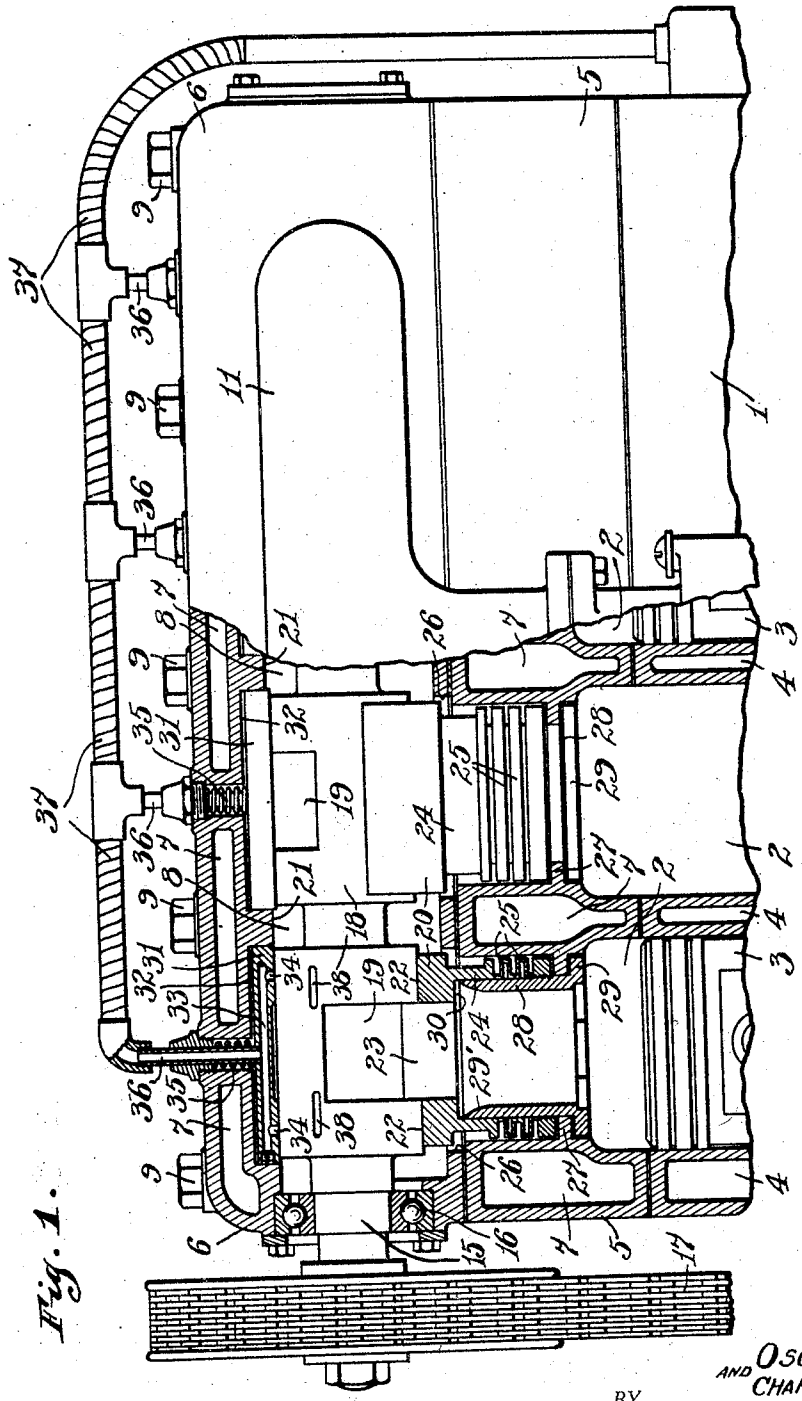


Fig. 1.

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Fig. 2.

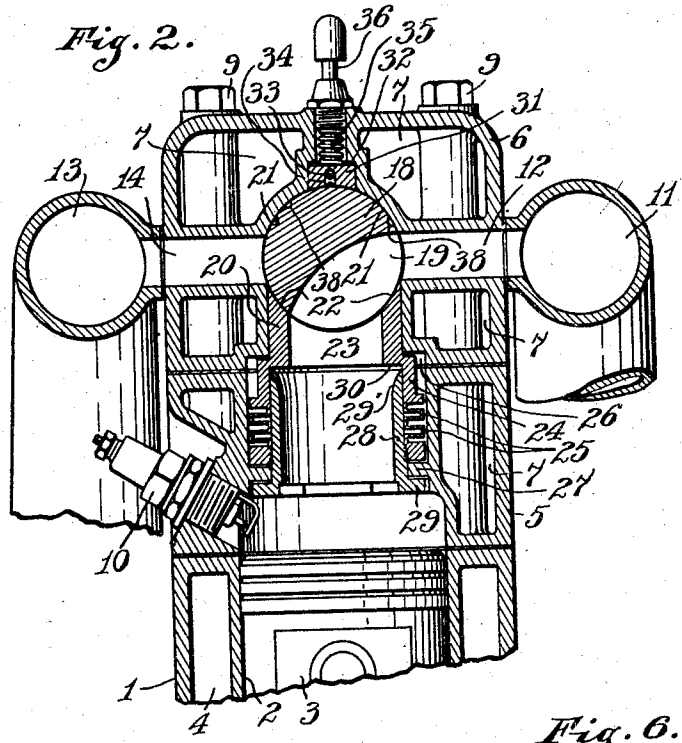


Fig. 4.

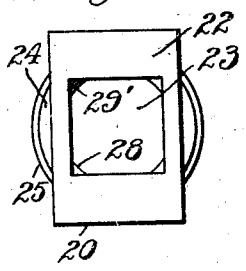


Fig. 5.

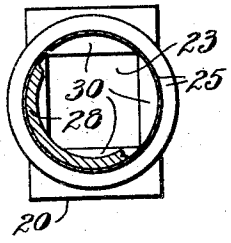


Fig. 6.

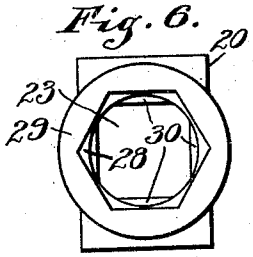


Fig. 7.

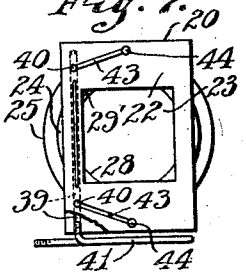


Fig. 3.

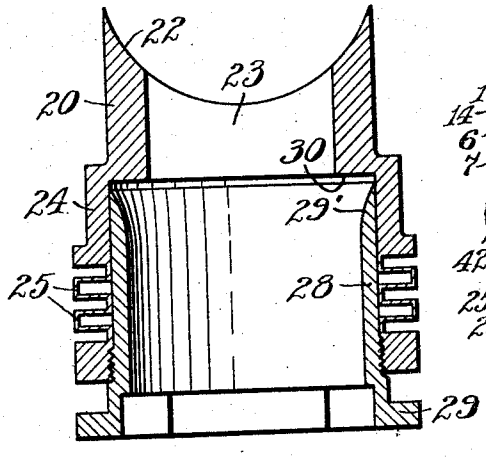


Fig. 8.

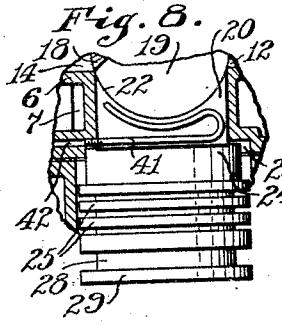
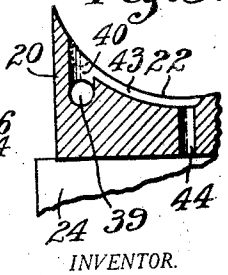


Fig. 9.



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Patented Oct. 9, 1928. 1,687,473

UNITED STATES PATENT OFFICE.

OSCAR L. DUGGER AND CHARLES M. DUGGER, OF EVANSVILLE, INDIANA, ASSIGNORS TO ROTARY VALVE COMPANY, OF EVANSVILLE, INDIANA, A CORPORATION OF INDIANA.

ROTARY VALVE FOR EXPLOSIVE ENGINES.

Application filed July 31, 1926. Serial No. 126,165.

This invention relates to rotary valve mechanism for internal combustion engines.

One of the objects of the invention is to provide improved means for packing the valve at the point where it serves the respective cylinders of the internal combustion member to prevent explosive pressure from passing said valve and to provide such a packing that will reduce the bearing pressure of the packing on the valve to a minimum and to insure a perfect packing of the valve under varying conditions of expansion and contraction of the metal parts due to variation in heat conditions to which the valve and its packing are subjected.

For the purpose of disclosing the invention certain embodiments thereof are illustrated in the accompanying drawings in which

Fig. 1 is a side elevation partly in section of an engine embodying the invention;

Fig. 2 is a transverse sectional view;

Fig. 3 is a sectional view of the packing shoe;

Fig. 4 is a top plan view of the packing shoe;

Fig. 5 is a transverse sectional view, looking from beneath, of one of the packing shoes;

Fig. 6 is a bottom plan view of one of the packing shoes;

Fig. 7 is a top plan view of one of the packing shoes showing a modified form of oiling means;

Fig. 8 is a side elevation of the packing shoe, the associated parts being shown in section, and showing an oil feed means;

Fig. 9 is a detail section of the shoe shown in Fig. 7.

The invention is illustrated as applied to a four cylinder combustion engine of the type wherein the combustion occurs in the ends of the cylinder and to this end the cylinder block 1 is provided with cylinders 2 ported at their tops and having the usual pistons 3, the block being provided with the usual water jackets 4.

The cylinder head comprises a main part 5 and a detachable cap or top section 6, each being hollow to provide water jackets 7 whose proximity to the valve chamber 8 is utilized for cooling. Bolts 9 which pass through the sections 5 and 6 are adapted for securing the sections together and for connecting them to the cylinder block.

It will be understood that suitable spark plugs 10 are provided for the cylinders to provide for the ignition of the charge therein.

The cap section 6 is provided with an intake manifold 11 on one side of the head which manifold communicates with intake ports 12, one for each cylinder, and on the other side of the head is provided an exhaust manifold 13 communicating with exhaust ports 14, one for each cylinder.

The rotary valve 15 is formed in a single piece and extends through the valve chamber 8 being journaled at each end in suitable bearings 16 and rotatably driven by a suitable driving connection 17 operated from the crankshaft or other moving part of the engine. This valve 15 is provided with cylindrical members 18 corresponding in number to the engine cylinders to be served, which members are recessed or cut away as 19 to form pockets to receive the charge from the intake and deliver the same to the cylinder and to allow the exhaust to occur at proper times. In the structure illustrated these pockets are arranged at quadrant distances apart in order to properly serve the respective cylinders.

The respective members 18 are packed by and mounted to turn in packing shoes or bearings 20 on the under side and machined seats 21 on the upper side. Each packing shoe or bearing 20 consists of substantially rectangular shoe portions, the inner faces 22 of which are shaped to fit the cylindrical members 18 and are suitably ground to make a proper joint therewith. Each shoe is provided with a rectangular port 23 where it bears on the member 18 and this port is as of great a length as the pocket or recess 19. By having the port 23 rectangular the intake to and the exhaust from the cylinder through the port and pocket are in a given ratio, the admission of the charge to the cylinder is regular and the exhaust therefrom is carried out in a regular fashion as distinguished from the variability at different points of the turning of the valve as with a circular port. With a rectangular port the turning of the valve will cover the port in a regularly progressive fashion which would not be the case if the port were of other than rectangular form.

The bottom portion of the packing shoe is provided with a cylindrical neck 24 a portion

of which takes a spring bellows formation as 25. This bellows construction is integral with the cylindrical neck of the shoe and forms a part of the neck. The neck 24 fits within the circular intake opening 26 of the main part 6 of the head and the wall of this opening at its lower end is provided with an internal annular flange 27 on which the bottom of the neck 24 rests, this bottom portion of the neck being internally screw threaded. Fitting within the neck 24 is a conduit or bushing 28 provided at its lower end with an annular clamping flange 29 bearing on the under side of the flange 27 on the main part 5 of the cylinder head and the bushing above the flange 27 is externally screw threaded to engage with the screw threads on the bottom of the neck 24 so that when the parts are assembled the bottom portion of the neck 24 is securely clamped upon the annular flange 27 while the top portion of the neck is free to move vertically, it having a sliding engagement with the bushing 28, which bushing at its top has its walls tapered as at 29'. By this arrangement the bellows construction 25 has a spring tendency to hold the shoe 22 upwardly against the face of the cylindrical valve head 18 and at the same time there is ample provision made for the downward movement of the head when the metal parts become expanded under the influence of the heat of the exploded charges. The inner diameter of the neck, when the bushing 28 is in position, is greater than any dimension of the square opening 23 in the shoe and as a result there is formed on the under face of what might be termed the shoe proper a shelf or surface 30 the result being that when an explosion of the charge takes place in the cylinder the pressure exerted on this shelf tends to hold the shoe against the face of the rotary valve. As a matter of fact there is a certain balancing action which takes place on the shoe due to the tendency of the explosion of the charge in the cylinder. When this explosion takes place the pressure extends clear up against the face of the rotary cylinder or member of the valve and there is a tendency for this pressure to drive the shoe downwardly. This tendency is overcome by the pressure on the shelf 30 exerted in an upward direction and the surfaces are so proportioned that the preponderance of pressure is on the shelf side or upwardly.

In the structure which has been built embodying the invention it has been found that with the opening 23 one and one-half inches a circular bore in the neck 24 of two and one-eighth inches will provide a shelf having sufficient surface to give advantageous results. It will be understood however that while the above dimensions have been given as producing advantageous results they are subject to variation depending upon conditions.

For the purpose of lubrication of each of the rotary cylinders 18 there is provided a key member 31 preferably rectangular in shape and mounted in a pocket 32 in the cap 6 above the cylinder. This key has a longitudinally extending bore 33 having a pair of ports 34 extending to the face of the key disposed on each side of the recess 19. The key is normally pressed into engagement with the face of the cylindrical member 18 by a suitable coil spring 35 and oil is supplied by a stem 36 leading into the bore 33 and connected with a suitable oil conduit 37 through which oil is delivered under pressure. At predetermined points on the cylindrical member 18 there is provided a pair of grooves 38 which at one point in the rotation of the member coincide with the openings 34 so that at this point these openings are unsealed permitting a certain amount of oil to pass into the grooves 38 and are again immediately sealed by the face of the rotary head as these grooves pass away from the openings 34. Sufficient oil however is delivered to these grooves during this period to properly maintain the rotary head lubricated.

In Figs. 7 to 9 there is illustrated another method of lubricating the rotary valve. In the structure illustrated in these figures the shoe 22 is provided with a longitudinally extending bore 39 having ports or openings 40 extending therefrom to the face of the shoe. This bore is connected by a flexible conduit 41 with an opening 42 extending through the water jacket and connected at its opposite end with a suitable conduit such as the conduit 37 through which oil is supplied under pressure. The face 22 of the shoe is provided with a pair of transversely diagonally extending grooves 43 terminating in holes 44 passing through the shoe and to the space beneath the same. The ports 40 are adapted to coincide periodically with the grooves 38 in the face of the rotary head 18 to permit the escape of oil from the openings 40 to the face of the shoe during this period. Any excess oil will follow the grooves 43 and pass down through the openings 44, eventually finding its way back to the crank case of the engine.

We claim as our invention:

1. In an internal combustion engine the combination with a rotary valve, of a movably mounted ported packing seated against the face of said valve and having a ported neck connecting the packing with the engine cylinder, means for rigidly connecting one end of said packing to the engine cylinder, said neck having a flexible portion to permit relative movement between said packing and the cylinder and a hollow gland telescoping inside of said neck to prevent said neck from receiving the pressure of the exploded charge.

2. In an internal combustion engine the combination with a rotary valve, of a movably mounted ported packing seated against

the face of said valve and having a ported neck connecting the packing with the engine cylinder, a hollow gland telescoping inside of said neck and having means for rigidly securing the neck to the engine cylinder, said neck including a flexible portion permitting a relative movement between said shoe and the engine cylinder.

3. In an internal combustion engine the combination with a rotary valve, of a movably mounted ported packing therefor, a hollow gland or conduit stationarily mounted relatively to the engine cylinder and telescoping inside the ported packing and a flexible connection between said gland and the packing.

4. In an internal combustion engine the combination with a rotary valve, of a movably mounted ported packing seated against the face of said valve, a bellows conduit extending between said packing and the engine cylinder having one end connected to the packing and the other end connected to the cylinder and a hollow gland telescoping inside of said conduit and preventing said conduit from receiving the pressure of the exploded charge.

5. In an internal combustion engine the combination with a rotary valve, of a movably mounted ported packing seated against the face of said valve, a spring bellows conduit extending between said packing and the engine cylinder and having one end connected to the packing and the other end to the cylinder and a hollow gland telescoping inside of said conduit to prevent said conduit from receiving the pressure of the exploded charge.

6. In an internal combustion engine the combination with a rotary valve, of a movably mounted ported packing seated against the face of said valve, a spring bellows conduit having one end connected to the packing, a hollow gland telescoping inside of the bellows to prevent the bellows from receiving the pressure of the exploded charge and having means for securing one end of the bellows to the engine cylinder.

In witness whereof, we have hereunto set our hands at Evansville, Indiana, this 4th day of March, A. D. one thousand nine hundred and twenty-six.

OSCAR L. DUGGER.
CHARLES M. DUGGER.