PATENT SPECIFICATION

Application Date: July 17, 1935. No. 20382/35. 448,368

Complete Specification Left: Oct. 31, 1935.

Complete Specification Accepted: June 8, 1936.

PROVISIONAL SPECIFICATION

Improvements in Rotary Valve Internal Combustion Engines and Pumps

I, ROLAND CLAUDE CROSS, a British subject, of 33, Midford Road, Odd Down, Bath, Somerset, do hereby declare the nature of this invention to be as follows:—

This invention relates to internal combustion engines, pumps and the like comprising a rotary cylindrical distributing valve surmounting a cylinder and disposed at right angles thereto, and has for its object to take up automatically undue clearance between the valve and its housing whilst at the same time to avoid possibility of the valve seizing in its bearing. The invention is also designed to eliminate difficulties of expansion due to temperature changes, and to provide a port sealing device.

The invention consists broadly in mounting the cylinder (or a part thereof containing the cylinder head) and rigidly with it the lower part of the valve housing so as to have a limited degree of resilient movement in the direction of the axis of the cylinder in relation to the upper part of the housing. For example, the rotary valve housing is divided preferably along its centre line at right angles to the axial centre line of the cylinder, and the top part of the housing is fastened to the crank chamber by means of two or more tie bolts. The cylinder is interposed between the top cap or upper part of the housing and the crank chamber, and in the joint between the cylinder and the cap and also between the cylinder base flange and the crank chamber is interposed a resilient packing such as heat resisting rubber or one of the resilient vegetable or other soft packings that are readily obtainable commercially.

With such an arrangement, when the valve is placed in the valve bore, the nuts of the tie bolts are tightened down on the cylinder head until the valve is resiliently gripped in the housing. In order to do this the two resilient packings i.e. under the cylinder base flange and between the cap and the cylinder respectively must be compressed. When there is a rise of gas pressure in the cylinder, the cylinder is automatically forced upwards from the crank chamber towards the valve which seals the port hole in the cylinder head by pressing that part of the bearing firmly against the valve. The higher the pressure the greater will be the tendency for the cylinder to remain firmly pressed against the valve.

Providing the maximum pressures thus obtainable are adjusted so as not to impose more than reasonable bearing loads between the valve and the housing, then it will not be possible to seize the valve, as these pressures cannot be exceeded. In the case of an ordinary valve in an unyielding bore the pressures may become very great indeed due to the valve expanding and becoming too large for the valve bore, but in the present invention it is impossible for this to happen.

A further great advantage is that gas pressure cannot leak along the valve and allow communication between the exhaust and the inlet as undue clearance is always eliminated with this system by the tendency of the cylinder always to press against the valve due to the resilient packing underneath the cylinder barrel and to the gas pressure in the cylinder tending to force it upwards from the crank case on to the valve.

Dated this 17th day of July, 1935.
EDWIN C. AXE, A.I.M.E.,
27, Chancery Lane, London, W.C. 2,
Agent for the Applicant.

COMPLETE SPECIFICATION

Improvements in Rotary Valve Internal Combustion Engines and Pumps

I, ROLAND CLAUDE CROSS, a British subject, of 33, Midford Road, Odd Down, Bath, Somerset, do hereby declare the nature of this invention and in what

[Price

manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to internal combustion engines and pumps of the type comprising a rotary cylindrical distributing valve mounted in a split housing which surmounts and is disposed at right angles to an axially slidable cylinder, the lower part of the housing being made rigid with the cylinder so as to have with the cylinder a certain amount of resilient movement in relation to the upper part of the housing. In this type of engine the cylinder is usually resiliently supported upon springs which press the lower part of the housing into contact with the valve, a rise of gas pressure in the cylinder being effective to force the cylinder upwards towards the valve so that it seals the inlet port by pressing that part of the valve housing firmly against the valve.

By employing this type of engine undue clearance between the valve and its housing is automatically taken up and the possibility of the valve seizing in its bearing is reduced.

With such engines, however, no provision has hitherto been made for ensuring absolute gas tightness at the joint between the two part housing at the cylinder head or between the foot of the cylinder and the crank case and it is the object of the present invention to increase the efficiency of engines of the type referred to by providing at the foot and head of the cylinder a seal which also gives the necessarily resilient movement thereof.

According to the invention an internal combustion engine or pump of the type defined is characterised by resilient packing interposed between the parts of the split housing and between the foot of the cylinder and the crank case so as to constitute a gas tight seal irrespective of the movement of the cylinder the resilience of which is provided by the packing.

The features of the present invention will be more readily understood by referring to the accompanying drawing in conjunction with the following description.

In the drawing:—

Figure 1 is a vertical section through a cylinder of an engine according to one embodiment of the invention; and

Figure 2 is a similar view through another embodiment of the invention.

Like reference numerals are used in both drawings to designate similar parts.

The housing of the rotary valve 1 is split along its centre line at right angles to the axial centre line of the cylinder 2, to provide an upper part 3 and a lower part 4 which is made rigid with the cylinder, conveniently by being cast integral therewith, and the inlet port 5 of which may be provided with a springy lip to ensure port sealing as described in the prior Cross British Patent No. 373,660. Both housing parts and the cylinder are suitably jacketted as shown to receive cooling fluid.

From each side of the upper part 3 of the valve housing projects a rib 6 which interfits a groove 7 formed in the lower housing part 3, and the foot 2*a* of the cylinder is located on the crank case 8, there being inserted in the joint between the housing parts a resilient packing 9, and also in the joint between the cylinder foot 2*a* and the crank case 8, a second resilient packing 10, the whole assembly being bolted down to the crank case with the packings under compression so that the cylinder is resiliently dispositioned between the upper housing part 3 and the crank case, and an absolute gas seal is provided at the joints.

In Figure 1 the tie bolts 11 which hold the assembly together, pass through the packings 9, 10 and the compression in the latter can be adjusted by tightening the bolts, whereas in Figure 2 distance pieces 12 are mounted between the upper housing part 3 and the crank case 8 to ensure that this part is bolted down square to the crank chamber and is not twisted. With this arrangement any adjustment as to the compression of the packings can be readily effected by altering the thickness of the latter. Although separate distance pieces are shown it will be clear that the tie bolts themselves can distance and locate the members by being suitably shouldered.

During working, a rise in gas pressure in the cylinder automatically forces the latter upwardly—the upper part of the cylinder being, if desirable, suitably shaped and stiffened as indicated in Figure 2 to obtain the maximum effect and to take the strain of the pressure—so as to compress the upper packing 9 and at the same time to press the portion of the bearing about the port hole 5 firmly into contact with the valve. Thus a complete seal at the cylinder head is provided so that the whole power derived from the explosion can be utilised to the full and without loss, and this seal will be rendered more effectual by a high gas pressure. Similarly, the packing 10 at the cylinder foot, during the movement of the cylinder, maintains a seal at this end.

In the preferred embodiment the packing 9 between the parts 3, 4 of the split housing is made so as to have a greater resistance to deflection, i.e. compression, than the packing 10, and can therefore

absorb a certain amount of the load imposed by the rise in gas pressure in the cylinder, with the result that the valve can work more freely in its bearing whilst the seal is retained. This effect can be realised by using washers of different thicknesses or of different materials.

Providing the maximum pressures obtainable are adjusted so as not to impose more than reasonable bearing loads between the valve and the housing, then it will not be possible to seize the valve, and due to the general flexible mounting of the valve and the cylinder not only are the pressures kept within reasonable and practical limits but the tendency to distortion is greatly minimised so that true running of the valve is ensured with the effective sealing.

Moreover, gas pressure cannot leak along the valve and allow communcation between the exhaust and the inlet as undue clearance is always eliminated with this system by the tendency of the cylinder always to press against the valve due to the resilient packing underneath the cylinder barrel and to the gas pressure in the cylinder tending to force it upwards from the crank case on to the valve.

In Figure 2, the port 5 is surrounded by an annulus 13 which is slightly raised from the bearing surface of the valve to provide for and ensure a better sealing at the port as described in the specification of co-pending Application No. 30087/35 (Serial No. 448,383).

For the purpose of sealing the ends of the valve without affecting the axial cylinder play, there may be inserted between the cylinder or cylinders block and the usual flanges closing the valve at either end resilient packing which secures gas tightness. One method of inserting this packing may be seen in the specification of co-pending application No. 30088/35 (Serial No. 448,384) which is directed to the construction of a multi-cylinder engine with axial play of the individual cylinders.

Having now particularly described and ascertained the nature of my said invention, and in what manner the same is to be performed, I declare that what I claim is:—

1. An internal combustion engine or pump of the type defined, characterised by resilient packing interposed between the parts of the split housing and between the foot of the cylinder and the crank case so as to constitute a gas-tight seal irrespective of the movement of the cylinder the resilience of which is provided by the packing.

2. An internal combustion engine or pump according to Claim 1, wherein the packing between the parts of the split housing is constructed so as to have a greater resistance to deflection than the packing between the cylinder foot and the crank case.

3. An internal combustion engine or pump according to either of the preceding claims, wherein adjustment of the resilient packing is effected by bolting the top part of the valve housing to the crank chamber by a plurality of tie bolts.

4. An internal combustion engine or pump according to Claim 3, wherein distance pieces are provided on opposite sides of the engine to ensure that the top part of the valve housing is bolted down square to the crank chamber.

5. An internal combustion engine or pump according to any one of the preceding claims, wherein between the cylinder block and flanges closing the valve at either end is inserted resilient packing to provide a gas seal as well as allow for the required axial movement of the cylinder.

6. An internal combustion engine constructed and arranged substantially as herein described and as illustrated, in the acompanying drawings.

Dated this 31st day of October, 1935.

EDWIN C. AXE, A.I.M.E.,
27, Chancery Lane, London, W.C.2,
Agent for the Applicant.

Leamington Spa: Printed for His Majesty's Stationery Office, by the Courier Press.—1936.

Fig.1.

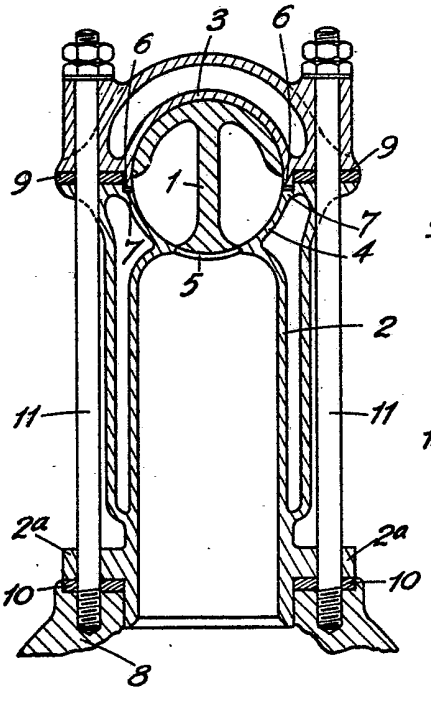
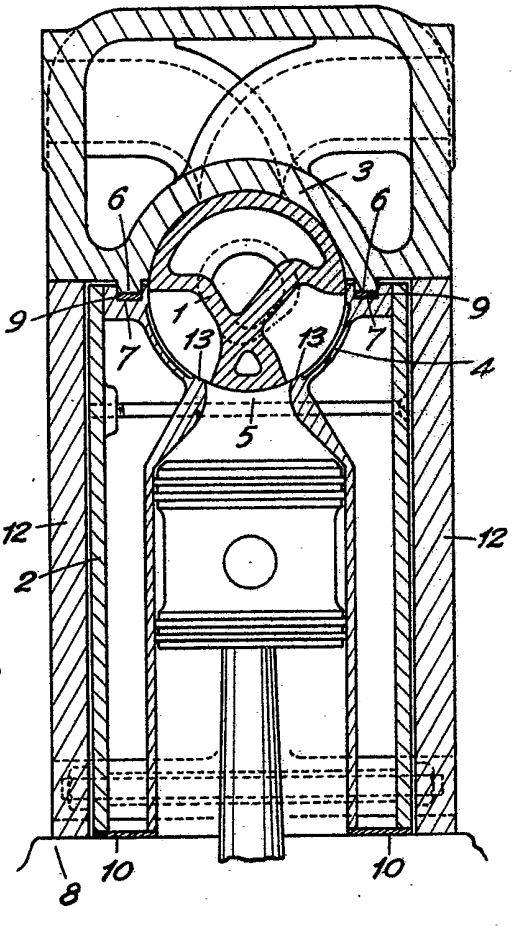


Fig.2.



Malby & Sons, Photo-Lith.