PATENT SPECIFICATION

Application Date: May 27, 1942. No. 7164/42. **557,565**

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PROVISIONAL SPECIFICATION

Improvements in or relating to Rotary Valves for Internal Combustion Engines

I, FRANK METCALF ASPIN, a British subject, of 149, Walmersley Road, Bury, Lancashire, do hereby declare the nature of this invention to be as follows:—

This invention relates to rotary valves for internal combustion engines of the kind in which the rotary valve member is axially loaded by gaseous pressures within the cylinder in a direction to vary the loading between the gas sealing surfaces of the rotary valve member and its seating. An example of a rotary valve construction of such kind is described in the Specification of my prior Patent No. 463,412, and this invention is particularly, though not exclusively, applicable to the valve construction of my aforesaid earlier Patent.

The invention may also conveniently embody the construction described in my co-pending Application for Patent No. 7163/42 (Serial No. 557,564) in which the cylinder head and valve is embodied in a plug-like unit fitting and adapted to be secured in the end or integral extension of the engine cylinder.

The lubrication of a rotary valve of kind referred to is a problem which is considered and dealt with in some of my other earlier Patents, such as Patent No. 537,863, whilst the problem of bearing loads is the subject of my Patent No. 511,208 in which the axial load on the valve due to fluid pressure in the cylinder is distributed between anti-friction bearings and the tapered gas-sealing bearing surfaces of the rotary valve member and its seating, such bearing surfaces carrying an oil film and being adapted to take the major portion of " peak " loads.

Loading of the gas sealing bearing surfaces, beyond that which is necessary to maintain the gas seal, increases friction at the bearing surfaces and the object of the present invention is an improved construction to enable the loading at such surfaces to be limited to a pre-determined maximum and substantially unrelated to the loading on the valve due to gaseous pressures in the cylinder.

According to the invention a rotary valve for an internal combustion engine comprises a rotary plug member and a seating member therefor with complementary gas-sealing bearing surfaces, thrust bearings for the rotary valve member supplementary to such bearing surfaces and a yieldable mounting for the seating member including a resilient element to predetermine the maximum loading between the seating member and the rotary valve member.

According to a preferred embodiment of the invention the rotary valve is characterised in that the seating member comprises a plug-like unit axially slidable in the end of the cylinder.

In one example of the invention the cylinder is extended above the limit of travel of the piston for a distance approximately equal to the diameter of the bore of the cylinder, and the bore of such extension is larger than that of the cylinder so as to form an annular shoulder. The cylinder bore is fitted with a liner which is flanged at its upper end, such flange being located against the aforesaid shoulder. In the bore of the upper end of the cylinder is located a plug-like unit which is a sliding fit whilst being held against rotation and embodies the rotary valve, the rotary valve member being of the conical type seating in a conical recess in the plug. In the rotary valve member is an off-set combustion space as described in the Specification of my aforesaid earlier Patent No. 463,412 whilst in the plug and in the extension of the cylinder are registering inlet and exhaust ports and a " plug " hole. The upper end of the cylinder liner has a small cylindrical upstanding flange above its locating end flange whilst the lower end of the plug-like unit has an annular recess which fits closely over such upstanding flange to form a gas seal. The stem of the valve above its conical portion is cylindrical and is a good bearing fit in the plug-like part.

The plug-like unit is secured in the end of the cylinder by a flanged ring, fitting over it and holding an anti-friction thrust bearing. The flanged ring also houses a flat spring located between itself and the

upper end of the plug-like unit.

In use, the body of the plug-like unit is forced downwardly to its normal position by the spring and the rotary valve member is so mounted that such spring effort provides a load on the complementary gas sealing surfaces to maintain gas sealing relation between the valve and its seating. Gaseous pressures in the cylinder will cause the rotary valve member to be forced upwardly and the thrust bearing to yield thereto but the pressure between the co-acting conical gas sealing surfaces of the rotary valve member and its seating cannot, in spite of the resultant axial movement of the rotary valve member towards its seating, exceed the pressure which is determined by the spring as any excess of pressure will also move the plug-like unit against the resistance of the spring. Obviously, the yield of the thrust bearing will normally be only very small and the order perhaps of tenths of thousandths of an inch, so that the plug-like member will only be required to move very little.

The invention is obviously not limited to all the details of construction of the example above described, some of which may be modified without departing from the nature of the invention.

Dated this 18th day of May, 1942.

For the Applicant,
WILSON, GUN & ELLIS,
54/56, Market Street, Manchester, 1.

COMPLETE SPECIFICATION

Improvements in or relating to Rotary Valves for Internal Combustion Engines

I, FRANK METCALF ASPIN, a British subject, of 149, Walmersley Road, Bury, Lancashire, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to rotary valves for internal combustion engines of the kind in which the rotary valve member is axially loaded by gaseous pressures within the cylinder in a direction to vary the loading between the gas sealing surfaces of the rotary valve member and its seating. An example of a rotary valve construction of such kind is described in the Specification of my prior Patent No. 463,412, and this invention is particularly, though not exclusively, applicable to the valve construction of my aforesaid earlier Patent.

The invention may also conveniently embody the construction described in my co-pending Application for Patent No. 7163/42 (Serial No. 557,564), in which the cylinder head and valve is embodied in a plug-like unit fitting and adapted to be secured in the end or integral extension of the engine cylinder.

The subjects of lubrication and bearing loads of a rotary valve of the kind referred to are major problems which are considered and dealt with in some of my other earlier Patents, such as Patent No. 537,863, dealing with lubrication, whilst the problem of bearing loads is the subject of my Patent No. 511,208, in which the axial load on the valve due to fluid pressure in the cylinder is distributed between anti-friction bearings and the tapered gas-sealing bearing surfaces of the rotary valve member and its seating, such bearing surfaces carrying an oil film and being adapted to take the major portion of " peak " loads.

Loading of the gas sealing bearing surfaces, beyond that which is necessary to maintain the gas seal, increases friction at the bearing surfaces and entails more lubrication and the object of the present invention is an improved construction to enable the loading at such surfaces to be limited to a pre-determined maximum and substantially unrelated to the loading on the valve due to gaseous pressures in the cylinder.

According to the invention a rotary valve for an internal combustion engine comprises a rotary valve member and a seating member therefor with complementary tapered gas-sealing bearing surfaces on the said rotary member and in the said seating member, thrust bearings for the rotary member supplementary to such complementary gas sealing and bearing surfaces and a yieldable mounting for the seating member permitting axial movement only and including a resilient element to predetermine the maximum loading between the seating member and the rotary member.

According to a preferred embodiment of the invention the rotary valve is characterised in that the seating member comprises a plug-like unit axially slidable in the end of the cylinder.

In the accompanying drawing,

Fig. 1 is a sectional elevation showing one example of the invention.

Fig. 2 is a similar view of a modified construction.

In the example of the invention shown in the drawings the cylinder 10 is extended

above the limit of travel of the piston 11 for a distance approximately equal to the diameter of the bore of the cylinder, and the bore 12 of such extension is larger than that of the cylinder so as to form an annular shoulder. The cylinder bore in Fig. 1 is fitted with a liner 13 which is flanged at its upper end, such flange 14 being located against the aforesaid shoulder. The cylinder is shown having a space 15 for a coolant fluid. In the bore of the upper end of the cylinder is located a plug-like unit 16 which is a sliding fit whilst being held against rotation by any suitable means and embodies the rotary valve housing, the rotary valve member 20 being of the conical type seating in a conical recess in the plug. In the rotary valve member is an off-set combustion space not shown but constructed as described in the Specification of my aforesaid earlier Patent No. 463,412, whilst in the plug and in the extension of the cylinder though not shown are registering inlet and exhaust ports and a " sparking plug " hole. The upper end of the cylinder liner has a small cylindrical upstanding flange 14a above its locating end flange 14 whilst the lower end of the plug-like unit has an annular recess which fits closely over such upstanding flange 14a to form a gas seal. The stem 20a of the valve above its conical portion is cylindrical and is a good bearing fit in the plug-like part.

The plug-like unit 16 is secured in the end of the cylinder by a flanged ring 17, fitting over it and secured by suitable studs 18 and holding a pair of taper roller anti-friction thrust bearings 21. The flanged ring also houses a compression spring 23 located between a washer 24 and the upper end of the plug-like unit 16. A driving gear 22 is located on the end of the valve.

As shown in Fig. 1, the cylinder and cylinder extension are cored for liquid cooling. As shown in Fig. 2, however, the cylinder and its extension are constructed for air cooling and the cylinder is not fitted with a liner. In both Figures a gas sealing ring 25 is shown fitted on the plug-like unit and engaging the socket in which the unit with its ring may move like a piston whilst maintaining a gas seal.

In use, the body of the plug-like unit 16 is forced downwardly to its normal position by the spring 23 and the rotary valve member is so mounted that such spring effort provides a load on the complementary gas sealing surfaces to maintain gas sealing relation between the valve and its seating. Gaseous pressures in the cylinder will cause the rotary valve member to be forced upwardly and the anti-friction thrust bearing to yield thereto, but the pressure between the coacting conical gas sealing surfaces of the rotary valve member and its seating cannot, in spite of the resultant axial movement of the rotary valve member towards its seating, exceed the pressure which is determined by the spring 23 as any excess pressure will also move the plug-unit against the resistance of the spring. Obviously, the yield of the thrust bearing will normally be only very small and the order perhaps of tenths of thousandths of an inch, so that the plug-like member will only be required to move very little, whilst, as such permitted movement is axial only, the said tapered surfaces function at all times as bearing for the lower end of the rotary valve member. The upstanding flange 14a will maintain a gas seal in spite of such axial movement.

The invention is obviously not limited to all the details of construction of the examples above described, some of which, for instance, the details of the anti-friction thrust bearings, may be modified without departing from the nature of the invention.

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. A rotary valve for an internal combustion engine comprising a rotary valve member and a seating member therefor, with complementary tapered gas sealing and bearing surfaces on the said rotary member and in the said seating member, thrust bearings for the rotary member supplementary to such complementary gas sealing and bearing surfaces and a yieldable mounting for the said seating member permitting axial movement only and including a resilient element to predetermine the maximum loading between the seating member and the rotary member.

2. A rotary valve according to Claim 1, characterised in that the seating member comprises a plug-like unit axially slidable in the end of the cylinder.

3. A rotary valve member according to Claim 2, characterised in that the plug-like unit is fitted with a gas sealing ring engaging the wall of a socket in the end of the cylinder in the manner of a piston.

4. A rotary valve according to either of the preceding claims 2 or 3 characterised in that the cylinder and the plug-like member have at least one registering port complementary with a port in the rotary member.

5. An internal combustion engine having a rotary valve constructed according to any of the preceding Claims.

6. An internal combustion engine according to Claim 5, characterised in that

the cylinder is fitted with a liner having an annular extension and in that the end of the plug-like member is recessed to engage the annular extension and form a gas seal whilst permitting movement of the seating.

7. An internal combustion engine having a rotary valve constructed and arranged substantially as herein described with reference to and as illustrated in either figure of the accompanying drawings.

Dated this 5th day of May, 1943.

For the Applicant,
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Fig.1.

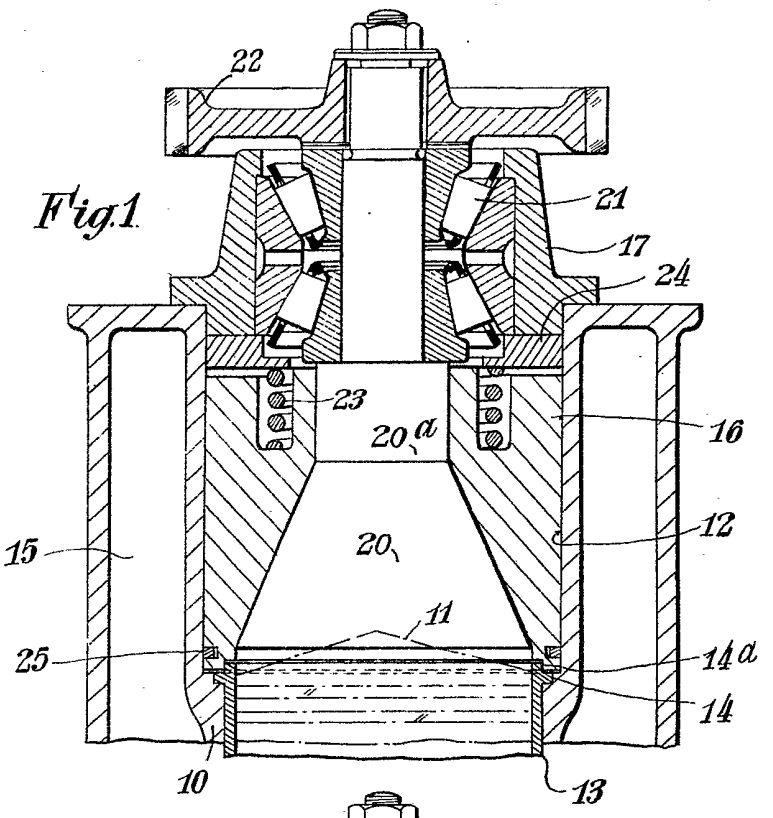
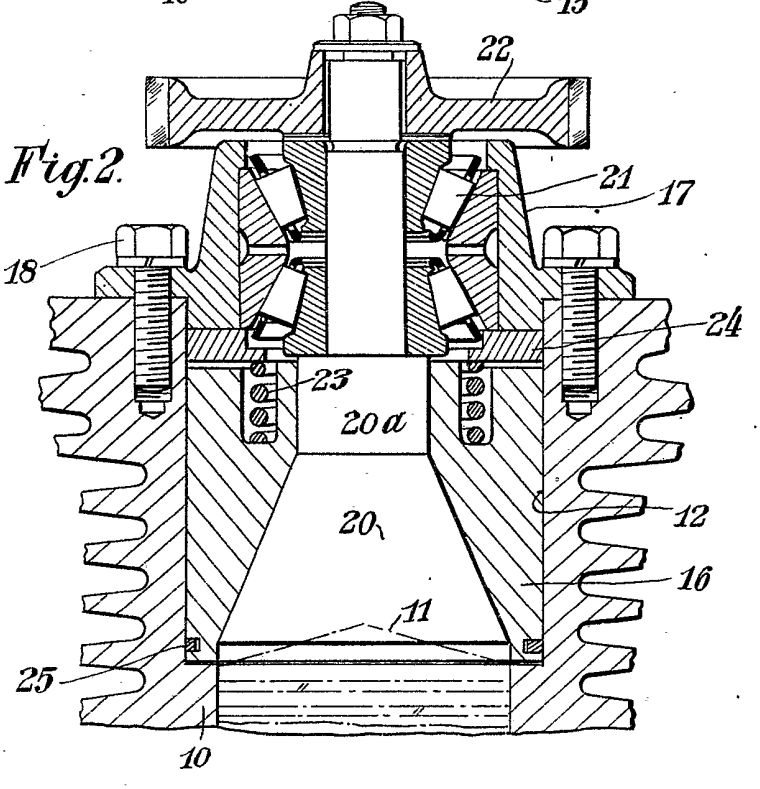


Fig.2.



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