PATENT SPECIFICATION

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COMPLETE SPECIFICATION

Improvements in Rotary Valve Internal Combustion or other Engines or 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 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 or other engines, or pumps of the type employing rotary cylindrical distributing valves, and it more especially relates to that type of rotary valve engine or pump wherein the rotary valve is mounted in a two part housing which surmounts and is disposed at right angles to the cylinder, the lower part of the housing preferably being made rigid with the upper end of an axially slidable cylinder so as to have with the cylinder a certain amount of resilient movement in relation to the upper part of the housing. The cylinder is so constructed that the compression and explosion pressures therein will cause the housing to press on the valve by virtue of the said resilient movement. Engines of this type are exemplified in the Cross Copending Applications Nos. 20382/35, (Serial No. 448,368) 30087/35 (Serial No. 448,383) and 30088/35 (Serial No. 448,384), and the invention is particularly, although not exclusively, applied to such engines. These engines have many advantages in as much that clearance being automatically taken up between the valve and the housing, better contact is assured for the valve for cooling purposes and the suppression of exhaust and inlet gases mixing is practically complete, and it is an object of the present invention to improve the efficiency of the engines, more particularly in high compression engines, when working at full throttle, where the pressures on the valve, being extremely high, cause excessive bearing loads which absorb power, increase the rate of wear and also tend to increase the working temperature of the valve.

The present invention provides for a mechanical arrangement whereby the pressure on the valve may be greatly reduced, although still being proportional to the compression loads, and to this end, in a rotary valve engine or pump of the type defined, the upper part of the valve housing is, according to the invention, mounted for bodily displacement in the direction of movement of the lower part of the housing and the two parts are mechanically connected so as to constitute a pair of floating members which are pressed together by the cylinder pressures.

With the improved construction, in the practical embodiment of which the mechanical connection is such that the force applied for pressing the upper housing part into contact with the valve is less than the cylinder pressures, the lighter loading on the valve not only reduces the problem of lubrication, but increases the mechanical efficiency of the valve gear considerably, besides enabling the engine, when hot or cold, to be more freely turned for starting purposes.

When employed in conjunction with a sealing packing between the two housing parts and particularly with a sealing packing at the head and foot of each cylinder as described in copending application No. 20382/35 (Serial No. 448,368) and with the sealing annulus around each inlet port as described in copending application No. 30087/35 (Serial No. 448,383) or the valve liner having the springy lip at the edge of each inlet port according to Cross British Patent No. 373,660, and, in the case of a multi-cylinder engine, together with the flexible connection between each cylinder as described in copending application No. 30088/35 (Serial No. 448,384), the invention provides for moderate pressures between the inlet port and the valve, efficient sealing at all points and under all conditions of running, and high efficiency at all speeds and especially at full throttle working.

The feature of the invention can, therefore, be broadly expressed as the provision in a rotary valve engine or pump, wherein the valve is mounted in a two part housing both parts of which are displaceable and pressed on to the valve by the cylinder pressures, of means responsive to the cylinder pressures for govern-

ing the degree of force applied to one housing part with respect to the other housing part.

In order that the invention may be more clearly understood, one embodiment thereof, by way of example only, will now be described with reference to the accompanying drawings, wherein:—

Figure 1 is a diagrammatic view showing the principle of the controllable valve loading method according to the invention,

Figure 2 is an elevation, partly in section, of a practical embodiment of the invention, and

Figure 3 is a plan of Fig. 2.

In the drawings like reference numerals denote like or similar parts.

Referring to the drawings and first more particularly to Fig. 1, the housing of the rotary valve 1 is split longitudinally at right angles to the cylinder 2 to provide an upper part 3 and a lower part 4 which is cast integral with the cylinder, sealing packings 5, 6 being disposed between the two housing parts and at the foot of the cylinder to provide for the resilient movement of the latter as described in Cross copending application No. 20382/35 (Serial No. 448,368). The cylinder is shaped and stiffened internally to provide an adequate surface to receive the impact of gases due to a rise in pressure in the cylinder, this rise in pressure causing the housing parts to press on the valve.

In previous proposals, the upper housing part is fixed rigidly to the crank case 7, but according to this invention both parts are made floating, and are mechanically connected by linkage fulcrumed about a fixed point, e.g. the crank case, so that both parts are pressed towards each other when a rise in gas pressure occurs.

In the simple diagrammatic form of linkage shown in Fig. 1, the upper valve housing part 3 is connected to the lower housing part 4, by a cross beam 8 connected by a pair of links 9 to the ends of a pair of levers 10, fulcrummed intermediate their ends, at points 11, on a pillar or tension plate 12 secured to the crank case 7. The inner ends of levers 10 are pivoted on a pin 13 projecting from the cylinder. With this arrangement, the proportion of the cylinder pressure transferred to the upper housing part will depend on the position of the fulcrum points 11 of the levers 10. By so arranging the fulcrums that a gear up will take place to the upper housing part, the bulk of the cylinder pressure will be taken on the tension plate 12, the remainder being spent in causing the two housing parts to be pressed towards each other. By suitable positioning of the fulcrums 11, any desired degree of loading of upper housing part in relation to cylinder pressure can be obtained; it would, for instance, be quite possible so to arrange the leverage that the upward force tending to lift the cylinder and the lower housing part is 100 times as great as the force tending to press the upper housing part on the valve. This leverage would not be very practicable, as it is necessary to allow for the force acting directly on the valve itself through cylinder inlet port; this force is usually about one-fifth or one-sixth of the cylinder pressure, and accordingly the leverage employed will be sufficient both to balance out this directly acting force and to provide the necessary pressure for capping the upper housing part into good contact with the valve.

In the example shown, the leverage employed is of about the order of 3 to 1, and it will be seen that as the cylinder tries to travel upwards with a rise in gas pressure, the outer ends of the levers 10 are pressed downwards and will cause the upper housing part or valve cap 3 to be pressed on to the valve. Therefore, if the cylinder pressure is considered to be a force W lbs., it will be transferred to the upper housing part such that the load on each fulcrum 11 will be W/2 lbs., and the downward pull in each link 9 will be W/6 lbs., and the total downward force for capping the upper housing part tightly into contact with the valve will be W/3 lbs. When the valve comes into contact with both housing parts 3, 4 it forms a strut which prevents further movement of the assembly.

Various ways of carrying out the invention can be employed, and the invention is, therefore, not to be considered limited to the constructions herein shown. For example, instead of applying a downward push to the upper valve housing part as illustrated in the drawings, the linkage may be arranged so as to exert a downward pull, and as an alternative to mounting the linkage transversely of the valve as shown, it may be mounted on suitable tension members at the sides thereof. In the case of a multicylinder engine, several sets of linkage may be distributed along the cylinder block, and where the levers 10 alone are employed, they could be arranged parallel, with adjacent ends of the levers linked together, and be connected through the links to the appropriate housing part so as to avoid elongating the pivot bearings to allow for the relative movement between the housing parts.

In one practical embodiment of the invention, as illustrated by way of example in Figs. 2 and 3, the tension members are in the form of tie bolts 14 which are bridged at the top by a plate 15 which carries a pair of oppositely disposed levers 16 pivotally mounted between their ends 17, 18 on parallel pins 19 secured in the bridge plate 15. One end 17 of each lever bears on the side of the upper bearing part 3 which is slidably mounted on the tie bolts 14, and the force for capping the upper housing part on to the valve 1 is applied through push rods 20 mounted in recesses 21 in the lower housing part and pressing at their top ends against the opposite ends 18 of the levers 16.

Conveniently, the tie bolts and cylinder together with the sealing packing 6 at the cylinder foot are mounted in an adapter plate 22 secured to the top of the crank case 7.

In this embodiment it will be seen the levers act directly on the upper housing part and apply a push, the force of which is proportional to the cylinder pressures and dependent on the position of the fulcrum pins 19. As shown, the cylinder pressures will be applied to the upper housing part 3 through a leverage of about 3 to 1, so that the downward load on the said part 3 will be about a third of the cylinder pressures.

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 engine or pump of the type defined, wherein the upper part of the valve housing is mounted for bodily displacement in the direction of movement of the lower part of the housing, and the two parts are mechanically connected so as to constitute a pair of floating members which are pressed together by the cylinder pressures.

2. An engine or pump according to Claim 1, wherein the mechanical connection is such that the force applied for pressing the upper housing part into contact with the valve is less than the cylinder pressures.

3. An engine or pump according to claim 1 or 2, wherein the mechanical connection consists of a system of levers fulcrummed about fixed points and arranged so that the cylinder pressures are transferred to the upper housing part through a predetermined leverage which governs the degree of pressure in relation to the cylinder pressures, applied to the upper housing part.

4. An engine or pump according to any one of the preceding claims, wherein a resilient sealing packing is interposed between the two housing parts.

5. An internal combustion engine comprising an axially slidable cylinder surmounted at right angles by a rotary cylindrical distributing valve which is mounted in a two part housing of which the lower part is rigid with the cylinder and the upper part is bodily displaceable along the cylinder axis, sealing packings between the two housing parts and between the foot of the cylinder and the crank case, and a linkage connecting the housing parts so that the latter are pressed together with a predetermined force by the cylinder pressures.

6. In an internal combustion or other engine or pump having a rotary cylindrical distributing valve mounted in a two part housing both parts of which are displaceable and pressed on to the valve by the cylinder pressures, means responsive to the cylinder pressures for governing the degree of force applied to one housing part with respect to the other housing part.

7. An engine or pump according to any one of the preceding Claims 1 to 4, wherein the mechanical connection between the two housing parts is arranged so as to apply a direct downward push to the upper housing part.

8. An engine or pump according to any one of the preceding Claims 1 to 4, wherein the mechanical connection between the two housing parts is arranged so as to apply a direct downward pull on the upper housing part.

9. An engine or pump according to Claim 7 or 8, wherein the mechanical connection consists of a number of levers pivoted intermediate their ends on tension members upstanding from the crank case, the levers being arranged so as to apply pressure equally from either side of the cylinder axis, which results in a total downward force for capping the upper housing part tightly into contact with the valve, which is less than the upward cylinder pressures.

10. An engine or pump according to Claim 9, wherein the upper floating housing part is mounted on the tension members.

11. An engine according to Claims 5 and 10, wherein the tension members are constituted as tie bolts bridged at the top by a plate which carries a pair of levers pivoted between their ends, one end of each lever bearing on the side of the upper housing part and the force for capping the upper housing part on to the valve being applied to the opposite ends of the levers through push

rods mounted on the lower housing part.

12. An engine according to Claim 11, wherein the tie bolts and cylinder together with the sealing packing at the bottom of the cylinder are mounted in an adapter plate secured to the top of the crank case.

13. An internal combustion engine constructed and arranged as herein described with reference to the accompanying drawings, particularly Figs. 2 and 3.

Dated this 21st day of February, 1936.
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Fig. 1.

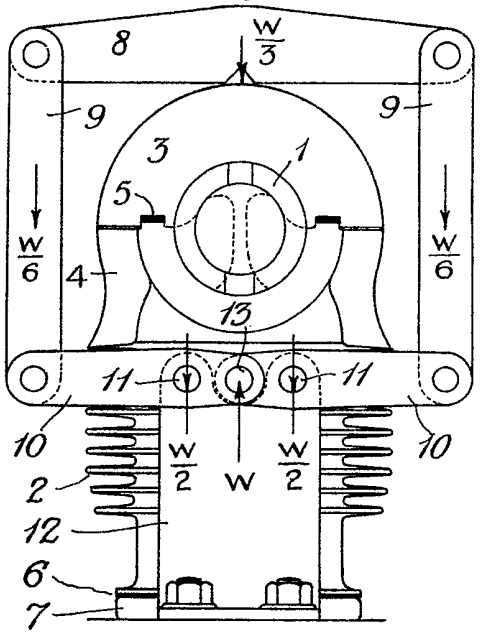


Fig. 2.

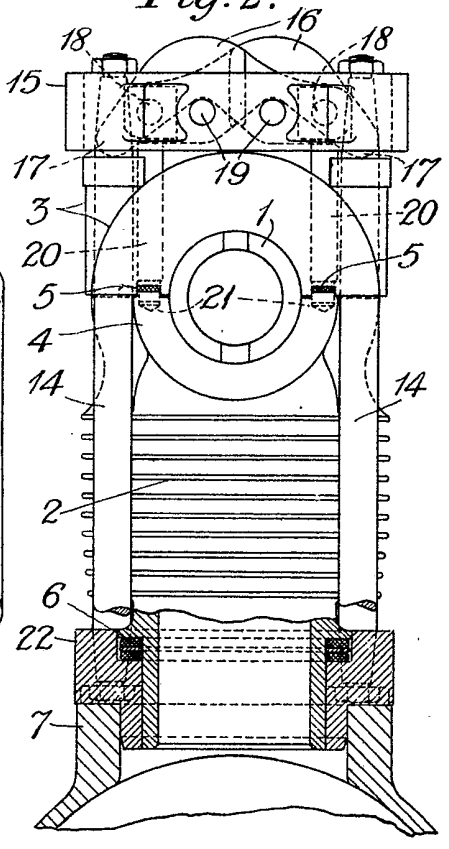
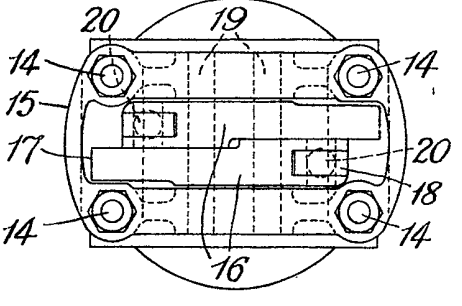


Fig. 3.



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