

# RESERVE COPY

## PATENT SPECIFICATION

Application Date: March 27, 1936. No. 9147/36.  
(Patent of Addition to No. 451,917; Dated Feb. 21, 1936).

467,620



Complete Specification Left: Nov. 18, 1936.

Complete Specification Accepted: June 21, 1937.

### PROVISIONAL SPECIFICATION

## Improvements in Rotary Valve Internal Combustion or other Engines or Pumps

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

This invention is an improvement in or modification of the rotary valve internal combustion or other engine or pump described and claimed in the co-pending application No. 5276/36, (Serial No. 451,917).

In the said parent case No. 5276/36, (Serial No. 451,917), the invention relates more especially to that type of rotary valve engine wherein the rotary distributing 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 head 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, and the cylinder being 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. The improvement of the parent case provides in a rotary valve engine of the above type, means responsive to the cylinder pressures for governing the degree of force applied by the cylinder pressures to one housing part with respect to the other housing part, and to this end 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. In a practical application of the improvement a resilient sealing packing is interposed between the two housing parts, and 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. According to the embodiment described in the parent case, the mechanical arrangement

whereby the pressure on the valve is greatly reduced although still being proportional to the compression loads, takes the form of a system of levers which are fulcrummed about a fixed point and connect the two housing parts so that the cylinder pressures are transferred to the upper housing part through a predetermined leverage governing the degree of pressure in relation to the cylinder pressures, applied to the upper housing part.

The present invention has for its object to simplify the lever system of the parent case, and to this end the upper housing part according to the invention itself constitutes a lever to which the cylinder pressures are applied by the resilient movement of the lower housing part.

Thus the upper housing part may be fulcrummed about a fixed pivot, carried for example on a U-frame attached to the crank case and straddling the upper housing part, the pivot being located between the plane containing the axis of the cylinder and a plane parallel with and spaced from the cylinder axis so that the force applied by the upper housing part to the valve will be governed by the ratio of the respective distances of the pivot from the said planes. If the distance from the cylinder axis plane is greater than the other distance then the applied force will be less than the cylinder pressures.

In one embodiment the two housing parts may be hinged together along one side, the fulcrum pivot lying between the hinge and the cylinder axis. For example, the two parts may hinge about a rod running lengthwise thereof in grooves made in adjacent faces of the housing parts on one side of the valve, the two parts being slightly spaced apart by the rod and having inserted between them along the other side a resilient packing—e.g. of flat or rod-like form—which not only forms a gas seal but a means of taking up the resilient movement of the two parts as they are pressed together by the cylinder pressures. If desirable, a resilient packing may also be incorporated at the hinge connection

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between the parts.

Any suitable form of pivot for the upper housing part may be employed; for example the outer periphery of the latter may have two raised ribs which form a bearing for a rod or pins carried by the U-frame above referred to.

Alternatively, the upper housing part may be slidably mounted—with lateral play—on vertical tie bolts disposed along each side of the valve and connected at the top by a bridge plate from which depends a fulcrum pin about which the upper housing part pivots. The tie bolts may extend from the crank case and be attached thereto by means of an adapter

plate as described in the parent case.

With the arrangement according to the present invention, it will be seen that while the advantages of the parent case have been retained, a much simpler construction has been provided which inter alia reduces manufacturing costs, and renders the device easier to assemble and more robust, thus tending to greater mechanical efficiency.

Dated this 27th day of March, 1936.

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Agent for the Applicant.

## COMPLETE SPECIFICATION

### Improvements in Rotary Valve Internal Combustion or other Engines or Pumps

I, ROLAND CLAUDE CROSS, a British Subject, of 33, Midford Road, Combe 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 is an improvement in or modification of the rotary valve internal combustion or other engine or pump described and claimed in Specification No. 451,917.

In the said parent Specification there is described a rotary valve engine or pump with lower and upper valve housing members which surmount the cylinder and which are both made floating and pressed together by the cylinder pressures. According to the embodiments described in the aforesaid parent specification, pressure in the cylinder is transmitted with reduction to the upper valve housing member through a lever system, and the pressure thereby exerted by the housing members upon the valve member is less than the pressure in the cylinder, the lever system being so arranged as to obtain the most suitable pressure on the valve member.

The term "floating" as used herein denotes that the member so described is yieldable in relation to other parts so as to be capable of transmitting varying pressures applied thereto to another member contacting therewith, whether the said floating member be actually displaced or not. The term "stationary," where applied to a part, denotes that that part is non-floating in the above sense.

The present invention has for its object to modify the lever system described and

claimed in the parent Specification, and to this end the floating upper housing member is, according to the invention, itself constructed as a lever, and means responsive to the pressure in the cylinder are adapted to transmit said pressure or the available part thereof to the said lever, the connection between said pressure transmitting means and the lever being so arranged in relation to the fulcrum of the lever that a predetermined amount of said transmitted pressure is applied to the valve member.

In an embodiment of the invention the floating upper housing member is constructed as a two-armed lever and the floating lower housing member has a hinged connection with one arm of said lever which transmits the pressure in the cylinder as applied to the lower housing part, to the upper housing member, the relative lengths of the two arms determining the amount of transmitted pressure which is applied to the valve member.

In this embodiment a resilient sealing packing will be interposed between the housing members along the side of the valve remote from the hinge pivot, and, if desired, along the near side of the valve also.

Two examples of the invention will now be described with reference to the accompanying drawing wherein the floating upper valve housing is in the form of a two arm lever of which one arm has a hinge connection with the floating lower housing member.

In the drawings:

Figure 1 is an elevation, partly in section, of one form of this lever, and Figure 2 is a sectional elevation of another

form of this lever as adapted particularly for a radial cylinder aeroplane engine, the valve member being offset with respect to the cylinder axis.

5 With reference to the drawings it will be seen that the rotary valve member 1 is mounted in a housing which surmounts the cylinder 2 and which is split in a horizontal plane to form an upper housing member 3 and a lower housing member 4. The lower housing member 4 is formed integral with the cylinder and is a floating member by reason of the fact that the cylinder is capable of axial yielding movement as described in the parent Specification. The top of the cylinder is shaped and stiffened internally to provide an adequate surface (such as shown at 2a in Figure 2) to receive the impact of gases due to a rise in pressure in the cylinder, this rise in pressure causing the lower housing member 4 to press on the valve; this lower housing member causes the upper housing member to press on the valve by means, now to be described, with a pressure which is a predetermined proportion of that which presses the said lower housing member on to the valve.

According to this invention, the upper housing member 3 is fulcrummed about a stationary point 5, so as to comprise a two-armed lever. One arm is shaped to form the bearing for the valve and the pressure applied to the lower housing member is transmitted to the other arm by a hinge connection 6. The position of the fulcrum 5 between the hinge connection 6 and the axis of the valve determines the effective lengths of the arms of the lever comprising the upper housing member and thus the amount of pressure which is applied by the latter to the valve. In the example shown the leverage is such that the pressure applied by the upper valve housing member is less than the pressure causing the lower housing member to press on the valve. Hence the loading on the valve is less than the pressure in the cylinder and can be controlled to give the most suitable running conditions for the valve.

The hinge connection may take any suitable form so long as it will transmit the pressure. In one convenient form shown in the drawings, it comprises a rod 6 extending lengthwise of the valve and mounted in grooves made in the adjacent faces of the two housing members. This rod slightly spaces the housing members, and along the side of the valve remote from the hinge connection is interposed between the housing members a resilient sealing packing 7, e.g. of flat or rod-like form as shown. A second resilient sealing packing 8 may be provided along the other

side of the valve as in the case of the construction shown in Figure 2, or a resilient packing may be incorporated at the hinge connection between the housing members. This packing arrangement not only provides a gas and oil seal, but a means of allowing for resilient axial yielding of the cylinder, packing 9 (as shown in Figure 1) being interposed between the foot of the cylinder and the crank case 10 for this purpose also.

The stationary fulcrum 5 forms part of an inverted U-shape frame, designated 11 in Figure 2, and 12, 12, 13 in Figure 1, which straddles the upper housing member and cylinder and is attached at the bottom to the crank case. In Figure 1, this frame is attached to the crank case by means of an adapter plate 12a.

According to the form shown in Figure 1, the U-shape frame is constituted by tie bolts 12 and bridge 13, and lies in a plane at right angles to the valve axis, the tie bolts 12 being vertical and disposed along each side of the valve, whilst the connecting bridge 13 has a depending projection which constitutes the fulcrum 5. The upper housing member 3 is mounted on the tie bolts with axial and lateral play so as to be yieldable and therefore capable of transmitting to the valve member 1 with the desired reduction, the pressures applied thereto through the hinge connection 6.

In the case of Figure 2 the frame 11 lies parallel to and offset from the axis of the valve, and the bridge part 14 is curved, as shown, to fit a recess 15 in the upper housing member, and thus constitute the fulcrum for the latter.

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 improvement in or modification of the rotary valve engine or pump described and claimed in Specification No. 451,917, which consists in constructing the floating upper valve housing member as a lever and in adapting means which are responsive to the pressure in the cylinder to transmit said pressure or the available part thereof to the said lever, the connection between said pressure transmitting means and the lever being so arranged in relation to the fulcrum of the lever that a predetermined amount of said transmitted pressure is applied to the valve member.

2. A rotary valve engine or pump as set forth in Claim 1, wherein the floating upper valve housing member is constructed as a two-armed lever, and the floating lower housing member has a hinged connection with one arm of said

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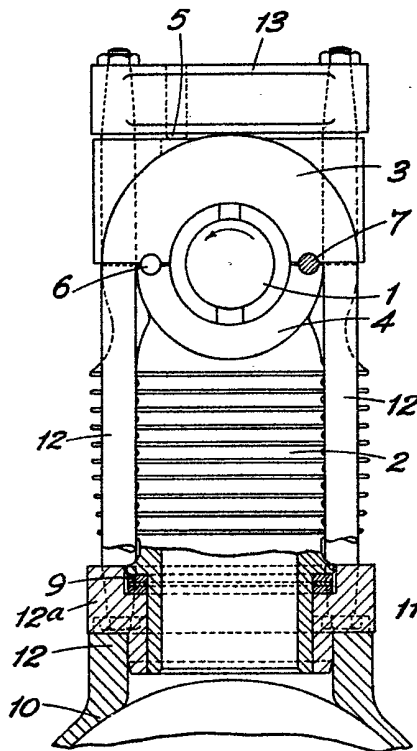
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- lever which transmits to the said upper housing member the pressure in the cylinder as applied to the lower housing member, the relative lengths of the two arms determining the amount of transmitted pressure which is applied to the valve member.
3. A rotary engine or pump as set forth in Claim 2, wherein the ratio between the lengths of the arms of the lever comprising the upper housing member is such that a reduced pressure is applied by the said lever to the valve member.
4. A rotary engine or pump as set forth in Claim 2 or 3, wherein there is interposed between the said floating housing members along the side of the valve remote from the hinge or along each side of the valve member a resilient sealing packing.
5. A rotary engine or pump as set forth in Claim 2, 3 or 4, wherein the fulcrum for the floating upper valve housing member is carried by the bridge of an inverted U-frame straddling the said upper housing member and attached at the bottom to the crank case.
6. A rotary valve internal combustion engine or pump as described and claimed in Specification No. 451,917 and having a floating upper valve housing member in the form of a two armed lever constructed as herein described with reference to Figure 1 or 2 of the accompanying drawings.

Dated this 18th day of November, 1936.  
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 Agent for the Applicant.

[This Drawing is a reproduction of the Original on a reduced scale.]

*Fig.1.*



*Fig.2.*

