

## PATENT SPECIFICATION



Application Date: Sept. 19, 1936. No. 25555/36.

479,539

„ „ Oct. 17, 1936. No. 28260/36.

One Complete Specification Left: Sept. 7, 1937.

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Specification Accepted: Feb. 8, 1938.

### PROVISIONAL SPECIFICATION

No. 25555 A.D. 1936.

### Improvements in Rotary Valve Internal Combustion Engines and other Rotary Valve 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 relates to improvements in rotary valve internal combustion engines and other rotary valve engines or pumps. In my prior Specification No. 451,917 I have dealt with the problem of loading the valve by pressing together a two-part housing, and controlling this load according to the cylinder pressures. Thus whilst an effective seal is brought about in a manner which provides that when cylinder pressures are highest the sealing load on the valve reaches its greatest degree and valve clearance is at a minimum, the whole loading of the valve is such as to reduce the possibility of seizing or binding of the valve, thus minimising heating or frictional difficulties and making for greater general efficiency. In the aforesaid prior Specification the cylinder was constructed to float axially with relation to the crank shaft, and also the cap of the valve housing had a movement in a similar direction.

According to the present invention the controlled loading of the valve in its housing is brought about by the upper part or cap of the housing moving under the control of a floating crank shaft, the latter being mounted for this purpose, in bearings resiliently movable or with a certain degree of movement in the crank case.

This may be carried out in a variety of ways. For example the cylinder may be united with the crank case and the crank shaft may be carried in bearings which are mounted in an arm or arms pivoted at one end within and to the crank case. This pivoted arm may be connected by a tie rod or rods to the valve cap which itself may be a hinged member so that a

rise of pressure in the cylinder causes the crank shaft to be pushed down and the cap to be pulled on to the valve, the loading on the valve applied through the cap being determined by the distance of the point of application of the cylinder pressures via the rod, from the valve cap hinge. The tie rod or rods may act direct on the valve cap or it or they may act on an overhead lever system which is connected to the valve cap. Floating movement of the crank shaft may be restricted by any suitable means which would also take the load on the event of failure of the tie rod. Such means may consist of a cross rod mounted in enlarged holes in the crank case walls.

In an alternative arrangement, the crank shaft may be mounted to float in a rectilinear direction. For this purpose the crank shaft bearings may be guided to slide in the crank case with the sliding movement controlled by springs. The bearings have four symmetrically arranged pillars which are bridged by a reaction member against an underneath point of which a part of the valve hinged cap takes its bearing or fulcrums, the fulcrum being disposed between the cap hinge and the valve centre and the amount of off-set from the valve centre determining the loading applied to the valve.

Resilient movement of the valve cap is provided by sealing packing between the cap and the lower housing part of the valve.

Where the hinged connection between the valve and the lower housing part— which is integral with the cylinder and the crank case—takes the form of a pin, a bolt is passed through the hinged pin and clamped with the interposition of a spring. This keeps the valve cap in place avoids chatter and wear of the hinge pin with consequential mal-alignment of the two halves of the valve housing.

It will be understood that any suitable

[Price 1/-]

Price 2/6

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connection may be provided between the valve cap and the cylinder block to allow for the required movement of the cap. For example instead of the hinged pin  
 5 aforesaid the valve cap could be connected to the cylinder block by a piece of metal which would deflect enough to give the desired movement. Thus a spring steel connecting plate might be used for the  
 10 valve cap—which may be in aluminium—

need not be completely parted from the cylinder block, the joining aluminium piece providing the necessary resilient action.

Dated this 19th day of September, 1936.  
 EDWIN C. AXE, A.I.M.E.  
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 Agent for the Applicant.

#### PROVISIONAL SPECIFICATION

No. 28260 A.D. 1936.

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

15 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:—

20 This invention relates to rotary valve internal combustion or other engines or pumps, of the kind including a two part housing for the valve and wherein the pressure in the engine cylinder is utilised  
 25 for loading the housing parts in their application to the valve member with a view to providing a fluid tight seal therebetween.

In this Specification the term "floating"  
 30 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  
 35 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. Further, for simplicity, it will be assumed that the  
 40 engine cylinder is vertically disposed and the rotary valve surmounts it, the valve housing being split in a substantially horizontal plane to form an upper and a lower housing member. Where the  
 45 arrangement differs the correspondence of parts will be obvious to those skilled in the art.

It is known to provide a rotary valve  
 50 internal combustion engine with a floating lower valve housing member and stationary upper valve housing member, the full force of the pressure in the cylinder being applied to the lower housing member and transmitted thereby  
 55 to the valve member. This pressure on the valve member has been found in certain circumstances to be excessive, particularly at high engine speeds.

60 In my prior Specification No. 451,917, there is a rotary valve internal combustion engine with floating lower and upper valve

housing members, wherein part of the pressure in the cylinder is transmitted to the upper valve housing member through a reducing lever system. Thus, the pressure exerted by the housing members upon the valve member is less than the pressure in the cylinder and the lever system may, of course, be so arranged as to obtain the most suitable pressure on the  
 65 valve member. 70

According to the present invention one of the valve housing members is stationary and the other is floating, and means responsive to pressure in the cylinder are provided to transmit said pressure or the available part thereof with reduction to the floating valve housing member. Conveniently, the pressure transmitting and reducing means comprise a lever  
 75 system. 80

The invention affords the possibility of a simple and neat arrangement of the whole engine and particularly of the pressure transmitting means. 85

In one embodiment the lower valve housing member is stationary and the upper is floating. The pressure transmitting means comprise a lever system. This lever system includes a one armed lever  
 90 on which the crankshaft is mounted, the upper floating valve housing member, which is itself formed as a one armed lever, and a tie rod connected at one end to the crankshaft bearing lever and at the  
 95 other end to the floating valve housing member, the point of connection of the tie rod to the floating valve housing member being offset from the pivot point of same. Obviously, the amount of cylinder  
 100 pressure transmitted by the lever system to the floating valve housing member will depend upon the spacing between the pivotal point thereof and the point of connection of the tie rod thereto. 105

In another embodiment a further one armed lever is provided which is pivoted at one end to a stationary bracket and is

pivoted at the other end to that end of the tie rod which in the previous example is connected to the floating valve housing member. At a point offset from the pivotal point of the floating valve housing member said further one armed lever is applied thereto, thereby transmitting part of the cylinder pressure to said upper floating valve housing member.

10 In a further embodiment the crankshaft is mounted in plummer blocks, wherein are secured at least two parallel upright rods extending above the upper floating valve housing member and connected together at their upper ends by a bridge

member. The floating valve housing member is formed as a one armed lever and the bridge member is arranged to press thereon at a point offset from the vertical plane passing through the axis of the valve. Thus, only part of the cylinder pressure is transmitted to the floating valve housing member through the lever system.

Dated this 17th day of October, 1936.  
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### COMPLETE SPECIFICATION

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

25 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:—

30 This invention relates to rotary valve internal combustion or other engines or pumps, of the kind including a two part housing for the valve and wherein the pressure in the engine cylinder is utilised for loading the housing parts in their application to the valve member with a view to providing a fluid tight seal therebetween.

40 In this Specification the term "floating" 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.

50 Further, for simplicity, it will be assumed that the engine cylinder is vertically disposed and the rotary valve surmounts it, the valve housing being split in a substantially horizontal plane to form an upper and a lower housing member. Where the arrangement differs the correspondence of parts will be obvious to those skilled in the art.

60 It is known to provide a rotary valve internal combustion engine with a floating lower valve housing member and stationary upper valve housing member, the full force of the pressure in the cylinder being applied to the lower housing member and transmitted thereby to the valve member. This pressure on

the valve member has been found in certain circumstances to be excessive, particularly at high engine speeds.

70 In my prior Specification No. 451,917, there is a rotary valve internal combustion engine with floating lower and upper valve housing members, wherein part of the pressure in the cylinder is transmitted to the upper valve housing member through a reducing lever system. Thus, the pressure exerted by the housing members upon the valve member is less than the pressure in the cylinder and the lever system may, of course, be so arranged as to obtain the most suitable pressure on the valve member.

80 According to the invention there is provided a rotary valve engine or pump having a split two-part housing of which one of the parts is stationary and the other is "floating," in combination with control means which positively maintain the said parts in contact with the valve and which include a mechanical force reducing arrangement which is subject to the pressure in the cylinder to cause the floating housing part to press on the valve with a force less than that arising from the cylinder pressure.

90 Conveniently, the said arrangement comprises a lever system.

95 The invention affords the possibility of a simple and neat arrangement of the whole engine and particularly of the control means including the force reducing arrangement.

100 In carrying out the invention there is provided a rotary valve engine or pump having a split two-part housing of which the lower part is stationary and the upper part is floating, in combination with control means which positively maintain the said parts in contact with the valve

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and which includes a floating crank shaft and a force reducing connection between the crank shaft and the upper housing part which causes the latter to press on the valve with a force less than that applied by the cylinder pressures to the crank shaft.

Several embodiments of the invention will now be described with reference to the accompanying drawing, these embodiments having a floating crankshaft by which the force is applied to the floating housing part.

In the drawing:—

15 Figure 1 is a vertical section through a rotary engine according to one embodiment,

Figure 2 is a diagrammatic vertical section of another embodiment, and

20 Figures 3 and 4 are respectively vertical section and outside elevation of another embodiment.

Like reference numerals denote like or similar parts throughout the drawings.

25 With reference first to figure 1, the engine shown comprises a cylinder 1 surmounted at right angles by a rotary valve 2 which is housed in a split two-part housing of which the lower part 3 is integral with the cylinder (i.e. stationary) and the upper part 4 is floating, being constituted as a one armed lever hinged to the cylinder at 5, and having resilient sealing packing 6, interposed one at each side of the valve, between it and the stationary lower part 3.

The cylinder is united with the crank case 7, wherein is pivoted at 8 a one armed lever 9 carrying the crank shaft 10 which is rotated, by the reciprocation of the piston 11, through a connecting rod and crank arrangement 12.

This crank shaft by being made floating is capable of transmitting the force of the cylinder pressures, and in accordance with the invention this force is transmitted to the floating upper housing part 4 with reduction. To this end, the end of the lever 9 which carries the crank shaft, is connected by a tie rod 13 to the upper housing part 4 at a point 14 between the hinge 5 and the vertical plane containing the valve axis. Obviously, the amount of cylinder pressure transmitted by this lever system to cause the floating upper housing part 4 to press on the valve will depend upon the spacing between the hinge 5 and the point of connection 14.

60 It will be seen that with this arrangement, the valve housing parts are positively maintained in contact with the valve and that the force with which the upper housing part 4 presses on the valve is less than that applied to the floating crank shaft by the cylinder pressures.

As a safety device in the event of failure of the tie rod 13, and to restrict the possible floating movement of the crank shaft, the embodiment illustrated includes a reaction cross rod 15 passing through an enlarged hole 16 in the lever 9 with its ends mounted in the crank case walls. Instead of the hole in the lever 9 being enlarged, the ends of the cross rod 15 may be mounted in enlarged holes in the crank case walls.

Where the hinged connection 5 consists, as shown, of a horizontal pin, a bolt 17 is passed through the hinge pin, being screwed into the cylinder and clamped down on to the housing part 4 with the interposition of a spring 18. This keeps the floating valve housing part 4 in place, avoids chatter and wear of the hinge pin with consequential mal-alignment of the two halves of the valve housing.

Provision for adjustment of the initial pressure of the housing parts on the valve to ensure and maintain contact irrespective of the cylinder pressures, is obtained by the screw thread adjustment shown at 14. As pressure in the cylinder rises, the crank shaft will have a downward thrust applied thereto, a proportion of this thrust being transmitted to oppose the force on the valve from the cylinder pressures acting through the cylinder port 25 and thereby holds down the upper housing part 4 on to the valve, the resultant force keeping the housing parts in contact with the valve being thus controlled and less than the force of the cylinder pressures.

The embodiment shown diagrammatically in figure 2 is similar to that just described, except that the transmission of the cylinder pressure force is effected indirectly through an intermediary one-armed lever 26 which is pivoted at one end to a stationary bracket 27 and is pivoted at the other end 28 to that end of the tie rod 13 which in the previous example is connected direct to the floating valve housing member 4. At a point 29 offset from the pivotal point 5 of the floating valve housing member 4 said one-armed lever is applied thereto, thereby transmitting part of the cylinder pressure to said upper floating valve housing member.

In a further embodiment shown in figures 3 and 4, the crankshaft is mounted to float in a rectilinear manner in plummer blocks 30, wherein are secured four symmetrically arranged upright rods 31 extending above the upper floating valve housing member and connected together at their upper ends by a bridge member 32. The floating valve housing member is, as before, formed as a one-

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armed lever hinged at 5 to the cylinder 1 and the bridge member is arranged to press thereon at a point 33 offset from the vertical plane containing the axis of the valve. Thus, only part of the cylinder pressure is transmitted to the floating valve housing member through the lever system.

The valve housing parts are adjustably held down to the valve irrespective of the pressure in the cylinder, by means of bolts 34 which screw into the plummer blocks 30 and take an abutment against the crank case, conveniently through the intermediary of springs 35.

It will be understood that any suitable connection may be provided between the floating upper valve housing part 4 and the cylinder to allow for the required floating of the housing part 4. For example, instead of the hinged pin aforesaid, the part 4 could be connected to the cylinder by a piece of metal which would deflect enough to give the desired movement. Thus, a spring steel connecting plate might be used for the part 4 or the latter—which may be in aluminium—need not be completely parted from the cylinder block, the joining piece providing the necessary resilient action.

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 having a split two-part housing of which one of the parts is stationary and the other is "floating," in combination with control means which positively maintain the said parts in contact with the valve and which include a mechanical force reducing arrangement which is subject to the pressure in the cylinder to cause the floating housing part to press on the valve with a force less than that arising from the cylinder pressure.

2. A rotary valve engine or pump

according to Claim 1, wherein the said arrangement comprises a lever system. 50

3. A rotary valve engine or pump having a split two-part housing of which the lower part is stationary and the upper part is floating, in combination with control means which positively maintain the said parts in contact with the valve and which includes a floating crank shaft and a force reducing connection between the crank shaft and the upper housing part which causes the latter to press on the valve with a force less than applied by the cylinder pressures to the crank shaft. 55 60

4. A rotary valve engine or pump according to Claim 3, wherein the crank shaft is carried on a one-armed lever and the floating housing part is also a one-armed lever, a tie rod being connected directly or indirectly through another lever between the crank shaft lever and the floating housing part to effect the required force reduction to the floating housing part. 65 70

5. A rotary valve engine or pump according to Claim 3, wherein the crank shaft is mounted for rectilinear floating and is connected by tie rods to a bridge piece surmounting the floating upper housing part, the said floating part being a one-armed lever against which the bridge piece presses at a point offset from the vertical plane passing through the axis of the valve. 75 80

6. A rotary valve engine having a split valve housing of which the upper part is floating and the lower part is stationary, and control means including a floating crank shaft and a lever arrangement connecting it to the floating housing part, all constructed and operating as herein described and illustrated in the accompanying drawings. 85 90

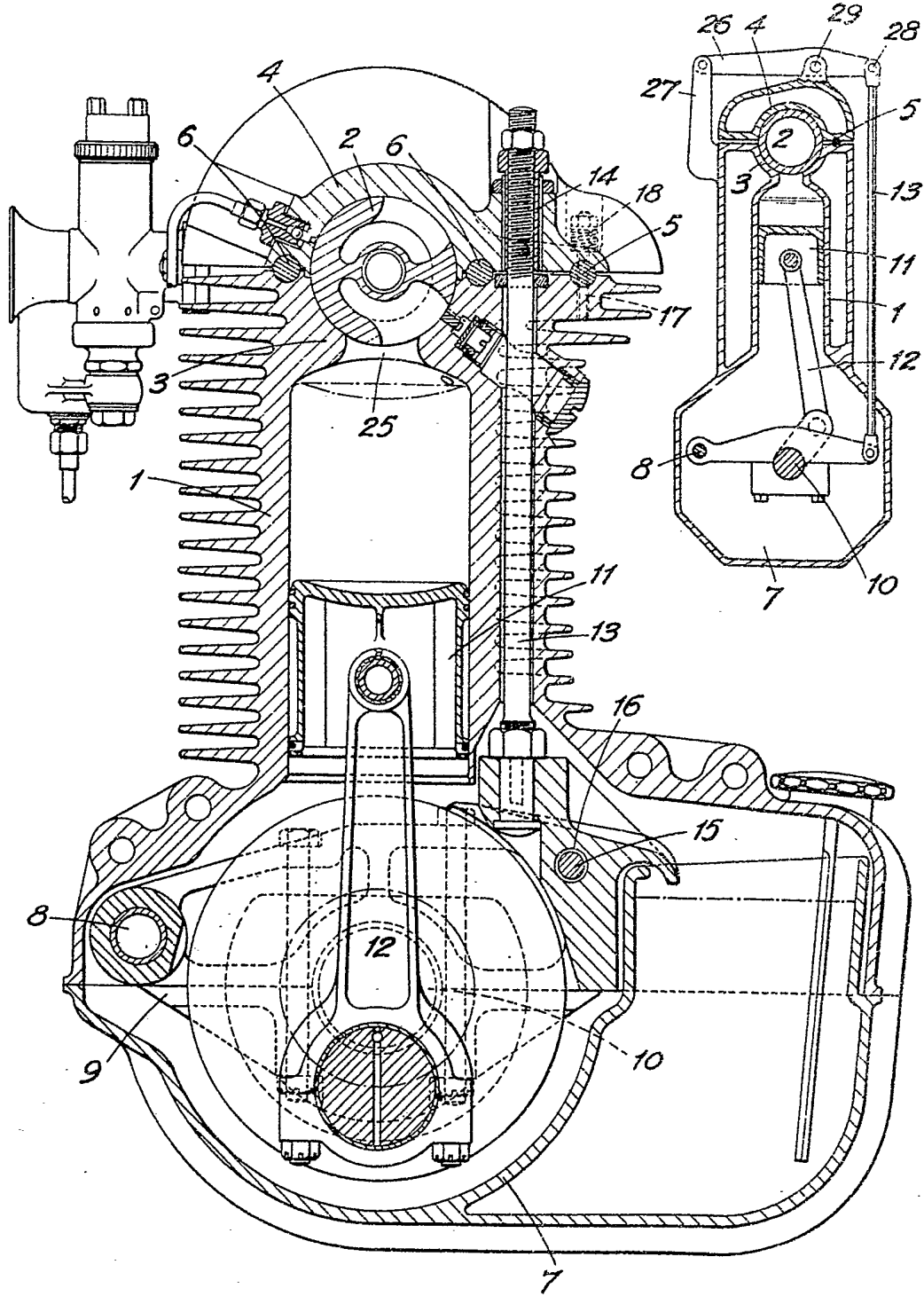
Dated this 7th day of September, 1937.

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Fig. 1.

Fig. 2.



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

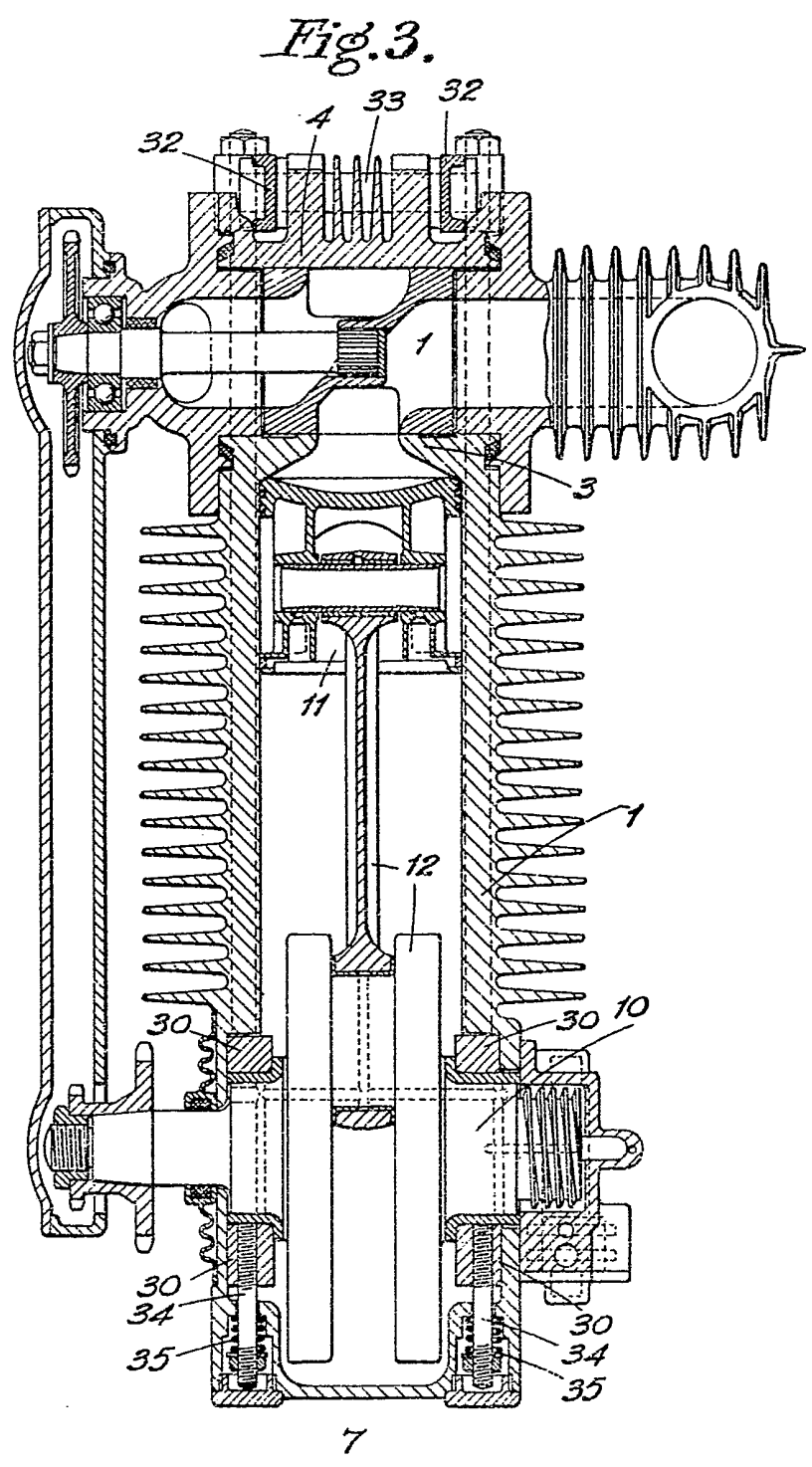
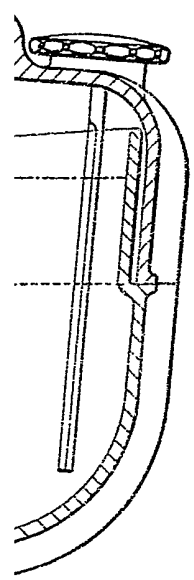
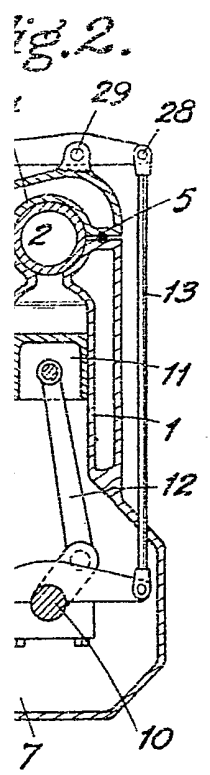


Fig. 1.

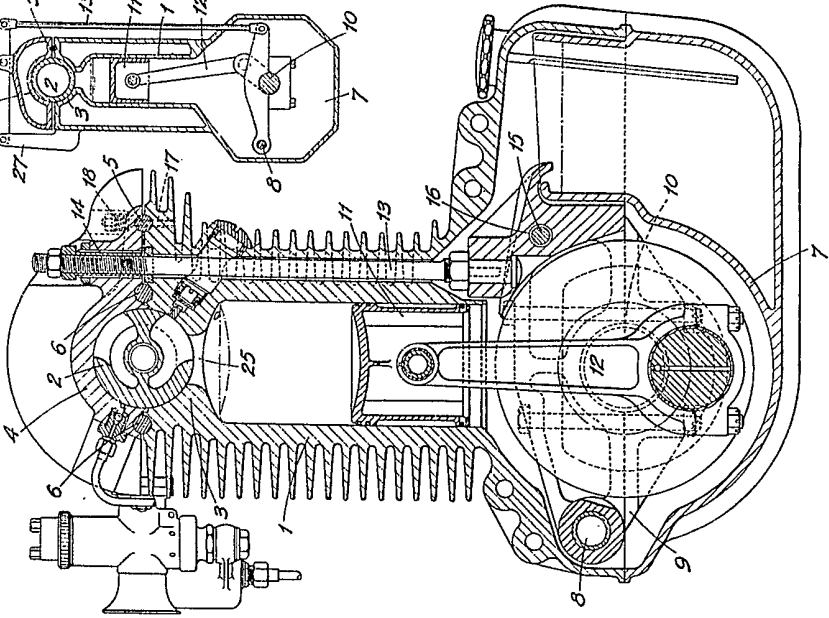


Fig. 2.

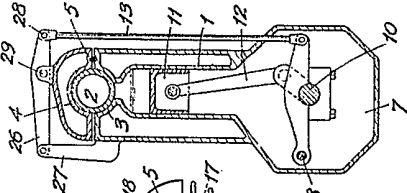
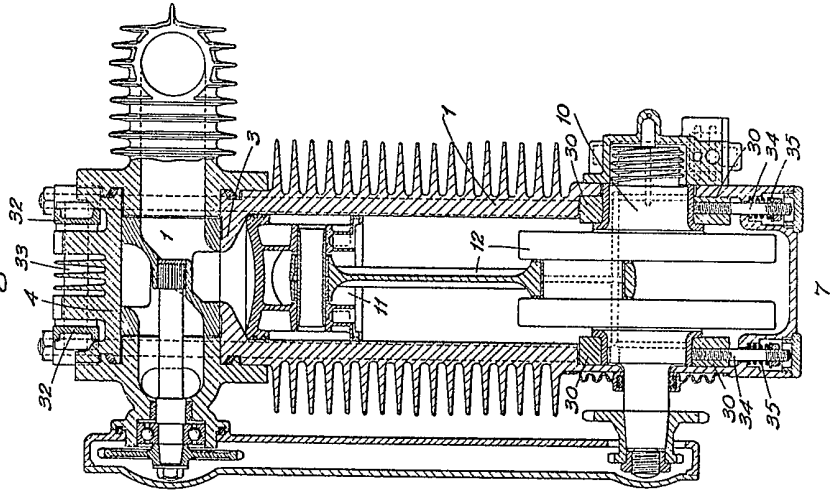


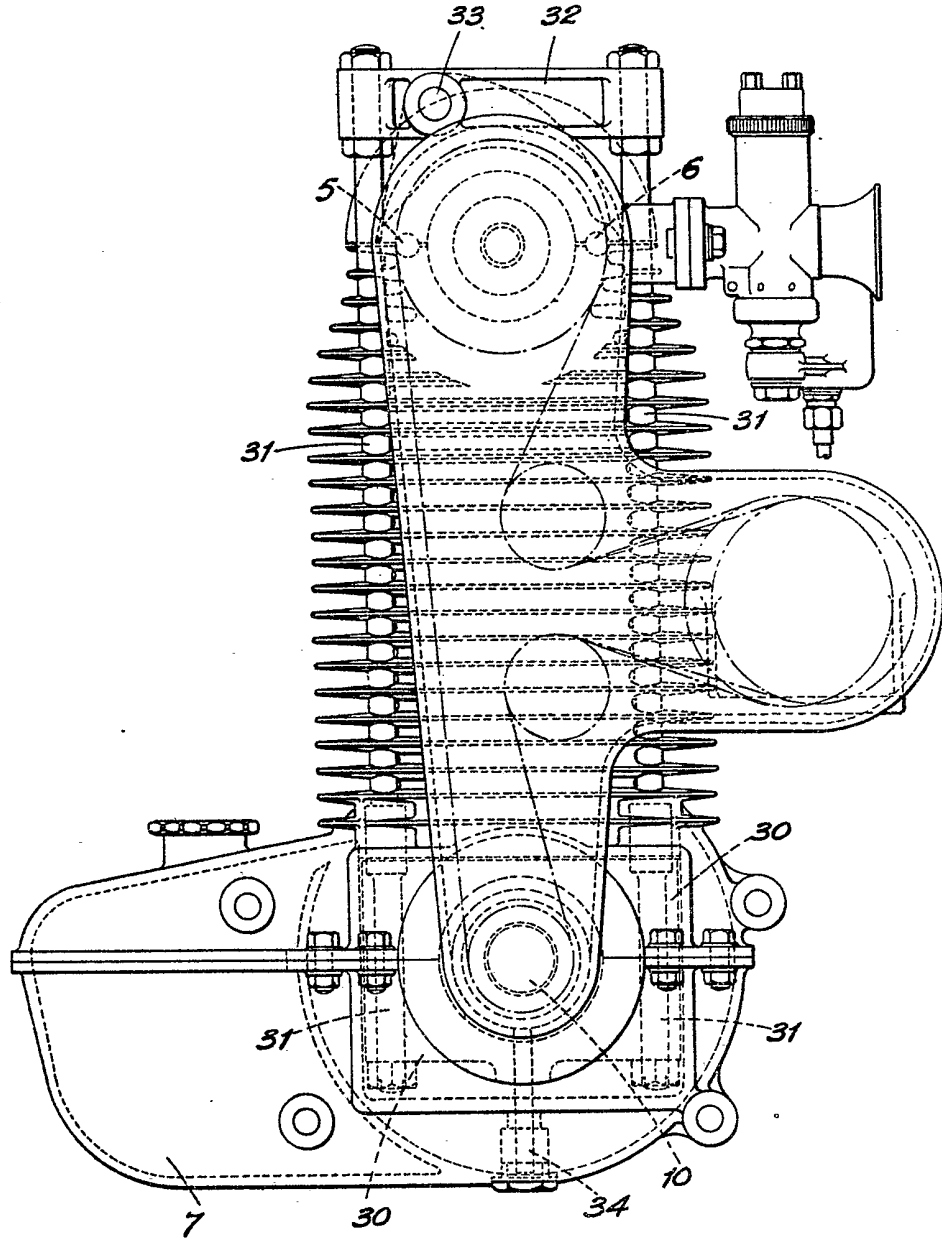
Fig. 3.



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



*Fig. 4.*



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