PATENT SPECIFICATION

358,802

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COMPLETE SPECIFICATION.

Rotary Valve for Internal Combustion Engine.

I, JAN ZEEMAN, a Dutch Subject, of 158, Stadhouderskade, Amsterdam, Holland, 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 engines of the type in which a rotary valve mounted in a housing at the head of the cylinder controls the inlet and exhaust by means of ports or recesses in the valve, packing rings being pressed by spring and/or gas pressure against the rotary valve to form a gas-tight joint, such packing rings being placed at the port leading from the combustion chamber and preferably also, to give a balancing effect, on the diametrically opposite side of the rotary valve; in the latter case gas pressure may be transmitted from the combustion chamber through a conduit in the valve to the said latter packing ring to provide for the balance of the gas pressure.

According to the present improvements, a plurality of side by side chambers or openings are simultaneously in use to form a single inlet or exhaust port and a plurality of packing rings are fitted in the housing for the valve at the end of the port leading from the combustion chamber, whereby a plurality of packing rings are used for a single port constructed as aforementioned. Heretofore each separate inlet or exhaust port in the rotary valve has comprised a single chamber, but by this invention a single port is formed by a plurality of chambers and the gas tight joint is formed by a plurality of packing rings which give a better gas tight joint than a single large packing ring. A corresponding number of packing rings are provided diametrically opposite the first mentioned packing rings and between the inlet and exhaust ports in the wall of the cylindrical housing of the rotary valve, and these latter packing rings are axially movable on projections in a hollow boss in the valve housing. A plurality of small diameter tubes pass diametrically in crossed relationship through the valve to transmit the gas pressure in the combustion chamber to the space under the said projection. The body of each packing ring is cylindrical for fitting in a cylindrical recess in the valve housing and has a thin circular flange for engaging the cylindrical wall of the opening in the rotary valve housing communicating with the combustion chamber or respectively with the cylindrical wall of the said projection in the hollow boss on the valve housing, a wire spring ring for pressing the packing ring against the rotary valve being fitted in a recess in the outer edge of the body of the ring. Two passages are provided in the wall of the housing, one of which when the port in the valve has moved out of register with the inlet port is in communication with the gas inlet pipe, whilst the other is in communication with the outside air so that the gas remaining in the port is drawn back into the inlet pipe by reduced pressure in the inlet pipe.

It has previously been proposed to construct a spring pressed packing ring axially movable in the port leading from the combustion chamber and to provide such packing ring with a thin flange which is expanded outwardly by gas pressure against the wall of the port to give a gas tight joint. It has also been proposed to provide an aperture in a rotary valve housing open to the atmosphere so that, when an extension of the inlet port in the rotary valve registers with the aperture, air is drawn into the port by the low pressure of the induction pipe to salve the contents of the inlet port.

These improvements are shown by way of example to the annexed drawings, in which the same numbers refer to the same parts.

Figure 1 is a vertical cross section of the cylinder-head with the rotating cylindrical valve.

Figure 2 is a vertical longitudinal section of the cylinder-head, taken on the line II—II and looking in the direction of the arrow of Figure 1.

Figure 3 is a similar view to Figure 2, showing the upper portion of the

[P

cylinder head and with the cylinder valve removed.

Figure 4 is a perspective view of a part of the cylindrical valve.

Figures 5 and 6 show, respectively in vertical cross section and in plan view, a spring controlled packing piece arranged beneath the valve.

Figures 7 and 8 show, respectively in side and in plan view, an annular spring, coacting with the packing ring.

Figures 9 and 10 show, respectively in vertical cross section and in plan view, a spring controlled packing piece at the top of the valve.

The working-cylinder 1 communicates by way of the port 2 with the cylindrical housing 3 in which the valve 4 fits and rotates. In this valve two chamber-like recesses or ports 5 are diametrically arranged and shaped by pressed copper walls 6 soldered or otherwise fixed in position. In the example the recesses 5 are, for reasons afterwards to be explained, constructed as double-chambers, so that the recesses 5 are arranged in pairs, whereby for each cylinder there are two ports each comprised of two recesses arranged in the valve-body. The valve 4 rotates in the direction of the arrow P at one quarter the speed of the crank shaft, so that the pairs of chambers 5, one after the other, will communicate respectively with the inlet port 7 and with the exhaust port 8. The valve-body is provided on the upper and lower or diametrically opposite sides with two upper spring packing pieces 9 and two lower spring packing pieces 10 which are arranged side by side to coact with the pairs of chambers and to effect a gas tight joint with the cylindrical valve. Both the lower packing pieces 10 are arranged in the port 2 leading to the combustion chamber whilst both the upper packing pieces 9 are placed in a boss on the wall of the cylindrical housing 3 in which the valve 4 rotates. The bronze packing pieces 9 and 10 (see Figs. 5—10) consist of a ring part 12 and a very thin flange 11. Rotation of the rings 12 is prevented by means of small pins 13, but the rings are free to move in an axial direction to enable them to be pressed against the valve 4 by a spring ring 14 which is bulged out at four places to give the necessary spring pressure in the axial direction. During the compression, explosion, and expansion period the lower packing pieces 10 are both pressed upwards against the valve-body 4 by the gas-pressure in the working-cylinder 1, assisted by the permanent pressure of the spring ring 14, whilst the very thin flange 11 is expanded by the gas-pressure whereby in all directions an efficacious closing of the port 2 is obtained.

The two upper packing-pieces 9, arranged side by side, and also pressed against the valve 4 by spring rings 14 and by gas pressure, are both constructed similar to the packing-pieces 10, however with the difference, that their bores are circular whereas the bores of the packing pieces 10 are rectangular shaped. The bores are however equal in area for the purpose of balancing the valve-body. As it is very difficult to form in the metal the necessary very narrow annular groove for the upwardly directed flange 11 of the upper packing pieces 9, the ring 15 is made separate and the difference between the inner diameter of this ring 15 and the outer diameter of the core-piece 16 is about twice the thickness of the wall of the flange 11. The latter however must be able to move freely in an axial direction.

For the purpose of balancing the cylindrical valve 4 during the compression, explosion, and expansion periods, small communicating tubes 17 and 18 are arranged such that diametrically opposite points of the circumference of the valve are connected to each other. As illustrated they are shown of increased diameter for the sake of clearness, as the inner diameter is a little smaller than 1.5 mm. With two tubes for each packing piece, thus four per cylinder, it is ensured that the cylindrical valve is balanced during 224° rotation of the crank-shaft, that is during 89° compression and 135° explosion and expansion. The depth of the pressure space between the cylindrical valve and the core 16 is hereby only about 0.3 mm. (drawn on an enlarged scale in the drawings) so that the amount of gas used for causing the balance-pressure is so small as to be negligible. The balancing effect ceases at the beginning of the exhaust period.

In contradistinction to the usual valve devices which, in view of the large gas-tight joint surface, and the length of the valve body to be made gas-tight, prevents the obtaining of a good supporting surface, the packing pieces, in accordance with the invention are self-adjusting and effect by their small dimensions a good bearing and gas-tight fit against the valve body. For this reason there are made for each cylinder, instead of one large packing piece, two small ones corresponding with the pair of chambers arranged side by side in the valve 4, because two small insert pieces will give a better adjustment and gas-tight fit than only one large packing piece.

Because the valve-body in consequence

of the higher temperature will expand more than the cylindrical housing 3, there must always be a little play between them, which play moreover will enlarge with the wear and tear. Without the self adjusting and self tightening packing pieces it would be found that at the underside of the valve body 4 a larger surface would be subjected to an unbalanced pressure, and leakage of the valve would result. By this invention the valve-body is subjected to a similar pressure on the cylinder port side and the side diametrically opposite. By these means the rotary valve floats as it were on the gases, so that all superfluous metal contact is avoided.

For regaining the combustible mixture remaining in the valve chambers 5 after the inlet period, the passages 20 and 21 are provided. The passage 21 communicates on the one side by way of an oblong slot 22, with the cylindrical housing 3, in which the valve 4 rotates, and on the other side with the open air. The passage 20 communicates on the one side with the housing 3 and on the other side with the inlet-pipe immediately behind the carburettor. These passages 20 are duplicated (see fig. 3) so that one set is provided for each chamber 5 of the pair (dash point lines in figure 3). The valve chambers have communicating lateral passages 23 and 23^a (see particularly figs. 2 and 4) which during the rotating of the cylindrical valve, at the moment that the valve chambers 5 are closed from the inlet, communicate with the oblong opening 22. At the same time the chambers 5 also communicate with the openings 20 which communicate with the inlet pipe and the explosive gas mixture residue contained in the chambers 5 will be sucked back to the inlet pipe caused by the reduced pressure in such pipe.

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 of the type set forth in which a plurality of side by side chambers or openings are simultaneously in use to form a single inlet or exhaust port in the rotary valve and in which a plurality of packing rings are fitted in the housing for the valve at the end of the port leading from the combustion chamber, whereby a plurality of packing rings are used for a single port.

2. An internal combustion engine as claimed in claim 1, in which a plurality of balancing spring pressed packing rings are located in the valve housing on the side diametrically opposite the port leading from the combustion chamber, which packing rings are axially movable on projections in a hollow boss on the valve housing.

3. An internal combustion engine as claimed in claim 2, in which a plurality of small diameter tubes pass diametrically in crossed relationship through the valve to transmit the gas pressure in the combustion chamber to the space under the said projections.

4. An internal combustion engine as set forth in claims 1 and 2, in which the body of each packing ring is cylindrical for fitting in a cylindrical recess in the valve housing and has a thin circular flange for engaging the cylindrical wall of the opening in the rotary valve housing communicating with the combustion chamber or respectively with the cylindrical wall of the said projection in the hollow boss on the valve housing, a wire spring ring for pressing the packing ring against the rotary valve being fitted in a recess in the outer edge of the body of the ring.

5. A rotary valve for internal combustion engines, as set forth in the preceding claims, in which two passages are provided in the wall of the housing, one of which when the port of the valve has moved out of register with the inlet port is in communication with the gas inlet pipe, whilst the other is in communication with the outside air so that the gas remaining in the port is drawn back into the inlet pipe.

6. A rotary valve for internal combustion engines, substantially as herein set forth or shown.

Dated this 29th day of August, 1931.

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3, New Street, Birmingham.

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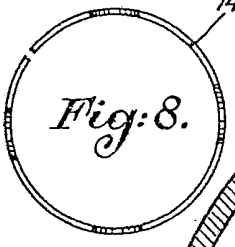
Fig:7.

Fig:8.



II Fig:1.

Fig:4.

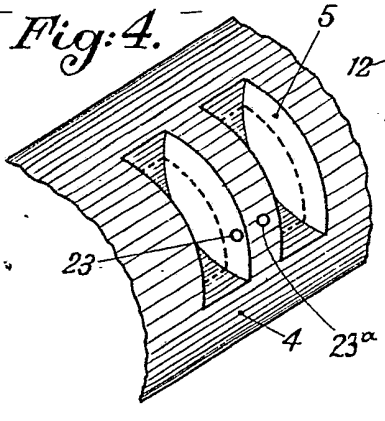


Fig:5.

Fig:6.

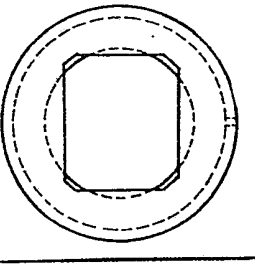


Fig:9.

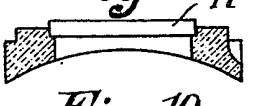


Fig:10.

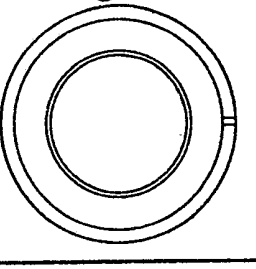
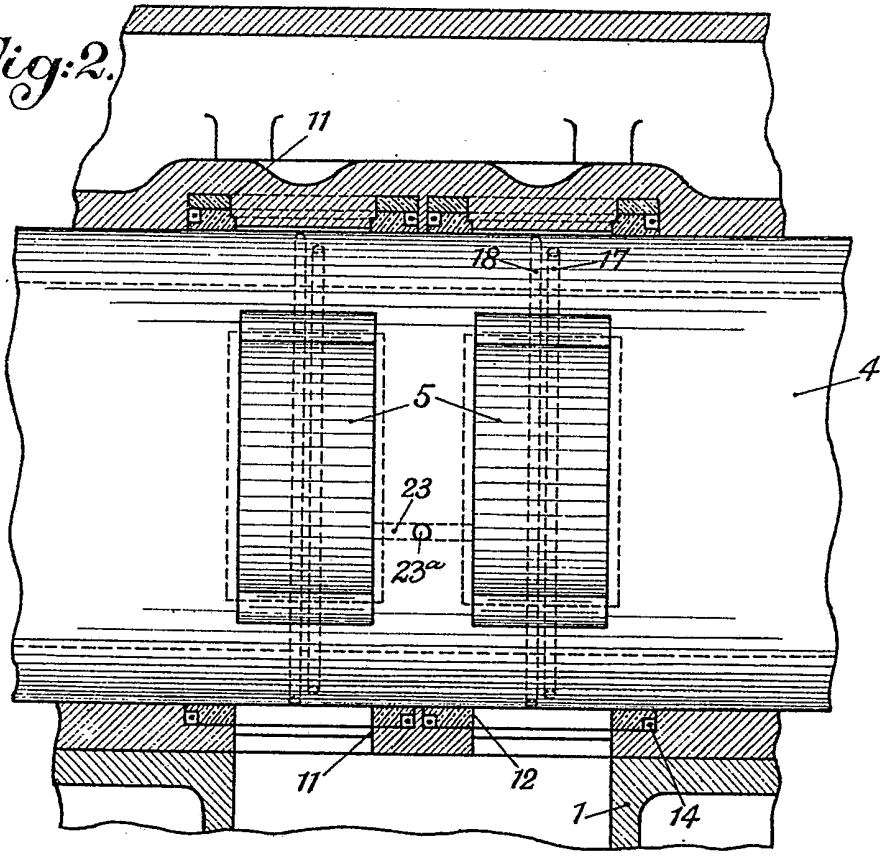


Fig:2.



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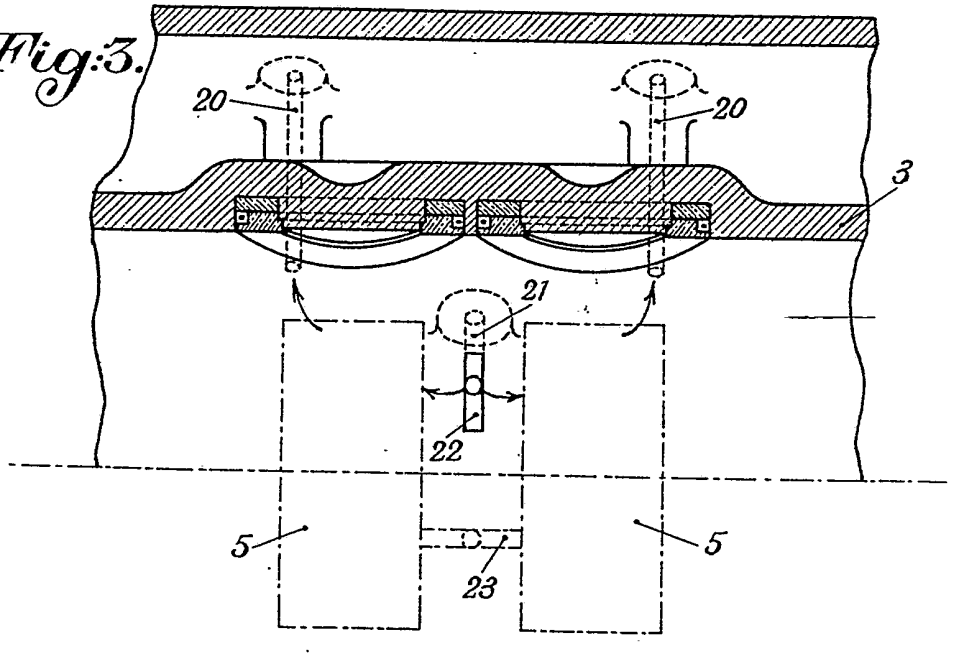

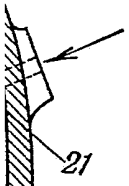

Fig:9.

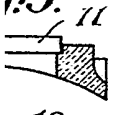

Fig:10.

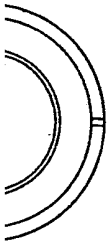

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Fig:2.

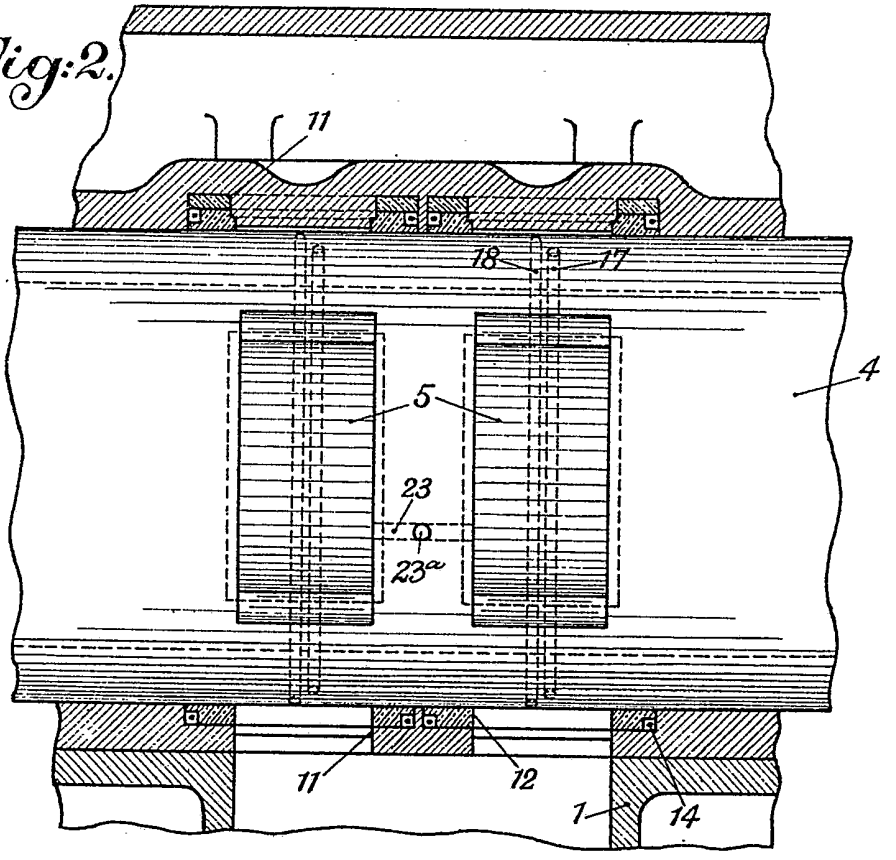
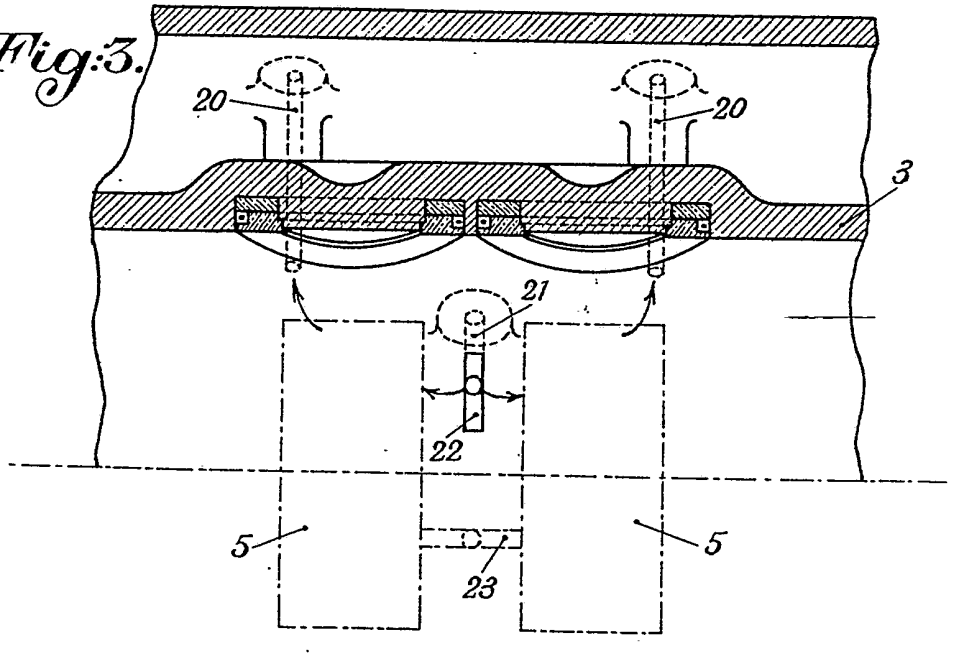


Fig:3.



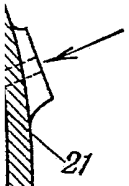


Fig:9.

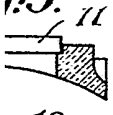
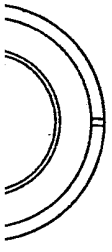


Fig:10.



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