PATENT SPECIFICATION

683,814

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COMPLETE SPECIFICATION.

Rotary Valves and Combustion Chambers of Internal Combustion Engines.

We, D.M.W. MOTORCYCLES WOLVERHAMPTON LIMITED, a British Company, of Valley Road Works, Sedgley, Dudley, Worcestershire, and MICHAEL WILLIAMSON COLCOTT RILEY, a British Subject, of 6, High Park Crescent, Sedgley, Dudley, Worcestershire, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to internal combustion engines of the kind comprising, in association with the or each cylinder, a conical rotary valve member having therein a chamber which is in constant communication with the cylinder and constitutes the major portion of the combustion space, and in which said chamber, as the valve rotates in a conical seating in the cylinder head, is placed in communication alternately with inlet and exhaust ports in the cylinder head.

In an internal combustion engine of the kind referred to and according to the present invention the or each conical rotary valve has a solid conical head having ports afforded by the opposite ends of a diametrical channel or slot formed in the valve head and extending fully across the base or undersurface thereof so as to constitute the chamber which is in constant communication with the associated engine cylinder.

The conical seating for the rotary valve would preferably be provided directly in the cylinder head, as distinguished from being formed in a plug in a cylinder extension or in a separate liner fixed in the cylinder head, so as to improve heat transference from the rotary valve to the usual cooling fins or cooling jacket.

Preferably also the valve will be co-axial with the cylinder.

According to a further feature of the invention, the rotary valve member is provided at its apex with an axial stem whereby it is mounted for rotation in roller or other anti-friction radial thrust bearings which, in addition to permitting free rotation of the valve stem, afford negligible resistance to axial displacement thereof.

The invention will now be more fully described with reference to and by the aid of the accompanying drawings, in which:—

Figs. 1 and 2 are a side elevation and a plan respectively of the cylinder head for a twin-cylinder motor cycle engine of the kind referred to.

Fig. 3 is a section taken on the line A,B of Fig. 2, but showing a rotary valve mounted in its conical seating in the cylinder head.

Figs. 4 and 5 are side elevations of one of the rotary valves, these views being in planes at right angles to each other, whilst Fig. 6 is a plan of said valve.

Referring to the drawings, each rotary valve comprises a solid conical valve head 1 formed integrally at its apex with an axial stem 2, and the ports in the valve are afforded by the opposite ends of a through diametrical channel or slot 3 where the latter breaks into the conical surface of said head. This diametrical channel or slot 3 is machined or otherwise formed in and extends fully across the base or under the surface of the valve head 1 so as to constitute a chamber which will be in constant communication with the cylinder, and said channel or slot 3 is of such height as to extend almost to the apex of the conical head 1, whilst its confronting side surfaces are correspondingly and oppositely inclined to the diametrical centre plane of said channel or slot 3, the base or open side of the latter being wider than the top. The valve head 1 is symmetrical with respect to the axis in all diametrical planes, thereby ensuring accurate balance.

The cylinder head is provided, in axial alignment with each cylinder, with a conical seating 4 within which the conical valve (Figs. 4, 5 and 6) will rotate, and inlet and exhaust ports 4x, 4y respectively formed in the cylinder head enter each conical seating 4 at appropriately angularly displaced positions. The stem 2 of each valve passes through an axial clearance bore 5 at the top of the conical seating 4 and is encircled by a helical spring 6 which operates, between the cylinder head and an axial thrust ball bearing 7 carried by the stem 2, to maintain the conical surfaces of the valve and seating in gas sealing engagement (see Fig. 3). The valve stem 2 also carries the inner race of a radial thrust roller bearing 8 the rollers of which run upon the inner surface of the outer race which is fixed in a housing 9 co-axial with the valve seating. The inner race of this radial thrust bearing 8 is of channel form to prevent relative axial movement of the rollers, but the axial dimension of the cylindrical inner surface of the outer race is such as to allow relative axial movement of the rollers.

With the above described arrangement of valve mounting, the valve will be maintained in gas-sealing engagement with its seating by the axial loading spring, and wear upon the conical sealing surfaces will be taken up automatically by such spring loading, there being negligible resistance to the automatic axial adjustment of the valve since the rollers of the radial thrust bearing are free to move axially upon its plain cylindrical outer race.

In the example shown each valve stem 2 has keyed to its upper end a spur gear 10. An externally toothed driving ring 11 is fixed to either valve, and in Fig. 2 both alternatives are shown. The two gears 10, one on each of the two valves, directly intermesh, whilst the driving ring 11, on only one of the valves, meshes with a driving pinion 12 which is carried by the upper end of a vertical and intermediately disposed countershaft (not shown) which is driven from the engine crank shaft through appropriate gearing. As applied to a four-stroke engine each valve could run at one quarter the speed of the engine crank shaft, if said valve had only two diametrically opposed ports; if it had two pairs of diametrically opposed ports, displaced 90 degrees, it could run at one-eighth engine speed.

The sparking plug or fuel injector would, of course, be provided for in the cylinder head at appropriate locations between each inlet port 4x and associated exhaust port 4y. Tapped bores for mounting the sparking plugs are indicated at 13 in Figs. 1 and 2 of the drawings.

The base area of each rotary valve would preferably be the same as the cross sectional area of the associated cylinder, or nearly so.

It will be seen that the present invention provides a conical rotary valve of accurately balanced construction which works in a complementary conical seating, preferably formed directly in the cylinder head, and a mounting for said valve which permits automatic axial adjustment of the valve, under spring loading as wear of the conical sealing surfaces takes place, so as to maintain the efficiency. In this latter connection, instead of employing a helical spring, any other appropriate form of spring may be used to load the valve so as to maintain it on its seating. Also the rollers of the radial thrust bearing may be axially slidable on a plain cylindrical inner race and be held against axial movement relatively to an outer race, instead of the reverse arrangement described and shown. Moreover the provision of diametrically disposed ports in the valve enables it to be run at reduced speed.

What we claim is:—

1. An internal combustion engine of the kind referred to, wherein the or each rotary valve has a solid conical head having ports afforded by the opposite ends of a diametrical channel or slot formed in the valve head and extending fully across the base or undersurface thereof so as to constitute the chamber which is in constant communication with the associated engine cylinder.

2. An internal combustion engine as claimed in Claim 1, wherein the diametrical channel or slot in the conical head of the or each valve is of such height as to extend almost to the apex of said head, and the confronting side surfaces of said channel or slot are correspondingly and oppositely inclined to the diametrical centre plane of said channel or slot, the base or open side of the latter being wider than the top.

3. An internal combustion engine as claimed in either of the preceding claims, wherein the or each conical valve is formed integrally with an axial stem which passes through an axial clearance bore at the top of the conical seating in the cylinder head and carries an axial thrust bearing between which and the cylinder head a spring operates to maintain the conical surfaces of the valve and seating in gas-sealing engagement.

4. An internal combustion engine as claimed in Claim 1, 2 or 3, wherein the rotary valve is mounted for rotation in antifriction radial thrust bearings which, in addition to permitting free rotation of the valve stem, affords negligible resistance to axial displacement thereof.

5. An internal combustion engine, substantially as described with reference to the accompanying drawings.

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PROVISIONAL SPECIFICATION.

Rotary Valves and Combustion Chambers of Internal Combustion Engines.

We, D.M.W. MOTORCYCLES WOLVERHAMPTON LIMITED, a British Company, of Valley Road Works, Sedgley, Dudley, Worcestershire, and MICHAEL WILLIAMSON COLCOTT RILEY, a British Subject, of 6, High Park Crescent, Sedgley, Dudley, Worcestershire, do hereby declare the nature of this invention to be as follows:—

This invention relates to internal combustion engines of the kind comprising, in association with the or each cylinder, a conical rotary valve member having therein a chamber which is in constant communication with the cylinder and constitutes the major portion of the combustion space, and in which said chamber, as the valve rotates, is placed in communication alternately with inlet and exhaust ports in the cylinder head.

In an internal combustion engine of the kind referred to and according to the present invention the conical rotary valve has diametrically opposed ports for alternate co-operation with the inlet and exhaust ports in a complementary conical seating within which the valve rotates and with the surface of which it is maintained in gas-sealing contact by axial spring loading, and the valve is further characterised in that its chamber and ports are so formed that it is symmetrical with respect to the axis of rotation in all diametrical planes, thereby securing accurate balancing.

The conical seating for the rotary valve would preferably be provided directly in the cylinder head, as distinguished from being formed in a plug in a cylinder extension or in a separate liner fixed in the cylinder head, so as to improve heat transference from the rotary valve to the usual cooling fins or cooling jacket.

Preferably also the valve will be co-axial with the cylinder.

According to a further feature of the invention, the rotary valve member is provided at its apex with an axial stem whereby it is mounted for rotation in roller or other anti-friction radial thrust bearings which, in addition to permitting free rotation of the valve stem, afford negligible resistance to axial displacement thereof.

In an embodiment of the invention, the rotary valve member comprises a conical valve head formed integrally at its apex with an axial stem. The ports in the valve head are afforded by the opposite ends of a through diametrical channel or slot where the latter breaks into the conical surface of said head, and said diametrical channel or slot is machined or otherwise formed in and extends fully across the base or undersurface of the valve head so as to constitute a chamber which will be in constant communication with the cylinder. This diametrical channel or slot may be of such height as to extend almost to the apex of the conical head, and its confronting side surfaces may be correspondingly and oppositely inclined to the diametrical centre plane of said channel or slot, the base or open side of the latter being wider than the top.

The cylinder head is provided, in axial alignment with the or each cylinder, with a conical seating within which the conical rotary valve will rotate, and inlet and exhaust ports formed in the cylinder head enter the conical seating surface at appropriately angularly displaced positions. The stem of the valve passes through an axial clearance bore at the top of the conical seating and is encircled by a helical spring which operates, between the cylinder head and an axial thrust ball bearing carried by the stem, to maintain the conical surfaces of the valve and seating in gas-sealing engagement. The valve stem also carries the inner race of a radial thrust roller bearing, the rollers of which run upon the inner surface of an outer race. The inner race of the roller bearing is of channel form to prevent relative axial movement of the rollers, but the cylindrical inner surface of the outer race is of such axial dimension as to allow relative axial movement of the rollers. The outer race is carried by a housing which is co-axial with the valve seating and the usual driving gear wheel is secured to the upper projecting end of the valve stem. As applied to a four cycle engine, the valve would run at one quarter the speed of the crank shaft.

With the above described arrangement of valve mounting, the valve will be maintained in gas-sealing engagement with its seating by the axial loading spring, and wear upon the conical sealing surfaces will be taken up automatically by such spring loading, there being negligible resistance to the automatic axial adjustment of the valve since the rollers of the radial thrust bearing are free to move axially upon its plain cylindrical outer race.

Whereas the invention has been described with reference to an embodiment in which the chamber in the valve head and its ports are afforded by a diametrical channel or slot formed in the valve head, it will be appreciated that the chamber and ports may be provided in other ways so long as a truly balanced form in all diametrical planes is obtained. For example, the chamber in the valve head may be conical and co-axial with the outer conical surface and identical diametrically opposed ports may be formed through the walls of the hollow cone.

The sparking plug or fuel injector would, of course, be provided for in the cylinder head at an appropriate location between the inlet and exhaust ports.

The base area of the rotary valve would preferably be the same as the cross sectional area of the cylinder, or nearly so.

It will be seen that the present invention provides a conical rotary valve of accurately balanced construction which works in a complementary conical seating, preferably formed directly in the cylinder head, and a mounting for said valve which permits automatic axial adjustment of the valve, under spring loading and as wear of the conical sealing surfaces takes place, so as to maintain the efficiency. In this connection, instead of employing a helical spring, any other appropriate form of spring may be used to load the valve so as to maintain it on its seating. Also the rollers of the radial thrust bearing may be axially slidable on the inner race and held against axial movement relatively to the outer race, instead of the reverse arrangement described. Moreover the provision of diametrically disposed ports in the valve enables it to be run at a reduced speed. For example in a four-cycle engine with a valve having two diametrically opposed ports, the valve would run at one quarter engine speed, which if the valve had two pairs of diametrically opposed ports it could run at one-eighth engine speed.

Dated this 10th day of October, 1949.

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Agents for the Applicants.

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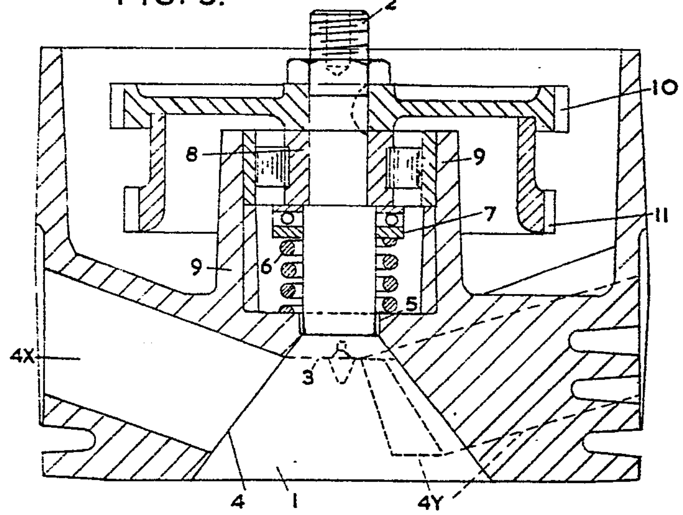
FIG. 3.



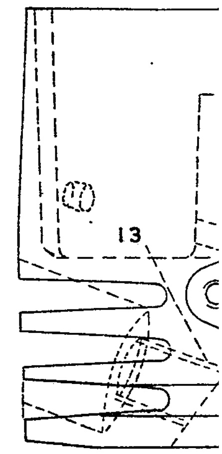
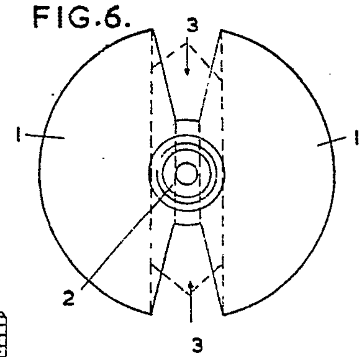


FIG.6.



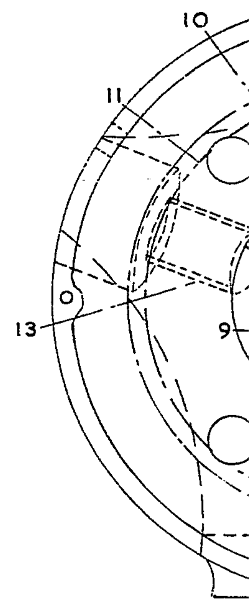


FIG.4.

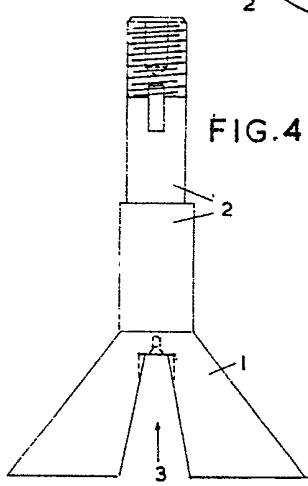
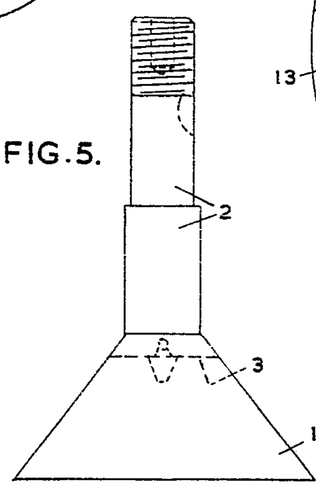


FIG.5.



683,814 COMPLETE SPECIFICATION
1 SHEET

This drawing is a reproduction of the Original on a reduced scale.

FIG.1.

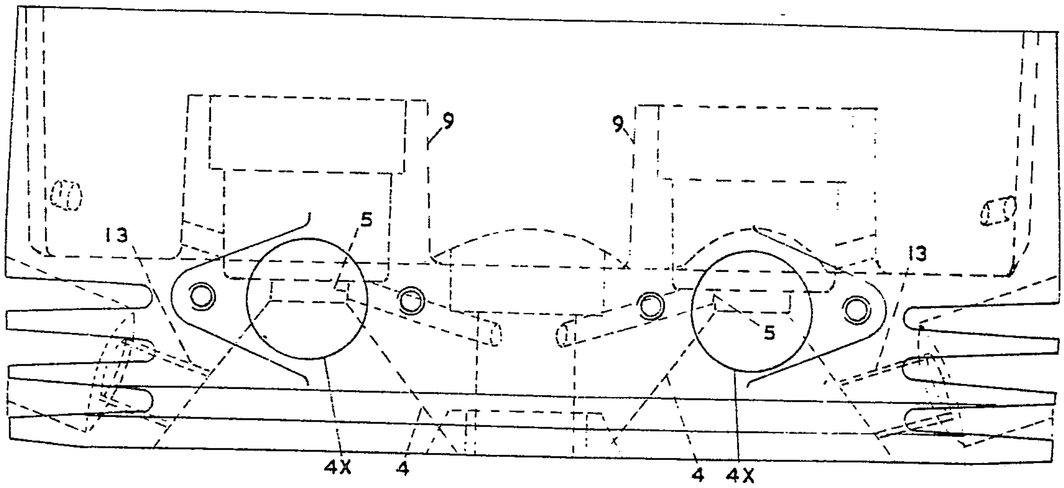
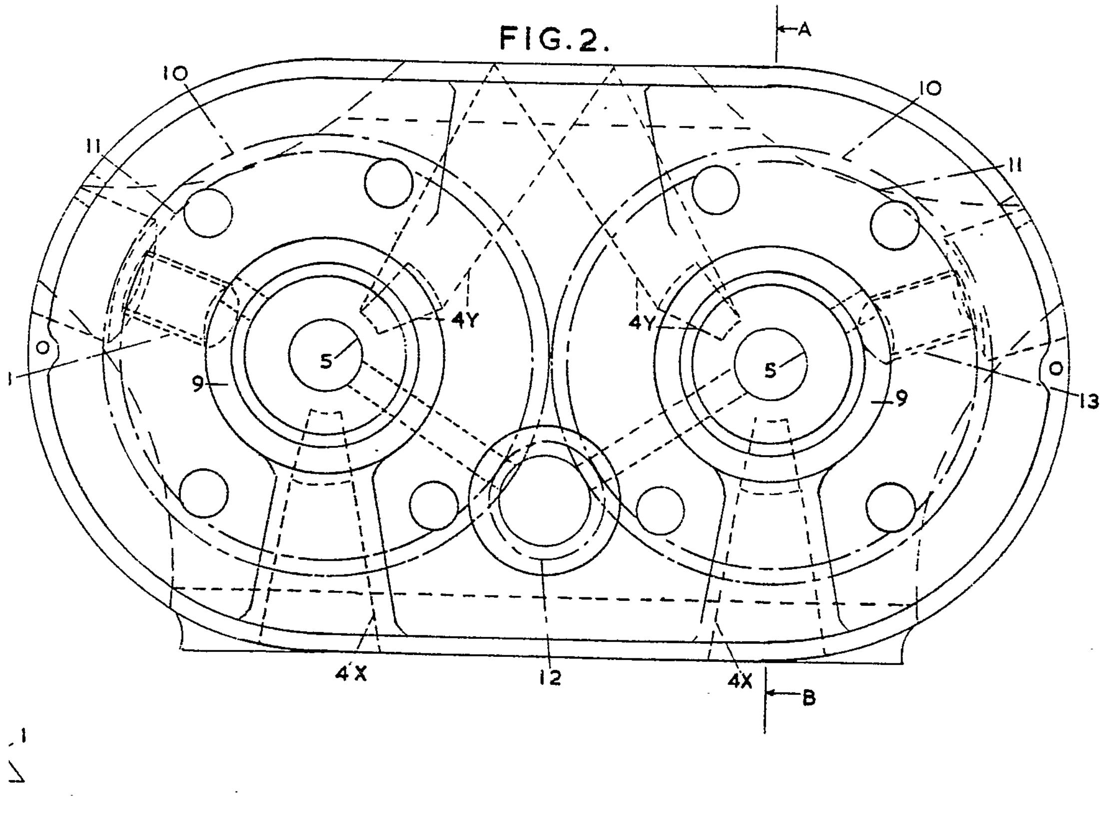


FIG.2.



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This drawing is a reproduction of the Original on a reduced scale.

FIG. 3.

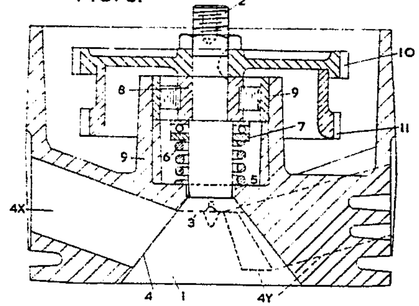

FIG.1.

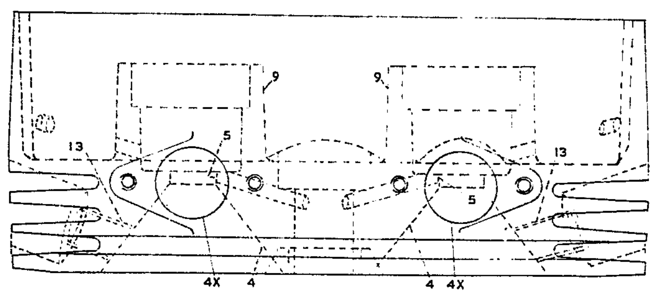

FIG.6.

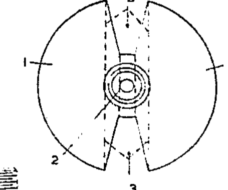

FIG.2.

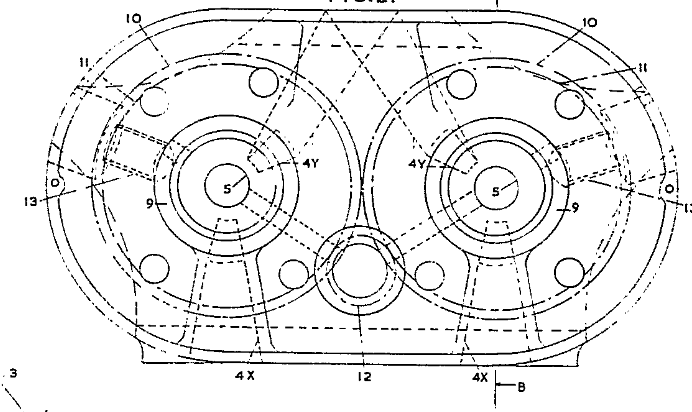

FIG.4.

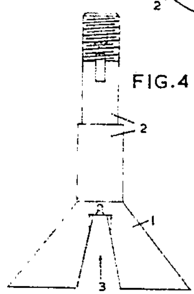

FIG.5.