UNITED STATES PATENT OFFICE.

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ROTOR VALVE FOR EXPLOSIVE ENGINES.

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To all whom it may concern:

Be it known that I, Robert C. Russell, a citizen of the United States of America, residing at Dallas, in the county of Dallas, and State of Texas, have invented certain new and useful Improvements in Rotary Valves for Explosive Engines, of which the following is a specification.

This invention relates to new and useful improvements in rotary valves for explosive engines.

The object of the invention is to simplify the construction of rotary valves for explosive engines, as well as to increase the efficiency and reduce the wear of such valves.

In all of the rotary valves, which have come under my observation I have found certain fundamental difficulties such as extremely accurate machine finished parts; very close fitting of component parts; excessive wear, sticking of parts due to unequal expansion; leakage from one cylinder to another; and intricate parts expensive and difficult to manufacture.

My invention seeks to overcome these difficulties by so designing the valve that it will be practically floating and free from the impact of the explosions, as well as accomplishing a substantial reduction of friction.

An object of the invention is to provide simple means for preventing the leakage or by-passing of compression or the exhaust gases.

Another object is to utilize the carbon deposits to provide smooth bearing surfaces for the valve, whereby a further reduction of friction is obtained and compression tight fittings are had.

Another object is to provide a valve casing fully movable in all directions with relation to the motor head, the intake manifold and the exhaust manifold.

A construction designed to carry out the invention will be hereinafter described together with other features of the invention.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings, in which an example of the invention is shown, and wherein:

Fig. 1 is a longitudinal vertical sectional view of the upper end of an engine equipped with a valve constructed in accordance with my invention.

Fig. 2 is a horizontal cross-sectional view of the same.

Fig. 3 is an enlarged transverse sectional view taken on the line 3-3 of Fig. 1, and:

Fig. 4 is a sectional detail of one of the valve cases and component parts.

In the drawings the numeral 10 designates the block of an explosive engine which is illustrated as having four cylinders; but this number may vary. On the block is fastened a head 11. The head and block may be of the usual type and the water jacket and passages have been omitted so as to simplify the drawings. At one side and above the head is disposed an intake manifold 12 having for each cylinder, a lateral sleeve 13.

On the opposite side of the head is an exhaust manifold 15 having sleeves 14 directly opposite the sleeve 13.

The head has over each cylinder a circular opening 16 considerably less in diameter than the cylinder. A longitudinal tubular valve 17 is mounted over the head and at its center is supported in a bearing box 18. The ends of the valve are closed and provided with trunnions 19 and 20, respectively, supported in bearing boxes 21. It is to be understood that the boxes 18 and 21 may be of any suitable construction and may have ball or roller bearings, if desired. The trunnion 20 has a sprocket 22 mounted thereon driven by a sprocket chain 23, which in turn is driven by a suitable timing gear (not shown).

Over each cylinder is a three-armed valve case 24 comprising a central cylindrical jacket 25. From one side of the jacket an arm 26 extends, said arm having a flared neck portion 26' terminating in a cylindrical shank portion 27. The neck and shank have a passage 28 which is flared outwardly from the jacket in a vertical plane (Fig. 3) and converged outwardly from the jacket in a horizontal plane (Figs. 2 and 4). This affords an ample passage for the incoming gases.

On the opposite side of the jacket an arm 26 having neck 29 and shank 30 like the parts 26' and 27 are provided and formed with a passage 31 like the passage 28.
arm 32 depends from the jacket and has a stem portion 32' terminating in a cylindrical shank portion 33. The stem and shank have a downwardly flaring passage 34. The valve 17 has a sector cut out to form a gap or by-pass 35, said by-pass being separated from and closed against communication with the bore of the valve by a wall 36.

The by-pass 35 is of such amplitude as to connect the intake passage 28 with the passage 34 or to connect the exhaust passage 31 with the passage 34. The valve at points during its rotation shuts off communication between these passages. The valve has a close turning fit in the jacket which is bored smooth. Near each end the bore of the jacket has a plurality of closely spaced annular grooves 37. Longitudinal grooves 38 are provided in the bore above and below the passages 28 and 31 and intersect at their ends with the innermost grooves 37. These grooves are small and are for the purpose of accumulating carbon deposits which provide bearing surfaces and take the wear of the rotation of the valve.

The shanks 27, 30 and 33, each have a circumferential groove 39, angular in cross-section, for receiving packing rings 40; ordinary piston rings having been used. The shank 27 fits in the sleeve 12 of the intake manifold 12 and the shank 30 fits in the sleeve 14 of the exhaust manifold; while the shank 33 fits the opening 16. The shanks are slightly less in diameter than the parts in which they fit. The packing rings contact with the walls of the sleeves and the openings 16, which at these points may be machined if desired. The packing rings seal the joints and prevent leakage.

It will be seen that the three-armed case 29 is substantially "full floating", its arms being yieldingly supported by the rings 40, and may therefore move vertically, laterally or longitudinally or in any other direction. These rings, it will be observed serve the dual function of yielding supports and packing elements. The case being outside of the cylinder and above the head is not subject to the extreme heat present in the cylinder. It has been found that the packing ring joints are very effective and prevent leakage but permit a free movement of the valve case. The grooves 38 assist in building up carbon deposits which provide compression-tight engagement between the valve and the bore of the case.

In operation the valve is timed to admit the firing charges into cylinders through the passages 28 at the proper time; also to cut off the exhaust passages 31 during the compression and explosive strokes and to permit the escape of exhaust gases during the scavenging stroke. The bottom of the shank 33 being exposed to the compression and explosion takes the impact and thrust together with the valve 17; whereby a balance is effected which prevents excessive pressure on the valve and consequently undue wear on the valve. The proportions may be such as to relatively tend to move the case upwardly and compensate for any upward distortion of the valve, due to the pressure from the charge either under compression or when exploding.

It is not practical to lubricate a rotary valve of this type except by supplying oil with the fuel charge, and the full floating case affords such compensation as will tend to reduce wear to a minimum. The carbon grooves or other means for collecting carbon is very important because the parts may be made comparatively loose for the reason that the carbon soon deposits and forms a close fit and a wearing surface superior to that of metal. This precludes the necessity of extremely accurate machining and makes for simple and comparatively inexpensive manufacture. It is highly desirable to so proportion the parts that they will balance, because on the down stroke of the piston there is a tendency to pull the case down and upon the up stroke the case is forced upward. Upon the explosion of the fuel charge there is a re-action in the case 24 which tends to move it down as well as up, hence the necessity of balancing.

Various changes in the size and shape of the various parts as well as modifications and alterations may be made within the scope of the appended claims.

What I claim is:

1. In an engine, a cylinder, an intake manifold, an exhaust manifold, said cylinder and manifolds having openings, a rotary valve, and a three-armed case enclosing the rotary valve, said arms being hollow and forming passages connecting the valve case with the openings of the cylinder and manifolds, said arms being yieldably supported in the openings to adapt the valve and case to have a universal floating action.

2. In an engine, a cylinder having an opening in its top, intake and exhaust manifolds arranged above the cylinder and at opposite sides thereof and having opposed openings in their inner walls, a rotary valve disposed above the cylinder and between the manifolds, and a three-armed case enclosing the valve, the arms of said case being hollow and seated in said openings and forming passages between the cylinder, manifolds and case, said arms being yieldably mounted in said openings to support the valve and case for a universal floating action.

3. In an engine, a cylinder having an opening in its top, intake and exhaust manifolds arranged above the plane of the cylinder and on opposite sides of the vertical center thereof and provided with alined openings in the opposed walls thereof, a rotary valve...
disposed above the cylinder and between the manifolds, and a cylindrical casing enclosing the valve and provided with three radial arms projecting at angles of 90° therefrom, said arms being seated in the openings in the cylinder and manifolds and forming passages between the same and the valve case, and means resiliently supporting the arms in the openings to adapt the valve and valve case to have a universal floating action.

4. In an engine, a cylinder having an opening therein, intake and exhaust manifolds provided with openings, a rotary valve, a case enclosing the valve and provided with radial arms forming passages and extending into the openings in the cylinder and manifolds, said arms being provided with external grooves and spring packing rings seated in said grooves and engaging the walls of the openings to form backing members, and cushioning supports adapting the valve and valve case to have a universal floating action.

5. In an engine, a cylinder having an opening, intake and exhaust manifolds having openings, a rotary valve, and a case enclosing the valve and provided with three integral hollow arms arranged at angles of 90° to each other, said arms being yieldably supported in the openings to adapt the valve and valve case to have a universal floating action, each arm having a passage flaring outwardly from the case in a vertical plane from end to end thereof and converging outwardly from the case in a horizontal plane from end to end thereof.

6. In an explosive engine, the combination of a cylinder having an inlet at its top, an intake manifold sleeve, an exhaust manifold sleeve, said sleeve being disposed on opposite sides of the cylinder, a valve over the cylinder opening and between the sleeves, a valve case surrounding the valve and having arms provided with passages and loosely engaged in the cylinder openings and the sleeves, and spring packing rings surrounding the arms and engaging in the cylinder inlet and sleeves and yieldingly supporting the arms thereon.

7. As a sub-combination in an explosive engine, a unitary structure comprising a valve case in the form of a cylindrical jacket having radial arms projecting therefrom, said arms being provided with passages.

8. As a sub-combination in an explosive engine, a valve case having three radial arms, each provided with a passage, each passage communicating with the interior of the valve case.

9. As a sub-combination in an explosive engine, a valve case having radial arms on each side, cylindrical shanks on the outer ends of the arms, and an arm depending from the case and having a cylindrical shank on its lower end, the arms having radial passages extending therethrough and communicating with the case.

10. In an engine, a cylinder having an opening therein, intake and exhaust manifolds provided with openings, a rotary valve, a case enclosing the valve and provided with radial arms forming passages and extending into the openings in the cylinder and manifolds, said arms being loosely fitted in said openings and normally spaced at all points from the walls of the openings, and cushioning supports in the spaces between the arms and walls of the openings closing said spaces and adapting the valve and valve case to have a universal floating action.

11. In an explosive engine, the combination of a block having a plurality of cylinders, each having an inlet at its top, an exhaust manifold on one side of the block, an exhaust manifold on the other side of the block, a rotary valve extending longitudinally of the block between the manifolds, a plurality of three-armed valve cases surrounding the valve, a case being disposed over each cylinder and each having radial arms engaging in the inlet of the cylinder and the manifolds, the cases being movable in all directions independently of the block and manifolds, and yielding means for supporting said arms and making leak-proof joints between the arms and the walls of the openings in the cylinder and manifolds with which they engage.

In testimony whereof I affix my signature.

ROBERT C. RUSSELL.