Dec. 18, 1928. 1,695,348

H. SCHEEL

ROTARY VALVE

Filed Oct. 21, 1920 2 Sheets-Sheet 1

Fig. 1.

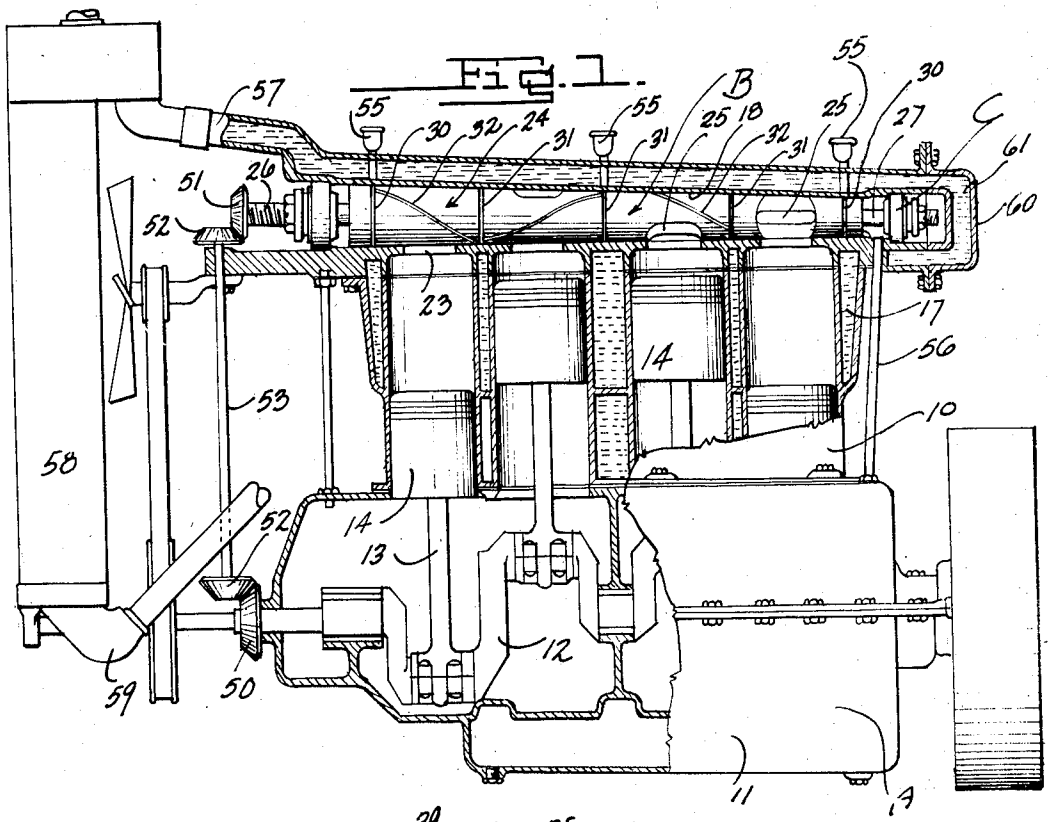
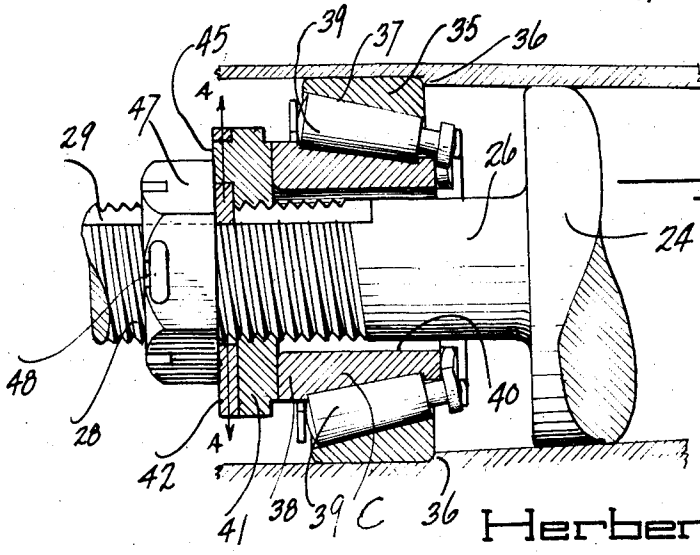


Fig. 2.



Herbert Scheel.

Inventor

By Lancaster and Allwine

Attorneys

Dec. 18, 1928. 1,695,348

H. SCHEEL

ROTARY VALVE

Filed Oct. 21, 1920 2 Sheets-Sheet 2

Fig. 2.

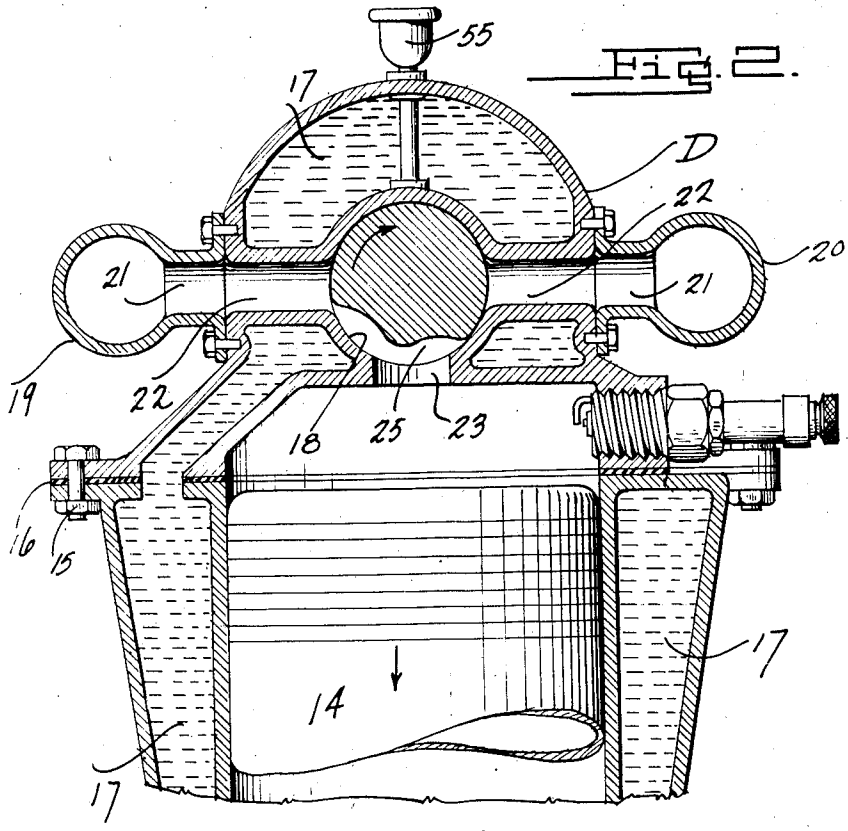


Fig. 4.

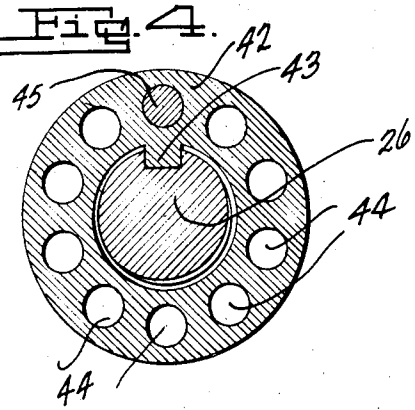
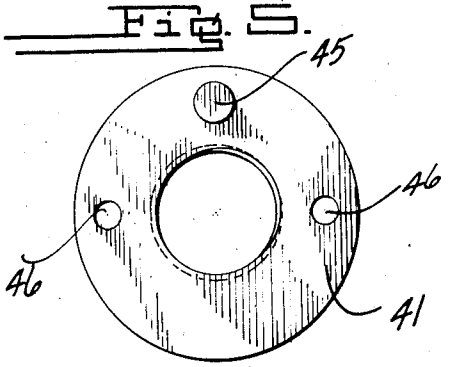


Fig. 5.



Herbert Scheel.
Inventor

By Lancaster and Allwine
Attorneys

Patented Dec. 18, 1928. 1,695,348

UNITED STATES PATENT OFFICE.

HERBERT SCHEEL, OF MAPLEWOOD, MISSOURI, ASSIGNOR, BY MESNE ASSIGNMENTS, TO SCHEEL MOTORS CORPORATION, A CORPORATION OF DELAWARE.

ROTARY VALVE.

Application filed October 21, 1920. Serial No. 418,564.

This invention relates to internal combustion engines, and the primary object of the invention is the provision of an improved rotary valve for internal combustion engines which will effectively take the place of the ordinary poppet valves now in universal use, and thereby eliminate the complicated operating and timing mechanism thereof.

A further object of the invention is the provision of a rotary valve designed from a practical and technical standpoint to overcome the impractical features heretobefore involved in the construction of a rotary valve.

A further object of the invention is the provision of a rotary valve adjustably located with respect to a seat in the cylinder head of an internal combustion engine, and one which is constructed of permanently expanded metal, and one which can consequently be floated in a thin film of oil, and spaced from its seat in the cylinder head.

A further object of the invention is the provision of a permanently expanded tapered valve which is adjustably disposed in its seat in the cylinder head by anti-friction thrust bearings.

A further object of the invention is to provide an improved rotary valve arranged in a removable cylinder head and which is adapted to be associated with motors now on the market, thereby rendering the invention applicable to existing motors as well as motors in the course of manufacture.

A further object of the invention is the provision of a rotary valve for internal combustion engines, which is gradually tapered toward one end thereof so as to permit the correct seating thereof in its valve seat, the tapered valve being so associated with the cylinder head that the confronting conical portion thereof is at substantially right angles to the axes of the bores of the cylinders.

Other objects and advantages of the invention will be apparent in the following detailed description, taken in connection with the accompanying drawings, forming a part of this specification, in which drawings:

Figure 1 is a fragmentary longitudinal section through the internal combustion engine showing the improved rotary valve associated therewith.

Figure 2 is a lateral cross section taken through the cylinder head of an internal combustion engine, and showing the rotary valve in relation to the intake and exhaust ports therein.

Figure 3 is a fragmentary cross sectional view showing the means of supporting the rotary valve in the cylinder head.

Figure 4 is a cross sectional view taken on the line 4—4 of Figure 3.

Figure 5 is an end elevation of the adjusting nut for adjusting the position of the rotary valve with respect to its seat in the cylinder head.

In the drawings, wherein for the purpose of illustration is shown a preferred embodiment of my invention, the letter A designates the motor or internal combustion engine of any approved type having a rotary valve B disposed within the cylinder head thereof, and adjustably maintained therein by the anti-friction or roller bearing construction C.

The motor A as herein illustrated, comprises a cylinder casing 10 having four cylinders therein cast en bloc. The crank case 11 comprises the ordinary internal combustion engine construction having the crank shaft 12 bearing therein, and the connecting rods 13 mounted thereon having the pistons 14 pivotally mounted upon the ends thereof and disposed within the cylinders of the cylinder casing 10.

The cylinder head D is of special construction and is mounted upon the cylinder casing 10 by bolts 15 or the like having a gasket 16 disposed therebetween to render the connection leak proof. It is preferred that the motor be of the water cooled type having the passageways 17 therein for complete water circulation about the cylinders and through the cylinder head D. The cylinder head D has a circular conical seat 18 extending longitudinally therethrough which is provided for the purpose of receiving the rotary valve B. An intake manifold 19 and an exhaust manifold 20 are provided, having passageways 21 therein leading or connecting with passageways 22 in the cylinder head D; and which connect or feed into the longitudinally extending rotary valve seat 18. Passageways 23 are provided in the cylinder head D which establish communication between the longitudinal seat 18 and the cylinders of the internal combustion engine. The rotary valve B preferably comprises a solid shaft 24 of heat treated cast iron and permanently ex-

panded to its maximum diameter at any section taken therethrough.

The success of this rotary valve lies in the fact that the surface thereof does not bear directly upon its seat 18 in the cylinder head D but rather has a clearance of .001 of an inch therebetween for a thin film of oil. Rotary valves heretofore constructed have borne directly upon their seats in the cylinder head resulting in a comparatively snug fit and thus creating considerable friction which in time wears upon the rest side, and produces an oval bearing surface upon the lower side of the cylinder head, which results in the loss of compression. A practically uniform clearance between the rotary valve and its seat is maintained by means of frictionless bearings, which may be either ball or roller bearings.

In order to maintain the clearance between the valve seat and the valve it is necessary to provide some means of preventing expansion of the valve itself, and to accomplish this result, the rotary valve is geared in a ratio of 4:1 with the crankshaft, and also the valve ports in the said valve are disposed diametrically opposite each other and are caused to rotate in such a manner that immediately after the surface of the valve port is exposed to the heating influence of the exhaust gases, the identical same surface is immediately subjected to the cooling influence of the incoming mixture of air and fuel. Again, the valve is substantially solid thereby supplying large conductive cross-sectional area.

The periphery of the valve is in close juxtaposition with a circumambient water-jacketed housing. Between said housing and the valve, a film of oil is maintained, hence the heat transmitted to the valve by the exhaust gases is first subject to the cooling effect of the incoming charge and then further conducted through the oil film to the water-jacketed housing.

By this means the valve is maintained at practically a uniform, low temperature during all conditions of service, and experiments have proven this to be true.

The rotary valve has depressions or ports 25 therein and which are of such formation as to establish communication between the exhaust or intake manifolds, and the cylinders through passageways 22 and 23. The rotary valve B is preferably provided with the reduced ends 26 and 27 having the screw threads 28 thereon and the longitudinal slots 29 therein and which are provided for the purpose of receiving the roller bearing construction C to adjustably support the rotary valve B in its seat 18 in the cylinder head D. Oil grooves 30 are disposed upon the ends of the rotary valve body portion 24 and oil grooves 31 of similar formation are circumferentially disposed about the rotary valve B, intermediate each of the ports 25 thereon. Spiral oil grooves 32 are provided longitudinally upon the rotary valve and establish communication between the various grooves 30 and 31. The oil passageways are very shallow in depth and insure a complete film of oil circumferentially around the rotary valve and intermediate the same and its seat 18.

The roller bearing construction C is provided to adjustably support the rotary valve B within its seat and to maintain the desired clearance therebetween. It comprises a roller bearing cup 35 maintained in fixed position within the cylinder head D by the annular shoulder 36 therein and having the internal, smooth bevelled seat 37 diverging from the motor, and adapted to receive therein a hollow supporting body 38 rotatably supporting the roller bearings 39 thereon, and which has an internal bore 40 the surface of which is free of the stem surface 26 of the valve. An adjusting nut 41 is provided for binding engagement against the outer face of the roller bearing support 38 and which is internally screw threaded for engagement with the threads 28 of the stem 26. It is thus evident that as the adjusting nut 41 is rotated upon the stem 26, it will bind against the face of the roller bearing support 38 and either advance or retract the rotary valve B within its seat 18. Since such a fine adjustment as .001 of an inch is required between the rotary valve and its seat, it is necessary that a lock washer 42 be provided to maintain the adjusting nut 41 in a determined position. For this purpose a projection 43 is formed upon the lock washer 42 and adapted for longitudinal sliding engagement within the slot 29 of the stem 26; and a plurality of apertures 44 are circumferentially stamped therein to receive the projection 45 upon the adjusting nut 41. A number of apertures 46 are provided upon the adjusting nut 41, and diametrically opposed for the reception of a spanner wrench or the like to more easily rotate the same upon the stem 46. In order to provide a permanent adjustment, an auxiliary lock nut 47 is provided for binding against the lock washer 42, and which has a cotter pin 48 therein for locking the same to the shaft 26. One of the bearing structures are placed upon each end of the rotary valve B and it is thus obvious that a fine adjustment can be maintained between the rotary valve and its seat especially in view of the non-expansible construction of the rotary valve.

An operative connection is established between the bevelled gear 50 keyed to the crank shaft 12, and the bevelled gear 51 keyed to the outer end of the stem 26 of the rotary valve; by the bevelled gears 52 upon the connecting shaft 53 and which insure that the crank shaft and rotary valve will rotate synchronously and at the same ratio of speed, and that the intake, compression, explosion, and exhaust strokes will be successively performed in their proper order.

In the type of internal combustion engine here shown it is preferred that oil cups 55 be located upon the top of the internal combustion engine and leading directly into alternate oil grooves, for the conveying of lubricant to the rotary valve B. An oil connecting pipe 56 establishes a drip connection between the rotary valve seat 18 and the crank case of the internal combustion engine. It is preferred that the lower edge of the tapered valve B be disposed at substantially right angles to the axes of the various cylinders.

A passageway 57 establishes an outlet for the circulating water into the radiator 58, while the pipe 59 is provided to convey the cooled water into the jacket 17. A head 60 is bolted or otherwise connected upon an end of the cylinder head D and upon that end which encases the smaller end of the rotary valve B, said casing having passageways 61 for the free circulation of the water within the water jacket of the motor.

A rotary valve as herein described will be maintained at a practically uniform diameter at all times and thus an even clearance between the same and its seat can be maintained at all times, thus doing away to a maximum extent with friction which is the common cause of failures of all rotary valves. No packing rings are required since the thin film of oil disposed about the rotary valve will insure against escape of compression and explosion of the combustible vapors. Due to the finely adjusted roller bearings, a permanent adjustment of the very small clearance can be maintained especially in view of the non-expansible construction of the rotary valve B. The stems 26 upon the conical valve 25 however, can be tapered or otherwise constructed of a high grade steel in order to make the same suitable for the screw threads and other strains incident thereto.

Very small chance of carbon accumulations upon the rotary valve will be afforded in view of the fact that the same port is used for the intake and exhaust gases, for it is readily seen that whatever carbon deposits are formed upon the port 25 will be broken up by the oxygen contained in the inrushing combustible vapors. Thus it will be seldom necessary to clean the valves in contra-distinction to the ordinary poppet valves now in use.

It is to be understood that the form of my invention herewith shown and described is to be taken as a preferred example of the same and that various changes in the shape, size and arrangement of parts may be made without departing from the spirit of the invention or the scope of the subjoined claims.

I claim:

1. In an internal combustion engine the combination of a plurality of cylinders and a cylinder head, having a longitudinal seat therein, of a rotary valve disposed in said seat, anti-friction means for adjusting said valve to provide and maintain a practically uniform predetermined clearance between said valve and said seat, and means for maintaining said valve at a practically uniform temperature whether said engine is running free or running under varying loads.

2. In an internal combustion engine the combination of a plurality of cylinders, a cylinder head having a longitudinally extending conical seat therein communicating with said cylinders, a conical rotary valve disposed within said seat and maintained at a practically uniform clearance therefrom, said valve having ports diametrically opposite each other adapted to communicate with exhaust and intake ports leading from and into said cylinders, said exhaust and intake cylinder ports being opposite each other so that the exhaust gases emitted from said exhaust ports contact with the surface of the port in said valve and immediately thereafter the same surface of said valve port will be swept and cooled by the incoming charge entering said cylinder through said intake valve ports, thereby tending to maintain said rotary valve at a relatively uniform temperature, means for rotating said conical valve at such a speed, relative to the rotation of the crankshaft of said engine, that diametrically opposite surfaces of said rotary valve will be caused to alternately and immediately contact first with the exhaust gases emitted from said cylinders and then with the cooling vapor of the incoming charge, thereby maintaining the said rotary valve at a practically uniform temperature under all working conditions.

3. In an internal combustion engine the combination of a plurality of cylinders, a cylinder head having a longitudinally extending conical seat therein, communicating with said cylinders, a conical rotary valve disposed within said seat, means for maintaining said valve at a practically uniform distance from said seat, said valve having ports diametrically opposite each other adapted to communicate with exhaust and intake ports leading from and into said cylinders and positioned opposite each other, so that the exhaust gases emitted from said cylinders will first contact with the surface of the port in said valve and immediately thereafter the same surface of the said valve port will be swept and cooled by the incoming charge entering said cylinders through their said intake ports, thereby tending to maintain said rotary valve at a relatively uniform temperature, means for rotating said conical valve at such a speed, relative to the rotation of the crankshaft of said engine, that diametrically opposite surfaces of said rotary valve will be caused to alternately contact with the exhaust gases emitted from said

exhaust ports of said cylinders, which said same surfaces will immediately be exposed to contact with the cooling vapor of the incoming charge, thereby tending to neutralize and absorb the heat from said exhaust heated surfaces in a manner to maintain the said rotary valve at a practically uniform temperature under all working conditions, said rotary valve being disposed within a water-jacketed housing, means for interposing and maintaining a film of oil between the external periphery of said valve and the internal periphery of said water-jacketed housing, thereby to assist in maintaining said rotary valve at a practically uniform temperature under varying conditions.

4. A combustion engine of the class described, comprising a plurality of cylinders, pistons reciprocable in said cylinders, a cylinder head common to all of said cylinders, having a longitudinal bore therethrough, open ports leading from said bore into said cylinders, a round rotatable valve disposed within said bore, adapted when rotated, to alternately open and close said ports, anti-friction means for rotatably mounting said valve within said bore in non-physical contact with the wall of said bore, means for maintaining a film of oil between the periphery of said valve and the wall of said bore, means for maintaining the temperature of said valve substantially constant under various loads and at various speeds.

5. A combustion engine of the class described, comprising a cylinder, a piston reciprocable therein, a cylinder head, having a longitudinal bore therethrough, a port connecting said bore with the interior of said cylinder, a rotatable valve disposed within said bore, anti-friction means for maintaining said valve in said bore in non-contact with the periphery of said bore.

6. A combustion engine of the class described, comprising a plurality of cylinders having pistons reciprocable therein, a cylinder head having a longitudinal bore therethrough, a rotatable valve disposed within said base in non-physical contact therewith, exhaust and intake ports in said cylinder head adapted to be alternately and intermittently in open and closed communication with the interior of said cylinders, means for putting said ports into alternating open and closed communication with the interior of said cylinders in timed relation with the movement of said pistons.

7. An internal combustion engine of the class described, comprising a plurality of cylinders having a common cylinder head, a bore longitudinally disposed throughout said head, a rotatable valve disposed within said bore in non-physical contact with the walls of said bore, the diameter of said bore at all points along its major axis being larger by a small fraction of an inch than the diameter of the said rotary valve at like points along its major axis when operatively disposed within said bore, means for maintaining a film of oil in the space between the walls of said bore and the periphery of said valve.

HERBERT SCHEEL.