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AUTOMATIC ROTARY VALVE CLEARANCE REGULATOR FOR
INTERNAL COMBUSTION ENGINES

Filed March 10, 1926

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The invention relates to tapered rotary valve mechanism for internal combustion engines.

The objects of the invention are to provide simple, economical, durable and practical means to prevent the rotary valve of the internal combustion engine described in my application Serial Number 71,404, and other internal combustion engines, from sticking in its seat; to provide means to maintain said valve in close proximity but spaced apart relation to its seat, whereby lubricant is adapted to occupy the clearance space between said valve and its seat to prevent the escape of compressed gases through said space from the cylinders of said engine; to provide mechanism to minimize the friction of said valve during its operation, whereby said valve is adapted to actuate with minimum wear and maximum efficiency; to provide means adapted to permit said engine to be rotated with the application of minimum power thereby saving the wear of the usual electric starting battery; to provide means adapted to automatically maintain said valve in substantially equal spaced apart distance from said seat irrespective of the normal operating temperature of said valve and engine; and to provide manually operative means whereby the clearance of said valve from its seat may be conveniently and correctly adjusted.

With the foregoing and other objects in view, which will appear as the description proceeds, the invention resides in certain novel features, the combination, arrangement of the parts and in the details of the construction, as will be more fully hereinafter described and claimed.

In the drawings:

Fig. 1 is a perspective view of an internal combustion engine with parts broken away, and showing the invention;

Fig. 2 is a section, with parts broken away, taken on a line corresponding to 2—2 in Fig. 1;

Fig. 3 is a section, with parts broken away, taken on a line corresponding to 3—3 in Fig. 1;

Fig. 4 is a section taken in the same plane as Fig. 3, but showing a modified form of the invention;

Fig. 5 is a vertical transverse section of the engine in Fig. 1, showing another modified form of the invention attached thereto;

Fig. 6 is a vertical transverse section of the tube supporting arm;

Fig. 7 is a vertical transverse section taken on a line corresponding to 7—7 in Fig. 1; and

Fig. 8 is a section taken on a line corresponding to 8—8 in Fig. 4.

In the preferred construction of the invention, I provide internal combustion engine 1 comprising usual engine block 2 having engine head 3 suitably fixed thereto. The block 2 is provided with usual cylinders 4 into which are fitted usual reciprocating pistons 5.

The engine head 3 consists of valve casing 6 which extends horizontally and longitudinally of the head and has bearing or seat 7 slightly tapered from front 8 to rear 9 of the engine. Extending longitudinally of head 3, and fixed by bolts 10 to its sides 11 and 12, respectively, are inlet and exhaust pipes 13 and 14. The pipes 13 and 14, respectively, have pipes connected therewith which lead to a usual carbureter (not shown) and to a usual exhaust pipe muffler (not shown). Water jackets 15 and 16, respectively, are around casing 6 and cylinders 4.

The tubular tapered valve plug 17 is rotatably mounted in seat 7 of casings 6, and as hereinafter will be fully explained, the valve 17 is unadapted to contact seat 7.

The webs 18 in the form of fans 19 are fixed in spaced apart relation inside valve 17 for the combined purposes; to create air currents through the rotatable valve to effectually maintain a low temperature of the valve; to support the walls of the valve against inward pressure exerted by the force of the explosions within cylinders 4 of the engine; and to provide means to secure shaft 20 to the valve.

Each of the webs 18 has hole 21 into which shaft 20 is fitted and fixed in concentric relation to the outer tapered bearing surface 23 of valve 17.

The outer ends 24 and 24', respectively, of shaft 20 are rotatably mounted and slidable longitudinally in bearings 25 and 26, suitably secured to engine 1, whereby the valve is slidable longitudinally of its seat 7. The shaft 20 being concentrically positioned in
relation to valve 17 and seat 7 of casing 6, the tapered surface 23 of the valve is always parallel to the tapered seat 7 in casing 6.

To provide automatic means to exert rearward force on valve 17, the rear end 27 of shaft 20 has race plate 28, of thrust bearing 28, fixed thereto. Compressed coil spring 29, positioned around portion 30 of the shaft, has ends 31 and 32, respectively, secured to race plate 28 and contacting bearing 25 whereby compressed spring 29 is caused to exert continuous pressure against plate 28 thereby tending to force valve 17 rearwardly in contact with tapered seat 7 of casing 6.

Pipes 33 and 34, shown in Figs. 1, 3 and 4 are, respectively, connected with casing water jacket 15, and usual water jacket 16 around cylinders 4 in engine block 2. The water jacket 16, of engine block 2, as usual, is connected with the bottom of the usual radiator (not shown) by pipe 34 and the water jacket 15, of casing 6, is connected with the top of the radiator by pipe 33, whereby the water is caused to circulate, inasmuch as jackets 15 and 16, are connected, and the water, or other cooling agent, within the jackets is heated as a result of the explosions within cylinders.

The ends 33 and 38, respectively, of flexible pipes 37 and 38, are connected with casing jacket 16 and block jacket 16. The ends 39 and 40, respectively, of pipes 37 and 38, are connected with tube 41, of metal or other suitable material adapted to contract and expand by effect of temperature. The water is adapted to circulate from jacket 16 through pipe 38 into tube 41, and through pipe 37 into jacket 15, whereby the temperature of the water in jacket 16 is adapted to effect the temperature of tube 41. Extended end 42 of tube 41 is pivotally mounted, by pivot 43, in bifurcated end 44 of proper port 45 fixed to head 2 by bolts 46. Rod 47, integral with end 48 of tube 41, has groove 49 in its end 50. Rotatably mounted in groove 49, as by pin 51, is roller 52 having bearing contact with pendent arm 53 having its upper end fixed to the end of spindle 54 rotatably mounted in bearings 55 fixed to lower rear edge 56 of head 2 by bolts 57. Rocker arm, 58 having its lower end 59 fixed to spindle or rod 54, bolt 60 threaded in its upper end 61. Integral with end 62 of bolt 60 is concave holder 63 having semi-spherical member 64 movable universally therein. The outer side 64 of member 64 is in contact with race plate 65 of thrust bearing 25, whereby shaft 20 is adapted to be moved longitudinally (by screwing or unscrewing bolt 60) to position valve 17 in spaced apart relation from seat 7 in casing 6. This adjustment is made permanent by tightening nut 60', whereby during the operation of engine 1 the surface 23 of the rotary valve rotates in sufficiently close proximity to seat 7 to prevent actual contact of the valve with the casing and to permit lubricant or other suitable sealing element (suitable conveyed to seat 7) to seal the space 66 between the valve and its seat, whereby the compressed gases are prevented from escaping from cylinder 4 through space 66.

Inasmuch as the linear expansion, for a unit length for each degree of temperature, of certain metals is not proportional to the applied heat, the coil spring 67, secured to tube 41 and side 68 of block 2, is arranged to urge the tube downwardly in contact with roller 69 rotatably mounted in top of elongated container 71 made of metal or other suitable material which is caused to expand by the application of heat.

The elongated container is fixed to engine block 2, as by bolts 72 received through the bottom of the tube, whereby expansion and contraction, respectively, of the container is adapted to force tube 41 upwardly and permit spring 67 to force tube 41 downwardly. To provide means to expand and contract the container 71 proportionally to the temperature of engine 1, the ends 73 and 74, respectively, of flexible pipes 75 and 76, are connected with the upper and lower portions respectively of the container. The ends 77 and 76, respectively, of the pipes 75 and 76, are connected with water jacket 16 of the engine block whereby water from within jacket 16 is adapted to circulate through pipe 76, container 71 and pipe 75 thereby causing the container to expand and contract as the temperature of the water changes. The curved surface 79 of arm 80, upon which roller 52 is adapted to roll may be plotted to permit the required movement (through rod 54, arm 58, bolt 60, member 64 and bearing 25) of shaft 20 to maintain valve 17 closed, or spaced apart from seat 7 irrespective of the temperature of the engine during its normal operation.

In Fig. 4, I show a modified form of the invention which is adapted to maintain valve 17 in equal spaced relation from seat 7 during the various conditions under which the engine will operate, when the various parts of the mechanism are made of metals which expand proportionally to the applied heat. The tube 41 is pivotally connected with support 45, in the manner previously described of the structure shown in Figs. 1 and 2.

The L-bolt 80 is pivotally mounted in groove 81 in end 82 of tube 41, as by bolt 83 combinedly received through holes 84 and 85, respectively, in end 82 and bolt 83. The upper end of bolt 80 is threaded in the lower end of pendent arm 86, having its upper end fixed to spindle 54, whereby the adjustment of bolt 80 to a position, depending upon the expansibility of tube 41, in the threaded end of arm 86 is adapted to main-
tain the valve 17 spaced a predetermined distance from seat 7 of casing 6 through operation of the mechanism herein previously described and comprising, arm 58, bolt 60, member 64, bearing 28, spring 29 and shaft 20. The pipes 33 and 34, respectively, are connected with jackets 15 and 16, to provide water to regulate the temperature of the tube.

In Fig. 5 I show still another modified form of the invention in which tube 41, in combination with either of the detailed structures shown in Figs. 1 or 4, may be connected with flexible pipes 37 and 38 whose respective ends 35 and 36 are connected with exhaust pipe 14, adjacent the engine, and the exhaust pipe adjacent the muffler (not shown), whereby the temperature of tube 41 is regulated by the heat transmitted from engine 1, for purposes herein previously fully explained.

The chief advantage of the invention is to permit valve 17 to rotate, during the operation of engine 1, in close proximity of seat 7 of casing 6, whereby the spring 29 is unadapted to force the valve in wedging engagement with its seat. Because of the fact that sufficient compression must be maintained in spring 29 to prevent the valve from being removed a substantial distance from its seat, during the operation of the engine and under the various conditions of the utilization of the engine, the effect of heat or the rapid rotation of the valve or the loss of lubricant or the combined effect of some or all of these things is likely to cause the valve to stick or wedge in its seat, as well as score and mutilate the surface 23 of the valve and its seat if spring 29 were permitted to force valve 17 in direct contact with seat 7, whereby the rotary valve would be rendered valueless as a dependable, economical and durable mechanism. The lubricant, or other suitable sealing agent or element, may be forced into space 66 by usual means, as by a usual oil or other pump 87, suitably operated, supplying the sealing agent under pressure to pipe 88 and thence into auxiliary pipes 89 and onto surface 23 of valve 17.

Another advantage of the invention is that the outer surface of valve 17 or its seat 7 is unlikely to be scored or otherwise damaged should the engine become overheated as a result of depletion of the lubricant between the valve and its seat, as the mechanism herein previously described is adapted to maintain the valve from actual contact with its seat.

While I have chosen to illustrate the forms and constructions of the invention by the herein drawings and explanations of the same, it is understood that the invention resides in the combination, arrangement of the parts and in the details of the construction, as hereinafter claimed. It is further understood that changes in the precise embodiment of the invention, as disclosed herein, can be made within the scope of what is claimed without departing from the spirit of the invention, as other expediency may readily suggest themselves to the art.

What I claim as new and desire to secure by Letters Patent is:

1. In a device of the class described, a valve casing, a tapered valve rotatable in said casing, thermostatic means to maintain said valve in close proximity to the inner walls of said casing whereby a space is formed between said valve and said casing, a sealing element, and means to supply said sealing element into said space.

2. In a device of the class described, a valve casing, a valve rotatable in said casing, thermostatic means to maintain said valve in close proximity to said casing whereby a space is formed between said valve and said casing, a sealing element, and means to supply said sealing element into said space.

3. The combination with an internal combustion engine, of a tapered rotary valve, a tapered seat for said valve, means to maintain said valve in close but spaced apart relation to said seat, whereby lubricant is adapted to occupy the space between said valve and its seat to prevent the compression within the cylinders of said engine escaping between the valve and its seat, and means adapted to maintain said valve in equal distance from said seat irrespective of the normal temperatures of said engine.

4. The combination with an internal combustion engine, of a tapered rotary valve, a casing, a tapered seat in said casing in which said valve is adapted to rotate, means to automatically maintain said valve in closely spaced apart relation to said seat, means to fill the space between said valve and said seat whereby the compression within the cylinders of said engine is unadapted to escape through said space, and automatic means to maintain said valve in a predetermined spaced relation to said seat.

5. The combination with an internal combustion engine, of a casing fixed to the block of said engine and having a tapered valve seat therein, a tapered valve rotatably mounted in said seat, means to automatically maintain said valve in closely spaced relation to said seat and means to fill the space between said valve and said seat whereby the compressed gases are unadapted to escape from the cylinders of said engine between the valve and its seat.

6. The combination with an internal combustion engine, of a casing having a tapered valve seat therein, a tapered valve rotatably mounted in said seat, means to automatically maintain said valve in closely spaced relation to said seat and means to fill the space
between said valve and said seat whereby the compressed gases are unadapted to escape from the cylinders of said engine between the valve and its seat.

7. The combination with an internal combustion engine having a water jacket around the cylinders, of a tapered rotary valve, a casing in which said valve is rotatable, and having a water jacket, a shaft supporting said valve and fixed thereto and slide longitudinally, bearings for said shaft, a coil spring to maintain outward force longitudinally of said shaft and having its inner end in engagement with one of said bearings, a thrust bearing having its inner race fixed to the outer end of said shaft and the other end of said coil spring fixed to the outer race, a spindle rotatably mounted transversely of said engine, a rocker arm fixed to said spindle, a bolt threaded in the upper end of said rocker arm and having connection with said shaft, whereby screwing and unscrewing said bolt is adapted to cause longitudinal movement of said shaft and said valve for spacing said valve from said bearing, a tube fixed to said engine, means connecting the water jacket of said casing to said tube, means connecting the water jacket of said casing to said tube, means connecting the water jacket of said cylinders to said tube, and connecting means between said tube and said spindle whereby expansion and contraction of said tube effected by the temperature of the water from said jackets is adapted to rotate said spindle thereby determining the longitudinal position of said valve, substantially as and for the purposes specified.

8. The combination with an internal combustion engine, having a water jacket around its cylinders, of a tapered rotary valve, a casing having a tapered bearing in which said valve is rotatable and having a water jacket, a shaft supporting said valve and fixed thereto and slide longitudinally, bearings for said shaft, resilient means to maintain outward force longitudinally of said shaft, a spindle rotatably mounted transversely of said engine, a rocker arm fixed to said spindle, a bolt threaded in the upper end of said rocker arm and having connection with said shaft, whereby screwing and unscrewing said bolt is adapted to cause longitudinal movement of said shaft and said valve for spacing said valve from said bearing, a tube fixed to said engine, means connecting the water jacket of said casing to said tube, means connecting the water jacket of said casing to said tube, means connecting the water jacket of said cylinders to said tube, and connecting means between said tube and said spindle whereby expansion and contraction of said tube effected by the temperature of the water from said jackets is adapted to rotate said spindle thereby determining the longitudinal position of said valve, substantially as and for the purposes specified.

9. The combination with an internal combustion engine, having a water jacket around its cylinders, of a tapered rotary valve, a casing having a tapered bearing in which said valve is rotatable and having a water jacket, a shaft supporting said valve and fixed thereto and slide longitudinally, bearings for said shaft, a coil spring to maintain outward force longitudinally of said shaft, a spindle rotatably mounted transversely of said engine, a rocker arm fixed to said spindle and having connection with said shaft, a metal tube fixed to said engine, a pipe connected from the water jacket of said casing to said tube, a pipe connected from the water jacket of said cylinders to said tube, and connecting means between said tube and said spindle whereby expansion and contraction of said tube effected by the temperature of the water from said jackets is adapted to rotate said spindle, thereby determining the longitudinal position of said valve with relation to said casing bearing is determined, substantially as and for the purposes specified.

10. The combination with an internal combustion engine, of a rotary valve, a seat for said valve, and automatic means to maintain said valve in adjusted position with relation to said seat.