Aug. 12, 1924. 1,504,507

E. E. RICHARDSON

ENGINE VALVE

Filed Jan. 10, 1920 2 Sheets-Sheet 1

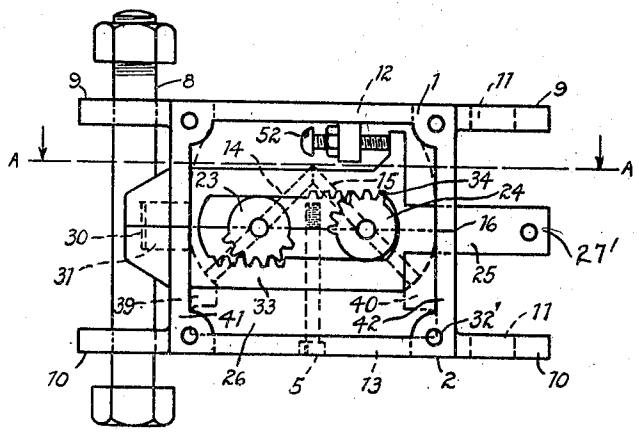

Fig-1

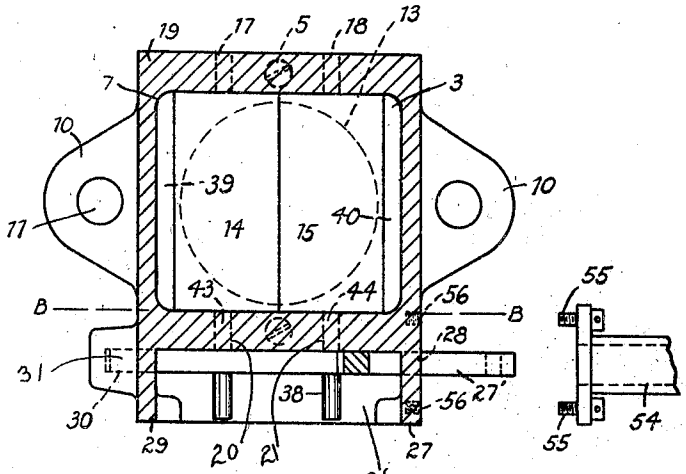

Fig-2

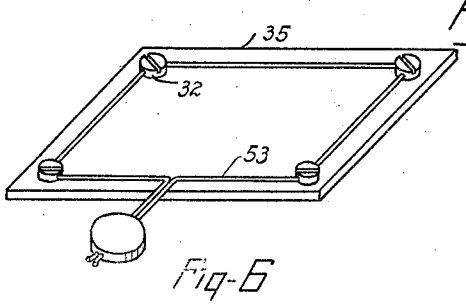

Fig-6

E. E. Richardson.
INVENTOR.

BY Richey Slough & Tales

HIS ATTORNEYS

Aug. 12, 1924. 1,504,507

E. E. RICHARDSON

ENGINE VALVE

Filed Jan. 10, 1920 2 Sheets-Sheet 2

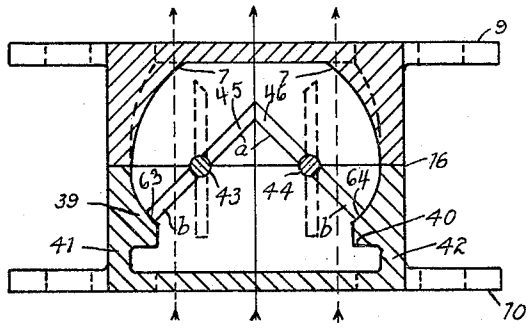

Fig-3

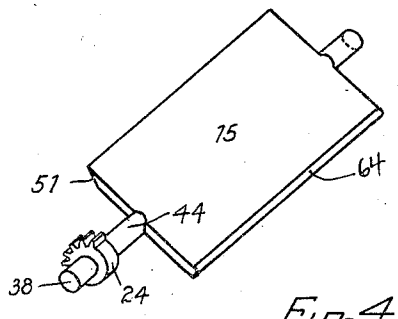

Fig-4

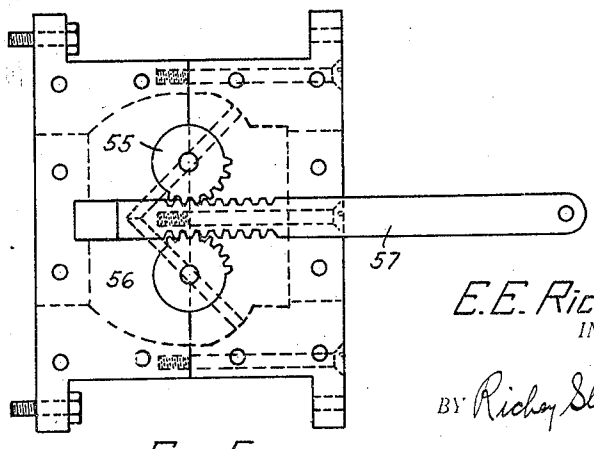

Fig-5

E. E. Richardson
INVENTOR.

BY Richey Slough & Tilso

HIS ATTORNEYS

Patented Aug. 12, 1924.

1,504,507

UNITED STATES PATENT OFFICE.

EDWARD E. RICHARDSON, OF TOLEDO, OHIO, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO THE R. & S. VALVE COMPANY, OF ELYRIA, OHIO, A CORPORATION OF OHIO.

ENGINE VALVE.

Application filed January 10, 1920. Serial No. 350,696.

To all whom it may concern:

Be it known that I, EDWARD E. RICHARDSON, a citizen of the United States, residing at Toledo, in the county of Lucas and State of Ohio, have invented certain new and useful Improvements in Engine Valves; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to throttle or governing valves for engines of various types, but is particularly adapted to explosion engines. Throttle valves for explosion engines consist, generally, of circular vanes inside a casing having a circular passage. When the vane or butterfly-valve is rotated to the open position, the gas or fuel mixture passes along both sides of the vane in substantially equal volume. Two streams of gas, therefore, are directed past the valve and these flow along the side walls and encounter a maximum amount of frictional resistance. The velocity of the gas streams is, therefore, reduced and condensation on the passage walls takes place, to a considerable extent. This type of valve is not all that could be desired for any kind of throttle control of gas engines, and it is especially unsatisfactory for the so-called "governor" control, where a speed governor is used to throttle the gas, in addition to the usual hand control, as the two controls cause an excessive amount of condensation. For this reason, a great deal of trouble has been experienced with governor control of gas engine throttles.

It is the object of my invention to overcome these disadvantages, as well as others referred to in the following description, reference being had to the drawings, in which:

Fig. 1 is a side view of my improvement with the cover plate removed.

Fig. 2 is a sectional plan taken on the line A—A of Fig. 1.

Fig. 3 is a sectional elevation taken on the line B—B of Fig. 2.

Fig. 4 is a perspective view of the vane or shutter.

Fig. 5 is a modification showing a slightly different valve operating device.

Fig. 6 shows the securing means for certain screws.

Referring to the drawings, the valve consists preferably of two parts 1 and 2 having a chamber 3 of rectangular cross section. The two sections are secured together by any means, such as screws 5. The sections 1 and 2 have standard size couplings 9 and 10 for attaching to the cylinder block of the engine and to the carburetor, or to any other desired part of the engine. Suitable holes 11 are made in the fittings 9 and 10 to permit the valve to be clamped in position.

I have shown the couplings with lugs or ears through which the connecting bolts 8 (one only being shown) are adapted to pass. These bolts extend not only through the connections 9 and 10, but also through the flanges of the carburetor and intake pipe or other part of the engine to which they are clamped. In this way the bolts hold the sections 1 and 2 tightly together in addition to clamping the valve casing to the engine parts. It is, therefore, necessary to use only a few screws, such as 5, as these will be needed in order to keep the parts together only when the valve casing is removed from the engine. By constructing the connecting flanges in this way, the strain is taken off of the lugs in which the holes 11 are placed, and these, therefore, may be made of light construction. The openings 12 and 13 in the valve sections may be of any desired shape, but preferably they are made circular, as shown, since this is the general section of passageway in standard engine and carburetor fittings. Fillets 7 may be used to cause the rectangular chamber 26 to merge into the circular openings.

Inside the valve casing are journalled two vanes or shutters 14, 15 and for ease of assembly, I prefer to make the bearings by drilling out holes 17, 18, 20 and 21 in the two blocks along the center line 16, shown more clearly in Fig. 3. The journals or shafts of the shutters are secured to pinion members 23, 24, which mesh with a rack

member 25. The casing members 1 and 2 have a gear housing 26 for the reception of the pinion and rack members, as shown clearly in Figs. 1 and 2. The end wall 27 of the housing has a slot 28 adapted to permit the end 27′ of the rack member 25 to slide therein, while the other wall 29 of the housing has a slot 30 receiving a projection 31 on the other end of the member. The rack 25 is provided with a slot, and the opposite walls are provided with teeth 33, 34, which mesh with the teeth on the pinion members 23, 24. A cover plate 35 (Fig. 6) is secured on the housing walls by suitable screws 32 adapted to thread into holes 32′.

The casing member 2 has seat members 39 and 40 on its side walls 41, 42 and the seating surfaces on these are substantially concentric with the axes 43, 44 of the shutters. The shutters have curved bottom wings 63, 64, preferably made concentric with the axes referred to, and the arrangement is such that these make a snug moving fit with the seating surface on the side wall projections.

In order to pass the major portion of the fuel mixture through the center of the passageway, indicated by the full line arrow, Fig. 3 the seat members 39 and 40 project sufficiently inwardly from the side walls 41 and 42 to permit the top or leading wings 45, 46 to have considerable movement to and from the closed position before the bottom wings leave the valve seats. With this construction the gas will pass entirely between the upper wings of the shutters for a considerable range of speed of the engine, which is very desirable, as in the lower engine speeds condensation will be very materially reduced. Inasmuch as the shutters make a snug moving fit with the end walls, no gas will pass around the ends.

The upper wings *a* of the vanes 14 and 15 are preferably bevelled, as shown at 51 (Fig. 4), though, of course, this may be omitted when desired, and the seating surfaces 39, 40 are so arranged that there will be sufficient space for movement of the lower or trailing wings *b* of the shutters to insure that the bevelled surfaces on the upper wings of the shutters can be brought into contact with each other. However, it is not always desirable to completely close the throttle valve of a gas engine, and, of course, whenever desired, the valves can be adjusted to a minimum closed position by a suitable screw stop 52. This screw adjustment is preferably enclosed in the housing 26 and a sealing wire 53 may be passed through the screw heads 32 to prevent unauthorized tampering with the adjustment when the cover is in position. To further prevent tampering, a tube member 54 may enclose the rack end 27′ and the governor connection (not shown). Screws 55 may thread into the holes 56 in the housing wall 27 to secure the tube 54 in position. Sealing means may also be used to prevent the removal of these screws, if desired.

Various changes may be made in the valve arrangement, and another embodiment is shown in Fig. 5. In this embodiment the pinion members 55 and 56 secured to the shutters are operated by a rack member 57 passing between them.

My improved valve casing can be readily die-cast and no machine will be required. The cost of manufacture will, therefore, be low.

The slides 25 and 57 may be connected to the hand throttle for controlling the engine, or they may be connected to any suitable governor to limit the speed of the engine, as is quite common, especially in trucks. By moving the control towards the open position, the rack members 25 will be forced to the right in Fig. 1 and the pinion members 23, 24 will move simultaneously counter-clockwise and clockwise, respectively. This will move the shutter 14 counter-clockwise and the shutter 15 clockwise and permit fuel mixture to pass between the top wings *a*. The stream of gas mixture will be directed through the center of the passageway, as indicated by the arrow in Fig. 3, and will meet with minimum resistance, as skin friction from the casing walls will be absent. To increase the fuel mixture, the rack member can be shoved farther to the right and permit more and more mixture to pass between the top wings *a*, until finally the bottom wings *b* pass off of the curved surfaces of the seats or projections 39, 40. Fuel mixture will then commence to pass to the outside of the shutters, but the resistance of the chamber walls will be much reduced, as there is a wide channel for the outer streams of gas, due to the projecting seat members sealing the passage until the lower wings are a considerable distance from the chamber walls. The path of the gas is not along the side walls, but follows the line of the dotted arrows in Fig. 3.

The operation of the modification shown in Fig. 5 will be evident from what has already been described, but it may be briefly said that since the rack 57 engages with opposite sides of the pinion members 55 and 56, movement of the rack will simultaneously move the vanes in opposite directions in the same manner as in the first modification.

My improved form of throttle valve has been found to be especially suited for explosion engines, as there is substantially no skin friction from the casing walls. Condensation is, therefore, materially reduced, or entirely eliminated in the neighborhood of the valves. Consequently, superior results are obtained.

While I have shown particular embodiments of my invention, it will be apparent that various other changes and modifications may be made without departing from the spirit of the invention.

Having described my invention, what I claim is:

1. In engine valves, a casing having a chamber, a plurality of shutters journalled in said chamber and snugly fitting the end walls thereof, means for rotating said shutters simultaneously in opposite directions, and seats projecting inwardly from the side walls of said chamber and being adapted to engage certain wings of adjacent shutters before the other wings engage with each other.

2. In engine valves, a casing having a chamber, a plurality of shutters in said chamber and snugly fitting the end walls thereof, journals on the ends of said vanes, means for rotating said vanes simultaneously in opposite directions, and curved seats projecting inwardly from the side walls of said chamber, the curvature of each seat having a center in the journal of the adjacent shutter.

3. In engine valves, a casing having a chamber, a plurality of shutters therein, journals attached to the ends of said shutters and dividing them into two wings, the edges of certain of said wings being curved about said journals, and the edges of others of said wings being bevelled, means for rotating said shutters simultaneously in opposite directions, and seats projecting from the side walls of said chamber and having surfaces curved about adjacent journals to engage said curved edges on the wings before the bevelled edges of the vanes engage each other.

4. In engine valves, a casing having a chamber, two shutters therein, journals attached to the ends of said shutters and dividing them into two wings, and having bearings in the end walls of said chamber, the edges of the bottom wings having centers of curvature in said journals, and the edges of the top wings being bevelled, means for rotating said vanes simultaneously in opposite directions, seats projecting from the side walls of said chamber having surfaces curved about adjacent journals and being adapted to engage the bottom portions of adjacent vanes before the said bevelled edges engage with each other.

5. The combination with a valve casing, of a plurality of rotatable vane members mounted in a passage of the said casing, each vane being adapted to rotate about an individual axis located intermediate its ends, side wall projections of the said casing, means to simultaneously rotate the vanes on their axes to cause adjoining vane ends to form a closed connection and to move the opposite ends of vanes next adjacent the side wall projections over the surfaces of the said projections.

6. The method of operating an internal combustion engine valve, consisting in first opening the center of the valve passage, then gradually increasing the area of the center opening, and finally, after a predetermined center opening, opening another valve passage section, said operations being performed by a continuous movement of the same mechanism.

7. The method of operating an internal combustion engine valve, consisting in first opening the center of the valve passage, then gradually increasing the area of the center opening, and finally, after a predetermined center opening, opening side valve passage sections, said operations being performed by a continuous movement of the same mechanism.

8. The method of operating an internal combustion engine valve, consisting in first opening the center of the valve passage, then gradually increasing the area of the center opening, then, after a predetermined center opening, opening side valve passage sections, and then gradually increasing the area of all the valve passage openings, said operations being performed by a continuous movement of the same mechanism.

9. In combination with a valve casing, of a plurality of rotatable vane members mounted in a passage of the said casing, each vane being adapted to rotate about an individual axis located intermediate its ends, side wall projections of the said casing, adjusting means to simultaneously rotate the vanes on their axes to cause adjoining vane ends to form a closed connection and to move the outer end of each of said vanes over a surface of one of said projections.

10. The combination with a valve casing, of a plurality of rotatable vane members mounted in a passage of the said casing, each vane being adapted to rotate about an individual axis, the axis of each of said vanes being located intermediate the sides of and at the ends of each vane, side wall projections of the said casing, means to simultaneously rotate in opposite directions each of the said pair of vanes on its axis to cause their approaching vane ends to form a closed connection and to move the receding ends of the said pair of vanes each over a surface of an adjacent one of the said projections.

In witness whereof, I have hereunto set my hand this 6th day of January, 1920.

EDWARD E. RICHARDSON.