Aug. 12, 1924. 1,504,508

E. E. RICHARDSON

ENGINE VALVE

Filed Jan. 10, 1920 2 Sheets-Sheet 1

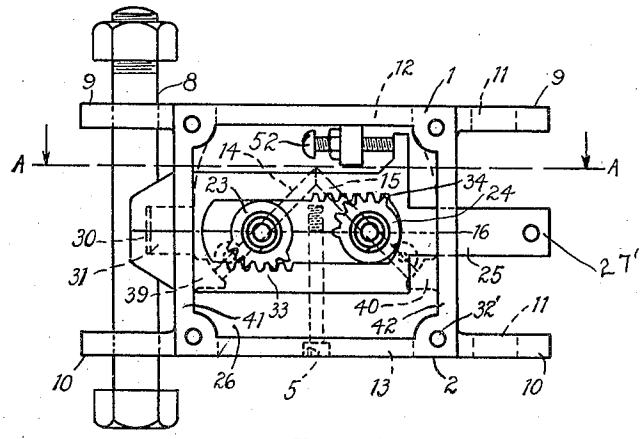
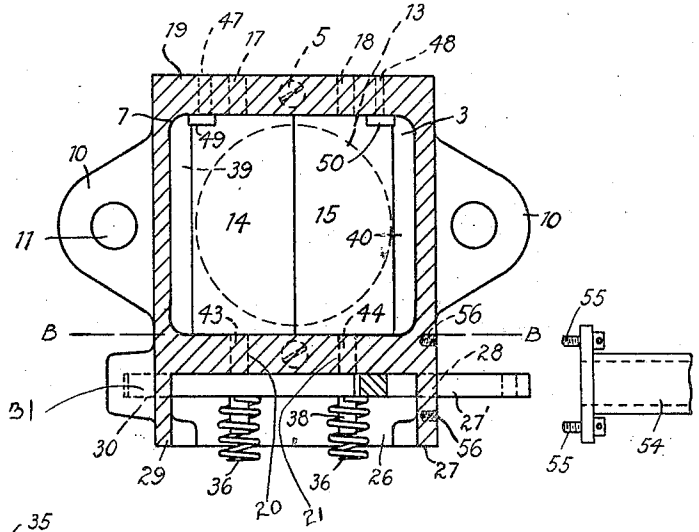


Fig-1



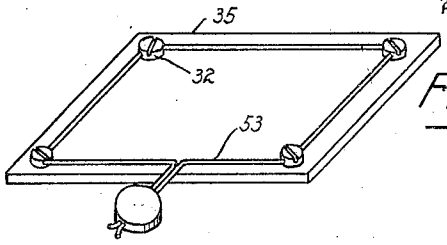


Fig-2

Fig-6

E. E. Richardson.
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HIS ATTORNEYS

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ENGINE VALVE

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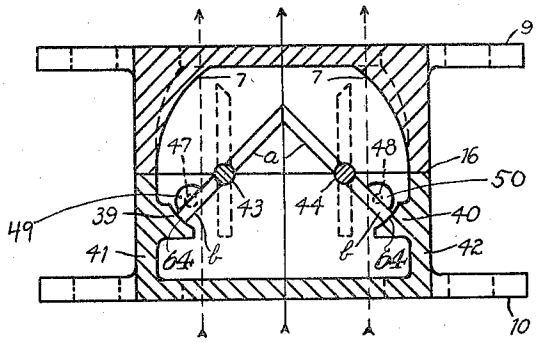


Fig-3

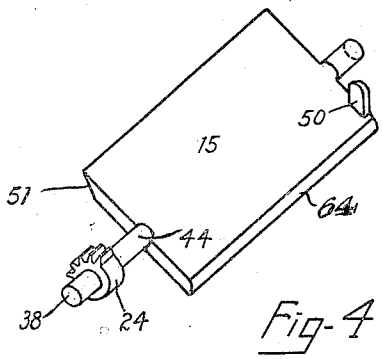


Fig-4

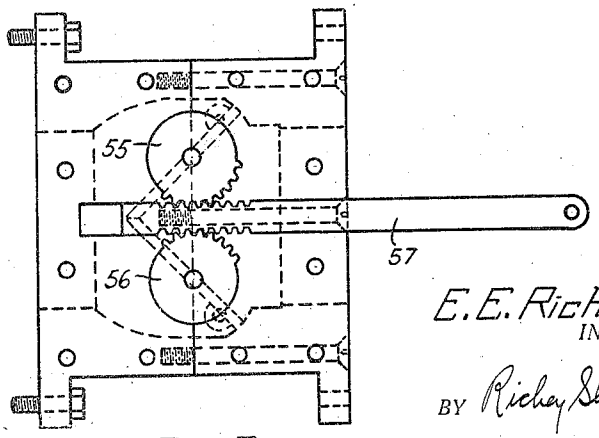


Fig-5

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Patented Aug. 12, 1924. 1,504,508

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. 350,697.

To all whom it may concern:

Be it known that I, EDWARD E. RICHARDSON, a citizen of the United States, and a resident of 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 stream 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 means to securely hold certain screws in set position.

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 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 of the rack member 27′ 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 rack 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′, and in this housing are arranged springs 36 adapted to press against the pinion members to yieldingly maintain the shutters against the opposite wall 19, for a purpose to be referred to later. The springs are shown as fitting around extensions 38 on the axes of the shutters, and bear against the cover 35 when it is put in place.

The casing member 2 has seat members 39 and 40 on its side walls 41, 42 and the seating surfaces on these are preferably concentric with the axes 43, 44 of the shutters. The shutters have curved bottom portions 64, Figures 3 and 4, 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.

It would naturally be supposed that the axes 43, 44 should be in the center of the shutters, in order to produce balancing and easy movement. However, in my experiments, I have discovered that this is not the case. The shutters are held tightly closed under engine suction, and a considerable force is required to open them. To overcome this tendency to stay in closed position, I make the upper wings *a* longer than the bottom wings *b*, that is, the lengths projected on the plane passing through the axes 43, 44. However, when the wings are so proportioned as to balance, there is a tendency to chatter, and a failure to follow instantly the movements of the governor or throttle lever, because of the back-lash of the gear teeth and the play in the throttle or governor connections, both of which are unavoidable from a practical standpoint. Therefore, to avoid these disadvantages, I make the leading wing *a* enough longer than the trailing wing *b* to always bias the shutters to the open position through the engine suction. The shutters, therefore, follow up the movement of the governor or throttle lever, and open as far as permitted. Chattering is, therefore, eliminated, and the shutters instantly respond to the backward and forward movements of the governor or throttle lever.

In order to pass the major portion of the fuel mixture through the center of the passageway, the seat members 39 and 40 project sufficiently inwardly from the side walls 41 and 42 to permit the top wings *a* to have considerable movement from the closed position before the bottom wings *b* leave the valve seats. With this construction the gas will pass entirely between the upper wings of the shutters, as shown by the full line arrow, 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.

It is an advantage to introduce uncarbureted air into gas engine intakes at the higher speeds, and I prefer to provide small air vents 47, 48 in the end wall 19 of the lower member 2. These vents are shown in dotted lines in Figs. 2 and 3. The vents may be screw-threaded and made of different sizes, so that screws may be threaded into them. For example, by placing a screw in the hole 47 a small amount of air will pass into the chamber 26 when the shutters are opened. By removing the screws from 47 and putting another one in 48 a greater amount of air will be admitted. Further, by leaving both vents 47 and 48 open, a maximum amount of air can be admitted. Adjustment is, therefore, made possible for particular cases.

The bottom wings of the shutters 14 and 15 have projections 49, 50 adapted to hold these vents closed until the shutters have moved a considerable extent. While various degrees of movement may be provided, I prefer to delay the opening of the air vents until the lower wings of the shutters are substantially leaving the valve seats. Then as the carbureted mixture passes to the outside of the bottom wings, uncarbureted air will be drawn in through the vents to mix therewith.

The springs 36, previously referred to, yieldingly maintain the vent closures 49 and 50 snugly against the end wall 19, so as to prevent leakage when the vents are closed. The springs, however, may be omitted, if desired, as the shutters should make a snug enough moving fit with the end walls to prevent the fuel mixture passing by the ends, and this would be sufficient in most cases to prevent undue leakage through vents 47 and 48 in closed positions.

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 member 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*. In case the shutters are biased to open position, as referred to, they will open as far as the control movement permits. 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 the 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 and preferably at this time, the air vents 47, or 48, or both, commence to open and uncarbureted air will mix with the fuel. Further movement of the rack member will permit more and more gas to pass through the center cells to the outside of the shutters, and more and more uncarbureted air to enter through the vents. The operation of the shutters in the reverse arrangement will be clear from this description.

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. Chattering is also eliminated, and movement of the control lever backward or forward will produce, instantly, similar movements of the shutters. Even when the wings *b* leave the valve seats and a stream of fuel mixture is permitted to flow past the outside of the wings *b*, there is substantially no condensation, since the path of the mixture is not directed along the walls, the path being indicated by the dotted arrows in Fig. 3. Therefore, the seat members 39 and 40 on the side walls of the casing act to prevent condensation, even after the wings *b* have ceased to make contact therewith.

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, shutter mechanism journaled in said chamber to provide wings therein of unequaled length, a seat on a wall of said chamber and means operative to cause said wings to be moved to different operative positions, in one of said positions one of said wings will engage said seat and the other wing being so disposed as to maintain a slightly opened passage through said chamber, in another operative position said wing engaging said seat and said other wing closing the passage, and another operative position being that in which the passage is opened by both wings, said first wing being out of engagement with said seat.

2. In engine valves, a casing having a chamber with a by-pass opening, a plurality of shutters journalled in the end walls of said chamber, seats on the side walls of said chamber adapted to engage adjacent shutters, and means on one shutter adapted to close said by-pass before the shutters are rotated into engagement with each other.

3. In engine valves, a casing having a chamber with a by-pass opening, a plurality of shutters journalled in the end walls of the chamber, seats on the side walls of said chamber adapted to engage adjacent shutters before the shutters engage each other, and means on one shutter adapted to close said by-pass substantially when the shutters engage said seats.

4. In engine valves, a casing having a chamber, a plurality of shutters journaled

in said chamber each having wings of unequalled length disposed on either side of the shutter journal, a pair of seats on opposite walls of said chamber, a shorter wing on each shutter being adapted to engage its adjacent seat when the shutters are moved to close the passage through the chamber, said other wings of said shutters remote from the seats being at the time adapted to engage with each other, said seats being of sufficient length to permit movement of the shutters to cause separation of the contacting wings thereof without said other wings entirely leaving said seats.

5. In engine valves, a casing having a chamber therein, a plurality of shutters so journalled in said chamber as to provide each with wings of unequal length, seats on the walls of said chamber and means for rotating said shutters to cause a pair of said shorter shutter wings to make a gas flow restricting connection with said seats.

6. In engine valves, a casing having a chamber therein, a plurality of shutters journalled in said chamber to provide wings of unequal length, seats on the walls of said chamber and means for rotating said shutters to cause certain of said wings to engage said seats before certain of the opposite wings engage each other.

7. In engine valves, a casing having a chamber therein, a plurality of shutters in said chamber, journals eccentrically mounted on said shutters to provide wings of unequal length, seats on the walls of said chamber and means for simultaneously rotating said shutters in opposite directions to cause the shorter wings of said vanes to engage the said seats.

8. In engine valves, a casing having a chamber therein, a plurality of shutters in said chamber, journals eccentrically mounted on said shutters to provide wings therefor of unequal length, seats on the walls of said chamber, by-passed openings in the chamber walls, means for simultaneously rotating said shutters in opposite directions to cause the more remote wings of said shutters to engage said seats and to close said by-passed openings.

9. In engine valves, a casing having a chamber, shutter mechanism so journalled in said chamber as to provide wings of unequal length, a seat on a wall of said chamber, and means whereby said shutter mechanism is adapted to be moved to cause one wing to engage said seat before the other wing closes the passage through said chamber.

10. In engine valves, a casing having a chamber, shutter mechanism so journalled in said chamber as to provide wings of unequal length, a seat in a wall of said chamber and means whereby said shutter mechanism may be rotated to cause the shorter wing to engage said seat before the other wing closes the passage through said chamber.

11. In engine valves, a casing having a chamber therein, a plurality of shutters in said chamber, journals eccentrically mounted to divide said shutters into short and long wings, seats projecting inwardly from the walls of said chamber and means for simultaneously rotating said shutters in opposite directions to cause the adjacent shorter wings to engage said seat before the longer adjacent wings engage each, said seat permitting movement of the vanes after engagement therewith.

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

EDWARD E. RICHARDSON.