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SILENCER FOR GAS ENGINE VALVE MECHANISM

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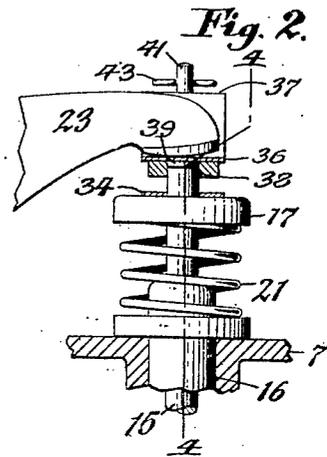
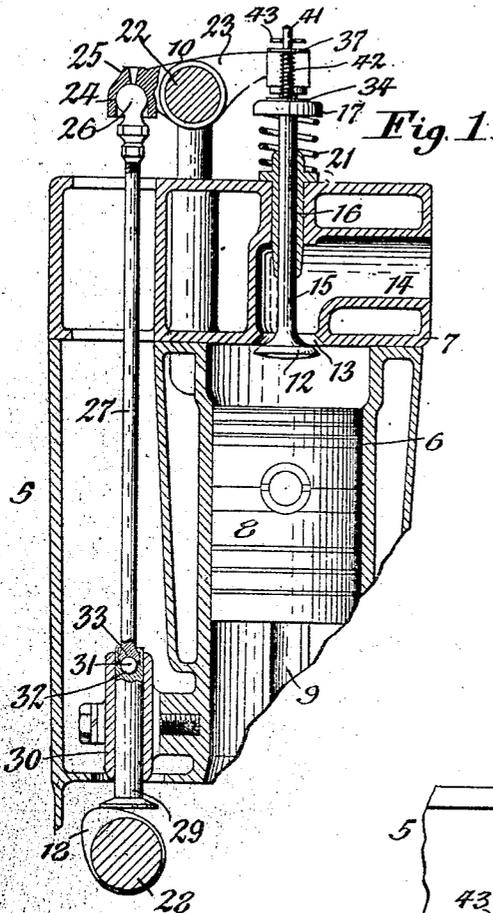
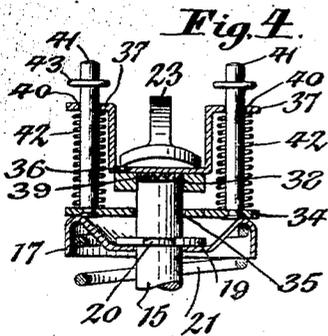
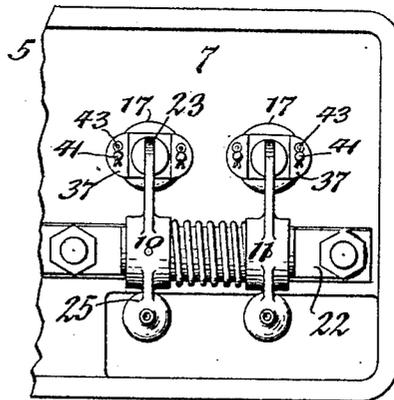


Fig. 3.



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# UNITED STATES PATENT OFFICE.

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SILENCER FOR GAS-ENGINE-VALVE MECHANISM.

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*To all whom it may concern:*

Be it known that I, GEORGE H. CHARNOCK, a citizen of the United States, residing in Buffalo, in the county of Erie and State of New York, have invented new and useful Improvements in Silencers for Gas-Engine-Valve Mechanism, of which the following is a specification.

This invention relates to means for silencing the working of the mechanism for operating the overhead valves of gas engines, such as are now commonly employed for driving gasoline propelled automobiles.

As is well known, the slack space or play which occurs between the upper end of the stem of each valve and the rocker arm which engages therewith is extremely limited since these parts must be arranged very closely together and barely touch each other so that this arm will permit the valve spring to fully close the valve, but at the same time avoid a clicking noise when the arm engages the valve stem for opening the valve. When the valve or its seat or the opposing surfaces of the valve stem and rocker arm become worn, the clearance between the rocker arm and valve stem increase which causes a proportionate increase in the idle movement of the rock arm before engaging the valve stem and thus produces a noisy hammering or clicking blow which is not only objectionable because it is unpleasant and annoying, but also because the wear on the co-operating surfaces increases more rapidly in the same measure as the slack or clearance increases.

It is the object of this invention to provide means which are interposed between the valve stem and the rock arm of the valve mechanism and which permit the requisite clearance between the valve stem and rocker to enable the valve to close properly at all times and still ensure engagement of the rocker arm with the valve stem without making any appreciable noise or wearing the parts unduly.

In the accompanying drawings: Figure 1 is a fragmentary vertical section of an internal combustion engine having its valve mechanism equipped with my invention. Figure 2 is a fragmentary view, on an enlarged scale, of those portions of the valve mechanism immediately adjacent to where the rocker arm and valve stem come together. Figure 3 is a fragmentary top plan view of the engine embodying my improve-

ments. Figure 4 is a vertical section taken on line 4-4, Fig. 2.

Similar characters of reference refer to like parts throughout the several views. 60

This invention is applicable to gas engines which may vary as to details of construction, that shown in the drawings being merely typical of one in which my invention can be used to advantage. As shown, 65 this engine comprises a body or frame 5 containing an upright cylinder 6, a head 7 at the top of the cylinder, and a piston 8 reciprocating vertically in the cylinder and having its connecting rod 9 coupled with the crank of the driving shaft in any suitable and well known manner. 70

With each cylinder is associated a valve mechanism comprising a fuel inlet valve and an exhaust valve by means of which live 75 gaseous fuel is admitted to the cylinder and the products of combustion are discharged therefrom. The inlet and exhaust valves are operated respectively by means which comprise rock levers 10, 11, and as the 80 mechanism associated with the inlet and exhaust valves is identical in construction, the following description relating to the mechanism for operating the inlet valve 12 will, so far as it applies, also serve to describe the mechanism for operating the 85 exhaust valve.

The inlet valve 12 is of the usual circular outwardly flaring form and adapted to move vertically toward and from a valve seat 13 90 arranged around the inner end of the fuel inlet or passage 14 in the head of the body. On its upper side this valve is provided with a vertical valve stem 15 which extends to the exterior of the body and has its intermediate 95 part guided in a sleeve 16 mounted in the upper part of the head.

Each of the valves is yieldingly held in its upper closed position by a collar 17 preferably of cap shaped form mounted on the 100 upper part of each valve stem and engaging its upper side with a shoulder formed by a washer 19 interlocking with a groove 20 in the valve stem, and a helical spring 21 surrounding the valve stem and engaging its 105 lower end with the guide sleeve 16 and its upper end with the underside of said collar, as shown in Figs. 1, 2 and 3.

The inlet and exhaust valve rock levers are pivotally supported side by side on a 110 shaft 22 mounted on the top of the head and the inlet valve rock lever has its rock

arm 23 arranged over the upper end of the stem of the inlet valve while its tail 25 is provided with a downwardly opening socket 24 which receives the spherical upper end 26 of an upright push rod 27. In the lower part of the body is rotatably mounted the valve shaft 28 which is provided with a rotary cam 18 engaging the lower end of a vertical tappet 29. The latter slides in a guide sleeve 30 on the lower part of the body or frame and transmits a lifting movement to the push rod through the medium of a ball 31 interposed between the ball sockets 32, 33, formed on the opposing ends of the tappet and push rod, as shown in Fig. 1. As the high part of the cam engages the tappet, the rock lever is turned in the direction for depressing and opening the valve and when the lower part of this cam is presented to the tappet the spring 21 is permitted to close the valve.

Ordinarily, the underside of the rocker arm is set so close to the upper end of the valve stem by means of the screw connection between the tail 25 and the push rod 27 that the rocker arm and stem barely touch, which adjustment however is difficult to make and is also unsatisfactory on account of the wear which occurs in due time and produces a noise when the valve mechanism is in operation. When the rocker arm is set very close to the valve stem to avoid noise a subsequent elongation of the valve stem due to the heat when running the engine for a time prevents the valve from engaging its seats perfectly with the result that the exploding gases will pit the face of the valve head and valve seat, warp the valve head, cause a loss of compression and power development, and an excessive consumption of gasoline.

For the purpose of avoiding noise between the valve stem and rocker arm, push rod and tappet and to allow a greater clearance between the rocker arm and valve stem, to avoid warped valve heads, pitted valve seats and excessive gasoline consumption, to give increased horse power, and to avoid constant valve grinding, the silencer embodying my invention is employed, the same being constructed and assembled with the rocker arm and stem as follows:

34 represents an inner or lower cross piece of sheet metal or the like provided centrally with an opening 35 which receives the outer or upper part of the valve stem and rests with its opposite ends on the outer side of the collar 17. An outer or upper cross piece of sheet metal or the like is arranged above the inner cross piece and bent or formed so that its central part 36 is deflected inwardly and its opposite ends 37 are deflected outwardly. The outer side of the central inwardly deflected part of the outer cross piece engages with the inner side of the rocker arm and the inner side of this part of

the outer cross piece is provided with a socket 38 in which is secured, by friction or otherwise, a cushion member 39 consisting preferably of a disk of fiber. This socket receives the upper part of the valve stem which latter is guided therein and has its upper end arranged close to the underside of the cushion disk, the distance between these members being somewhat exaggerated in Figs. 2 and 4, for the purpose of illustration. The opposite ends of the outer cross piece are provided with guide openings 40. Arranged lengthwise on opposite sides of the valve stem are two guide rods 41 which have their inner ends secured to opposite ends of the inner cross piece while their outer parts slide in the guide openings 40 of the outer cross piece. The latter is yieldingly held in its elevated position so that the cross pieces are separated by helical springs 42 each of which surrounds one of the guide rods and bears at its inner end against the collar 17 while its outer end bears against the inner side of one end of the outer cross piece. Complete separation of the outer cross piece from the guide rods is prevented when the silencer is removed from the valve mechanism by means of stops 43 arranged on the outer ends of the guide rods and adapted to be engaged by the outer side of the outer cross piece.

In the preferred construction, these stops consist of cotter pins passing through appropriate openings in the guide rods, as shown in the drawings.

In assembling this silencer with the valve mechanism, the same is so adjusted that when the valve is closed by its spring 21 and the rocker arm is in its highest position, the slightest possible clearance is present between the valve stem and the cushion disk, and outer cross piece is moved away to some extent from the stops 43 and the springs 42 are under tension. The strength of these springs 42 is however less than that of the valve spring 21, so as to ensure closing of the valve whenever the low part of the cam is presented to the tappet.

Whenever the high part of the cam is presented to the tappet, the rocker arm is turned so that the same moves inwardly or downwardly. During the first part of this inward movement of the rocker arm, the outer cross piece is first depressed until its cushion disk bears against the upper end of the valve stem during which time the tension on the springs 21 is slightly increased. After the cushion disk bears against the valve stem, motion is transmitted positively from the rocker arm to the valve stem, whereby the valve is opened in opposition to the spring 17. As the rocker arm moves outwardly, the valve stem moves in unison therewith until the valve has seated, then the rocker arm continues its outward movement

independently of the valve to a minute extent, sufficient to ensure tight closing of the valve, during which time the outer cross piece is separated slightly farther from the inner cross piece under the action of the springs 21. These springs and the cushion disk however, at all times cause the motion of the rocker arm to be transmitted to the valve stem gradually and without shock, noise or undue wear, thereby causing the valve mechanism to operate silently and without tapping, thus avoiding the annoyance usually experienced by the operation of valve mechanisms as heretofore constructed.

If at any time one of the springs 21 should become weakened or broken, the same can be readily replaced upon removing the stop pin or cotter from the respective guide rod.

This silencing device can be assembled as a complete unit of which none of the parts are capable of being detached while handled or when in use and the same can be applied to the valve mechanism of automobile gas engines or the like without requiring any alteration in the construction of the valve mechanism, thus adapting the same for use not only for new engines, but also engines already in use.

As a whole, this silencer is very simple in construction, the same can be produced at low cost, it can be readily installed, it operates efficiently to eliminate noise and reduce wear, and it automatically takes up wear and lost motion wear between the rocker arm and valve and between the rocker arm and push rod, so that frequent adjustments are not necessary.

I claim as my invention:

1. A gas engine comprising a body having a valve seat, a valve movable toward and from said seat and having a stem, a collar arranged on the outer part of said stem, a spring engaging said collar for closing said valve, a rocker arm arranged across the outer end of said stem, and a silencer comprising an inner cross piece engaging said collar, an outer cross piece arranged between said arm and stem, spring means for separating said cross pieces, and means for guiding said outer cross piece on said inner cross piece and limiting the separation of said cross pieces.

2. A gas engine comprising a body having a valve seat, a valve movable toward and from said seat and having a stem, a collar arranged on the outer part of said stem, a spring engaging said collar for closing said valve, a rocker arm arranged across the outer end of said stem, and a silencer comprising an inner cross piece engaging said collar, an outer cross piece arranged between said arm and stem, spring means for separating said cross pieces, and means for guiding said outer cross piece on said inner cross piece and limiting the separation of said cross

pieces, comprising guide rods which are secured to said inner cross piece and upon which said outer cross piece slides, and stops arranged on the guide rods on the outer side of said outer cross piece.

3. A gas engine comprising a body having a valve seat, a valve movable toward and from said seat and having a stem, a collar arranged on the outer part of said stem, a spring engaging said collar for closing said valve, a rocker arm arranged across the outer end of said stem, and a silencer comprising an inner cross piece engaging said collar and provided with a central opening which receives said stem, an outer cross piece having its central part bent inwardly and engaging its outer side with the inner side of said lever while its ends have openings, a socket arranged on the inner side of the central part of said outer cross piece, a fiber disk arranged in said socket and adapted to engage the outer end of said stem, guide rods secured at their inner ends to the ends of said inner cross piece and passing through the openings of said outer cross piece, springs surrounding said rods and serving to separate said cross pieces, and stops arranged on said rods outside of said outer cross piece.

4. A silencer for the valve operating mechanism of a gas engine having a valve stem provided with a collar, and a rocker arm at the end of said stem, comprising an inner cross piece adapted to rest on said collar, an outer cross piece arranged between said stem and said arm, and yielding means interposed between said cross pieces.

5. A silencer for the valve operating mechanism of a gas engine having a valve stem provided with a collar and a rocker arm at the end of said stem, comprising an inner cross piece adapted to rest on said collar, an outer cross piece arranged between said stem and said arm, yielding means interposed between said cross pieces, and means for limiting the separation of said cross pieces under the action of said yielding means.

6. A silencer for the valve operating mechanism of a gas engine having a valve stem, a collar mounted on the outer part of said stem, a spring engaging the inner side of said collar, and a rocker arm arranged across the outer end of said stem, said silencer comprising an inner cross piece adapted to rest on the outer side of said collar and provided with a central opening which is adapted to receive the outer part of said valve stem, an outer cross piece adapted to engage its outer side with the inner side of said rocker arm, a cushion arranged on the inner side of said outer cross piece and adapted to engage the outer end of said stem, spring means for separating said cross pieces, and means for guiding said outer cross piece relative to the inner cross piece and limiting the

separation of said cross pieces under the action of said spring means.

5 7. A silencer for the valve operating mechanism of a gas engine having a valve stem, a collar mounted on the outer part of said stem, a spring engaging the inner side of said collar, and a rocker arm arranged across the outer end of said stem, said silencer comprising an inner cross piece adapted to rest on the outer side of said collar and provided with a central opening which is adapted to receive the outer part of said valve stem, an outer cross piece adapted to engage its outer side with said arm and provided on its inner side with a socket, a fiber disk arranged in said socket and adapted to engage the outer end of said stem, yielding means for separating said cross pieces, means for guiding the outer cross piece on the inner cross piece, and means for limiting the separation of said cross pieces.

10 15 20 25 8. A silencer for the valve operating mechanism of a gas engine having a valve stem, a collar mounted on the outer part of said stem, a spring engaging the inner side of said collar, and a rocker arm arranged across the outer end of said stem, said silencer

er comprising an inner cross piece adapted to rest on the outer side of said collar and provided with a central opening which is adapted to receive the outer part of said valve stem, an outer cross piece having its central part deflected inwardly and adapted to engage its outer side with the inner side of said arm while the outwardly deflected ends of said outer cross piece are provided with openings, a socket arranged on the inner side of the inwardly deflected central part of said outer cross piece and adapted to receive the outer end of said stem, a cushion disk arranged in said socket and adapted to engage with the outer end of said stem, guide rods secured at their inner ends to opposite ends of said inner cross piece and passing through the openings in the ends of said outer cross piece, springs surrounding said guide rod and bearing with their inner ends against said inner cross piece and with their outer ends against said outer cross piece, and stops arranged on the outer ends of said guide rod and adapted to limit the outward movement thereon of said outer cross piece.

30 35 40 45 50  
GEORGE H. CHARNOCK.