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CHECK VALVE

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2 Claims. (Cl. 251-119)

This invention relates to a check and more particularly to a check valve adapted for attachment to the exhaust manifold of a multi-cylinder internal combustion engine.

The device shown is an improvement upon that described in my co-pending applications, Serial No. 421,800, filed December 5, 1941, which issued as U. S. Patent No. 2,345,569, on April 4, 1944, and No. 462,473, filed October 19, 1942.

The invention is illustrated in the drawing in which Fig. 1 is a sectional elevation of the check valve and of a portion of an exhaust manifold; Fig. 2 is a plan view of the valve seat; Fig. 3 is a plan view of the inner cover; Fig. 4 is a plan view of the diaphragm valve; and Fig. 5 is a plan view of the finger spring.

As shown in the drawing, the device consists of a tubular neck 10 adapted for connection to an exhaust manifold 11 in any suitable manner, as by threads 12. Secured to the top of the neck is a valve housing 13 which comprises a bottom housing 14, an inner housing 15, and a cover 16. A valve seat 17 is sweated within the bottom housing 14, the bottom of the seat being held in spaced relation to the bottom housing by the ring 18. The ring 18 also provides a seat for the inner cover 15. The valve seat is circular in shape and is provided with a series of valve openings 20 having substantially radial sides. The valve seat has considerable depth and the valve openings 20 are provided with a series of grooves 51 and lands 52.

The bottom housing 14, which is generally dome-shaped, is provided with an inwardly convex section 21 which limits the area beneath the valve openings. The deflector 22 consisting of a circular plate of metal having a downwardly directed edge portion 23 is mounted a predetermined distance below the valve openings and serves not only to deflect the current of air but to limit the available area in the chamber 24 formed within the bottom housing.

Between the deflector 22 and the valve openings is a thin flexible wafer spring 25 which is shown in detail in Figure 5. This spring is provided with a large number of peripheral fingers 26, it being preferred to have at least six of these fingers and preferably eight. The fingers are curved at their ends to press upon the valve 30. The valve is likewise a thin wafer of metal having no substantial inertia. It is in the form of an annulus, the edges 31 of which overlap slightly the valve openings. The ends of the fingers 26 touch the valve at approximately the mid-portion of each valve opening; that is, the number of valve openings

is preferably the same as the number of spring fingers.

Above the valve seat is an accumulator chamber 35 bounded at the top by the inner cover 15. This chamber 35 is broken up into a series of smaller chambers 36, 37 and 38 by the series of baffles 39 and 40. These baffles are of thin metal, are circular in form, and their outer edges are spaced only a very little from the wall of the inner cover 15. The lower baffle is separated from the valve seat by a spacer 41 and other spacers 42 and 43 separate the second baffle and the inner housing.

The inner housing is provided with a relatively small opening 45 which communicates with the annular passageway 46 formed by the spacing of the inner cover 15 and the cover 16.

The cover is spaced from the inner cover by spacers 47; and the deflector 22 is spaced from the spring 25 by an additional spacer 48. The spring is spaced from the valve seat by the spacer 49. The various spacers, the valve seat, the valve, the valve spring, the deflector, the baffles, the inner cover, and the cover are held in spaced relationship by the bolt 50. In assembling the structure the various parts just referred to are assembled on the valve seat and the latter is then inserted in the bottom housing.

The figures are shown drawn to scale, and size is of considerable importance, although spacing and size are naturally varied in accordance with the amount of air which is to be passed inwardly through the structure. The dimensions given are suitable for the ordinary passenger car having a six or eight cylinder multi-cycle engine developing up to 100 horse power.

The valve seat shown has a diameter of approximately 2 inches. The valve openings are centered at a point $\frac{5}{8}$ inch from the center of the valve seat. They are approximately $\frac{1}{2}$ inch long, along the radius, and are $\frac{3}{8}$ inch wide at their widest point and approximately $\frac{1}{4}$ inch at the narrowest point as measured between the straight sides. The valve seat is $\frac{1}{8}$ inch deep and the grooves 51 are each 0.114 inch wide and $\frac{3}{64}$ inch deep. The two lands 52 are $\frac{1}{2}$ inch wide. The bottom of the valve seat is smoothly finished.

This valve 30 is $1\frac{1}{4}$ inches in outside diameter and 0.75 inch inside diameter, and the material is between 0.003 and 0.004 inch thick, flat and free from burrs. It is preferably made from National Clock Spring steel.

The valve spring 25 is $1\frac{1}{2}$ inches in diameter, is 0.003 inch in thickness, with the fingers depressed to give a total width of 0.075 inch. The

central $\frac{3}{4}$ inch erose circle is flat and the curvature commences only at the outer edges. The fingers are approximately $\frac{1}{4}$ inch across at the outside, although the very edge is rounded.

The baffles 39 and 40 provide an annular space 0.015 inch in width between the edge of the baffles and the inside of the inner housing 15. The space between the edge of the deflector 22 and the inside of the bottom housing is approximately $\frac{1}{8}$ inch. The opening 45 in the inner housing is a circle $\frac{1}{8}$ inch in diameter.

The annular chamber 46 is approximately $\frac{3}{4}$ inch wide.

The entire structure is delicately balanced to take full advantage of the very rapid sequence of vacuum and pressures which occurs in the exhaust manifold. It is desired to feed air whenever there is a vacuum in the manifold and not to feed air when there is pressure. There is a tendency for any movement of air, once established, to continue even after the vacuum which originally actuated the movement has disappeared. The series of baffles here established has proved effectively and over long periods to break up this motion and to provide a device even more immediately responsive than my previous devices.

The deflector 22 is primarily intended to prevent any dirt from being forced on the valve in a back fire or otherwise from the manifold.

The foregoing detailed description has been given for clearness of understanding only, and no unnecessary limitations should be understood therefrom.

What I claim as new, and desire to secure by letters patent, is:

1. A check valve comprising a housing adapted to communicate with an exhaust manifold

through the bottom of the housing, said housing comprising a bottom, an inner cover, and an outer cover, each generally cylindrical in form, a valve seat within the housing having a plurality of circumferentially spaced valve openings and forming a bottom chamber with the housing bottom, an accumulator chamber between the valve seat and the inner cover, an annular inlet chamber between the outer cover and the inner cover, baffle means within the accumulator chamber substantially restricting the same, a valve of light weight in the bottom chamber covering the valve openings, and a light wafer spring adjacent the valve and having a plurality of peripheral fingers individually holding the valve in engagement with the valve seat to close the several valve openings.

2. A check valve comprising a housing adapted to communicate with an exhaust manifold through the bottom of the housing, said housing comprising a bottom, an inner cover, and an outer cover, each generally cylindrical in form, a valve seat within the housing having a plurality of circumferentially spaced valve openings and forming a bottom chamber with the housing bottom, an accumulator chamber between the valve seat and the inner cover, an annular inlet chamber between the outer cover and the inner cover, baffle means within the accumulator chamber substantially restricting the same, a valve of light weight in the bottom chamber covering the valve openings, a light wafer spring adjacent the valve and having a plurality of peripheral fingers individually holding the valve in engagement with the valve seat to close the several valve openings, and baffle means in the bottom chamber between the valve and the outlet.

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