May 26, 1925. 1,539,167

H. DIEL ET AL

VALVE

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FIG. 1

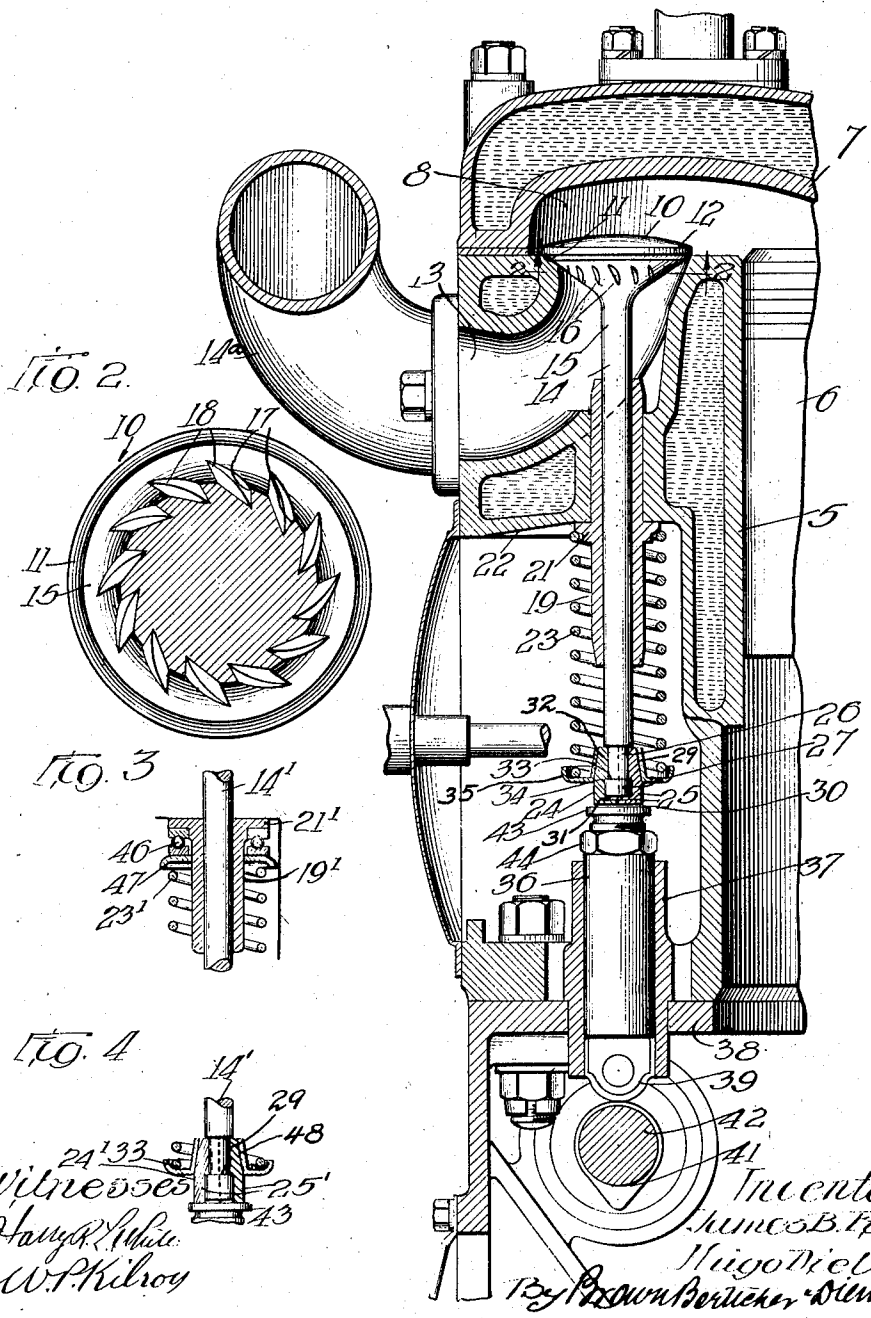


FIG. 2.

FIG. 3

FIG. 4

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UNITED STATES PATENT OFFICE.

HUGO DIEL AND JAMES B. FISHER, OF WAUKESHA, WISCONSIN.

VALVE.

Application filed October 1, 1919. Serial No. 327,760.

To all whom it may concern:

Be it known that we, HUGO DIEL and JAMES B. FISHER, citizens of the United States, residing at Waukesha, in the county of Waukesha and State of Wisconsin, have invented a certain new and useful Improvement in Valves, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

Our invention relates to valves.

More specifically, our invention relates to poppet valves for internal combustion engines, and is primarily concerned with an improved construction of poppet valve provided with rotary propeller means whereby the flow of the fluid past the valve imparts a rotary motion thereto. It will be hereinafter apparent, however, that the essence of the invention is applicable to poppet valves employed in other relations than solely in internal combustion engines, or to valves of other descriptions than the poppet type of valve.

One of the particular advantages residing in the rotary construction of poppet valve is the self-grinding action of the valve with its seat, which results in the effective grinding of the carbon deposit therefrom. This grinding action follows from the rotative inertia created in the valve by the propelling force of the rapidly moving fluid passing through the valve. The impetus of this fluid impinging on the propeller surfaces imparts sufficient rotative energy to the valve to cause it to continue to rotate slightly even as it engages the valve seat, with a consequent grinding of these surfaces.

Another characteristic of the rotary type of poppet valve is the uniformity of wear of the valve surfaces and the avoidance of high spots and the like on these surfaces.

The primary object of our invention is to provide improved means for completely relieving the poppet valve of the retarding influence of the valve spring when the valve is off its seat, so as to permit entire freedom of rotation of the valve under the impulse of the passing fluid.

Another object is to provide an improved construction of thrust relieving means for accomplishing the above object, which will be applicable to practically any standard design of internal combustion engine, without modification or addition to either the valve mechanism or to the related design of the engine.

In order to acquaint those skilled in the art with the manner of constructing and practicing our invention, we shall now describe, in connection with the accompanying drawings, one embodiment of the same.

Figure 1 is a partial sectional view of an internal combustion engine taken through one of the exhaust valve passages;

Figure 2 is an enlarged sectional view taken on the line 2—2 of Figure 1;

Figure 3 is a fragmentary sectional view of a modified construction; and

Figure 4 is a fragmentary view of a modified construction of thrust collar.

Figure 1 illustrates fragmentarily an internal combustion engine cylinder 5 in which reciprocates the piston 6. A removable cylinder head 7 covers the top of the cylinder 5 and defines a valve chamber extending to one side of the cylinder as designated at 8. Operating in the valve chamber 8 are the intake and exhaust valves, only the latter of which is shown. The invention is embodied in both types of valves, being substantially identical in each valve.

The exhaust valve 10 is of general poppet formation, having a tapered valve surface 11 seating on a similarly tapered valve seat 12 formed around the exhaust valve passage 13. This exhaust passage has communication with an exhaust manifold 14ª, as in ordinary internal combustion engine practice.

The valve 10 is provided with a stem 14 which joins the valve head by a flaring portion 15, formed on a relatively long taper. In this tapered head portion are milled a plurality of vane-like flutes 16, spaced uniformly about the circumference of the head portion. The relatively long taper 15 disposes the vanes or flutes 16 sufficiently below the head of the valve to secure efficient action by the exhaust gases as they pass downward under the valve. These milled flutes are inclined to the axis of the stem 14, and, as shown in Figure 2, consist of an arcuate slot or depression which is cut in the taper portion 15, preferably by a rotary milling cutter. The cutting edge of the milling tool is preferably of right or acute angle formation and the tool is inclined to the surface of the portion 15 so as to cut a relatively abrupt wall or surface 17, which inclines sharply to the pe-

ripheral surface of the portion 15. The wall 17 forms a propeller surface against which the gases impinge in passing through the valve opening. The bottom of the milling cut is joined with the peripheral surface by a sloping wall or surface 18 which inclines obtusely to the peripheral surface 15. The passing gases have practically no impelling effect on the obtuse walls 18, so that the impetus of the gases impinging on the propeller walls 17 produce a rotation of the valve.

The novel construction and relation of the propeller flutes 16 is made the subject-matter of the co-pending application of James B. Fisher, filed October 1, 1919, under Serial Number 327,758, and since matured into Patent No. 1,426,560, August 22, 1922.

Referring again to Figure 1, the valve stem 14 is extended down through a guide 19 which is sleeved over the stem, and has a collar 21 lying against the under side of the water jacket 22. A compression spring 23, for normally retaining the valve on its seat, bears against the collar 21. The lower end of this compression spring bears upon a novel construction of thrust collar 24, the function of which is to relieve the valve stem 14 of spring pressure when the valve is raised from its seat. This thrust collar is split into two semi-circular collar halves 25 which are machined out to engage over the lower end of the valve stem 14. Adjacent its end, the stem 14 is formed of a reduced shank portion 26, thereby providing an enlarged head 27 on the end of the valve stem, and an upper annular shoulder 28 on the head 27. The thrust collar sections 25 are formed with small and large bores 29 and 31 for embracing the reduced shank 26 and the head 27. The upper end of the thrust collar is tapered, as indicated at 32, for bearing the pressure of the compression spring 23. A cup 33, having a tapered bearing extension 34 engaging over the taper 32 of the thrust collar, supports the lower end of the compression spring 23. The spring is confined in the cup 33 by the upturned rim 35. The pressure of the spring 23, acting through the tapered bearing extension 34, retains the thrust collar sections 25 in close embrace about the end of the valve stem 14. The valve stem, however, is arranged to have absolute freedom of rotation on the thrust collar 24 as soon as the valve is raised. If desired, the two collar sections 25 may be secured together over the end of the valve stem by screws or any other suitable means. From this, it is to be seen that the valve stem 14 possesses a floating action in so far as any appreciable force is exerted upon it to retard the rotation thereof.

The bottom or thrust collar 24 is closed off solid, as indicated at 30, and this solid end is adapted to be engaged by the tappet 36. The tappet 36 is guided for reciprocation in a tappet guide 37 which extends down through the crank case 38. At its lower end the tappet carries a pivoted roller 39 which is adapted to be engaged by the cam 41 of the cam shaft 42. The tappet 36 is provided with the usual adjusting screw 43 and lock nut 44 for adjusting the clearance between the tappet 36 and thrust collar 24.

As in ordinary practice, this tappet screw is so adjusted as to leave a very slight clearance between the tappet 36 and thrust collar 24, as shown in magnified degree in Figure 1. It will, therefore, be apparent that when the valve is on its seat the pressure of the spring 23 will be transmitted directly to the valve stem through the thrust collar 24 and shoulder 28. Upon raising of the tappet, however, for opening the valve, the pressure of the spring is instantly transferred directly to the tappet 36 through the thrust collar 24, thereby relieving the valve stem of the pressure of the spring and permitting the valve to rotate freely under the impulse of the passing gases. As the exhaust gases are expelled from the cylinder they flow through the valve chamber 8 in a substantially horizontal direction and, thus, have direct action on the propelling flutes 16. The high velocity of these exhaust gases imparts a quick rotative impulse to the valve, which persists until the flow of gas ceases with the closing of the valve. As a result, the valve comes down into contact with its seat while rotating under considerable inertia, with a consequent grinding action between valve and seat. This grinding action effectively removes carbon from the valve surfaces, and furthermore obviates high spots and the like by uniformly distributing the wear over the entire valve surfaces.

The above described action also occurs in the operation of the intake valve, the upward flow of the mixture impinging on the inclined vanes 16 and thus imparting the rotative impulse to the valve. The inclination of these vanes to the axis of the valve utilizes the high velocity impact of the ascending gases striking the under surface of the valve for assisting in imparting the rotative impulse to the valve. The inclination of these propeller vanes is not essential to the rotation of the intake valve, however, as the horizontal flow of the mixture into the valve chamber from under the valve imparts ample rotative impulse to the valve. If desired, the intake valve can be made with the propeller vanes inclined to the axis of the valve, and the exhaust valve with the propeller vanes upright or parallel to the axis of the valve.

It is to be noted that in the above described construction, the actual effort of lifting the valve occurs between the solid bottom 30 of the thrust collar 24, and the bottom of the enlarged head 27, and not at the upper shoulder formed by the reduced shank 26. This is the preferred arrangement, but in certain situations it is impracticable to extend the thrust collar 24 beyond the end of the valve stem any more than is absolutely required. In such cases the construction of thrust collar shown in Figure 4 is employed. In this form, the collar sections 25′ are extended but a slight fraction of an inch below the end of the valve stem, just sufficient to support the stem out of contact with the tappet 36. With this arrangement the effort of raising the valve occurs between the reduced bore 29′ and the shoulder 48 on the valve stem 14′.

In Figure 3, I have shown a thrust ball-bearing 46 interposed between the upper end of the compression spring 23′ and the flange 21′ of the guide 19′. A cup-shaped washer 47 confines the upper end of the spring on the lower race of the thrust bearing 46. The bearing 46 is adapted to permit free rotation of the compression spring 23′ with the valve stem, in the rotation of the latter, by reducing the thrust friction between the compression spring and its stationary abutment. This modified arrangement may be used in conjunction with the previously described embodiment, or on any construction of internal combustion engine and valve, independently of the above embodiment, for the purpose of permitting free rotation of the poppet valve and spring.

I do not intend to be limited to the details herein shown and described.

I claim:

1. In an internal combustion engine, the combination of a valve passage having a valve seat, a poppet valve seating thereon, flutes milled in said valve for rotating said valve under the impulse of the fluid passing therethrough, a stem for said valve, a tappet for raising said valve, a compression spring for closing said valve, a reduced shank portion in said valve stem, said reduced shank portion forming a head on the end of said valve stem, a thrust collar on the end of said valve stem, said collar comprising two separable collar sections, said collar sections being bored out with different diameters to engage over said reduced shank portion and over said head, said collar projecting below said valve stem for engagement by said tappet, and a washer carried by said collar for receiving the pressure of said spring.

2. In an internal combustion engine, the combination of a valve passage having a valve seat, a poppet valve seating thereon, said poppet valve comprising a valve head, a valve stem and a tapering portion joining said head and said stem, a plurality of rotary propelling flutes milled in said tapering portion, a tappet for raising said valve, a compression spring for closing said valve, a shoulder formed on the end of said valve stem, a split thrust collar engaging over said stem and having a shoulder co-operating with said first shoulder, said thrust collar projecting below said valve stem for engagement by said tappet, a tapering portion on said thrust collar and a correspondingly tapering cup-washer engaging over the tapering portion of said thrust collar for supporting the lower end of said compression spring.

3. In combination, a valve seat, a rotatable poppet valve cooperable therewith, a stem for said valve, means for opening said valve, a spring for closing the valve, a tapered collar rotatable upon and secured against movement along said stem, said collar projecting from said stem for engagement by said valve opening means, a collar for engagement by said valve closing spring, said last collar being mounted upon said first collar and having a tapered socket cooperable therewith.

4. In combination, a valve seat, a rotatable poppet valve cooperable therewith, a stem for said valve, means for opening said valve, a spring for closing said valve, a shoulder formed near the end of the valve stem, a split thrust collar engaging over said stem and having a shoulder cooperating with said first shoulder, said collar projecting from said stem for engagement by said valve opening means, a tapering portion on said collar and a correspondingly tapering cup-washer engaging over the tapering portion of said collar for engagement by said valve closing spring.

5. In an internal combustion engine, the combination of a valve passage having a valve seat, a valve seating thereon and having means for causing rotation of the valve under the impulse of the flow of fluid past the valve, a stem for said valve, a tappet for raising said valve, spring means for closing said valve, a reduced shank portion in said valve stem, said reduced shank portion forming a head on the end of said valve stem, a split thrust collar on the end of said valve stem, said collar being bored out with different diameters to engage over said reduced shank portion and over said head, said collar projecting below said valve stem for engagement by said tappet and means on said collar for receiving the pressure of said spring.

In witness whereof we hereunto subscribe our names this 26th day of September 1919.

HUGO DIEL.
JAMES B. FISHER.