Aug. 13, 1929. E. P. MOOERS 1,724,036

VALVE SEAT FOR INTERNAL COMBUSTION ENGINES

Filed Feb. 12, 1927

Fig. 1

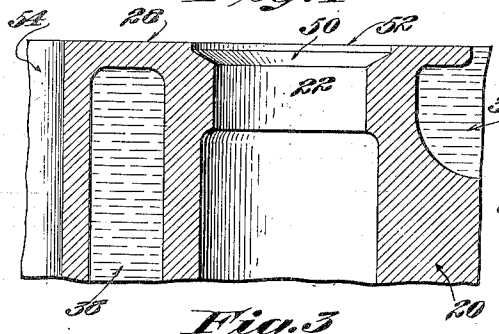


Fig. 2

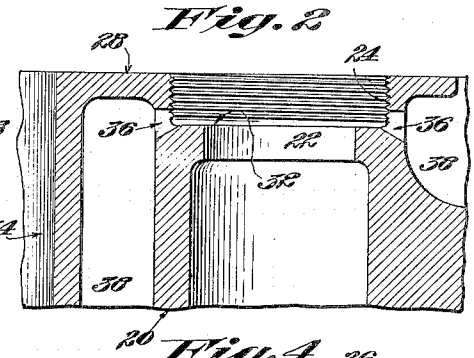


Fig. 3

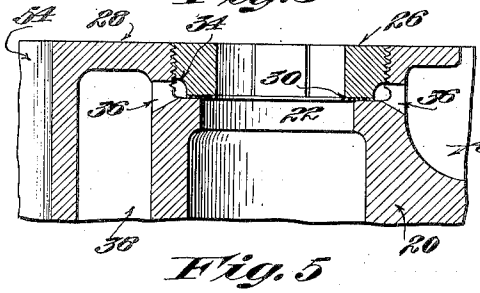


Fig. 4

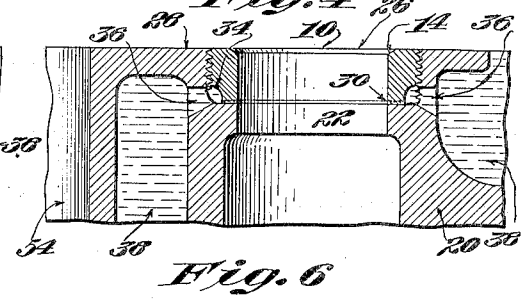


Fig. 5

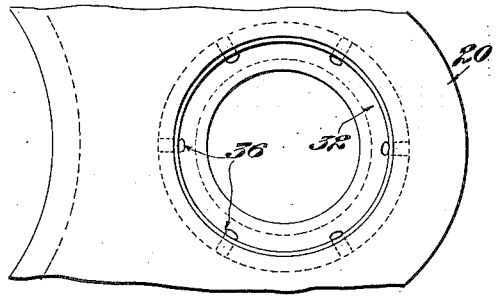


Fig. 6

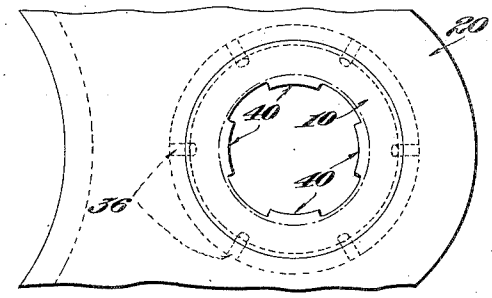
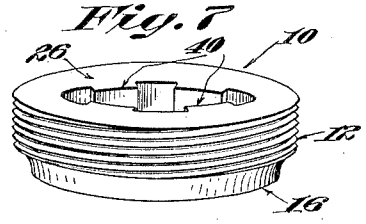


Fig. 7



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UNITED STATES PATENT OFFICE.

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VALVE SEAT FOR INTERNAL-COMBUSTION ENGINES.

Application filed February 12, 1927. Serial No. 167,745.

This invention relates to a valve seat for internal combustion engines and is more particularly designed as a renewable valve seat for use with engine bodies in the form of block castings.

In the manufacture of some forms of internal combustion engines, especially those designed for use in motor trucks, it has been and is customary to cast the body of the engine in the form of a block with suitable cavities or bores for the cylinders, the valve passages and the water or cooling medium passages. After the block has been cast, the cylinders are ground out and valve seats are formed on the top surface of the block casting by grinding the edges of the openings of the valve passages. The use of block castings for such engine bodies has been open, however, to the serious objection that the repeated grinding of the valve seats greatly reduces the life of the body of the engine which otherwise would be unlimited. The successive grindings finally result in the upper edges of the valve seats being below the top surface of the block casting in which event the vertical edges of the block surrounding the valve seats interfere with and partially block the escape of the gases from the valve passages thereby materially decreasing the efficiency of the engine. To obviate this difficulty, the vertical edges surrounding the valve seats are sometimes ground off obliquely but this method is not entirely satisfactory and is limited in application becoming more difficult and less satisfactory as the valve seats are moved further down into the body of the block by repeated grindings.

In addition, repeated grindings are liable to break through the walls of the valve passages into the cooling medium passages which renders the body of the engine worthless. The foregoing difficulties, while present to a greater or less degree in all engine bodies of the block casting type to reduce the normal life thereof, are particularly noted in engines used on motor trucks due to the hard usage which they receive and the frequency with which the valves are ground.

The main object of my invention is the provision of a valve seat of such form that the life of the engine may be prolonged to an unlimited extent and to this end, I provide a valve seat of ring form adapted for mounting in the valve passage opening and for removal when worn down by grinding to permit the insertion of a new valve seat.

Another object of the invention is the provision of a valve seat which may be easily mounted in the engine block casting and set up tightly to avoid leakage and to this end the valve seat is threaded on its periphery to screw into a threaded recess in the engine body and is provided with interior splines to facilitate the use of a tool for setting it up tightly in said recess.

Another object of the invention is the provision of a valve seat so formed that when mounted in an engine body a passage is left adjacent the inner end of the valve seat which may be connected to the cooling medium passages in the engine body for reducing the temperature of the valve seat when the engine is operated.

A further object of the invention is the provision of a method of sealing the valve seat when installed to prevent leakage especially when the parts are subjected to high temperatures. I accomplish this object by spraying the joint between the valve seat and the engine body with molten metal to form a coating thereover integral with the parts sprayed.

Other objects of the invention will be more specifically set forth and described hereinafter.

In the drawings illustrating the preferred embodiment of my invention, Figure 1 is a vertical sectional view of a portion of an internal combustion engine block casting through the center of a valve passage showing the ordinary form of valve seat worn down by successive valve grindings; Fig. 2 is a similar view of an engine block casting bored and threaded to receive a threaded valve seat in accordance with my invention; Fig. 3 is a similar view with the valve seat mounted in position and provided with interior splines for setting it up; Fig. 4 is a view like Fig. 3 showing the valve seat finished with the interior splines ground off and with a seating surface to receive the valve; Fig. 5 is a top plan view looking downwardly in Fig. 1; Fig. 6 is a similar view looking downwardly in Fig. 3; and Fig. 7 is a view in perspective of the valve seat in condition preparatory to being mounted in the engine block casting.

Referring to the drawings, illustrating the preferred form of my invention, 10

designates a valve seat of annular or ring form having a central bore or opening and a peripheral thread 12. The outer end of the valve seat is provided with an oblique valve seating surface 14 and its inner end 16 is reduced in diameter to afford a passage therearound for a cooling medium. In mounting the valve seat in the engine block casting 20, the outlet end of the exhaust valve passage 22 is enlarged and provided with an interior thread 24 to receive the peripheral thread of the valve seat when the latter is screwed into the outlet end of the valve passage. The enlarged portion of the valve passage should be of such depth that the end surface 26 of the seat is flush with the top surface 28 of the block casting 20 when the valve seat is set up tightly. If desired, a suitable ring gasket 30 may be interposed between the inner end 16 of the valve seat and the wall 32 of the block casting to prevent leakage from or into the valve passage. The reduced end of the valve seat provides an annular passage 34 which may be connected by one or more by-passes 36 to the main passages 38 in the block casting for the circulation of a cooling medium. The top wall or walls of the by-pass or by-passes, if more than one is provided, should preferably be horizontal or inclined upwardly in an outward direction to insure circulation of the cooling medium through the annular passage 34 and to prevent pocketing of that medium. In the drawings I have shown six by-passes but any number either more or less may be employed so long as a free circulation of the cooling medium through the passage 34 is assured.

The valve seat may be made in any suitable manner but, preferably, it is cast of iron or other metal in the form of a blank shown in Figure 7, with the exception of the thread 12 which is cut on the periphery of the blank afterwards. The bore of the blank is provided with a plurality of splines 40 parallel to its central axis which facilitate the use of a suitable tool for setting up the valve seat tightly in the block casting. This is an important feature because otherwise it is practically impossible to mount the valve seat in the block casting with sufficient tightness to avoid subsequent leaks between the inner end of the valve seat and the wall 32 of the block casting, especially when these parts expand under the influence of the high temperatures and in the presence of the high pressure induced by the operation of the engine at high speed. After the valve seat has been mounted and set up tightly in the engine body, the splines 40 may be removed and the bore of the valve seat smoothed into circular form and the seating surface 14 added as shown in Fig. 4.

To prevent leaks between the threads on the seat and the engine body, the threaded portions may be coated with any suitable sealing composition such as a mixture of litharge and glycerine and after the valve seat has been set up the surface joint between it and the block casting may be sealed by applying thereto under pressure a thin coating of molten metal in accordance with a well-known process for coating one metal with another metal to form an integral structure. If desired, the surface joint may be slightly grooved to strengthen this sealing operation. By using for this sealing a metal having a coefficient of expansion equal to the coefficient of expansion of the parts sealed, any liability of breaks in the sealing agent under expansion is obviated.

After a valve seat has been worn down by repeated grindings until the upper edge of the seating surface has reached the surface joint between the valve seat and the block casting, the former may be removed from the latter in any suitable manner as by cutting it in two places and forcing out the parts and a new valve seat may be installed as heretofore described.

In Figure 1 of the drawings, the engine block casting 20 is shown with a valve seat 50 formed in the casting itself in accordance with the practice heretofore in vogue and illustrating the conditions which arise after the seat has been ground down below the top surface of the casting and which determines the life of the engine body otherwise unimpaired. The depression of the seating surface 50 below the top surface of the casting leaves a vertical ridge 52 which restricts the valve opening and chokes the flow of exhaust gases therethrough and materially reduces the efficiency of the engine. Even if this ridge be ground out obliquely it is a temporary expedient and can not be repeated indefinitely. Further, it will be observed that the metal mass between the cylinder 54 and the valve seat and on the other sides of the latter varies and consequently the uneven expansion of the body of the engine at the valve seat, due to the extremely high temperatures at that location is apt to twist the valve seat away from a true circular form and prevent the tight seating of the valve. This uneven expansion attended by valve leakage is noticed more especially in motor trucks and the frequent and repeated grindings of the valves in such vehicles to obviate this difficulty results in shortening the life of the engine body.

The use of my invention, however, entirely cures the foregoing difficulties because the valve seat may be renewed an indefinite number of times and being a separate mass of metal of circular form its expansion is uniform in all directions. The results secured by these features are of great value because to-day the comparatively short life of engine bodies is a matter of large expense

and much trouble. There is no valid reason why the life of an engine body should not be unlimited if deterioration of the valves can be checked because the cylinders are the only other parts which are subject to conditions of wear and they can always be relined when necessary.

Another advantage of great importance is the provision of a cooling passage for the valve seat by means of which the temperature of the valve seat may be substantially reduced. Although I have shown the water passage as being formed by the reduction of the inner end of the valve seat, it will be apparent to one skilled in the art that it may be formed in other ways without departing from my invention. For instance, it may be entirely cut out of the block casting or partially out of the casting and partially out of the valve seat. The by-passes or ports connecting the cooling medium passage around the valve seat may be connected to the main cooling passage in various ways.

Although I have described my inventition as applied to valve seats in the exhaust valves it is to be borne in mind that it is also applicable for use at the inlet end of the engine, especially if there are heat conditions there present. As a general rule, however, the operating fluid is delivered through the inlet valves to the cylinders at a comparatively low temperature, consequently the valves at that end are generally in better operative condition and require less frequent grinding than at the exhaust end of the engine.

My invention is applicable to all types of internal combustion engines of single or multiple cylinders having cast bodies or in which the valve seats are subject by repeated grindings to a depression of the seating surface below the adjacent engine body or to unequal expansion under heat conditions. It is also capable of application to compressors and other machines in which the efficiency of the valve seats is affected either by wear or by heat conditions.

It is to be observed that my invention is not to be limited to the specific form herein shown and described because it may be embodied in various other forms of construction without departing from the spirit thereof and which would be evident to one skilled in the art.

What I claim is:

1. A valve seat for internal combustion engines and the like having a body portion of annular form provided with a peripheral thread, and having one end restricted in diameter to form a cooling medium passage when mounted in operative position.

2. A valve seat for internal combustion engines and the like having a body portion of annular form peripherally threaded and provided on one end with a seating surface and having its other end restricted in diameter to form a cooling medium passage when mounted in operative position.

3. In an internal combustion engine, the combination of a block casting having a valve passage and a passage for a cooling medium surrounding said valve passage, the outlet end of said valve passage being enlarged and threaded, a valve seat in annular form threaded into the outlet end of said valve passage and having its inner end restricted to form an annular passage between its said inner end and the wall of said valve passage and a plurality of by-passes connecting said annular passage to the cooling medium passage.

4. In an internal combustion engine, the combination of a cast engine body, a valve passage in said body having its outlet end threaded, passages in said body for the circulation of a cooling medium, an annular valve seat threaded into the end of said outlet passage and sealed therein against leakage and an annular cooling medium passage surrounding said valve seat and connected to the first mentioned cooling passages in said engine body.

5. The combination of an engine body, a valve passage in said body, a main passage in said body for the circulation of a cooling medium, an annular valve seat threaded into the outlet end of said valve passage and sealed therein to prevent leaks and an annular passage around the inner end of said valve seat, said passage being connected to said main passage by a plurality of by-passes or ports.

6. The combination of an engine body, a valve passage in said body, an annular valve seat threaded into the outlet end of said passage and a cooling medium passage surrounding the inner end of said valve seat.

7. The combination of a cast body having a valve passage, a valve seat of annular form threaded into the outlet end of said valve passage and provided on its exposed end with a seating surface and a passage for a cooling medium surrounding the inner end of said valve seat.

8. In an internal combustion engine, the combination of an engine body having a valve passage, the outlet end of said valve passage being enlarged and threaded, a valve seat threaded into said outlet end of said valve passage with its outer face flush with the outer face of said engine body and a passage for a cooling medium surrounding the inner end of said valve seat.

In witness whereof, I hereunto set my hand this fifteenth day of January, 1927.

EDWARD P. MOOERS.