July 23, 1957 F. W. HOWELL 2,800,122

VALVE SEAT INSERT

Filed March 16, 1955

FIG. 3

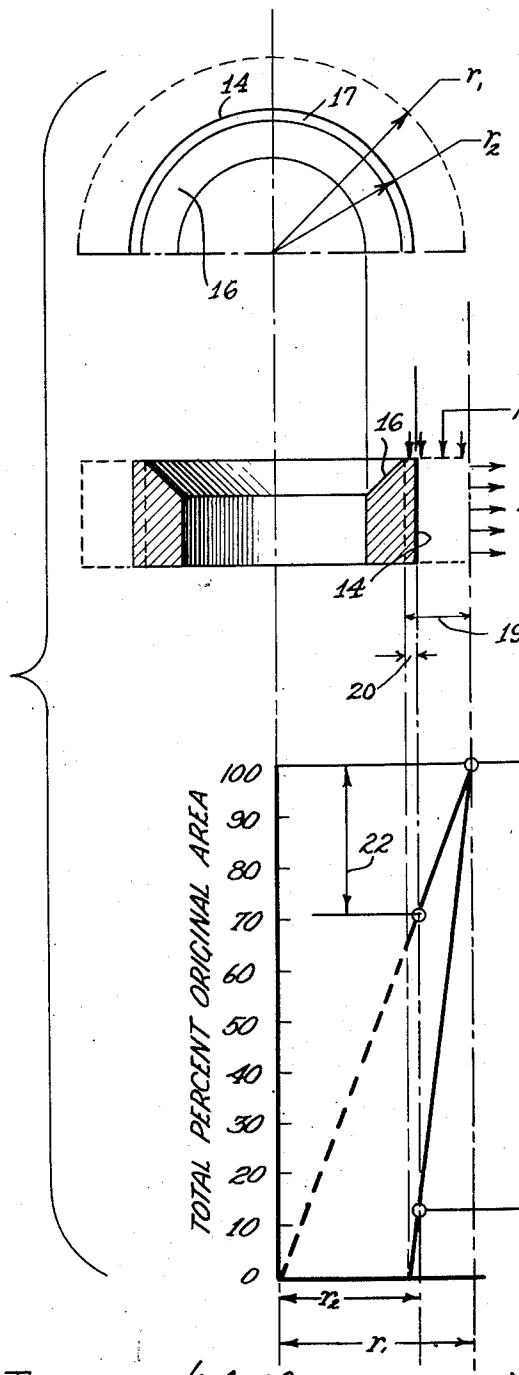


FIG. 1

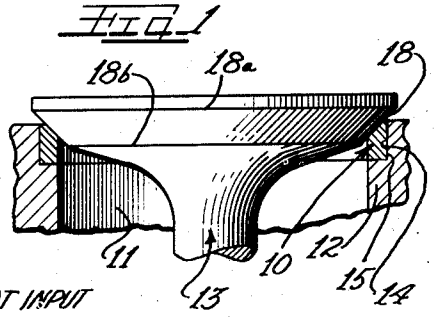
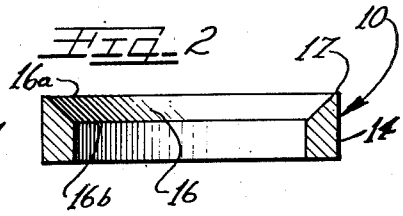


FIG. 2



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VALVE SEAT INSERT

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6 Claims. (Cl. 123—188)

This invention relates to an engine poppet valve seat insert of reduced heat input area exposed to the combustion chamber of the engine and more particularly this invention deals with valve seat insert rings of such thin-walled construction that the total diameter thereof is not more than about 1.1 times the major diameter of the seating face thereof.

In engines, such as internal combustion engines, valve seat inserts are usually provided at the mouth of ports to be controlled by valves. These inserts are usually of wear and heat resistant material as, for example, tungsten alloys, while the engine block or head through which the ports extend is of a material having a different coefficient of expansion, as for example, cast iron or steel. Thus, it is seen that the principal advantages derived from the use of valve seat inserts are that materials may be used which will better withstand high temperatures associated with valve ports, and the replaceability feature extends the useful life of a cylinder head or block. However, valve seat inserts operate at substantially higher temperatures than integral seats due to a thermal barrier existing at the juncture of the valve seat insert and the cylinder head or block, which tends to cancel some of the performance advantages.

In valve seat inserts of standard dimensions a large area is always exposed to the engine combustion chamber and it was found that heat dissipation is a function of the amount of diametral area between the insert and counterbore of the engine head or block where real, intimate contact had existed. This real contact area could neither be predicted nor controlled.

Heretofore, in an effort to improve the contact area between the valve insert and the cylinder head or block, the valve seat insert was molecularly bonded to the cylinder head counterbore. However, no material reduction in valve and seat operating temperatures was realized because of the porous nature of the bond.

It was found through field test observations that the valve and valve seat operating temperatures were directly affected by valve seat insert geometry, and that by improving the heat transfer through the thermal barrier existing at the juncture of the valve seat insert and the cylinder head or block resulted in substantial reductions in valve head temperatures of approximately 100° F. Such a reduction in valve operating temperature not only can mean the difference between the valve burning and not burning, but also will lengthen the useful life of the valve, the valve insert, and the cylinder head or block.

Therefore, this invention now reduces the valve face and valve insert operating temperatures by decreasing the heat input to the exposed face of the valve seat insert and by conforming the insert with the counterbore of the engine block or head to enhance heat transfer.

Accordingly, it is an object of this invention to provide a valve seat insert of reduced heat input area and increased flexibility.

Another object of this invention resides in the provision of a valve seat insert for internal combustion engines

or the like of thin-walled construction that is possessed of such flexibility as to enhance the conformability of the insert to the counterbore of the engine head or block, thus insuring more intimate contact therewith.

A further object of this invention is to provide a valve seat insert for internal combustion engines or the like of thin-walled construction, which functions at a lower operating temperature, thereby reducing the operating temperature of the valve face and lengthening the life of the valve, the valve seat insert, and the engine head or block.

Still a further object of this invention resides in the provision of engine valve seat insert rings of such thin-walled construction that the maximum or outside diameter thereof is not more than about 1.1, and preferably not more than about 1.01, times the major seat face diameter of the ring.

A specific object of this invention is to provide automotive engine valve seat insert rings having the outside diameter thereof not more than about .020 inch more than the seat face major diameter thereof.

Other objects, features and advantages of the invention will be apparent from the following detailed disclosures, taken in conjunction with the accompanying sheet of drawing, wherein like reference numerals refer to like parts, in which:

Figure 1 is a fragmentary sectional view, showing a valve port in an engine block or head of an internal combustion engine or the like equipped with a thin-walled valve seat insert according to the invention, and a valve in seating position with the valve seat insert;

Figure 2 is an enlarged elevational view, in section, of a valve seat insert according to the invention before installation in the counterbore of an engine head or block; and

Figure 3 is a graphic illustration depicting a comparison between the heat input and the heat output of a valve seat insert of standard dimension and a valve seat insert according to the invention.

Referring to the drawings, a thin-walled valve seat insert, generally designated by the numeral **10**, according to the invention, is shown in Figure 1 as being mounted in a counterbore of a valve port **11** of an internal combustion engine block or head **12**. A poppet valve **13** is shown in closing position of the valve port **11** and in seating engagement with the valve insert **10**.

In accordance with the invention, the thin-walled valve seat insert **10** is possessed of such flexibility as to be readily conformable to the counterbore surface of the engine block or head **12**, even to the extent of the conforming to slight distortions occurring in the counterbore, thus insuring more intimate contact between an outer wall **14** of the insert **100** and a counterbore surface **15** of the engine block **12**.

The valve seat insert **10** includes a beveled seating face **16** having a seat face major diameter **16*a*** and a seat face minor diameter **16*b***, and a small top land **17**. The valve seat insert seating face **16** is adapted to engage with a beveled valve seating face **18** of poppet valve **13**. The width of the valve seating face **18** is measured by the upper edge **18*a*** and the lower edge **18*b***. It is generally considered good practice to let .015–.030 inch of valve seating face to overhang the edge of the insert seating face. Such a measured overhang, when projected to the plane of the insert, amounts to .010–.020 inch of the valve's radius which extends beyond the edge of the seating surface of the insert.

In most installations, the valve insert will be sized so that the valve head diameter is as great or greater than the outside diameter **14**, and wherein the maximum diameter of the insert will not exceed .020 inch more

than the seat face major diameter of the insert, as indicated by **16***a* in Figure 2. The absolute minimum limit that may be established is when the seat face major diameter of the insert equals the outside diameter of the insert, resulting in a knife edge, this arrangement being theoretically ideal. However, for practical application, a small top land, such as indicated by numeral **17** in Figure 2, would be provided to allow for handling, ease of manufacture, wear and to prevent the valve face from riding on the engine block or head wall surface.

It can now be understood that the thin-walled valve seat insert rings **10** will better conform to the counterbore surface **15** of the cast iron cylinder head or block **12**, due to the increased flexibility brought about by the thinness of the rings and a more intimate contact is established at the juncture of the valve insert and the engine block. In laboratory tests it was found that heat dissipation from a valve insert was the function of the amount of diametral area between the insert and the counterbore of the engine block where real, intimate contact existed. By improving that contact in the instant case, it is seen that the heat dissipation from the valve insert to the engine block is increased, thereby allowing for lower valve seat operating temperatures and lower valve face operating temperatures which can mean the difference between a valve burning or not burning.

In accordance with the instant invention, Figure 3 illustrates that by reducing the top insert wall thickness beyond the major diameter of the valve seating face **16** from the thickness designated by the numeral **19** of a standard insert to the thickness designated by the numeral **20** of thin-walled insert of the instant invention, and also indicated respectively from r_1 to r_2, the top exposed area for heat input during combustion is reduced by approximately 88%, as indicated by the line **21**, while the peripheral area along the outer wall **14** for heat rejection or output from the insert is reduced by only approximately 28%, as indicated by the line **22**. Thus, it is seen that by employing a thin-walled valve seat insert, according to the invention, the area of heat input may be materially reduced while affecting the heat output area only slightly, thereby causing a reduction in the operating temperature of the valve insert face and a valve in working association therewith.

From the above descriptions it should therefore be understood that this invention provides engine valve seat rings not only having better conformity with the engine block or head to increase heat dissipation, but also having reduced heat input area exposed to the combustion chamber when the valve is seated. Thus, for an insert ring of any desired depth or any seat face width, according to this invention, the overall ring diameter approaches the major seat face diameter and in automobile engine insert rings this overall diameter should not exceed the maximum seat face diameter by more than about .020. In general the ratio of maximum seat face diameter to overall ring diameter will be from 1 to 1.01 up to 1 to 1.10.

It will be understood that modifications and variations may be effected without departing from the scope of the novel concepts of the present invention, but it is understood that the application is to be limited only by the scope of the appended claims.

I claim as my invention:

1. In an internal combustion engine having a metal part defining a valve port with a counterbore surrounding the valve port, the improvement of a thin-walled valve seat insert ring composed of wear and heat resistant alloy having a different coefficient of expansion than said metal part of the engine, said insert being tightly fitted into said counterbore in intimate contact with said metal part of the engine throughout substantially the entire opposed faces of the insert and counterbore, and said insert having the overall diameter thereof not substantially greater than the maximum seat face diameter and being sufficiently flexible to conform to the counterbore surface and maintain said intimate contact during operation of the engine.

2. A valve seat insert ring for engines adapted to be mounted in a counterbore of a valve port, which comprises a relatively flexible and thin-walled temperature and corrosion-resistant metal ring having a valve seating face, the overall diameter of the ring being from 1.01 to 1.10 times the maximum seating face diameter whereby said insert is substantially flexible and readily conformable to the counterbore surface so that it attains intimate contact with the counterbore surface enhancing the transfer of heat and has a reduced heat input surface.

3. A valve insert for internal combustion engines or the like, which comprises a thin-walled cylindrical shell adapted to be received in a counterbore of an engine valve port and possessed of such flexibility as to readily conform to the counterbore, said shell including a beveled valve insert seating face having a major seat face diameter slightly less than the outside diameter of said insert by not more than .020 inch.

4. In an internal combustion engine or the like having a cylinder head or block, a valve port, a counterbore in said port, the improvement in a thin-walled valve seat insert in said counterbore possessed of such flexibility as to intimately contact the counterbore surface, and a beveled seating face on said insert adapted to be engaged by a valve, the maximum diameter of said insert not exceeding .020 inch plus the seat face major diameter of the insert.

5. A valve insert which comprises a substantially thin-walled cylindrical shell, and a beveled seat face having a major diameter no more than .020 inch smaller than the outside diameter of said shell.

6. A valve seat insert ring for internal combustion engines adapted to be seated in a cylindrical counterbore of uniform diameter surrounding a valve port in a metal part of the engine which comprises a flexible thin-walled temperature and corrosion resistant metal ring having a valve seating face and a cylindrical peripheral wall for intimate contact with the counterbore of the engine, said insert ring being sufficiently flexible to conform to the counterbore surface and maintain intimate contact during operation of the engine, and the ratio of the maximum seat face diameter of the ring to the overall ring diameter being generally of the order of from about 1 to 1.01 up to about 1 to 1.10.

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