Nov. 28, 1944. C. A. JENSEN 2,363,673

METHOD OF INSTALLING AND RETAINING VALVE SEAT INSERTS

Filed March 13, 1942

Fig. 1.

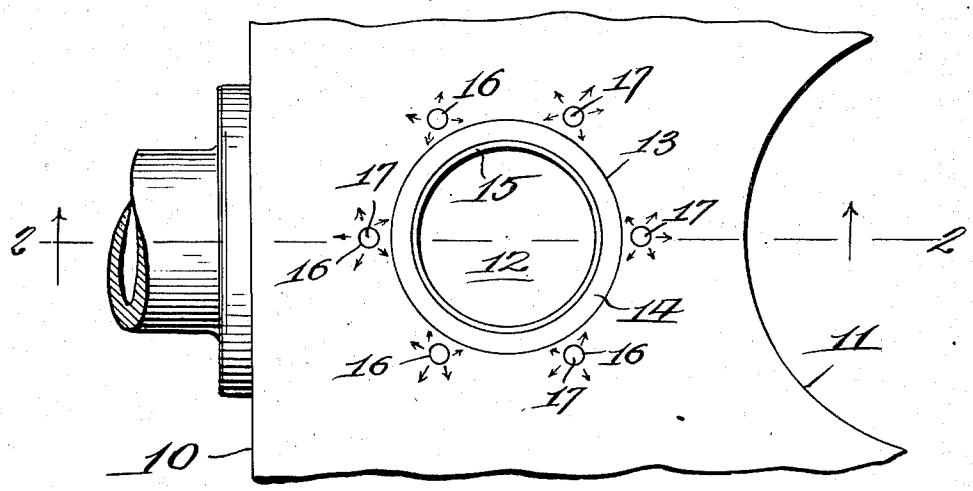


Fig. 2.

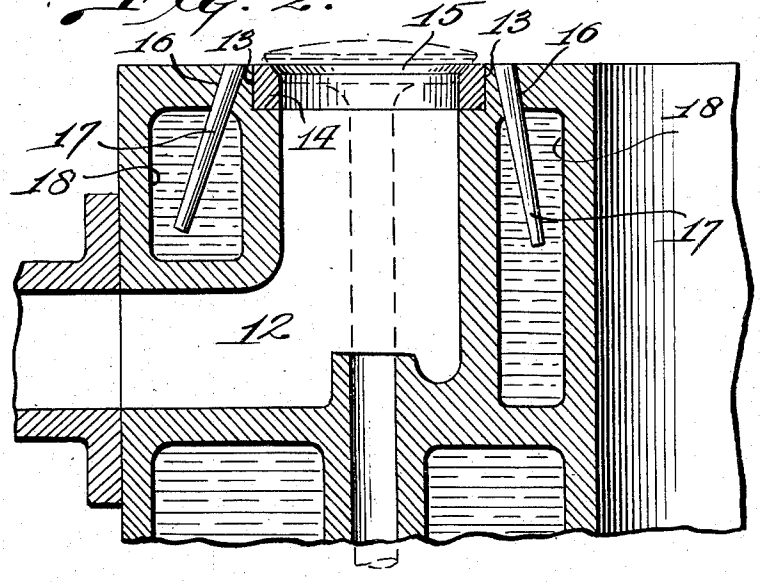
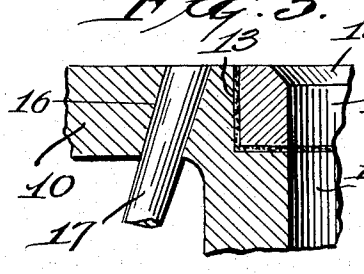


Fig. 3.



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METHOD OF INSTALLING AND RETAINING VALVE SEAT INSERTS

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Application March 13, 1942, Serial No. 434,503

1 Claim. (Cl. 29—156.7)

My invention relates to a method for installing and retaining valve seat inserts, particularly, those inserts that provide seats for the intake and exhaust valves of internal combustion engines, and my present invention is an improvement on the exhaust valve seat insert retaining and cooling means forming the subject matter of United States Letters Patent #2,191,485 issued to me February 27, 1940.

The principal objects of my invention are to generally improve upon the means and method disclosed in my aforesaid patent, as well as other methods of installing valve seat inserts, further, to eliminate the possibility of cracking the cylinder block while installing inserts, and further, to provide improved means for cooling the insert.

It is more or less a general practice to drive the insert very tightly into a recess in the cylinder block around the inlet or outlet port so as to produce a close contact between the insert and the block, and where a slightly over size insert is driven into the block, it creates an outward pressure in the metal immediately adjacent the recess, and this pressure coupled with the impact of the heavy hammer used in driving the insert, frequently cracks the casting. Where the insert becomes loose, it is the general practice to re-bore the recess and install the next size larger insert. Such practice weakens the casting, and, if repeated several times, the boring goes through the wall of the casting to the water chamber therein. Further, caulking or peening around the insert is sometimes practiced, but this is only effective near the surface of the metal, and does not tighten the insert to any appreciable degree.

Inserts are sometimes threaded and screwed into the threaded recesses, but such practice is not entirely satisfactory, for the inserts frequently become loose because they can not be screwed tight enough, and, further, they have no direct contact with the cooling medium in the circulation chambers of the block, except through the casting.

I propose to overcome the difficulties and objectionable results above set forth by drilling a number of holes in the block around and immediately adjacent the outer circumference of the insert recess, which holes are preferably tapered toward their lower ends, and then, after the insert has been seated in the recess and sealed with suitable cement, driving ordinary tapered pins into said holes so as to exert pressure on the metal surrounding the holes, and consequently compressing the same, which action causes those portions of the metal between the holes and the outer circumference of the recess to expand and exert great pressure against the insert, and thereby securely anchor the same to the block.

The pin receiving holes are spaced apart from the outer circumference of the recess so that said pins do not touch the insert, and if the insert should be removed, no pins will be visible. The holes are drilled all the way through the metal to the adjacent cooling fluid circulation chambers, and the length of the pins is such that they project substantial distances into the circulation fluid chambers thereby effecting a transference of heat from the insert to the cooling fluid, and, consequently, exerting a cooling effect on said insert.

The recesses that receive the inserts are bored to practically the same diameter in length as the insert, and, therefore, it is not necessary to use any appreciable amount of pressure or driving forces to position the inserts in the recesses, and the subsequent insertion of the tapered pins compresses and crowds the metal against the inserts so as to rigidly anchor the same in the block.

In order to more rigidly anchor the inserts in the block, the outer and under surfaces of the inserts and the surfaces of the recesses are coated with a suitable cement before the insertion of the inserts, thus effectually sealing the joints between said inserts and blocks.

With the foregoing, and other objects in view, my invention consists in certain steps and procedure hereinafter more fully described and claimed.

In the drawing:

Fig. 1 is a plan view of a portion of an internal combustion engine cylinder block, and showing a valve seat insert 9 therein according to my invention.

Fig. 2 is a vertical section taken on the line 2—2 of Fig. 1.

Fig. 3 is an enlarged detail view showing the sealed joint between the inserted valve seat and the cylinder block.

Referring by numerals to the accompanying drawing, 10 designates the block of an internal combustion engine 11, one of the piston chambers therein, and 12, the conventional duct which may be for the inlet of gaseous fuel, or for the exhaust of burned gases or products of combustion.

In practicing my improved method, an annular recess 13 is formed in the top of the block 10 around the end of the duct 12, and which recess is of such size as to snugly receive the valve seat insert 14.

This insert is in the form of a metal ring, the upper inner edge of which is chamfered so as to form a valve seat 15.

In order to more firmly secure the insert in the recess, and to effectively seal the joint, between the insert and the block, the outer and under faces of the insert and the surfaces of the recess, are prior to the placing of the insert in the recess, coated with a suitable cement that is not affected by heat. After the insert has been positioned in the recess, and sealed as just described, a plurality of tapered holes 16 are drilled through that portion of the cylinder block around and immediately adjacent the recess 13 and tapered metal pins 17 are now driven into said holes 16, said pins having sufficient length so that substantial portions thereof project into the cooling fluid circulation chambers 18 that are formed in the cylinder block.

As a result of the driving of the pins into the block, as just described, those portions of the metal immediately surrounding the holes 16, will be expanded and, consequently, compressed, and, thus the metal between the pin holes and the recess 13 will be compressed to such a degree as to materially increase the solidity of such metal, and this compression directly engages the outer face of the insert to very securely anchor the same in its inserted position.

Obviously the pressure exerted by the pins 17 when driven into holes 16 compresses the metal outwardly from those portions of the metal between said pins and the insert receiving recess 13 and thus the substantially circular area of metal disposed immediately outward from the pins, is compressed and solidified so as to effectively counteract tendency of the insert to expand under high temperatures and counteracting tendency of the compressed areas of metal between the pins 17 and recess to expand away from the insert. In other words, the insertion of the pins 17 in the casting compresses and solidifies a substantially circular area of metal immediately surrounding the insert and particularly, those portions of the metal lying between the pins and said insert.

In Fig. 1, I have illustrated arrows surrounding the upper ends of the inserted pins, and which arrows indicate the compression forces that are developed when the pins are driven into the block.

It is to be understood that in practicing my improved method, the pin holes 16 are spaced apart from the recess 13, and thus, the inserted pins do not directly contact with the valve seat insert 14.

Inasmuch as substantial portions of the pins driven into the cylinder block project downwardly into the cooling fluid circulation chambers, said pins are continuously cooled as the fluid circulates and such cooling effect is transmitted to the metal in which the upper ends of the pins are embedded and in turn, this cooling effect is transmitted to the valve seat insert.

In the event that portions of the upper ends of the pins, after being driven into the block, project above the upper surface thereof, said projected ends may be ground off flush with the upper surface of said block. In as much as the pins are small in diameter, and they act only in relatively small areas of the metal in the cylinder blocks surrounding the valve insert, said pins may be driven into the block without the attendant danger of cracking the same, and which latter condition exists where the inserts are driven into the recesses in the block with large heavy hammers, and which latter are necessary to produce a drive fit between the inserts and the block.

I have demonstrated a practice that the average valve seat insert requires only five or six pins to rigidly anchor said insert in the block, but in the event that an insert should become loose, the additional holes for the accommodation of additional pins are drilled into the block between the holes and pins already provided, thus compressing and forcing the metal in the block between the holes and insert against the outer face of the latter to provide the additional anchorage.

In Fig. 3, I have illustrated the cement or sealing compound between the inserted valve seat and the block, but this illustration is exaggerated for, as will be understood, the insert fits snugly in the recess in the block, and, therefore, the sealing cement or compound has no appreciable thickness.

Thus it will be seen that I have provided a relatively simple and easily practiced method for installing and retaining valve seat inserts in cylinder blocks of internal combustion engines, and the practicing of which method provides for the transference of the temperatures of the cooling medium, which is circulated within the cylinder block, to those portions of the metal in the block immediately surrounding the insert.

I claim as my invention:

The method of installing and securing valve seat inserts in the metal cylinder blocks of internal combustion engines which consists in forming an annular recess in the cylinder block around the end of a port therein, positioning a valve seat insert in said recess, forming a series of apertures at equally spaced intervals in the metal of the block at points beyond the outer marginal edge of the annular recess so as to provide substantial thicknesses of metal between said recesses and apertures and then inserting tapered pins into said apertures with sufficient force to compress and solidify the surrounding metal in said block and force these portions of the metal between the inserted pins and the insert toward the latter.

CHARLES AUGUSTUS JENSEN.