May 15, 1934. A. STOLL 1,959,068

METHOD OF PRODUCING VALVE SEAT RINGS

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Fig. 1.

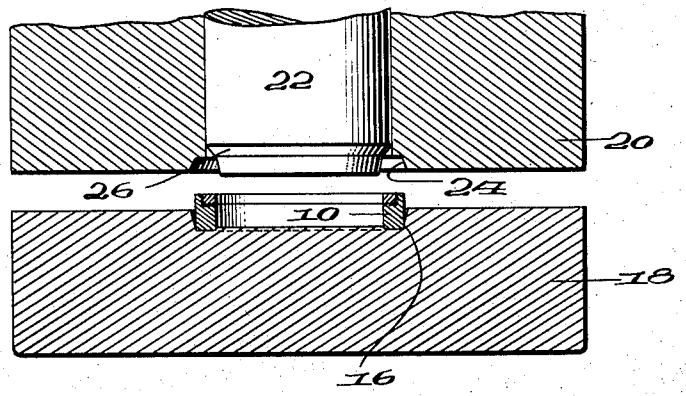


Fig. 2.

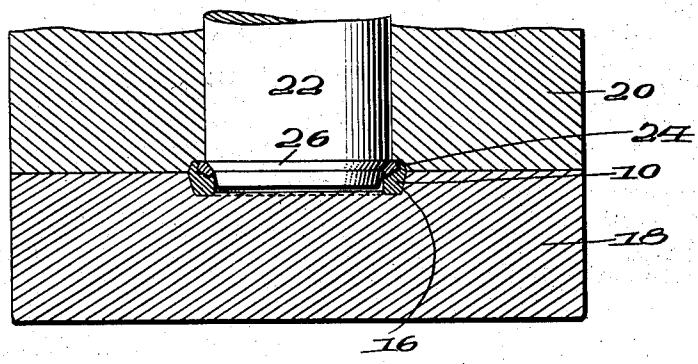


Fig. 3.

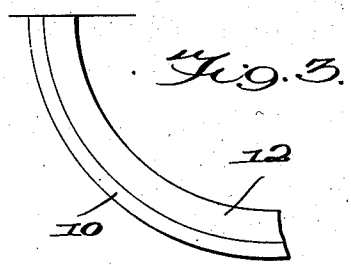


Fig. 5.

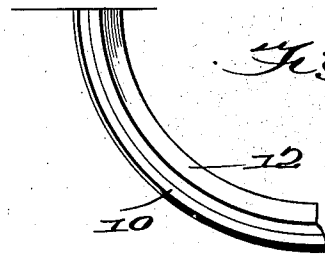


Fig. 4.

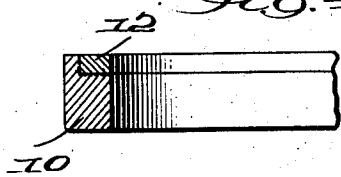
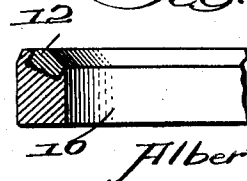


Fig. 6.



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METHOD OF PRODUCING VALVE SEAT RINGS

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11 Claims. (Cl. 29—156.7)

This invention relates to a method of making valve seats for internal combustion engines and more particularly to a method of making valve seats of that type embodying a ring adapted to be inserted in a cylinder block.

Valve seats of this type, especially exhaust valve seats, are made from a superior grade of alloy steel so as to provide the necessary resistance to heat, acid, impact and abrasion and their use allows the cylinder blocks to be made from a softer and therefore more readily machined cast iron, than is possible to employ when the valve seats are made from integral portions of the cylinder block.

Heretofore, inserted valve seats for internal combustion engines whether produced in the rough by casting, forging or machining from a bar, require numerous steps looking to the completion of the same and such steps, combined with the fact that the entire seat is formed of a costly metal, makes the inserted valve seat an initially expensive addition to an internal combustion engine, although such cost has been found to be justified by increased resistance to wear as compared to valve seats formed in the iron from which the cylinder is cast, and further by the fact that as stated above, such inserted seats make possible the employment of a softer and hence more easily machined cylinder block than is allowed where the seat is formed in the material of the block.

The present invention has for one of its objects a method looking to the provision of an inserted valve seat which, while possessing all the desirable attributes of a ring made of high grade and hence costly steel, will be composed of a relatively minor portion of costly metal and which at the same time may be completed with a less number of successive operations than are required in the manufacture of a one-piece ring, all to the end that the composite ring is made commercially available at a cost less than that of the one-piece ring.

Also, the practice of the method forming the subject of this application will be found to result in the production of a composite ring less susceptible to breakage than a ring formed entirely from one-piece of costly alloy steel and to be capable of a more intimate union with the cylinder block than is possible with a ring composed entirely of a high grade alloy steel so that in addition to reducing the cost, the employment of a composite ring has material physical advantages over a one-piece alloy steel ring.

More specifically, a valve seat unit produced by the practice of the method herein disclosed will be found to have an improved valve seating area while the remaining portion of the unit will be soft and tough to protect the ring against breakage and to allow of the subsequent establishment of effective cohesion between the valve seat and the cylinder block through the direct contact of the soft tough metal of the ring with the metal of the cylinder block, as distinguished from the direct contact of a relatively hard and brittle alloy steel one piece ring with the iron of the cylinder block.

Other objects and advantages of the invention will be apparent during the course of the following description.

In the accompanying drawing forming a part of this application and in which like numerals are employed to designate like parts throughout the same,

Figure 1 is a vertical sectional view illustrating the sections of a composite ring in position to be united in the manner contemplated by the invention,

Figure 2 is a similar view illustrating the sections joined through the practice of the improved method,

Figure 3 is a fragmentary plan view of the sections of the ring in position to be united,

Figure 4 is a vertical sectional view through the sections of the ring in position to be united as provided by the improved method,

Figure 5 is a fragmentary plan view of the composite ring resulting from the practice of the method,

Figure 6 is a fragmentary vertical sectional view of the composite ring.

In the drawing, the numeral 10 designates a base or attaching ring formed from solid or tubular stock of low carbon or mild steel.

It is shown in Figures 1 and 4 that the base or attaching ring 10 has the inner upper portion thereof rabbeted to define a seat for a ring 12 of a dissimilar metal. More particularly, the ring 12 is of a superior grade of steel, possibly a tungsten or molybdenum alloy steel having the required heat, acid, impact and abrasion resisting qualities necessary for use in connection with the poppet valves of internal combustion engines, particularly the exhaust valves of such engines.

In carrying out the invention, the ring 12 is formed from flat and suitably thin sheet stock of an alloy steel and such production of the ring may be by way of punching, leaving the ring in the flat form as disclosed in Figures 1 and 6 for application to the base or attaching ring 10.

Preparatory to the permanent joining of the rings 10 and 12, the same are brought to a forging heat, one that is also a hardening temperature for the high grade steel ring 12 and while at such heat, and with the parts 10 and 12 loosely connected as shown in Figure 1 the same are placed in the recess 16 of the punch press 18 in position for engagement by the ram 20 and the punch 22, of such press.

It is shown in Figure 1 that the ram 20 is bored as indicated at 24 to receive portions of the rings 10 and 12 and also that the lower portion of the punch 22 is reduced diametrically and shouldered as indicated at 26 so that when the parts of the punch press are brought into the position shown in Figure 2, the ring 12 of a hard alloy steel will be embedded in the softer material forming the base ring 10 producing ledges flatly and securely engaging the inner and outer peripheral edges of the alloy steel ring 12 and at the same time giving to the alloy steel ring the conical or tapered form of a conventional poppet valve seat.

It is important to observe that the descent of the punch and the engagement of the shouldered portion 26 with the alloy steel ring 12 coins the surface of such seat into practically its finished state so that no further major operations are necessary in the production of the finished seating surface, except of course, the grinding necessary for the provision of companion surfaces between the seat and its mating valve.

Also, it is pointed out that the mild or low carbon steel attaching ring 10 has a greater coefficient of expansion and contraction than the steel alloy ring 12 so that the relatively greater or more rapid rate of change of the base ring will cause the base ring to shrink securely about the alloy ring during cooling of the parts with the result that an intimate and inseparable union is established between the parts.

With reference to Figures 4 and 6 it will be observed that in addition to the shrink fit of the rings 10 and 12, such parts may be joined by a suitable bonding or brazing material such, for example, as copper, applied by electro-plating or any other convenient manner.

Subsequent to the union of the parts as shown in Figure 2, the ram is moved upward a distance less than the concurrent upward movement of the punch 22 so that the composite ring is stripped from the punch, this being necessary because of the rapid shrinkage of the heated parts as will be apparent to those skilled in the art to which this invention relates.

From Figures 1 and 2 it will be seen that the opposed recesses 16 and 24 are slightly flared toward the meeting portions thereof to provide for the easy insertion and removal of the parts and the external radial rib formed on the composite ring as an incident to such flaring of the recesses, may be easily removed at the same time the composite ring is brought to the required final external diameter by grinding or otherwise.

The finished composite seat disclosed in Figure 6 may be conveniently applied to a cylinder block and by reason of the mild nature of the material forming the attaching ring 10 as distinguished from the hardness and brittleness of the alloy steel ring 12, a more perfect cohesion between the composite ring and the surrounding iron of the cylinder block is brought about than is possible where the ring is formed entirely of a tungsten or molybdenum alloy steel.

With reference to the foregoing description taken in connection with the accompanying drawing, it will be apparent that the composite ring forming the subject of this application has all the advantages of a one-piece alloy steel ring such, for example, as effective resistance to heat, acid, and impact, while such composite ring is not so susceptible to breakage as a one piece ring and hence may be applied to a cylinder block in a highly expeditious manner.

In addition to possessing the physical advantages of a one piece alloy steel ring, without the disadvantages that are known to accompany the one piece alloy ring, the composite ring herein disclosed, embodying as it does but a minor portion of relatively expensive metal, may be produced at a cost less than that of the one-piece ring.

Thus, it will be seen that in the practice of the method forming the subject of this application an annular blank 12 is struck or otherwise produced from a sheet of flat stock of an alloy steel such for example, as a tungsten or molybdenum alloy having the qualities necessary to resist abrasion, heat and impact incident to use in an internal combustion engine.

The blank thus formed is mounted in or upon an attaching blank 10 of a softer and tougher low carbon steel.

The attaching blank 10 is greater in all dimensions than the impact blank 12 and has the upper inner corner portion thereof rabbeted to form a seat for the impact ring.

Before the deformation of the initially flat blanks 10 and 12 the same are heated to the critical temperature of the impact ring 12 and to the forging temperature of both blanks. With the blanks thus heated, the same are placed in the punch press in the manner suggested in Figure 1 so that when the ram and the punch carried thereby are brought down into pressure relation to the assembled parts as suggested in Figure 2, the impact ring, being harder than the attaching ring, will embed itself in the attaching ring and will take a flared form and at the same time will have a seating surface coined thereon.

It will be seen that the deformation of the hard annulus 12 to give it the conical form suggested in Figure 6 disposes or locates the inner and outer peripheral edges of the ring at acute angles to the longitudinal axis of the ring. Also, this deformation of the ring and the operation of simultaneously embedding the ring 12 in the softer ring 10 causes portions of the material forming the ring 10 to closely engage the angularly extending inner and outer peripheral edges of the annulus 12 with the result that there is established a permanent and relatively inseparable union between the two annuli.

A brazing medium of any character may be employed between the opposed surfaces of the impact and attaching rings and such bonding medium will cooperate with the ledges engaging the inner and outer edges of the impact ring in resisting either axial or lateral movement of the rings with respect to each other.

When the rings 10 and 12 have been joined, the unit thus formed is removed and since a seating surface has been coined upon the impact ring 12 it is merely necessary to grind the outer peripheral wall of the ring to the diameter required for application to an internal combustion engine cylinder block.

Of course, the heating and subsequent cooling of the blanks may be carried on in accordance with accepted practice.

Having thus described the invention what is claimed is:—

1. The herein described method of making a composite valve seating ring for the poppet valves of internal combustion engines which consists in heating and interfitting relatively hard and soft annuli, and in subjecting the interfitting annuli to axial pressure to embed the harder annulus in the softer annulus and simultaneously giving to the harder annulus a flared form and coining a valve seat thereon.

2. The method of making a valve seat for the poppet valve of internal combustion engines which consist in forming a relatively small, annular, flat blank from a hard metal, in forming a relatively large annular blank from a softer metal, arranging the blanks in superposed relation and heating them to the hardening temperature of the smaller blank, and subjecting the heated assembly to pressure to embed the smaller blank in the larger blank and to deform the smaller blank to provide a conical valve seating surface.

3. The method of making a valve seat for the poppet valve of internal combustion engines, consisting in forming a relatively small, annular, flat blank from a hard metal, in forming a relatively large blank from a softer metal, in heating the blanks to the hardening temperature of the smaller blank and to the forging temperature of both blanks and in subjecting the heated blanks to pressure to recess the smaller blank in the larger blank with portions of the larger blank pressed against the edges of the smaller blank and to coin a conical seating surface on the smaller blank.

4. The method of making a valve seat unit for the poppet valve of internal combustion engines, consisting in forming a relatively small, flat annular blank from hard metal sheet stock, in forming a relatively large blank from a softer metal, in heating both blanks to the hardening temperature of one of the blanks, and to the forging temperatures of both blanks, and in subjecting the heated blanks to a uniting pressure to recess the smaller blank in the larger blank and deform the smaller blank to provide a conical valve seating surface.

5. The method of making a valve seat for poppet valves of internal combustion engines consisting in uniting a hard metal contact ring and a softer attaching ring by forging with the rings at the hardening temperature of the contact ring and simultaneously coining a valve seating surface on the outer surface of the hard metal ring.

6. The method of making a valve seat of the insert type for use with the poppet valves of internal combustion engines consisting in forming a relatively small annular flat ring from a hard metal, in forming from a softer metal a relatively large blank having a counter-bore, in placing the smaller blank in the counter-bore with a bonding material between the blanks, in heating the blanks and in subjecting the heated blanks to pressure to embed the smaller blank in the larger blank and to coin a valve seating surface on the smaller blank.

7. The method of making a valve seat for the poppet valve of an internal combustion engine which consists in deforming an initially substantially flat annular blank to give the same a conical form and simultaneously embedding the blank in a second blank of a softer material.

8. The method of making a valve seat for the poppet valve of an internal combustion engine which consists in deforming an initially substantially flat annular blank to give the same a conical form and simultaneously embedding the blank in a second blank of a softer material, and in closely engaging the material of the softer blank with the inner and outer peripheral edges of the first blank.

9. The method of making a valve seat unit for the poppet valve of an internal combustion engine, consisting in heating and bringing together an annular blank of a mild steel and a second annular blank of a substantially harder and more brittle steel; in subjecting the heated blanks to pressure to embed the harder blank in the mild steel blank and simultaneously coining a conical valve seat on the second blank.

10. The method of making a valve seat unit for internal combustion engines which consists in deforming a hard initially flat annular blank to locate the outer surface thereof at an acute angle to the longitudinal axis of the annulus and in disposing the inner and outer peripheral walls of the annulus at acute angles to the longitudinal axis of the blank and simultaneously embedding the annulus in a second annulus of softer material and closely engaging such softer material with the angularly disposed inner and outer peripheral walls of the hard annulus.

11. The method of making a valve seat unit for internal combustion engines which consists in deforming a hard initially flat annular blank to locate the outer surface thereof at an acute angle to the longitudinal axis of the annulus and in disposing the outer peripheral wall of the annulus at an acute angle to the longitudinal axis of the blank and in embedding the annulus in a second annulus of a softer material and closely engaging said softer material with the angularly disposed outer peripheral wall of the hard annulus.

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