April 7, 1936. B. F. STOWELL ET AL 2,036,656

VALVE SEAT CUTTER

Filed June 8, 1932

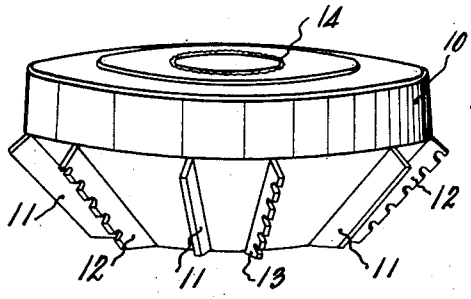


Fig. 1.

Fig. 2.

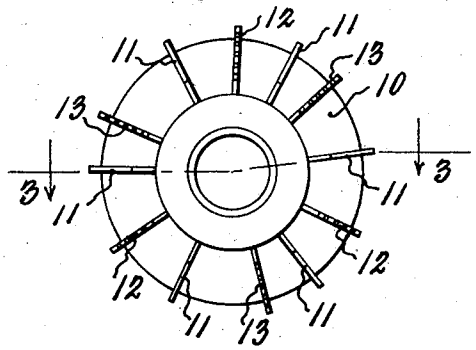


Fig. 3.

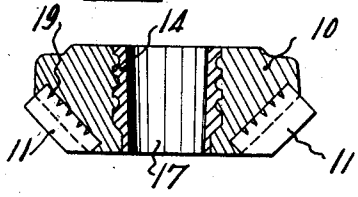


Fig. 4.

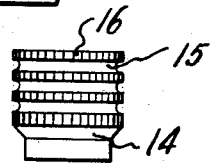


Fig. 6.

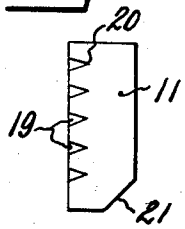


Fig. 7.

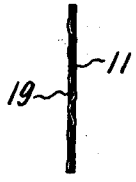


Fig. 5.

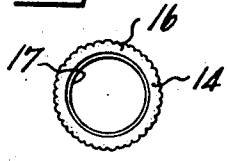


Fig. 10.

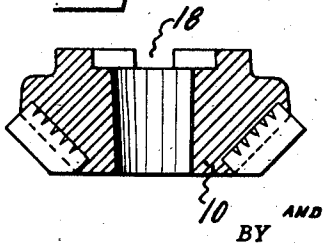


Fig. 9.

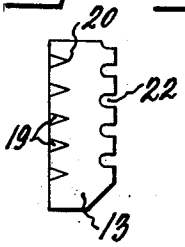
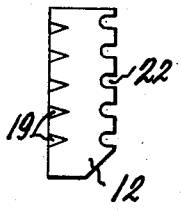


Fig. 8.



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VALVE SEAT CUTTER

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Application June 8, 1932, Serial No. 615,972

1 Claim. (Cl. 29—103)

This invention relates to cutting reamers, especially those adapted to serve for resurfacing the worn and carbonized valve seats of internal combustion motors. The hard surfaces of these valve seats have presented a difficult problem, due mainly to the desirability of using a steel of very high grade, and therefore of high cost, for the cutting elements. The expense of using high grade alloy steel for cutters composed entirely of that material has been prohibitive, and in practice it has been necessary in order to produce a cutter at a marketable price, to lower the grade of steel below what would be theoretically desirable. Attempts have also been made to secure the advantages of high grade steel without a prohibitive cost by using cutters of the inserted blade type. The forms of inserted blade cutters heretofore proposed for this purpose have not been entirely satisfactory, and it is the general object of the present invention to improve upon them in several particulars.

One object of the invention is to produce a cutter which will hold its cutting edge without resharpening for a longer time than was possible with prior cutters. A further object is to provide a superior cutter at a lower manufacturing cost. A further object is to produce a cutter which will be free from chatter during operation. A further object is to provide an inserted blade cutter which may be used upon a tapered pilot or arbor. A further object is to provide a cutter which will leave a more perfect finish on the valve seat than has heretofore been possible. Additional objects will appear from the following description and claim.

Referring to the drawing:

Fig. 1 is a perspective view of a valve seat cutter embodying our invention;

Fig. 2 is a bottom view thereof;

Fig. 3 is a section on line 3—3 of Fig. 2;

Fig. 4 is a side elevation of a central bushing forming a part of the completed cutter;

Fig. 5 is a top plan view of the bushing shown in Fig. 4;

Fig. 6 is a detail, on an enlarged scale, of one form of cutting blade;

Fig. 7 is a view of the blade shown in Fig. 6, looking from the left in that figure;

Fig. 8 is a view similar to Fig. 6 showing a different form of cutting blade;

Fig. 9 is a similar view showing a still different form of blade; and

Fig. 10 is a view similar to Fig. 3, showing a modified form of cutter.

The cutter comprises a body portion 10 preferably of a hard zinc alloy, and bears series of blades 11, 12, and 13, formed of high grade steel and permanently united to the base at the time the latter is cast. The center of the cutter is preferably formed by a bushing 14 made of a hard material such as steel, having its outer surface formed with circumferential grooves 15 and peripheral knurlings or flutings 16. This bushing is also permanently united to the body 10 at the time the latter is cast, the flutings and grooves preventing any possibility of shift after the material of the base has hardened. The interior 17 of the sleeve is preferably tapered so that the cutter may be mounted without further interconnection upon a tapered arbor or pilot of the usual type. If desired, however, the bushing 14 may be omitted and the interior of the central hole in the cutter left cylindrical as in Fig. 10. In this case the body of the cutter is formed with lug engaging portions 18 or similar devices by which the cutter may be rotated by an arbor or pilot having suitable lugs or dogs thereon.

The blades are, as stated above, preferably of three kinds in order to secure the advantages present in one aspect of the invention. Each kind is made of a high grade tool steel, preferably of a tungsten alloy, and is heat treated so as to render it suitable for cutting. The special manner of heat treatment will depend upon the particular alloy used, as is well understood in the art. Each blade is provided with some means for causing it to become permanently located in the cast base when the latter has become solidified, so that the blades will not become loose under the strains of use. In the embodiment shown the means chosen comprises a series of flutings or depressions 19 adjacent what is to become the inner edge of the blade, the flutings being indented from opposite sides of the blade and preferably tapering from a point 20 to the inner blade edge. By reason of this tapering and the raised character of the flutings when considered in relation to the general plane of the side of the blade, the blades will be anchored firmly in place against a force tending to dislodge them in any direction when the matrix of cast material in which they are set has hardened.

Each of the blade types may, if desired, be beveled as at 21 on one corner, so that when the blades are mounted in the body these beveled surfaces will form a continuation of the base of the cutter. This is clearly shown in Fig. 3.

The blades 11 are straight and plain on their cutting edges. The blades 12 and 13 are generally similar to each other, having notches 22 cut

in their edges. The notches are preferably differently positioned in the two cases, however, so that they will be out of line when assembled in the cutter. The blades 12 and 13 are preferably alternated around the cutter, as shown in Fig. 2, the notches breaking step as is customary, in nicked tooth cutters so that the two sets of blades taken together cover the entire surface of the valve seat being worked on. One or more plain blades 11 are interposed between adjacent nicked blades, as is also shown in Fig. 2; resulting in a very smooth finish being given to the valve seat while retaining the added speed of cut due to the nicking of the teeth. It will be observed from Fig. 2 that adjacent blades are unevenly spaced around the base 10. Preferably this unevenness of spacing is such that no blade is opposite any other blade and no two blades are spaced similarly. This can be worked out in many ways, depending on the number of blades used. Using twelve blades, a suitable angular spacing of the blades is 27½°, 20½°, 33°, 34°, 27°, 23°, 37½°, 31½°, 34½°, 23½°, 38°, 30°. The angles are measured between adjacent blades, which converge towards the axis of the cutter, and are given consecutively around the cutter. If desired, the plain blades may be used instead of notched blades, as it has been found that a cutter of this type with plain blades cuts valve seat scale satisfactorily. The use of notched blades does, however, add somewhat to the speed of cutting.

One relation between the steel blades and the alloy base is of importance in making possible the production of this type of cutter. As is known in the heat treatment of alloy steels, the metal when once hardened and then drawn to a predetermined temperature can subsequently be reheated to a lower temperature without destroying the properties given to it by its heat treatment. The casting temperature of the alloy chosen is lower than the drawing temperature of the steel blades by an amount sufficient to prevent any accidental impairment of the hardness of the blades. It will thus be seen that the blades can be hardened and suitably tempered, subsequently placed in a mold or die, and the molten alloy for the base poured in place without injuring the blades.

One type of alloy which is suitable for the body 10 is a standard one used in die casting and having 88% zinc, 4% aluminum, 3% copper, and 5% magnesium. This alloy, which is given as illustrative only, has a melting point of 750 degrees and a pouring temperature in the neighborhood of 880 degrees. Contrasted with this is the tempering heat of a tunsten steel alloy blade of 1050 degrees. It is obvious that if metals of substantially these characteristics are used, the already tempered steel blades may be cast in place without danger of injuring them.

What we claim is:

An inserted blade cutter comprising a relatively soft body of cast metal, a relatively hard metal sleeve centrally located in the body and shaped externally to provide a bonding anchorage with the body, said sleeve being formed with a central bore whereby the cutter may be detachably supported on an arbor, and a plurality of tempered sheet metal blades set into the body and having their extreme inner edges laterally distorted with corrugations diminishing in size as they extend into the bodies of the blades, whereby the extreme inner edge of each blade is of substantially greater thickness than the body of the blade, and a bonding anchorage is provided with the cast metal body, the metal of which the body is formed being of such a composition that its moulding temperature is substantially below that at which the blades are tempered.

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