April 14, 1964 D. H. BENSON 3,128,755

UNDERCUT RESISTANT DIAMOND ABRASIVE SAW BLADE

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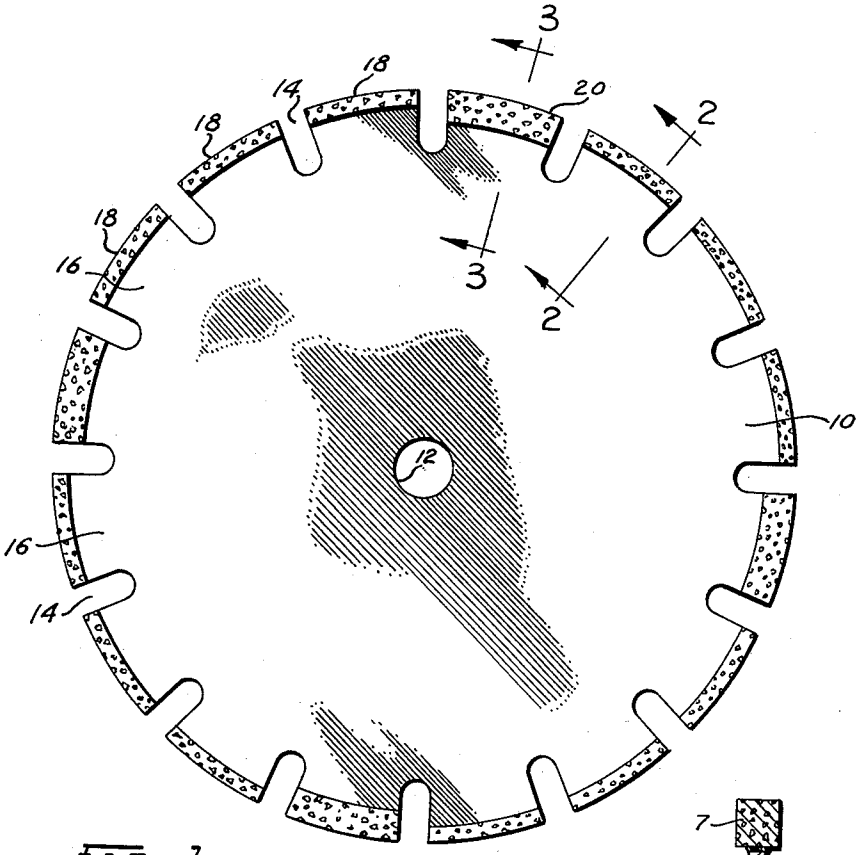


Fig. 1

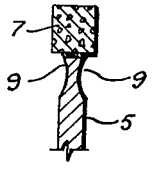


Fig. 4

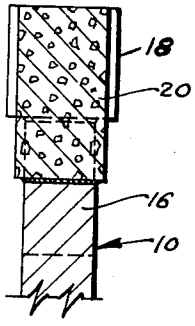


Fig. 3

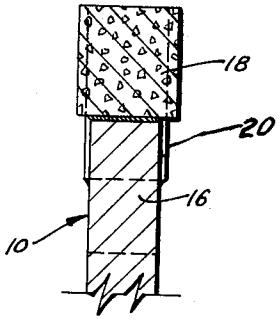


Fig. 2

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UNDERCUT RESISTANT DIAMOND ABRASIVE SAW BLADE

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This invention relates to abrasive blades or wheels for use in cutting various types of stone, cement, ceramic material, and other non-metallic materials.

An object of the invention is the provision of a generally improved and more satisfactory diamond abrasive saw blade, and particularly one which has improved resistance to so-called undercutting.

Another object of the invention is to provide a circular diamond abrasive blade that eliminates the localized high concentration of abrasive swarf that causes premature failure of the blade adjacent to the cutting segments.

Still another object of the invention is in providing a circular diamond abrasive blade that will eliminate the concentration of abrasive swarf in the area where the diamond segment is attached to the blade by distributing the swarf over a greater area of the blade surface inwardly of the diamond segment until it is discharged through the radial slots.

A further object of the invention is in providing an abrasive blade having abrasive segments mounted on the periphery of the blade in which selected abrasive segments extend inwardly to a greater extent than the other segments for cooperation in eliminating the localized high concentration of abrasive swarf adjacent the connection of the abrasive segments to the blade.

A still further object of the invention resides in providing a diamond abrasive blade formed with a plurality of radial slots to form spaced radial sections about the margin of the blade in which predetermined sections carry diamond abrasive segments and selected sections intermediate the diamond abrasive segments carry abrasive segments of greater width than the thickness of the blade and having a thickness that is not greater than the diamond cutting segments with the inner edge portion of the abrasive segments extending inwardly beyond the inner edges of the diamond segments for cooperation therewith to eliminate localized high concentration of abrasive swarf adjacent the inner edges of the segments and premature failure of the blade adjacent the segments.

These and other desirable objects may be attained in the manner disclosed as an illustrative embodiment of the invention in the following description and in the accompanying drawings forming a part hereof, in which:

FIG. 1 is a side elevation of an abrasive blade constructed according to the invention;

FIG. 2 is an enlarged transverse fragmentary cross section taken substantially on line 2—2 of FIG. 1 through a radially extending section of the blade and the diamond abrasive segment mounted thereon;

FIG. 3 is a fragmentary cross section similar to FIG. 2 taken approximately on line 3—3 of FIG. 1 through a radial section carrying an abrasive segment and illustrating the construction thereof in comparison with a diamond abrasive segment as shown in FIG. 2; and

FIG. 4 is a fragmentary cross section similar to FIG. 2 showing how the abrasive swarf cuts the blade at the base of the diamond cutting segment.

The development of diamond abrasive cut-off wheels or blades has progressed to the point where the life of the diamond abrasive segments exceeds the life of the steel blade or center or core. This condition is more prevalent when a loosely bonded material such as green cement is cut. The premature failure of the steel center and brazed joints usually takes place adjacent the base of the diamond cutting segment through the collection and concentration of the abrasive swarf beneath the diamond bearing segment during the sawing operation. This wears away the surface of the steel blade adjacent the base of the diamond cutting segment in the manner indicated in FIG. 4, where a fragment of a conventional steel core is shown at 5, a conventional abrasive segment is shown at 7, and the undercut or weakened part is seen at 9. This wear of the blade eventually cuts through the steel center and wears out the blade before the cutting segments are worn out. Various attempts have been made to reduce this wear.

The present invention provides an improved blade construction for eliminating the localized high concentration of abrasive swarf that causes premature failure of the blade and impairs the bond strength of the brazed joint between the diamond bearing segment and the steel center.

The abrasive blade made according to the present invention uses a circular steel blade or core 10 having a central opening 12 to receive the shart or arbor on which the blade is mounted and has the marginal portion formed with a plurality of radial slots 14 opening through the outer periphery and providing a plurality of radially extending sections 16.

Diamond bearing cutting segments 18 are mounted on a predetermined number of the radially extending sections 16 by brazing or the like according to well known conventional methods. As shown in FIG. 1 diamond segments 18 are mounted on each group or series of three adjacent radially extending sections 16, spaced circumferentially from the next adjacent group or series. The remaining radially extending sections 16 intermediate the groups of three diamond cutting segments 18 each have an abrasive segment 20 secured thereon by brazing or other conventional means well known in the art.

The abrasive segments 20 are provided by the invention and arranged to be interspersed between one or more of the diamond segments 18 as shown in FIG. 1 for example, where an abrasive segment 20 is arranged between each group of three diamond cutting segments 18. It will be understood, however, that according to the invention, a lesser or greater number of diamond cutting segments 18 may be arranged between the abrasive segments 20 as may be found desirable according to the size of the blade and character of the material to be cut.

The segments 18 and 20 are shown in the drawing as being mounted on the peripheral edges of the radially extending sections 16 by brazing or other conventional means. The radially extending sections 16 carrying the abrasive segments 20 are constructed to have the radius of the peripheral edge of less length than the radius to the peripheral edge of the sections 16 carrying the diamond cutting segments 18. This provides a construction where according to the invention, the abrasive segments 20 may be formed with a greater radial dimension from the inner to the outer surface thereof than the diamond cutting segments 18. The greater dimension of the abrasive segments 20 between the outer and inner edges thereof, as shown in FIG. 3, in comparison with the diamond seg-

ments 18, as shown in FIG. 2, with the radial sections 16 having a shorter length where they mount the abrasive segments 20 provides a construction where the outer periphery of the segments 18 and 20 may be arranged in circumferential relation.

The invention also provides for constructing the abrasive segments 20 with a thickness greater than the thickness of the blade 10 but not greater than the thickness of the diamond segments 18. By having the thickness of the abrasive segments 20 slightly less than the thickness of the diamond segments 18, it is found that the segments 18 and 20 will cooperate in the sawing operation to saw stone, cement, or other material being cut along the peripheral edges of the segments. With the side faces of the segments 20 spaced inwardly a slight distance from the side faces of diamond segments 18 by reason of the diamond segments 18 being wider than the segments 20, the swarf will pass between the surfaces of the abrasive segments 20 and the surface of the material being cut adjacent thereto for additional cutting action thereby. The greater radial dimension between the inner and outer surfaces of the abrasive segments 20 with the inner edge extending inwardly to a greater distance than the inner edge of the diamond segments 18 produces a cooperation in which the inner marginal portions of the abrasive segments 20 will agitate the swarf about the base portions of the diamond segments 18 and adjacent portions of the blade sections 16. The swarf is distributed inwardly over a substantially wide area of the blade surface and divided up so that it will not concentrate or pack against the edges of the blade sections 16 adjacent the base portion of the segments 18. By this agitating action of the abrasive segments 20 the swarf will be caused to flow inwardly and then fall into the radial slots and be discharged outwardly from the blade.

As shown in FIG. 1 both the diamond segments 18 and the abrasive segments 20 are each constructed of arcuate formation to fit the curvature of the periphery of the blade so that the outer periphery of the several segments are arranged in circumferential relation. The segments have a length as shown in FIG. 1 equal to the length of the periphery of the section 16 where they are attached to the radial sections 16 and cooperate to form continuations of the walls of the segments in radially extending relation so that the slotted portion about the margin of the blade is uniform, as shown in FIG. 1.

The abrasive segments 20 provided by the invention may extend inwardly a distance of approximately five hundredths of an inch to one-half an inch more than the inner edge of the diamond segments 18 in order to produce the effective operation above described for distributing the swarf. As shown in the drawing, the abrasive segments 20 have substantially the same length as the diamond cutting segments 18. However, it will be understood that the length of the abrasive segments may be greater or less than the length of the diamond cutting segments 18 according to the cooperation desired between the two types of segments and the type of material to be cut.

It will be understood that this invention may be applied to any of the various sizes of blades that are constructed for sawing stone, cement, ceramic material, and other non-metallic materials. It will also be understood that the construction of the abrasive segments 20 and diamond segments 18 will be made from materials and by processes now well known in the art.

The abrasive segments 20 may be constructed of the same materials as the diamond cutting segments 18, or both segments may be made of any of the various abrasive materials used for cutting blades which may or may not include diamond particles, the terminology used herein being for the purpose of identifying the different structural parts of the invention rather than to limit the segment construction to diamond bearing segments.

It is seen from the foregoing disclosure that the objects and purposes of the invention are well fulfilled. It is to be understood that the foregoing disclosure is given by way of illustrative example only, rather than by way of limitation, and that without departing from the invention, the details may be varied within the scope of the appended claims.

What is claimed is:

1. An abrasive blade comprising a steel center having a radially slotted outer marginal portion forming a plurality of spaced peripheral segments, selected segments having a shorter radial dimension than the other segments, a diamond segment bonded to the peripheral edge of each of said other segments, and an abrasive segment bonded to the peripheral edge of each of said selected segments, said diamond segment having a width greater than the width of said steel center about said outer marginal portion, said abrasive segment having a width greater than said steel center about said marginal portion and not exceeding the width of said diamond segment, and said abrasive segment having the inner bonded edge portion spaced inwardly in offset relation to the corresponding portions of said diamond segment, each of said abrasive segments being of diamond-impregnated material throughout its entire radial thickness from its outer circumferential edge to its inner edge offset inwardly with respect to the inner edges of said diamond segments.

2. An abrasive blade comprising a steel center having the circular margin thereof radially slotted to form a plurality of radially extending sections, a diamond segment mounted on the outer portion of each of a plurality of predetermined sections, an abrasive segment mounted on the outer portion of each of a plurality of said sections intermediate said predetermined sections, each of said abrasive segments having a radial dimension greater than said diamond segments and a width greater than said sections and not exceeding that of said diamond segments, each of said abrasive segments being of diamond-impregnated material throughout its entire radial thickness from its outer circumferential edge to its inner edge offset inwardly with respect to the inner edges of said diamond segments.

3. A blade according to claim 2, wherein said segments have the outer peripheries in circumferentially alined relation and the inner edges of said abrasive segments project inwardly beyond the inner edges of said diamond segments for cooperation to reduce wear of said sections adjacent said segments by distributing and aiding in the discharge of swarf through said slots, and wherein there are a plurality of said radially thinner diamond segments between each two adjacent radially thicker abrasive segments.

4. An undercut resistant abrasive saw blade comprising a metallic core adapted for rapid rotation about a center, circumferentially spaced sections of said core having peripheral edges at one radial distance from said center, other circumferentially spaced sections intermediate the first mentioned sections having peripheral edges at a greater radial distance from said center, a first series of abrasive segments secured to the peripheral edges of said first mentioned sections of the core, and a second series of abrasive segments secured to the peripheral edges of said other sections of the core, all of the segments of both series having their outermost peripheral edges at the same radial distance from said center of said core, all of the segments of the second series being thicker in an axial direction than the thickness of said core and projecting laterally beyond both respective faces of the core, the segments of the first series being thicker in a radial direction than the segments of the second series and being at least as thick in an axial direction as the axial thickness of the core and being no thicker in an axial direction than the segments of the second series, all of said segments of both series being formed of diamond-bearing material, there being a substantially greater number of

radially thinner segments of the second series than the number of radially thicker segments of the first series.

5. A construction as defined in claim 4, in which the segments of the first series are individually arranged at substantial distances from each other in a circumferential direction, and in which the segments of the second series are arranged in groups, each group comprising a plurality of segments of the second series in the circumferential space between two adjacent segments of the first series.

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