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ABRASIVE CUTTING WHEELS

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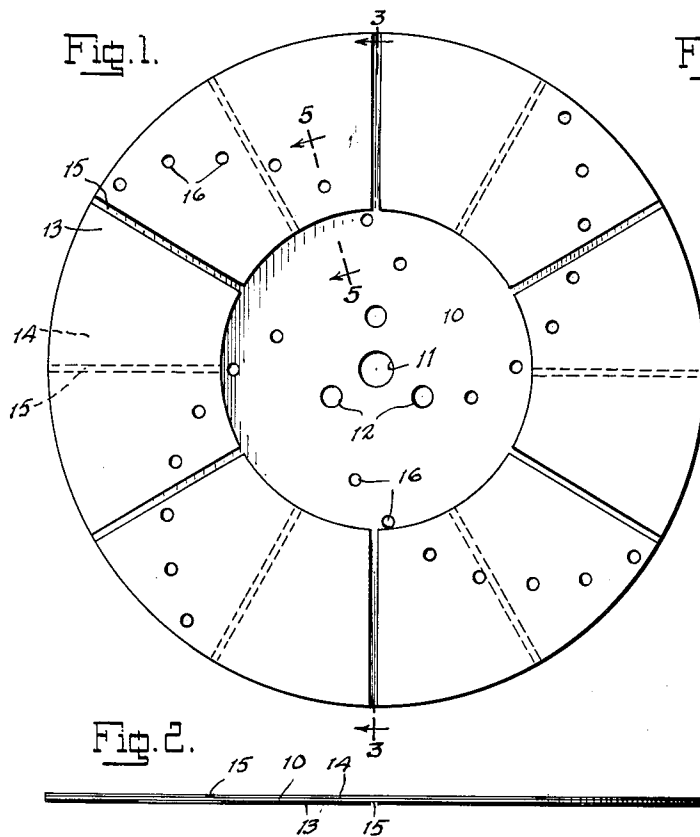


Fig. 3.

Fig. 4.

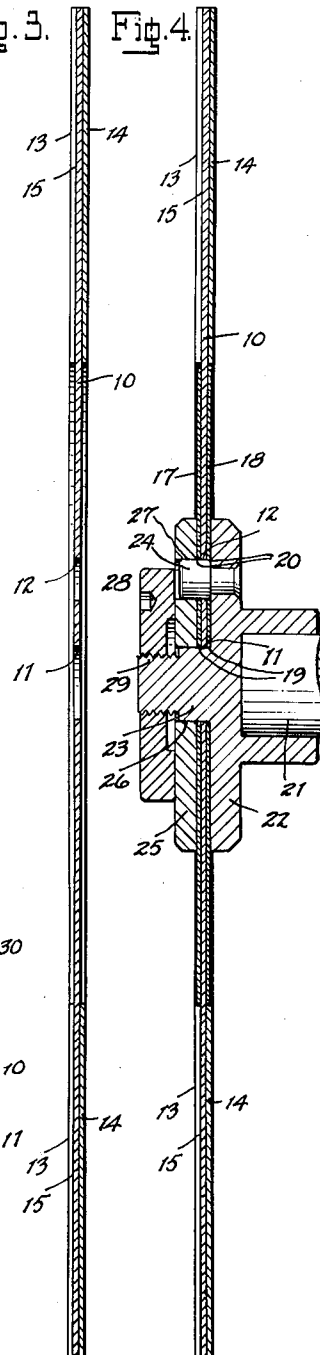


Fig. 5. Fig. 6. Fig. 7.

Fig. 8.

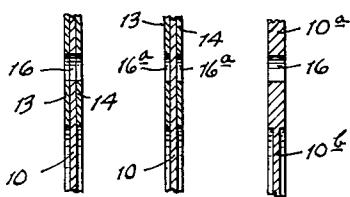
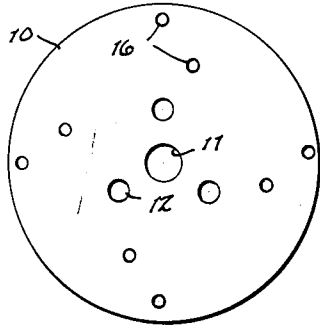
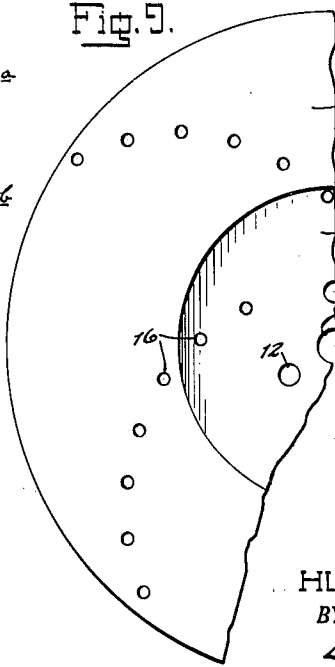


Fig. 8.



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2,735,243

ABRASIVE CUTTING WHEELS

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8 Claims. (Cl. 51—207)

This invention relates to an improvement in abrasive cutting wheels of the type employed for cutting alloy steel and other tough metals. Cutting wheels are characterized by their relatively small thickness and relatively large diameter, and are to be distinguished from grinding or other types of abrasive wheels in that their use is limited to such operations as cutting, cutting-off, grooving, slotting, coping, jointing, etc., and it is the purpose of such wheels in general, and of the present invention in particular, to provide a wheel of minimum thickness and maximum diameter while still maintaining adequate stability against breakage, fracture, etc., resulting from the extremely high speed at which such wheels are operated and the forces developed through centrifugal force and resistance of the material being cut. In the American Standard Safety Code relating to abrasive wheels, issued by American Standards Association, cutting wheels are defined as having a thickness not more than $\frac{1}{8}$ of their diameter for wheels up to 20" in diameter, and not more than $\frac{1}{60}$ of the diameter of those larger than 20" in diameter.

It is an object of the present invention to provide an abrasive cutting wheel in which the body of the abrasive material extends outwardly from a point in close proximity to the center of the wheel, and further to provide reinforcing plates or discs enclosing a relatively large area of the central portion of the wheel, these plates or discs being inwardly offset from the side surfaces of a thickened peripheral rim portion of the wheel. The central portion of the wheel is thus in the form of a sandwich, consisting of a relatively thin body of the abrasive material and the reinforcing plates at each side, and which is adapted for mounting between the flanges of a driving arbor.

It is further proposed to provide a positive driving connection for the central body of the abrasive wheel in the form of driving pins carried by the driving arbor and engaged in driving holes in the reinforcing plates and in the body of the wheel between them, to the end that slippage between the wheel and the plates is overcome and at the same time the body of abrasive material between the plates is given added strength to sustain any torsional or bending strains thereon.

A further object is to provide a cutting wheel in which the thin central area may be utilized after the thicker rim portion has been reduced by wear beyond the optimum size for cutting large diameter material, the thin central portion of the wheel previously between the reinforcing plates being usable upon removal of the plates for conventional cutting operations.

Other objects and advantages of the invention will become apparent from a consideration of the following detailed description taken in connection with the accompanying drawing wherein satisfactory embodiments of the invention are shown. However, it is to be understood that the invention is not limited to the details disclosed but includes all such variations and modifications

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as fall within the spirit of the invention and the scope of the appended claims.

In the drawing:

Fig. 1 is a front elevational view showing a cutting wheel, according to the invention, in which the side surfaces of the rim portion of the wheel are segmented;

Fig. 2 is a top edge view;

Fig. 3 is a vertical sectional view on an enlarged scale, taken along the line 3—3 of Fig. 1;

Fig. 4 is a vertical sectional view similar to Fig. 3, and showing the cutting wheel attached to the flanges of a driving spindle, also shown in vertical section;

Fig. 5 is a fragmentary sectional view taken along the line 5—5 of Fig. 1, showing the laminated structure making up the cutting wheel, and also showing one of the water holes therethrough;

Fig. 6 is a view similar to Fig. 5, showing a modified form of the water holes;

Fig. 7 is a sectional view similar to Fig. 5, showing a modified form of the invention in which the wheel is formed in one piece;

Fig. 8 is a front elevational view showing the center portion of the wheel following the removal through wear of the rim portion; and

Fig. 9 is a fragmentary front elevation of a modified form of the wheel in which the side surfaces of the rim portion are circumferentially continuous.

Referring to the drawings, and more particularly to Figs. 1-5 thereof, the improved abrasive cutting wheel, according to the illustrated exemplary embodiment of the invention, consists of a thin circular disc-shaped body member 10 constituting the central body of the wheel, and which is molded or otherwise suitably formed of the usual abrasive materials, such as abrasive grain and a suitable bond such as resin, rubber or the like, the material being subject during its formation to the usual curing procedures.

This member 10 extends into close proximity to the center point of the wheel, being provided with a relatively small center hole 11 and then provided in outwardly spaced relation to the center hole with a plurality of driving holes 12. While the diameter of the wheel may range from approximately 16" to 60", the illustrated wheel may be considered a typical example in which the diameter of the body member 10 is 20", its thickness is approximately $\frac{1}{8}$ ", and the diameter of the center hole is approximately 1". The rim portion of the wheel has an increased thickness over the center portion and comprises the body member 10 and laminations 13 and 14 disposed at each side of the body member 10, these laminations consisting of sheets of abrasive material, of similar or of different material from the sheet 10, of approximately $\frac{1}{16}$ " thickness in the illustrated example, and which are bonded to the body member 10 by suitable bonding material, the laminated structure being then suitably cured so that the structure of the laminated rim portion is, in effect, a homogeneous mass of abrasive material.

The lamination layers 13 and 14 are in the form of segments of a ring with the adjacent edges of the segments radially disposed and spaced from each other so as to produce a radially extending groove 15 between the adjacent segments, this groove in the illustrated example being approximately $\frac{1}{4}$ " in width. The grooves 15 at one side are preferably in staggered relation to the grooves at the other side. The radial dimension of the rim portion is approximately equal to the radial dimension of the center portion, although this relationship may be varied within limits, as desired, to produce the proper rigidity at the cutting periphery. The grooves 15, in addition to forming water grooves for feeding water to the periphery of the wheel, also provide a series of clear-

ance breaks in the periphery of the wheel, which provides a better cutting action, in that they prevent portions of the removed metal of the material being cut from collecting upon the periphery of the wheel and causing glazing.

The wheel is further provided with water holes 16 which are arranged in a pattern designed to produce a proportional reduction in weight toward the periphery and therefore reduce the effect of centrifugal force upon the rim section of the wheel. The arrangement preferably consists in disposing a plurality of series of spaced holes along circumferentially spaced spiral lines extending from the periphery of the wheel to a point near the center. Additional holes may be provided near the periphery to further reduce the mass. While the holes are shown as extending through the wheel, they may, as shown in Fig. 6, be provided only in the laminations 13 and 14, in which case they form pockets 16a.

As seen in Fig. 3, the abrasive cutting wheel has a relatively large diameter center portion extending from the inner periphery of the rim portion into close proximity to the center of the wheel, and at each side of this center portion is recessed with respect to the side surfaces of the rim portion. In mounting the wheel, circular reinforcing plates or discs 17 and 18, of metal or other suitable rigid material, are placed in these recesses at each side of the central abrasive body portion 10 of the wheel, the plates having an outer diameter slightly less than the diameter of the inner periphery of the rim, so that they fit freely therein, and having a thickness slightly less than the thickness of the laminations 13 and 14 of the rim portion of the wheel, so that their outer surfaces are inwardly offset from the outer side surfaces of the rim portion of the wheel. This allows the cut being made by the wheel to extend beyond the inner periphery of the rim portion of the plates 17 and 18 to a point where the mounting hub will prevent further depth of cut. The plates 17 and 18 are each provided with a center hole 19 and driving holes 20 in register with the center hole 11 and driving holes 12 of the abrasive wheel.

The driving spindle 21 has a hub flange 22 secured thereon which carries a center stud 23 engaged through the center holes 11 and 19 of the abrasive wheel and reinforcing plates, the flange also having a series of driving studs 24 engaged through the driving holes 12 and 20 of the abrasive wheel and plates. A flange plate 25 having a center hole 26 and driving stud receiving holes 27 is engaged at the opposed side of the wheel from the flange 22, and is clamped to secure the wheel by a lock ring 28 screwed upon a threaded extension 29 of the hub 23 and bearing upon the forward face of the flange plate 25.

In Fig. 7 there is shown a modified form of the invention in which the rim portion 10a of the wheel is formed as a one-piece structure with respect to the center portion 10b, as distinguished from the laminated structure shown in Fig. 5, this structure being produced by molding or pressing and suitable curing of the bonded abrasive material. In this case, the grooves 15, as shown in Fig. 1, will be molded or cut in the sides of the rim portion.

In Fig. 9 there is shown a modified form of the invention in which the side surfaces 30 of the rim portion of the wheel are circumferentially continuous, there being no radial grooves 15. Obviously, this wheel may be formed by either of the methods shown in Figs. 5 and 7, i. e., by a laminated structure or a one-piece structure.

Fig. 8 illustrates the center portion of the wheel following the wearing down of the rim portion, this center portion then being usable as a conventional cutting wheel upon removal of the metal plates 17 and 18. It may be mounted between the flanges of a driving spindle similar to that shown in Fig. 4, in which case suitable blotters or metal plates may be disposed at each side for protection, these being of substantially the diameter of the flanges of the driving spindle.

What is claimed is:

1. An abrasive wheel of the cutting wheel type having a thickness not more than $\frac{1}{48}$ of the diameter for wheels up to 20" diameter and not more than $\frac{1}{60}$ of the diameter for wheels larger than 20" diameter, comprising a circular disc including a circular material cutting rim portion of bonded abrasive material having flat substantially parallel side surfaces and a material cutting central portion of bonded abrasive material integral with said rim portion having its side surfaces inwardly offset with respect to the side surfaces of said rim portion, said cutting wheel presenting a continuous cutting periphery throughout the life of the rim portion and the central portion thereof, the thickness between the side surfaces of said rim portion determining the width of cut during the cutting life of said rim portion and the thickness between the side surfaces of said central portion determining the width of cut following the wearing away of the rim portion.

2. The invention as defined in claim 1, further characterized in that said rim portion has at each side a series of radially extending grooves terminating at the outer periphery of said central portion.

3. The invention as defined in claim 1, further characterized in that said rim portion has at each side a series of radially extending grooves terminating at the outer periphery of said central portion, the bases of said grooves being substantially flush with the side surfaces of said central portion.

4. The invention as defined in claim 1, further characterized in that said rim portion has at each side a series of radially extending grooves terminating at the outer periphery of said central portion, the grooves at one side being in staggered relation to the grooves of the other side.

5. The invention as defined in claim 1, further characterized in that said wheel comprises a medially disposed circular sheet of material including a central portion forming the central portion of the wheel and a rim portion forming a medial lamination of the rim portion of the wheel, and said rim portion of the wheel further includes lamination sheets of material bonded to the sides of said rim portion of said circular sheet of material.

6. The invention as defined in claim 1, further characterized in that said wheel comprises a medially disposed circular sheet of material including a central portion forming the central portion of the wheel and a rim portion forming a medial lamination of the rim portion of the wheel, said rim portion of the wheel further includes lamination sheets of material bonded to the sides of said rim portion of said circular sheet of material, said lamination sheets of material at each side consisting of a plurality of segments of a circular ring having the adjacent edges of said segments radially disposed and spaced apart to provide radial grooves.

7. The invention as defined in claim 1, further characterized in that said wheel comprises a medially disposed circular sheet of material including a central portion forming the central portion of the wheel and a rim portion forming a medial lamination of the rim portion of the wheel, said rim portion of the wheel further includes lamination sheets of material bonded to the sides of said rim portion of said circular sheet of material, said lamination sheets of material at each side consisting of a plurality of segments of a circular ring having the adjacent edges of said segments radially disposed and spaced apart to provide radial grooves, the grooves at one side being in staggered relation to the grooves at the other side.

8. In combination, an abrasive wheel of the cutting wheel type having a thickness not more than $\frac{1}{48}$ of the diameter for wheels up to 20" diameter and not more than $\frac{1}{60}$ of the diameter for wheels larger than 20" diameter, comprising a circular disc including a circular material cutting rim portion of bonded abrasive material

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having flat substantially parallel side surfaces and a material cutting central portion of bonded abrasive material integral with said rim portion having its side surfaces inwardly offset with respect to the side surfaces of said rim portion, said cutting wheel presenting a continuous cutting periphery throughout the life of the rim portion and the central portion thereof, the thickness between said side surfaces of said rim portion determining the width of cut during the cutting life of said rim portion and the thickness between said side surfaces of said central portion determining the width of cut following the wearing away of said rim portion, and a pair of discs respectively fitted in the recesses at each side of the central portion of said abrasive wheel and freely removable from the side surfaces of said central portion, the outer surfaces of said discs being inwardly offset from the side surfaces of said rim portion.

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