Feb. 15, 1938. A. W. WALKER 2,108,630

GRINDING DEVICE

Filed July 27, 1936

Fig. 1.

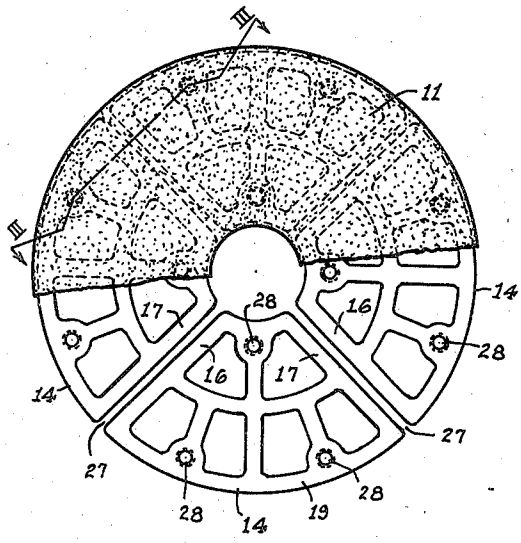


Fig. 2.

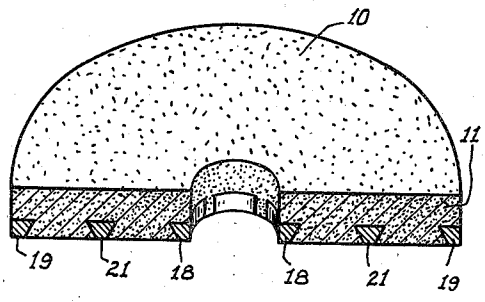


Fig. 3.

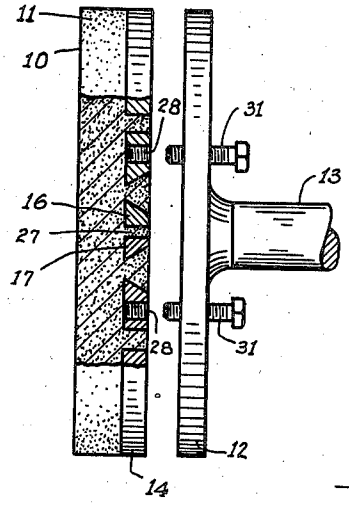


Fig. 4.

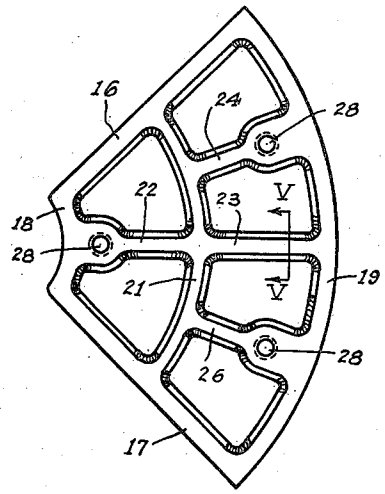


Fig. 5.



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UNITED STATES PATENT OFFICE

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GRINDING DEVICE

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Application July 27, 1936, Serial No. 92,741

3 Claims. (Cl. 51—209)

The present invention relates to grinding wheels and particularly the type often referred to as abrasive disks wherein one face is adapted to be moved over a work surface. More specifically, the invention pertains to improved means for reinforcing and supporting such an abrasive structure including the method of fabricating the abrasive disk.

Various types of reinforced abrasive disks have been devised and used in the past. The principal objective in the construction of the structures of the prior art has been concerned with increasing the strength of the abrasive in an effort to prevent breaking of the bond during the initial operation of the disk and particularly after the abrasive has worn away and the disk becomes thin. The various reinforced grinding wheels have enjoyed only a fair degree of success and breakage of the abrasive has been found to take place in spite of efforts to avoid cracking. A particularly unfortunate characterisic of grinding devices of this type, even when reinforced, lies in the fact that when breakage occurs it is of irregular shape so that the faulty portion may be confined to a small area of the wheel with the result that upon further operation of the disk the broken portion is eventually severed from the backing support to end the useful life of the device. In other words, the cracks may appear in any portion of the abrasive and spread to other parts in a haphazard fashion with the result that a chunk of the abrasive finally falls away to render the disk no longer useful.

It is therefore an object of the present invention to provide improved reinforcing means for strengthening an abrasive disk wherein an additional feature is provided permitting the device to be supported in such a manner that if a crack develops in the abrasive the scope and direction thereof will be predetermined.

Another object of the invention is to provide improved reinforcing means for an abrasive disk wherein a rigid framework is embedded in the bonded abrasive and spread over a relatively large area of the abrasive to prevent cracking of that portion of the disk embraced by the framework.

A still further object of the invention is the provision of a rigid grid structure around which an abrasive disk may be molded to reinforce the same and by means of which the disk may be supported whereby the driving forces applied to the disk will be transmitted through the grid structure and thus spread over a relatively large area of the abrasive.

Other and further features and objects of the invention will be more apparent to those skilled in the art upon a consideration of the accompanying drawing and the following description wherein an exemplary embodiment of the invention is disclosed.

In the drawing:

Fig. 1 is a front face view in elevation of a grinding wheel constructed in accordance with the invention, the abrasive disk being broken away to illustrate the arrangement of the reinforcing members;

Fig. 2 is a perspective view showing the shape and arrangement of the reinforcing ribs in the central section;

Fig. 3 is a view of the edge of the wheel and a rotatable support showing a portion of the disk in section taken on the lines III—III of Fig. 1;

Fig. 4 is a back face view of one of the reinforcing members; and

Fig. 5 is a sectional view of one of the ribs of the anchor members taken on the line V—V of Fig. 4.

Referring to the drawing there is shown in Figs. 1 and 3, a grinding wheel of the type adapted to have one face 10 moved over a work surface comprising a disk 11 consisting of abrasive material, a binding medium or bond including reinforcing and anchoring means. This type of grinding wheel is intended to be fixed to a rotatable support 12 and driven for work engaging operation by means of a shaft 13.

In the construction of the grinding wheel a number of reinforcing members or anchors 14 in the nature of open frameworks or lattice structures are employed to strengthen the abrasive and provide unique means for detachably securing the disk 11 to the support 12. One of such anchors is more clearly shown in Fig. 4 wherein the shape may be regarded as being that of a sector or segment of a circle. The anchors may be fashioned from any rigid material such as metal and formed with radially extending boundary ribs or bars 16 and 17 and circumferentially extending boundary ribs 18 and 19. The chord span of the ribs 16 and 17 may be of any appropriate division of 360 degrees so that various numbers of frameworks may be arranged with the radial bounding bars substantially adjacent to each other to complete a circle.

The circumferentially extending boundary bars or ribs 18 and 19 are intended to outline the inner and outer edges of the abrasive wheel as hereinafter described and these ribs may be spaced with

respect to each other to provide any suitable effective diameter.

Various arrangements of interconnecting ribs may be provided to form a lattice structure between the joined bounding bars. For example, an intermediate circumferentially extending rib 21 joining the bars 16 and 17 provides a support for other radially extending ribs 22 and 23. To further reduce the area of the intervening spaces other lattice bars 24 and 26 are provided extending radially from the intermediate rib 21 at each side of the rib 23 and connecting with the peripheral boundary bar 19. In actual construction of such a framework the entire assembly may be molded or forged as a unit to integrally join all of the bars and thus form a rigid lattice structure.

In order that the frameworks may be interlocked in the abrasive the interconnecting ribs and the inner edges of the boundary ribs are undercut as illustrated in Fig. 4. In order words, the cross-section of the inner-connecting ribs are shaped with a wide face 29 and a narrower back face 30 so that the edges thereof slope inwardly towards the back face as shown in Fig. 5. The outer edges of the boundary ribs, however, may be straight as indicated in Figs. 2 and 3 since the abrasive material does not engage these edges.

A suitable number of such frameworks, preferably four, may then be arranged around a central point or opening in a manner as illustrated in Fig. 1 to provide radial extending spaces 27 between the adjacent segmental shaped frameworks. In positioning the reinforcing members in such a circumferentially spaced manner to form a circle the undercut faces 30 of the ribs are positioned downward so that an abrasive mix consisting of abrasive granules such as silicon carbide or fused alumina and any suitable binding medium such as a heat hardenable bond may be molded around the ribs of the segments and into the spaces between the ribs including the radially extending spaces 27.

In order that the abrasive may be caused to adhere to the ribs of the reinforcing members the same may be coated with any adhesive material such as a resin of the heat hardenable type. Such a coating will also serve to protect the framework from corrosion as a result of the binding medium that may be employed in certain bonds for the abrasive.

The segmental shaped reinforcing members 14 are adapted to provide anchors for the grinding wheel as hereinafter set forth and for the purpose of supporting the wheel a number and preferably three threaded holes 28 are provided in each of the frameworks. These threaded apertures may also be utilized to secure the segments in the bottom of a cup-shaped mold in a well known manner to properly hold the frameworks in a spaced relation with respect to each other while the abrasive mix is being pressed therearound. The under-cut or tapering cross section of the ribs permits the abrasive to spread outwardly beyond the inner face of the ribs so that the bars of the reinforcing members 14 are substantially encircled by the abrasive and in fact only the narrow outer faces 30 of the lattice ribs are visible on the back face of the disk when the reinforcing members are properly embedded in the abrasive.

After the binding medium or bond has been properly cured with the reinforcing members embedded in the abrasive the wheel may be attached to the rotatable support 12 by means of a plurality of screws or threaded bolts 31 which are adapted to pass through appropriately spaced openings in the support 12 and engage threaded openings 28 provided in each of the anchor members 14. For the purpose of simplifying the drawing only two of such bolts are shown in Fig. 3 but in actual construction a fastening device is provided for each of the threaded openings 28 established in the anchor members. The important consideration in securing the disk to the support resides in the provision of a rigid, non-rotatable attachment for each of the individual anchor members 14. It is for this purpose that three bolts 31 are employed for drawing the back face of the disk into engagement with the rotatable support 12.

A grinding wheel constructed in accordance with the present invention is therefore a unitary abrasive disk reinforced with a plurality of embedded frameworks each extending over a relatively large area of the abrasive to strengthen and rigidly reinforce individual portions of the disk. The interconnecting ribs of the frameworks provide a lattice structure within the abrasive to further hold the intermediate portions of the disk spanned by the segments so that the small areas of abrasive between the ribs are provided with rigid supporting means. The undercut arrangement of the ribs adds further to the strength of the structure by providing a gripping area for the abrasive which extends throughout the disk to a greater extent than prior devices of this character.

Each of the segmental reinforcing members is adapted to be securely attached to a driving support so that the frameworks act as anchors to spread the driving forces throughout a plurality of relatively large areas of the disk.

A further advantage results from the use of the anchor members particularly if formed of metal in that the relatively large volume of metal provides an exceedingly good medium by which the heat generated during the course of grinding is conducted from the abrasive and thereby reduce any tendency of the disk to become distorted or cracked as a result of expansion of the abrasive or bond. Local heating often renders that portion of the wheel more susceptible to breakage and the lattice structure of the anchor members extending to practically all portions of the present disk conducts heat therefrom to equalize the internal stresses.

While the grinding wheel formed in accordance with the teachings of the present invention is reinforced in an improved manner any cracks that may develop in the disk during the use thereof will be along the abrasive lying in the spaces 27 between the bounding ribs 16 and 17 of two adjacent frameworks. Even though such cracking should take place the wheel may be continued in use since the remainder of the abrasive is held firmly by reason of the ribs of each segmental framework.

Although certain preferred embodiments of the invention have been described, it is apparent that modifications may be made by those skilled in the art. Such modifications may be made without departing from the spirit and scope of the invention as set forth in the appended claims.

I claim:

1. A grinding wheel comprising, a homogeneous bonded abrasive disk, a rigid segmental framework embedded in one face of said disk, said framework having bounding ribs in the shape of a sector of a circle and provided with intercon-

necting ribs formed integrally with said bounding ribs to provide a grid structure within the abrasive whereby the disk is reinforced in the segmental area embraced by said framework.

2. In a grinding wheel, the combination of a homogeneous abrasive disk, with a plurality of anchors having bounding ribs of segmental shape and interconnecting ribs rigidly secured thereto, each of said anchors being individually embedded in one face of said disk in a circumferentially spaced relation with respect to each other, to reinforce the portions of the disk embraced by said anchors and to provide relatively weak points in the abrasive along the radial extending spaces between said anchors.

3. A grinding device comprising, the combination of, a rigid rotatable support, with a homogeneous abrasive disk having a plurality of segmental anchor members individually embedded in one face of the abrasive, each of said members consisting of a number of interconnecting ribs extending throughout separate portions of said abrasive in a relatively large contact area with the respective abrasive portions, and means for attaching said anchor members to said support, whereby the driving forces of said support may be transmitted to individual portions of said disk and dispersed throughout abrasive of said portions.

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