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METHOD OF MAKING A COMPOSITE ABRASIVE WHEEL

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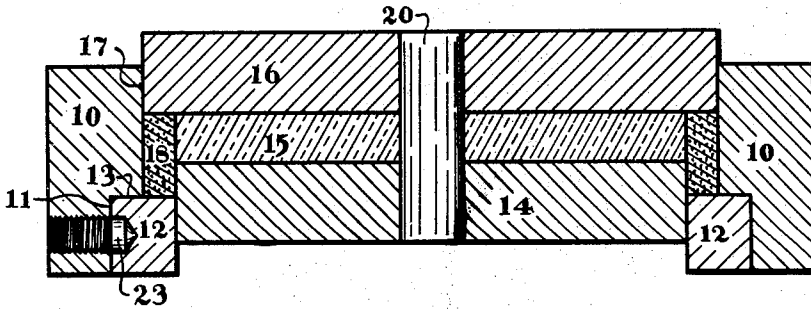


Fig. 1.

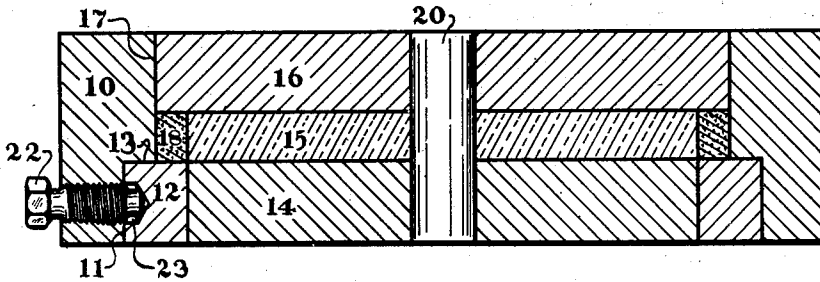


Fig. 2.

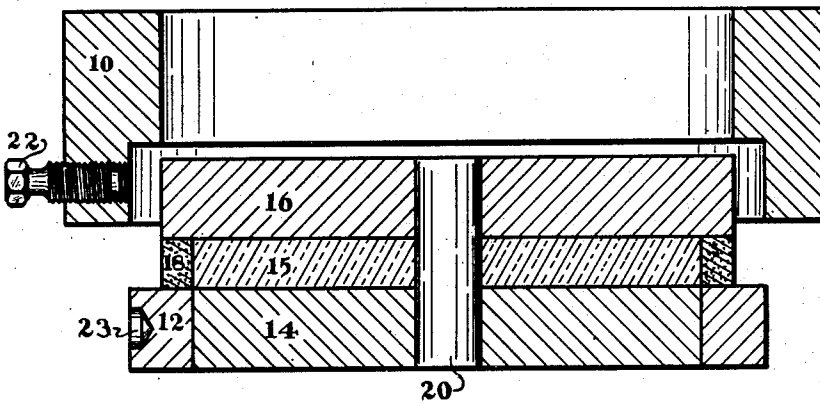


Fig. 3.

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METHOD OF MAKING A COMPOSITE
ABRASIVE WHEEL

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3 Claims. (Cl. 51—278)

This invention relates to the manufacture of composite grinding wheels and particularly wheels of the type which have a solid supporting center carrying a rim of bonded diamonds or other abrasive material.

It has been proposed to make a grinding wheel by first premolding a supporting center of a suitable material, such as a resinoid body pressed to its final form, and then compressing a rim of abrasive material onto the periphery of the support. Various problems are involved in the manufacture of that type of wheel and particularly in controlling the structure and density of the abrasive rim and of insuring a substantially integral union between the rim and the support. In that method, the central resinoid supporting body formed a part of the mold and it was necessary to compress the abrasive mixture within the mold space lying between the central support and the mold band to a thickness which was materially less than that of the central support. This required cutting away the face of the central support in order that it would not project beyond the abrasive rim.

The objects of the present invention are to provide a method of making such a composite wheel which will serve for shaping an abrasive rim and uniting it integrally with a central support prior to the step of maturing the bond, and to provide a mold device which will insure making duplicate structures without requiring that either the abrasive material or the support be cut away to shape the article further after the molding operation. Further objects will be apparent in the following disclosure.

One embodiment of a mold structure suitable for carrying out the method of this invention is illustrated in the drawing in which:

Fig. 1 is a diametrical section through the mold showing the central wheel support and the abrasive mixture in the mold cavity prior to the pressing operation;

Fig. 2 is a similar view showing the mold closed and the parts in their final pressed condition; and

Fig. 3 shows the mold parts in a disassembled relation, which indicates how the grinding wheel is removed therefrom.

In accordance with this invention, I have provided a special mold construction by which an abrasive and bond mixture may be compacted onto a supporting center. This may comprise a mold band 10 of substantially L-shaped cross section which has two internal annular surfaces of different diameters. The larger annular sur-

face 11 is arranged to carry a ring 12 slidably fitted therein. The outer plane surface of the ring 12 is flush with the bottom of the mold band when its upper surface contacts with the shoulder 13 of the ring 10. Slidably mounted within the ring 12 is a central disk shaped mold plate 14 which is adapted to support the wheel center 15 made of a resinoid or rubber which has been previously molded by another operation. In the present embodiment, the premolded wheel center 15 and the mold plate 14 are disk shaped bodies having the same diameter. Mounted above the center support 15 in their assembled relationship is a further mold plate 16 which is slidable against the inner surface 17 of the upper smaller diametered portion of the mold band 10. This arrangement is such that when the parts are assembled as shown in Fig. 1, the mold band 10, the two plates 14 and 16, the mold ring 12 and the wheel center 15 leave an annular mold cavity 18 which is considerably thicker than the plate 15, as indicated in Fig. 1, whereby this cavity 18 may be filled with a mixture of abrasive grains and a suitable bond therefor which may be thereafter compacted onto and integrally united with the supporting body 15. The band 10 and ring 12 could be made integral as an L-shaped mold (in cross section) but it is preferable to have them separable for the purpose of removing the molded body.

The central wheel support 15 is made in a separate operation of a suitable material, which is preferably of the same type as that used for the abrasive bond. That is, a resinoid support may be used for a resinoid and abrasive rim and a rubber support for a rim of rubber and abrasive, but other materials may be used for the central support, if desired. The resinoid may be a "Bakelite" phenolic aldehyde condensation product or other synthetic material capable of being heat set to a hard non-plastic condition, and various fillers, such as wood flour, silica, etc., may be incorporated therein in suitable amounts to insure that its volume will not change materially during the final pressing operation involved in mounting the abrasive rim thereon. The support 15 may be pressed in a suitable mold to the disk shape shown in the drawing, or other required shape, and it may be left in its unconverted state, if desired, until after the rim has been pressed thereon. In that case, the uncured body 15 is in a plastic condition and it may be made slightly over size in thickness, as predetermined to give a required plastic flow outwardly into a firm union with the abrasive rim during the final

pressing operation. It is, however, feasible and preferred to press the resinoid to substantially its final volume and to heat treat before the final assembly with the abrasive rim. This insures that the abrasive rim has a rigid support during the final molding step.

Likewise, the support 15 may be made of vulcanized hard rubber compound or of a vulcanizable compound of raw rubber, sulfur and an accelerator proportioned to form hard rubber. In either case, the rubber compound should be initially pressed to substantially its final volume before it is assembled with the rim material. The rubber compound may include various well known fillers and which may be proportioned to insure a uniform volume for the rubber body.

If the mold parts 10, 12 and 14 are assembled as indicated in Fig. 1, with the part 14 temporarily mounted on shims to hold it in the indicated position, then the previously molded support 15 may be laid on this plate 14 in a central position as indicated. If the wheel is to have a central hole, a pin 20 of suitable shape may be inserted in holes through the plates 14 and 16 in order to prevent distortion of the support 15. The height of the shim which positions the plate 14 will have been previously determined to provide a space 18 in the mold which is sufficient for holding the correct amount of abrasive and bond mixture to be compacted in place. This initial cavity may be twice as large as the final pressed rim material.

This abrasive and bond mixture may be made of suitable abrasive material, such as diamond grains of desired grit size, e. g. 100 grit, incorporated with a heat settable, organic bond having the capacity of being plastic and flowing when compressed in the mold so as to make an integral union with the body 15. Of the various organic materials which may be employed for this purpose I may utilize an unconverted resinoid powder of the type of "Bakelite" phenolic formaldehyde condensation product together with inert fillers, if desired, such as asbestos, wood powder, silica or other pulverized mineral substances. A precalculated amount of the mixture of abrasive grains and the bond, such as 25 to 50% by volume of diamonds and 75 to 50% of resinoid bond, is then placed in the mold cavity 18, as shown in Fig. 1, and carefully leveled off and such other precautions as may be needed are taken to insure a uniform distribution of the material within the annular space. Then the mold plate 16 is slidably fitted within the mold band 10 and the assembly is placed in a power press with the shims originally placed under the mold plate 14 now removed.

Upon applying pressure to the top of the mold plate 16 and the bottoms of the band 10 and ring 12, the material in the cavity 18 will be compacted while lateral pressure is applied to the side of the resinoid support 15. This pressure will close the mold or bring all of its outer faces into alignment with two parallel planes as indicated in Fig. 2; and the material 18 will have been compacted to the exact thickness of the premolded central support 15, since the mold parts will have been sized for this result. If the premolded support 15 has not been converted by heat to the solid, non-plastic condition then the pressure of the plates 14 and 16 thereon will cause the material to flow radially outwardly and insure a fit union between the molded ring 18 and the support. For this purpose the unconverted resinoid body 15 may be made slightly

thicker than required for the final article and this excess of thickness is intended to provide material for the plastic flow thereof.

It will be particularly observed that the parts are so shaped that the mold space 18 is adequate for the loose, granular, uncompacted abrasive and bond mixture, and the dimensions are preferably so calculated that when the mold parts have been forced together to their final positions, the outer faces of the plates and ring will be in the planes of the two faces of the mold band and the annular abrasive material 18 will have been compacted to the same thickness as that of the center support 15. Hence, it is not necessary to shave off or to grind away either the surface of the support 15 or the side of the abrasive rim 18 to insure that the sides of the two parts of the grinding wheel are in two parallel planes.

The mold with its compacted mass, as shown in Fig. 2, may be subjected to heat and the article thus cured while under pressure. In this case, a set screw 22 is threaded through the mold band 10 so as to engage a groove 23 in the mold ring 12 and lock the parts in assembled relationship. This screw is to be removed later for disassembling the mold parts. It is equally feasible to remove the molded article from the mold and to cure it in a separate apparatus as desired, so as to convert the resinoid or rubber material to its solid infusible condition. Standard practice may be followed for the curing operation.

The mold assembly has been so constructed that the molded article may be readily removed therefrom either before or after the heating or curing operation. As indicated in Fig. 3, it is merely sufficient to loosen the set screw 22 and force the mold plate 16 downwardly through the mold band 10 and thus drive the plate 14 and ring 12 out of the band and leave the molded grinding wheel exposed. When the band 10 and the upper plate 16 have been removed, the molded article may be taken from its lower support and treated as desired.

It will now be appreciated that I have thus provided a special type of mold and a method whereby a precalculated amount of abrasive and bond may be pressure molded onto the periphery of a central support of suitable material. The molding of the abrasive rim is done independently of any pressure applied to the support, hence it may be compacted to any desired density, depending on the proportions and weights of abrasive and bond selected. This method insures a strong union with the periphery of the support, and particularly where the latter is not heat set prior to the pressing operation and is caused to flow radially outwardly by pressure applied to the plates 14 and 16 while the bond and abrasive mixture is being pressed by the ring 12 and associated parts.

I claim:

1. The method of making a composite abrasive wheel comprising the steps of premolding a heat settable compound to form a central support having substantially its final volume, providing a mixture of abrasive grains and a heat settable plastic bond proportioned in amount to form an abrasive rim of required width and the same thickness as the central support when compacted to its final density, confining the support within a mold which provides walls defining a mold cavity around the support which is higher than the thickness of the support and will hold the precalculated amount of abrasive and bond, and

then compressing the abrasive and bond laterally until it attains the same thickness as the support and is united therewith, but without applying pressure directly to the support, after which the wheel is heated to set the bond to its final solid condition.

2. The method of making an abrasive wheel according to claim 1 in which the material of the premolded central support is cured by heat to

its final, hard, non-plastic condition prior to the step of molding the abrasive rim thereon.

3. The method of making a composite wheel according to claim 1, wherein the central support is made slightly oversize in thickness and the rim is initially compressed to the thickness of the support, after which the rim and support are compressed simultaneously to cause lateral flow thereof into a firm union.

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