Jan. 6, 1953 E. D. TEAGUE 2,624,660

GRINDING WHEEL

Filed Sept. 7, 1950

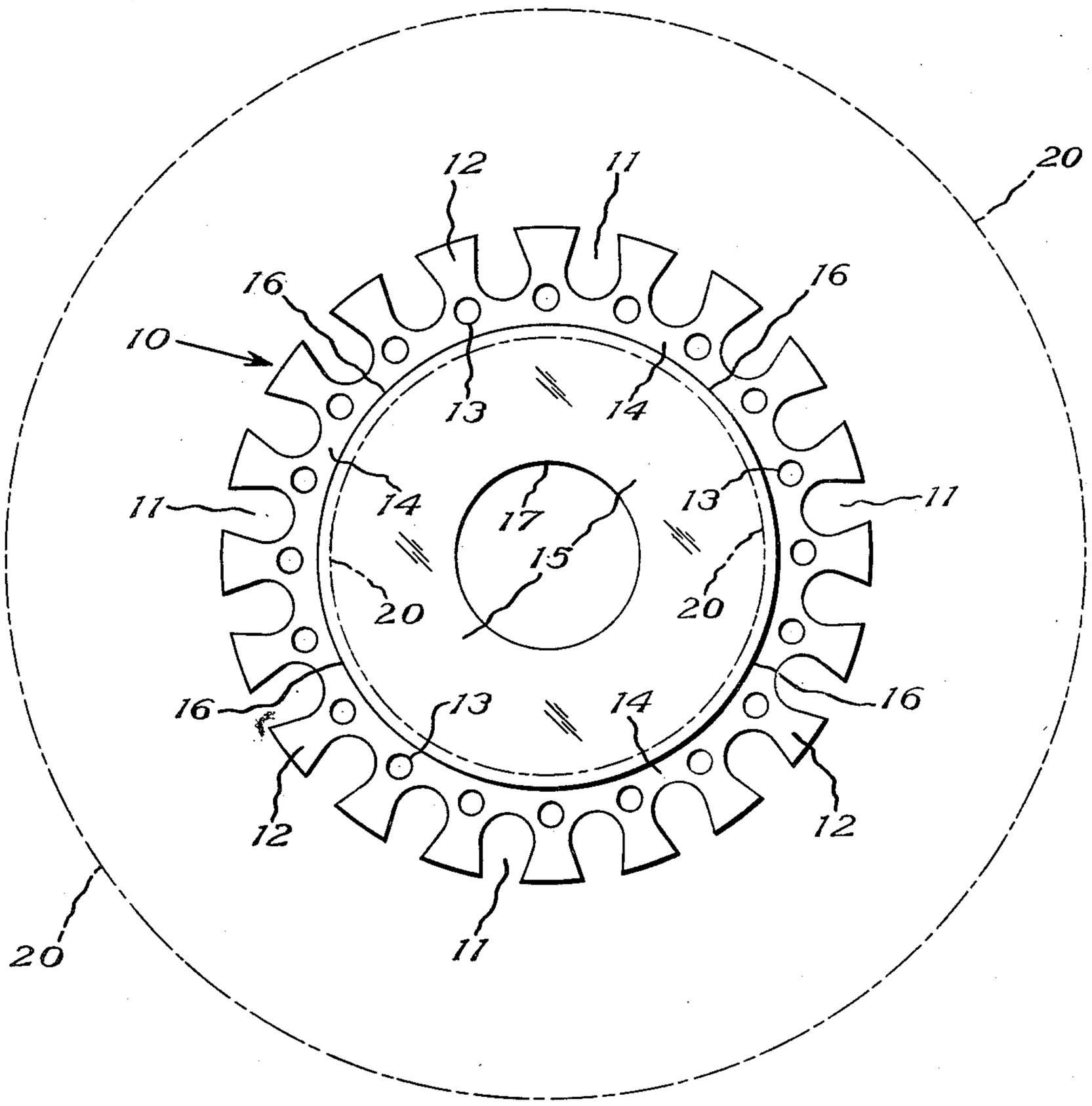

FIG. 1

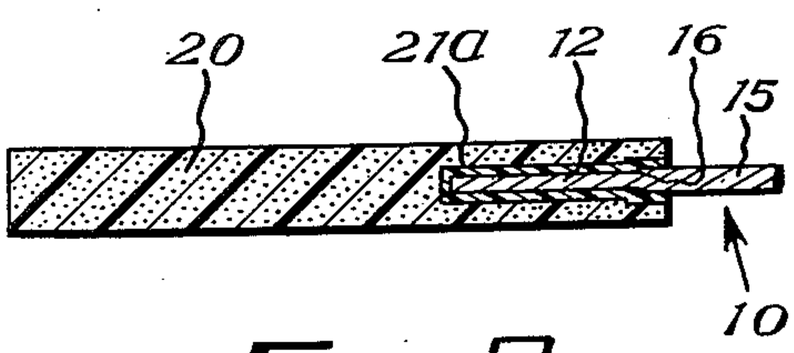

FIG. 2

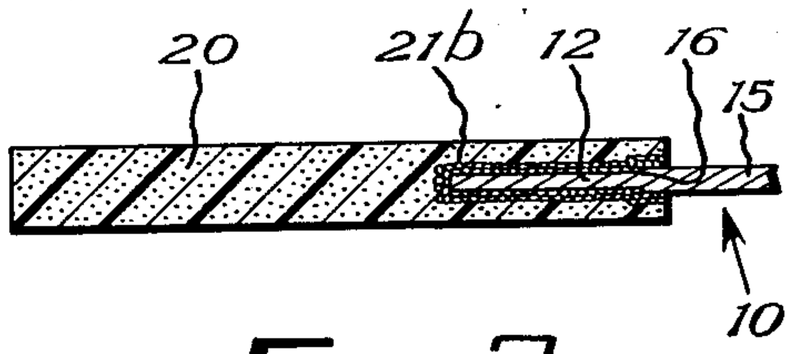

FIG. 3

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Patented Jan. 6, 1953 2,624,660

UNITED STATES PATENT OFFICE

2,624,660

GRINDING WHEEL

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Application September 7, 1950, Serial No. 183,552
In Great Britain September 29, 1949

4 Claims. (Cl. 51—298)

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The invention relates to grinding wheels particularly to that variety thereof known as coping wheels, which are used to cut stone and other hard non-metallic materials.

One object of the invention is to provide a superior coping wheel. Another object of the invention is to provide a coping wheel which can be used in dry grinding operations and which will cut at a high rate without fracturing. Another object of the invention is to provide a coping wheel which can be used under conditions which will make it very hot without fracturing. Another object of the invention is to provide a coping wheel which can be used under such conditions that it becomes very hot and which nevertheless has a high rate of cut and relatively low wheel wear.

Other objects will be in part obvious or in part pointed out hereinafter.

In the accompanying drawings illustrating two of many possible embodiments of the mechanical features of this invention.

Figure 1 is a side elevation of a typical steel center for a coping wheel, the boundaries of the abrasive material to be molded thereon being indicated by dotted lines,

Figure 2 is a fragmentary diametral cross-sectional view on a larger scale than Figure 1 of a coping wheel constructed in accordance with the invention,

Figure 3 is a cross-sectional view similar to Figure 2 illustrating another embodiment of the invention.

For the manufacture of a coping wheel in accordance with the invention, I provide a steel center such as the steel center 10. This steel center 10 as illustrated in Figure 1 is a typical shape of steel center for coping wheels, the shape in cross section of the peripheral portion being shown in Figures 2 and 3. This steel center 10 has cut-outs 11 at the periphery thereof forming a plurality of peripheral dovetails 12. Desirably also a plurality of holes 13 are provided in the peripheral portion 14 in which the dovetails 12 are formed; this peripheral portion 14 is separated from the hub portion 15 by means of shoulders 16, one on each side of the center 10. The hub portion 15 has a central hole 17 so that the center 10 can be mounted upon a spindle. The sides of the hub portion 15 may be plane parallel surfaces and the sides of the peripheral portion 14 may also be plane parallel surfaces. The section planes of Figures 2 and 3 are not taken through the cut-outs 11 or holes 13. The foregoing description of the steel center 10 is illustrative and other shapes and styles of steel centers may be used in accordance with this invention. It will be seen that the steel center 10 is essentially a disc modified by the features above described.

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On the steel center 10 is molded an annular portion 20 of abrasive and phenolic resin bond. This annular portion 20 is continuous around the entire steel center 10 and interlocks with the dovetails 12 and holes 13. Between the steel center 10 and the annular portion 20 is a layer 21*a* of shellac as shown in Figure 2 or a layer 21*b* of shellac including granular, refractory or abrasive material, as shown in Figure 3.

The abrasive material in the annular portion 20 is preferably silicon carbide abrasive since this abrasive is preferred for the grinding of most stones such as granite, marble or the like, or the grinding of other hard non-metallic materials such as porcelain, glass and concrete. However, within the scope of the invention other abrasives may be used such as aluminum oxide abrasive including the product of the electric furnace or natural corundum or emery.

The bond in the annular portion 20 is a phenol formaldehyde resin of any desired variety. Commercial resins usually contain a minor proportion of cresol formaldehyde and such resins can be used advantageously in this invention. Furthermore I use the word phenol in the broad sense to include phenolic bodies such as cresol and xylenol. These, as well as phenol in the stricter sense, comprise a benzene ring with an OH group thereon. In making up the mixture furfural can be used as a plasticizer in which case there will result some furyl methylene linkages as well as methylene linkages. The uncured resin may have a substantial proportion of hexamethylenetetramine therein to speed the curing. In any case the resin bond should be cured to a thermo-irreversible condition. This resin bond I will term thermo-irreversible phenol-formaldehyde resin. This class of material and the manner of curing and compounding it is now well known in the abrasive art and also in other arts and therefore needs no further description. The proportions of the abrasive and of the thermo-irreversible phenol-formaldehyde resin, the grit size of the abrasive, the porosity of the annular portion 20 may all be varied within the usual limits and in accordance with the practices now well known in the abrasive art and particularly adapted for coping wheels. These matters, therefore, need no further elucidation herein.

The layer 21*a* consists of and the layer 21*b* comprises shellac. Shellac is a natural resin and is well known so it needs no further definition.

In order to form the annular portion 20 with the layer 21*a* of shellac thereunder on the center 10, the following procedure may be adopted: the steel center 10 is thoroughly cleaned on both sides of the peripheral portion 14 and on both sides of the hub portion 15 near the shoulders 16 to remove grease therefrom, and this may be done by immersing these portions in a suitable grease solvent such as gasoline. These portions are then coated with a solution of shellac. Any suitable solvent may be used, acetone, methyl alcohol and ethyl alcohol being examples. The shellac solution is then allowed to dry at room temperature and then another coating of the solution is applied. These steps are repeated until a layer of shellac of the required thickness is obtained. That is to say, the solution is brushed on, dried, more of the solution is brushed, dried again, still more of the solution is brushed on, dried again, and these steps are repeated over and over until the layer has been built up to the required thickness. This required thickness is not less than one thirty-second of an inch and may be varied in accordance with the grit size of the abrasive in the annular portion 20, being greater the greater the grit size. There is, however, no upper limit to the thickness of the layer 21*a* excepting that that part of the annular portion 20 outside of the layer 21*a* on either side should have a thickness at least as great as that of the layer 21*a* within it. For shellac the best solvent is ethyl alcohol.

In order to form the annular portion 20 a suitable mold can be used. A layer of a mixture of uncured phenolformaldehyde resin and abrasive can be placed in the mold, then the center 10 with the layer 21*a* can be placed thereon, then a further layer of resin and abrasive can be added and levelled off, the top plate of the mold can then be placed in position, the contents of the mold can then be pressed in an hydraulic press thereafter the center 10 with pressed layer 21*a* and pressed annular portion 20 can be stripped from the mold and cured in an oven. This technique of molding, pressing and curing grinding wheels including coping wheels is now well known in the art so it need not further be described herein. Also various ways of compounding a mixture of uncured resin and abrasive are well known and need not be further described. However it is pointed out that, just prior to inserting the center 10 with the layer 21*a* into the mold, the last brushing on of the solution of shellac should be done without any subsequent drying step as this promotes adhesion of the layer 21*a* to the annular portion 20. The curing in an oven should be sufficient that is to a high enough temperature and for a long enough time to convert the uncured phenol-formaldehyde resin to the thermo-irreversible stage, the temperatures and times necessary to do this being also well known. During this curing the remainder of any solvent in the shellac is driven off and the layer 21*a* becomes rigid and adheres firmly to the center 10 but it is still slightly plastic when heated.

For the formation of the annular portion 20 with the layer 21*b* of shellac thereunder on the center 10 I may proceed as above with the following differences: a first coating of the solution of shellac is applied and dried at room temperature. Abrasive grain, refractory grain or other inert (at the temperatures involved) granular material is coated with the shellac and this can be done by mixing the granular material with a solution of shellac and subsequently drying to evaporate the solvent, and these steps may be repeated several times to build up a substantial layer of the shellac on each granule, three repeats of the coating process being sufficient and even one such coating being adequate in many cases. The granular material can be ordinary sand such as quartz sand, or abrasive such as aluminum oxide abrasive or silicon carbide abrasive can be used. The grit size of this granular material can be varied but ordinarily should not be greater than the grit size of the abrasive in the annular portion 20; I have had good results using granular material of 60 mesh grit size for this purpose. If the granules of the granular material stick together screening or other procedure should be employed to separate the individual granules at least for the most part. The granular, refractory or abrasive material in the layer 21*b* may be properly described generically as inert material. It functions as an inert filler.

Now the steel center is brushed a second time with the solution of shellac and while the coating thus produced is still in a tacky condition the center is rolled in the coated granular material above described. Then, if the thickness of the coating is not yet sufficient, the coating is air dried. Application of solution, rolling and air drying is then continued or repeated until the desired thickness of coating has been attained, but as in the previous case the last applied portion of the coating is not permitted to air dry but rather the molding operation previously described is undertaken while the coating which now constitutes the layer 21*b* is still in a tacky condition. The rest of the procedure is or may be as above described. The thickness of the layer 21*b* should also be not less than one thirty-second of an inch and may be varied in accordance with the grit size of the abrasive in the annular portion 20, being greater the greater the grit size, and there is likewise no upper limit to the thickness of the layer 21*b* excepting as stated in connection with the layer 21*a*.

The excellence of thermo-irreversible phenol-formaldehyde resin as a bond for the manufacture of coping wheels is already known. That is to say coping wheels having the abrasive portion bonded with thermo-irreversible phenol-formaldehyde resin give superior results when measured by proper standards to coping wheels the abrasive portion of which is bonded with any other organic bond now known. However the abrasive portion, when bonded with thermo-irreversible phenol-formaldehyde resin, has frequently fractured especially when the coping wheels have been used in dry grinding. Dry grinding operations heat the abrasive portion and in so much as the steel center may be relatively cool, being a good conductor of heat, and furthermore since the coefficient of thermal-expansion of the abrasive portion and the steel center is different, breakages have been frequent. The present invention, however, solves this difficulty in that the plasticity of the layers 21*a* and 21*b* is such as substantially to eliminate this cause of wheel breakage. Expansion of the annular portion 20 relative to the steel center 10 is accommodated by the layer 21*a* or the layer 21*b* which, especially when heated, will deform, stretch or bend instead of breaking. Furthermore I have found that the adhesion of the layers 21*a* and 21*b* to the steel center 10 and to the portion

20 is entirely satisfactory. Thus the invention provides a coping wheel which is highly efficient in operation, can be used in dry grinding operations, and will not readily fracture.

I have illustrated and described two practical embodiments of the invention. I now prefer the embodiment shown in Figure 3 where the layer 21*b* underlies the abrasive portion 20. This is for the reason that the layer 21*b* is a little stronger than the layer 21*a*. However for many wheels the layer 21*a* is adequate and it is a little simpler to make a wheel having the layer 21*a* than it is to make a wheel having the layer 21*b*.

It will thus be seen that there has been provided by this invention a grinding wheel particularly of that variety known as a coping wheel in which the various objects hereinabove set forth together with many thoroughly practical advantages are successfully achieved. As many possible embodiments may be made of the above invention and as many changes might be made in the embodiments above set forth, it is to be understood that all matter hereinbefore set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

I claim:

1. A coping wheel comprising a steel center, an annular abrasive portion of abrasive grain bonded with thermo-irreversible phenol-formaldehyde resin on the periphery of said steel center, and a layer of shellac between said abrasive portion and said steel center on both sides of said steel center,

said layer being at least one thirty-second of an inch thick and said annular abrasive portion outside of the layer of shellac on both sides having a thickness at least as great as that of the layer of shellac within it.

2. A coping wheel as claimed in claim 1 in which the layer of shellac includes particles of inert material.

3. A coping wheel comprising a steel center, an annular abrasive portion of abrasive grain bonded with thermo-irreversible phenol-formaldehyde resin at least one thirty-second of an inch thick on the periphery of said steel center, and a layer of shellac between said abrasive portion and said steel center on both sides of said steel center, said layer being at least one thirty-second of an inch thick and said annular abrasive portion outside of the layer of shellac on both sides having a thickness at least as great as that of the layer of shellac within it.

4. A coping wheel as claimed in claim 3 in which the layer of shellac includes particles of inert material.

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The following references are of record in the file of this patent:

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