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H. E. MILLER ET AL
MOUNTED ABRADING WHEELS
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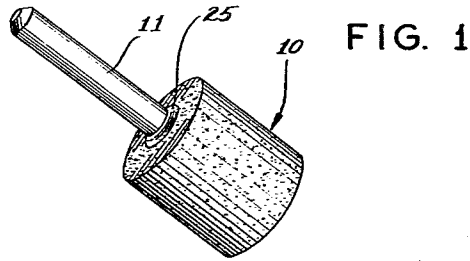


FIG. 1

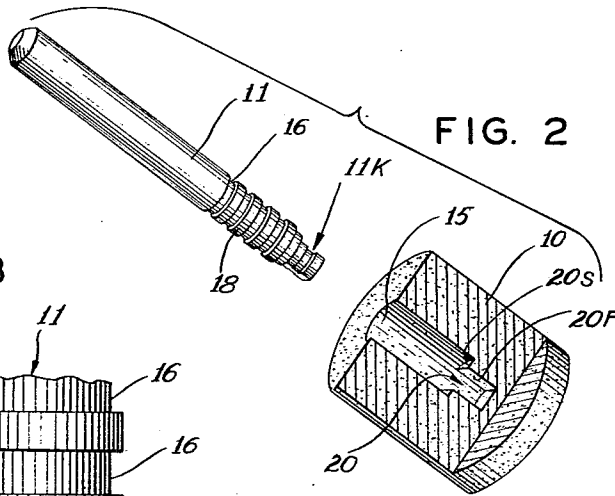


FIG. 2

FIG. 3

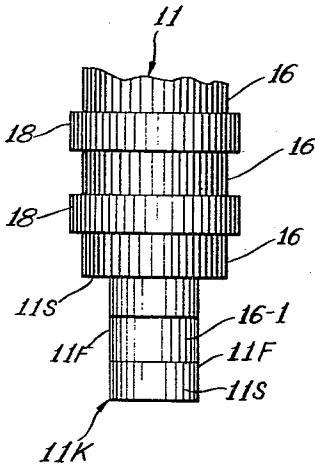


FIG. 5

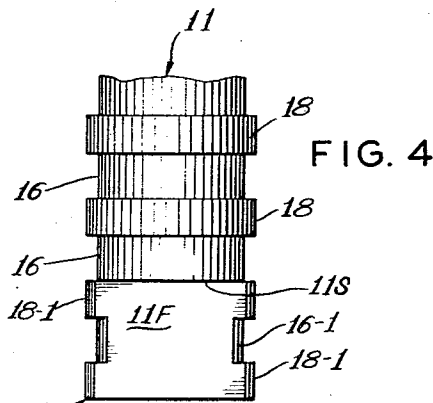
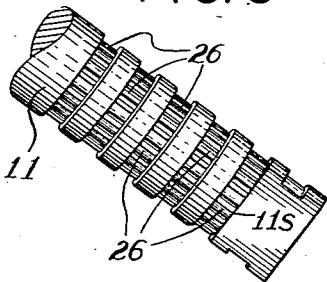


FIG. 4

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MOUNTED ABRADING WHEELS

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6 Claims. (Cl. 51—206)

This invention relates to mounted abrading wheels.

This application is a continuation-in-part of our application Serial No. 517,276 filed June 22, 1955, which is issued as Patent No. 2,763,970, on Sept. 25, 1956.

Abrading wheels that are formed of finely divided abrasive material bonded by conventional procedures and molded in a suitable fashion to the desired shape are quite well known, and in the manufacture of abrading wheels of this kind it is common practice to mold the wheel with an opening for receiving a mandrel on which the abrading wheel is to be carried. The ordinary method of securing the mandrel to the abrading wheel is by a cement, and it will be appreciated that this cement must be exceptionally strong.

Abrading wheels of the foregoing kind are subjected to high torque and impact stress under many circumstances, such that the abrading wheel tends to work loose from the mandrel. This is particularly common where the abrading wheel is applied to a surface that produces extreme vibration or chatter of the abrading wheel, and as was mentioned, the common practice is to resort to a cement for securing the wheel to the mandrel. This has been accomplished by placing a quantity of the cement in the mandrel-receiving opening or bore in the wheel followed by the insertion of the mandrel, and if desired the mandrel itself prior to being inserted in the bore of the abrading wheel may be dipped in the cement and used as a swab. It will be appreciated that the diameter of the mandrel-receiving opening in the abrading wheel cannot be very much larger than that of the mandrel, because if the mandrel is to be accurately aligned with the axis of the wheel and is not to tip substantially from a truly centered relation during the setting of the cement, the bore of the wheel and the mandrel disposed therein must be relatively close fitting. As a consequence, the amount of the cement that can be used is not great, and, therefore, must be exceedingly strong, and one of the primary objects of the present invention is to enlarge the cement-receiving capacity of the bore of an abrading wheel without increasing the diameter of the bore or decreasing the diameter of the mandrel.

Another problem that has been encountered in mounted abrading wheels of the foregoing kind is that after prolonged periods of use the stresses that were encountered produce weakening of the cement that holds the wheel to the mandrel, and a further object of the present invention is to reduce the stress to which the aforesaid cement is ordinarily subjected.

Specifically, the object of the present invention is to form the mandrel of a mounted abrading wheel with juxtaposed, circular grooves at the end that is to be inserted in the bore of the abrading wheel, and to provide the inner or driving end of the mandrel with flat faces adapted to engage or seat in a key-way at the inner end of the mandrel-receiving bore of the abrading wheel. The grooves thus afforded greatly enlarge the cement-receiving capacity of the bore in the wheel, and the flat

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faces at the end of the mandrel disposed in the aforesaid key-way lessen the torque stress on the cement since the wheel will be rotated primarily by the flat faces of the key of the mandrel rather than by the shaft or shank portion of the mandrel bonded to the abrading wheel.

Other and further objects of the present invention will be apparent from the following description and claims and are illustrated in the accompanying drawing which, by way of illustration, shows a preferred embodiment of the present invention and the principle thereof and what we now consider to be the best mode in which we have contemplated applying that principle. Other embodiments of the invention embodying the same or equivalent principle may be used and structural changes may be made as desired by those skilled in the art without departing from the present invention and the purview of the appended claims.

In the drawings:

Fig. 1 is a perspective view of an abrading wheel mounted on a mandrel in accordance with the present invention;

Fig. 2 is an exploded view of a mandrel and the abrading wheel in separated or dismounted relation, the abrading wheel being shown in half-section;

Fig. 3 is an enlarged elevation of the driving end of the mandrel;

Fig. 4 is an elevation similar to Fig. 3, except that the mandrel is rotated through 90°; and

Fig. 5 is a fragmentary perspective view of a modified form of construction for the mandrel.

The present invention is illustrated in Fig. 1 as embodied in a mounted abrading wheel 10 which is formed of finely divided abrasive particles such as abrasive ceramics or the like that are molded and bonded together in accordance with known practice, and since the precise composition and method of manufacture of the abrading wheel constitute no part of the present invention it will be recognized that such may be selected of any desired formulation and procedure. The abrading wheel 10 is mounted on a steel mandrel 11 in a way to be described hereinafter, and the mandrel 11 at the end opposite that mounted in the wheel 10 is adapted to be driven by the chuck of a power tool in the usual way.

To mount the abrading wheel 10 to the mandrel 11, the wheel 10 is molded in the axial center thereof with a circular bore or mandrel-receiving opening 15, and this bore will be of slightly larger diameter than the diameter of the mandrel 11. This difference may be but several thousandths of an inch since it is necessary that the mandrel 11 and wheel 10 be accurately centered as was mentioned above.

Under the present invention, the portion of the mandrel 11 that is to be received in the bore 15 is machined or otherwise formed with a plurality of uniformly spaced apart grooves 16, and because the mandrel 11 is circular in cross section these grooves will necessarily be of true annular shape. The grooves 16 will be separated by uniformly dimensioned annular ribs or ridges 18, and these ribs 18 will have the same outer diameter as the portion of the mandrel 11 that extends beyond the bore 15 of the abrading wheel 10. Thus, to produce the grooves 16 it is merely necessary to select a piece of stock material for the mandrel, and to turn the stock piece down where it is desired to produce the grooves as 16.

Further in accordance with the present invention, the inner end of the mandrel is milled or otherwise provided with flat faces 11F so that in effect a square or right-angular driving key 11K is afforded at the end of the mandrel opposite that to be received in the chuck of the power tool. Preferably, the grooves as 16 are pro-

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vided prior to providing the flat faces 11F, since so to do also provides at least one groove 16—1 at the driving end of the mandrel as shown in Figs. 3 and 4, and this groove will be defined by segments 18—1 of the ribs 18 that result from milling out the faces 11F. Thus, when the flat faces 11F are provided as by milling or a like operation, to remove substantial quantities of metal at the driving end of the mandrel 11, portions only of the ribs as 18 and the grooves as 16 will remain.

The bore 15 in the wheel 10 at the inner end is formed with a key-way 20, that terminates at a dead end within the body of the wheel 10. The opposed faces 20F of this key-way are flattened so as to be complementary to the flat faces 11F of the key 11K of the mandrel 11. The key-way 20 thus formed will include forwardly facing shoulders 20S which will be engaged by corresponding shoulders 11S at the driving end of the mandrel 11.

The aforementioned grooves as 16 and 16—1 in the mandrel 11 constitute annular recesses in which significant quantities of the cement used to hold the mandrel to the wheel may be retained. Thus, in contrast to the uniform diameter on the exposed portion of the mandrel 11, Fig. 1, the grooves 16 enlarge the cement receiving capacity of the bore 15, and in like manner the grooves or recesses 16—1 on the key 11K enable an increased amount of cement to be utilized in the key-way 20. We have found that the following cement produces excellent results:

Polyester resin (low molecular weight) -----cc--	25
Activated charcoal -----gm--	0.3
Micro-sized silica -----gm--	0.5
250 mesh flint -----gm--	28.0

Low molecular weight polyester resin is liquid in its natural state, as is well known, and is typified by the "Laminac" class of resins (viscosity 65-70 poise) marketed by the American Cyanamid Company. Resins of this kind are thermosetting without pressure, but with the addition of a small amount of catalyst in the form of an organic peroxide such as benzol peroxide or methyl ethyl ketone peroxide will set to an infusible state at room temperature after about twenty-four hours. However, by the use of an even smaller amount of catalyst and an oven cure at 300 F. the resin will set completely in approximately 15 minutes.

The cement, apart from the catalyst, can be placed on the shelf in a sealed container, and just prior to use the catalyst is added. The purpose of the charcoal is to adsorb the resin so that there will be no tendency for the resin to be absorbed by the abrading wheel. The filler is represented by the flint, and the finely divided silica substantially in "flour" form is intended to fill the voids between the larger size flint particles.

The primary advantage of the foregoing cement is that the resin is promoted directly to a rigid state while setting in the presence of the catalyst or activator and does not pass through an intermediate liquid state as is common with many of the resin cements heretofore used for mounting an abrading wheel to a mandrel. Thus, the disadvantage of the aforementioned liquid intermediate state is that if the mandrel has been trued in the bore of the abrading wheel, the mandrel will tip when the cement passes through the intermediate liquid state during the course of the cure.

Where a room temperature cure, rather than an oven cure is used, the amount of catalyst is about one percent based on the weight of the polyester resin. Where an oven cure is used, however, less of the catalyst is necessary, and this amount will depend of course upon the curing temperature preferred.

The cement to which the catalyst has just been added may be "worked up" with a spatula, and after this preliminary step has been performed, a selected amount of the cement may be picked up on the mandrel, and the mandrel then inserted in operative position in the bore 15 of the

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abrading wheel. In about forty minutes, the cement is sufficiently set to hold the mandrel in a trued position.

A small amount of the cement will be extruded resulting in a rim 25, Fig. 1, of cement about the base of the exposed portion of the mandrel 11, but because of the grooves 16 substantial quantities of the cement will be trapped in the bore 15.

It has been found advantageous under some circumstances to provide the mandrel with a plurality of spaced apart ribs, knurls or the like formed within the grooves 16. In the present instance, such take the form of parallel related rolled ribs 26 that are parallel to the longitudinal axis of the mandrel 11. These represent projections that account for a multitude of firm bites between the cement and the mandrel mounted in the bore of the wheel 10. It may be pointed out that projections as 26 need not be formed in the grooves 16—1 at the key end of the mandrel.

Of particular importance in the present instance is that by having resort to a key as 11K, the amount of torque stress on the cement will be greatly reduced, and as a consequence, the effective life of the abrading wheel is materially increased.

Hence, while we have illustrated and described the preferred embodiment of our invention, it is to be understood that this is capable of variation and modification, and we therefore do not wish to be limited to the precise details set forth, but desire to avail ourselves of such changes and alterations as fall within the purview of the following claims.

We claim:

1. A mounted wheel for abrading comprising an abrading wheel formed with a bore for receiving a mandrel, the inner end of said bore including a key-way of reduced size defined by a pair of parallel spaced apart flat faces, a mandrel of circular cross-section mounted in said bore and having at the inner end a key of reduced size defined by flat faces fitting in to said key-way, a plurality of spaced apart annular cement-receiving grooves formed about a portion of said mandrel that is mounted in said bore, said grooves being formed with spaced projections providing bite for cement, said key also including a cement-receiving groove, and cement in at least some of said grooves holding the mandrel to the wheel.

2. A mandrel adapted to be cemented to an abrading wheel including, a plurality of spaced apart cement-receiving grooves formed about a portion of the mandrel inwardly of one end, spaced projections formed in said grooves to provide bite for the cement, the end of said mandrel adjacent said grooves being provided with flat faces affording a driving key for the abrading wheel, and a cement-receiving groove formed in said driving key.

3. A mounted wheel for abrading comprising an abrading wheel formed with a bore for receiving a mandrel, the inner end of said bore including a key-way, a mandrel mounted in said bore and having at the inner end a key fitting in to said key-way, a plurality of spaced apart cement-receiving grooves formed in the portion of said mandrel that is mounted in said bore, spaced projections formed in said grooves to provide bite for the cement, said key being formed with a cement-receiving groove, and cement in at least some of said grooves holding the mandrel to the wheel.

4. A mounted wheel for abrading comprising, an abrading wheel formed with a bore for receiving a mandrel, the inner end of said bore including a flat-faced key-way, a mandrel of circular cross-section mounted in said bore and having at the inner end a flat-faced key fitting in to said key-way, a plurality of spaced apart grooves formed in a portion of said mandrel that is mounted in said bore, said grooves having spaced apart cement gripping projections formed therein, and cement in at least some of said grooves having projections therein as aforesaid holding the mandrel to the wheel.

5. A mandrel adapted to be cemented to an abrading

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wheel and including a plurality of spaced apart grooves formed about a portion thereof, and spaced apart cement gripping projections formed within said grooves to provide bite for the cement.

6. A mounted wheel for abrading comprising, an abrading wheel formed with a bore for receiving a mandrel, the inner end of said bore including a key-way of reduced size defined by spaced apart opposed faces, a mandrel mounted in said bore and having at the inner end a key of reduced size defined by opposed faces complementary to the faces of said key-way and fitting in to said key-way, a plurality of spaced apart cement-receiving grooves formed about a portion of said mandrel that is mounted in said bore, spaced projections formed in said cement-receiving grooves to provide bite for the cement, and

cement in at least some of said grooves holding the mandrel to the wheel.

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