Aug. 15, 1950 C. C. ESTY 2,519,035

GRINDING WHEEL AND BUSHING THEREFOR

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Fig. 1

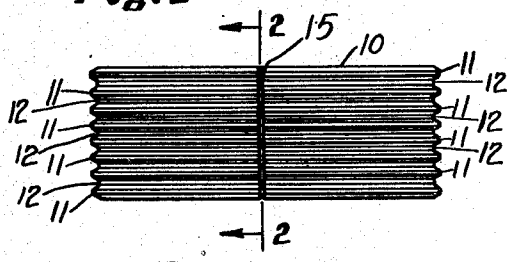


Fig. 2

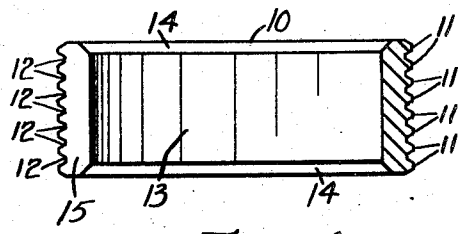
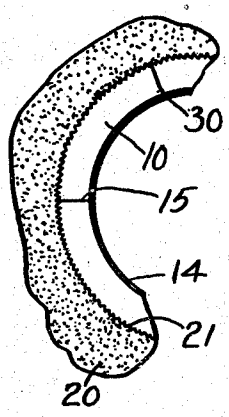


Fig. 3.



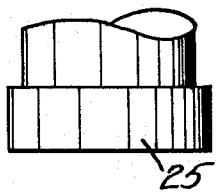
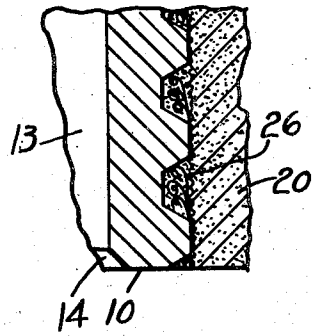


Fig. 4



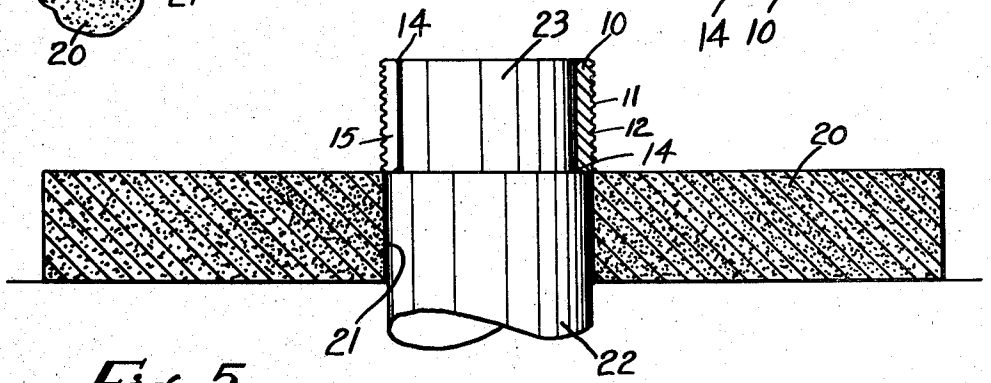


Fig. 5

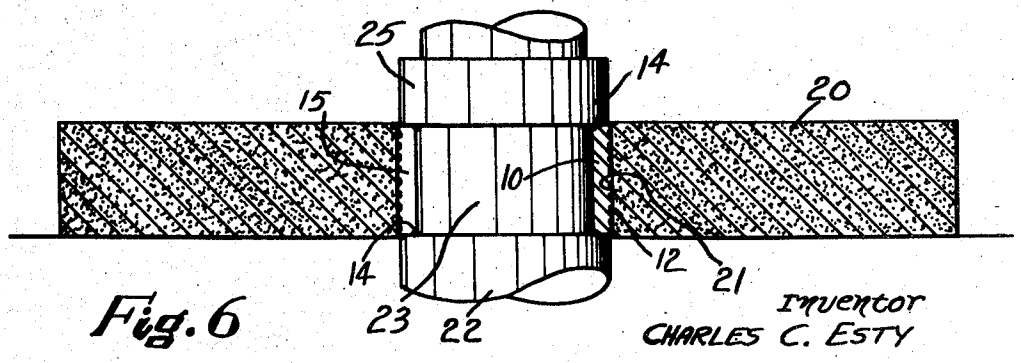


Fig. 6

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Fig. 7

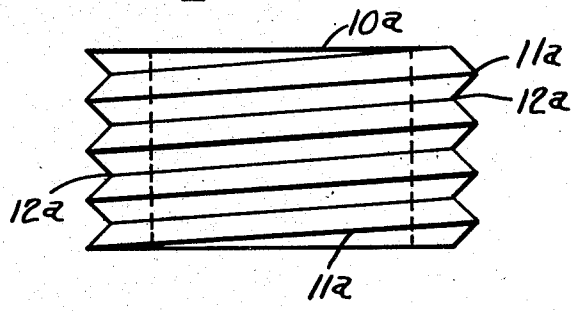


Fig. 8

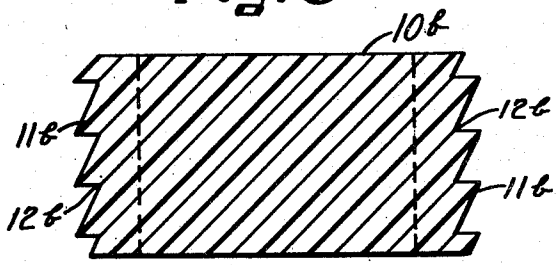
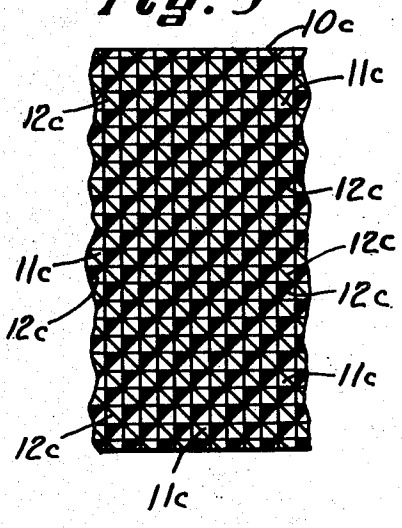


Fig. 9



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Patented Aug. 15, 1950

2,519,035

UNITED STATES PATENT OFFICE

2,519,035

GRINDING WHEEL AND BUSHING THEREFOR

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Application February 15, 1950, Serial No. 144,351

4 Claims. (Cl. 51—206)

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The invention relates to grinding wheels and bushings therefor.

One object of the invention is to provide a bushing for grinding wheels which can be inserted thereinto by a very simple operation. Another object of the invention is to provide a tightly fitting bushing. Another object of the invention is to provide an inexpensive bushing. Another object of the invention is to provide an accurate bushing. Another object of the invention is to provide a bushing which can be made to standard designs within reasonable tolerances and which will automatically interlock itself with a grinding wheel as it is inserted thereinto. Another object is to provide a grinding wheel with a bushing of one or more of the above characteristics. Another object of the invention is to provide a bushing of hardness greater than that of the Babbitt metals, and preferably harder than 25 on the Brinell scale so constructed that it can be easily and accurately inserted into the hole in a grinding wheel and will fit therein with a good fit and be firmly held in place.

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

The invention accordingly consists in the features of construction, combinations of elements, and arrangements of parts, all as will be illustratively described herein and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings illustrating one of many possible embodiments of the mechanical features of this invention:

Figure 1 is a side elevation of a bushing according to the invention,

Figure 2 is a sectional view taken on the line 2—2 of Figure 1,

Figure 3 is a fragmentary plan view of a grinding wheel showing a portion of the bushing therein,

Figure 4 is a fragmentary sectional view on a considerably enlarged scale showing a portion of a bushing and a portion of a grinding wheel,

Figure 5 is a vertical sectional view of a grinding wheel and a bushing showing the mandrel and the ram of a press by means of which the bushing is inserted into the central hole of the grinding wheel,

Figure 6 is a view similar to Figure 5 after the mandrel and ram have inserted the bushing.

Figures 7, 8 and 9 illustrate modifications of the invention showing additional species of ridges and grooves for the outer surface of a bushing according to the invention.

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Referring now to Figures 1 and 2, the bushing 10 is a cylindrical annulus having annular ridges 11 on the periphery leaving grooves 12 between the ridges. The inside of the bushing 10 is a smooth cylindrical surface 13 with beveled edges 14. It will be noted that the bushing 10 which is in the form of a ring is split at 15; this is not a functional feature but is rather a manufacturing feature. That is to say accurate bushings can be made by grooving long ribbons of metal, cutting the ribbons into desired lengths, then pressing the short lengths into rings as shown. This turns out to be less expensive than the manufacture of continuous rings and the grooving thereof whether before, during or after the formation of the rings. However, manufacturing conditions change from time to time and so therefore it should be understood that the bushing 10 can be a continuous ring if desired and furthermore instead of distinct and separate ridges 11 with distinct and separate grooves 12 a continuous thread as on a screw or a plurality of continuous threads may be formed on the periphery of the bushing.

According to the invention the bushing 10 is made of soft metal or of a suitable plastic. Soft metals which can be used are aluminum, copper, brass, bronze, zinc, and various alloys. Plastics which can be used include phenol formaldehyde resin, polybasic acid-polyhedric alcohol condensation products, styrene, or methyl methacrylate, rubber, butadiene acrylic nitrile, butadiene styrene. The essential feature is that the material shall have a Brinell hardness less than 100.

The following is a table of Brinell hardness of certain materials which however represents usual rather than complete experience:

Aluminum and its alloys	17–45
Copper	57–107
Brass and bronze	65–240
Lead Babbitt metals	7–20
Magnesium alloys	50–73
Nickel alloys	70–240
Tin alloys	8–27
Phenol-formaldehyde resin	Up to 45
Styrene resin	20–30
Methyl methacrylate	18–20
Rubber, butadiene styrene and butadiene acrylic nitrile	Up to 31

At present I prefer to use bushings made of aluminum and its alloys. One of the features of the invention is that it is not necessary to use the softer materials such as Babbitt metals, but they can be used. Naturally the harder the bushing is, the more durable it will be and so if the

material will readily shear as hereinafter described (see Figure 4) it can be used and otherwise than that, the harder it is the better it is, other factors such as strength being equal. As above stated materials which are softer than 100 on the Brinell scale are usable in the invention. I prefer that my bushing shall have a Brinell hardness greater than 25.

Referring now to Figures 3, 4, 5 and 6, a grinding wheel 20 consists of abrasive grains such as aluminum oxide abrasive or silicon carbide abrasive bonded with any kind of bond known to the art and which includes vitrified ceramic bond, phenol formaldehyde resin bond and aniline formaldehyde resin bond. Wheel 20 is shown to have a shape of a cylindrical disc and has a central hole 21. For inserting the bushing 10 into the hole 21 I provide an arbor 22 which is a cylinder with a reduced cylindrical end 23. The large diameter of the arbor 22 will just pass into the hole 21 without too much friction while the bushing 10 just fits over the small diameter portion 23. This arbor 22 is part of a press equipment which need not be illustrated and the grinding wheel 20 is laid upon the table of the press which is horizontal and the arbor 22 is movable vertically through the table. The press has a ram 25 which is movable downwardly and can be stopped at any desired position.

First the wheel 20 is placed upon the table not shown and the arbor 22 is raised to the position shown in Figure 5 where the boundary between the large diameter portion and the portion 23 is in the plane of the upper face of the wheel 20. Then the ram 25 is caused to descend until the parts are in the position shown in Figure 6. The diameter of the ridges 11 is slightly greater than the inside diameter of the hole 21 but the diameter of the grooves 12 is less than the diameter of the hole 21. Therefore as the ram 25 descends, the abrasive grains of the grinding wheel 20 cut the ridges 11 and the material cut from the ridges 11 becomes lodged in the grooves 12. This action is clearly shown in Figure 4. Chips 26 of material cut from the ridges 11 of the bushing 10 are shown between the grooves 12 and the grinding wheel 20 in Figure 4.

Figure 7 illustrates a bushing 10*a* having on its outer surface a continuous ridge 11*a* separated by a continuous groove 12*a* which together constitute a continuous thread around the bushing such as can readily be made in a screw machine.

Bushings such as shown in Figure 7 can readily be pressed into the central holes of wheels in the manner shown in Figures 5 and 6. As in the case of the first embodiment of the invention the overall diameter of bushings of the type shown in Figure 7 should be slightly greater than the inside diameter of the central hole 21 of the wheel 20 and likewise the overall diameter less double the depth of the grooves 12*a* should be less than the inside diameter of the hole 21.

Figure 8 shows still another type of grooving in that a plurality of ridges 11*b* are formed leaving a plurality of grooves 12*b* between them and these ridges and grooves are quite satisfactory for the purposes of this invention and the same conditions as to overall diameter of the bushing 10*b* and the depth of the grooves 12*b* obtain as in the embodiment of Figures 1 and 2 and the embodiment of Figure 7.

Figure 9 shows still another modification of the invention herein illustrated as a plan view of a fragment of the material after it has been grooved but while it is still flat. The material

10*c* has pyramidal ridges 11*c* each one being a pyramid with a square base and four triangular sides, but the polyhedral angle of the pyramids may be varied within wide limits. Between pyramids are grooves 12*c* running in two different directions at right angles to each other. This sort of surface is now termed a knurled surface and is well known and also easily formed.

In all forms of the invention the bushing is literally cut by the abrasive grains of the grinding wheel as it is forced into position and in all forms of the invention there are grooves to receive the chips, the depths of the grooves being such that they are not destroyed by the pressing operation. In other words the overall diameter of the bushing less twice the depth of the grooves is less than the inside diameter of the wheel in order that there may always be clearance for the chips of metal. It will be seen that as the bushings are cut as they are inserted they make a perfect fit in the holes of the wheels.

Figure 3 illustrates the fact that the cutting of the bushings by the insertion thereof forms teeth 30 on the ridges 11 and in the same manner teeth are cut on the ridges 11*a* and 11*b*. The ridges 11*c* or pyramids are teeth to begin with. These teeth 30 are not regular or evenly spaced but they do interlock with the material of the grinding wheel to prevent rotation of the bushing within the grinding wheel.

In the embodiments shown in Figures 1, 2 and in Figures 8 and 9, there are a plurality of ridges. In the embodiment shown in Figure 7 there are in effect a plurality of ridges even though in another sense this plurality of ridges forms a continuous ridge. In the preferred form of the invention the ridges extend around the periphery of the bushing and from end to end thereof but it will be understood that the bushing would still be tightly held in the grinding wheel if some areas thereof were undercut so as to have no contact with the central hole.

It will thus be seen that there has been provided by this invention an article in which the various objects hereinbefore 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 grinding wheel and a bushing therein, said bushing being of a material softer than 100 on the Brinell scale, said bushing having ridges around its periphery from end to end thereof leaving grooves between the ridges, said ridges having teeth interlocking with the grinding wheel in the central hole of the grinding wheel, and chips of material from the bushing between the grooves and the grinding wheel.

2. A grinding wheel bushing in the form of an annulus of material having a Brinell hardness less than 100 and having ridges around its periphery and from end to end thereof, there being grooves between the ridges, the overall diameter of the bushing being greater than the inside diameter of the central hole in the grinding wheel for which said bushing is intended, the overall diameter of the bushing less twice the depth of the grooves being less than the inside diameter of said grinding wheel.

3. A grinding wheel having a central hole, said grinding wheel constituting abrasive grains bonded together with bonding material, and a bushing in the central hole made from material having a Brinell hardness less than 100, said bushing having ridges over the major part of its circumference and over the major part from end to end thereof, there being grooves between the ridges, and chips of material from the bushing located between the grooves and the grinding wheel, said ridges having teeth interlocking with the grinding wheel.

4. A grinding wheel bushing in the form of an annulus of material having a Brinell hardness less than 100, said bushing having an internal cylindrical surface, ridges on the major part of the circumference of the bushing and extending the major distance from end to end of the bushing, there being grooves between the ridges, and the overall diameter of the bushing being greater than the inside diameter of the hole in the wheel for which the bushing is intended and the overall diameter of the bushing less twice the depth of the grooves being less than the inside diameter of the wheel for which the bushing is intended.

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No references cited.