July 27, 1943. B. EGEBERG 2,325,180

FREE GRINDING DEVICE FOR STEELS AND ALLOYS

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FIG. 1

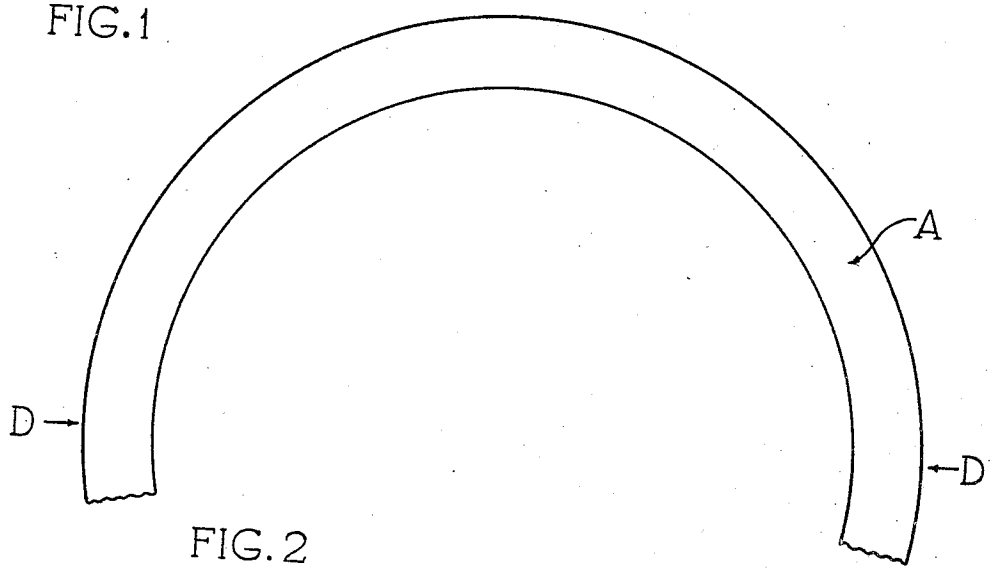
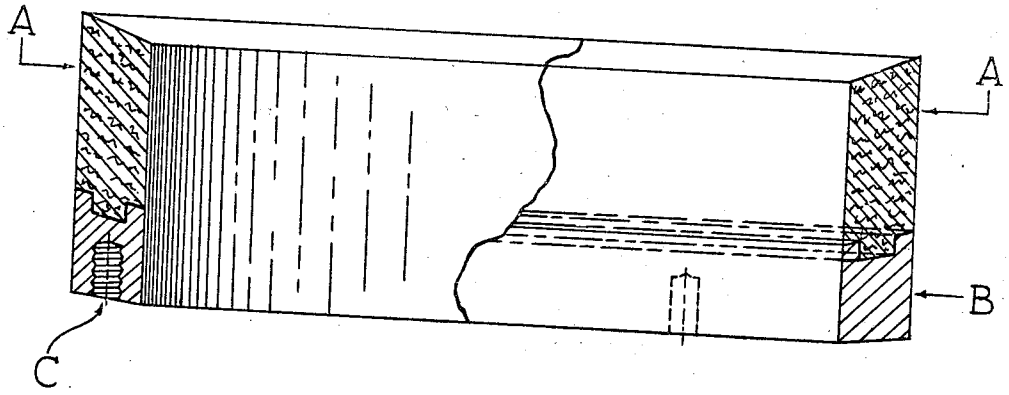


FIG. 2



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FREE GRINDING DEVICE FOR STEELS AND ALLOYS

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17 Claims. (Cl. 51—295)

The invention relates to the free grinding of steels and alloys and the like and to abrasive wheels therefor.

In the manufacture of articles of steel and alloys and particularly certain steels as, for example, articles of cutlery and flat tableware, difficulties have been experienced with the use of the conventional grinding wheel in that the wheel was not of a sufficiently free cutting nature to avoid clogging with abraded steel particles and to avoid scorches and cracks. I have found that these difficulties are considerably reduced, if not entirely obviated, by intimately incorporating a suitable lubricating material into the body of and with the particles of the grinding wheel so as to function as a lubricant at the very point or points of action between the particles of the grinding wheel and the work. I have obtained particularly good results by the use of a sulphide such as molybdenum sulphide, MoS_2, which is present in suitable quantity with the particles thereof dispersed throughout the grinding body.

The relative proportions of the sulphide and the abrasive material may vary over a considerable range, depending somewhat upon the particular articles to be worked upon. In the manufacture of cutlery and tableware I have found that a grinding wheel embodying molybdenum sulphide of one part by weight of sulphide to from ten parts to twenty parts by weight of abrasive material possesses marked advantages over the conventional abrasive wheel in that a freer cutting or grinding is produced with the clogging by abraded metallic particles being substantially reduced or entirely obviated and with the scorches and cracks reduced or substantially eliminated.

The sulphide may be intimately incorporated as a part of the body of the abrasive or grinding wheel in any suitable manner and according to any suitable formula. In the manufacture of a grinding wheel embodying the invention I have used to good advantage a formula consisting of 6 to 6½ pounds of abrasive material (as for example No. 60 emery), 30 to 40 ounces of shellac (as for example commercial flake shellac), 8 ounces of common salt (coarse fine) and around 8 ounces of molybdenum sulphide.

The following procedure may be employed in the manufacture of the abrasive or grinding wheels: The abrasive material, the common salt, and the sulphide are mixed while in a thoroughly dry state as, for example, in a steam-jacketed mixer, and after the thorough mixing has been effected the shellac is added and thoroughly mixed while the heat in the mixer is increased sufficiently to melt the shellac. The mixture is then removed to a steam-jacketed hydraulic press, put in suitable form bottomed by the usual iron ring (for attachment to the grinding shaft), or other method of holding such as lugs or inserts, and is then put under the desired amount of pressure to form the wheel. Good results have been obtained with an exerted pressure of 45 tons, but this may be increased if a harder wheel is desired. The wheel is allowed to cool until set and then removed for use.

The constituents of the wheel including the lubricant itself are thus intimately mixed and bonded together to form a homogeneous mass of abrasive and lubricant particles. The lubricant content may thus be adjusted to the exact degree desired in the manufacture of the wheel, while the porosity may be regulated entirely independently thereof as, for example, by incorporating as a part of the original mixture the required quantity of common salt or other porosity giving constituent. The molybdenum sulphide particles thus being intimately mixed and bonded with the abrasive particles act as a lubricant at the point or points of contact of the abrasive particles and the work, with substantially improved results in the grinding operation as above indicated. It has also been found that by the incorporation of molybdenum sulphide into the abrasive or grinding wheel an increase of 20% or more in its life may be obtained, in addition to the better quality work, less burns and less cracks, with less rejects and a larger percentage of good work. That is, both better quality work and better life service are obtained. The added cost of introducing the sulphide into the wheel is thus more than compensated.

After such a wheel has been ground down to its lowest point of safety, the remainder can be removed from the iron ring and with sufficient heat remelted and used over and over again with apparently equal efficiency, with a consequent minimizing of waste. A firmer cutting wheel of longer lasting ability is obtained by introducing the sulphide into the body of the wheel and none of it is wasted as all is used at the point or points of contact.

It is understood that although I have found that molybdenum sulphide is particularly suitable and advantageous when incorporated into the body of an abrasive or grinding wheel for the purposes above indicated that sulphides of other heavy metals having specific gravities within the range of 6 to 12 may be introduced with useful

results, such for example as iron sulphide and manganese sulphide.

It is understood that any suitable method for incorporating the sulphide or the lubricant into the body of the grinding or abrasive wheel may be used and that the invention is not limited to the specific formula or proportions of formula or the specific technique described above. Instead of a shellac binder any other suitable binder may be used amongst which may be mentioned the other natural resins, the synthetic resins (such as Bakelite), rubber (natural and artificial), etc.

The relative proportions of the sulphide or lubricant and the abrasive material used are determined to some extent by the purpose for which the grinding wheels are to be used. For example, instead of a ratio of one to twelve or thirteen parts of sulphide and abrasive material, I may employ substantially less or substantially greater relative proportions of the molybdenum sulphide, as for example, one to twenty or one to ten.

The incorporation of the molybdenum sulphide in other and altogether different formulae and differently bonded wheels than those set forth above substantially improves the wheels in the respects above described. For example, the sulphide may be incorporated in grinding or abrasive wheels made with sodium silicate, or in wheels of the hard vitrified type, and the molybdenum sulphide is particularly suitable as the lubricant to be employed because of its high melting point.

The invention also has utility as applied to "set-up" wheels, and good results have been obtained with wheels of this type embodying approximately one part of molybdenum sulphide to fourteen parts of emery by weight.

The common salt employed in the above formula is for the purpose of providing for the desired porosity in the wheels and the desired cool cutting therein, that is, wheels less liable to burn at high speeds. This contributes to and enhances the advantage gained by the use of a lubricant. It is understood that any other equivalent material may be used for this purpose.

I am aware of the fact that molybdenum sulphide and other sulphur bearing materials, as well as selenium, have been used or proposed for use as additions to steels in order to produce certain free machining and free grinding properties. By the use of my invention it is unnecessary to incorporate such sulphides in the steels or steel alloys or other metallic alloys, since the free grinding function is produced by the material incorporated in the grinding or abrasive wheel itself. Moreover, some steels and alloys are rather sensitive to the addition of molybdenum sulphide and the like in that they acquire undesirable physical properties by reason of the incorporation of the sulphides therein. For example, a high carbon variety of stainless steel is in this category, and it being impossible to obtain a high carbon steel of the free grinding variety which does not possess the undesirable physical properties referred to, my invention is particularly useful in connection with the grinding and polishing of articles, as for example cutlery and flat tableware, of high carbon stainless steels. The same applies to tool steels and to alloy steels difficult to grind. Especially in the case of alloy addition, the heat conductivity of the steel is lowered and local overheating and cracking during grinding is induced. Such steels therefore require an exceptionally cool and free cutting grinding wheel. For the reasons indicated, however, the invention is not limited to the working of high carbon stainless steels or tool steels or alloy steels as it has the advantages and utility above set forth generally in this art.

A grinding wheel embodying the invention is illustrated in the drawing forming a part of this application. In this drawing—

Fig. 1 is a segment of the face of a grinding wheel; and

Fig. 2 is a vertical cross section of the entire wheel on diametral axis D—D of Fig. 1.

The face of the wheel is shown as flat and perpendicular to its axis of rotation but it may be at any other angle, or concave or convex instead of flat—depending on the nature of the work for which any particular wheel is intended.

The compressed grinding material A is mounted on the usual iron ring B having threaded holes C for receiving screws whereby the wheel is mounted on a shaft.

I claim:

1. A grinding wheel embodying molybdenum sulphide incorporated therein.

2. A grinding wheel embodying an abrasive material and a sulphide of a heavy metal as a lubricant incorporated therein in proportions of one part lubricant to ten to twenty parts abrasive material by weight.

3. A grinding wheel embodying an abrasive material and molybdenum sulphide intimately incorporated therein in proportions of one part lubricating material to ten to twenty parts abrasive material by weight.

4. A grinding wheel embodying by weight ten to twenty parts of abrasive material, three to six parts of binder, and one part of molybdenum sulphide.

5. A grinding wheel embodying by weight 10 to 20 parts of abrasive material, 3 to 6 parts of binder, 1 part of common salt and 1 part of molybdenum sulphide.

6. An abrasive device comprising a homogenous bonded mass of an abrasive material and a sulphide of a heavy metal of comparatively small particle size.

7. An abrasive device embodying an abrasive material, a sulphide of a heavy metal as a lubricant, and a porosity-giving substance bonded together to form a homogeneous mass.

8. An abrasive device having self-lubricating and the desired porosity qualities which are independently regulated both as to amounts and as to relative locations, formed of an intimate mixture of granular abrasive material, a sulphide of a heavy metal of comparatively small particle size, and a separate porosity-giving substance all bonded together in the original mix.

9. An abrasive device embodying an abrasive material and a sulphide of a heavy metal of comparatively small particle size intimately mixed and bonded in the original mix by a binder of the class consisting of natural and synthetic resins and rubber.

10. An abrasive device embodying an abrasive material, a sulphide of a heavy metal as a lubricant, and a porosity-giving substance bonded together by a binder of the class consisting of natural and synthetic resins and rubber to form a homogeneous mass.

11. An abrasive device having self-lubricating and the desired porosity qualities which are independently regulated both as to amounts and as to relative locations, formed of an intimate mixture of granular abrasive material, a sulphide of a heavy metal of comparatively small

particle size, and a separate porosity-giving substance all bonded together in the original mix by a binder of the class consisting of natural and synthetitc resins and rubber.

12. An abrasive device embodying an abrasive material and molybdenum sulphide of comparatively small particle size intimately mixed and bonded with the abrasive material in the original mix.

13. An abrasive device embodying an abrasive material and iron sulphide of comparatively small particle size intimately mixed and bonded with the abrasive material in the original mix.

14. An abrasive device embodying an abrasive material and manganese sulphide of comparatively small particle size intimately mixed and bonded with the abrasive material in the original mix.

15. An abrasive device embodying an abrasive material, molybdenum sulphide as a lubricant, and a porosity-giving substance bonded together to form a homogeneous mass.

16. An abrasive device embodying an abrasive material, iron sulphide as a lubricant, and a porosity-giving substance bonded together to form a homogeneous mass.

17. An abrasive device embodying an abrasive material, manganese sulphide as a lubricant, and a porosity-giving substance bonded together to form a homogeneous mass.

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