

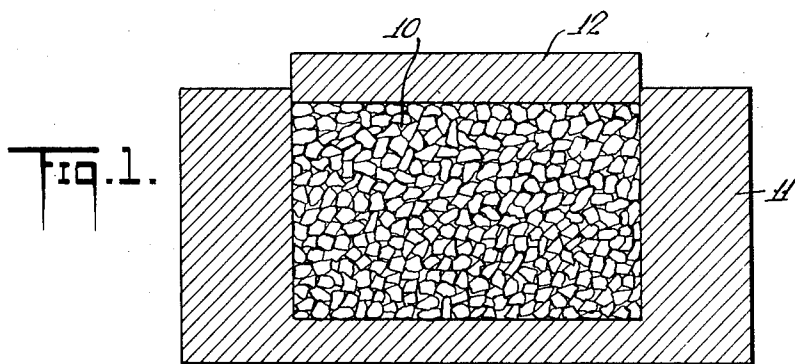
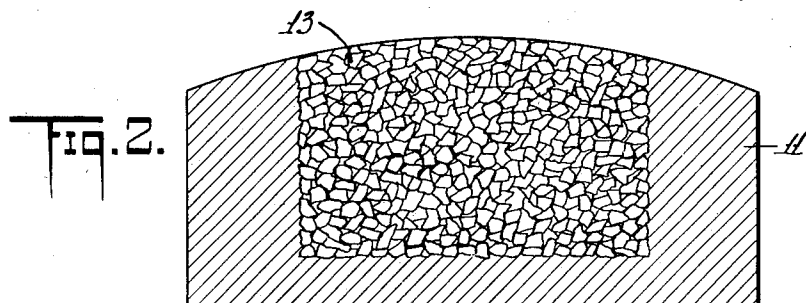
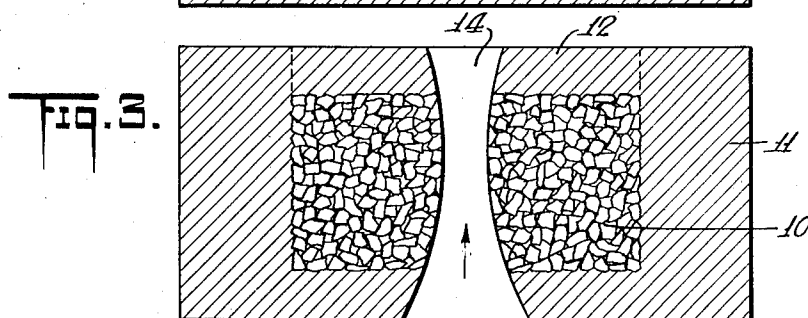
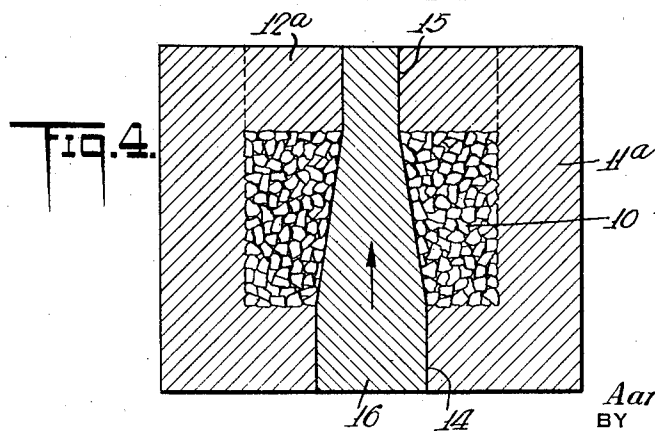
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1,939,468

DRAWING DIE

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8-187

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1,939,468

DRAWING DIE

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3 Claims. (Cl. 205—29)

This invention relates to a new composition of matter which is particularly adapted for use where it is desirable to present a very hard surface which will withstand pressure and friction. Such a composition may be used in the manufacture of dies for drawing purposes and for cutting and punching, and may be used as a guide where resistance to wear is of importance.

In carrying out my invention I employ a finely divided abrasive material as the main constituent and which presents the desired hard surface. The particles of this abrasive material are held together and united in a hard solid body by a metal binder which prevents dislodgment of the abrasive particles and holds them in fixed relative position so that the body may be subjected to high pressure and/or friction. This metal binder is also welded to a casing so that a product is produced in which the hard solid body of abrasive material and the metal binder are firmly encased, supported and reenforced during its use.

In preparing my improved composition or the dies or other articles made therefrom, the fine particles of abrasive material and the finely divided metal are mixed as powders and in such proportion that the metal when partially melted or rendered plastic will fill the interstitial space between the particles of abrasive, but at the same time will permit the particles of abrasive to come in direct contact or as close together as possible so that the main body will be made up of the abrasive particles and the minimum amount of metal will be used as the binder.

The mixture of the two powders is sealed in a metal casing so as to exclude the air and the mixture is heated and pressure is applied to bring about the softening of the metal particles and the metal casing, the flow of the metal, and the welding of the metal particles to the casing. The sealing during heating is important as it prevents the oxidation of the metal, while the application of both heat and pressure is important in that the abrasive particles are brought close together and the metal is caused to flow to the minimum extent to completely fill the interstitial space. The casing serves not only as a mold for the mixture, but also serves to support and reenforce the abrasive body against outward disruptive forces during wire drawing operations.

My die or other article made in accordance with my invention may be easily and cheaply manufactured and possesses superior wear and pressure resisting qualities.

As the abrasive particles are irregular and the

metal is forced into intimate contact with the surfaces of the particles, the metal will give great structural strength and will effectively resist the outward disruptive forces and rubbing action caused in the use of the article. The abrasive particles being of extreme hardness and being firmly and rigidly held in place give the wear resisting qualities which are necessary for a die and particularly the drawing die without the necessity of using such costly material as diamonds or other precious stones.

In the process of forming my improved composition, abrasive material such as silicon carbide, tungsten carbide, flint, quartz, diamond powder or the like, is mixed in powder form with a mass of finely divided metallic particles having hard tough properties. The abrasive powder or particles should be harder than steel. The mixture is then placed in a closed mold and subjected to high temperature and compression. The mixture and the casing during this operation are permitted to attain a temperature which is sufficient to soften the metallic particles and the casing, but not sufficient to permit flow of the metal. Under these conditions, the mixture will coalesce into a consolidated compact mass and the metal particles on the peripheral surface of the mass will become welded to the casing. During this heating operation the powders are protected from contact with the air because the mold is closed. Thus the finely divided metal does not burn or oxidize. The entire mass of powder is covered by the mold or protecting casing so that it cannot contact with the air during the heating. The operating surface may be smoothed or polished by the use of a diamond powder, the metallic binder being sufficiently strong to prevent the dislodgment of the abrasive particles during this operation.

If the article is to be used as a drawing die the protecting casing in which the mixture is heated and subjected to pressure may later serve as the supporting casing for the composition during the use of the latter as a die or for other purposes.

In this manner, an article is formed which is very cheaply constructed and which has all the wear resisting properties necessary for a die.

Where the article is used as a drawing die and the operating surface has been worn to enlarge the die aperture or to otherwise change its shape, it may be reshaped very easily by the mere expediency of resubjecting it to a molding process under high pressure and temperature.

In the accompanying drawing which is for the purposes of illustration and not limitation,

Fig. 1 is a section through an apparatus showing the parts prior to heating and pressure, the particles sizes being very greatly exaggerated,

Fig. 2 is a section through a completed device for use as a punching or heading die or as a guide,

Fig. 3 is a section of a drawing die, and

Fig. 4 is an alternative form illustrating a step in the manufacture of a drawing die.

Like reference characters denote like parts in the several figures of the drawing.

In the following description and in the claims parts will be identified by specific names for convenience, but they are intended to be as generic in their application to similar parts as the art will permit.

In the following the process of the invention, any suitable abrasive material, such as silicon carbide, flint, quartz or the like in a pulverulent form is mixed with a suitable proportion of metal powder sufficient to fill up the voids between the abrasive particles. It is preferred to use a hard, tough metal in powdered form, and for that purpose a chrome nickel alloy has been found highly desirable. This metallic powder may be formed by filing or grinding. However, for the purpose of the present invention, the metallic powder obtained in this manner might not be of a preferred fineness. In that case, it is preferable to agitate the mixture of abrasive powder and metallic powder in a tumbler or any other suitable container so as to reduce this metallic powder to the desired fineness by the cutting action of the abrasive powder on the metal powder.

The mixture 10 is placed in a cup shaped mold or casing 11 and a close fitting metal cover or top 12 is inserted. This casing is then subjected to high heat, but not necessarily in a non-oxidizing atmosphere because the air is excluded from contact with the mixture. It may be placed in an open hearth furnace. When heated to the proper temperature, but not to the point at which the metal particles are actually melted, high pressure is applied to the cover 12 to press the mixture to as great an extent as possible. The heat resulting from the pressure, together with the heat of the casing and mixture, is such that the softened metal particles are caused to flow to completely fill the voids between the abrasive particles, and the abrasive particles are brought together as close as possible. The same heat and pressure cause the top 12 to become welded to the periphery of the casing, and will cause the metal particles not only to weld together but to weld said casing and to said top.

After the application of heat and pressure as above described the article is permitted to cool and is then finished according to the purpose for which it is to be used. If the article is to be used as a heading die or as a guide or for other purposes in which a flat or rounded exposed surface is desired, a portion of the casing may be cut away so as to expose the upper surface of the coalesced mixture and the surface of this mixture given the desired contour, smoothness and finish by cutting it with a diamond or polishing it with diamond powder. During such polishing or cutting operation exposed particles of the abrasive material will be cut in two leaving smooth or polished the exposed surfaces flush with the surface of the interspersed metallic binder.

In Fig. 2 I have shown an article in which the

cover has been removed and the wall cut away so as to leave the coalesced mixture with an exposed curved operating surface 13.

If the article is to be used as a drawing die the cover 12 if not permanently secured in place during the heating and pressing operations, may be further heated and a hole may be cut through the article as shown in Fig. 3. The metal of the top and the bottom may be drilled with an ordinary drill while the aperture through the mixture may be cut and polished by the use of a carborundum drill or diamond powder. This will leave an aperture 14 through which a rod, wire or other member may be drawn to reduce the diameter and render the latter uniform.

In Fig. 4 I have shown a somewhat different form of mold in which the cup shaped casing 11a has an aperture 14 in the bottom, and the cover 12a has a smaller aperture 15 in alignment with the aperture 14. A plug or core 16 is placed in the aperture 14 to closely fit the latter, and after the powdered mixture has been placed in the casing the cover 12a is applied to closely fit the wall of the casing as well as the smaller end of the core 16. The device is heated and compressed as above described and when cooled the core 16 may be removed. In this arrangement it is not necessary to cut away as much of the top and bottom walls or to cut a hole through the coalesced mixture. It is merely necessary to finish up the surfaces of the hole to give the proper curvature and diameter depending upon the purpose for which the die is to be used.

In making some articles from my improved composition the entire casing may be removed after the coalescing of the mixture and the cooling of the latter and the composition held in some other form of support for use, but preferably the casing which is employed during the coalescing of the mixture is used as a casing during the use of the final article.

If the apparatus is used as a drawing die and the aperture becomes worn to larger diameter or undesirable shape, the composition may be easily and economically reshaped to the proper form. This can be done by placing a core of the proper size in the hole to seal the composition from exposure to air and the die may be resubjected to heat and compression. The metal will then be softened sufficiently to cause the composition to flow into contact with the core to thereby determine the shape of the aperture, and after cooling the surface of the aperture may be re-finished.

If the article is to be used as a shaping die a construction such as that shown in Fig. 2 may have the exposed surface cut to give the desired contour whether concave, convex, irregular, or provided with depressions or projections. To avoid unnecessary cutting of the coalesced mixture to give it the desired contour, the inner surface of the cover 12 may be of a contour approximately corresponding to that of the exposed surface of the completed article so that the minimum amount of finishing of the coalesced mixture will be necessary.

The article may be used for a grinding wheel or a lapping wheel. For instance, the construction shown in Fig. 2 may be mounted in a suitable chuck or the casing may be suitably designed whereby it may be conveniently supported and rotated, and the exposed surface of the coalesced mixture may have either a curved surface as shown in Fig. 2 or the surface may be flat.

Having thus described my invention, what I

claim as new and desire to secure by Letters Patent is:

1. A wire drawing die including a metal casing, a mixture in said casing, comprising finely divided abrasive material uniformly distributed throughout a mass of finely subdivided metal, the metal particles being welded together to firmly hold the abrasive particles and welded to said casing whereby said casing forms a support and reinforcement for the united mixture therein, and a cover plate welded to said casing and to said metal particles, said casing, mixture and cover plate having a passage therethrough, and said mixture within said casing having a smooth wire drawing surface comprising a layer of said finely divided abrasive material firmly embedded in said metal.

2. A wire drawing die including a cup shaped metal casing having a central aperture in the bottom thereof, and an abrasive body permanently held within said casing and including as the main portion thereof abrasive particles in close

juxtaposition and held together by an integral mass of metal disposed between said particles, said metal mass having its entire peripheral surface directly welded to said casing whereby said casing supports and reinforces the body of abrasive particles and metal during use of the die, said body having a central passage in alignment with said aperture and presenting a hard wire drawing surface comprising a layer of said abrasive particles firmly embedded in said metal.

3. A die including a cup shaped metal casing, and a body substantially filling said casing and formed therein and having the essential portion thereof made up of abrasive particles, said particles being closely juxtaposed and firmly held together and to said metal casing by an interstitial metal matrix having its entire peripheral surface directly welded to the inner surface of said casing whereby said casing supports and reinforces the matrix and abrasive particles during use of the die.

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