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2,219,423

METHOD OF FORMING POROUS METAL ARTICLES

Filed July 28, 1938



Fig. 1

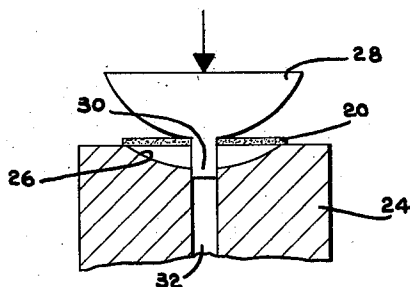


Fig. 2

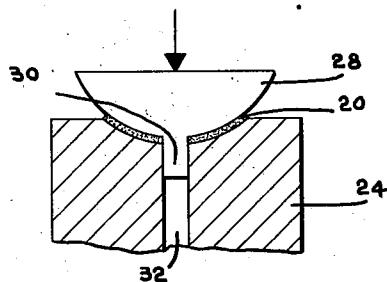


Fig. 3

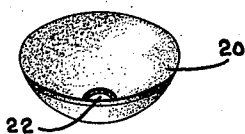


Fig. 4

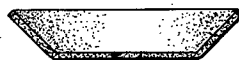


Fig. 5

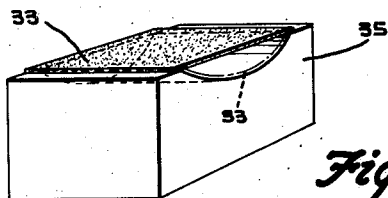


Fig. 6

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METHOD OF FORMING POROUS METAL ARTICLES

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7 Claims. (Cl. 75—22)

This invention relates to a method of shaping thin sectioned articles prefabricated from powdered material.

An object of the invention is to provide a method whereby thin sectioned preformed articles fabricated from powdered material may be shaped and simultaneously sintered so as to conform to a more complex configuration and maintain a substantially uniform density throughout any section of the article.

Another object of the invention is to provide a method for making semi-spherical washers, and the like, whereby the density at any section of the washer is uniform.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawing wherein a preferred embodiment of the present invention is clearly shown.

In the drawing:

Fig. 1 is a perspective view of a preformed flat washer, as made from powdered material.

Fig. 2 represents the washer in place on a mold prior to heating the assembly.

Fig. 3 shows the washer and mold after heating the assembly.

Fig. 4 is a view, in perspective, of the semi-spherical washer formed by the herein described method.

Fig. 5 is a view in section of one of the many other shapes of washers, or thin sectioned articles, which may be formed by practicing the herein described method, and

Fig. 6 is a view showing a mold and a flat strip thereon, the strip being shown in the mold after heating in dotted lines.

In the past it has been impossible to fabricate thin sectioned articles from powdered materials, such as powdered metals, in more than one plane. When attempting to briquette powdered metal in the shape of a semi-spherical washer, for example, the density of the metal varies at different sections thereof. This is explained by the fact that it is impossible to fill a die cavity uniformly when briquetting thin sectioned articles in more than one plane. The present invention eliminates these past difficulties and makes it possible to form thin sectioned briquettes having a flat surface and then, during the sintering operation, change the shape of the briquette to a more complex form such as a semi-spherical shape.

Referring to the drawing and more particularly to Fig. 2, 20 represents a preformed briquette

made from powdered material and having a central hole 22 therethrough. The simple shape of the briquette resembles a flat washer. When it is desired to make semi-spherical washers, a mold 24 is provided having a semi-spherical cavity 26 therein. The mold 24 may be formed from any material which does not have a tendency to bond to the material of the briquette. Such a material, as graphite has been found to be very suitable for use with briquettes of powdered metal. The mold may be formed from steel and have the surface of the cavity thereof dusted with an impalpable powder such as finely divided alumina, or graphite, etc., so that the briquette will not stick thereto. A second mold member 28 having a male configuration corresponding to the shape of the cavity 26 is also provided and is preferably formed from a material similar to that used in the mold 24. Preferably the mold member 28 is provided with a pilot portion 30 which is guided within a hole 32 in the mold 24. It is obvious however that the use of this pilot is not necessary, but merely facilitates the assembly of the washer and mold.

When practicing the herein described method, the flat washer 20 is placed on the surface of mold 24 so that it bridges the cavity 26. The washer 20 is usually briquetted so that it has a greater diameter than the diameter ultimately desired for the semi-spherical washer. The mold member 28 is then placed on top of the washer 20 with its pilot 30 passing through aperture 22 in the washer and positioned within the guide hole 32 in the mold 24. In this manner the pilot 30 centers the washer 20 with respect to cavity 26 and the mold member 28.

The assembled mold and washer are then placed in a furnace and sintered at a suitable temperature. During this sintering operation the weight of the mold member 28 gradually presses the softened briquette into the cavity 26 until the washer 20 conforms to the shape of the cavity as shown in Fig. 3. In the preferred form additional pressure is applied on top of the member 28 in the form of a weight to increase the downward force as applied to washer 20. It is apparent that in very thin sectioned articles that the weight of the mold member 28 alone may be sufficient to conform the washer to the shape of the cavity.

In this respect, when it is desired to shape a thin flat strip 33 to a semi-cylindrical shape for example, it is only necessary to provide a lower

mold member 35, as shown in Fig. 6. In this instance the weight of the strip causes the same to sag and conform to the shape of the mold due to the softening of the strip at the elevated temperature.

Fig. 5 shows another shape of the washer which may be made by practicing the present method. In this instance a flat washer of a simple shape may be formed and then by utilizing the proper shaped mold may be conformed to the shape of the mold.

It is manifest that when a briquette of powdered material is utilized, such as washer 20 or strip 33, that the material is sintered together during this forming operation. However my invention is not limited to the simultaneously forming and sintering of briquettes, but may likewise be applied to preformed articles which have previously been sintered. In this instance the temperature of the heating step need only be raised to a point sufficient to soften the preformed material.

From the foregoing it is apparent that I have provided a method wherein thin sectioned articles of simple shape may be conformed to a more complex shape, such articles having a uniform density throughout. Furthermore I have provided a method wherein articles of uniform density may be simultaneously formed and sintered.

While the embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. In a method of fabricating thin sectioned porous articles of complex shape from powdered metal comprising, briquetting the metal powder in a relatively thin sheet of simple shape and then sintering the briquetted article and concomitantly causing the article to gradually change its configuration to a predetermined more complex shape wherein the sintered porous article has a substantially uniform density.

2. In a method for shaping thin sectioned preformed porous articles made from powdered material comprising, placing the preformed article upon a mold having a cavity therein so that the article bridges the mold cavity, said mold having no bonding affinity for the material of the preformed article, placing the second mold member having a male configuration corresponding to that of the mold cavity upon the preformed article and in substantial alignment with the mold cavity, and then heating the assembled mold and article for causing the article to gradually conform to the shape of the mold cavity due to the weight of the second mold member without destroying the porosity of the article.

3. In a method for making thin sectioned porous semi-spherical washers from powdered metal comprising, forming a briquette in a relatively thin flat plate having a larger diameter than the diameter ultimately desired, placing the bri-

quetted plate upon a graphite mold having a semi-spherical cavity of the shape ultimately desired therein so that the briquette bridges the mold cavity, placing a second mold member having a semi-spherical shape adapted to fit within the cavity upon the briquette, and then heating the assembled mold and briquette for causing the briquette to conform to the shape of the mold cavity and to sinter the briquetted material together for forming a porous washer of substantially uniform density.

4. In a method for shaping thin sectioned porous briquettes made from powdered material comprising, forming a briquette of a simple shape and of a relatively thin section by the application of high pressure, placing the briquette so formed upon a mold having a cavity therein of complex shape so that the briquette bridges the mold cavity, said mold having no bonding affinity for the material of the briquette, placing a second mold member having a male configuration corresponding to that of the mold cavity upon the briquette, and then heating the assembled mold and briquette while applying pressure to the second mold member for causing the briquette to gradually conform to the complex shape of the mold cavity and to sinter the briquette together for forming a porous sintered article having a substantially uniform density.

5. In a method of shaping thin sectioned porous articles fabricated from powdered material comprising, providing a relatively thin preformed article of a simple shape, placing such an article on a mold having a cavity therein of the desired shape so that the article bridges the cavity, and then heating the assembled article and mold to such a temperature and for such a time that the article gradually conforms to the shape of the cavity and simultaneously is sintered together into a porous article having a substantially uniform density.

6. In a method of fabricating thin sectioned porous articles of complex shape from powdered material comprising, briquetting the powdered material in a simple shape and to a thickness substantially equal to the thickness ultimately desired and then sintering the article so formed while simultaneously causing the article to gradually change its shape to a predetermined more complex shape for forming a porous article of substantially uniform density.

7. In a method of fabricating thin sectioned porous articles of complex shape from powdered material comprising, briquetting the powdered material in a simple shape and to a thickness substantially equal to the thickness ultimately desired, placing the preformed article so that it bridges a die cavity of a complex shape, and then heating the article and the die to sinter the powdered material together while simultaneously causing the article to gradually assume the more complex shape of the die cavity for forming a porous article of substantially uniform density.

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