ABSTRACT: In hydrostatic compression of powder, the powder is enclosed in a capsule of yielding material having an opening therein. Adjacent the opening there is a portion of enlarged cross section connected to the adjacent portion of the main body of a capsule by a transverse member which is a plane substantially perpendicular to the axis of the opening. The opening is closed by a lid having a main body portion overlying the opening and sloping walls, the upper end of the lid being of substantially the same cross section as the enlarged part of the capsule. Upon subjecting the capsule filled with powder to hydrostatic compression, the powder and the main body are compressed while the wall of the enlarged section is pressed inwardly against the sloping wall of the lid.
METHOD OF MANUFACTURING RODS OR TUBES FROM POWDER

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a method of manufacturing components, for example rods or tubes, from powder by enclosing the powder in a capsule which is inserted in a high pressure chamber where it is subjected to an all-sided liquid pressure which compresses the enclosed powder to a body having great density. The body produced may be further treated, for example by sintering. The capsule may consist of a mold of yielding material, for example rubber or plastic, having at least one opening closed by a tightly fitting lid. The capsule can be used repeatedly and thus only provides a tool. When tubular products are being manufactured a rod-shaped core is inserted in a capsule tube, the core being centered by the lid at the ends of the tube.

2. The prior Art

With previously used capsules the finished powder body has a somewhat greater diameter at the ends. This enlargement is caused by the lid at the ends of the capsule having greater rigidity so that the powder is pressed axially towards the end of the capsule.

SUMMARY OF THE INVENTION

According to invention this is avoided by the insertion of a bevelled lid in an enlarged part at the end of the tube with an annular connecting portion between the different diameters of the tube, substantially perpendicular to the longitudinal axis of the tube. Between the bevelled part of the lid, the annular connecting portion and the enlarged part of the tube an annular space is formed having preferably triangular cross section. Thus the annular connecting portion can slide without noticeable obstruction against the end surface of the lid when the powder is compressed by the liquid pressure, and the diameter thus decreases.

DESCRIPTION OF THE DRAWINGS

The invention will be further described with reference to the accompanying drawings. FIGS. 1 and 2 show a capsule of previously conventional type before and after compression, respectively, and FIGS. 3 and 4 a capsule according to the invention, also before and after the compression, respectively. The capsule shown is intended for the manufacture of rods. FIG. 5 shows an apparatus for carrying out the method according to the invention.

In FIGS. 1 and 2, 1 designates a tube of yielding material and 2 a lid which closes the tube 1 so that a sealed capsule is obtained. The capsule is filled with a powder 3 which during the compression forms a solid body 4 with considerably reduced diameter. At the end closures the finished rod has a larger diameter than otherwise and must therefore be adjusted to the correct dimensions.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In FIGS. 3 and 4, 5 designates the main body of a tube of yielding material which is shaped at its outer part with an enlarged part 6 of greater cross section than the inner adjacent part 7 of the main body having an opening 8. Between the different diameters of the tube in the annular connecting portion 9 which is substantially perpendicular to the longitudinal axis A-A of the tube. The lid 10 is shaped with a bevel 11 which forms an angle α with a plane B-B perpendicular to the longitudinal axis of the tube and thereby has an outer frustoconical surface. The angle α should be greater than 45°, preferably greater than 60°. A space 12 of triangular cross section is thus formed between the parts 6, 7 and the lid. The capsule is filled with powder 13 which is shaped to a powder body 14 by the compression. Because the annular part 7 of the tube can slide against the inner surface of the lid, the tube 5 is deformed almost as easily at the end parts of the capsule as in the central part, so that the enlargement of the ends of the finished powder body which was unavoidable with previously used capsules, does not arise and a body of substantially constant cross section throughout its length is produced. A better product is thus obtained and an adjustment step is eliminated. In FIG. 5, the tube 5 of the yielding material is filled with a powder and the tube is closed by two lids 8, then immersed in a pressure medium 16 enclosed in a container 13, which is supplied with liquid under pressure from source 18.

Foregoing description shows the shaping of a circular rod, but the process is equally suitable for the manufacture of rods having a different cross section, in the manufacture of tubes or irregular molded components. Many variations of the method are thus possible within the scope of the following claims.

1. Method of manufacturing components by means of hydrostatic compression of powder which comprises enclosing the powder in a capsule of yielding material having a main body and at least one opening at an end of the main body, said capsule having adjacent the opening an enlarged part of greater cross section than the immediately adjacent part of the main body of the capsule and a connecting portion between said parts said portion lying in a plane perpendicular to the axis of said opening, which method comprises inserting into said enlarged part a bevelled lid taping inwardly towards the main body of the capsule and having an outer frustoconical surface, said lid having its greatest cross section substantially equal to the cross section of said enlarged part and having its smallest cross section in contact with said connecting portion and exceeding the internal cross section of said immediately adjacent part of the main body forming a space of triangular cross section on the outside of said lid and within said enlarged part, and subjecting said capsule to external hydrostatic pressure sufficient to reduce substantially the cross section of the capsule and the powder contained therein, said connecting portion moving inwardly under such pressure and at least partly pressing inwardly the enlarged part towards the outer bevelled surface of said lid, whereby to produce a component of substantially constant cross section throughout its length.

2. The method of claim 1 in which the angle between the lid frustoconical surface and said plane perpendicular to said axis is at least 45°.