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METHOD OF MANUFACTURING COMPOSITE METAL BODIES

Filed Feb. 8, 1927

Inventor:
Walther Ehlers,
by His Attorney
My invention relates to the manufacture of bodies of compressed particles of electrically conductive or magnetic material, such for example, as may be used for electric resistance bodies or for magnetic cores adapted for use in loading coils for telephone apparatus or other purposes.

The manufacture of such bodies on a large scale with a sufficiently high degree of uniformity is subject to considerable difficulty because of the magnitude of the mechanical stresses of the powder caused by the compressing process being subject to large variation. Such variations may be due to various causes such for example, as the kind of press employed, the different speeds used for compressing the time consumed with the pressing operation, and the degree of skill of the workman.

The object of my invention is to provide a method of conducting the pressing operation whereby the properties of the compressed articles will be independent to a large extent of the variations in the processes of pressing which are employed.

My invention depends upon the discovery of the fact that a point of substantially constant density exists when pulverized material is pressed; that is, when the pressing operation is carried to a certain point the density of the compressed body will be substantially constant over quite a wide range in the pressure employed. For example, if a powder in a mold is gradually pressed with a hydraulic press beginning with zero pressure, the density of the pressed body first increases rapidly with increasing pressure, it then increases more slowly, and finally remains constant up to a certain pressure. The increase of the density or the decrease of volume is caused in this instance by the shifting of the individual particles with respect to one another. Until the minimum of volume is reached, the increase of the pressure will not cause any appreciable increase in the density.

In the accompanying drawing, I have indicated a curve showing the relation between density and pressure, the density being represented by the ordinates and the pressure by abscissae. It will be seen from this curve that the density of the body gradually increases with increase of pressure until a pressure corresponding to \( P \) is reached. The density then remains substantially constant over the range \( K \) until the pressure corresponding to \( P_1 \) is reached. If beyond this point the pressure is increased to very high values the density of the body increases and approaches asymptotically the density \( S_0 \), which represents the density of the particles of which the body is composed.

If in the case illustrated, a pressure corresponding to \( P_1 \) is chosen as the pressure to be employed, variations of this pressure amounting to as much as 40\% do not have any appreciable influence upon the mechanical properties of the pressed object. The electrical and mechanical properties of the compressed body may be illustrated by similar curves. It is not necessary in carrying out the invention that the \( D-P \) curve should be made horizontal from \( P_1 \) to \( P_2 \). If it has a flat tendency along this range, this will be sufficient.

Attempts have been made in the past to manufacture pressed bodies with uniform characteristics which would be little dependent on the variation of pressure by choosing a range of pressure at a point where the \( D-P \) approaches asymptotically the limiting value \( S_0 \). This process, however, requires the application of exceptionally high pressures which should be avoided as far as possible in view of the technical difficulties of producing such high pressures, such for example, as producing molds of sufficient strength. It will also be found frequently that the characteristics of the compressed body are less desirable due to the great deformation of the powdered particles. Moreover, in this part of the curve the density only is comparatively independent of the pressure, while the magnetic and electrical properties of the compressed body are not independent of the pressure.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. The method of manufacturing bodies of pressed powdered magnetic material which consists in applying to a mass of powdered material a pressure of a value within a range over which the density remains substantially constant with variations in the pressure employed.

2. The method of constructing bodies of pressed powdered material which consists in applying to a mass of powdered material a pressure of a value within a range over.
which the density is substantially independent of the pressure, and below pressures at which a further increase in density will be produced.

3. The method of constructing bodies of pressed magnetic material which consists in applying to a mass of powdered material a pressure of a value within a range over which appreciable differences of pressure produce no appreciable change in the electrical and magnetic properties of the body.

In witness whereof, I have hereunto set my hand this 17th day of January 1927.

WALTHER EHLERS.