

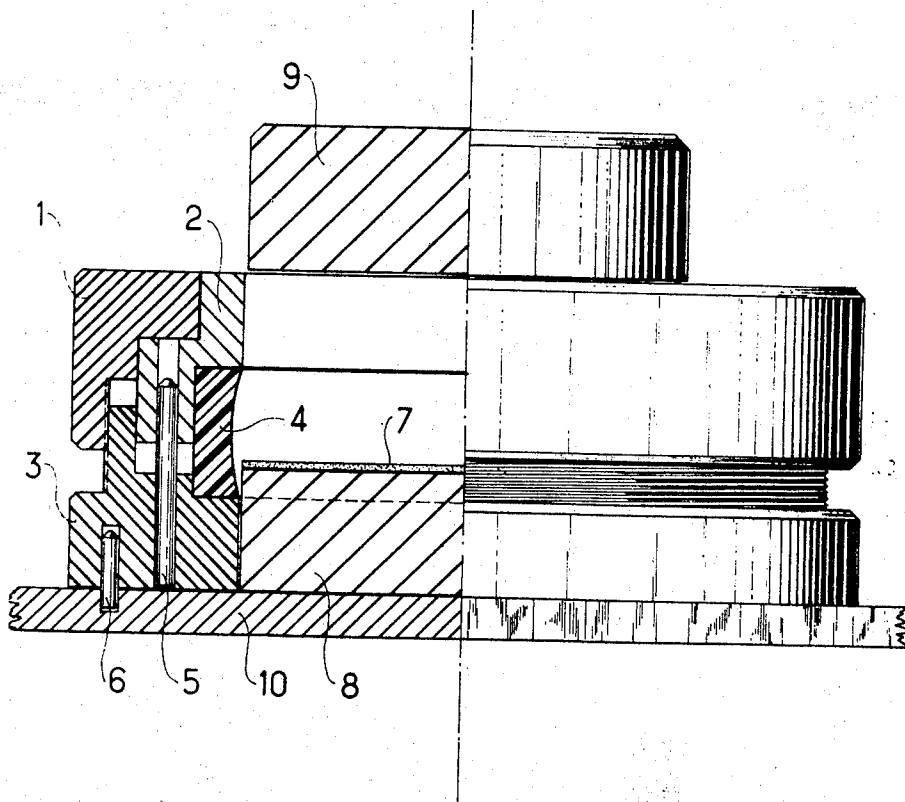
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DEFORMABLE MOLD DIE

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## DEFORMABLE MOLD DIE

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5 Claims

### ABSTRACT OF THE DISCLOSURE

A die alterable in shape, for the manufacture, by compression, of mechanical parts from powdery raw materials, the die comprising a fixed rigid part and a movable rigid part, assembled one against the other and gripping between them an elastic part, the inner surface of which forms the lateral part of the mold intended to contain the object to be manufactured.

When producing mechanical parts or the like by compression from a substance in powder form, for example, in sintering, molds or dies which can be disassembled are generally used. Whatever the care taken in the production of the various parts of which such molds or dies are constituted, the assembly of the said parts with one another is never perfect and it is inevitable that pulverulent material will penetrate into the more or less wide interstices which remain between the said component parts.

This causes losses of material. A further result is that the component parts of the die have to be carefully cleaned before each new operation.

The present invention proposes obviating this disadvantage, while making it possible to keep within the manufacturing tolerances imposed, with all the precision which is desirable.

The invention relates to a deformable die permitting the production of mechanical articles of substantially flat shape by pressure.

The compression operation is effected in the usual way in a press between two rigid parts, one of which is placed on the lower plate and the other, the ram, is fast with the other plate of the press.

The deformable die according to the invention has as its object to delimit with all the desired precision, the external contour of the article being produced, while permitting the immediate removal of the article from the die after production and eliminating interstices or joints in contact with the pulverulent material to be compressed.

An essential feature of the deformable die according to the invention is that it comprises a component part made of compressible elastic material, which surrounds the external contour of the article to be produced, over the entire periphery thereof.

The elastic component part is imprisoned between at least two rigid parts of the die so that by a strong clamping of the two rigid parts against the elastic part, it is subjected to considerable compression, and the elastic part then moves, in deforming, to the previously defined contour of the article being manufactured. The sense in which the clamping of the two parts is effected is substantially the same as the direction in which the compression of the pulverulent material is to be effected at the following stage of the operation; the deformation of the elastic part under the action of this clamping is carried out in directions substantially perpendicular to the clamping and compression directions.

Having carried out the said clamping of the rigid parts against one another, as has just been explained, the rela-

tive position of these two parts is maintained by known locking means after precisely marking this position.

As a result of the compression to which it is subjected, the elastic part is given great rigidity during the entire duration of compression, which permits machining and truing of its internal faces, until a peripheral contour is obtained which is identical with the external contour of the article to be produced, within construction tolerances.

The die is then ready for use and it is sufficient to compress the pulverulent raw material within the contour defined hereinbefore between the ram and the supporting part which corresponds thereto.

To strip, after raising the ram, the two rigid parts of the die simply have to be unclamped from one another, which frees the elastic intermediate part of the said die from all constraint. The internal contour of the intermediate part, which has previously been brought to the desired dimensions by truing, then widens out elastically sufficiently to permit the produced article to be withdrawn easily.

Losses of pulverulent material can no longer occur during operations.

Other features and advantages of the invention will be brought out from the following description with reference to the accompanying drawing, the description and drawing concerning a preferred form of embodiment of the invention which is given purely by way of illustration and is not intended to imply any limitation.

The single figure shows a vertical half section of a deformable die according to the invention.

To simplify, it has been assumed that the article 7 to be manufactured is a circular disc of uniform thickness. It goes without saying, however, that it would not constitute a departure from the framework of the invention, if the invention is applied to the production of an article whose outline can be obtained at the instant of compression by the action of molds of various shapes interposed between, on the one hand, the pressure parts (ram 9 and supporting part 8) and on the other hand, the respective upper and lower faces of the article to be produced. Similarly, the external contour of the article can be of any desired shape provided only that it can easily be rectified by acting on the internal wall or walls of the elastic part 4.

In the example of the embodiment selected, this part is in the form of a hollow cylinder with circular bases.

In the preparatory phase of the operation, the elastic part is compressed by the action of the two parts 1 and 3 which are concentric in this case, and the second of which is screwed for example onto the first. The function of the intermediate part 2 which is also concentric with the two parts 1 and 3 is to transmit to the elastic part 4 the compression resulting from the screwing of the two parts 1 and 3 on one another, in such a manner that the part 1, rotating on the part 2, is not in contact with the elastic part 4, which thus is not subjected to any forces tending to cause rotation, but only to axial compression.

Once compressed, the part 4 will comprise a convex hard swelling on its internal wall. The truing (by means not shown) will affect the swelling in question, so as to bring the internal face of the part 4 to a perfect cylindrical shape, within the tolerance imposed on the diameter of the face.

Care will then be taken to mark exactly the respective positions of the parts 1 and 3, so as to make it quite certain that the exact cylindrical form of the internal face of the part 4 can be established again during the course of the succeeding cycles, bringing the parts 1 and 3 into the relative positions which these parts occupy at the time when the internal face of the part 4 is trued.

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It will be seen more particularly from the illustration that when the parts 1 and 3 are unclamped, after truing of the part 4, the internal face of the part has a concave shape.

5 is one of the guide pins whereby the parts 2 and 3 can be made integral with one another, each of these pins extending through two holes formed opposite one another for this purpose in the parts in question.

6 is one of the pins for the convenient positioning of the die assembly according to the invention on the lower plate of the press, interposing, for example, an intermediate plate 10 between the die and the press plate, the plate 10 supporting the locating pins 6.

All the parts of the die except for the part 4 are made of special tool steel of appropriate characteristics.

The part 4 could be made, for example, of neoprene rubber with a hardness of between 70 and 90 Shore units; the part 4 could also be made of any other elastic material of similar properties.

It will be apparent that the various phases of the operation which has just been described could also be automated to a greater or lesser degree, without thereby departing from the framework of the present invention.

What is claimed is:

1. A deformable die for the production of mechanical parts by mold pressure from pulverulent raw materials, said die comprising first and second rigid parts, a third elastic part having a concave inner surface when in relaxed condition and a cylindrical surface when axially compressed and in a mold condition, and means for clamping said first and second parts together and axially compressing said third elastic part to make said inner surface of said third part cylindrical, said third part forming the whole wall of the mold to contain the article being press molded and having an axial dimension larger than that of the mechanical part to be molded.

2. The deformable die as claimed in claim 1 wherein the internal face of said third part is trued subsequent to com-

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pression between said first and second rigid parts to ensure uniform surface configuration and ultimate dimension of the subsequent series of articles to be press molded.

3. The deformable die as claimed in claim 1 wherein said means for clamping said first and second parts comprises screw coupling means carried thereby.

4. The deformable die as claimed in claim 1 wherein said first rigid part is fixed to said press and said second rigid part is removable, and wherein said die further includes a fourth rigid part positioned between said removable second part and said third elastic part, and means carried by said first and fourth parts to maintain axial alignment of said first, said third and said fourth parts during axial compression of said third elastic part.

5. The deformable die as claimed in claim 4 wherein said means carried by said first and fourth parts to maintain axial alignment comprises pins carried by said first part, and extending axially away from said first part, and holes circumferentially spaced about said fourth part and receiving in pin receiving relationship.

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