Oct. 22, 1935. A. WILLINK 2,018,392

DIE AND METHOD OF MAKING THE SAME

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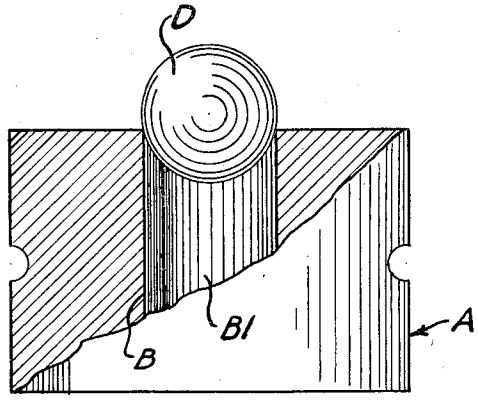


Fig. 1

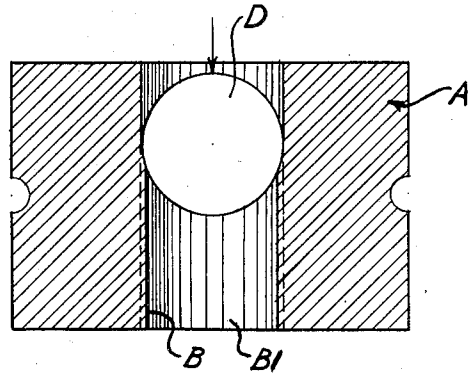


Fig. 2.

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DIE AND METHOD OF MAKING THE SAME

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4 Claims. (Cl. 76—107)

My invention relates to the production of tablets or other compressed material, and relates more particularly to the die employed in medicinal tablet molding machines for manufacturing compressed tablets.

Dies or molds used in the making of molded or compressed material such as pharmaceutical pills, medicinal tablets, metallic powders, explosives, resistance discs, abrasives, etc. are usually constructed of hardened steel. Crevices are formed in the die by corrosion or undue wear at the tablet bounding surface. Granulations that comprise the tablet per se are compressed into the crevices of the die. The crevices define an irregular tablet bounding surface, and when a tablet is withdrawn from the die a portion of the tablet is found to be split or the tablet may be unsymmetrical in shape. Thus, it is readily seen that a die that produces either a split or an unsymmetrical tablet means a loss in labor, time and material.

Steel employed in the die for forming tablets is porous and granulations of the salts, which comprise the tablet, are forced into the pores or interstices of the steel die. Upon the salts in the pores of the die absorbing moisture a chemical reaction is set up which results in corroding the die. This corrosion of the die appears to efface or wear away the die.

It is, therefore, an object of my invention to construct a die that will not readily wear or corrode.

A further object of my invention is to provide a die that will have a highly polished and an accurately finished working surface.

Another object of my invention is to improve the wearing qualities of the working surface of the die.

A further object is to construct a hardened steel die that will not crack when plated, as by chromium.

Another object is to prevent the permeating of the granulations of salt into the pores or interstices of the die.

Another object is to close the pores of the die and to harden the die by cold working the surface.

With the above objects in view my invention comprises a die of suitable metal wherein the pores or interstices are closed and, also, covered with a non-corrosive metal.

Other objects of my invention are to provide an improved device of the character described, that is easily and economically produced, that is sturdy in construction, and which is exceedingly accurate.

With the above and related objects in view, my invention consists in the details of construction and combination of parts, as will be more fully described when the description is read in conjunction with the accompanying drawing in which:—

Figure 1 is a fragmentary sectional view of the die showing the ball presently to be forced through a tablet forming aperture; and

Figure 2 is a fragmentary sectional view of the die showing the ball in the tablet forming aperture.

A steel die, generally designated as A, used in tablet compressing machines is preferably constructed of the following ingredients: carbon 1.35%; manganese 0.80%; tungsten 3.50%; silicon 0.25%; phosphorus or sulphur 0.25%; and the remainder iron. The die is then heat treated to possess the following physical properties; yield point 150,000 to 175,000 pounds per square inch and Rockwell hardness approximately 65 (on the C scale of Rockwell).

To effect the necessary cold work I subject the curved wearing surface B, defining an aperture B1, in the die to a pressure beyond the yield point of the steel. The pressure, preferably, should be obtained by means of a hydraulic press. A steel ball D having a smooth bounding surface, slightly larger in diameter than the diameter of the hole, is driven through the hole in the die. However, any other steel object of suitable size and shape may be driven through the opening on the die to widen the opening and to close the pores of the die. The operation of passing a plurality of steel balls through the opening is repeated until the proper size opening is formed. The operation above outlined of enlarging the hole also closes the interstices in the die; the operation prevents permeating of the granulations of the compressed material into the wearing surface of the die; and the operation, also, produces a highly polished and a hardened wearing surface by throwing the surface fibres into an initial state of compression. By initial state of compression is meant the compressing for the first time of the fibres of the material into a finished surface.

The die after the cold working is subjected to chromium plating, or other means of surface hardening, to improve its wearing qualities. When chromium plated the likelihood of cracking the hardened steel is practically eliminated.

The die may, also, be subjected to a coating of non-corrosive metal.

As a modification, I have obtained good results with a steel die having the following ingredients: carbon 0.50%; manganese 0.80%; molybdenum 0.50%; silicon 0.25%; nickel 0.10% and phosphorus or sulphur 0.02% maximum; and the remainder iron. The die is heat treated to possess the following physical properties: yield point 80,000 to 100,000 pounds per square inch, and Rockwell hardness of approximately 45 (on the C scale of Rockwell).

Although this invention has been described in considerable detail such description is intended as illustrative rather than limiting, as the invention may be variously embodied, and the scope of the invention is to be determined as claimed.

I claim:—

1. A method of hardening a die that comprises forming a die block having an aperture defining surface through the die slightly less in cross-section than the cross-section desired, forcing an object through said aperture which object is slightly larger in cross-section than the cross-section of the aperture in order to enlarge said aperture, and coating the aperture defining surface with a surface hardening material.

2. A die comprising a hardened steel body of fibres having a continuous wearing surface defining an opening, said fibres in an initial state of compression, and a covering of chromium on the wearing surface of said die.

3. A die comprising a hardened steel body of fibres having a continuous wearing surface defining an opening, said fibres in an initial state of compression, and a covering of non-corrosive metal on the wearing surface of said die.

4. A method of hardening dies or molds comprising forming the die, and a continuous wearing surface defining an opening, compressing said wearing surface therein into an initial state of compression, and coating said die with a non-corrosive metal.

ARTHUR WILLINK