

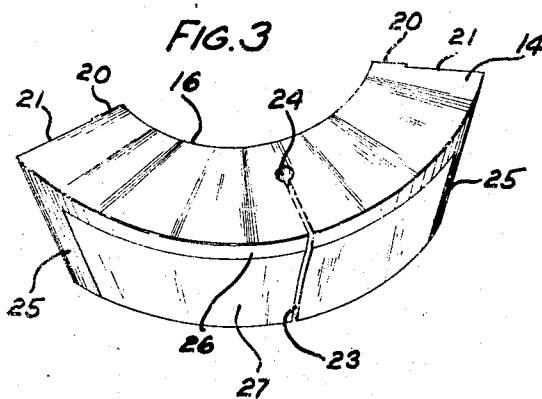
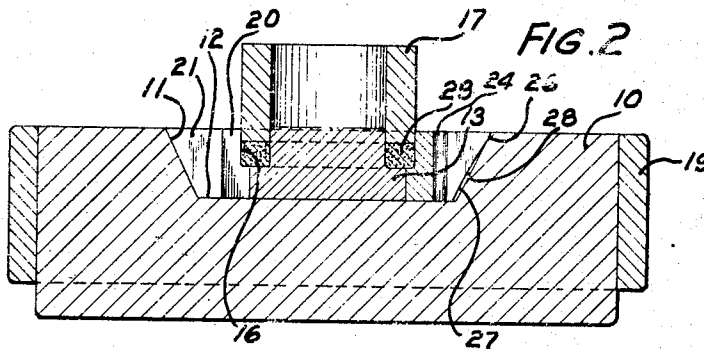
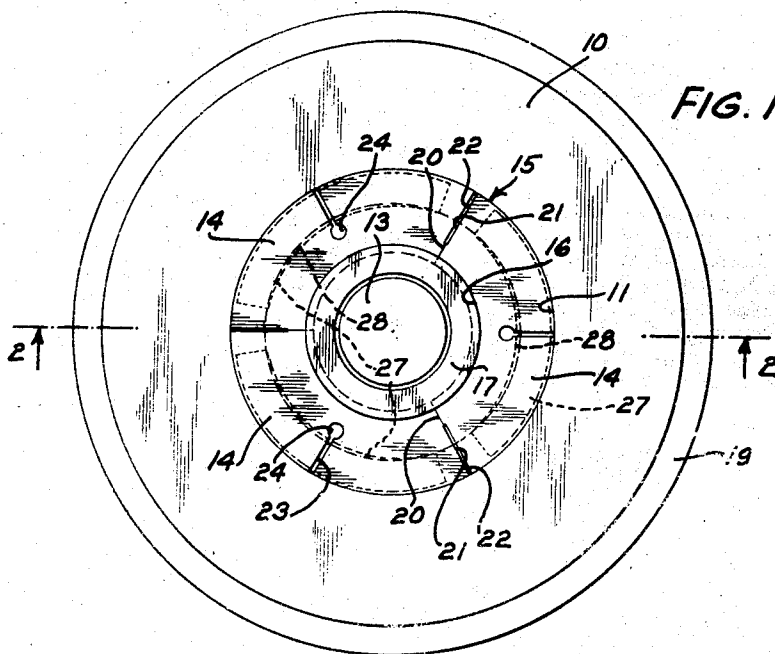
May 5, 1942.

A. F. BANDUR

2,282,155

MOLDING DIE

Filed Oct. 11, 1939



INVENTOR
A. F. BANDUR
BY *Emery Robinson*
ATTORNEY

UNITED STATES PATENT OFFICE

2,282,155

MOLDING DIE

Adolph F. Bandur, Berwyn, Ill., assignor to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York

Application October 11, 1939, Serial No. 298,875

7 Claims. (Cl. 18—34)

This invention relates to molding dies, and more particularly to dies for molding or pressing insulated particles of magnetic metal or alloy into magnetic cores.

In the manufacture of insulated dust magnetic cores, the magnetic metal or alloy is generally pulverized to the required fineness, after which the particles are coated with a combination insulation and binder and then compressed into a unitary body of the required shape. In the usual molding or pressing operation the coated particles are placed in an open die cavity and compressed by means of a compacting member applied against the top surface of the particle mass.

Toroidal cores, which are used in certain types of communication apparatus, have been formed by this general procedure in a die comprising a plurality of separable segments or sections arranged in a conical depression in a holder or base member around a center plug so that the sections and plug provide an annular groove in which the insulated dust is deposited. A pressure ring is placed over the dust, and suitable hydraulic or mechanical power is used to force the ring into the annular groove to form the dust into an integral core ring. Certain of these core types are pressed at pressures around 250,000 pounds per square inch of forming ring engaging surface. The application of this high pressure on the confined magnetic dust tends to distort the contour of the cavity containing the particles. As a result, the formed core may be subjected to localized stresses, which impair its properties, when the pressure is released and the cavity is restored to its normal shape and in some cases these stresses may be of sufficient intensity to crack the core.

An object of this invention is the provision of an improved, simple and efficient die construction for compressing or molding finely divided magnetic material into shaped bodies having desirable mechanical, magnetic and electrical properties.

One embodiment of the invention provides a die in which a plurality of arcuate sections supported in a recessed die base and forming a circular pressure cavity are constructed to distort under the forming pressure and become restored when the pressure is released without appreciably distorting the contour of the pressure cavity. Each of the die sections has a radial slot positioned mid-way between its ends and extending through the section body from the outer periphery to a point near the inner, or cavity forming, wall of the section. The outer wall of each

section is so formed that the end portions and the top portion thereof are always in full contact with the wall of the supporting base, while the lower central portion, adjacent to the slot, is normally spaced from the base wall. With this construction, each section distorts uniformly under the molding pressure without substantially changing the contour of its cavity forming wall and when the pressure is released, the sections return to their normal shape without applying a concentrated force at any portion of the formed core.

Following is a more complete description of the invention taken in conjunction with the appended drawing, in which

Fig. 1 is a plan view of a die embodying certain features of the invention;

Fig. 2 is a sectional view of Fig. 1 taken on the line 2—2, and

Fig. 3 is a perspective drawing of one of the sections comprising the die shown in the other figures.

Referring now to the drawing, a die base 10 of high strength steel has a circular recess therein with a tapering side wall 11 and a flat bottom 12. Within the recess is a center plug 13 and three arcuately shaped die sections 14 which form a sectional ring 15 around the center plug. The ring and plug cooperatively form a cavity 16 in which a quantity of magnetic dust particles or other material is pressed by means of a pressure ring 17 adapted to be inserted into the cavity at a suitable pressure. As a safety measure, a retaining band 19 of high tensile strength steel may be pressed on the outer periphery of the base.

The three arcuate sections forming the sectional ring 15 are positioned in abutting relationship. The end surfaces of each section are shaped so that the inner portions 20 thereof, which are adjacent to the cavity, are in contact with the adjacent section and the outer end portions 21 are spaced from the next section. About one-seventh of the end surfaces of adjacent sections are normally in contact and a clearance 22 of about five-thousandths of an inch is provided between the remaining portions of these end surfaces.

Each of the three sections has a radial slot 23 mid-way between its ends. This slot extends through the body of the section and runs from the external wall or periphery of the section, which is adjacent to the tapered wall 11 of the base recess, to a point near the inner wall of the section, which forms a part of the pressure

cavity. At its inner end the slot terminates in a round hole 24 which is drilled through the body of the section parallel to its inner face or wall. The exact dimensions of the slot depend upon the size of the die sections as well as the core forming pressures employed. In a representative installation for pressing insulated dust magnetic cores at a pressure of 250,000 pounds per square inch, the sectional ring formed by the die sections had an outside diameter of $5\frac{1}{2}$ " and an inside diameter of $1\frac{3}{4}$ " and the die sections were $2\frac{1}{2}$ " thick. Under these conditions a slot $\frac{1}{8}$ " wide extending to within $\frac{3}{8}$ " of the inner wall of the section was used and the diameter of the hole 24 was $\frac{1}{4}$ ". In general, a slot extending around four-fifths of the distance between the outer and inner peripheries of the section is satisfactory.

The tapered outer wall of each of the die sections is shaped (Fig. 3) so that the end portions and the top portion thereof are normally in full contact with the tapered wall 11 of the die base recess while the remaining part of the section wall is spaced from the base. The two end portions 25 of the section wall in contact with the base each extend about one-sixth of the peripheral distance between the section ends, and the upper bearing surface 26 which engages the base continuously across the section wall extends downwardly from the top edge of the section a distance equal to about one-fourth of the depth of the outer section wall. The remaining portion 27 of the external section wall on each side of the central slot is shaped, by grinding or machining, to provide a clearance 28 between that portion of the section wall and the base. This clearance is greatest at the slot and gradually decreases to a zero value towards the bearing surfaces that are located at each end of the section. The amount of clearance required will depend upon the size of the die members and the magnitude of the forming pressures, but a clearance around .010" is usually satisfactory.

When using the above described die, a measured quantity of insulated magnetic particles 29 is placed in the cavity provided by the sections and the center plug, as shown in Fig. 2. Next, the pressure ring is inserted into the cavity onto the particles and forced against the particle mass at a pressure around 250,000 pounds per square inch. As the pressure is applied, lateral forces are exerted by the confined particle mass against the die sections. Due to the combined action of the slot, bearing surfaces and clearances, the sections distort uniformly under these forces. The slots, end wall clearances, and external wall clearances accommodate the distortion of the sections while the arrangement of the bearing surfaces at the ends and outer walls of the sections prevents appreciable change in the contour of the pressure cavity formed by the inner wall of the sections. Consequently, when the pressure is released and the sections are restored, the resultant forces exerted against the completed core are applied uniformly over the core periphery, with the result that localized pressure, and the resultant developed of unbalanced stresses in the core, are avoided. The elimination of concentrated stresses in the cores improves the properties of the cores. At the completion of the pressing operation, the pressure ring is removed and the sections are then slid out of the base to permit removal of the completed core.

The die sections are made of an alloy steel

having sufficient tensile and elastic strength to withstand repeated deformation and restoration to normal shape. The sections are usually produced by forging and grinding operations.

Although the invention as herein illustrated and described is particularly valuable for use in pressing insulated dust core rings, various modifications and adaptations of the described structure are feasible, and it is to be understood that the invention is limited only by the scope of the appended claims.

What is claimed is:

1. A molding die comprising a base having a recess therein, and a plurality of arcuately shaped die sections positioned in the recess with the external surfaces of their walls in partial contact with the wall of the recess and with the internal surfaces of their walls forming a molding cavity, each of said sections having a radial slot positioned between its ends and extending from the external surface part way through the section wall.

2. A molding die comprising a die base having a circular recess therein, and a plurality of arcuately shaped mold sections positioned in the recess with the external surfaces of their walls in contact with the wall of the recess only at predetermined points thereof and the internal surfaces of the section walls cooperatively forming a circular molding cavity, each of said sections having a radial slot positioned mid-way between its ends and extending through the wall of the section from the external surface to a point near the internal surface of the section.

3. A molding die comprising a die base having a circular recess therein, a center member positioned in the base recess, and a plurality of arcuately shaped die sections positioned in the recess with the internal surfaces of their walls cooperating with the central member to form a ring shaped molding cavity, each of said sections having a radial slot positioned between its ends and extending from its external surface part way through the wall of the section, and the external surface of each section being shaped to cause the end portions and the top portion thereof to normally engage the base recess wall and the remaining portions thereof to be normally spaced from the base recess wall.

4. A molding die comprising a die base having a circular recess therein with a tapering side wall, a center member positioned in the base recess, and a plurality of arcuately shaped die sections positioned in the recess with the external surfaces of their walls in contact with the wall of the recess only at predetermined points thereof and the internal surfaces of the section walls cooperating with the central member to form a ring shaped molding cavity, each of said sections having a radial slot positioned mid-way between its ends and extending through the section body from the external surface of the section wall to a point near the internal surface of the section, and the external surface of each section being shaped to cause predetermined portions thereof adjacent to the section ends and along the top of the section to normally engage the base recess wall while the remaining portions of the external section wall surface are spaced from the base recess wall.

5. In a die for pressing finely divided particles into a unitary body, a base having a recess therein, a plurality of arcuately shaped die sections positioned in the recess with the internal surfaces of their walls cooperatively forming a cen-

tral cavity for receiving the particles, each of said die sections having a radial slot part way through its mid-section and each section being so constructed that only predetermined portions of the external surface of its wall will normally engage the base while the remaining portions of its external wall surface will be normally spaced from the base, whereby forces transmitted to the sections by pressure applied on the particles will cause the sections to distort without changing the contour of the cavity.

6. In a die for pressing finely divided particles into a unitary body, a die base having a recess therein, and a plurality of arcuately shaped mold sections positioned in abutting relationship in the recess with the internal surfaces of their walls cooperatively forming a circular cavity for receiving the particles, and means for compressing the particles in the cavity, all of said mold sections being identical in shape with the external surfaces of their walls normally in partial contact with the base wall for causing the sections to distort when pressure is applied on the

particles in a manner to cooperatively form a circular cavity of the same contour as the cavity normally formed by the sections.

7. In a die for pressing finely divided particles into a unitary body, a base having a recess therein, three arcuately shaped mold sections positioned in the recess in abutting relationship with the internal surfaces of their walls cooperatively forming a cavity for receiving the particles, each of said mold sections having a radial slot positioned mid-way between its ends and extending about four-fifths of the distance between the external surface and the internal surface of the section wall, and each section being so constructed and positioned in the recess that about one-sixth of the external surface of its wall at each end of the section and about one-fourth of the top portion of the external surface of its wall will normally engage the base recess wall while the remaining portion of the external surface of the section wall is normally spaced from the base recess wall.

ADOLPH F. BANDUR.