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W. W. BROUGHTON

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METHOD OF CASTING STEREOTYPE PLATES

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Fig. 1,

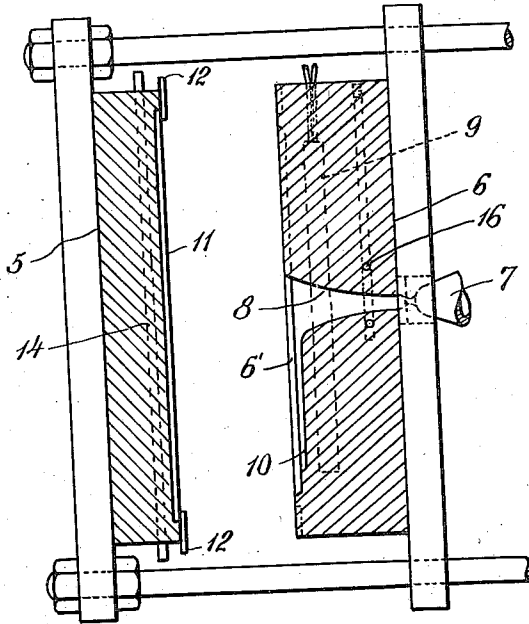


Fig. 2,

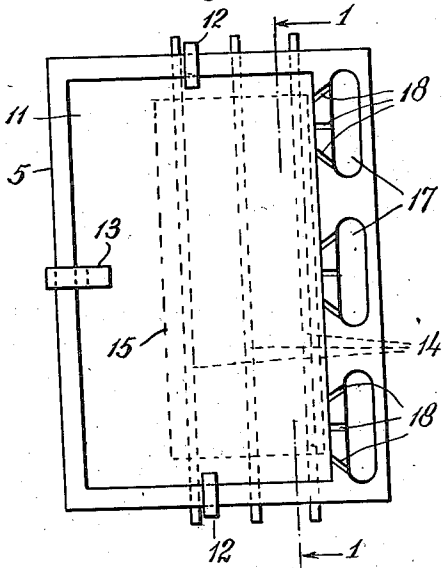
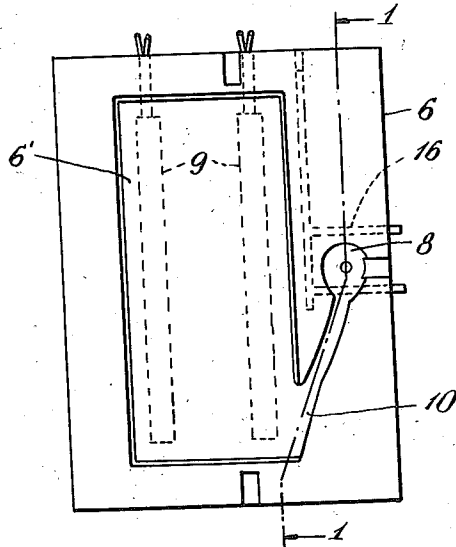


Fig. 3,



INVENTOR
William Waite Broughton
BY
Pennie Davis, Marvin J. Edmonds
ATTORNEYS

UNITED STATES PATENT OFFICE

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METHOD OF CASTING STEREOTYPE PLATES

William Waite Broughton, Hohokus, N. J., assignor to The New Jersey Zinc Company, New York, N. Y., a corporation of New Jersey

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6 Claims. (Cl. 22—212)

This invention relates to stereotype plates and has for its object the provision of a method of making zinc alloy stereotype plates by die-casting.

Stereotype plates have heretofore been usually made by casting in a mold lined with a paper matrix containing the design to be reproduced on the plate. Antimonial lead or lead-antimony-tin alloys have been generally used for making these plates. The metal has been introduced into the mold either by pouring or by pumping, as, for example, by a machine similar to the usual die-casting machine, but adapted for operation at the relatively low temperature required for casting lead alloys.

In recent years zinc base die-casting alloys have been extensively substituted for the lead alloys formerly used in the manufacture of die-castings. However, the use of zinc base die-casting alloys has not heretofore extended to the manufacture of stereotype plates. One reason for this is that heretofore no suitable zinc base die-casting alloy has been available. Such zinc base alloys as were available were not suitable for the die-casting of stereotype plates on account of one or all of the following disadvantages:

1. Tendency to crack when cast in thin shapes of irregular thickness, such as stereotype plates,
2. Lack of sufficient fluidity to fill the mold or to reproduce the fine details in the paper matrix, particularly the half-tone dots,

3. The relatively high melting point of zinc base die-casting alloys and their shrinkage during freezing create the following dilemma when the heretofore available zinc alloys are used:

- (a) If the mold is fully lined by the use of a paper insert in the back of the mold in addition to the paper matrix in the face of the mold, in order to secure uniform cooling of the casting, the cooling rate will be too slow on account of the insulating action of the matrix and insert, so that the matrix and insert will be in part consumed by the heat, and the gases thereby evolved will cause severe pitting.

- (b) If the paper insert is omitted and the back of the mold left bare to secure sufficiently rapid cooling to protect the paper matrix from over-heating, the differential cooling will cause freezing to begin at the relatively cool back of the mold and the shrinkage of the metal during freezing will tend to draw the metal locally away from the matrix, so that the surface of the final cast plate will be marred by shrinkage depressions.

I have discovered that die-cast stereotype plates may be satisfactorily made from suitable

zinc alloys by appropriate control of the thermal characteristics of the two opposite faces of the mold cavity. Thus, my present invention involves making die-cast stereotype plates by introducing a suitable molten zinc alloy into a mold cavity of which one face possesses relatively higher heat conductivity than the opposite face, and compensating for the differential cooling of the zinc alloy in the mold cavity in consequence of the relative difference in heat conductivity of its opposite faces by applying heat to that face of the mold cavity of relatively high heat conductivity. In carrying out the method of the invention, a paper mat (matrix) of the type customarily used for producing stereotype plates is inserted in a casting die or mold. This paper mat contains the design or matter to be printed which it is desired to reproduce on the stereotype plate. The mat is inserted in one-half of the mold and held in position by suitable clips so that molten metal entering the mold during the die-casting operation cannot flow behind the mat. The mold is provided with appropriate means for discharging the casting without injuring the mat, and with means for breaking the sprue of the casting from the nozzle of the machine.

When the mold is assembled with the paper mat for producing the casting, one side of the mold namely the side that forms the back of the stereotype plate, is of bare metal, and the other side of the mold is lined with the paper mat. In consequence of the relatively low heat conductivity of the paper mat, the zinc alloy during the die-casting operation tends to cool more rapidly at the bare metal back of the mold than at the paper-lined face. In accordance with our invention, this differential cooling is compensated for by maintaining the half of the mold containing the paper mat at a suitably lower temperature than the bare metal back of the mold. Thus, the half of the mold containing the paper mat may be water-cooled to a temperature between room temperature and 100° C., but preferably not higher than about 40 to 50° C. The temperature of the other half of the mold is then maintained at between 150 and 225° C., preferably at about 180° C. This increased temperature of the back half of the mold may be secured by electric heating or by placing this half of the mold next to the casting pot so that it becomes the so-called hot half of the mold.

The mold is provided with a suitable recess for holding the paper mat, and with suitable gates, runners, vents and overflow wells. In order to secure uniform flow of the metal into the rela-

tively flat mold, it has usually been found desirable to have the gate of the mold enter in such a manner as to secure minimum turbulence, for example, near a corner of the plate to be cast.

5 The paper mat may with advantage be protected from direct contact with the inflowing molten zinc alloy at its point of entrance into the mold cavity by placing a paper or metal shield above the mat at this point. The paper mat or matrix
10 used may be of the kind now commonly employed in making stereotype plates with the usual lead alloys. It may, for example, be made of blotting paper and tissue paper with a backing of gum cardboard or plastic material to prevent crushing
15 of the mat by the pressure of the molten alloy. The mat may also contain heat-resistant material, such as asbestos. It may be desirable to dust the surface of the mat for its protection during the die casting operation with a suitable
20 substance adapted to prevent adhesion of the casting to the mat, such, for example, as talcum powder.

In order to avoid crushing the mat, the pressure used in die-casting stereotype plates from
25 zinc alloys is substantially lower than that generally used in die-casting. Pressures ranging from 35 to 150 pounds per square inch have been found appropriate in practice. In spite of the low unit pressures used, the force tending to
30 separate the two halves of the mold may be extremely high on account of the great area of the internal surface of the mold, so that special precautions must be taken to hold the two halves of the mold together during the die-casting operation.
35 This can be readily effected by constructing the members that hold the two halves of the mold together with somewhat greater mechanical strength than is customary in the construction of ordinary small die-casting machines.

40 The accompanying drawing illustrates a mold or die adapted for the practice of the invention. In this drawing,

45 Fig. 1 is a section (on the lines 1—1 of Figs. 2 and 3) through the two plates of the mold in open position,

Fig. 2 is a plan of the "cold" plate of the mold (as viewed from the "hot" plate), and

Fig. 3 is a plan of the "hot" plate (as viewed from the "cold" plate).

50 The mold illustrated in the drawing comprises a cold or front plate 5 and a hot or back plate 6 having in its face a mold cavity 6' of a depth equal to the desired plate thickness. The plate 6 is stationary and is positioned near the nozzle 7 of the die-casting machine and the pot of molten metal from which metal for casting is supplied. The plate 6 is traversed by the sprue cavity 8 which may be surrounded near the outer face of the plate by a water-cooling pipe 16. In addition
60 to receiving heat from the pot of molten metal in the die-casting machine, the hot plate 6 is provided with spaced electric resistance heaters 9, positioned directly opposite the casting cavity (see Fig. 3). The gate 10 enters the casting cavity at one corner and at an angle, this having been found desirable to prevent warping of the plate after its withdrawal from the mold. The cold plate 5 of the mold is movable with respect to the hot plate for closing and opening the
70 mold. The face of the cold plate is provided with a recess 11 for the accommodation of the paper matrix, and the latter is held in place in the recess by movable fingers 12 at the top and bottom of the cold plate. The cold plate is provided with a sprue pulling finger 13, for with-

drawing the sprue from the sprue cavity when the die or mold is opened after casting. A small metal or paper plate may be inserted between the sprue pulling finger and the matrix in order to protect the matrix from being burned during casting by the incoming jet of molten metal.

The cold plate of the mold is provided with water lines 14 in the area covered by the part of the matrix containing the type impression to be reproduced in the casting. This area is indicated by the dotted outline 15 in Fig. 2 of the drawing. The sprue and broken-off portions of the plate are returned to the pot of the die-casting machine for remelting and reuse. The cold plate 5 is provided with overflow wells 17 communicating
15 with the mold cavity through channels 18 (Fig. 2) for receiving the first portion of molten metal introduced into the mold and also for providing a means of escape for air and gases evolved from the matrix during the casting operation in consequence of the contact with the molten metal.

In practicing the present invention, I prefer to use the zinc base alloy described and claimed in the copending United States patent application of George L. Werley and myself, Serial No. 721,152, filed April 18, 1934.

This alloy is prepared with high purity zinc metal containing not more than 0.05%, and preferably not more than 0.01%, lead. The alloy contains copper and aluminum. The aluminum percentage exceeds the copper percentage. The relative proportions of zinc, aluminum and copper are adjusted so that sufficient eutectic is present to secure freezing over a narrow temperature range. This is of importance since it prevents the cast plate from drawing away from the matrix during freezing of the alloy. The aluminum content may exceed the copper percentage by 5. Thus, the composition of the alloy may be 5.0 to 6.5% aluminum (preferably 5.45 to 5.85%); 0.3 to 1.8% copper (preferably 0.85 to 1.35%); and the balance high purity zinc containing not more than 0.01% lead.

The temperature of the molten zinc alloy during the die-casting operation may advantageously be maintained at between 415 to 450° C., and preferably at about 427° C.

By the method of the invention, satisfactory printing plates can be made containing reproductions not only of type and line ingredients but of detailed half tones, with screens as fine as 80 mesh and even finer.

The plates can be cast flat and readily shaped to fit the curvature of the cylinders of rotary presses, since the die-castings thus prepared are sufficiently ductile for this to be done. Moreover, the plates can be readily machined with a routing machine in the manner conventionally used for preparing stereotype plates and zinc engravings. It is preferable to use in this operation the routing machines commonly used in preparing zinc engravings. Furthermore, the thickness of the die-cast plates can be readily reduced if desired with the usual machine tool used in working zinc or zinc alloys.

Stereotype plates die cast in accordance with the present process are superior to ordinary stereotype plates made of lead alloys on account of greater tensile strength, impact strength, ductility, hardness and durability, as well as decreased weight, with consequent lower cost of metal and diminished shipping cost.

The following table shows a comparison of the mechanical properties of zinc alloy stereotype

plates, cast in accordance with the invention, with those of a stereotype plate cast with an ordinary lead-antimony-tin alloy:

Analysis

Lead alloy		Zinc alloy	
Lead.....	80.4%	Aluminum.....	5.50%
Antimony.....	13.3%	Copper.....	1.15%
Tin.....	5.6%	Balance zinc (99.99% pure)	

Physical properties

	Lead alloy	Zinc alloy
Tensile strength-lb./sq. in.....	8,400	43,600
Impact strength-ft. lbs.....	.25 (1/4" sq. specimens)	19.00 (1/4" sq. specimens)
Brinell Hardness.....	17	87
% elongation in 2".....	.5	3.7

Using the standard practice of applying a 500 kg. load on a 10 mm. ball for 30 seconds, the average diameter of impressions for the lead alloy was 5.8 mm., whereas the average diameter for the zinc alloy was only 2.7 mm.

It will be understood that in view of the necessity of using high purity zinc metal in preparing these alloys, care must be taken to avoid contaminating the alloy with ordinary stereotype metal (antimonial lead or lead-antimony-tin alloys).

I claim:

1. The method of making zinc alloys stereotype plates by die-casting which comprises introducing the molten zinc alloy into a mold cavity of which one face is lined with a matrix of relatively low heat conductivity and the opposite face possesses relatively higher heat conductivity, controlling the temperature of the opposite faces of said mold cavity so that the face of relatively higher heat conductivity is maintained at a temperature of about 50 to 150° C. higher than the temperature of the face of relatively low heat conductivity, and freezing the molten zinc alloy in the mold cavity.

2. The method of making zinc alloy stereotype plates by die-casting which comprises introducing the molten zinc alloy into a mold cavity of which one face possesses relatively higher heat conductivity than the opposite face, and maintaining the face of relatively low heat conductivity at a temperature of about 40 to 100° C. and

the face of relatively high heat conductivity at a temperature of about 150 to 225° C.

3. The method of making zinc alloy stereotype plates by die-casting which comprises introducing the molten zinc alloy into a mold cavity of which one face is lined with a matrix of relatively low heat conductivity and the opposite face possesses relatively higher heat conductivity, and compensating for the differential cooling of the zinc alloy in the mold cavity in consequence of the relative difference in heat conductivity of its opposite faces by maintaining the face of relatively low heat conductivity at a temperature of about 40 to 50° C. and the face of relatively high heat conductivity at a temperature of approximately 180° C.

4. The method of making zinc alloy stereotype plates by die-casting which comprises introducing the molten zinc alloy under a pressure of from 35 to 150 pounds per square inch into a mold cavity of which one face is lined with a matrix of relatively lower heat conductivity than the opposite face, compensating for the differential cooling of the zinc alloy in consequence of the relative difference in heat conductivity of its lined and unlined faces by applying heat to that face of the mold cavity which is unlined, and freezing the molten zinc alloy in the mold cavity.

5. In a method of die casting stereotype plates involving the freezing of a molten zinc alloy in a mold a portion of which is lined with a matrix having a lower heat conductivity than the mold, the improvement which comprises compensating for the differential cooling of the zinc alloy in the mold cavity in consequence of the difference in heat conductivity of the lined and unlined portions of the mold by heating the unlined portion of the mold.

6. In a method of die casting zinc alloy stereotype plates involving the freezing of a molten zinc alloy in a mold cavity a portion of which is lined with a matrix having a lower heat conductivity than the mold, the improvement which comprises maintaining the temperature of the unlined portion of the mold approximately 100° C. higher than the portion of the mold which is lined with the matrix to compensate for the differential cooling of the zinc alloy in the mold cavity in consequence of the difference in heat conductivity of the lined and unlined portions of the mold.

WILLIAM WAITE BROUGHTON.