

Sept. 14, 1948.

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METHOD OF MAKING MOLDS

2,449,136

Filed Jan. 1, 1945

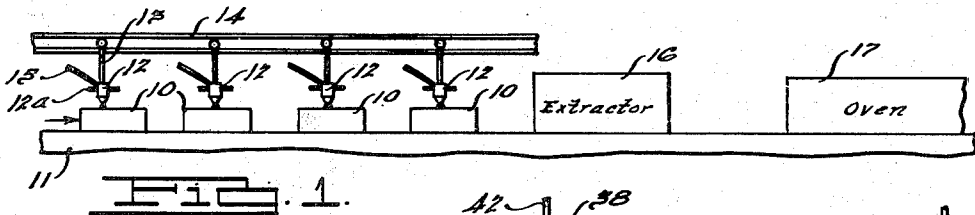


FIG. 1.

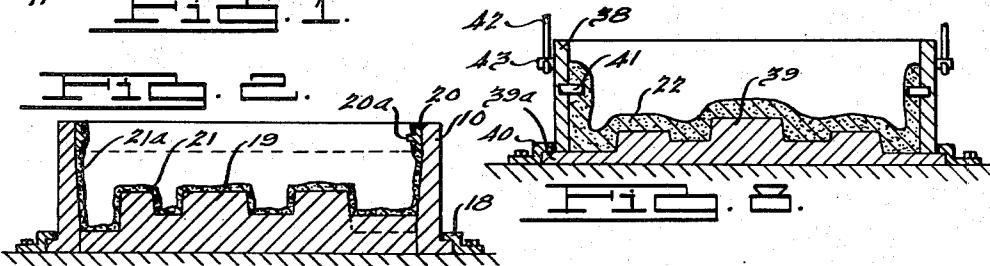


FIG. 2.

FIG. 3.

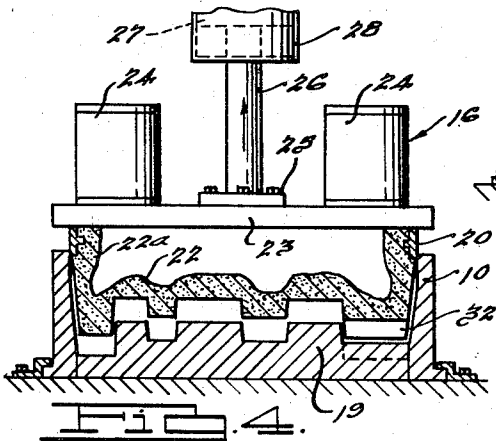


FIG. 4.

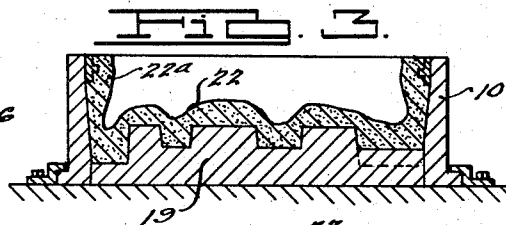


FIG. 5.

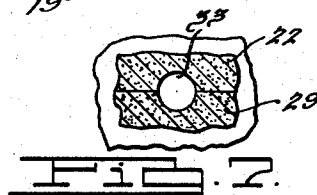


FIG. 6.

FIG. 7.

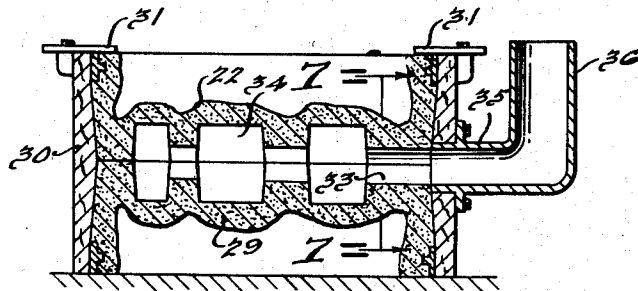
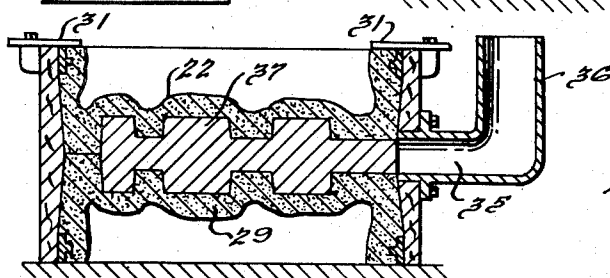


FIG. 8.



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2,449,136

METHOD OF MAKING MOLDS

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Application January 1, 1945, Serial No. 570,929

4 Claims. (Cl. 22—193)

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This invention relates to a method and apparatus for producing molds for use in casting metals. Molds produced in accordance with the invention may be utilized to make metal patterns or may be in the form of foundry molds useful for the purpose of pouring production castings. The invention especially relates to molds produced from materials in which plaster or gypsum is a principal ingredient.

An object of the invention is to provide an improved plaster or gypsum mold of the shell type having thin wall sections produced by spraying the wet plaster mix onto the surface of the pattern.

An object of the present invention is to provide an improved method and apparatus for producing a mold, such as a plaster or gypsum base mold, having relatively thin wall sections permitting more rapid and uniform solidification of the metal when cast in the mold.

A further object of the invention is to provide an improved method and apparatus for making plaster or gypsum base molds by which the walls of the mold may be reduced materially in thickness and in such manner as to be more or less uniform in cross-section so as to achieve more nearly uniform chilling or congealing of the molten metal within the mold thereby improving the texture and quality of the castings and reducing imperfections.

A further object of the invention is to provide an improved method and apparatus for producing a shell mold in which the wall sections may be built up in successive layers by spray operation to any desired thickness with the outer surface thereof conforming generally to the contour of the pattern and the wall sections compacted to any desired consistency as determined by the pressure used in the spray operation.

Other objects of this invention will appear in the following description and appended claims, reference being had to the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

Fig. 1 is a diagrammatical view illustrating an apparatus which may be utilized for preparing plaster or gypsum molds in accordance with the present invention.

Figs. 2 and 3 are sectional elevations illustrating successive steps in the formation of a shell mold by spray operations.

Fig. 4 is a fragmentary elevation, partly in section, illustrating the extraction of the mold from the flask.

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Figs. 5 and 6 are sectional elevations illustrating assembled cope and drag mold members forming a cavity within which a casting is poured.

Fig. 7 is a section taken substantially through lines 7—7 of Fig. 5 looking in the direction of the arrows.

Fig. 8 is a sectional elevation illustrating a modified flask construction within which a shell mold is prepared by spray operations.

Before explaining in detail the present invention, it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

In Fig. 1 there is illustrated more or less diagrammatically an apparatus for producing a succession of plaster or gypsum molds in a continuous operation. The molds are built up in successive layers by spray operation within flasks 10 adapted to be moved in succession on a suitable conveyor 11 beneath a series of spray guns 12 suspended by hanger brackets 13 from an overhead beam or frame 14. The brackets may be pivotally connected to the beam 14 for limited universal movement to permit the guns 12 to be swung to any desired angular positions for properly directing the spray mixture issuing from the gun nozzle. The guns are provided with handles 12a by which they may be manipulated. The wet plaster mix is fed under pressure to the guns through conduits 15. It will be understood that the plaster mix of the desired consistency is prepared in a tank (not shown) and is fed by air pressure through conduits 15 to the guns 12.

After the plaster molds have been built up so as to have the desired wall thicknesses the flasks containing the molds are conveyed to an extractor mechanism 16 where the molds are withdrawn from the flasks and deposited on the conveyor. Thence the molds are conveyed through an oven 17 which subjects the molds to heat for a suitable period of time and at a temperature sufficient to dry the molds. The cope and drag mold members may then be assembled in a flask and the metal poured in the casting cavity formed by the mold members.

The flask 10 may be rectangular or circular in shape as desired and received within each flask is a metal pattern 18. The pattern and flask are supported upon a suitable base and held in

position by means of clamping devices 18 co-operating with the lower flanged edges of the flask. Removably supported in position within the upper edge of the flask is a frame 20 having an inwardly projecting rib 20a. This frame is preferably formed of alloy steel in order to permit the mold to be withdrawn by magnetic action as hereinafter described. The flask 10 with its assembled pattern 19, illustrated in Fig. 2, is moved by the conveyor 11 beneath the successive spray guns 12 and each spray gun is adapted to spray under predetermined pressure a thin layer of wet plaster mix over the upper contoured surface of the pattern 19. Any number of spray guns may be provided for the purpose of building up a plaster impression within the flask 10. In Fig. 2 a plaster impression 21 in an intermediate stage of development is illustrated. It will be understood that as the flask moves beneath each of the spray guns 12 the operator may manipulate the gun by grasping the handles 12a and pass the gun back and forth across the upper surface of the pattern while also directing the spray against the inner side walls of the flask as shown at 21a in Fig. 2. Although in the illustrated apparatus a series of spray guns 12 are shown, it will be understood that the plaster impression may be built up within the flask 10 through manipulation of a single spray gun which, as it is passed back and forth over the pattern, will progressively build up the mold impression through deposit of successive layers of plaster one upon the other. Thus, a shell mold, such as that illustrated at 22 in Fig. 3, having any desired wall thickness may be produced depending upon the number of passes of the spray gun or guns across the top of the pattern and the amount of plaster mix deposited thereby.

It will be noted that as the plaster is sprayed over the pattern it follows the contour of the pattern. Hence, the final mold impression, such as that illustrated at 22 in Fig. 3, will have the upper surface thereof roughly conforming to the pattern contour, as a result of which the walls of the mold impression will be more nearly uniform in cross-section. This is of considerable advantage in obtaining uniform chilling or congealing of the molten metal throughout the mold cavity. The mold impression 22 is formed with side walls 22a within which the extractor frame 20 is embedded, the frame being anchored to the plaster by means of the inwardly projecting rib 20a.

In carrying out the process it is desirable that the plaster mix be in such condition when it issues from the spray guns as to set or solidify immediately after deposit within the flask. Hence, after the final layer of plaster has been deposited the mold impression will be in a set condition permitting its extraction from the flask.

The extractor mechanism 16, illustrated particularly in Fig. 4, is of the magnetic type comprising a vertically reciprocable magnetic head 23 adapted to be magnetized by means of a pair of electro-magnets 24 mounted thereon. Secured to the magnetic head 23 by means of a plate 25 bolted thereto is a plunger or piston rod 26 secured at its upper end to a piston 27 reciprocable within a hydraulic cylinder 28. Fluid under pressure may be introduced through any conventional means into the cylinder at opposite ends of the piston thereby raising and lowering the magnetic head 23. After the mold impression

22 has been formed within the flask and has properly set so as to enable the mold to be withdrawn from the flask, the flask is moved into position beneath the extractor mechanism 16, and the head 23 is shifted downwardly into contact with the frame 20. Thereupon the magnets 24 are energized and the hydraulic mechanism operated to raise the magnetic head vertically. Since the flask 10 is held down upon its base by means of the clamps 18, the mold 22 will be withdrawn from the flask in the manner shown in Fig. 4 through the medium of the magnetic head acting upon the frame 20. In the use of the apparatus shown in Fig. 1 the successive molds 22, after being extracted from the flasks 10, are deposited upon the conveyor and thence conveyed through the oven 17 which subjects the molds to drying heat.

It will be understood that the cope and drag members 22 and 29 of a foundry mold may be produced in accordance with the foregoing method, and in Fig. 5 these members are shown assembled within a suitable flask 30 and held tightly in engagement by removable clamps 31. As illustrated in Figs. 3 and 4 each mold impression forming either the cope or the drag may be provided with a channel portion 32 so that when the mold members 22 and 29 are assembled in the manner shown in Fig. 5 these channel portions will form a passage or gate 33 into the casting cavity 34. This gate registers with a tube 35 extending through an aperture in one side wall of the flask 30, the tube terminating in a vertical sprue 36 through which the molten metal is poured to produce a casting 37 as shown in Fig. 6.

In the preparation of the plaster mix, although the water or liquid proportion of the wet mixture will be varied to suit requirements, I prefer to use a mixture in which the water and solids are in approximately equal proportions by weight so that there will be very little excess water in the mixture. The solid constituents of the mixture consist principally of calcined gypsum with a small amount of accelerator, such as terra alba, added thereto. Where, as in the example given, the mixture has as little excess water as possible the plaster will set very rapidly when sprayed upon the pattern. This is accelerated by careful control of the temperature of the mixture which I prefer to maintain at approximately 140° F. at the zone of impact of the mixture within the flask. Rapid setting of the plaster during the spraying operation is preferred since it enables the mold impression to be built up more rapidly while giving added strength thereto. The strength of the mold is also enhanced by spraying the plaster under high pressure so as to give a very compact consistency. In the event less rapid setting of the mixture is desired under some conditions the temperature of the mixture at the zone of impact may be lowered but should not be below approximately 112° F.

In the embodiment illustrated in Fig. 8 the cope or drag member 22 of a foundry mold may be formed by spray operations in a flask section 38 which may be used directly in the pouring operation without removing the plaster member 22 therefrom. The flask section 38 is mounted upon the marginal edge 39a of the pattern 39 which is held in place by clamps 40. Anchor pins 41 project from the walls of the flask and are embedded in the plaster during the spray operation. After the shell mold 22 has been formed in the manner previously described the flask and mold are lifted as a unit off the pattern as by means

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of hooks 42 engaging beneath pins 43 secured to the flask.

I claim:

1. In the method of producing a plaster mold, the steps of spraying under pressure a wet plaster mixture over a pattern within a flask to provide a shell mold and at the same time embedding a member in the upper edge of the mold formed of magnetizable metal, and removing the mold from the flask by magnetic action on said member.

2. In the method of producing a plaster mold, the steps of spraying a wet plaster mixture over a pattern within a flask to provide a mold and at the same time embedding a member in the mold while leaving exposed a portion of said member formed of magnetizable metal, and removing said mold from the flask by magnetic action on said member.

3. In the method of producing a plaster mold, the steps of arranging a pattern within a flask having therein a removable member of magnetizable metal provided with an inwardly projecting portion, spraying a wet plaster mix over the pattern to form a mold while embedding said portion in the plaster, and withdrawing the mold from the pattern and flask through magnetic action on said member.

4. In the method of producing a plaster mold,

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the steps of arranging a pattern within a flask having removable means therein formed of magnetizable metal, spraying a wet plaster mix over the pattern to form a mold and embedding a portion of said means in the plaster mold, separating said mold from the pattern by magnetic action on said means.

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