April 18, 1961 I. J. LUBALIN 2,979,790

MOLDS

Filed Aug. 9, 1957 2 Sheets-Sheet 1

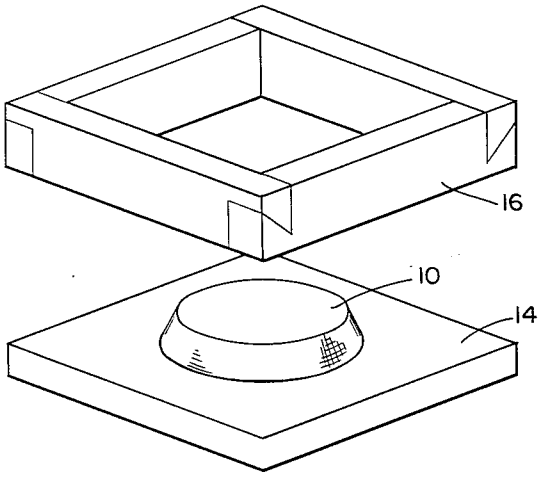


FIG. 1

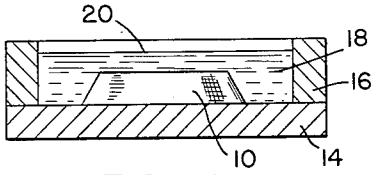


FIG. 2

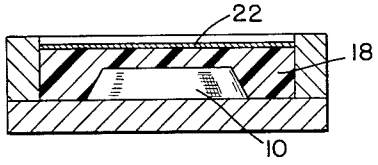


FIG. 3

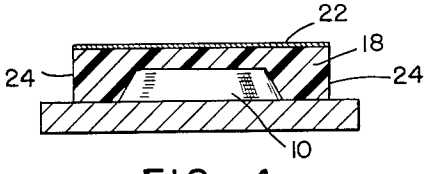


FIG. 4

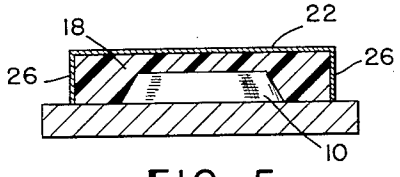


FIG. 5

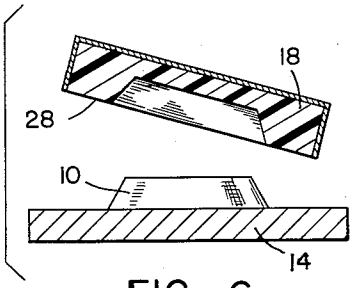


FIG. 6

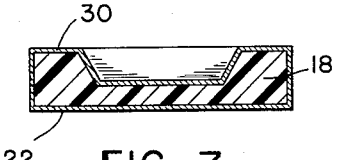


FIG. 7

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April 18, 1961 I. J. LUBALIN 2,979,790

MOLDS

Filed Aug. 9, 1957 2 Sheets-Sheet 2

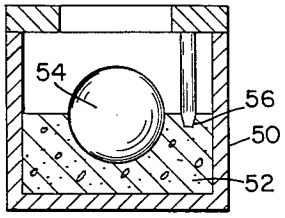


FIG. 8

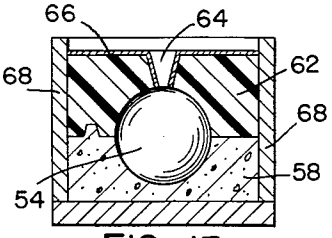


FIG. 13

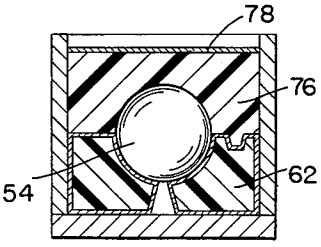


FIG. 18

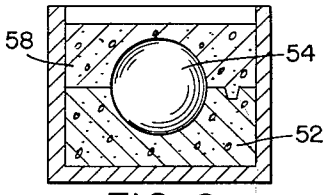


FIG. 9

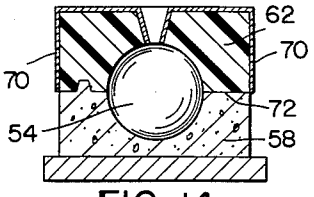


FIG. 14

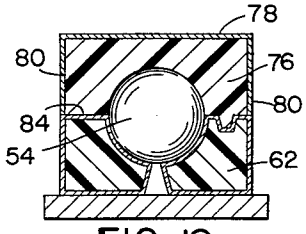


FIG. 19

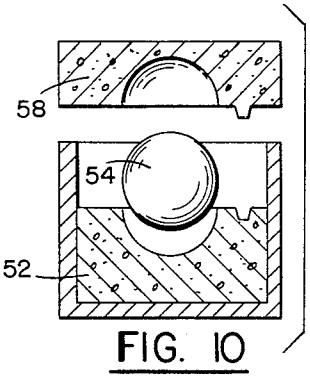


FIG. 10

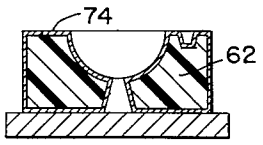


FIG. 15

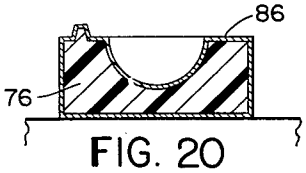


FIG. 20

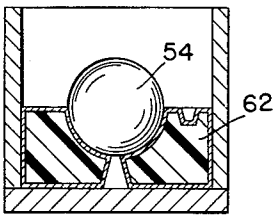


FIG. 16

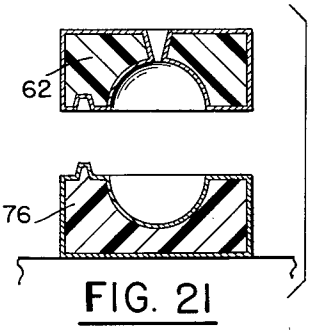


FIG. 21

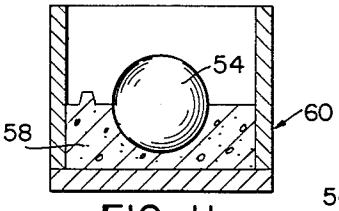


FIG. 11

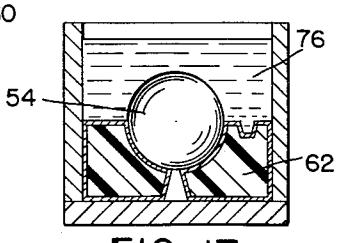


FIG. 17

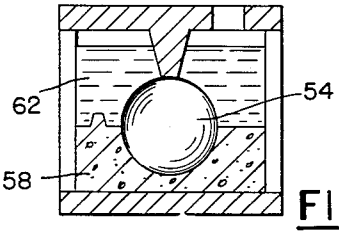


FIG. 12

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United States Patent Office 2,979,790 Patented Apr. 18, 1961

2,979,790

MOLDS

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Filed Aug. 9, 1957, Ser. No. 677,262

3 Claims. (Cl. 22—129)

This invention relates to the manufacture of molds for metal casting. In particular, it is directed to improvements in the handling of molds prepared by the gelling, with avoidance of compacting, of a slurry of comminuted refractory material and a binder of a lower alkyl silicate such as ethyl silicate.

Molds made from slurries aforesaid which rapidly gel without compacting, i.e., with the gelling being allowed to proceed with a minimum of disturbance, are described in the patent of Noel Shaw, No. 2,795,022. The art is now familiar with the manufacture of such molds. As is known, the gelled mass embodies volatiles, such as alcohol or other volatiles, as components of the binder. It also evolves volatiles resulting from hydrolysis of the alkyl silicate. When the silicate is ethyl silicate, the alcohol evolved is ethanol.

In carrying out the manufacture of such molds, the gelled mass, that is the mold form, is separated from the pattern and immediately is placed on a suitable support and the volatilizing alcohol and/or alcohol plus other volatile solvents, if present, ignited. The high temperature thus generated by the burning of the volatiles effectuates a "freezing" of the external mold dimensions. The internal mold structure of the finished mold is characterized by porosity and microcracks. The art recognizes the advantages thereof.

As has been mentioned, the rapid volatilization of the volatiles from the gelled slurry results, if the mold is not immediately ignited or fired, in a shrinking of the mold due to the evaporation of the volatiles. It is necessary, therefore, in order to avoid such shrinking, rapidly to separate the mold form from the pattern and immediately to ignite or fire it after separation from the pattern.

It has now been found that this precaution need not be observed if the mold is treated in such wise as to inhibit or markedly restrict the evaporation of the volatiles.

Accordingly, it is among the principal objects of this invention to provide a means for treating a mold of the class described, which is now referred to in the art as a "Shaw Process Mold," in such wise as to prevent or very substantially retard the evaporation of volatiles evolving therefrom.

In its fundamental aspects this principal object is achieved by painting or coating a Shaw Process Mold as its surfaces are exposed with a solution of a wax, the solvent of which is quite volatile. In consequence of such coating or painting, the wax, upon volatilization of its solvent vehicle, is left as a deposit on the surface of the mold in a continuous film. This film of wax constitutes a barrier which effectively seals in the volatiles.

In consequence of such coating of the mold form, evaporation of the volatiles is prevented or retarded during the time involved in separating the mold form from the pattern. By this technique the mold form may be very carefully separated from the pattern with consequent preservation of the finest details as a result of the prevention of distortion and shrinking before it is subjected to ignition.

By means of the instant procedure it is possible, in manufacturing molds for use in casting of three-dimensional objects, to use the "green" mold half as a base or support for the pattern in preparing the second half of the mold and thus to obtain reduction of the parting line to a minimum, accurate mating of the mold halves and thereby to achieve perfect reproduction of the pattern.

This new procedure provides a marked advantage over the previous method of producing such halves, wherein the first half had to be ignited immediately upon separation from the pattern, and then, after the completion of the ignition, it was allowed to cool before it could be used in the preparation of the second half. By this new technique of this invention, both halves are true, and make possible the achievement of the closest tolerances known, for matching refractory mold pieces.

Suitable sealants for the purpose described are solutions of waxes such as beeswax, paraffin wax, dental waxes based on blendings of beeswax and paraffin wax, microcrystalline waxes, etc. Suitable solvents for such waxes are carbon tetrachloride, mineral spirits, gasoline, benzene, and even kerosene, etc. When solvents are used in which the waxes enter slowly into solution at normal or room temperatures, it has been found that solution thereof is accelerated if the solvent be slightly heated.

A fuller understanding of the invention will become apparent from the following examples taken in connection with the accompanying drawings, which show the various stages in the preparation of the mold forms from the pouring of the slurry up to the time they are ready for ignition.

Example 1

The various stages of preparing a one-piece mold for use in making a casting are illustrated in Figures 1–7.

A pattern, schematically illustrated by the object **10**, is placed in a mold box having a bottom **14** and removable walls **16**. Then a slurry **18** of comminuted refractory binder and a suitable gelling accelerator, such as the slurry of Shaw Patent No. 2,795,022 or Prange Patent No. 1,909,008, is poured over **10**. As taught in the Shaw patent, the slurry is not compacted. When the slurry **18** gels, the top surface **20** thereof is coated, as by brushing or by any other suitable means, with the sealant, a solution of beeswax in carbon tetrachloride (100 gms. of the wax per liter of the solvent). The solvent evaporates, leaving a thin film **22** of the wax. Then the walls **16** are removed, as shown in Figure 4, and the sides **24** of the mold form are similarly coated with the aforesaid wax solution, which leaves films **26** of wax, as shown in Figure 5. Then the mold form, now coated on five sides with the wax film, is carefully separated from the pattern (see Figure 6), and the remaining unwaxed surface **28** is similarly coated with the aforesaid sealant solution to form the wax film **30**. The mold form is then ignited, as described in the Shaw patent aforesaid.

Example 2

The various stages of preparing a mold form of two mating halves for use in making castings are illustrated in Figures 8–21.

A mold box **50** is partially filled with clay **52** into which is set a pattern, schematically illustrated by the object **54**, as shown in Figure 8. A keying may be provided, as at **56**. The mold box is then filled with plaster **58**, following which the plaster, when set, is removed. The plaster is then set in the mold box **60** and the pattern **54** positioned therein, as shown in Fig. 11. Following this step, the mold box is then filled with a slurry **62** of comminuted refractory, binder and gelling agent as used in Example 1, as shown in Fig. 12. A

pour hole for use in casting metal may be provided therein by suitable means, as at **64**. The top surface **66** is coated with the wax solution of Example 1. Then the walls **68** of the mold box are removed, in manner akin to the removal of the walls of the mold box as described in Example 1, and the side walls **70** of the gelled mold form **62** are then coated with the sealing solution as described in Example 1, as shown in Fig. 14. The thus wax-coated mold form is separated from the pattern and the unwaxed side **72** coated with the wax solution leaving the film **74**. After inverting the thus completely wax-coated mold form, it is set in a mold box and the pattern positioned therein, as shown in Fig. 16. The mold box is then filled with the slurry, as aforesaid, as shown at **76** in Fig. 17. When the slurry gels, the top surface **78** thereof is coated with the wax solution, as shown in Fig. 18. Then the walls of the mold box are removed, as shown in Fig. 19, and the sides **80** thereof are coated with the aforesaid wax solution. The mold half **76** is then separated from the lower mating half **62** and the pattern **54**; and the unwaxed side **84** is then coated with the wax solution at **86**. The two wax-coated halves **62** and **76** of the full mold, as shown in Fig. 21, are then ready for ignition.

Example 3

A one-piece mold is prepared in accordance with the procedure described in Example 1 except that the sealant solution used is a dental wax, such as is known in the art, in carbon tetrachloride, the concentration of the wax being about 12 percent.

Example 4

A mold form of mating halves is prepared in accordance with the general procedure described in Example 2 except that the sealant solution is that used in Example 3.

Example 5

A mold form is prepared in accordance with the general procedure described in Example 1 except that the sealant solution is that of beeswax dissolved in gasoline, the concentration of the wax in the solution being about 10 percent.

Example 6

A mold form of mating halves is prepared in accordance with the general procedure described in Example 2 except that the sealant solution is the wax solution of Example 5.

The wax content of the sealant solutions may range from about 5 percent to about 40 percent. Concentrations of the wax in the amount of from about 10 percent to 15 percent are preferred, however, in that they allow for greater fluidity of the wax solution.

It will be understood that the foregoing description of the invention and the examples set forth are merely illustrative of the principles thereof. Accordingly, the appended claims are to be construed as defining the invention within the full spirit and scope thereof.

I claim:

1. A mold form comprising an uncompacted gelled slurry comprising comminuted refractory and an alkyl silicate binder containing a volatile material, the entire external surface of the said mold form having thereon a film of wax, whereby the evaporation of volatile materials contained within the mold form is retarded prior to the ignition thereof.

2. A mold form comprising an uncompacted gelled slurry comprising comminuted refractory and an ethyl silicate binder containing a volatile material, the entire external surface of the said mold form having thereon a film of wax, whereby the evaporation of volatile materials contained within the mold form is retarded prior to the ignition thereof.

3. A mold form comprising an uncompacted gelled slurry comprising comminuted refractory and an ethyl silicate binder containing a volatile material, the entire external surface of the said mold form having thereon a film of beeswax whereby the evaporation of volatile materials contained within the mold form is retarded prior to the ignition thereof.

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