Feb. 24, 1942. C. H. BRACE 2,274,186

METHOD OF AND APPARATUS FOR INVESTING PATTERNS UNDER VACUUM

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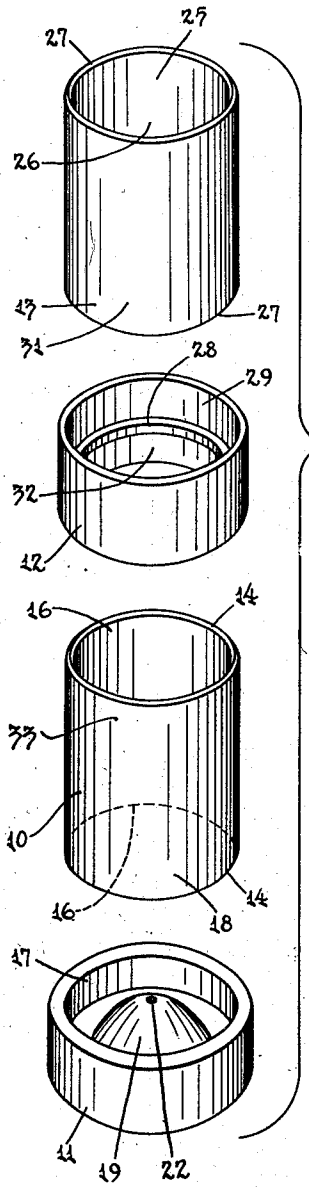


Fig. 1

Fig. 3

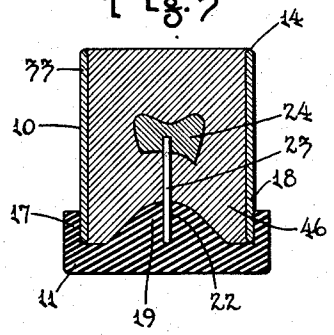


Fig. 4

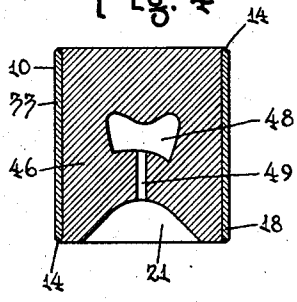
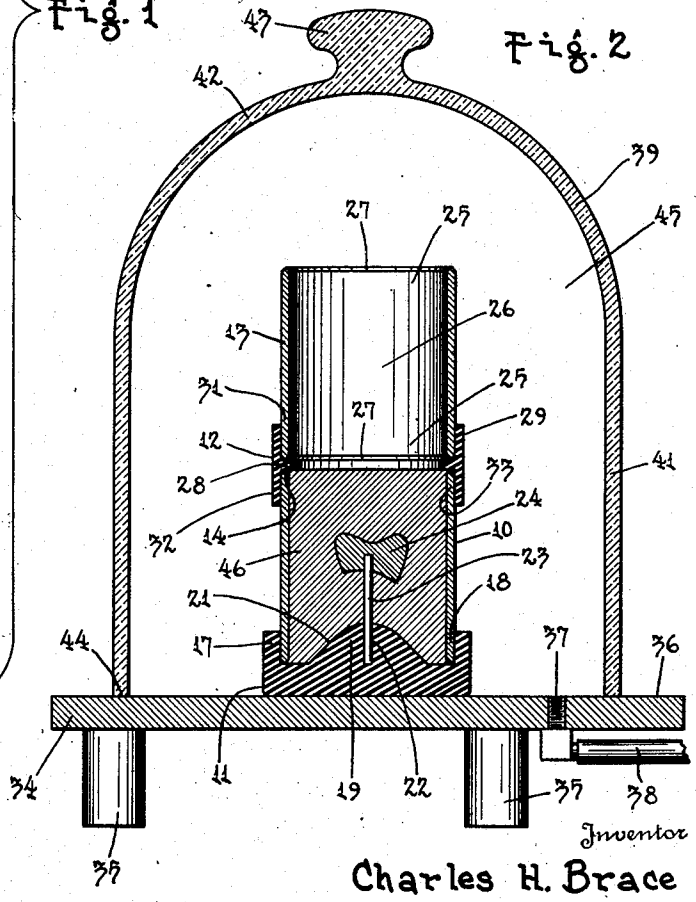


Fig. 2



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METHOD OF AND APPARATUS FOR INVESTING PATTERNS UNDER VACUUM

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Application December 9, 1940, Serial No. 369,143

14 Claims. (Cl. 22—113.1)

My invention relates to methods of and molding apparatus for investing patterns under vacuum, and has for an object to provide a method and apparatus whereby the molding can be quickly and efficiently performed.

Another object of the invention resides in producing an apparatus by means of which standard flasks or casting rings may be employed.

A still further object of the invention resides in applying to the upper end of a flask, a flask extension open at its ends and communicating with the interior of the flask and forming an ebullition chamber in which ebullition of the investment occurs during formation of the mold.

A feature of the invention resides in providing a coupling for detachably connecting the flask extension to the flask.

Another object of the invention resides in constructing said coupling with two gripping portions adapted to extend about the flask and in constructing said gripping portions of a resilient friction material adapted to hold the flask and extension in properly assembled relation.

Another object of the invention resides in constructing the coupling with a positioning flange forming seats for engagement with the juxtaposed edges of the flask and flask extension for positioning the flasks with reference to the coupling and forming a seal between the flask and flask extension.

Another object of the invention resides in providing a base for closing the lower end of the flask and supporting the pattern and forming a sprue communicating with the mold cavity.

A still further object of the invention resides in constructing the base with a gripping member formed of flexible resilient material for holding the base attached to the lower end of the flask.

An object of the invention resides in the method of investing patterns under vacuum which consists in using an ordinary flask and in temporarily attaching thereto a removable flask extension forming an ebullition chamber communicating with the interior of the flask and in removing said flask extension after formation of the mold.

Another object of the invention resides in the method of investing patterns under vacuum which consists in attaching the flask to a base, in placing the pattern within the flask and supporting the same from the base, in applying a coupling to the upper end of the flask, in inserting a flask extension within said coupling, in placing the mold assembly within a chamber and exhausting the air from within said chamber, and in subsequently removing the base, coupling and extension from the flask.

Other objects of the invention reside in the novel combination and arrangement of parts and in the details of construction hereinafter illustrated and/or described.

In the drawing:

Fig. 1 is a perspective view of the component parts of molding apparatus embodying my invention, and showing the parts separated from one another.

Fig. 2 is an elevational sectional view of the molding apparatus of my invention disposed within suitable evacuating means.

Fig. 3 is a sectional view of the flask and base of the molding apparatus with the coupling and flask extension removed.

Fig. 4 is a view similar to Fig. 3 showing the completed mold.

My invention consists of a flask 10 to which is attached a base 11. A coupling 12 is secured to the upper end of the flask and supports a flask extension 13. These various parts will now be described in detail.

In the form of the invention shown, the flask 10 consists of an ordinary casting ring, cylindrical in form which is of proper height and dimensions to receive the pattern and allow for sufficient space to invest the pattern within said flask. This flask is formed with sharpened edges 14 at the upper and lower ends thereof by means of which a seal may be procured between the said casting ring or flange and the associated parts. The flask 10 is of the usual construction, being open at its ends, as designated at 16 and is preferably constructed of metal or some other suitable material of equal strength and capable of withstanding the temperature brought about by pouring the molten casting material into the mold. Although I have shown the flask 10 as being cylindrical it can readily be comprehended that the same may be constructed with any suitable form, as for example to fit the particular article desired to be cast in the same.

The base 11 is constructed of rubber or some other similar suitable resilient material and is circular in form, being provided at its periphery with an upwardly extending annular gripping member 17 adapted to extend about and receive the lower end 18 of the flask 10. The rubber from which the base 11 is constructed is preferably of such a nature that the member 17 has sufficient friction to hold the base securely attached to the flask 10. At the center of the base 11 is provided a protuberance 19 which extends upwardly into

the interior of the flask 10 and serves to form the sprue enlargement 21 in which the molten casting material is inserted and by which the same is directed into the mold cavity. This protuberance has at the highest point of the same formed in it a vertically extending hole 22 which is adapted to receive and support a sprue pin 23. The wax pattern is indicated at 24 and is mounted upon the sprue pin 23, as clearly shown in Fig. 2.

The flask extension 13 has been shown in the drawings as a duplicate of the flask 10. This flask extension is cylindrical in form, being open at its ends, as designated at 25, and forms an ebullition chamber 26 communicating with the interior of the flask 10 when superimposing the same. This flask extension is formed with sharpened edges 27 which serve the same purpose as the sharpened edges 14 of the flask 10. It can readily be comprehended, however, that the flask extension 13 can be constructed of any desired shape and size, although with my invention an extra flask which is always available in the casting room may be used to form this extension. Inasmuch as the flask extension 13 is not subjected to temperatures above room temperature, the same may be constructed of any desired material.

The flask extension 13 is held attached to the flask 10 by means of the coupling 12. This coupling is constructed of any suitable flexible material having sufficient friction to hold the parts in place and if desired may be constructed of rubber or the same material as the base 11. The said coupling comprises a positioning flange 28 which is adapted to be disposed between the juxtaposed sharpened edges 27 and 14 of the flask extension 13 and the flask 10 and forms a seal between these two parts preventing leakage of investment from between the same. The coupling 12 has an annular grip issuing upwardly from the positioning flange 28 of the same material as said flange, which grip is adapted to encircle the lower end 31 of the flask extension 13 to hold the same rigidly attached thereto. Coupling 12 has another similar annular grip 32 issuing downwardly from flange 28 which is adapted to encircle the upper portion 33 of the flask 10 to hold the said coupling securely attached to the flask. The positioning flange 28, in addition to forming a seal between the ends of the flask and flask extension, also serves to position the coupling with relation to the ends of the flask and flask extention so that the two ends thereof project similar distances into the coupling. By means of this construction the coupling is rigidly secured to the two parts with the parts in proper relation to one another. The internal diameter of the flange 28 is substantially equal to the internal diameter of the flask 10 and also that of the flask extension 13 which may be the same as that of said flask. In this manner the inner surfaces of the flask extension 13 and the flask 10 lie substantially in continuation of one another.

In the use of my invention I employ evacuating apparatus which consists of a table 34 supported upon feet 35. This table has a smooth top 36 and has connected to it an air outlet 37 which in turn is connected to a hose or tube 38 leading to a suitable vacuum pump or any suitable evacuating chamber. The said apparatus further includes a bell jar 39 having a cylindrical wall 41, a top 42 and a knob 43 secured to said top. The lower edge 44 of the wall 41 is ground to form an air-tight seal between said bell jar and the table 34 so that, when the said bell jar is placed upon the table in a manner to enclose the air outlet 37, an evacuating chamber 45 is provided.

The method of using the invention is as follows: The sprue pin 23 is first inserted into the hole 22 in the base 11 and the wax pattern attached to the same in any suitable manner. The said sprue pin is of such length and dimensions as to support the pattern in spaced relation to the walls of the flask 10 when the same is applied to the base. Flask 10 is next placed over the pattern and the lowermost end 18 thereof inserted into the annular grip 17 of the base, until the sharpened edge 14 of said flask engages the upper surface of the base 11. When so applying the flask to the base the grip 17 hugs the lower end 18 of the flask and holds the base rigidly attached to the flask. The coupling 12 is next applied to the upper end 33 of the flask 10 by forcing the grip 32 over the end of the same and moving the said coupling downwardly. This procedure continues until the sharpened edge 14 of the flask 10 engages the underside of the flange 28. The flask extension 13 is now applied to the upper end of the coupling 12 by inserting the lower end 31 thereof into the annular grip 29 until the sharpened edge 27 of said flask extension engages the upper surface of the flange 28. By pressing downwardly upon the assembled structure both the sharpened edge 14 and the sharpened edge 27 are caused to form a seat against the flange 28 whereby leakage of investment out of the molding apparatus is prevented. After the parts have been assembled, as designated, a sufficient quantity of investment in plastic form is inserted into the flask 10 through the open end of the flask extension 13. An amount sufficient to fill the flask 10 may be employed or a lesser amount may be used if less investment is required to completely invest the pattern within the same. The molding apparatus is then set upon the table 34 and the bell jar 39 placed over the same and caused to rest upon the said table to bring the ground edge 44 thereof in contact with the surface 36 of said table. The chamber 45 within the bell jar 39 is then evacuated through the air outlet 37 and the tube 38. Such evacuation produces ebullition within the ebullition chamber 36 whereby all of the air trapped in the investment is withdrawn therefrom. The chamber 45 is preferably subjected to vacuum during a period continuing throughout the ebullition within chamber 26. Thereupon the vacuum is cut off and the bell jar 39 removed to give access to the molding apparatus. During ebullition the investment bubbles up into the ebullition chamber 26, and upon termination of ebullition settles back into the flask 10 to completely invest the pattern. In Fig. 2 the investment is shown as reaching up to the top of the flask 10 and is indicated by the reference numeral 46. At this stage the flask extension 13, the coupling 12 and the base 11 are all removed from the flask 10. The relation of the parts with the flask extension and coupling removed is shown in Fig. 3. Thereafter the sprue pin 23 is withdrawn from the investment. Upon applying heat to the mold comprising the flask 10, the investment 46 and the pattern 24, the pattern is melted and flows out of the mold to leave the mold cavity 48 within the mold of suit-

able size and shape. Withdrawal of the sprue pin from the mold provides the sprue 49 and the sprue enlargement 21 being formed by the protuberance 19 of base 11. The mold as completed is shown in Fig. 4 and is ready to receive the molten casting material.

The advantages of my invention are apparent. By evacuation, the air within the investment is completely withdrawn so that air bubbles are prevented from forming at the surface of the mold cavity whereby extremely smooth and perfect castings result. By the use of the base with the flexible annular grip the lower end of the mold is readily and easily closed. By means of the flask extension standard flasks such as are readily found in the casting room may be employed without alteration. The coupling used serves to connect the flask extension to the flask which functions only during the ebullition of the investment and which may be easily removed after setting of the investment to permit of continuing with the elimination of the wax from the mold cavity and the casting of the molten casting material. The flange formed in the coupling serves to position the juxtaposed ends of the flask and flask extension within the coupling so that each part extends the required distance into the coupling and in addition forms a seal between two ends of the flask and flask extension preventing leakage of the investment out of the flask. Due to the fact that the flask extension is of the same dimensions as the flask the inner surface thereof lies in continuation of the inner surface of the flask whereby the investment in the ebullition chamber readily returns into the flask upon cessation of ebullition and with a minimum danger of adhering to the walls of the flask extension. By employing a bell jar for forming an evacuation chamber the upper end of the flask extension may be left open to permit of pouring the investment into the flask through the open end thereof, thus greatly simplifying the method of investing the pattern. With my improved method the steps are exceedingly simple and practical and result in considerable economy in time and in addition produce castings of smooth surface and without flaws.

Changes in the specific form of my invention, as herein disclosed, may be made within the scope of what is claimed without departing from the spirit of my invention.

Having described my invention, what I claim as new and desire to protect by Letters Patent is:

1. Molding apparatus for investing patterns under vacuum comprising a flask open at its ends, and adapted to receive a quantity of investment sufficient to invest the pattern; a base attached to said flask and closing the lower end thereof, means carried by the base for supporting the pattern and forming a sprue leading to the mold cavity, a flask extension superimposing said flask and open at its ends, said flask extension forming an ebullition chamber communicating with said flask, and having a capacity sufficient to receive a portion of the contents of the flask during ebullition, and a coupling connecting said extension to said flask.

2. Molding apparatus for investing patterns under vacuum comprising a flask open at its ends, a base attached to said flask and closing the lower end thereof, means for supporting the pattern and forming a sprue leading to the mold cavity, a flask extension superimposing said flask and forming an ebullition chamber communicating with said flask, and a coupling having a part forming a seat for engagement with the edges of said flask and flask extension to form a seal therebetween.

3. Molding apparatus for investing patterns under vacuum comprising a flask open at its ends, a base attached to said flask and closing the lower end thereof, means for supporting the pattern and forming a sprue leading to the mold cavity, a flask extension superimposing said flask and forming an ebullition chamber communicating with said flask, a coupling having two flexible friction grips for engagement with the juxtaposed ends of said flask and flask extension for connecting them together, and positioning means within the coupling for engagement with the edges of said flask and flask extension for procuring proper engagement of the grips with said flask and flask extension.

4. Molding apparatus for investing patterns under vacuum comprising a flask open at its ends, a base attached to said flask and closing the lower end thereof, means for supporting the pattern and forming a sprue leading to the mold cavity, a flask extension superimposing said flask and forming an ebullition chamber communicating with said flask, a flexible coupling having two annular friction grips for engagement with the juxtaposed ends of said flask and flask extension, said friction grips being constructed of flexible resilient material and holding said parts in proper relation, and positioning means within the coupling for engagement with the edges of said flask and flask extension for procuring proper engagement of the grips with said flask and flask extension.

5. Molding apparatus for investing patterns under vacuum comprising a flask open at its ends, a base on which said flask is adapted to rest for closing the lower end thereof, an annular grip formed on said base and constructed of flexible resilient material for embracing the lower end of said flask upon the exterior thereof and holding the base attached thereto, and means carried by the base for supporting the pattern and forming a sprue leading to the mold cavity.

6. Molding apparatus for investing patterns under vacuum comprising a flask open at its ends, a base on which said flask is adapted to rest for closing the lower end thereof, an annular grip formed on said base and constructed of flexible resilient material for embracing the lower end of said flask and holding the base attached thereto, means for supporting the pattern and forming a sprue leading to the mold cavity, a flexible coupling having two annular friction grips for engagement with the juxtaposed ends of said flask and flask extension, said friction grips being constructed of flexible resilient material and connecting said parts, and positioning means within the coupling for engagement with the edges of said flask and flask extension for holding said flask and flask extension in proper relation with respect to one another and to said grips.

7. Molding apparatus for investing patterns under vacuum comprising a flask open at its ends, a base attached to said flask and closing the lower end thereof, means carried by the base for supporting the patern and forming a sprue leading to the mold cavity, a second flask open at its ends and superimposing said first named flask and forming an ebullition chamber com-

municating with said first named flask, and a coupling encircling said flasks upon the exterior thereof and connecting said flasks together in a manner to produce substantial continuity between the surfaces of said flasks.

8. Molding apparatus for investing patterns under vacuum comprising a casting ring open at its ends, a base attached to said casting ring and closing the lower end thereof, means for supporting the pattern and forming a sprue leading to the mold cavity, a second casting ring of the same diameter as said first casting ring and open at its ends, said second named casting ring superimposing said first named casting ring and forming an ebullition chamber communicating with said first named casting ring, and an annular coupling encircling the juxtaposed ends of said casting rings and having a positioning flange intermediate its ends adapted to engage the edges of said casting rings for holding the casting rings properly mounted in said coupling and suitably positioned relative to one another.

9. Molding apparatus for investing patterns under vacuum comprising a casting ring open at its ends, a base attached to said casting ring and closing the lower end thereof, means for supporting the pattern and forming a sprue leading to the mold cavity, a second casting ring of the same diameter as said first named casting ring and open at its ends, said second named casting ring superimposing said first named casting ring and forming an ebullition chamber communicating with said first named casting ring, and an annular coupling encircling the juxtaposed ends of said casting rings and having a positioning flange intermediate its ends adapted to engage the edges of said casting rings for holding the casting rings properly mounted in said coupling and suitably positioned relative to one another, the internal diameter of said flange being substantially equal to the internal diameter of said casting rings to make the inner surfaces of said casting rings lie substantially in continuity relative to one another.

10. The method of investing patterns under vacuum which consists in attaching a base to the lower end of a flask in a manner to close the same, in supporting the pattern from the base, in applying a flask extension open at its ends to the upper end of the flask by means of a coupling in a manner to communicate with the interior of the flask, in pouring into the flask through the open end of the flask extension sufficient investment to invest the pattern and less than the combined volume of the flash and flash extension, in placing the entire mold assembly into a chamber, in exhausting the air from the chamber for a period continuing during ebullition of the investment within said flask extension and in removing said flask, extension coupling and base from said flask.

11. The method of investing patterns under vacuum which consists in attaching a base to a casting ring open at its ends in a manner to close the lower end thereof, in supporting the pattern within the casting ring, in applying an annular coupling to the exterior of said casting ring at the upper end thereof, in inserting the lower end of a second casting ring into said coupling in a manner to form an ebullition chamber communicating with the interior of said first named casting ring, in placing the entire mold assembly into a chamber, in exhausting the air from the chamber for a period continuing during ebullition of the investment within said ebullition chamber and in removing said second named casting ring, coupling and base from said first named coupling ring.

12. Molding apparatus for investing patterns under vacuum comprising a flask open at its ends, a base attached to said flask and closing the lower end thereof, means carried by the base for supporting the pattern and forming a sprue leading to the mold cavity, a second flask open at its end and superimposing said first named flask and forming an ebullition chamber communicating with said first named flask, and means having a chamber under vacuum communicating with the upper end of the second flask.

13. Molding apparatus for investing patterns under vacuum comprising a flask open at its ends, a base attached to said flask and closing the lower end thereof, means carried by the base for supporting the pattern and forming a sprue leading to the mold cavity, a flask extension superimposing said flask and means having a chamber under vacuum communicating with the upper end of said flask extension.

14. Molding apparatus for investing patterns under vacuum comprising a flask open at its ends, a base on which said flask is adapted to rest for closing the lower end theroef, an annular flange formed on said base and constructed of flexible resilient material, said flange embracing the lower end of the flask upon the exterior thereof and means carried by the base for supporting the pattern and forming a sprue leading to the mold cavity.

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