Apr. 17, 1923. 1,452,246

S. P. MARSHALL

ART OF AND APPARATUS FOR CASTING METALS

Filed Dec. 30, 1922 2 Sheets-Sheet 1

Fig. 2.

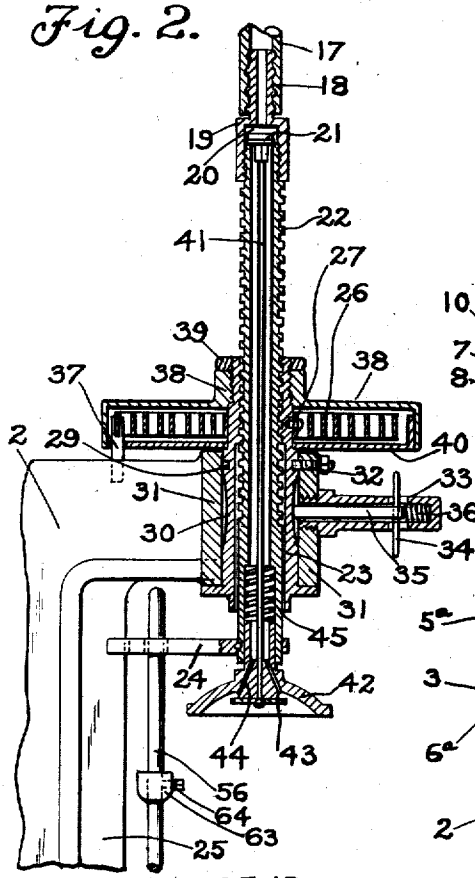
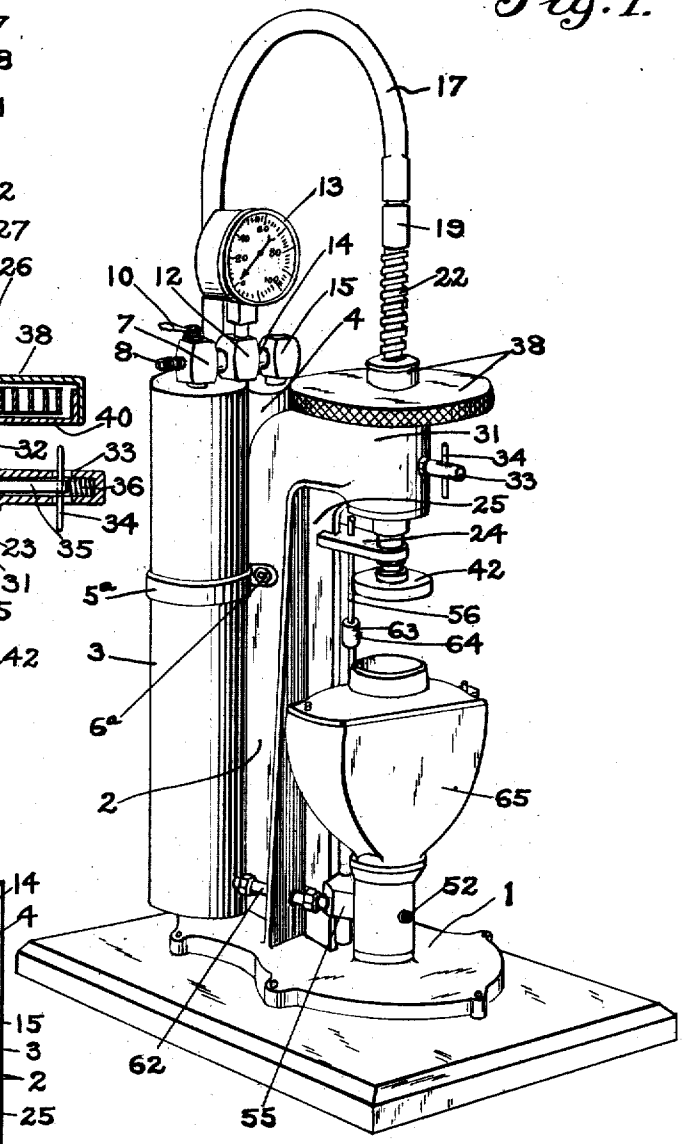


Fig. 1.



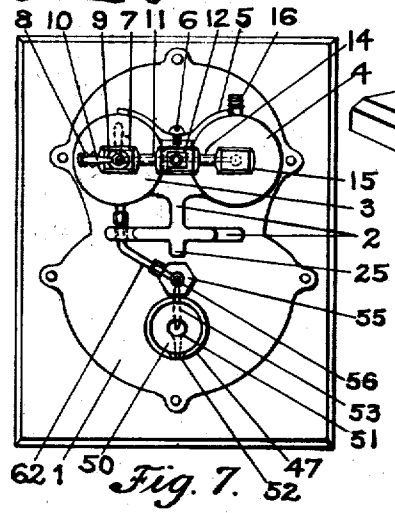


Fig. 7.

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ART OF AND APPARATUS FOR CASTING METALS

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Fig. 3.

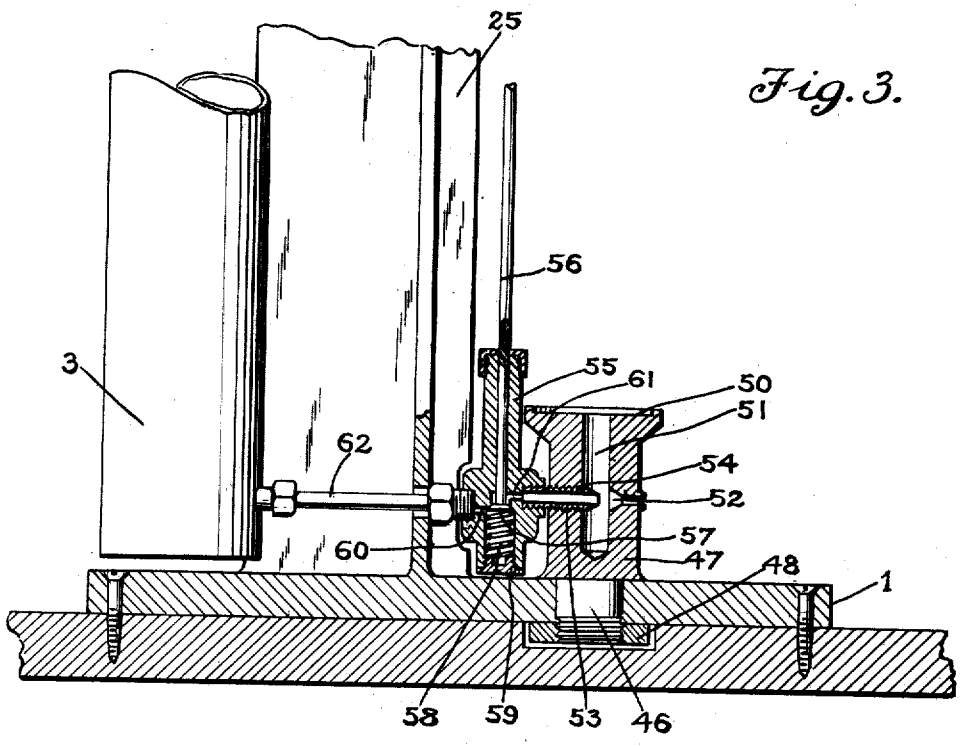


Fig. 5.

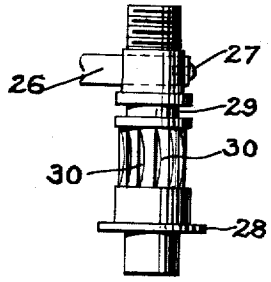


Fig. 6.

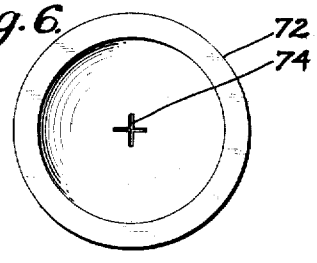
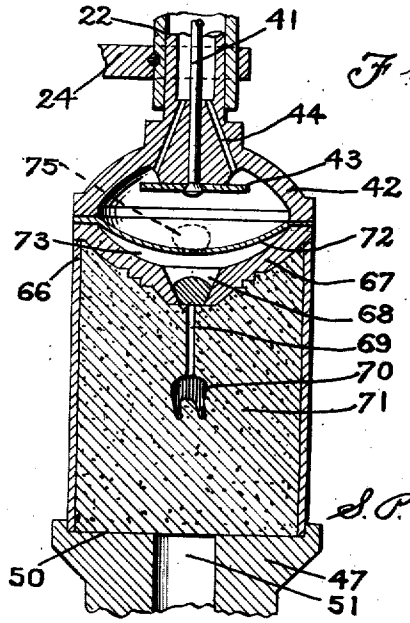


Fig. 4.



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Patented Apr. 17, 1923. 1,452,246

UNITED STATES PATENT OFFICE.

STANMORE P. MARSHALL, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNOR TO H. B. BYRD MANUFACTURING COMPANY, INCORPORATED, OF WASHINGTON, DISTRICT OF COLUMBIA, A CORPORATION OF VIRGINIA.

ART OF AND APPARATUS FOR CASTING METALS.

Application filed December 30, 1922. Serial No. 609,781.

To all whom it may concern:

Be it known that I, STANMORE P. MARSHALL, a citizen of the United States, residing in the city of Washington and District of Columbia, have invented certain new and useful Improvements in the Art of and Apparatus for Casting Metals, of which the following is a specification.

My invention relates to the art of casting metals, such as gold and alloys thereof, and to improved casting apparatus of the pneumatic pressure and vacuum type, and in which the metal is fused in a separate crucible above the flask or mold, so as to avoid undue heating of the flask and its investment.

While my method and apparatus are capable of general utility in producing perfect castings of any suitable material, they are particularly concerned with the production of dental castings, for use as inlays for filling cavities or as bridges or plates for supporting artificial teeth.

The main objects underlying this invention are the provision of improved means and methods of operation over those disclosed in my copending application Serial No. 509593, filed Oct. 22, 1921, of which this application is a continuation in part and by which delicate castings may be perfectly formed even in a comparatively cold mold, and any chilling before the molten metal reaches every part of such a mold avoided, and which is also adapted to avoid the distortion resulting from casting in a hot mold, as in the usual practice, in which the investment material is often cracked or disintegrated.

A further object of my invention is to provide means and a method by which relatively large castings may be produced more quickly than is possible with other methods and dental machines.

A further object of the invention is the production of a compact and simple apparatus in which the casting is effected in the minimum of time and therefore at the least expense, and which does not require special skill in operation.

A further object of the invention is the provision of simple means whereby both the vacuum pressure and the casting pressure containers may be simultaneously or, if desired, separately, filled with compressed air, and wherein a vacuum-producing device, of the ejector type, is operated by the compressed air.

Another object of my invention is to dispense with the use of pump rods and hand levers, as in my former machines, and the substitution of valves and a spring flywheel for releasing the pneumatic pressure device required to force the molten metal into the mold, while preventing leakage of compressed air past said metal and into said mold.

A still further object is the substitution of simpler means, such as the provision of separable but normally closed slits in the base of an integral crucible, and which are openable to discharge the crucible contents by air pressure alone, for the lever means and divided crucible illustrated in my copending application.

In my present structure, finally, the asbestos lined guide funnel provided in the crucible containing receptacle of my former casting machine is eliminated by the provision of a guiding hopper that does not require a lining and is not a separate element, but is integrally formed with the receptacle at its base.

Other features of my invention will be set forth hereinafter and pointed out in the claims.

With the above and such other objects in view and realized advantages, as will be apparent from the description, my invention resides in the novel methods and in the novel construction, combination and arrangement of parts, as hereinafter described and claimed, taken in connection with the accompanying drawings, in which

Fig. 1 represents a perspective view of the assembled casting apparatus, with the compression valve stem and cover in raised position.

Fig. 2 is an enlarged vertical central sectional view, taken through the piston latch, of the compression valve stem, spring fly wheel, and its connecting parts, and showing the upper portion of the supporting bracket and ejector control valve stem in elevation.

Fig. 3 is an enlarged vertical central sectional view through the ejector and parts connected therewith and of a portion of the base plate and of the ejector control valve stem, and also showing the lower portion

of one of the compression tanks and the supporting bracket in elevation.

Fig. 4 is a vertical central sectional view on a larger scale, of the assembled flask, funnel, asbestos crucible and cover with some of the connecting parts broken off, and showing a ball or plug of molten gold in position above the sprue channel in section, and its previous position on the asbestos crucible in dotted lines.

Fig. 5 shows a vertical detail view of the latch bushing and a portion of the coiled spring secured to it.

Fig. 6 is a top plan view of the asbestos crucible, showing the normally closed crossed slits in its center, and

Fig. 7 is a top plan view on a somewhat smaller scale, of the tank valves, tanks and their connections with the flask stand but not showing the parts of the pressure and casting devices above the latter, including the pressure gage and the hose connecting the casting device with the tanks.

Referring now to the drawings and particularly to Figures 1, 2 and 7, 1 represents a metal base plate integrally supporting the bracket 2 and carrying all of the operating mechanism, and which is usually secured by screws to a wooden base for handy transportation of the assembled casting machine or to any other convenient support. Pressure tanks 3 and 4 are secured preferably by means of straps 5 or 5^a which may be fastened by means of screws 6 or bolts 6^a, or in any other suitable manner to the bracket 2.

On tank 3 is a valve casing 7 preferably provided with a nipple 8 adapted to take a hose leading to a pressure pump or pressure line not shown, and containing a 3-way valve 9, provided with a handle 10 and bored across horizontally, and vertically from said passage way downwardly so as to lead into said tank 3. Valve 9, by means of a passageway 11 communicates with a support 12, carrying the pressure-registering gage 13 and with a passageway leading thereto and which support, by means of passageway 14, communicates with an end piece 15 on the tank 4 and leading thereinto. Preferably the valve casing 7, support 12 and end piece 15 and their interconnections are formed integrally in one casting to which the tanks 3 and 4 are then secured, but, of course, they may be formed separately and secured to the tanks in any well-known way. In case it be desired to fill either of the containers separately, instead of simultaneously, it is obviously only necessary to provide a by-pass in the 3-way valve casing 7.

Means, such as nipple 16, which may be provided on tank 4, as shown in Fig. 7, or on the support 12, as is preferred, operatively connects tank 4 with a flexible hose 17, adapted to carry air, nitrous oxide or other suitable gas under pressure to the casting device proper.

Hose 17 is fitted to the nipple 18 of a sleeve 19, which is provided at its upper portion with a valve chamber 20 in which the valve disk 21 may have up and downward play, and is threaded below on the inside for screwing over the threaded end of the hollow compression shaft 22.

Shaft 22 is provided with large square screw-threads for the greater portion of its length for up and down movement in a bushing 23 and at its lower smooth end fixedly carries a notched guide plate 24, whose notch straddles the front rib 25 of the bracket 2, and serves to prevent shaft 22 from turning as it is moved up and down.

Bushing 23, shown in detail in Figs. 2 and 5, is threaded internally at its upper portion with large square threads for receiving shaft 22, but for the remainder of its length is slightly larger in internal diameter than the external diameter of the said shaft. Externally said bushing is threaded at its upper end, is then enlarged in diameter to provide a shoulder to which a flat coiled spring 26 is fixed by means of screw 27, and is then again increased in diameter to near its lower flanged end 28, excepting for the provision of a horizontal circular groove 29 near its top, and a concave portion provided with teeth 30 below said groove. The bushing 23 is rotatably held mounted in the upper circularly bored-out arm 31 of the bracket 2 by means of a pin 32.

To the front of the arm 31 is screwed a horizontal spring casing 33, which is slotted to provide play for the vertical rod handle 34 secured to a bolt or piston latch 35, which is held in the said casing forwardly projected against one of the grooves between two of the teeth 30, by the tension of the spring 36 which bears against the end of said casing.

The horizontal flat spring 26 carries a vertical pin 37, which fits in a socket provided in the top of the bracket 2 and thereby secures the outer end of said spring against movement.

Housing said spring is a hollow wheel 38, milled on its edge for convenient handling in turning, which is fixedly secured on the bushing 23 by threads and a collar 39, and closed below by a bottom plate 40, but rotating free thereof.

To the valve disk 21 is secured a valve stem or rod 41, whose lower end carries a shouldered and flanged circular crucible cover of metal 42, by means of a washer 43. Said crucible cover is provided with a plurality of downwardly directed passageways 44 leading from a chamber located in the narrower upper portion or neck of the said

crucible and which freely communicates with the hollow shaft 22.

A spring 45 is interposed between the upper edge of the neck of the crucible and an inner shoulder provided on the shaft 22 and tends to hold the said crucible cover slightly extended, leaving a circular gap between its shoulder and the lower end of said shaft, but permitting said cover to move upwardly, closing said gap, against the tension of said spring, when the cover strikes or rests upon the crucible to be described later.

The base plate 1 is bored to receive the reduced and threaded lower end of an upright flask support 47 which is held in place by the nut 48, and which flash support is made flaring at the top and furnished with a raised rim 49 to provide a flat circular recess or table 50 adapted to receive the base of a flask.

Flask support 47 is provided with a vertical central bore 51 extending from the top to near its base and with two aligned horizontal passageways at or near its center, of which one, 52, is of smaller diameter and flares inwardly, while the other 53 is larger in diameter and threaded to receive a threaded nipple 54 projecting into said bore 51 and constituting therewith an ejector for exhausting the air or vapor content of said bore 51 when compressed air or any other suitable medium under pressure is forced through said nipple 54 and across bore 51 into the flaring inward end of the passageway 52 and out into the external atmosphere.

The threaded end portion of nipple 54 projecting outside said flask support is screwed into a vertical valve casing 55, which is bored vertically to receive the ejector control valve stem 56 carrying a conical valve disk 57, which is normally held upwardly against its seat by a compression spring 58 resting upon the threaded plug 59, and thereby closes communication between passageways 60 and 61 leading from the air outlet pipe 62 and tank 3 into the nipple 54.

The upper end of the ejector control valve stem 56 projects through an opening in the guide plate 24 and is provided below the latter with a stop collar 63, fixedly but adjustably secured by a set screw 64.

Of the several kinds of flasks which are employed in connection with the aforedescribed casting machine, Figs. 1 and 4 illustrate two types in common use, namely, a flaring large-size flask 65, shown in Fig. 1 and employed when making large dental castings, such as dentures and the like, and a small cylindrical flask 66, shown in Fig. 4, for making small castings, such as individual gold teeth. In all cases the upper openings or mouths of said flasks are preferably all made of the same uniform diameter, so as to adapt them for receiving the same size of receptacle or funnel 67, of brass or other suitable material whose flange is fitted upon the faced top of the flask walls. Said funnel is inwardly curved and provided at its bottom with a downwardly tapering central hopper 68, for receiving the molten casting metal and of sufficient size and taper to guide the same into and completely plug up the sprue channel 69 leading to the mold cavity 70, formed in the investment 71, which is a plastic composition usually comprising plaster of Paris and silica.

Over said funnel and with its rim resting on the funnel flange is placed metal receiving means, such as the receptacle or crucible 72, preferably of asbestos or other heat-resistant material, shown in Figs. 4 and 6, and of less curvature than the said funnel, so that it is separated from the latter by an air space 73, and having cross-shaped slits 74 at its lowest portion, which are normally closed but are adapted to be forced open by air pressure from above to admit of passage through them of the gold or other metal, shown as 75 in dotted lines in Fig. 4, which is melted in said crucible by means of an acetylene blowpipe or similar means not shown.

In practising my invention, and in particular in dental casting, I usually proceed as follows:

I first connect up the casting apparatus with a suitable source of air or gas pressure, such as an ordinary hand pump, and open the 3-way valve mounted in casing 7 by means of the handle 10, that is, I place said handle in the position shown in full lines in Fig. 7, whereby communication is established between the source of pressure and both tanks 3 and 4, and force air into them. When gage 13 registers the pressure desired, say 40 lbs. per square inch, then the said 3-way valve is closed by turning handle 10 to the position shown in Fig. 1 and in dotted lines in Fig. 7, whereby the supply line from the above source of pressure and also air pressure between the two tanks 3 and 4 is cut off.

I now place the properly prepared flask, such as shown in Fig. 4, and enclosing the mold cavity and with the funnel 67 in position, on the table 50 of the flask support 47, and put the asbestos crucible 72 on said funnel. The metallic alloy or other material to be used in making the casting, designated by the reference numeral 75 in Fig. 4, is now placed in the crucible, and fused therein, by suitable means, such as a portable blowpipe.

When the alloy has been thoroughly melted, the piston latch 35 is released by pulling it backward against its spring, whereupon the threaded shaft 22, carrying the crucible cover, and impelled by spring

26, moves downwardly. As shaft 22 proceeds down its guide plate 24 strikes the stop collar 63 mounted on the ejector control valve stem 56 and opens the ejector valve 57, thereby creating a vacuum as far as is possible with the means employed, to wit, a partial vacuum in the flask investiture and mold cavity, just prior to the sealing of the crucible cover on its seat provided on the brass funnel and with the interposed gasket provided by the rim of the asbestos crucible. Air pressure from tank 3, released by valve 21, now forces the molten metal through the slits of the crucible into the sprue channel and into the mold cavity. This is effected, it should be noted, by the threaded shaft 22 still continuing its downward course for a short distance, after the crucible cover is impeded from further movement, the play provided between the shoulder on said crucible cover and the bottom of the threaded shaft serving to raise valve 21 off its seat and bring spring pressure from element 45 to bear on said cover and hold it tightly in place on the crucible and the bottom of receptacle 67 tightly against the top of said flask.

In the casting operation itself the excess of molten metal forced through the slits in the bottom of the crucible completely plugs up the charging cavity above the sprue way and thus prevents compressed air from escaping past the metal and also prevents the union of the compressed and the exhausted air in the mold cavity and investiture during the casting. The provision of means to effect this in my casting apparatus constitutes what I consider a very important advance over prior constructions of dental casting apparatus, in which the advantage accruing from the use of both pressure and a vacuum in casting, over either alone, has never, it is believed, been demonstrated.

Positive pressure obtained from tank 4 is maintained upon the metal head in hopper 68, which communicates by the neck in the sprue-way 69 with the casting itself, until the latter has cooled sufficiently to admit of lifting of the crucible cover and removal of the flask and its contained casting, while the pressure in tank 3, acting through the ejector system represented by elements 62, 60, 57, 61, 54 and 52, draws air and water vapor from the base of the flask, through bore 51, until it has been reduced to normal atmospheric pressure. Then, by turning the spring wheel 38 by hand in the direction to wind up spring 26, the threaded shaft 22 is raised and with it the crucible cover, to any desired height, say to the elevated position shown in Fig. 1, where it is held, until released, by the latch bolt 35. This completes the cycle of the working of the machine, which is now ready for another casting operation.

What I claim as new is:

1. In the art of casting by machines in which two pressure containers are employed, the steps of filling said containers simultaneously from a single source of pressure, then cutting off the pressure between said containers, then fusing the material to be molded in temporary retaining means separated by an air gap from means for molding said material, then producing a vacuum in said molding means by an ejector device operated by pressure derived from one of said containers, and finally forcing said material through said temporary retaining means by fluid pressure derived from the other of said containers into said molding means.

2. In the art of casting by machines in which two pressure containers are employed, the steps of filling said containers simultaneously from a single source of pressure, then cutting off the pressure between said containers, then fusing the metal to be molded in a normally metal-retaining means for the temporary holding of said metal without undue heating of the metal-molding-means, then exhausting air from said metal-molding means by an ejector device operated by pressure derived from one of said containers, and finally forcing the molten metal through said temporary metal-retaining means by fluid pressure derived from the other of said containers into said molding means while maintaining a vacuum therein.

3. In the art of casting metal by machines in which two pressure containers are employed, the steps of first filling said containers simultaneously from a single source of pressure, then cutting off the pressure between said containers, then fusing the metal to be molded in a normally-closed valvular crucible located above a flask but separated therefrom excepting at its rim, then exhausting air from said flask by an ejector device operated by pressure derived from one of said containers, and finally forcing the molten metal through the valve of said crucible by air pressure derived from the other of said containers into said flask, while maintaining a vacuum in said flask.

4. The process of casting metals by the pressure-vacuum method which consists in using fluid pressure to force the metal into the mold cavity and using fluid pressure to create a vacuum on the base of the mold by an ejector device.

5. In a casting apparatus the combination of a pair of interconnected closed pressure containers with means for admitting a pressure medium to and cutting off its flow between said containers, a support for an upright crucible-carrying flask, controllable means for supplying the said pressure medium from one of said containers to said

crucible, and ejector means communicating with the other of said containers for exhausting the lower end of said flask through said support and controlled by said first controllable means.

6. In a casting apparatus the combination of a pair of interconnected closed pressure containers with means for admitting a pressure medium to and cutting off its flow between said containers, a support for an upright crucible-carrying flask, controllable means for supplying the said pressure medium from one of said containers to said crucible, and ejector means communicating with the other of said containers for exhausting the lower end of said flask through said support and means connected with said controllable means for starting said exhausting action before said pressure medium is admitted to said crucible.

7. In a casting apparatus the combination of a pair of interconnected pressure tanks with means for admitting a pressure medium to and cutting off its flow between said tanks, a support provided with passage ways therethrough and adapted to hold an upright crucible-carrying flask, controllable means for supplying the said pressure medium from one of said tanks to said crucible, ejector means communicating with the other of said tanks for exhausting the lower end of said flask through the passage-ways of said support, and means for controlling the start of operation of the last means relatively to that of the said controllable means.

8. In a casting machine the combination of a pair of interconnected pressure tanks with means for admitting a pressure medium to and cutting off its flow between said tanks, a support provided with passageways therethrough and adapted to hold an upright flask open at its ends and tightly fitted with a closable crucible on its upper end, controllable means for supplying said pressure medium from one of said tanks to said crucible when it contains molten material and is closed, and ejector means for previously drawing air and vapor from the lower end of said flask through its support and started in operation by said first controllable means.

9. In a casting machine the combination of a pair of interconnected tanks with means for admitting a pressure medium to and cutting off its flow between said tanks, a support provided with passageways forming an ejector therethrough and adapted to hold an upright flask open at its ends and tightly fitted with a closable crucible on its upper end, movable means including a valve for supplying said pressure medium from one of said tanks to said crucible when it contains molten material and is closed, spring means for actuating said movable means, locking means for restraining the operation of said spring means, means including a valve and communicating with the other of said tanks for exhausting the lower end of said flask through the ejector in said support, and means for controlling the operation of said last named valve actuated by said movable means.

10. In a casting machine the combination of a supporting base having an upright angular bracket arm, a pair of closed tanks for compressed air secured to said base, a three-way valve for controlling the supply of and means for leading compressed air to and from said tanks mounted thereon, a nipple on said means, a flexible hose secured to said nipple communicating with one of said tanks and fastened to a sleeve containing a normally-closed disk valve, an outwardly threaded hollow shaft threaded to said sleeve and containing the stem of said valve, an inwardly threaded bushing rotatably mounted in said bracket arm and carrying said shaft for reciprocating motion, a spring wheel for moving said shaft fixed on said bushing, a latch for locking said bushing against movement mounted on said bracket arm, a crucible cover slidably and resiliently mounted on the lower end of said shaft and carrying the end of said valve stem but permitting its upward movement to open said disk valve, when the movement of said cover is arrested, a straddle plate secured to said shaft and guided by said bracket arm to prevent rotation of said shaft but adapted, when said shaft moves downward, to strike a stop collar, a centrally bored flask support secured to said base and provided with an ejector communicating with the second of said tanks, a valve casing containing a normally closed disk valve interposed between said support and the last-named tank, a stem upwardly extended from said valve and an adjustably mounted stop-collar on said stem adapted to open said valve to admit compressed air to said ejector when moved downward by said plate on said shaft.

11. In a compression and vacuum casting machine, a vertically reciprocatable cover carried by a hollow shaft adapted to supply air pressure for casting, a temporary retaining means for fused metal adapted to be closed by said cover when said shaft reaches the end of its downward motion, and fixed but normally closed slits provided in said temporary metal-retaining means adapted to be opened to release its contents of fused metal and operated by air pressure supplied by said first-named means after it has reached its lowest position.

12. In a compression and vacuum casting machine provided with a reciprocatable cover, a crucible of refractory material adapted to coact with said cover to form an enclosure for temporarily retaining molten metal, said crucible having a convex body

and a flat rim and slits provided in said body which are normally closed to the passage of molten metal but are adapted to be opened when fluid pressure, admitted through said cover, is exerted upon their upper surface.

13. In a compression and vacuum casting machine provided with a reciprocatable cover, fused metal-receiving means adapted to form a covered enclosure with said cover, and a conical funnel for supporting said metal-receiving means by its rim and provided at its base with a charging hopper, and adapted to fit tightly upon a molding flask and its investiture, and to hold a head of fused metal above and therewith plug a sprue provided in said investiture against the ingress of air.

14. In an apparatus for casting articles of metal the combination with a flask adapted to enclose a mold of porous material and having an upper and lower opening, of a receptacle above the upper opening of the flask and in communication therewith, a crucible within the receptacle above the upper opening of the flask and at such distance from it as to leave a substantial air space between the crucible and the flask, means for creating a partial vacuum within the flask, and means permitting fluid pressure to discharge the contents of said crucible into said flask.

15. In an apparatus for casting articles of metal the combination with a flask adapted to enclose a mold of porous material and having an upper and a lower opening, of a normally open receptacle above the upper opening of the flask and in communication therewith, a crucible within the receptacle above the upper opening of the flask and at such distance from it as to leave a substantial air space between the crucible and the flask, means for creating a partial vacuum in the flask, means for closing the receptacle and for forcing air under pressure into it, and means permitting air pressure to discharge the contents of said crucible into the upper opening of said flask.

16. In an apparatus for casting articles of metal the combination with a flask adapted to enclose a mold of porous material and having an upper and a lower opening, of a receptacle above the upper opening of the flask and in communication therewith, a crucible within the receptacle above the upper opening of the flask and at such distance from it as to leave a substantial air space between the crucible and the flask, means for creating a partial vacuum in the flask, means permitting fluid pressure to discharge the contents of said crucible into said flask, and means carried by the flask for guiding the contents of the crucible into the sprue channel of the mold enclosed therein.

17. In an apparatus for casting articles of metal the combination with a flask adapted to enclose a mold of porous material and having an upper and a lower opening, of a receptacle above the upper opening of the flask and in communication therewith, a crucible within the receptacle above the upper opening of the flask and at such distance from it as to leave a substantial air space between the crucible and the flask, means for creating a partial vacuum in the flask, means permitting air pressure to discharge the contents of said crucible into the upper opening of said flask and a funnel carried by the flask for guiding the contents of the crucible into the sprue channel of the mold enclosed therein, thereby preventing the air pressure from escaping past the metal in the mold.

18. In an apparatus for casting articles of metal the combination with a flask adapted to enclose a mold of porous material and having an upper opening and a lower opening, of a receptacle above the upper opening of the flask and in communication therewith, a crucible within the receptacle above the upper opening of the flask and at such distance therefrom as to leave a substantial air space between it and the flask, means for holding the bottom of said receptacle tightly against the top of said flask, air exhausting means adapted to be placed in communication with the lower opening of the flask, means permitting air pressure to discharge the contents of said crucible into the upper opening of said flask, and means for connecting the exhausting means with the flask to create a partial vacuum therein and then discharging the contents of the crucible.

19. In an apparatus for casting articles of metal the combination with a flask adapted to enclose a mold of porous material and having an upper opening and a lower opening, of a normally open receptacle above the upper opening of the flask and in communication therewith, a crucible within the receptacle above the upper opening of the flask and at such distance therefrom as to leave a substantial air space between it and the flask, means for closing said receptacle and holding the bottom of said receptacle tightly against the top of said flask, air exhausting means adapted to be placed in communication with the lower opening of the flask, air pressure means adapted to be placed in communication with the receptacle, and means permitting air pressure to discharge the contents of said crucible into the upper opening of said flask.

20. In an apparatus for casting articles of metal the combination with a flask adapted to enclose a mold of porous material and having an upper opening and a lower opening, of a normally open receptacle above the upper opening of the flask and in communication therewith, a crucible within the re-

ceptacle above the upper opening of the flask and at such distance therefrom as to leave a substantial air space between it and the flask, means for closing said receptacle and holding the bottom of the receptacle tightly against the top of said flask, air exhausting means adapted to be placed in communication with the lower opening of the flask, air pressure means adapted to be placed in communication with the receptacle, means permitting air pressure to discharge the contents of said crucible into the upper opening of said flask, and means for first connecting the exhausting means with the flask to create a partial vacuum therein and then simultaneously closing the receptacle, turning on the air pressure and discharging the contents of the crucible.

21. In an apparatus for casting articles of metal the combination with a flask adapted to enclose a mold of porous material and having an upper opening and a lower opening, of a normally open receptacle above the upper opening of the flask and in communication therewith, a crucible within the receptacle above the upper opening of the flask and at such distance therefrom as to leave a substantial air space between it and the flask, means for closing said receptacle and holding the bottom of said receptacle tightly against the top of said flask, air exhausting means adapted to be placed in communication with the lower opening of the flask, air pressure means adapted to be placed in communication with the receptacle, means for discharging the contents of the crucible into the upper opening of the flask, operating means and means operated thereby for first connecting the exhausting means with the flask to create a partial vacuum therein and then simultaneously closing the receptacle, turning on the air pressure and discharging the contents of said crucible.

STANMORE P. MARSHALL.

Certificate of Correction.

It is hereby certified that Letters Patent No. 1,452,246, granted April 17, 1923, upon the application of Stanmore P. Marshall, of Washington, District of Columbia, for an improvement in "The Art of and Apparatus for Casting Metals," were erroneously issued to "H. B. Byrd Manufacturing Company, Incorporated, of Washington, District of Columbia, a Corporation of Virginia," as assignee of the entire interest in said invention, whereas said Letters Patent should have issued to the inventor, said *Marshall*, and *H. B. Byrd Manufacturing Company, Incorporated*, said corporation being assignee of *one-half* interest only in said invention, as shown by the records of assignments in this office; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 29th day of May, A. D., 1923.

[SEAL.]

KARL FENNING,
Acting Commissioner of Patents.