

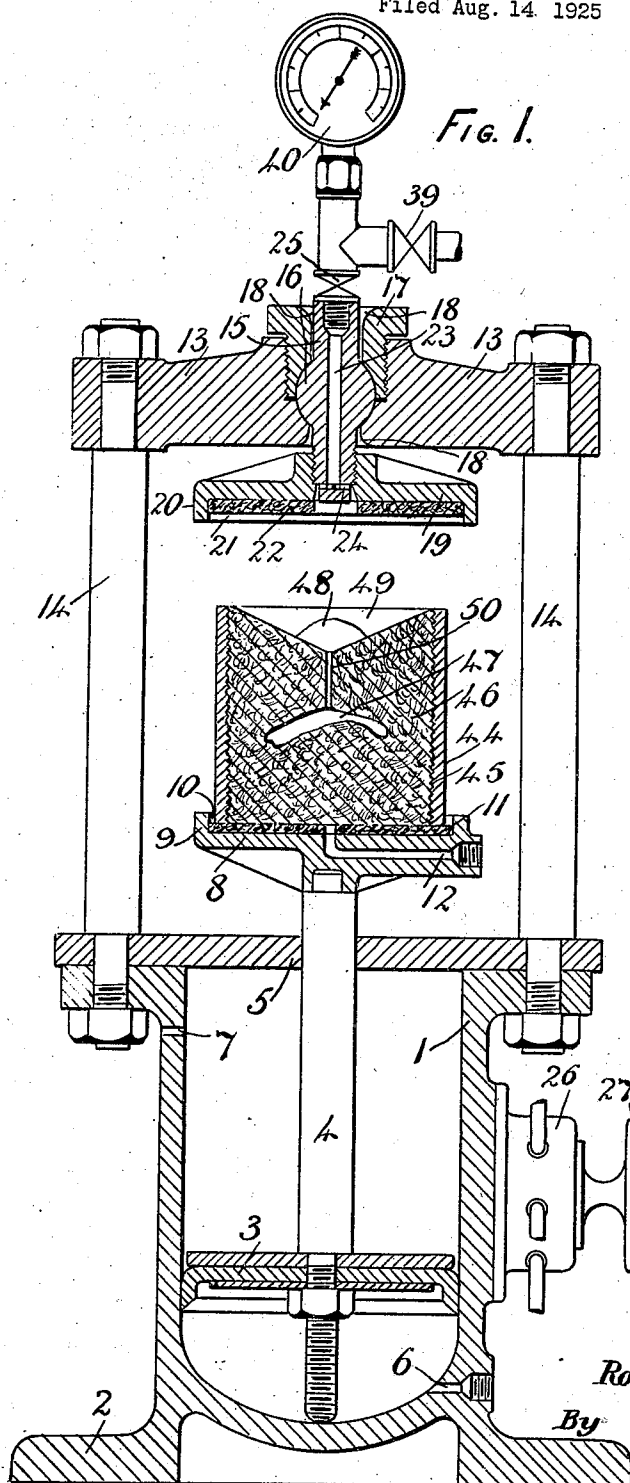
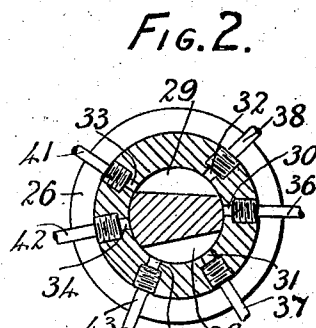
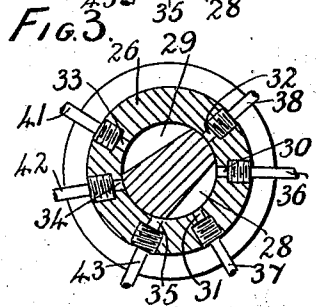
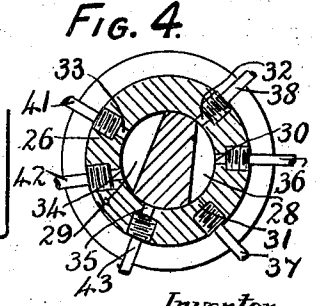
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MACHINE FOR CASTING DENTAL PARTS AND THE LIKE

Filed Aug. 14 1925



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# UNITED STATES PATENT OFFICE.

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MACHINE FOR CASTING DENTAL PARTS AND THE LIKE.

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This invention has reference to improvements in and relating to machines for casting dental parts and the like and particularly relates to machines adapted to cast in metal or other suitable material, such as low fusing porcelain, small articles, such as, dental parts, plants and insects, for example, dental inlays, plates, crowns and other dental parts, leaves, ferns, insects, rings, badges and articles of a like nature usually manufactured by the jewelry and similar trades.

The usual practice in casting such small articles is to form first a wax pattern of the article, if the article is such that it can be moulded in wax. This wax pattern is embedded in a suitable investment material contained in a casting cylinder or mould container which is open-ended, top and bottom. The investment material, which is of a porous nature, is in a plastic condition so that it fits or invests closely the wax pattern. Other small articles of little intrinsic value and which cannot conveniently be moulded in wax, for example, insects, leaves and ferns, are embedded in the investment material in the casting cylinder in the same manner as the wax pattern is invested. The casting cylinder, containing the wax pattern or other article and investment, is then placed in a suitable furnace, the heat of which dries the investment and melts the wax pattern which is absorbed by the investment and then burnt out, while in the case of articles other than wax patterns the heat of the furnace burns the article to carbon and finally to gaseous carbon dioxide. The hot casting cylinder, containing the dried investment having a cavity the shape of the wax pattern or other article, is then placed in a casting machine. Into a recess, previously made in the upper surface of the investment and from the bottom of which a sprue hole or conduit leads into the cavity, a piece of metal or other suitable material, in excess of the quantity required to form the article, is placed. Heat is applied, usually by means of a blow-pipe, to this piece of material so as to melt same. The casting cylinder is then closed by means of a cover plate or lid and pressure fluid is applied to the molten material in the recess so as to drive same through the sprue hole into the cavity in the investment; the air or vapour in the cavity passing into or through the investment material. After the material in

the cavity has cooled and solidified it is removed.

In such casting machines the following features are desirable:—

The casting cylinder should be closed as steadily and as quickly as possible after the metal or other material in the recess has reached the desired molten condition.

The force applied to close the cylinder or mould should be greater than the force applied to drive the molten material into the cavity, otherwise the mould may be forced open by the casting force.

The casting force should not be applied till after the mould is closed; otherwise the molten material may be blown out of the recess in the upper surface of the investment, and should be applied immediately after the mould is closed to avoid cooling of the molten material below the correct casting temperature.

The casting force should be capable of regulation and control independently of the mould closing force, for example, the mould closing pressure may remain constant at about 30 pounds per square inch while the casting pressure in some cases may be about 2 pounds per square inch and in other cases may be about 15 or 20 pounds per square inch. The pressure desired for driving the molten material into the cavity varies with the nature of the material and if too great a pressure is applied there is danger of the cavity being distorted.

There should be no leakage of the casting pressure fluid between the investment material and the internal surface of the casting cylinder. With the cylinders or mould containers generally in use there is, when the investment is dried, usually a small space between the cylinder walls and the investment due to unequal change in the size of the investment and mould container under the action of the heat. This space results in leakage of the casting pressure fluid.

The object of this invention is to construct a casting machine in which all the above desirable features are present, which will be simple and comparatively cheap in construction, which will be easily and expeditiously operated and which will be efficient and economical.

A casting machine constructed according to this invention comprises a piston adapted to operate within a vertical cylinder and

having a platform, on which the casting cylinder is placed, fitted horizontally at the upper end of the piston rod. A cover plate or lid, incapable of movement in a vertical direction, is located centrally a suitable distance above the platform and is fitted at the lower end of a central stem or tubular member. A plug-cock or the like is provided with two passages in the plug and a plurality of ports, preferably six ports, in the plug casing or body. One of these ports is placed in communication, by means of a pipe, with a source of pressure fluid supply, for example, compressed air or steam. Another of these ports is placed in communication, by means of a pipe, with the space in the vertical cylinder below the piston. Another port is placed in communication, by means of a pipe and the passage in the tubular member, with the undersurface of the cover plate or lid against which the upper end of the casting cylinder is made to bear. This pipe connection and tubular member is provided with a stop cock, a pressure regulator and a pressure gauge. Another port is placed in communication, by means of a pipe and a passage in the platform, with the upper surface of the platform on which the casting cylinder rests. Another port is placed in communication, by means of a pipe, with a vacuum tank or other source of suction supply. The remaining port is the exhaust port which is in communication with the atmosphere. These six ports and the two passages in the plug are so arranged in relation to each other that the first portion of the rotary movement of the plug closes the exhaust port to the atmosphere and admits pressure fluid to the vertical cylinder below the piston so as to raise the platform and close the upper end of the casting cylinder against the undersurface of the cover plate or lid. The exhaust port and the pressure fluid ports to the underside of the piston are so arranged in relation to each other that the exhaust port is partly open for a short duration of time during the first portion of the rotary movement of the plug so as to avoid any sudden or "jerky" upward movement of the piston and render the said upward movement steady and more easily controlled. Further rotary movement of the plug opens communication between the vacuum source and the upper surface of the platform so as to draw air and vapour out of the cavity into or through the investment. Further and final rotary movement of the plug admits pressure fluid to the undersurface of the cover plate so as to drive the molten material into the cavity in the investment from the recess. The opening of the upper surface of the platform to the suction from the vacuum source is slightly prior to the admission of pressure fluid to the under surface of the cover plate so that air or vapour does not become locked in any narrow or fine extremity of the cavity, while these two forces assist each other in performing their functions. During the further and final rotary movements of the plug the ports admitting pressure fluid below the piston remain open so as to maintain the mould closing pressure. The plug may be retained in this position till the metal in the cavity becomes cooled and solid. The first portion of the return rotary movement of the plug closes the port admitting pressure fluid to the under surface of the cover plate and the port leading to the vacuum tank. Further rotary movement in this return direction closes the port leading to the pressure fluid supply and opens the space below the piston in the vertical cylinder to the exhaust. By rotating the plug a little beyond the "off" position the casting pressure fluid may be used to open or unseal the mould so that the platform may be returned easily to the down or first position; the casting pressure fluid giving the casting cylinder its initial movement downward, that is, the maintenance of the casting pressure under the cover plate unseals the mould when the sealing pressure is removed. When the casting pressure is small, for example, about 2 pounds per square inch, it may not be sufficient to unseal the mould but this pressure may be increased for this purpose by operating the pressure regulator up to the maximum pressure in the supply pipe. The area of the piston is greater than the cross sectional area of the under surface of the cover plate within the upper end of the casting cylinder so that the mould closing force is always greater than the casting force, even should the casting pressure, in pounds per square inch, be the same as the mould closing pressure, in pounds per square inch. The mould closing pressure may be the same as the pressure in the main pressure fluid supply pipe and if this pressure is too great for a casting pressure it is reduced by means of the pressure regulator and the desired reduced pressure determined and indicated by the pressure gauge. The casting pressure, therefore, can be regulated and adjusted with a considerable degree of accuracy. Should there be any leakage of the casting fluid between the investment and the casting cylinder this accurate casting pressure will become inaccurate when admitted under the cover plate. To avoid this source of inaccuracy the interior surface of the casting cylinder is provided with a plurality of grooves and ridges, for example, for convenience in manufacture the interior surface of the casting cylinder may be screw-threaded. The investment material filling the screw-threads or grooves makes the joint between the investment material and the

casting cylinder comparatively and substantially tight. Further this construction or formation of the interior of the casting cylinder assists in retaining the dried investment in the cylinder. When there is a space between the cylinder and the investment there is a danger of the investment falling out of the cylinder when same is transported from the furnace.

In order that others skilled in the art to which this invention relates may properly understand the same I have hereunto appended one sheet of explanatory drawings in which Figure 1 is a sectional elevation of a casting machine as constructed according to this invention, while Figures 2, 3 and 4, are transverse sectional elevations of the plug-cock showing same in three positions.

Referring to these drawings:—

In carrying this invention into effect or practice a casting machine comprises a cylinder 1 provided with a sole or base plate 2 by means of which the machine may be secured to a bench, work-table or the like. A piston 3, secured on the end of a piston rod 4 which passes through the upper end plate 5 of the cylinder, is adapted to reciprocate within the cylinder 1. The cylinder is provided with an inlet and exhaust port 6 at its lower end and with a port or ports 7 at its upper end. This port 7 ensures that the space in the cylinder above the piston is always open to the atmosphere so as to prevent any back pressure or cushioning action in the cylinder when the piston is raised. The upper end of the piston rod is provided with a platform or the like 8 having a flange 9 all round its periphery so as to form a recess 10. Into this recess a washer 11 of asbestos or other suitable heat resisting jointing material is placed. In the platform and leading from the bottom of the recess 10 to the periphery a passage or conduit 12 is provided. An upper cross-head or the like 13 supported by pillars 14 is arranged a suitable distance above the highest position occupied by the platform 8. A central stem or tubular member 15, having a spherical portion 16, is arranged vertically above and in alignment with the piston rod 4. This tubular member 15 passes through the crosshead 13 and is retained in position by means of a nut or the like 17. Clearance spaces 18 are provided between the member 15 and the nut 17 and between the member 15 and the crosshead 13. From this construction it is obvious that a swivel connection is established between the crosshead 13 and the member for a purpose which will be later described. A cover plate or lid 19 is fitted, preferably by screwing, on to the lower end of the tubular member 15 below the crosshead 13 and is provided with a flange 20 round its periphery forming a recess 21 into which a washer 22 of asbestos

or the like is inserted. The passage 23 in the tubular member 15 opens into the center portion of the recess 21 by means of ports or holes 24. These holes 24 are arranged transversely to the member 15 and are so designed as to produce as uniform a pressure as possible on the top of the molten material and avoid scattering or breaking up of the molten material and drive the body of the material uniformly through the sprue hole. A stop cock 25 may be provided on the tubular member 15 above the crosshead 13. A plug-cock or the like 26 having an operating handle or knob 27 is fitted in a suitable position, preferably as shown to the side of the cylinder 1. This plug-cock is provided with two passages 28 and 29 and a plurality of ports, preferably six ports, 30, 31, 32, 33, 34 and 35. Port 30 is connected to a main source of pressure fluid supply, such as an air compressor or compressed air tank or to a boiler or other source of steam supply, by means of a pipe 36. Port 31 is connected, by means of a pipe 37, to the inlet and exhaust port 6 of the cylinder 1. Port 32 is connected, by means of a pipe 38, to the passage 23 in the tubular member 15. This pipe 38 is provided with a pressure regulator 39, while the passage 23 is provided with a pressure gauge 40. Port 33 is connected, by means of a pipe 41, to the passage 12 in the platform 8. Port 34 is connected, by means of a pipe 42, with a vacuum tank or the like, while port 35 opens to the atmosphere by means of a pipe 43.

The casting cylinder or mould container consists of an open-ended cylinder 44 having its interior surface formed with ridges and grooves or screw threads 45 so that when the cylinder is filled with the investment material the latter will seep within these grooves or ridges to establish a closed jointure between the internal surface of the cylinder and the investment material whereby the fluid under pressure will be caused to pass through the investment material and prevented from passing between the same and the walls of the cylinder.

In Figure 1 the casting cylinder 44 is shown placed upon the platform 8 which is in its lowest position ready to be raised to close the mould. When the cylinder is raised its upper end will be closed by means of the cover 20 and owing to the swivel connection between the member 15 which support the cover and the crosshead the cover will automatically adjust itself upon the cylinder. The cylinder 44 contains the investment material 46 having a cavity 47 formed by the wax pattern or other article which has been melted, burnt and absorbed by the investment 46. A piece of metal or other material 48 has been placed in the recess 49 in the upper surface of the investment and

melted ready to be forced through the sprue hole 50 into the cavity 47.

This machine may be operated to cast by different methods, for example, the molten material in the recess 49 may be driven into the cavity 47 by pressure fluid acting on the top of same. This pressure fluid may be compressed air or steam conducted to the machine from a source of supply outside the machine. This pressure fluid may be steam generated by the machine. Instead of pressure fluid acting upon the top surface of the molten material so as to drive same into the cavity 47 the molten material 48 may be drawn into the cavity 47 by suction acting through the investment. A further method may consist of the pressure fluid method in addition to or in combination with the suction method.

The first or preliminary operation is to set the machine to cast at the desired pressure and this is done by closing the stop-cock 25 so that no pressure fluid can escape through the passage 23 in the tubular member 15. The plug-cock 26 is then turned till port 30, passage 29, port 32, pipe 38, pressure regulator 39 and pressure gauge 40 only are in communication with each other and with the pressure fluid supply pipe 36. The desired pressure is obtained by operating the pressure regulator 39 till the desired pressure is indicated by the gauge 40. When stop-cock 25 is not provided, or if provided it may be left open and the machine set by placing a dummy cylinder on the platform 8 and moving the plug-cock from the position shown by Figure 2 to the position shown by Figure 3. In Figure 2 the compressed air inlet port 30 and the port 34 to the vacuum source are closed so that there is no pressure fluid nor suction in the machine. When rotary movement to the position shown by Figure 3 takes place pressure fluid is admitted through port 30, passage 28, port 31, pipe 37 and port 6 to the cylinder 1 below the piston 3 and raised same till the upper end of the dummy cylinder bears against the washer 22. Should the upper end of the cylinder be slightly off the horizontal the cover plate 19 will adjust itself automatically by means of the spherical portion 16. It will be noted that during the next movement of the plug-cock 26 ports 30 and 31 remain open to each other by means of the passage 28. Further rotary movement of the plug-cock 26 to the position shown by Figure 4 opens port 32, pipe 38, passage 23 and the underside of the washer 22 to the pressure fluid supply port 30 and passage 28, the pressure of which is indicated by the pressure gauge 40. If the pressure indicated is too great a casting pressure it is reduced and regulated by the pressure regulator 39. After the casting pressure has been regulated and adjusted

and the plug-cock 26 returned to its first position the machine is ready for the casting cylinder 44 to be placed in position as shown by Figure 1.

The first operation in casting is to operate the plug-cock 26 from the position shown by Figure 2 to the position shown by Figure 3. This raises the platform 8 and closes the mould as described above in reference to the dummy cylinder. Further rotation of the plug-cock 26 admits the casting pressure fluid above the molten material 48 and drives same into the cavity 47. Prior to the admission of the casting pressure fluid suction from the port 34 and vacuum source operates through the passage 29, port 33, pipe 41 and passage 12 in the platform 8 on the undersurface of the investment and draws air and vapour out of the cavity 47. The casting pressure fluid and the suction assist each other in drawing the molten material into the cavity 47. When it is desired to generate steam in the machine to drive the molten material into the cavity 47 the washer 22 is wetted and the stop-cock 25 closed. The casting cylinder, hot from the furnace, when placed against the wet washer 22 generates sufficient steam to perform this operation. This method of casting is known as the "wet" method. When it is desired to draw by suction the molten material 48 into the cavity 47 without the aid of pressure fluid the stop-cock 25 is closed, and when it is desired to dispense with the suction and to use the pressure fluid only on the top of the molten material the pipe connection to the vacuum source is disconnected.

I claim:—

1. A casting machine comprising in combination a support, a platform movably mounted upon said support, a casting cylinder carried by said platform, fluid actuated means for moving said platform whereby said cylinder will be caused to assume a mould closing position, means for supplying a casting force into said cylinder and means whereby said fluid actuated means and casting force supply means may be jointly and independently controlled.

2. A casting machine comprising in combination a support, a platform movably mounted upon said support, a casting cylinder carried by said platform, fluid actuated means for moving said platform whereby said cylinder will be caused to assume a mould closing position, means for supplying a casting force into said cylinder and a rotatable valve mounted upon said support for jointly and independently controlling said fluid actuated means and said casting force supply means.

3. A casting machine comprising in combination a support, a platform, a fluid actuated piston mounted within said support and

connected to said platform, a casting cylinder carried by said platform, a mould cover for said cylinder secured to said support, means for supplying a casting force through said cover into said cylinder, a valve rotary carried by said support and communicating with said casting force supply means and means whereby upon the rotation of said valve said piston will be first actuated and the casting force subsequently supplied to said cylinder.

4. A casting machine comprising in combination a casting cylinder, means for supplying a mould closing force to said cylinder, means for supplying a casting force to said cylinder, means for creating a suction within said cylinder and means for jointly controlling said mould closing and casting forces and said means for creating a suction within the cylinder.

5. A casting machine comprising in combination a vertically movable mould cylinder, fluid actuated means for moving said cylinder to a closed position, means for supplying a casting force into said cylinder, a single valve for controlling said fluid actuated and force supplying means and a pressure regulating means arranged within said casting force supply means adapted to be actuated independently of said valve.

6. A casting machine comprising a casting cylinder adapted to contain investment material, a mould cover plate for said cylinder, a movable platform for supporting said cylinder, means whereby pressure fluids may be admitted below said cover plate into said cylinder, and means whereby leakage of said pressure fluid between said investment material, contained within said cylinder, and the inner walls of said cylinder is prevented.

7. A casting machine comprising a mould cylinder adapted to contain investment material, means for supplying a casting force to one end of said cylinder, means for causing a suction at the opposite end of said cylinder and a plurality of projections arranged upon the inner wall of said cylinder whereby leakage between the investment material and the inner walls of said cylinder is prevented.

8. A casting machine of the character described comprising a support, a movable platform mounted upon said support, a casting cylinder carried by said platform, a mould cover plate suspended from and retained against vertical movement by said support, and means whereby said cover plate will adjust itself automatically to the upper end of said casting cylinder when the latter contacts therewith substantially as and for the purpose specified.

9. A casting machine of the character described comprising a support, a platform movably mounted upon said support, a casting cylinder carried by said platform, a cross head carried by said support, a cover plate pivotally connected to said cross head whereby the same will automatically adjust itself to the upper end of said casting cylinder, and means whereby a casting force may be supplied through said cover plate into said casting cylinder substantially as and for the purpose specified.

10. A casting machine of the character described comprising a support, a platform movably mounted upon said support, a casting cylinder carried by said platform, a cross head carried by said support, a tubular stem, a swivel connection between said tubular stem and cross head, and a cover plate carried by the lower end of said stem.

11. A casting machine of the character described comprising a base, a vertical cylinder formed with said base, a piston mounted for reciprocation within said cylinder, a platform carried by said cylinder, a casting cylinder carried by said platform, pillars carried by the vertical cylinder, a cross head supported by said pillars, a cover plate secured to said cross head, means for supplying a casting force through said cover plate into said casting cylinder, said platform having a suction passage way therein communicating with the casting cylinder, and a single control whereby fluid pressure may first enter said vertical cylinder and subsequently a casting force and suction created within said casting cylinder.

ROBERT YOUNG RICHMOND.

**CERTIFICATE OF CORRECTION.**

**Patent No. 1,644,543.**

**Granted October 4, 1927, to**

**ROBERT YOUNG RICHMOND.**

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, in the heading to the printed specification, line 5, date of filing application in Great Britain, for "July 9, 1927" read "July 9, 1925"; 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 24th day of January, A. D. 1928.

Seal.

**M. J. Moore,**  
**Acting Commissioner of Patents.**