ABSTRACT

In the production, by fluid pressure deformation of plastic foils, of molds for metal casting of small dental prosthetic parts, and in which a stomp model is imbedded in a vessel attachable to a work plate of a foil deforming appliance, an insert, formed with a number of openings, is provided for attachment to the work plate. At least one pot-type vessel, having a supporting edge formed with fine air discharged channels, is inserted into an appropriate opening of the insert and a kneadable composition is placed in the vessel and shaped to extend somewhat conically above the support edge. The unprepared stomp model is pressed into the composition and, after any necessary preparation of the stomp model, fine channels are notched into the surface of the conically shaped portion of the composition to extend between the base of the stomp model and the fine air discharge channels. Thereafter, a plastics foil is deformed into conforming relation with the model either by the application of fluid pressure or by vacuum drawing.

11 Claims, 11 Drawing Figures
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APPARATUS FOR THE PRODUCTION OF SYNTHETIC PLASTICS MOLDS FOR METAL CASTING SMALL DENTAL PROSTHETIC PARTS, SUCH AS CROWNS AND CAPS

BACKGROUND OF THE INVENTION

In the casting, in gold or white metal, of dental crowns and stump caps for use in the mouth, initially wax molds, or, more recently, synthetic plastics molds, are produced on the model and are them imbedded in ceramic compositions. In the subsequent heating of these ceramic muffle, the wax or the synthetic plastics material melts and burns away, and the metal is injected into the resulting cavity by a centrifuging method of the like.

In the production of wax molds, which generally were used earlier, no difficulties occurred if adequate mechanical skill was utilized, because any contractions occurring in setting and which took effect in the vertical dimension of the formed wax mold sleeve, such as lack of shoulder edge fit, could be eliminated by the application of liquid wax. Today, the contractions of the metals after casting, which occurs in all directions, is generally compensated by appropriately developed imbedding compositions which expand to the same extent due to the heating.

Synthetic plastics molds, generally used in modern technology, and usually produced by vacuum deep-drawing or by compressed air deformation, have the outstanding advantage of stability during the further processing and imbedding. However, the longitudinally acting traction, which cannot be eliminated, is a great disadvantage.

Attempts have been made to eliminate this drawback or disadvantage by the use of what are called "underlay foils," such as disclosed in German Pat. No. (DAS) 1,126,198,0, the lower foil being drawn out of the sleeve before imbedding. However, since in this procedure the lower foil extends over the cutting or chewing surface to beyond the marginal shoulder of the model, the gain occurring in one direction is lost again in the direction perpendicular thereto, namely in the direction perpendicular to the marginal shoulder.

For this reason, more recently, pastes applied with small brushes have been used, and these leave the marginal shoulder of the models free as well as having a compensating or equilibrating effect only at the shrinkage points. For a crown on short tooth stump only, it is possible, with the paste, even to model a complete anatomic assembly.

However, a further problem arises from the fact that, although the solidified compensating paste satisfactorily withstands the pressure of the foil, it can be damaged easily in the seating of the stump in the press appliances.

Imbedding in fine lead granulate, which is used in the case of larger jaw models, in fact provides secure seating of the object and permits the escape of entrapped air, but is not suitable for small stump models because the thin mold foil can be damaged easily.

Modelling clays ordinarily are too stiff, cause difficulties in socketing, and do not permit the escape of entrapped air. Layers of foam material laid upon the clay permit the entrapped air to escape well, but the retention of the model stump is insecure and the transition between stump and socketing is inexact.

While porous sintered plates formed with several receiving apertures of different sizes, provide firm retention for the stump models inserted directly into these apertures and permit escape of the entrapped air, the transitions between the sinter plate and the stump model are too right-angled, hard and unyieldable, so that folds form in the pressed mold foil.

SUMMARY OF THE INVENTION

This invention relates to the production, by deformation of plastics foils under fluid pressure, of molds for metal casting of small dental prosthetic parts and, more particularly, to an improved apparatus for this purpose.

The invention solves the problem of making possible the production of molds from synthetic plastics foils by drawing or pressing, even for relatively small parts, such as crowns or caps, in such a way that the small stump models are stably arranged in the drawing or pressing device and can be handled easily for preparation, rapid series work and good exploitation of the foils. The invention further insures that air trapped beneath the foil can escape satisfactorily, in order to avoid inaccuracies of fit and damage and/or folding of the synthetic plastics foil in the base region of the model.

In accordance with the invention, at least one pot-type vessel, with a support edge, is provided for insertion into an appropriate one of a number of corresponding openings of an insert attachable to the work plate. A kneadable composition is introduced into the vessel and shaped somewhat conically above the support edge. Thereupon the unprepared stump model is pressed into this composition and then, after any necessary preparation of the stump model, fine channels are notched in the surface of the conically formed imbedding composition, between the base of the stump model and fine air discharge channels formed in the support edge of the vessel. The synthetic plastics foil is then drawn or pressed against the model in the usual way.

With this procedure, all the above-mentioned problems are solved satisfactorily, since the use of a kneadable imbedding composition insures good stability of the stump model and there is satisfactory escape of air trapped beneath the synthetic plastics foil so that an extremely high accuracy of fit is attained. In addition, the nature of the socketing of the stump model also insures that no fold formation can occur in the region of the stump base. By the insertion of several vessels into the insert, particularly into corresponding openings therein, rapid series work and good exploitation of the foil are rendered possible.

In addition, a simple preparation of the stump model is made possible in that, after its first pressing into the kneadable composition, this model can be withdrawn again for preparation and then reinserted into the hollow formed by the first pressing-in.

The invention also provides for carrying out of preparation work or fine preparation work, the latter meaning the effecting of fine corrections, upon the stump model after the first or renewed insertion into the kneadable composition by extracting the vessel from the insert, without the necessity to grasp the stump model in any way for this purpose. Hitherto, it was always necessary, for this purpose, to take the entire heavy insert, formed directly as a vessel, with the stump model imbedded therein, in one's hand, which naturally makes specifically fine preparation work very difficult. Additionally, a fine asbestos dough had proven especially advantageous as the imbedding composition.

The apparatus of the invention includes an insert which is attachable to the work plate of a foil-drawing or pressing appliance, and which has a number of openings for the insertion of at least one pot-type vessel having a support edge in which there are formed the fine air discharge channels. These air discharge channels can be formed especially simply and advantageously as radial incisions in the support edge, arranged at equal angular intervals, and which are narrower and the thickness of the synthetic plastics foil utilized, so that blockage of the air discharge channels cannot occur.

With the generally existing extension of the foils over the support edge of the vessel, in order to insure escape of air trapped beneath the foil, it is advisable also to form an air discharge channel system in the insert, beneath the air discharge channels in the support edge of the vessel. Thus, the insert advantageously can be formed with an annular channel and a number of bores opening into the channel perpendicularly thereto and spaced at equal angular intervals therearound.

It is also preferably to round off the support edge of the pot-shaped vessel in such a way that, starting from the base of the stump model, and continuing along the conically formed por-
tion of the imbedding composition and the rounded support edge, there is obtained a continuous curved form, which permits clean application of the foils and thus avoids formation of folds in the foils.

It has been found that if a number of vessels are arranged in one insert for a drawing or pressing operation, as is especially advantageous for rapid series work, the foil hangs itself up on the individual models situated in the vessel, and a relatively deep sagging of the foil occurs between the individual models. As a result, the compressed air or vacuum forces can act in an approximately horizontal direction upon the foil and cause formation of folds between the individual vessels containing the models. These folds can penetrate themselves into the base regions of the models in the individual vessels, whereby the molds obtained become useless.

In accordance with the invention, a feature is that the support edges of the vessels, inserted into the insert, are positioned lower than the surface of the insert. By reason of this procedure, sagging of the foil at the commencement of the drawing or pressing operation is limited, so that the vacuum or pressure forces cannot act to any considerable extent in the horizontal direction against the foil. Thus, major distortions or fold formations of the foil are avoided between the individual models. That is to say they at least cannot occur in the region of the actual models, and especially not in the base regions thereof. In this case, it is preferable to make the formation such that the insert is situated proximately at the level of the base of the models, and further to make the edges of the depressions, formed in the insert to receive the vessels, inclined, since this will contribute to the fold-free course of the foil in the molded condition, as far as possible.

In a particularly advantageous form of the invention, the insert is made in two parts including a lower part which is stationary in relation to the work plate and receiving the vessel, with the support edges resting thereon. The insert includes a second part situated above the lower part and resiliently movable toward the lower part, this second part having openings situated above the vessels, in the initial position, with its surface at the level of, or somewhat below, the heads of the models. As will be apparent, the foil, in this embodiment of the invention, is supported over nearly its entire area immediately at the beginning of the drawing or pressing operation and until a smooth application of the foil to the models occurs all over. Thus, sagging and fold formation are completely prevented.

In this embodiment also, it is preferable to make the openings of the upper movable part with inclined edges, and to make the formation such that the edges of the openings, in the lowered position, cover the support edges of the vessels. Thereby especially good foil support is attained, and furthermore the possibility of the foil entering into the fine air discharge channels in the support edges of the vessels is prevented. The last-described embodiment of the invention is advantageous, above all, because it makes it unnecessary to take particular precautions for the escape of air in the insert, since the air trapped beneath the foil can now flow away laterally and freely through the fine channels in the surface of the conically formed imbedding compositions and through the fine air discharge channels in the support edges of the vessels into the space between the two parts of the insert and the support edges of the vessels.

An object of the invention is to provide an improved apparatus for producing, by deformation of plastic foils, molds for metal casting of small dental prosthetic parts.

A further object of the invention is to provide such an apparatus for ready escape of air trapped under the foil.

Another object of the invention is to provide such an apparatus in which disadvantageous and unwanted folding and deformation of the foil is prevented.

A further object of the invention is to provide such an apparatus in which a pot-type vessel, having a support edge formed with fine air discharge channels, is inserted into an appropriate opening of an insert attachable to a work plate of a foil deforming appliance.

Another object of the invention is to provide such an apparatus in which a kneadable composition is introduced into the vessel and shaped to extend somewhat conically above the support edge thereof.

A further object of the invention is to provide such an apparatus in which the unprepared stump model is pressed into the composition and either retained therein or temporarily removed therefrom during any necessary rough and fine preparation of the stump model, without the necessity for the stump model being manually grasped.

For an understanding of the principles of the invention, reference is made to the following description of typical embodiments thereof as illustrated in the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a vertical sectional view through apparatus embodying the invention:

FIG. 2A is a plan view of the pot-type vessel forming part of the apparatus;

FIG. 2B is a partial diametric sectional view through the pot-type vessel;

FIG. 2C is a vertical sectional view of an alternate embodiment of the invention;

FIG. 3 is a diametric sectional view of the vessel having the imbedding composition introduced thereinto and a stump model inserted into the composition;

FIG. 4 is a top plan view corresponding to FIG. 3;

FIG. 5 is a vertical sectional view illustrating an embodiment of the invention apparatus with a single vessel in an insert and with the foil in the process of application to the stump model;

FIG. 6 is a vertical sectional view of an embodiment of the invention apparatus with several vessels positioned in one insert and with the foil in the process of application to the stump models;

FIG. 7 is a view, similar to FIG. 6, illustrating a modified form of the apparatus;

FIG. 8 is a vertical sectional view, similar to FIGS. 6 and 7, illustrating a preferred embodiment of the invention including a two-part insert, at the beginning of the foil pressing or drawing operation;

FIG. 9 is a view similar to FIG. 8 illustrating the apparatus of FIG. 8 at the termination of the foil pressing or drawing operation.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring first to FIGS. 1 through 4, a small potlike vessel 1 is provided with an externally rounded-off support edge 2 having radial incisions 3 formed therein, as particularly apparent in FIGS. 2A and 2B. Vessel 1 is insertable into an opening 5 of a lid-type insert 4 which can be attached to the work plate (this is not shown) of an ordinary foil-drawing or pressing appliance. Insert 4 has formed therein, beneath support edge 2 of vessel 1, an annular channel 6 and a number of bores 7 perpendicular to the channel 6 and spaced at equal angular intervals from each other, as shown in FIG. 1. The incisions 3 are also spaced at equal angular intervals from each other.

An alternate arrangement is shown in FIG. 2C where a ring of porous material 2a is positioned between the support edge 2 of the vessel 1 and the edge of the opening 5 in the insert 4.

After vessel 1 is placed in an opening 5 in insert 4, a kneadable imbedding composition 8, which is preferably a fine asbestos dough, is introduced into vessel 1 and shaped conically above support edge 2, after which a stump model 9 is pressed centrally into the conically shaped portion of the imbedding composition. After the first pressing of stump model 9 into composition 8, the stump model can be withdrawn again and finally prepared, after which it is reinserted into the hol-
low formed on the first pressing-in, within the composition 8 and without any danger of damage to the finally prepared stamp model. After the final insertion of stamp model 9 into composition 8, fine channels 10 are notched into the conically shaped surface of composition 8, these channels 10 starting from the base of stamp model 9 and extending to the radial incisions 3 in support edge 2, as particularly illustrated in FIGS. 3 and 4.

If now, and in a known manner, the synthetic plastics foil is pressed or drawn against the stamp model, the air trapped beneath the foil can escape through channels 10, incisions 3, channel 6 and bores 7, so that a satisfactorily fitting shaping of the synthetic plastics foil to the model is insured. Additionally, during all the steps of the method, a protective and convenient working of the stamp model can take place, and secure seating of the stamp model, for the pressing or drawing operation, is assured.

FIG. 5 illustrates an arrangement wherein only one vessel 1 is used in an insert 4 and, in such case, foil 20 applies itself well on all surfaces of tooth model 9, on the imbedding composition 8, and on the support edge 2 of vessel 1. Thus, formation of folds, especially in the region of the base of tooth model 9, is avoided.

On the other hand, and as shown in FIG. 6, when there is used an insert 4a receiving a number of vessels 1, at the beginning of the drawing or pressing operation, foil 20 sags relatively deeply between the individual tooth models 9 so that, as a result of the then horizontally acting pressure or vacuum forces, fold formations in foil 20 can occur between the individual models. These can be propagated into the region of the bases of the models, so that the resulting molds are useless.

FIG. 7 illustrates an improved embodiment of the invention in which depressions 17 are formed in an insert 4b, and have the openings for individual vessels 1 formed in the bases thereof. The edges 18 of the individual depressions are flattened off or inclined, and the top surface 19 of insert 4b is situated approximately at the level of the bases of the models 9. Thus, and as illustrated in FIG. 7, the sag of foil 20, during the drawing or pressing operation, is limited, so that horizontal vacuum or pressure forces cannot act to any appreciable extent upon the foil. Thereby, formation of folds in the foil is avoided, at least in the base regions of the models.

In a preferred embodiment of the invention as shown in FIGS. 8 and 9, there is a two-part insert 4c, the lower part 12 of which is stationarily fitted on the work plate (not shown) of the appliance. The individual vessels 1, with supported support edges 2, are inserted into stationary part 12 in the same way as in the embodiment of the invention shown in FIG. 6.

Above stationary part 12 of insert 4c, there is a movable part 11 which is lowerable in a direction towards stationary part 12 under the action of the vacuum or pressure and against the bias of coil springs 13a surrounding guide pins 13. Movable part 11 is formed with openings 14 with inclined or bevelled edges 15 above the individual vessel. As illustrated particularly in FIG. 9, these edges, in the lowered condition of upper mold part 11, cover the support edges 2 of vessels 1.

As shown in FIG. 8, the initial position of movable part 11 is such that foil 20, at the beginning of the pressing or drawing operation, rests nearly uniformly upon the upper surface 16 of movable part 11 and on the heads of tooth models 9. Thus, from the outset, sagging of foil 20, between the individual models, cannot occur, and a completely smooth mold is obtained even between the individual models.

Furthermore, and as indicated by the arrows in FIGS. 8 and 9, the air trapped beneath foil 20 can flow away laterally through the fine air discharge channels 3, in support edges 2, into the space between stationary part 12 and movable part 11 of insert 4c, so that no particular air escape precautions need be taken in the insert per se.

While specific embodiments of the invention have been shown and described in detail to illustrate the application of the principles of the invention, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. In apparatus for producing, by the deformation of plastics foil under fluid pressure, pattern molds for shell molds used for metal casting of small dental prosthesis parts, such as crowns and caps, and with which a stamp model is imbedded in a vessel attachable to a work plate of a foil deforming appliance the improvement comprising, in combination, an insert attachable to said work plate and formed with a number of openings; and at least one pot-type vessel, having an outwardly extending support edge formed with fine air discharge channels, insertable into an appropriate opening of said insert.

2. In apparatus for producing molds, the improvement claimed in claim 1, in which said air discharge channels are formed as radial incisions in said support edge and are arranged at equal annular intervals therearound; said radial incisions being narrower than the thickness of the synthetic plastics foils utilized.

3. In apparatus for producing molds, the improvement claimed in claim 1, in which said insert is formed with an air discharge channel system beneath and communicating with the air discharge channels in said support edge of said vessel.

4. In apparatus for producing molds, the improvement claimed in claim 3, in which said air discharge channel system in said insert comprises an annular channel and a plurality of bores opening into said last-named channel perpendicularly thereto and arranged at equal angular intervals therearound.

5. In apparatus for producing molds, the improvement claimed in claim 1, in which said air discharge channel system in said insert comprises an annular channel and a plurality of bores opening into said last-named channel perpendicularly thereto and arranged at equal angular intervals therearound.

6. In apparatus for producing molds, the improvement claimed in claim 1, in which the external surface of said support edge of said vessel is rounded off.

7. In apparatus for producing molds, the improvement claimed in claim 1, in which the support edges of vessels inserted into said insert are positioned beneath the upper surface of said insert.

8. In apparatus for producing molds, the improvement claimed in claim 1, in which the upper surface of said insert is positioned substantially at the level of the bases of the models.

9. In apparatus for producing molds, the improvement claimed in claim 1, in which said vessels are inserted in depressions in said insert, the edges of said depressions being bevelled.

10. In apparatus for producing molds, the improvement claimed in claim 1, in which said insert is a two-part insert including a lower part positioned in stationary relation on said work plate and supporting said vessels through their support edges; said insert including an upper part positioned above said lower part and resiliently biased away from said lower part, said upper part having openings formed above said vessels and having an initial position in which it does not extend above the level of the heads of the models.

11. In apparatus for producing molds, the improvement claimed in claim 10, in which the openings in said upper part of said insert are formed with bevelled edges which, in the lowered position of said upper part of said insert, cover said support edges of said vessels.