

Description

The present invention relates to dental models and, more particularly, to molds and methods for using same to form a base of a dental model and to bases formed from such molds.

To accurately form and position false teeth or caps, a dentist normally makes a negative impression of the affected tooth or teeth. The negative impression may be partial, unilateral or bilateral, depending upon the extent of work to be done; the negative impression serves as a mold for developing a die of the patient's tooth or teeth. The negative impression is obtained by partially filling a tray with thermoplastic material. The filled tray is inserted within the patient's mouth such that the teeth and adjacent gum sink into and create a cavity within the thermoplastic material. Shortly thereafter, the thermoplastic material will cure and obtain an exact impression of the patient's teeth and adjacent gum. This is an essentially standard technique presently used by most dentists.

To form a tooth die, a pourable casting stone, known as pink stone is poured into the negative impression up to at least the margin or base of the tooth. The pink stone is compacted to preclude voids and remove any air bubbles. After the pink stone is at least partially cured, wax or similar lubricant is swathed upon the surface of the pink stone.

In the prior art, the base for the dental mold is made by one of two methods. First, additional pourable hardenable stone, generally referred to as yellow stone, is poured within the negative impression to cover the pink stone and the retainer with sufficient depth of yellow stone to form a solid base. After both the pink stone and the yellow stone have hardened, the tray and supported thermoplastic material is peeled away to leave a conventional dental model. Alternatively, a patty of yellow stone is formed upon a glass or other smooth surface. The partially or completely cured pink stone is placed thereupon.

In either method, pins are lodged or fixated in the pink stone to extend into and slidably engage the yellow stone. Usually, three pins per model tooth to be worked on are used. The pins serve the function of maintaining registration of the model tooth with respect to the remaining die.

Either of the prior art methods for making the base of yellow stone requires substantial technician time to manually form the yellow stone into an initial shape. After it is cured, further time is required for cutting and grinding away excess yellow stone material. The time spent and material wasted necessarily adds to the cost of the dental model to the ultimate detriment of the patient.

Either of the above processes for making the

bases of dental models tends to result in each base being somewhat unique and individualized. When the dental models are placed upon a dental articulator to perform work on the dental model, a substantial amount of time and expertise is necessary to properly attach and align the upper and lower coacting dental models to reproduce the relationship of the patient's jaws. The requisite time for aligning the dental models is exacerbated by the nonuniformity of the dental model base configurations and thicknesses and requires yet further time and effort to positionally orient and attach each base upon its respective arm of the articulator.

The dental base described and illustrated in United States Patent No. 4,378,929 is formed by pouring the yellow stone into a mold. The mold standardizes the width, breadth, height and configuration of the base. Such standardization permits the use of indexing means in the bases to mount opposing bases of a dental model upon an articulator. Additionally, there is described and illustrated the use of an overhang for forcing a depression in the surface of the base to which the tooth die is attached, which depression delineates a platform. The tooth die (pink stone) is attached upon the platform. To sever a model tooth from the tooth die, mesial and distal saw cuts are made through the tooth die to a point just below the line of demarcation between the tooth die and the base. The line of demarcation is coincident with the surface of the platform. As the saw blade need not be angled to have the saw end clear the opposing quadrant of the tooth die, the depth of cut into the base may be minimized at a point just below the platform surface.

In United States Patent No. 4,382,787, there is described an articulator attachable to opposed pairs of dental model bases for dental models of the type described in United States Patent No. 4,378,929. One embodiment of the mounting means usable as part of the articulator includes a tab, tang or ridge for penetrable engagement with a slot formed in the rear sidewall of a dental model base.

The primary object of the present invention is to provide a standard sized base for a full or quadrant dental model and having a slot formed in the rear sidewall of the base, which slot is enhanced for adhesive engagement with an arm or an articulator.

According to the present invention there is proposed a flexible mold for forming, from a pourable hardenable compound deposited therein, the base of a dental model usable with an articulator, said mold comprising:

(a) a flexible sidewall for defining the perimeter of a mold cavity generally triangular in planform and having a planform that delineates the con-

figuration of said base to be formed, said flexible sidewall having an upper edge for defining the opening to the mold cavity which opening is essentially dimensionally coincident with the maximum, dimensional planform of the mold cavity;

(b) a flexible substrate for defining a generally flat bottom of the mold cavity said substrate and said sidewall member cooperating to define the bottom and lateral surfaces of the mold cavity;

(c) a shelf attached to a limited portion of said sidewall and extending within the perimeter of the mold cavity along a projection axis substantially parallel to the bottom and only partially across the mold cavity;

(d) said substrate and said sidewall being bendable in concert to lower sufficiently that part of said upper edge of said sidewall across the mold cavity from the location of said shelf to permit withdrawal of the formed base from the mold cavity along the projection axis of said shelf and allow sliding disengagement of the receptacle from said shelf;

said mold being characterised in that the shelf delineates a striated receptacle within the base to which receptacle the articulator may be attached, a plurality of ribs being disposed upon at least one of said shelf or upon said sidewall in proximity to said shelf for forming a plurality of striations in the receptacle of the base or in the base in proximity to the receptacle respectively.

Thus, the invention is directed to a uniformly sized full or quadrant dental model base having a slot formed within the rear sidewall which slot and sidewall are enhanced for adherence with an articulator and to a method for making such a base. Optionally, the base may include a platform for supporting the tooth die, as described in Patent No. 4,378,929.

The present invention also proposes a method of forming a base of a dental model from a pourable hardenable compound the base being usable with an articulator, the method comprising the steps of:

(a) defining the perimeter of a mold cavity and the opening to the mold cavity which opening is essentially dimensionally coincident with the maximum, dimensional planform of the mold cavity with a flexible sidewall and an upper edge of the sidewall respectively;

(b) further defining the bottom of the mold cavity with a flexible substrate cooperating with the sidewall to define the bottom and lateral surfaces of the mold cavity;

(c) removing the base formed from the mold cavity by bending the sidewall and substrate in concert to lower that part of the upper edge of the sidewall across the mold cavity from the

location of the protrusion;

(d) withdrawing the formed base from the mold cavity substantially along the projection axis of the protrusion to allow sliding disengagement of the protrusion from within the receptacle formed in the base;

the method being characterised by:

(e) forming, with a ribbed protrusion attached to a limited portion of the sidewall and extending within the perimeter of the mold cavity along a projection axis and partially across the mold cavity, a plurality of ribs being disposed upon at least one of said shelf, or upon said sidewall in proximity to said shelf a striated receptacle within the base, striations being provided in at least one of the receptacle of the base or in the base in proximity to the receptacle respectively to which receptacle the articulator may be attached.

Another object of the present invention is to provide a mold for making a base for a full or quadrant dental model, which mold includes a ribbed shelf for forming a striated slot in the rear sidewall of the base to enhance adhesive engagement between the base and an arm of an articulator.

These and other objects of the present invention will become apparent to those skilled in the art as the description thereof proceeds.

The present invention may be described with greater specificity and clarity with reference to the following drawings, in which:

Fig. 1 is a perspective view of full dental model base constructed in accordance with the present invention and attached to an articulator;

Fig. 2 is a side view showing the bases of the present invention attached to an articulator;

Fig. 3a is a perspective view illustrating a dental model base constructed in accordance with the present invention;

Fig. 3b illustrates a detail shown in Fig. 3a;

Fig. 3c is a cross sectional view taken along lines 3c-3c, shown in Fig. 3a;

Fig. 4a illustrates a mold for making a model dental base;

Fig. 4b illustrates a detail shown in Fig. 4a;

Fig. 5 is a cross sectional view taken along lines 5-5, as shown in Fig. 4a;

Figs. 6, 7 and 8 illustrate a method for molding a standard sized dental model base;

Fig. 9 is a perspective view of quadrant dental model bases constructed in accordance with the present invention and attached to an articulator;

Fig. 10 is a top view illustrating opposing quadrant dental model bases attached to an articulator;

Fig. 11 illustrates a mold for making a quadrant dental model base;

Fig. 12 is a top view of the mold shown in Fig. 11; and

Fig. 13 is a cross sectional view taken along lines 13-13 as shown in Fig. 12.

In the practice of prosthetic dentistry, one very important technical problem is the shaping and fitting of the restoration occlusal surfaces to register, meet and operatively cooperate with opposed surfaces in conformity with the established habits, idiosyncrasies and tooth facet inclinations of the user. The many factors peculiar to the individual have heretofore made proper operative correlation of the restoration with the associated dental elements almost invariably a matter susceptible of satisfactory resolution only through repetitious adjustments and modifications had in the dental chair after installation of the restoration. This occurs despite the use of fixed, even though adjustable, mechanically simulated axis articulation, planes and axes of occlusion, lines, planes and axis of symmetry and the like which fail to provide the full orbital range necessary for reconstitution of the natural dental relationships determinable from the traces and indices upon and established through use of the original dentures. To facilitate attainment of the desired operative registration between restorations and their associated dental elements and thereby largely obviate the necessity for adjustments and corrections in the dental chair, the present invention provides dental model bases particularly configured to mate with a specifically configured articulator to prove a device for laboratory use by dentists or it can be fully and accurately portrayed and operatively duplicated as a check mounting for the restoration.

Referring to Fig. 1, there is shown a complete dental model 10 having a pair of mating full dental model casts 12 and 14 simulative of the original dentures and the condition requiring restoration or correction. An articulator 16 is attached to the casts to maintain them positionally simulative of the natural relationships portrayed when substantially in parallel relationship at one limit of the range of relative movement. A pair of interconnecting elements or brackets 18 and 20 are pivotally attached to one another and are of resilient flexible material sufficient to accommodate relative movement about all axes and within all planes between the casts in simulation of the operative range and pattern of the original dentures.

Referring jointly to Figs. 1 and 2, further detail of articulator 16 and its relationship to casts 12 and 14 will be described. First and second mounting means 22 and 24 are attached to casts 12 and 14, respectively. Each mounting means includes a semi-spherical or partially spherical depression disposed at the respective extremity; in example, mounting means 22 includes depression 26 and

mounting means 24 includes depression 28. Brackets 18 and 20 include spheres 30, 32 sized to receivingly mate with depressions 26, 28 respectively. Brackets 18 and 20 are pivotally joined to one another by pivot means 34, 36; the pivot means may be a flexible interconnection or of the snap fit type illustrated.

To mount articulator 16, mounting means 22 and 24 are attached to the rear sidewalls of the respective casts. Spheres 30 and 32 are located within the respective depressions 26, 28 upon angular adjustment of the respective brackets to obtain the requisite spatial relationship therebetween; nominally, the brackets define an interior obtuse angle. To maintain the casts in the predetermined fixed spatial relationship to one another at one limit of the range of relative movement, an adhesive is applied intermediate the spheres and their respective depressions to fixedly secure the respective brackets in fixed angular orientation with respect to the mounting means. Pivotal movement of the casts is effected by relative angular displacement between the joined brackets about the respective pivot means or hinge line. Translational movement in any plane and rotational movement about any axis of the casts with respect to one another is accommodated by the flexing of brackets 16 and 18.

Mounting means 22 and 24 may be generally triangular in one plane to provide an apex within which the depressions (26, 28) are formed. To simplify manipulation of articulator 16 during attachment to the casts and fixation of the angular relationship between the brackets and the mounting means, retaining fingers 31 and 33 may be employed to extend from the perimeter of depressions 26, 28 respectively. These fingers are of resilient material and, in the quiescent state, cant toward one another to provide snap retention for a sphere inserted within the respective depressions. By the use of such fingers, the components of articulator 16 are retained attached to one another during positioning of casts 12 and 14. Upon achievement of the initial positioning orientation of the casts, an adhesive, such as any one of the commercially available fast setting cyanoacrylate, aerobic or anaerobic adhesives, may be employed to fixate each sphere within its respective depression.

Each of mounting means 22 and 24 includes a tab, key or ridge 42, extending from planar side 44 of the respective mounting means. A receptacle, key way or slot 48, 50 is formed in rear sidewalls 52, 54, respectively, of bases 12, 14 to matingly receive the ridge of the respective mounting means. The resulting mechanical engagement between the mounting means and the casts, in combination with mastic or adhesive disposed therebetween, rigidly secures each mounting means to

its respective cast.

Preferably, each slot 48, 50 is wider than the ridge to be inserted therein to permit lateral movement in attaching the respective mounting means thereto and to permit deliberate offset attachment of the articulator for particular purposes. Mounting means 22 and 24 are preferably of plastic and formed by any one of several available plastic forming techniques; thereby, the size, positioning and angular relationship between the ridge and the respective side mounting means can be controlled to close tolerances. Through the method to be described below, the height, width, length and configuration of each of bases 12 and 14 can be standardized and the configuration, positioning and angular orientation of slots 48, 50 with respect to the rear walls 52, 54 of the casts can be held to close tolerances. The resulting fit achievable between each slot and its ridge along with the parallelism achievable between the opposing adjacent sides and rear walls create a strong mechanical junction between each cast and the respective mounting means of the articulator. The further use of an adhesive to bond the mounting means to the casts ensures maintenance of a fixed relationship therebetween.

Referring to Fig. 3a, there is shown a standard sized dental model cast 14 having a base 60 upon which has been mounted a model tooth die 62. A slot 50 extends horizontally inwardly from rear sidewall 54; as described above, this slot receives a corresponding ridge 42 from one of the mounting means of the articulator. A method for securing the mounting means (24) to a cast (14) is by the application of an adhesive intermediate planar side 44 of the mounting means and rear sidewall 54 and between the surfaces of ridge 42 and the corresponding surfaces of slot 50. If the mounting means is held flush against the rear sidewall, penetrating of the adhesive intermediate the mounting means and the rear sidewall and slot must occur through wicking of the adhesive. Such wicking may be more or less effective in penetration throughout the juxtaposed surfaces of the mounting means and the rear sidewall and slot. To assure substantial wicking each and every time an adhesive is applied, channels 64 are formed in rear sidewall 54, which channels extend into the opposing sides of slot 50. As more particularly illustrated in Figs. 3b and 3c, a plurality of channels 64 are dispersed along slot 50. These channels are depicted as being parallel with one another. Moreover, the channels formed in the lower part of the rear sidewall and extending into side 66 of channel 50 are in general alignment with the channels extending from the upper rear sidewall into side 68 of slot 50. It is to be understood that channels 64 do not have to be parallel with one another or uniformly

spaced along slot 50 nor do the channels have to be formed with opposing counterparts on either side of the slot.

With channels 64 developed in cast 14, any adhesive applied intermediate the mounting means and the rear sidewall of a cast will, by its own wicking action and by transport in channels 64, tend to flow essentially throughout the junction between planar side 44 of the mounting means and the corresponding rear sidewall and between the surfaces of ridge 42 and the corresponding areas of slot 50. The resulting spread of adhesive will help assure a more rigid and stable bond between the mounting means and the cast than is achievable without the presence of channels 64.

Referring jointly to Figs. 4 to 8, a mold 70 for developing base 60 will be described. Mold 70 is formed as a monolithic unit of a rubber or rubber-like compound to provide sufficient rigidity to delineate the configuration of the base to be formed and yet permit outward bending and stretching of the mold sidewalls to effect release and removal of the formed base. An example of a suitable rubber compound is sold by the Friedheim Tool Supply Company under the mark Jofre.

A continuous sidewall 72 extends upwardly from a substrate or floor 74. The junction therebetween may be sharp edged, as illustrated, or may be curved, depending upon manufacturing considerations attendant formation of the mold. Sidewall 72 includes a rear sidewall 76 for defining the planar rear wall 54 of base 60 to be formed (see Fig. 3a). A protrusion or shelf 78, which is preferably parallel with floor 74, extends inwardly into mold cavity 80. The shelf is disposed approximately midway up inner side 82 of rear sidewall 76. The shelf will form an indentation or slot in the base to be molded. A plurality of ribs 84, 86 are disposed upon the upper and lower surfaces of shelf 78, respectively. These ribs may extend from the edge of the shelf to inner side 82 of rear sidewall 76. Furthermore, ribs 84, 86 may extend upwardly and downwardly, respectively, on inner side 82 from the shelf, as illustrated. These ribs develop channels 64 in cast 60, as illustrated in Figs. 3a, 3b and 3c.

To form a dental model cast 60 (see Fig. 3a), yellow stone 88 in a flowable state is poured into mold cavity 80, as illustrated in Fig. 5. The yellow stone will flow beneath and around shelf 78 and up to a level coincident with the top of continuous sidewall 72. A screed or the like may be employed to obtain a level top surface of the yellow stone. Before the yellow stone sets, a tooth die 62 (pink stone), having a plurality of dowels or pins 90 depending therefrom is placed upon the uncured exposed surface of base 60. Preferably, the extending part of pins 90 is commensurate in length

with the thickness of base 60, as shown in Fig. 6; the pins are coated with a release agent to permit sliding engagement with the base after the yellow stone is cured.

After curing of the yellow stone, front end 92 of continuous sidewall 72 is pried forwardly and downwardly away from the corresponding front 94 of base 60, as shown in Fig. 7, to permit manual grasping of the base. Thereafter, the base is pulled forwardly of mold 70 to permit sliding disengagement between shelf 78 and the resulting slot 50 formed in base 60 along with channels 64 formed in rear sidewall 54 and the slot; note in particular Fig. 8. Thereafter, the mold is released, which release permits it to resume its shape as depicted in Fig. 4a. The mold is now ready to be used in the making of a further full base 60. The dental model cast withdrawn from mold 70 corresponds to the configuration illustrated in Fig. 3a. It is now ready for attachment to articulator 16.

Referring to Fig. 9, there is shown a complete dental model 100 having a pair of mating quadrant dental model casts 102, 104 simulative of the original dentures and the condition requiring restoration or correction. An articulator 16, like that shown and described with respect to Figs. 1 and 2, is attached to the casts to maintain them positionally simulative of the natural relationships portrayed when substantially in parallel relationship at one limit of the range of relative movement. Mounting means 22, 24 each include a ridge 42 extending from planar side 44, of the respective mounting means. A slot 106, 108 is formed in rear wall 110, 112, respectively, of bases 114, 116 of casts 102, 104 to matingly receive the ridge of the respective mounting means.

As described above with respect to cast 14, a plurality of channels 118 are formed in the face of rear wall 110 in communication with slot 106. These channels may extend into one or both opposed sides of the slot. Alternatively, the channels may be formed only in one or both opposed sides of the slot.

Similarly, a plurality of channels 120 are disposed in rear wall 112 in communication with slot 108 or be limited to the slot. These channels may also extend into one or both of the opposed sides of slot 108. By employing such channels, wicking of the adhesive between planar side 44 of each of mounting means 22, 24 and the respective rear wall of casts 114, 118 is greatly encouraged. With the enhanced spread of adhesive, the bond formed on curing of the adhesive is likely to be quite robust. The resulting mechanical engagement between the mounting means and the casts, in combination with mastic or adhesive disposed therebetween, rigidly secures each mounting means to its respective cast.

Referring to Fig. 10, there is shown a standard sized quadrant dental model cast 102 having a base 114 upon which has been mounted a model tooth die 122. Slot 106 extends horizontally inwardly from rear wall 110. As described above, this slot receives a corresponding ridge from one of the mounting means of the articulator.

A mold 130 for developing base 114 will be described with reference to Fig. 11. The mold is formed as a monolithic unit of rubber or rubber-like compound to provide sufficient rigidity to delineate the configuration of the base to be formed and yet permit outward bending and stretching of the mold sidewalls to effect release and removal of the formed base. A continuous sidewall 132 extends upwardly from substrate or floor 134. The sidewall includes a rear sidewall 136 for defining the planar rear wall 110 of the base (see Fig. 10). A shelf 138, which may be parallel with floor 134, extends inwardly into mold cavity 140. The shelf is disposed approximately midway up to the top of rear sidewall 136. To form channels 118 in cast 114, a plurality of ribs 142 are formed on the upper surface of shelf 138 and a further plurality of ribs 144 are formed in the lower surface of the shelf; see Figs. 12 and 13. These ribs may extend rearwardly to the inside surface of rear wall 136 and extend therealong in opposed directions from shelf 138; alternatively, the ribs may be disposed only upon the surface of rear wall 136.

To form a quadrant dental cast 102 (see Fig. 10), yellow stone in a flowable state is poured into mold cavity 140. The yellow stone will flow beneath and around shelf 138 and up to a level coincident with the top of continuous sidewall 132. A screed or the like may be employed to obtain a level top surface of the yellow stone. Before the yellow stone sets, a tooth die 122 having a plurality of pins depending therefrom is placed upon the uncured exposed surface of the base. Preferably, the extending part of the pins is commensurate in length with the thickness of the base to be formed.

After the yellow stone has cured, front end 146 of continuous sidewall 132 is pried forwardly and downwardly away from the corresponding front of the base formed to permit grasping of the base. Thereafter, the base is pulled forwardly of mold 130 to permit sliding disengagement between shelf 138 and the resulting slot 106 formed in base 114. Reference may be made to Figs. 7 and 8 for these steps.

In the above discussion attendant Figs. 11 to 13, mold 130 for forming cast 114 has been discussed. It is to be understood that a mirror image of mold 130 is developed to obtain cast 116. All the elements and relationships described with respect to mold 130 would be incorporated in the mirror image of the mold. Thus, cast 116 is and would be

a mirror image of cast 114.

While the principles of the invention have now been made clear in an illustrative embodiment, there will be immediately obvious to those skilled in the art many modifications of structure, arrangement, proportions, elements, materials and components, used in the practice of the invention which are particularly adapted for specific environments and operating requirements without departing from those principles.

Claims

1. A flexible mold (70;130) for forming, from a pourable hardenable compound deposited therein, the base (60;114) of a dental model (10;100) usable with an articulator (16), said mold (70;130) comprising:

(a) a flexible sidewall (72;132) for defining the perimeter of a mold cavity (80;140) generally triangular having a planform that delineates the configuration of said base (60;114) to be formed, said flexible sidewall (72;132) having an upper edge for defining the opening to the mold cavity (80;140) which opening is essentially dimensionally coincident with the maximum, dimensional planform of the mold cavity (80;140);

(b) a flexible substrate (74;134) for defining a generally flat bottom of the mold cavity (80;140) said substrate (74;134) and said sidewall member (72;132) cooperating to define the bottom and lateral surfaces of the mold cavity (80;140);

(c) a shelf (78;138) attached to a limited portion of said sidewall (72;132) and extending within the perimeter of the mold cavity (80;140) along a projection axis substantially parallel to the bottom and only partially across the mold cavity (80;140);

(d) said substrate (74;134) and said sidewall (72;132) being bendable in concert to lower sufficiently that part of said upper edge of said sidewall (72;132) across the mold cavity (80;140) from the location of said shelf (78;138) to permit withdrawal of the formed base (60;114) from the mold cavity (80;140) along the projection axis of said shelf (78;138) and allow sliding disengagement of the receptacle from said shelf (78;138);

said mold being characterised in that the shelf (78;138) delineates a striated receptacle (48,50;106,108) within the base (60;102) to which receptacle (48,50;106,108) the articulator (16) may be attached, a plurality of ribs (84,86;142,144) being disposed upon at least one of said shelf (78;138) or upon said sidewall (72;132) in proximity to

said shelf (78;138) for forming a plurality of striations (64;118,120) in the receptacle (48,50;106,108) of the base (60;114) or in the base (60;114) in proximity to the receptacle (48,50;106,108) respectively.

2. The mold (70;130) as set forth in claim 1, characterised in that the mold cavity (80;140) is generally triangular in planform.

3. The mold (70;130) as set forth in claim 2, characterised in that said limited sidewall portion corresponds to the base portion (60,114) of the triangular planform.

4. The mold (70;130) as set forth in claim 1 or claim 2, characterised in that a plurality of ribs (84,86;142,144) are disposed upon the upper and lower surface of the shelf (78;138) and a plurality of ribs (84,86;142,144) are disposed upon the said sidewall (72;132).

5. The mold (70;130) as set forth in any preceding claim, characterised in that said plurality of ribs (84,86;142,144) disposed upon said shelf (78;138) are oriented parallel with the said projection axis.

6. A mold (70;130) as claimed in any preceding claim, characterised in that at least one of the plurality of ribs (84,86;142,144) on the shelf (78;138) extends onto the sidewall (72;132) to form a continuous rib (84,86;142,144).

7. The mold (70;130) as set forth in any preceding claim, characterised in that the individual ribs (84,86;142,144) of the respective said plurality of ribs (84,86;142,144) are parallel with one another.

8. The mold (70;130) as set forth in any preceding claim, characterised by ribs (84,86;142,144) disposed along said sidewall (72;132) and extending within the perimeter of the mold cavity (80;140) for delineating a striated surface on the base (60;114) and to which surface the articulator (16) may be attached.

9. A method of forming a base (60;114) of a dental model (10;102,104) from a pourable hardenable compound the base (60;114) being usable with an articulator (16), the method comprising the steps of:

(a) defining the perimeter of a mold cavity (80;140) and the opening to the mold cavity (80;140) which opening is essentially dimensionally coincident with the maximum, dimensional planform of the mold cavity



a mirror image of cast 114.

While the principles of the invention have now been made clear in an illustrative embodiment, there will be immediately obvious to those skilled in the art many modifications of structure, arrangement, proportions, elements, materials and components, used in the practice of the invention which are particularly adapted for specific environments and operating requirements without departing from those principles.

Claims

1. A flexible mold (70;130) for forming, from a pourable hardenable compound deposited therein, the base (60;114) of a dental model (10;100) usable with an articulator (16), said mold (70;130) comprising:

(a) a flexible sidewall (72;132) for defining the perimeter of a mold cavity (80;140) generally triangular having a planform that delineates the configuration of said base (60;114) to be formed, said flexible sidewall (72;132) having an upper edge for defining the opening to the mold cavity (80;140) which opening is essentially dimensionally coincident with the maximum, dimensional planform of the mold cavity (80;140);

(b) a flexible substrate (74;134) for defining a generally flat bottom of the mold cavity (80;140) said substrate (74;134) and said sidewall member (72;132) cooperating to define the bottom and lateral surfaces of the mold cavity (80;140);

(c) a shelf (78;138) attached to a limited portion of said sidewall (72;132) and extending within the perimeter of the mold cavity (80;140) along a projection axis substantially parallel to the bottom and only partially across the mold cavity (80;140);

(d) said substrate (74;134) and said sidewall (72;132) being bendable in concert to lower sufficiently that part of said upper edge of said sidewall (72;132) across the mold cavity (80;140) from the location of said shelf (78;138) to permit withdrawal of the formed base (60;114) from the mold cavity (80;140) along the projection axis of said shelf (78;138) and allow sliding disengagement of the receptacle from said shelf (78;138);

said mold being characterised in that the shelf (78;138) delineates a striated receptacle (48,50;106,108) within the base (60;102) to which receptacle (48,50;106,108) the articulator (16) may be attached, a plurality of ribs (84,86;142,144) being disposed upon at least one of said shelf (78;138) or upon said sidewall (72;132) in proximity to

said shelf (78;138) for forming a plurality of striations (64;118,120) in the receptacle (48,50;106,108) of the base (60;114) or in the base (60;114) in proximity to the receptacle (48,50;106,108) respectively.

2. The mold (70;130) as set forth in claim 1, characterised in that the mold cavity (80;140) is generally triangular in planform.

3. The mold (70;130) as set forth in claim 2, characterised in that said limited sidewall portion corresponds to the base portion (60,114) of the triangular planform.

4. The mold (70;130) as set forth in claim 1 or claim 2, characterised in that a plurality of ribs (84,86;142,144) are disposed upon the upper and lower surface of the shelf (78;138) and a plurality of ribs (84,86;142,144) are disposed upon the said sidewall (72;132).

5. The mold (70;130) as set forth in any preceding claim, characterised in that said plurality of ribs (84,86;142,144) disposed upon said shelf (78;138) are oriented parallel with the said projection axis.

6. A mold (70;130) as claimed in any preceding claim, characterised in that at least one of the plurality of ribs (84,86;142,144) on the shelf (78;138) extends onto the sidewall (72;132) to form a continuous rib (84,86;142,144).

7. The mold (70;130) as set forth in any preceding claim, characterised in that the individual ribs (84,86;142,144) of the respective said plurality of ribs (84,86;142,144) are parallel with one another.

8. The mold (70;130) as set forth in any preceding claim, characterised by ribs (84,86;142,144) disposed along said sidewall (72;132) and extending within the perimeter of the mold cavity (80;140) for delineating a striated surface on the base (60;114) and to which surface the articulator (16) may be attached.

9. A method of forming a base (60;114) of a dental model (10;102,104) from a pourable hardenable compound the base (60;114) being usable with an articulator (16), the method comprising the steps of:

(a) defining the perimeter of a mold cavity (80;140) and the opening to the mold cavity (80;140) which opening is essentially dimensionally coincident with the maximum, dimensional planform of the mold cavity



(80;140) with a flexible sidewall (72;132) and an upper edge of the sidewall (72;132) respectively;

(b) further defining the bottom of the mold cavity (80;140) with a flexible substrate (74;134) cooperating with the sidewall (72;172) to define the bottom and lateral surfaces of the mold cavity (80;140);

(c) removing the base (60;114) formed from the mold cavity (80;140) by bending the sidewall (72;132) and substrate in concert to lower that part of the upper edge of the sidewall (72;132) across the mold cavity (80;140) from the location of the protrusion (78;138);

(d) withdrawing the formed base (60;114) from the mold cavity (80;140) substantially along the projection axis of the protrusion (78;138) to allow sliding disengagement of the protrusion (78;138) from within the receptacle (48,50;106,108) formed in the base (60;114).

the method being characterised by:

(e) forming, with a ribbed protrusion (78;138) attached to a limited portion of the sidewall (72;132) and extending within the perimeter of the mold cavity (80;140) along a projection axis and partially across the mold cavity (80;140), a plurality of ribs (84,86;142,144) being disposed upon at least one of said shelf (78;138), or upon said sidewall (72;132) in proximity to said shelf (78;138) a striated receptacle (48,50;106,108) within the base (60;114), striations (64;118,120) being provided in at least one of the receptacle (48,50;106,108) of the base (60;114) or in the base (60;114) in proximity to the receptacle (48,50;106,108) respectively to which receptacle (48,50;106,108) the articulator (16) may be attached.

10. The method as set forth in claim 9, characterised in that said step of forming includes the step of forming the protrusion (78;138) at a location intermediate the upper edge of the sidewall (72;132) and the substrate (74;134).

11. The method as set forth in claim 9, wherein the ribbed protrusion includes ribs (84,86;142,144) oriented parallel with the projection axis.

12. The method as set forth in any of claims 9 to 11, characterised in that said step of further forming includes the step of further forming the striations (64;118,120) within the base (60;114) adjacent at least one side of the receptacle

(48,50;106,108).

13. The method as set forth in any of claims 9 to 12, characterised in that the ribs (84,86;142,144) extending from the sidewall (72;132) are parallel with one another and at least one of said ribs (84,86;142,144) is continuous with a corresponding rib (84;86) disposed upon said shelf (78;138) and said step of further forming creates parallel striations (64;118,120) in the base (60;114).

14. The method as set forth in claim 12, wherein the step of further forming includes the step of further forming the striations (64;118,120) within the base (60;114) adjacent opposed sides of the receptacle (48,50;106,108).

Revendications

1. Moule souple (70;130) pour former, à partir d'un composé coulable et durcissable qui y est déposé, la base (60;114) d'un modèle dentaire (10;100) utilisable avec un articulateur (16), ledit moule (70;130) comprenant :

a) une paroi latérale souple (72;132) définissant le périmètre d'une empreinte de moule (80;140) dont la forme, vue en plan, est sensiblement triangulaire et dessine la configuration de ladite base (60;114) à former et dont le bord supérieur définit l'ouverture de l'empreinte de moule (80;140), ladite ouverture coïncidant sensiblement, dans ses dimensions, avec la forme dimensionnelle maximale de ladite empreinte de moule (80;140), vue en plan :

b) un substrat souple (74;134) définissant un fond sensiblement plat de l'empreinte de moule (80;140), ledit substrat (74;134) et ladite paroi latérale (72;132) coopérant pour délimiter le fond et les surfaces latérales de l'empreinte de moule (80;140) ;

c) une plaque (78;138) fixée à une partie limitée de la paroi latérale (72;132) et faisant saillie à l'intérieur du périmètre de l'empreinte de moule (80;140) le long d'un axe de projection sensiblement parallèle au fond et traversant seulement en partie l'empreinte de moule (80;140) ;

d) ledit substrat (74;134) et ladite paroi latérale (72;132) étant incurvables simultanément afin d'abaisser suffisamment la partie du bord supérieur de ladite paroi latérale (72;132) en travers de l'empreinte de moule (80;140) à partir de l'emplacement de ladite plaque (78;138) pour permettre l'extraction de la base formée (60;114) de l'empreinte de moule (80;140) le long de l'axe de pro-



jection de ladite plaque (78;138) et autoriser le dégagement par glissement du réceptacle de ladite plaque (78;138) ;

ledit moule étant caractérisé en ce que la plaque (78;138) dessine dans la base (60;114) un réceptacle strié (48,50;106,108) auquel l'articulateur (16) peut être fixé, une pluralité de nervures (84,86;142,144) étant disposées au-dessus d'au moins l'une de ladite plaque (78;138) ou de ladite paroi latérale (72;132) à proximité de ladite plaque (78;138) pour former une pluralité de stries (64;118,120) dans le réceptacle (48,50;106,108) de la base (60;114) ou dans la base (60;114) à proximité du réceptacle (48,50;106,108) respectivement.

2. Moule (70;130) selon la revendication 1, caractérisé en ce que l'empreinte de moule (80;140) est de forme sensiblement triangulaire, vue en plan.

3. Moule (70;130) selon la revendication 2, caractérisé en ce que ladite partie limitée de la paroi latérale correspond à la partie de base (60;114) de la forme triangulaire, vue en plan.

4. Moule (70;130) selon la revendication 1 ou la revendication 2, caractérisé en ce qu'une pluralité de nervures (84,86;142,144) sont disposées sur la surface supérieure et inférieure de ladite plaque (78;138) et une pluralité de nervures (84,86) sur ladite paroi latérale (72;132).

5. Moule (70;130) selon l'une quelconque des revendications précédentes, caractérisé en ce que ladite pluralité de nervures (84,86;142,144) disposées sur ladite plaque (78;138) sont orientées parallèlement audit axe de projection.

6. Moule (70;130) selon l'une quelconque des revendications précédentes, caractérisé en ce qu'au moins l'une des pluralités de nervures (84,86;142,144) de la plaque (78;138) s'étend jusqu'à la paroi latérale (72;132) pour former une nervure continue (84,86;142,144).

7. Moule (70;130) selon l'une quelconque des revendications précédentes, caractérisé en ce que les nervures individuelles (84,86;142,144) de ladite pluralité respective de nervures (84,86;142,144) sont parallèles entre elles.

8. Moule (70;130) selon l'une quelconque des revendications précédentes, caractérisé en ce que les nervures (84,86;142,144) sont disposées le long de ladite paroi latérale (72;132) et s'étendent à l'intérieur du périmètre de l'empreinte de moule (80;140) afin de dessiner sur

la base (60;114) une surface nervurée à laquelle l'articulateur (16) peut être fixé.

9. Procéder pour former la base (60;114) d'un modèle dentaire (10;102,104) à partir d'un composé coulable et durcissable, la base (60;114) étant utilisable avec un articulateur (16), ce procédé comprenant les phases qui consistent à :

a) définir le périmètre et l'ouverture d'une empreinte de moule (80;140), les dimensions de ladite ouverture coïncidant essentiellement avec les dimensions maximales de l'empreinte de moule (80;140), vue en plan, avec respectivement une paroi latérale (72;132) et un bord supérieur de ladite paroi latérale (72;132) ;

b) définir en outre le fond de l'empreinte de moule (80;140) avec un substrat souple (74;134) coopérant avec la paroi latérale (72;132) pour définir le fond et les surfaces latérales de l'empreinte de moule (80;140) ;

c) retirer de l'empreinte de moule (80;140) la base formée (60;114) en incurvant simultanément la paroi latérale (72;132) et le substrat afin d'abaisser cette partie du bord supérieur de la paroi latérale (72;132) en travers de l'empreinte de moule (80;140) à partir de l'emplacement de la saillie (78;138) ;

d) retirer de l'empreinte de moule (80;140) la base formée (60;114) sensiblement le long de l'axe de projection de la saillie (78;138) pour permettre de dégager par glissement ladite saillie (78;138) de l'intérieur du réceptacle (48,50;106,108) formé dans la base (60;114),

ledit procédé étant caractérisé en ce que :

e) on forme, avec une saillie nervurée (78;138) fixée à une partie limitée de la paroi latérale (72;132) et s'étendant dans le périmètre de l'empreinte de moule (80;140), le long d'un axe de projection et en partie en travers de l'empreinte de moule (80;140), une pluralité de nervures (84,86;142,144) étant disposées sur au moins une de ladite plaque (78;138) ou sur ladite paroi latérale (72;132) à proximité de ladite plaque (78;138), un réceptacle strié (48,50;106,108) à l'intérieur de la base (60;114), des stries (64;118,120) étant ménagées dans au moins l'un du réceptacle (48,50;106,108) de la base (60;114) ou dans la base (60;114) à proximité du réceptacle (48,50;106,108) respectivement, auquel réceptacle (48,50;106,108) l'articulateur (16) peut être fixé.



10. Procédé selon la revendication 9, caractérisé en ce que ladite phase de mise en forme comprend l'étape de formation de la saillie (78;138) dans un emplacement situé entre le bord supérieur de la paroi latérale (72;132) et le substrat (74;134). 5
11. Procédé selon la revendication 9, dans lequel la saillie nervurée comprend des nervures (84,86;142,144) orientées parallèlement à l'axe de projection. 10
12. Procédé selon la revendication 9, caractérisé en ce que ladite phase de formation comprend en outre la réalisation de stries (64;118,120) à l'intérieur de la base (60;114), ces nervures étant adjacentes à au moins un des côtés du réceptacle (48,50;106,108). 15
13. Procédé selon l'une quelconque des revendications 9 à 12, caractérisé en ce que les nervures (84,86;142,144) qui font saillie sur la paroi latérale (72;132) sont parallèles entre elles et en ce qu'au moins une desdites nervures (84,86;142,144) est continue avec une nervure correspondante (84,86) disposée sur ladite plaque (78;138), ladite phase de formation ultérieure permettant de réaliser des stries parallèles (64;118,120) dans la base (60;114). 20 25 30
14. Procédé selon la revendication 12 dans lequel ladite phase de formation ultérieure consiste à former des stries (64;118,120) dans la base (60;114) à proximité de côtés opposés du réceptacle (48,50;106,108). 35

Patentansprüche

- Flexible Form zum Formen der Basis (60; 114) eines mit einem Artikulator (16) verwendbaren Dentalmodells (10;100) aus einer in die Form eingebrachten gießbaren, härtbaren Verbindung, wobei die Form in Kombination versehen ist mit: 40
- a) einer flexiblen Seitenwand (72;132) zum Definieren des Umfangs eines im Grundriß im wesentlichen dreieckigen Formhohlraums (80; 140), der einen Grundriß hat, der die Konfiguration der zu bildenden Basis (60;114) im Umriß vorgibt, wobei die flexible Seitenwand (72;132) eine obere Kante zum Definieren der Öffnung des Formhohlraums (80; 140) aufweist, welche Öffnung mit dem maximalen dimensional Grundriß des Formhohlraumes (80;140) im wesentlichen dimensional übereinstimmt; 45 50
- b) einem flexiblen Substrat (74;134) zum Definieren eines im wesentlichen flachen 55

Bodens des Formhohlraumes (80;140), wobei das Substrat (74;134) und das Seitenwandteil (72;132) zusammenwirken, um die Bodenfläche und die Seitenflächen des Formhohlraumes (80;140) zu definieren;

c) einen Sims (78;138), der an einem begrenzten Teil der Seitenwand (72;132) angebracht ist und sich innerhalb des Umfangs des Formhohlraumes (80;140) entlang einer zum Boden im wesentlichen parallelen Projektionsachse und nur teilweise über den Formhohlraum (80;140) hinweg erstreckt;

d) wobei das Substrat (74;134) und die Seitenwand (72; 132) gemeinsam biegebar sind, um den vom Ort des Simses (78;138) her über den Formhohlraum (80;140) hinweg gelegenen Teil der oberen Kante der Seitenwand (72;132) genügend so weit zu senken, daß die geformte Basis (60;114) aus dem Formhohlraum (80;140) entlang der Projektionsachse des Simses (78;138) herausgezogen werden kann und sich die Aufnahme vom Sims (78;138) gleitend lösen kann,

dadurch gekennzeichnet, daß der Sims (78;138) den Umriß einer gerieften Aufnahme (48,50;106,108) innerhalb der Basis (60;102) vorgibt, an welcher Aufnahme (48,50;106,108) der Artikulator (16) befestigt werden kann, wobei eine Vielzahl von Rippen (84,86;142,144) auf dem Sims (78;138) und/oder auf der Seitenwand (72;132) in der Nähe des Simses (78;138) angeordnet ist zum Bilden einer Vielzahl von Riefen (64;118,120) jeweils in der Aufnahme (48,50;106,108) der Basis (60;114) oder in der Basis (60;114) in der Nähe der Aufnahme (48,50;106,108).

2. Form (70;130) gemäß Anspruch 1, dadurch gekennzeichnet, daß der Formhohlraum (80;140) einen im allgemeinen dreieckigen Grundriß aufweist.
3. Form (70;130) gemäß Anspruch 2, dadurch gekennzeichnet, daß der begrenzte Seitenwandteil dem Basisteil (60;114) des dreieckigen Grundrisses entspricht.
4. Form (70;130) gemäß Anspruch 1 oder 2, dadurch gekennzeichnet, daß eine Vielzahl von Rippen (84,86;142,144) auf der oberen und unteren Oberfläche des Simses (78; 138) angeordnet ist und eine Vielzahl von Rippen (84, 86;142,144) auf der Seitenwand (72;132) angeordnet ist.
5. Form (70;130) gemäß einem der vorhergehenden Ansprüche, dadurch gekennzeichnet,



daß die vielen auf dem Sims (78;138) angeordneten Rippen (84,86;142,144) parallel zur Projektionsachse angeordnet sind.

6. Form (70;130) gemäß einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet**, daß zumindest eine der vielen Rippen (84,86;142,144) auf dem Sims (78;138) sich zur Bildung einer durchgehenden Rippe (84,86;142,144) auf die Seitenwand (72;132) erstreckt. 5
7. Form (70;130) gemäß einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet**, daß die einzelnen Rippen (84, 86; 142,144) der jeweiligen Vielzahl von Rippen (84, 86;142,144) zueinander parallel sind. 10
8. Form (70;130) gemäß einem der vorhergehenden Ansprüche, **gekennzeichnet durch** entlang der Seitenwand (72;132) angeordnete und sich innerhalb des Umfangs des Formhohlraumes (80;140) erstreckende Rippen (84,86;142,144) zum Vorgeben einer gerieften Oberfläche auf der Basis (60;114), an welcher Oberfläche der Artikulator (16) befestigt werden kann. 20
9. Verfahren zum Bilden einer Basis (60;114) eines Dentalmodells (10;102,104) aus einer gießbaren, härtbaren Verbindung, welche Basis (60;114) mit einem Artikulator verwendbar ist, wobei das Verfahren die folgenden Schritte umfaßt: 30
 - (a) Definieren des Umfangs eines Formhohlraums (80; 140) und der Öffnung zu dem Formhohlraum (80;140), welche Öffnung mit dem maximalen dimensional Grundriß des Formhohlraums (80;140) im wesentlichen dimensional übereinstimmt, mittels einer flexiblen Seitenwand (72;132) bzw. einer oberen Kante der Seitenwand (72; 132); 35
 - (b) ferner Definieren des Bodens des Formhohlraums (80;140) mit einem flexiblen Substrat (74;134), das mit der Seitenwand (72;172) zusammenarbeitet um den Boden und die Seitenflächen des Formhohlraumes (80;140) zu definieren; 40
 - (c) Entfernen der geformten Basis (60;114) aus dem Formhohlraum (80;140) durch gemeinsames Biegen der Seitenwand (72;132) und des Substrats, um den vom Ort des Vorsprungs (78;138) her über den Formhohlraum (80;140) hinweg gelegenen Teil der Oberkante der Seitenwand (72;132) abzusinken; 45
 - (d) Herausziehen der geformten Basis (60;114) aus dem Formhohlraum (80;140) 50

im wesentlichen entlang der Projektions-Achse des Vorsprungs (78;138), damit sich der Vorsprung (78;138) aus der in der Basis (60; 114) gebildeten Aufnahme (48,50; 106,108) gleitend lösen kann,

gekennzeichnet durch

(e) Bilden, mittels eines gerippten Vorsprungs (78; 138), der an einem begrenzten Teil der Seitenwand (72;132) angebracht ist und sich innerhalb des Umfangs des Formhohlraumes (80;140) entlang einer Projektions-Achse und teilweise über den Formhohlraum (80;140) erstreckt, wobei eine Vielzahl von Rippen (84,86;142, 144) auf dem Sims (78;138) und/oder auf der Seitenwand (72;132) in der Nähe des Simses (78;138) angeordnet ist, einer gerieften Aufnahme (48,50;106,108) innerhalb der Basis (60;114), wobei Riefen (64;118,120) in der Aufnahme (48,50;106,108) der Basis (60;114) und/oder in der Basis (60;114) in der Nähe der Aufnahme (48,50; 106,108) vorgesehen sind, an welcher Aufnahme (48,50; 106,108) der Artikulator (16) befestigt werden kann.

10. Verfahren nach Anspruch 9, **dadurch gekennzeichnet**, daß der Schritt des Bildens den Schritt des Bildens des Vorsprungs (78;138) an einem Ort zwischen der Oberkante der Seitenwand (72;132) und dem Substrat (74;134) einschließt.
11. Verfahren nach Anspruch 9, **dadurch gekennzeichnet**, daß der gerippte Vorsprung Rippen (84,86;142,144) umfaßt, die mit der Projektionsachse parallel ausgerichtet sind.
12. Verfahren nach einem der Ansprüche 9 bis 11, **dadurch gekennzeichnet**, daß der Schritt des ferneren Bildens den Schritt des ferneren Bildens der Riefen (64;118,120) innerhalb der Basis (60;114) benachbart zumindest einer Seite der Aufnahme (48,50;106,108) einschließt.
13. Verfahren nach einem der Ansprüche 9 bis 12, **dadurch gekennzeichnet**, daß die sich von der Seitenwand (72;132) erstreckenden Rippen (84,86;142,144) zueinander parallel sind und mindestens eine der Rippen (84,86;142,144) durchgehend ist mit einer entsprechenden Rippe (84;86), die auf dem Sims (78;138) angeordnet ist, und daß der Schritt des ferneren Bildens parallele Riefen (64;118,120) in der Basis (60,114) hervorruft.
14. Verfahren nach Anspruch 12, **dadurch ge-**

kennzeichnet, daß der Schritt des fernerer Bildens den Schritt des fernerer Bildens der Riefen (64;118,120) innerhalb der Basis (60;114) benachbart entgegengesetzten Seiten der Aufnahme (48,50;106,108) umfaßt.

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