United States Patent

Marshall et al.

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[54] DIE HOLDER FOR DENTAL LABORATORY

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[52] **U.S. Cl.** **32/11**

[51] **Int. Cl.** **A61c 13/00**

[58] **Field of Search** 32/11, 60, 32

[56] **References Cited**

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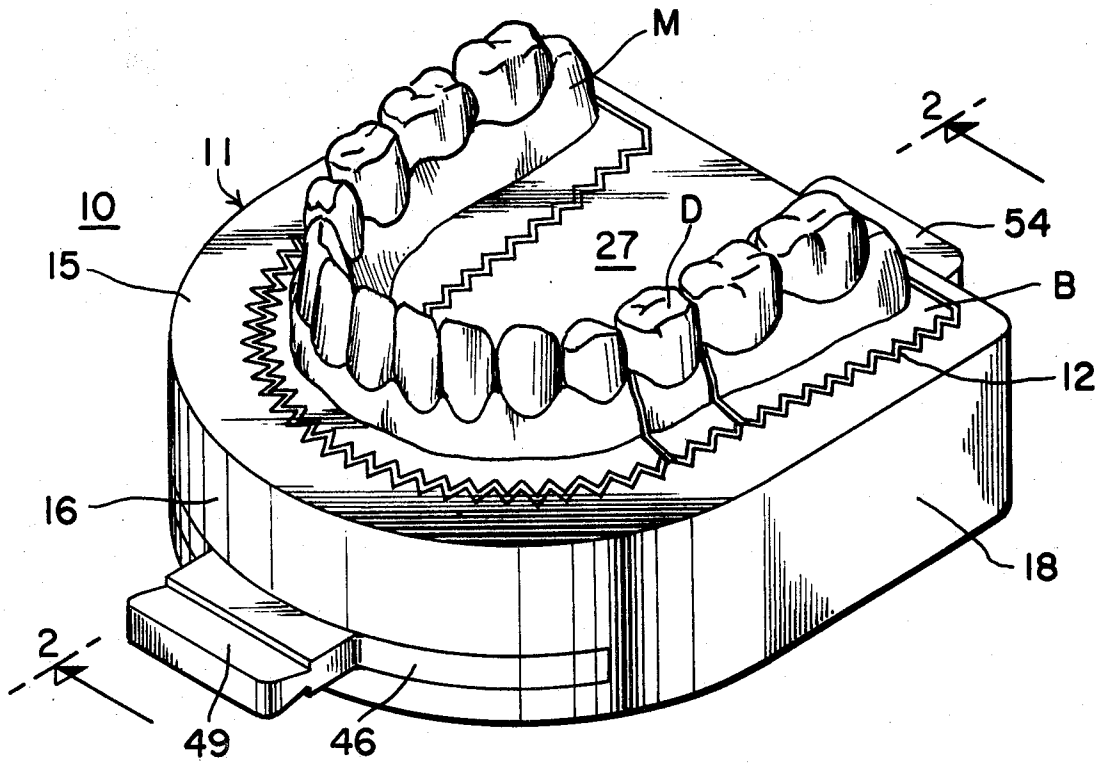
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[57] **ABSTRACT**

A dental restoration fabricating assembly includes a rigid body member having an arch shaped, open-topped cavity with vertically serrated faces and a thin liner member mating and separably nesting in the cavity and provided along its lower border with a peripheral groove. The line is prevented from vertical movement in the cavity by a pair of locking members slideable through opposite openings in the body member and tightly engaging the liner grooves. In employing the assembly the cavity held liner is partially filled with a plastic solidifiable mass and a model is positioned in the mass or the model is cast from the impression and allowed to harden with the mass in the liner. One or more dies may be separated by removing the unlocked liner and dental cast from the cavity, slicing the desired dies and the bonded sections of the liner from the remains of the cast, working the dies as desired, reassembling them in the cavity in their initial positions and then locking them in place by reinsertion of the locking member.

11 Claims, 6 Drawing Figures



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SHEET 1 OF 2

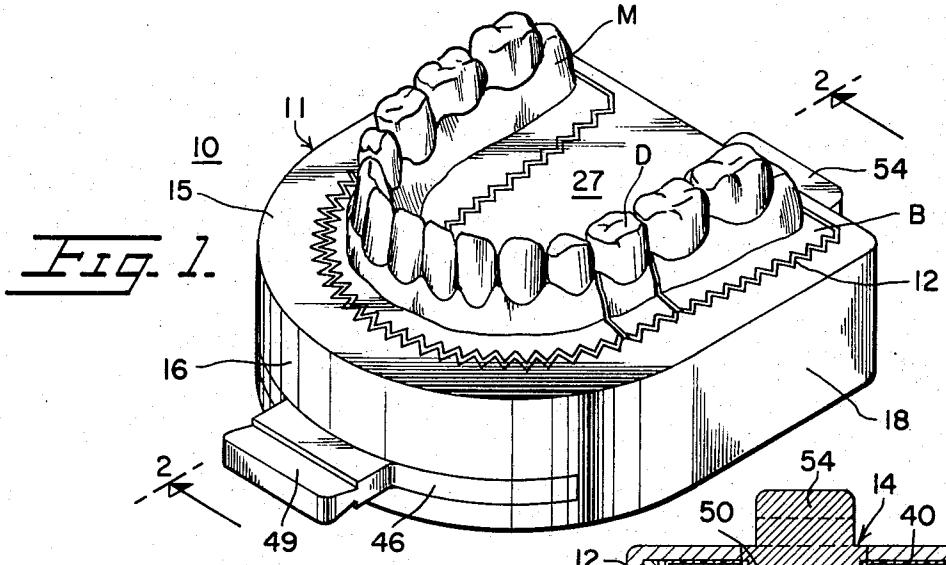


Fig. 1.

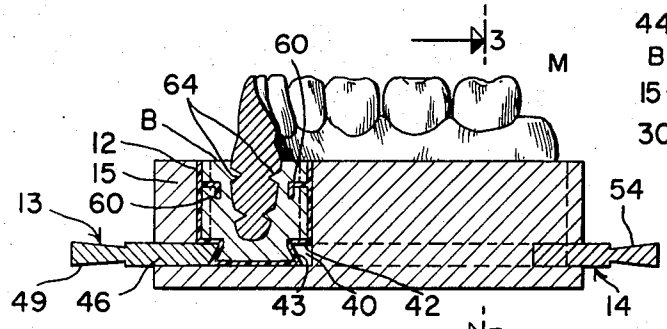


Fig. 2.

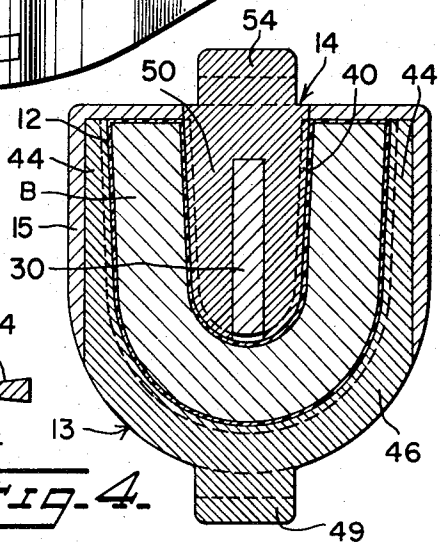


Fig. 4.

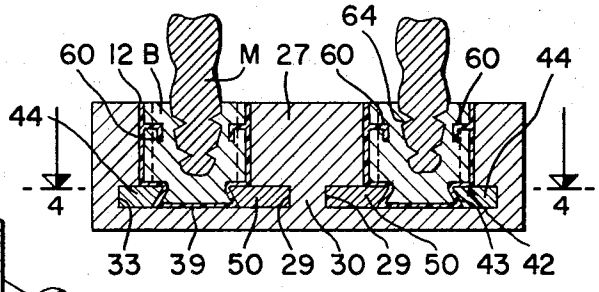


Fig. 3.

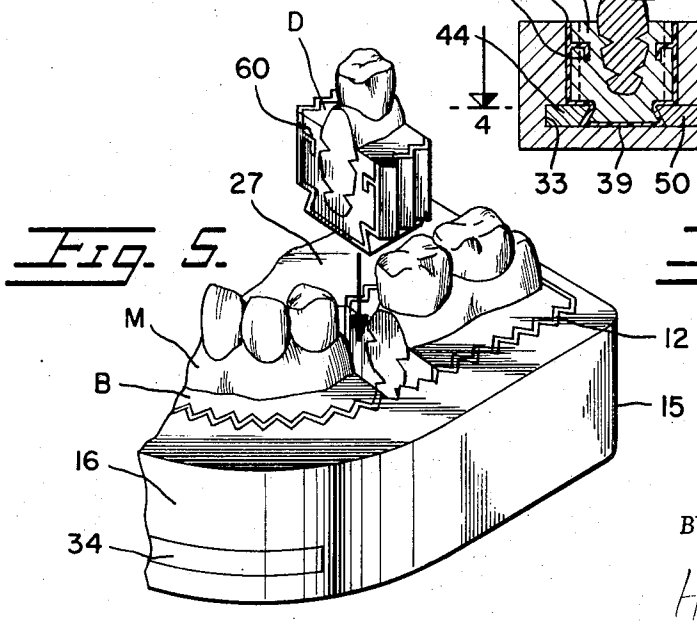
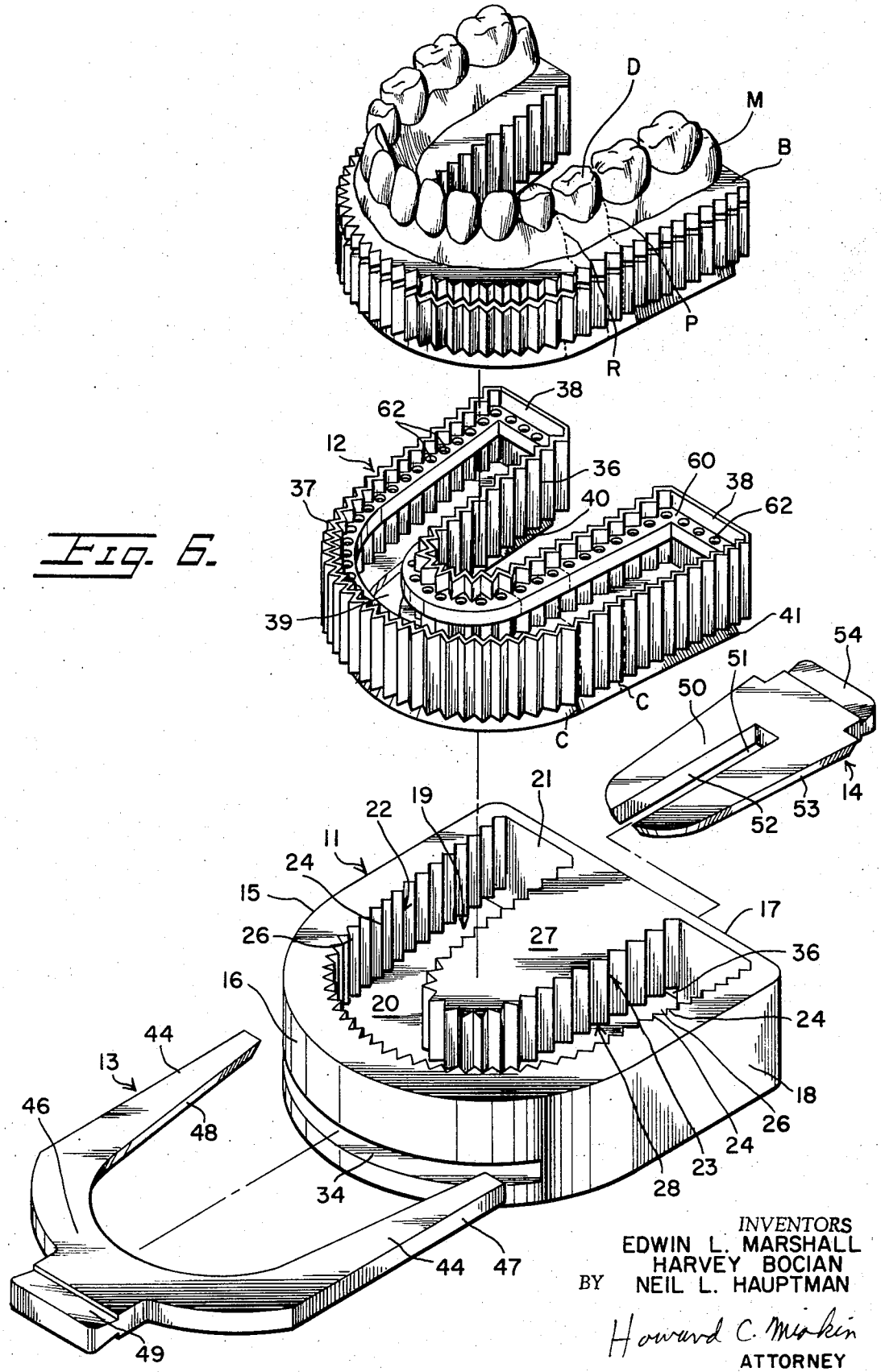


Fig. 5.

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Fig. 6.



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DIE HOLDER FOR DENTAL LABORATORY

BACKGROUND OF THE INVENTION

The present invention relates generally to improvements in the production and fabrication of dental restorations such as inlays, crowns, bridges and the like and it relates more particularly to an improved apparatus and method for fabricating removable and a master cast dental dies attendant to the production of such dental restorations.

In accordance with a method which is employed to great advantage in the fabrication of dental restorations, an impression is made with a hydrocolloid or other suitable material of the prepared tooth or teeth and the teeth adjacent and proximate thereto, preferably although not necessarily the whole upper or lower arch. A model is then cast from the impression, and one or more dies are cut from the model, and the dies are then employed in the known manner in the production of the restorations. It is necessary that the dies and the rest of the model be accurately reassembled to their original relationship to permit the application thereof to an articulator and the precise and proper finishing of the restoration. The methods and devices heretofore employed for the mounting of models and the separation and reassembly of the dies with the remainder of the model possess numerous drawbacks and disadvantages. Their application is highly time-consuming and requires a high degree of skill and is frequently unreliable and inaccurate, and is inconvenient and of low adaptability and versatility.

SUMMARY OF THE INVENTION

It is the principal object of the present invention to provide an improved method and apparatus for the production of dental restorations such as inlays, crowns, bridges and the like.

Another object of the present invention is to provide an improved method and apparatus for the production of dental dies attendant to the fabrication of dental restorations.

Still another object of the present invention is to provide an improved method and apparatus for the production of dental models and the obtaining of dies therefrom in a manner permitting the accurate reassembly of the dies with the remainder of the model at any desired time.

Yet another object of the present invention is to provide an improved apparatus for the production of dental dies which allows the dies and models to be transported to and from the fabricator to the dentist without the necessity of using the tray during transportation.

A further object of the present invention is to provide an improved dental tray or model holder assembly, which facilitates the production of models and dies and the release of the dies and accurate reassembly of the model in the holder so as to expedite the accurate production and finishing of the dental restorations and the employment of an articulator therewith, and avoid the necessity of a big cleaning operation of the tray after casting.

A still further object of the present invention is to provide a method and apparatus of the above nature, characterized by their reliability, accuracy, versatility and adaptability and ease and convenience of application and use.

The above and other objects of the present invention will become apparent from a reading of the following description taken in conjunction with the accompanying drawings which illustrate a preferred embodiment thereof.

In a sense the present invention contemplates the provision of a dental restoration device comprising a body member having an open topped cavity formed therein, a liner member vertically separably nesting in the cavity and having a peripheral surface substantially complementing the peripheral face of the cavity, and means for releasably locking the liner member nested in the cavity against vertical movement therein. Also within the scope of the present invention is the method of producing a dental die comprising vertically separably nesting in a cavity of holder member, a liner matching the cavity, releasably locking the nested liner against vertical movement in the cavity, depositing into the liner a solidifiable casting material and a model embedded in and projecting above the casting material, permitting the solidification of the casting material and the bonding thereof to said model to form a unitary base and model, separating based model from the holder member, and slicing at least one die therefrom and thereafter reassembling the die with the remainder of the model in the holder.

The improved device, in its preferred form, has a cavity of arched configuration with vertical serrations formed in its face, the liner having mating vertical serrations slideably engaging the cavity serrations. A groove is formed along the bottom peripheral border of the liner and the bottom face of the groove is upwardly inwardly inclined. The body member has slots formed in opposite ends communicating with the cavity along the inner and outer medial peripherals at the base of the cavity and grooves are formed in the bottom borders of the cavity inner and outer faces. Locking members are slideable through the front and rear slots and along the confronting cavity and liner grooves to releasably lock the liner in a nested mating position in the cavity. In employing the preferred form of the improved device, the liner is locked in position and partially filled with a fluid casting composition. A model is medially positioned in and projects above the casting composition which is then allowed to set. The liner, model and casting composition are bonded into a unit which is then unlocked and lifted out of the cavity, leaving it relatively clean, and the desired dies cut therefrom with corresponding sections of the liner connected thereto. After the dies have been employed, modified and supplemented as desired they are reassembled in the cavity in their original position with the remainder of the composite liner, base and model and locked therein by reapplication of the locking members. The model and dies are now in a position for mounting in an articulator and for finishing. As an alternative, the model may be cast simultaneously with the base by employing the cavity held liner and master impression concurrently.

The improved dental restoration producing device and method are simply and conveniently applied with a minimum of skill and time concumption, a maximum of accuracy and with great reliability and versatility.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top perspective view of a device embodying the present invention illustrated in an assembled condition supporting a model together with a cut delineated die;

FIG. 2 is a sectional view taken along line 2—2 in FIG. 1;

FIG. 3 is a sectional view taken along line 3—3 in FIG. 2;

FIG. 4 is a sectional view taken along line 4—4 in FIG. 3;

FIG. 5 is a fragmentary top perspective view illustrating a separated die being reinserted into the device; and

FIG. 6 is an exploded perspective view of the device with the model and base being shown separate from the liner.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings which illustrate a preferred embodiment of the present invention as applied to the handling of the full arch of the upper or lower jaw, it being understood that it is applicable, with corresponding modifications, to lesser sections such as quadrants or even less, the reference numeral **10** generally designates the improved casting and holding assembly which comprises a base holder or body member **11**, a separable, disposable liner member **12** and a pair of front and rear liner locking member **13** and **14**, respectively.

The base member **11** is formed by any suitable, sturdy, rigid wear resistant material such as an acetal, polyamide, polycarbonate or ABS resin, or a metal or the like and is in the form of a block **15** having an arcuate front face **16**, a flat rear face **17** and parallel side faces **18**. An arch or generally U-shape well or cavity **19** is formed in the top of block **15** and includes a flat horizontal base **20**. Cavity **19** includes flat coplanar end faces **21** parallel and proximate to block end face **17**, a U-shaped outer peripheral face **22** parallel to block faces **16** and **18** and an inner peripheral face **23** parallel to the outer peripheral face **22**. The cavity peripheral faces **22** and **23** are vertically serrated for the full extent thereof to provide vertical prismatic ridges **24** separated by similarly shaped vertical prismatic valleys or grooves **26**.

Formed at the bottom border of block section **27**, delineated by cavity face **23**, along the full lengths of the sides of face **23**, are rectangular grooves **28** having longitudinally extending parallel vertical bases **29** separated by a longitudinal wall **30**. Opposite rectangular grooves **32** of the height of grooves **28** are formed along the full lengths of the sides of cavity face **22** along the bottoms thereof and have parallel longitudinal bases **33**. A transverse slot **34** is formed in block end face **16** and is of the height and at the level of grooves **32** and communicates with cavity **19** at the base thereof and extends between groove base **33**. A transverse slot **36** is formed in block end face **17** at the level of and of the height of grooves **28** and is of a length greater than the width of block section **27** to provide communication with grooves **28** and cavity **19**.

The liner member **12** is of a shape substantially mating with block cavity **19** and is formed of a thin preferably flexible material such as polystyrene, polyethylene, polypropylene or the like such as by injection molding or vacuum forming. Liner member **12**, like cavity **19**, is U-shaped with serrated inner and outer peripheral walls **36** and **37** which closely and accurately complement cavity faces **23** and **22**, respectively, so as to permit the vertical slideable telescopic nesting of liner **12** in cavity **19** and the repeated removal and reinsertion thereof in their precise original relationship. The end walls **38** of liner member **12** are flat and match cavity end faces **21**. Liner member **12** includes a flat base **39** which is delineated from peripheral walls **36** and **37** by inner and outer peripheral locking grooves **40** and **41**, respectively, which extend for the full lengths of the inner and outer corners between base **39** and walls **36** and **37**. The grooves **40** and **41** are of similar transverse cross section and each includes a horizontal downwardly directed top face **42** and a downwardly outwardly inclined face **43** extending from the inner edge of face **42** to the level of liner base **39**. It should be noted that the inside faces of walls **36** and **37** are, like the outside faces, vertically serrated and are preferably of a rough texture to strengthen the bonding thereto of a casting material. To reduce slippage between the casting material and liner **12**, a rib **60** extends interiorly into the cavity and generally at right angles to the serrations. Also, rib **60** has openings **62** in which the casting material flows to further avoid slippage. Further, the vertical distance between the base **39** and the tops of walls **36** and **37** is preferably equal to that between cavity base **20** and the top edge thereof.

Locking member **13** is of U-shaped configuration and includes side legs **44** and a curved cross piece **46**, the thickness of locking member **13** being approximately equal to the height of slot **34** and of grooves **32** to permit the sliding of locking member **13** along the slot and grooves with a minimum of vertical movement. The outer faces **47** of legs **44** extend longitudinally and are parallel, their transverse spacing being equal to that between groove faces **33**. The inside periphery of locking member **13** mates the full length of liner groove **41**, the face **48** thereof being downwardly outwardly inclined so that the inner border of locking member **13** when in an inserted position mates and tightly engages liner groove **41** to wedge the liner downwardly. A medial outwardly directed finger piece or handle **49** is integrally formed with cross piece **46**.

The locking member **14** includes a flat tongue sections **50** of the height of slot **36** and groove **40** and with an outer periphery which mates the liner inner locking groove **40**. Medially formed in tongue **50** is a longitudinal slot **51** having parallel opposite faces **52** which are transversely spaced a distance about equal to the width of wall **30**. The peripheral face **53** of tongue **50** is downwardly outwardly inclined so that when locking member **14** is in its inserted position, the peripheral border of tongue **50** matingly engages liner groove **40**, slot **51** engages wall **30**, and tongue **50** slideably engages slot **36** and grooves **28**. A finger piece or handle **54** is directed outwardly from tongue **50**.

Considering now the application of the improved device **10** in practicing the present method, a model M of the dental arch is produced in the known manner from a master impression and properly trimmed.

Locking members 13 and 14 are retracted from base 11 and a liner 12 is seated or nested in cavity 19 its horizontal positioning therein being precisely effected by reason of the mating vertical serrations in the liner 12 and the faces of cavity 19. The locking members 13 and 14 are then inserted into base 11 through slots 34 and 36, respectively, to tightly engage liner grooves 41 and 40 and base grooves 32 and 28 whereby to wedge and releasably accurately lock liner 12 in a predetermined position in base 11. The locked, seated liner is then partially filled, for example, two thirds full, with a fluid or plastic casting material of known composition, for example die stone, dental cast stone, plaster of Paris or the like. The model M, properly trimmed and grooved at 64, is placed in the plastic casting mass and the casting composition which flows into openings 62, is then permitted to set to a solid state in the usual manner, to form a solid base section B which supports model M and is firmly bonded to liner 12 and model M.

Locking members 13 and 14 are then retracted from base 11 to release liner 12 and the composite unit of liner 12, base section B and model M is raised and separated from cavity 19. One or more dies D, each of which may include one or more teeth are separated from the composite unit by cutting along planes P, completely through the model M, base B and liner 12, planes P delineating the respective dies D. Each die D includes a selected section of the model M, base B and liner 12 which are in bonded relationship. The dies D are then worked on and treated as required and desired and are thereafter reassembled with the remainder of the composite unit by nesting the various elements of the unit in the cavity 19 in their original relationship as assured and facilitated by the mating serrations in the confronting faces of cavity 19 and liner 12. The subunits, that is the dies D and the remaining sections of the composite unit are then locked in cavity 19 in their reassembled condition by reinserting locking members 13 and 14. The reassembled composite unit is now firmly, accurately retained in base 11 with the different sections thereof in their precise original relationship. The reassembled model held in base 12 is now employed for finishing and other operations, for example, with the aid of an articulator. The separation of the dies D and their reassembly as above described may be repeated many times without any loss of accuracy of precision and allows easy cleanup of the base. In order to expedite the reassembly of the composite unit in cavity 19, the bases 39 and 20 of liner 12 and cavity 19 may be provided with corresponding indicia, for examples numbers or letters, so as to permit the rapid determination of the cavity locations of the various subunits. Further, apertures may be formed in the base 20 of cavity 19 for the reception of push rods so as to aid in the ejection of the composite unit from cavity 19.

While the separate casting of the model M and its subsequent embedment in the base B is highly convenient, as described above, an alternative method which may be used to advantage includes the step of pouring casting composition, similar to or compatible with that used for Base B, into the master impression and placing it in the unset casting composition in the liner 12 which is lock seated in cavity 19, and then allowing the simultaneously hardening of the cast mold M and base B into a uniform integral mass. This latter procedure obviates the need to cut the stone master model to fit the liner 12.

Although there have been illustrated and described preferred embodiments of the present invention, it is apparent that numerous alterations, omissions and additions may be made without departing from the spirit thereof.

What I claim is:

1. A dental restoration device for the production of dental dies comprising a body member having an open topped cavity formed therein, a removable liner member vertically slidably separably nesting in said cavity in a predetermined position and having a peripheral surface substantially complementing the peripheral face of said cavity and an upwardly facing shoulder on the outside face and above the base of said liner member, and means for releasably locking said liner member in said cavity in said predetermined nested position against vertical movement therein including a locking member movable into and out engagement with said shoulder.

2. The dental restoration device of claim 1 wherein said cavity and said liner member are provided with mating vertical serrations.

3. The dental restoration device of claim 1 wherein said cavity is of arched configuration.

4. The dental restoration device of claim 1 wherein said liner and said cavity have confronting peripheral grooves formed along their lower borders and said body member has a horizontal slot formed therein at the level of said grooves, said locking means comprising a locking member slideably projecting through said slot and engaging said grooves.

5. The dental restoration device of claim 1 wherein said cavity and said liner are of arched configuration and the peripheral wall of said liner and the peripheral face of said cavity are provided with mating serrations.

6. The dental restoration device of claim 5 wherein said liner has peripheral grooves formed along the bottom borders of the inner and outer outside faces thereof, said body member has first and second horizontal slots formed in the opposite ends thereof communicating with said cavity at the level of the base thereof and proximate the arched end of said cavity and the opposite end thereof, respectively, and said locking means comprises a first locking member slideably registering with said first slot and having an inner periphery matingly engaging the grooves in the liner outer face and a second locking member slideably registering with said second slot and having a periphery matingly engaging the grooves in the liner inner face.

7. The dental restoration device of claim 6 wherein said grooves have downwardly outwardly inclined bottom faces.

8. The dental restoration device of claim 6 wherein there are formed in the faces of said cavity at the level of the base thereof longitudinally extending grooves which are slideably engaged by said locking members.

9. The method of producing a dental die comprising vertically separably nesting in a predetermined position in a cavity of a holder member a liner matching said cavity, releasably locking said nested liner in said predetermined position against vertical movement in said cavity, depositing into said liner a solidifiable casting material and a model embedded in and projecting

above said casting material permitting the solidification of said casting material and the bonding thereof to said model to form a unitary base and model, separating said base and model from said holder member and slicing at least one die therefrom and thereafter reassembling said die with the remainder of said model in said holder and locking said assembly in said predetermined position.

10. The method of claim 9 wherein said solidified material is bonded to said liner, and said bonded model, cast base and liner are unlocked and separated as a unit from said holder member, said liner is sliced with said die from said unit and thereafter said die and the remainder of said unit is reassembled in said cavity and locked therein.

11. The method of claim 9 wherein said model and base are concurrently formed from a common castable mass with said liner in said holder and an impression.

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