United States Patent [19]

White

[11] **3,736,663**

[45] **June 5, 1973**

[54] **IMPRESSION TRAY**

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[22] Filed: **Jan. 31, 1972**

[21] Appl. No.: **221,985**

[52] **U.S. Cl.** **32/17**

[51] **Int. Cl.** **A61c 9/00**

[58] **Field of Search** 32/17

[56] **References Cited**

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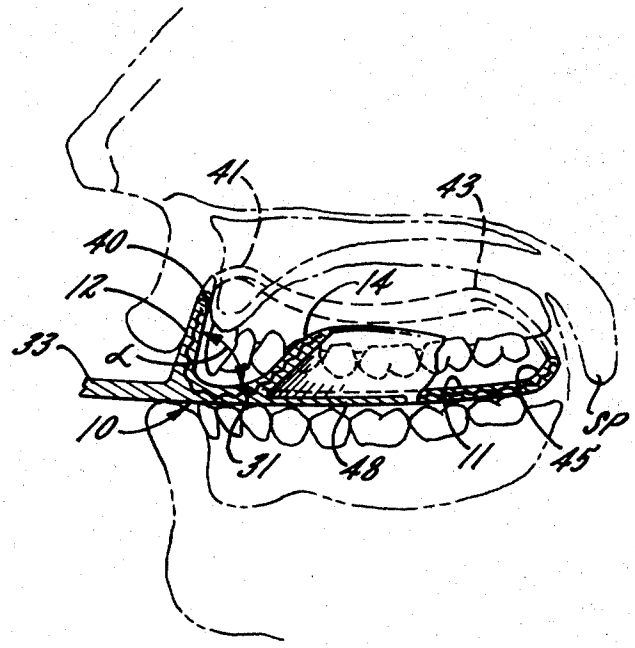
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[57] **ABSTRACT**

Novel dental impression trays are provided which are compatible with any usual patient's dental anatomy. A tray set includes trays for use with maxillary and mandibular deciduous, mixed and permanent dentition. Each tray is made of a flexible inner mesh form and an outer covering, and is hand moldable through a limited range of shapes.

6 Claims, 9 Drawing Figures



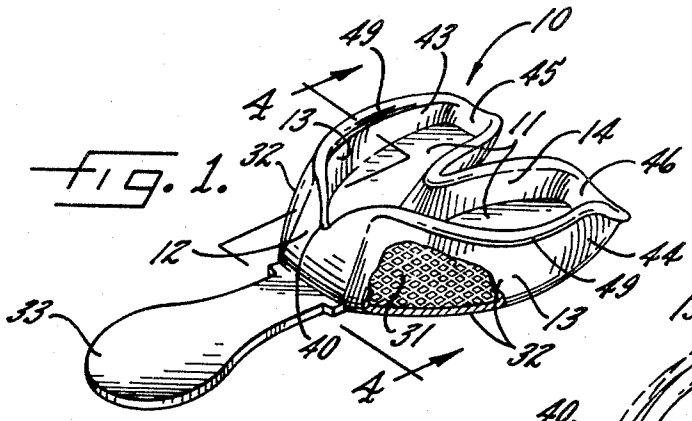


Fig. 1.

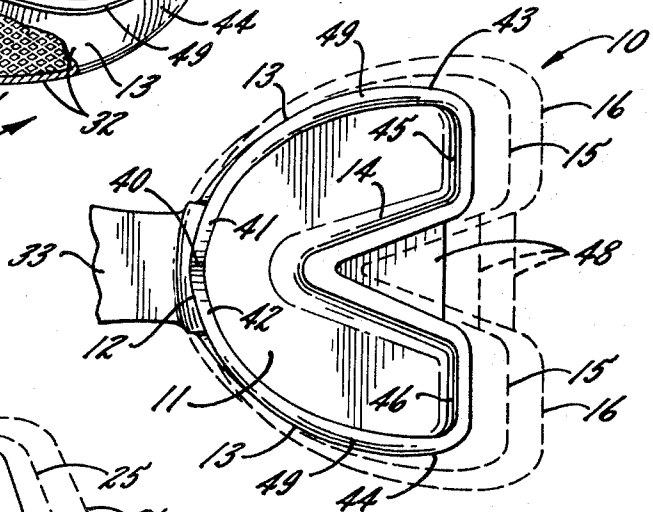


Fig. 2.

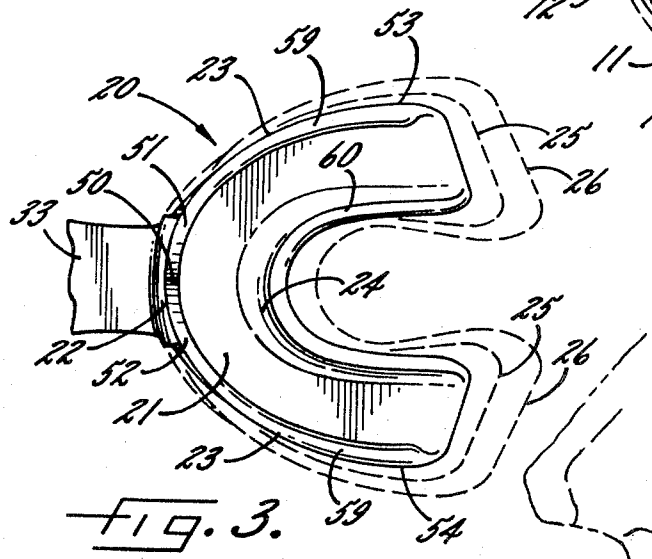


Fig. 3.

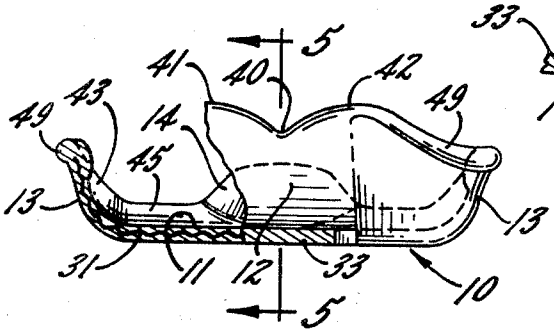


Fig. 4.

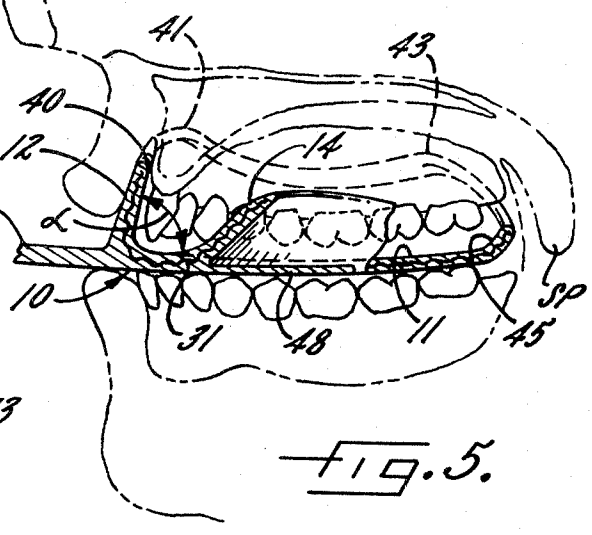


Fig. 5.

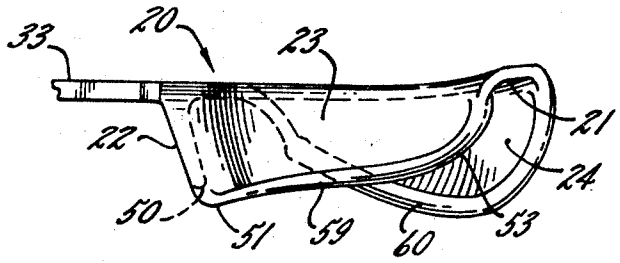


FIG. 7.

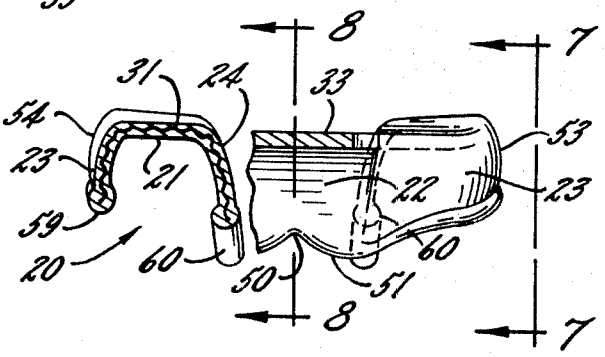


FIG. 6.

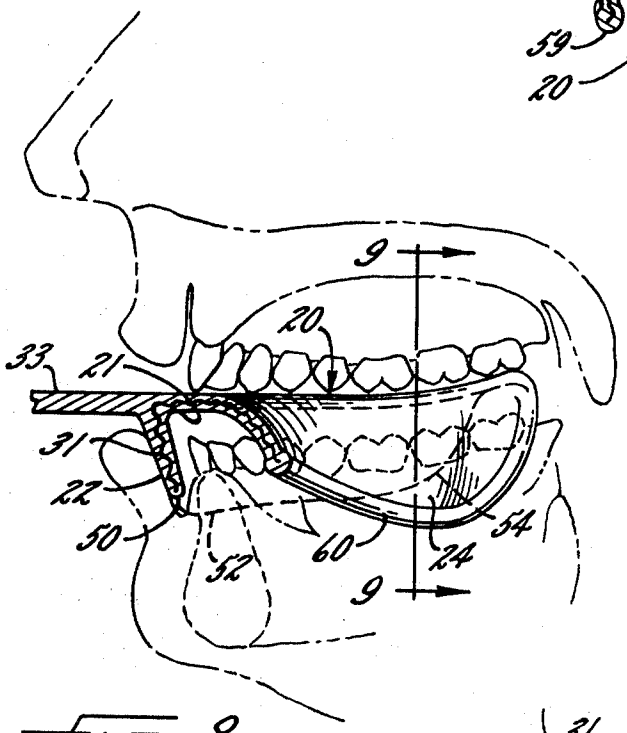


FIG. 8.

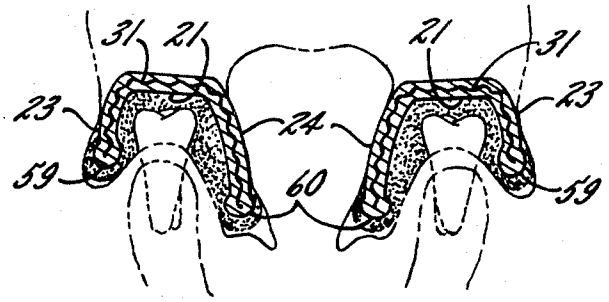


FIG. 9.

IMPRESSION TRAY

DESCRIPTION OF THE INVENTION

This invention relates generally to dental impression trays and more particularly concerns a novel set of adjustable dental impression trays which conform to the anatomy of any usual patient's dentition.

In dentistry, it has long been the practice to make a fullsize model of a patient's teeth and adjacent dentition. These models are then used in subsequent dental work such as the preparation of false teeth. To make such a model, an impression of the necessary dentition is first obtained by placing an impression tray carrying a plastic impression material, or alginate, around the appropriate dentition.

A general routine which has been used in obtaining such impressions with a contemporary commercial impression tray involves several steps. First, the tray is thoroughly cleaned of all traces of alginate and wax from previous use. Next, a paraffin or wax bead is applied to the edges of the tray to hold the alginate or impression material in place and to prevent the edges of the tray from abrading and irritating the patient's soft mouth tissues. When the wax bead has been applied, the tray is filled with the impression material. The filled tray is then pressed against the patient's teeth and adjacent dentition until the paste-like alginate has hardened sufficiently to acquire and hold a faithful impression of the teeth and the contiguous soft tissues. Since pressing the filled tray and alginate against the dentition displaces some of the alginate out of the tray, the dentist must be ready to remove any alginate which falls into the patient's mouth. After the alginate in the tray has hardened sufficiently, the tray containing the impression is removed from the mouth. The newly formed impression must be examined to insure that a sharp impression has been obtained and that none of the impressed alginate has been torn from the tray and retained in the mouth against the dentition.

Previous trays used in this procedure have proved at least partly unsatisfactory in a number of respects. Such trays are often provided with perforated surfaces and are consequently hard to clean. The emplacement of a paraffin bead requires time and attention. Since these trays generally do not conform closely to the anatomy of the mouth, a relatively large amount of alginate is required to fill the tray. As indicated above, there is a tendency for the alginate to break away, adhering to the patient's dentition rather than the tray when the tray is removed from the mouth. This ruins the impression. A spoiled impression must be retaken, causing extended discomfort to the patient. Displaced alginate falling from the tray in relatively great quantities into the mouth may be another source of patient discomfort. Moreover, a relatively large number of trays must be stocked by the dentist to insure the availability of a tray size which will fit the mouth of any normal or usual patient.

It is accordingly the general object of this invention to provide a set of impression trays which will overcome these difficulties. More specifically, it is an object to provide relatively few dental impression trays in a set which will closely fit all normal sizes and shapes of patient's mouths, from those of infants to those of adults. Another related object is to make each tray in the set adjustable through a limited range of shapes to fit a relatively limited range of patient's mouths.

Another object is to provide a dental impression tray which will fit relatively comfortably into the patient's mouth, which will not gag the patient, and which will permit relatively little spillage of displaced alginate into the mouth.

It is still another object of the invention to provide a dental impression tray which may be easily cleaned and which does not require the addition of an alginate-retaining bead along the top of the tray wall before the tray is used.

Other objects and advantages of the invention will become apparent upon reading the following detailed description and upon reference to the drawings, in which:

FIG. 1 is a general perspective view showing a typical dental impression tray in its maxillary embodiment for use with the upper teeth;

FIG. 2 is a plan view showing the relationship of the three sizes of maxillary trays provided in a part of the tray set in accordance with the invention;

FIG. 3 is a plan view similar to FIG. 2 but showing the three sizes of mandibular trays provided in the other part of the tray set in accordance with the invention;

FIG. 4 is a sectional view taken substantially in the plane of line 4—4 in FIG. 1 and showing in further detail the construction of the trays;

FIG. 5 is a sectional view taken substantially in the plane of line 5—5 in FIG. 4 showing the right side of the patient's oral cavity and a maxillary impression tray positioned in the patient's mouth, the tongue being omitted from the view for greater clarity;

FIG. 6 is a front elevational view of a mandibular tray oriented for insertion in a patient's mouth, a portion being broken away to show in further detail the construction and shape of the tray walls;

FIG. 7 is a side elevational view of the mandibular tray as viewed from the plane of line 7—7 in FIG. 6;

FIG. 8 is a sectional view taken substantially in the plane of line 8—8 in FIG. 6 showing the right side of the patient's oral cavity and showing a mandibular tray positioned in the patient's mouth, the tongue being omitted for greater clarity, and

FIG. 9 is a sectional view taken substantially in the plane of line 9—9 in FIG. 8 and showing in further detail the position of the mandibular tray with respect to the patient's teeth and tongue when the tray is located in the oral cavity.

While the invention will be described in connection with a preferred embodiment, it will be understood that it is not intended to limit the invention to that embodiment. On the contrary, it is intended to cover all alternatives, modifications and equivalents as may be included within the spirit and scope of the invention. Particularly, it is to be understood that the tray dimensions given simply specify the sizes of the trays illustrated. Based upon this description, persons skilled in the art will be able to devise trays which have or can be formed to have slightly different dimensions but which nonetheless fall within the spirit and scope of the invention.

To disclose fully the novelty of the present invention, it is necessary to outline the principles of growth and development of human dentures. Beginning at about the age of six months, a child's baby teeth begin erupting until all 20 are present at the end of the second year. These teeth are collectively called the deciduous dentition; all of these teeth are eventually lost owing to the natural resorption of their roots. Each jaw contains

four anterior incisors, two canines and four molars. During this period the alveolar or vertical heights of the child's dentition are not great; the teeth are small; and the patient's dental arches are often nearly semi-circular.

At about the age of six years, a child's jaws have grown forward enough to make room for the larger molar teeth in the alveolar processes, and the first permanent molars begin to erupt just behind or distal to the deciduous molars. The face continues to grow forward and downward and the alveolar heights increase as the permanent teeth erupt in succession following the loss of each baby tooth. During these years of mixed dentition, much growth is occurring in the patient generally, but the anterior arches change their form only slightly. The small deciduous teeth are separated by primate spaces which generally provide room in the alveolar base for the larger succedaneous teeth. Most noticeable growth occurs in the posterior parts of the jaw, where the jaws grow longer and slightly wider. In the spaces originally occupied by the deciduous molars, there erupt bicuspid teeth; distal to them erupt three molars in each one of the four buccal quadrants. At about the age of 12, the second permanent molars begin to erupt distal to the first molars and the permanent bicuspid teeth replace the deciduous molar teeth. Permanent dentition is finally completed in about the eighteenth year with the eruption of the third molars.

By about the 19th year, the labial and buccal vestibules have developed their full depths and contours. The space under the tongue has reached its ultimate depth. The bones of the skull and mandible have practically reached the end of their growth periods, although the fleshy parts of the face may not attain their mature form for another two or three years. Studies of serial casts have verified that the anterior arch forms existing during the periods of deciduous dentition appear to be pushed forward during the period of mixed dentition as the posterior portions of the jaw extend to accommodate the three permanent molars and continue their divergence as the skull increases to its mature width.

In view of these growth patterns, therefore, the present invention provides a single set of dental impression trays having as few as six trays in the set. A first tray is shaped for use with deciduous upper or maxillary dentition; a second is formed for use with mixed maxillary dentition; and a third is formed for use with permanent maxillary dentition. Another three trays are formed for use with deciduous, mixed, and permanent lower or mandibular dentition. Persons familiar with present tray sets will immediately realize that this six-tray set is a set considerably reduced in number from the many trays often required in some previous impression tray sets.

In further view of the described dental anatomy, the present invention contemplates that each tray in the set is formed or shaped to be relatively closely compatible with the dentition with which it is used. Persons familiar with present tray design will recognize that this close anatomical compatibility is also a departure from some previously offered trays.

Turning first to FIGS. 1—3, there are shown the dental impression trays of the present invention. In its general aspect, each maxillary tray **10** may be considered to have a floor **11** of arched plan shape conforming to the arched plan shape of a usual patient's upper dentition. Smoothly joined to the floor **11** are a front or anterior wall **12**, outer side or lateral walls **13** and inner side or central walls **14**. The mandibular trays **20** for use with lower dentition are provided with a corresponding floor **21**, anterior wall **22**, lateral walls **23**, and central walls **24**. It will be understood that these descriptions are general in nature since the walls sweep gradually and smoothly into one another and into the tray floor in order to provide good onformity with the dental patient's anatomy.

To accommodate the described changes in the shape of dental anatomy, the tray for use with maxillary deciduous dentition may be considered to have a floor **11** of generally flat and semi-circular shape. The tray for use with mixed dentition has relatively short tangential extensions **15** at both posterior ends; the tray for use with permanent dentition is provided with relatively long diverging tangential extensions **16** which curve away from the tray walls **13** and **14**. Similarly, in the mandibular trays illustrated in FIG. **3**, the deciduous dentition tray has a floor **21** of relatively semi-circular plan shape. The mixed dentition tray is provided with relatively short extensions **25** diverging from the tray walls; the permanent dentition tray is provided with relatively long diverging tangential extensions **26**.

In accordance with another important aspect of the invention, each tray in the set is adjustable or hand moldable through a limited range of shapes. To this end, the tray comprises a flexible inner mesh form **31** covered with a flexible outer covering **32**. The form **31** and covering **32** are selected for pliability to be hand moldable through a limited range of shapes. In practice, a metallic wire mesh screen covered with a polyvinyl chloride covering has been found to provide a tray which may be moldable by hand yet which will retain the shape into which it is pressed. Moreover, the covering is easily cleaned and provides a pleasing appearance.

For easy manipulation of the tray, a handle **33** of any convenient shape is attached to the tray front. If desired, the handle **33** may be color-coded to allow the tray user to select the appropriately sized tray from the set at a glance.

It is noted above that, in accordance with the invention, the impression trays have a shape compatible with the patient's dental anatomy. To this end, the typical maxillary tray shown in FIGS. **4** and **5** is provided with an anterior wall **12** formed at an acute angle with the adjacent tray floor **11**. This angle need be only so acute as to provide the illustrated correct anatomical fit with the patient's mouth; investigations have shown an angle of substantially 75˘ to be optimum.

To accommodate the patient's maxillary labial frenum, a cleft **40** is formed in the center of the anterior wall **12**. This cleft **40** is of a rounded V-shaped notch configuration. In the permanent maxillary dentition tray, this cleft is about 0.75 inch high; in the tray for mixed maxillary dentition, it is about 0.63 inch high; and in the tray for deciduous maxillary dentition, the cleft is about 0.50 inch high.

At both sides of the cleft **40**, the anterior wall **12** rises to a height sufficient to reach from the tray floor **11** to the roof or upper limit of the patient's upper anterior vestibule, thereby covering the anterior maxillary alveolar process. These crests **41** and **42** are about 1.00 inch high in the permanent dentition tray; about 0.87 inch high in the mixed dentition tray, and about 0.63 inch high in the deciduous dentition tray.

Proceeding distally, the anterior crests **41** and **42** slope smoothly into the lateral walls **13**. These lateral walls **13** are of a height less than the anterior wall **12** to accommodate the maxillary buccal frena which join the side lips to the buccal alveolar process. The median height of these walls in the permanent dentition tray is about 0.75 inch; and the mixed dentition tray, about 0.63 inch; and in the deciduous dentition tray, about 0.50 inch.

It is another important feature of the invention that the maxillary impression trays are formed to avoid gagging the patient during use. To avoid this gagging, the lateral tray walls **13** slope at their posterior ends **43** and **44** toward the floor **11**. At the ends **43** and **44**, posterior ridges **45** and **46** are formed having a low height to avoid contacting the soft palate SP immediately posterior the tray ridges. The ridges **43** and **44** easily slip around and cup the maxillary tubercles when the tray is emplaced in the mouth.

Rising smoothly from the relatively low posterior ridges **45** and **46** are the central walls **14**. These walls **14** have a height sufficient to reach from the tray floor **11** to the patient's hard palate. In the permanent dentition trays, these central walls are approximately 0.67 inch high; in the mixed dentition tray, about 0.50 inch high; and in the deciduous dentition tray, about 0.37 inch high. Thus contained by these tray walls, the alginate will provide a complete impression of the inner surfaces of the alveolar ridge and the rugae region. To provide structural rigidity for the tray, a web **48** may be provided, if desired, between the central walls at the level of the tray floor **11**.

It is another important feature of the invention that the partially hardened impression material is retained within the tray as the tray is withdrawn from the patient's dentition. To this end, a permanent bead **49** is formed at the upper edges of the lateral walls **13**. The bead **49** originates near the anterior wall crests **41** and **42**, and smoothly follows the contours of the lateral walls down to the posterior ridges **44** and **45**. In the illustrated embodiment of the tray, a bead projecting about 0.08 inch from the adjacent tray side is used. Since displaced alginate may flow over the tray top to the outer surface, the bead may be formed on the outer tray surface as well. Such formation provides an additional alginate-retaining capability for the tray.

The mandibular trays of the invention are illustrated principally in FIGS. **3** and **6–9**. The trays include floors **21** of arched plan shapes similar in general to the floors of the maxillary trays shown in FIG. **2**. In their elevational aspects, however, the tray floors **21** are shaped to conform to the Curve of Spee. At the rearmost point, this elevational sweep of the posterior ends **53** and **54** of the tray floor is about 0.10 inch.

As in the maxillary tray, the mandibular tray anterior wall **22** has a cleft **50** of a depth sufficient to accommodate the mandibular labial frenum. In the deciduous dentition tray, this cleft **50** occurs about 0.50 inch from the tray bottom; in the tray for mixed dentition the cleft occurs about 0.62 inch from the tray bottom; in the permanent dentition tray, the cleft occurs about 0.75 inch from the tray bottom.

As in the maxillary tray, the anterior wall rises from the cleft **50** to crests **51** and **52** of a height sufficient to reach from the tray floor **21** substantially to the bottom limit of the patient's lower vestibule, thereby covering the mandibular alveolar process. The crests are about 0.87 inch high in the permanent dentition tray; about 0.75 inch high in the mixed dentition tray; and about 0.63 inch high in the deciduous tray. From the crests, the lateral walls **23** sweep to a reduced height less than the anterior walls to accommodate the mandibular buccal frena. The sweep of these lateral walls continues at their posterior ends **53** and **54** where the wall terminates relatively abruptly at the tray floor **21**.

Central walls **24** are formed to reach from the tray floor **21** substantially to the bottom of the patient's sublingual vestibule, thereby covering the most lingual surface of the alveolar process. In the permanent dentition tray, these walls **24** reach a maximum height of about 0.70 inch; in the mixed dentition tray, the maximum height is about 0.62 inch; and in the deciduous tray, the maximum height is about 0.37 inch.

As in the maxillary tray, an alginate-retaining bead **59** is formed at the upper edges of the lateral walls and follows the contours thereof. For additional retentive capability, a second bead **60** is formed at the free edges of the central walls and follows the contours thereof around both posterior ends **53** and **54** of the tray floor to provide maximum retention for the carried alginate.

I claim as my invention:

1. A dental impression tray conforming to the anatomy of a usual patient's maxillary dentition, the tray including a substantially flat floor of arched plan shape, an anterior wall forming an acute angle of substantially 75° with the tray floor, having a maximum height ranging substantially from 0.63 inches to 1.00 inches and reaching from the tray floor to the roof of the patient's upper anterior vestibule, thereby covering the maxillary anterior alveolar process, a central cleft provided in the anterior wall having a minimum height measured at the cusp cleft ranging substantially from 0.50 inches to 0.75 inches sufficient to closely accommodate the maxillary labial frenum, lateral walls of a height less than the anterior wall to accommodate the maxillary buccal frena, a bead formed at the upper edges of the lateral walls and following the contours thereof, posterior ridges of a relatively low height sufficient to contain the maxillary tubercles, and central walls having a height ranging substantially from 0.37 inches to 0.67 inches reaching from the tray floor to the hard palate and sloping downward, at their posterior ends, to the posterior ridges to avoid contacting the soft palate and gagging the patient.

2. A dental impression tray conforming to the anatomy of a usual patient's mandibular dentition, the tray including a floor of arched plan shape and following the Curve of Spee in elevation, an anterior wall having a maximum height ranging substantially from 0.63 inches to 0.87 inches and reaching from the tray floor substantially to the bottom of the patient's lower vestibule, thereby covering the mandibular alveolar process, a central cleft provided in the anterior wall having a minimum height measured at the cusp cleft ranging substantially from 0.50 inches to 0.75 inches sufficient to accommodate the mandibular labial frenum, lateral walls of a height less than the anterior walls to accommodate the mandibular buccal frena, and sloping at their posterior ends to the tray floor, a bead at the free edges of the lateral walls and following the contours thereof, central walls having a height ranging substantially from 0.37 inches to 0.70 inches reaching from the tray floor to substantially the bottom of the patient's sublingual vestibule, thereby covering the most lingual

surface of the alveolar process, and a bead at the free edge of the central wall and following the contours thereof around both posterior ends of the floor.

3. A set of dental impression trays conforming to the anatomy of a usual patient's maxillary dentition, the tray set including a deciduous dentition tray, a mixed dentition tray, and a permanent dentition tray, each tray including a substantially flat floor of arched plan shape, an anterior wall forming an acute angle with the tray floor and reaching from the tray floor substantially to the roof of the patient's upper vestibule, thereby covering the maxillary alveolar process, a central cleft provided in the anterior wall of a depth sufficient to accommodate the maxillary labial frenum, lateral walls of a height less than the anterior walls to accommodate the maxillary buccal frena, a bead formed at the upper edges of the lateral walls and following the contours thereof, posterior ridges of a low height sufficient to contain the maxillary tubercules, the lateral walls sloping at their posterior ends to the posterior ridges, and central walls reaching from the tray floor to the hard palate and sloping at the posterior ends to the posterior ridges to avoid contacting the soft palate and gagging the patient, the trays having substantially the respective dimensions given in the following table:

	Permanent Dentition Tray	Mixed Dentition Tray	Deciduous Dentition Tray
Maximum Height of Anterior Wall, in.	1.00	0.87	0.63
Minimum Height of Anterior Wall at Cusp of Cleft, in.	0.75	0.63	0.50
Height of Inner Walls, in.	0.67	0.50	0.37

4. A set of adjustable dental impression trays compatible with the anatomy of a usual patient's maxillary dentition according to claim 3, the tray set including a tray for use with deciduous dentition having a substantially flat, semi-circular shaped floor, a tray for use with mixed dentition having a substantially flat floor of semi-circular shape with relatively short tangential extensions at both posterior ends, and a tray for use with permanent dentition having a substantially flat floor of semi-circular shape with relatively long diverging tangential extensions.

5. A set of dental impression trays conforming to the anatomy of a usual patient's mandibular dentition, the tray set including a deciduous dentition tray, a mixed dentition tray, and a permanent dentition tray, each tray including a floor of arched plan shape and following, in elevation, the Curve of Spee, an anterior wall forming an acute angle with the tray floor and reaching from the tray floor substantially to the bottom of the lower vestibule, thereby covering the mandibular alveolar process, a cleft provided in the anterior wall of a depth sufficient to accommodate the mandibular labial frenum, lateral walls of a height less than the anterior walls to accommodate the mandibular buccal frena, and sloping at their posterior ends to the curving tray floor, a bead formed at the upper edges of the lateral walls and following the contours thereof, central walls reaching from the tray floor substantially to the bottom of the patient's sub-lingual vestibule, and a bead formed at the upper edge of the central walls and following the contours thereof, the trays having substantially the respective dimensions given in the following table:

	Permanent Dentition Tray	Mixed Dentition Tray	Deciduous Dentition Tray
Maximum of Anterior Wall in.	0.87	0.75	0.63
Minimum Height of Anterior Wall and Cusp of Cleft, in.	0.75	0.62	0.50
Height of Inner Walls, in.	0.70	0.62	0.37

6. A set of adjustable dental impression trays compatible with the anatomy of a usual patient's mandibular dentition according to claim 5, the tray set including a tray for use with deciduous dentition having a substantially flat, semi-circular shaped floor, a tray for use with mixed dentition having a substantially flat floor of semi-circular shape with relatively short tangential extensions at both posterior ends, and a tray for use with permanent dentition having a substantially flat floor of semi-circular shape with relatively long diverging tangential extensions.

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