

Dec. 11, 1956

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2,773,308

METHOD AND APPARATUS FOR ADAPTING DENTURES

Filed March 2, 1953.

2 Sheets-Sheet 1

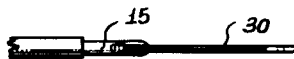
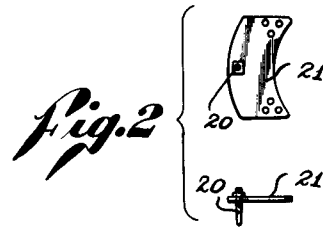
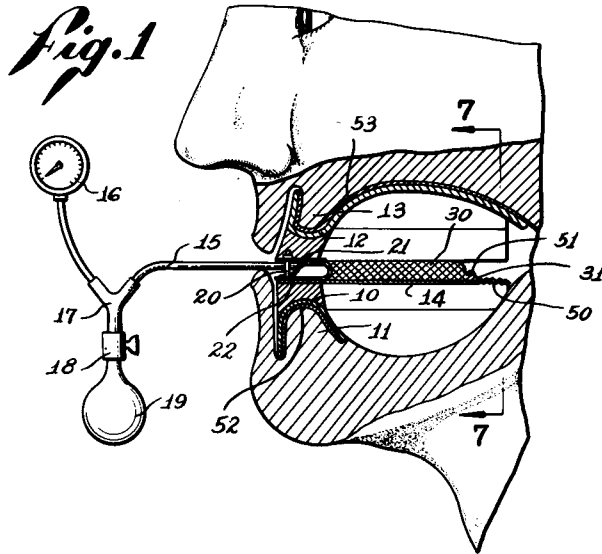


Fig. 3

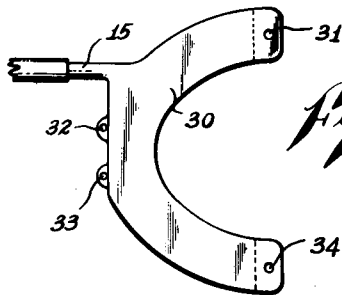


Fig. 4

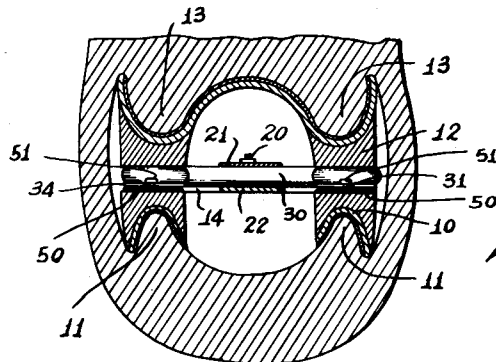
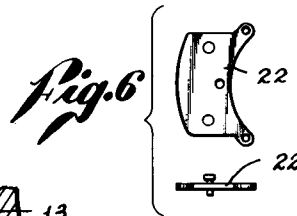
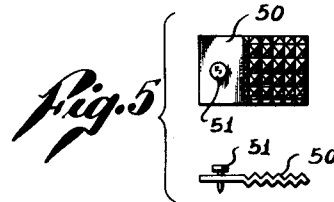


Fig. 7

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2 Sheets-Sheet 2

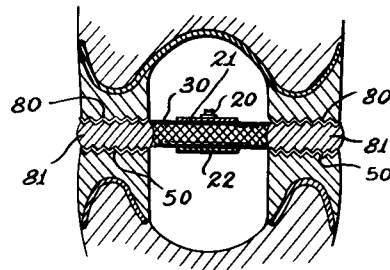
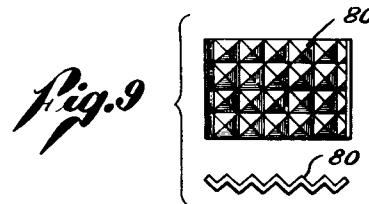
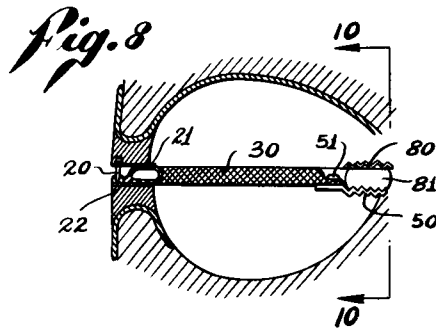


Fig. 10

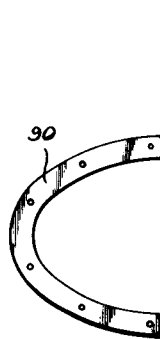
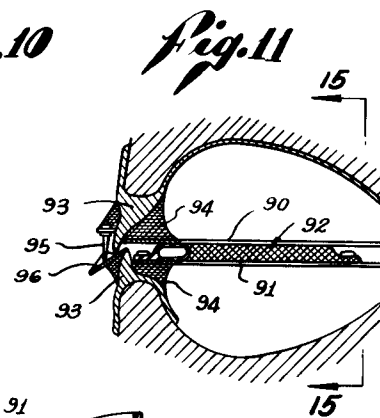


Fig. 12

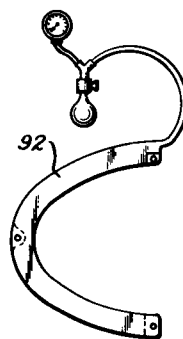


Fig. 13

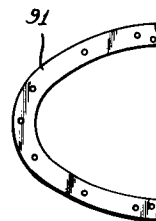


Fig. 14

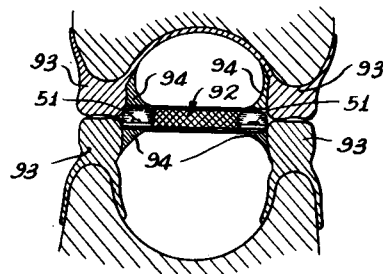


Fig. 15

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1

2,773,308

METHOD AND APPARATUS FOR ADAPTING DENTURES

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Application March 2, 1953, Serial No. 339,706

11 Claims. (Cl. 32—19)

This invention relates to methods and apparatus for adapting artificial dentures. More particularly, it is addressed to a novel means for coordinating impressions and mandibular relations, and for coordinating occlusal surfaces of completed dentures, permitting the fabrication of dentures that are vastly superior in adaptability and comfort to any heretofore known.

The extreme importance of having functional stresses and the natural occlusal pressure between the maxillary and mandibular dentures equalized and maintained is well-known. Unequal and incorrect pressures not only result in shifting of the denture bases on the alveolar ridges producing occlusal disharmonies, soreness, and possibly much pain, but can cause the more serious result of bone dystrophies. That is, the osseous foundations change and eventually tend to render the original dentures out of harmony.

Properly adapted dentures in which the occlusal pressure is not only that exact value for the individual patient's maximum comfort, but is equalized over the whole supportive area, will aid considerably in preventing the above noted soreness, bone dystrophies, and occlusal disharmony.

Heretofore, efforts to provide perfectly adapted dentures have been mainly directed towards systems for measuring mandibular denture positions and corresponding occlusal pressures under stresses only during certain periods, such as occur, for example, when the patient is masticating. There has been little if any controlled success, however, in fabricating perfectly adapted dentures that provide the patient maximum comfort throughout twenty-four hours a day. This is because of the difficulty in determining the occlusal pressures and corresponding relations of the mandible to the maxilla during the unconscious sucking and swallowing functions that take place by a patient hundreds of times each day and even while the patient is sleeping.

The provision of a continuously controlled and coordinated force which is properly related to the physiologic functions of the dentures worn by the individual patient is of the utmost importance. This force or sense of contact is controlled through the sensory nerve endings and developed by the neuromuscular system, the whole being coordinated with the cardiovascular and lymph systems. Thus, it is found that the most comfortable contact pressure corresponds approximately with the diastolic blood pressure of the individual; therefore, any imperfect contact pressure of the dentures in the patient's mouth will upset the natural coordination between the sensory nerve endings and the vascular and lymphatic systems. The application of controlled and coordinated forces to the impression methods, methods of mandibular relations, and the coordination of occlusal relations are absolutely essential to effect a proper physiologic functioning denture for that individual.

2

Adapting dentures in the past has been extremely arduous for many reasons, mainly, the difficulty in obtaining accurate information from the patient, and secondly, the lack of suitable apparatus for determining the inter-relations between denture pressures and the supportive tissues through the neural system. For example, the dentist has had to rely on the patient's signifying to him when the dentures "feel" comfortable. At this time the relative position of the denture bases or trays has been fixed by instructing the patient to retain them in the referred to comfortable position until a quick-setting plaster disposed between the trays has set. Even if the plaster can set in as short a time as one to three minutes, the patient cannot be expected to hold his jaws in the same relation and with the same force. If this is attempted, studies show that the muscular system is very likely to fatigue, and what the patient originally assumed to be the proper relation and force will no longer seem to him to be the same. In other words, this setting period results in the employment by the patient of further neuro-muscular control in order to try to maintain the bases in any one relative position.

Aside from the above noted difficulty of obtaining accurate information from the patient after a given time, there has not been available suitable apparatus for accurately recording exactly what the physiologic force should be. Some work in this field has resulted in instruments which are heavy, bulky and influence the function of structures within the mouth, require appendages outside of the mouth, and are not mechanically friction-free. They are not adaptable to impression making on a single maxillary or mandibular artificial denture opposing natural teeth, or similarly, for use with the denture base area of a partial denture.

For example, one past method is known as the central bearing method. This employs a single pivot located at a central point between the mandibular and maxillary base, and the theory is that the patient in biting will cause the base members to shift to such a relation that there is equalized pressure on the ridges. A balance is hoped for because of the use of only a single pivot against which the biting pressure is being applied, and a quick-setting plaster is inserted while the members are under stress. However, this method has not proved satisfactory in practice. One possible explanation is that it is difficult, and perhaps impossible, to locate the single pivot at the true center of pressure and thus the application of stress may lead to an incorrect angular relation between the members. Another reason is that there is no relation established between the sensory nerve receptors (touch, discriminating touch, and contact pressure, etc.) and the neuro-muscular system which applies the functional forces. Any number of individual studs means (hydraulically operated piston-cylinder arrangements, for example), if not coordinated to the sensory receptor nerve endings and carried through the neuro-muscular system, could not be equalized nor controlled, for there is no related physiologic factors to which balance or equalized force can be related. Any equipment used to record such delicate relations must necessarily present the least possible objectionable influences to the sensory nerve endings thereby not distributing the neuro-muscular relations. Therefore, the equipment used must necessarily be light in weight, have a minimum thickness, absolutely no external rigid appendages to record tracings, etc., must be friction free, and be capable of adequate and easy sterilization.

With the above considerations in mind, it is a primary object of the present invention to provide methods and apparatuses for creating dentures wherein the physiological

3

forces are related to the vascular pressures and the sensory nerve endings of the patient thereby establishing maximum comfort for the patient.

It is another object of the invention to provide a method for accurately determining a physiological force which is in complete harmony with the cardio-vascular system together with the intercellular and intracellular fluids, to the end that physiological adaptation of the dentures may be easily effected.

Another object of the invention is to provide means for simultaneously relating or coordinating the mandibular and maxillary impression trays so that the physiological force can be applied uniformly over the entire area of supportive structures.

A further object is to provide an efficient means of relating the finished impressions to centric and eccentric relations of the mandible to the maxilla utilizing a physiological force in this coordinating process. This allows the assembly to be related on an instrument such as an articulator in the same relative position that the assembly assumed under the physiological force obtained in the patient's mouth.

Still another object is to provide a novel method and apparatus for coordinating the occlusal relations of the dentures to physiological forces compatible with the supportive structures, after the dentures have been fabricated.

These and other objects and advantages of the present invention are attained by providing the mandibular or maxillary impression tray with a generally arch-shaped flexible fluid chamber formed from light, thin, inelastic material. The chamber is adapted to cover approximately the entire bite rim of the impression tray in such a manner that when inflated, it will exert a uniform force against the maxillary or mandibular tray at every contact point. Inflating of the fluid chamber with air, for example, will create a force between the trays while in the patient's mouth and their exact relation and functions can be easily effected with a nicety of action never before achieved.

The proper physiological forces and their effects are determined by establishing a proper relative position as follows: An anterior contact point on one tray is adjusted to touch a plate on the opposing tray when the mandible of the patient is approximately at the functional position it will occupy when in centric or eccentric relation. The fluid chamber is then slowly inflated, which creates a controlled and equalized force between the trays. The patient may then determine that force which seems to be most comfortable by his sense of "touch" when he closes his jaws to bring the pin into touch contact with the plate. This physiological force corresponds generally to the diastolic cardiovascular pressure of the patient and can be recorded by a suitable pressure gauge, preferably calibrated in mm. of mercury, connected to the fluid chamber. The provision of the contact pin and plate together with the flexible fluid chamber is essential to correlate the sensory receptor nerve endings with a controlled and equalized force on the alveolar ridges. This controlled force is obtained through the neuro-muscular system of the patient and the flexible fluid chamber apparatus.

It is to be noted that by virtue of the use of an inflatable chamber wherein the pressure is distributed over approximately the entire area of the bite rims, the impression trays will assume relative positions in response to this pressure, and their distal portions will angulate about the anterior contact point and plate as a fulcrum, until they assume the relation coordinated to physiologic forces applied. As stated, this relation is attained when the physiologic force is equalized over the entire supportive structure. Such equalization is automatically effected because of the characteristics of the flexible fluid chamber within which every point must be at the same pressure.

With the proper force recorded by the dentist, which

4

measurement can be made relatively quickly and before muscle fatigue in the patient becomes evident, one of the impression trays is removed from the mouth and impression material is applied. It is then reinserted in the mouth with the flexible fluid chamber at the recorded pressure. Since this pressure has been recorded, it is no longer necessary to rely on further determinations by the patient. After the first impression material has set, the other tray is removed and similarly supplied with impression material. This tray is then reinserted with the fluid chamber at the recorded pressure. The order in which the impressions are made is immaterial, but preferably the mandibular tray is removed first.

After the impressions are completed, the mandibular relations are recorded. This registration may be accomplished by the use of a Gothic arch tracing if desired. In establishing mandibular relations, either the maxillary or mandibular tray may be removed, but preferably the maxillary impression tray (due to the lack of equipment normally attached thereto) and a quick-setting material is applied to small corrugated relation plates distal to the area of the flexible fluid chamber. Thus, when the maxillary tray is reinserted and the impression trays are in proper position with the anterior contact point related to the plate through the sensory receptor system and the neuro-muscular system and with the recorded pressure applied to the flexible fluid chamber, the quick-setting material hardens and establishes, with the anterior contact point and plate, three points of support. These three support points enable the trays to be subsequently positioned in the precisely identical relationship on an instrument such as an articulator for fabricating the dentures.

A better understanding of the invention will be had by referring to the accompanying drawings in which:

Figure 1 is an elevation side view partly in section of a person's mouth showing one form of the present invention for making dentures;

Figure 2 shows a side and plan view of an anterior contact pin and plate employed in the maxillary impression tray shown in Figure 1.

Figure 3 is a side view of the flexible fluid chamber in collapsed position;

Figure 4 is a plan view of the flexible fluid chamber;

Figure 5 is a side and top view of the mandibular support for a quick-setting material;

Figure 6 is a side and top view of the lower anterior plate against which the anterior contact point of Figure 2 is adapted to bear;

Figure 7 is a sectional view of the patient's mouth as seen along the line 7—7 of Figure 1;

Figure 8 is another elevational side view partly in section of the patient's mouth showing apparatus for establishing the mandibular-maxillary relations;

Figure 9 is a top and side view of the maxillary quick-setting material support;

Figure 10 is a cross-section of the patient's mouth along the line 10—10 of Figure 8;

Figure 11 is another elevational side view partly in section of a patient's mouth fitted with dentures and apparatus for occlusal coordination of the dentures;

Figures 12, 13, and 14, are plan views of various elements employed in the apparatus of Figure 11; and

Figure 15 is a sectional view of the patient's mouth as seen along the line 15—15 of Figure 11.

In the fabrication of dentures in accordance with the present invention, there are normally three major steps. The first step involves the making of denture impressions and will be described in connection with Figures 1 through 7. The second step involves establishment of mandibular relations and will be explained in connection with Figures 8 through 10. The third step has to do with denture occlusal coordination and will be described in connection with Figures 11 through 15.

In the first step of making up dentures, primary impressions are taken and models are formed. An approximate centric relation is obtained with a soft material

5

such as beeswax. With this relationship, the primary models are positioned relative to each other on an articulator, and impression trays made from these models.

In accordance with the invention, an arch-shaped flexible fluid chamber is secured to the occlusal area of one of the trays. Also provided is a supporting plate and pin secured to the anterior portion of the maxillary impression tray, this pin being adjusted to project downwardly a distance so that it just contacts a bearing surface plate on the mandibular tray in approximate centric relation.

The above components of the apparatus are shown in assembled relationship in the patient's mouth in Figure 1. As shown in the drawings, the mandibular tray 10 is placed over the alveolar ridges 11 of the patient's mandible. The maxillary impression tray 12 is similarly fitted over the alveolar ridge 13 of the patient's maxilla. The flexible fluid chamber 30 shown in side and plan view in detail in Figures 3 and 4, respectively, is secured to the occlusal rim 14 of the mandibular tray as at the points 31, 32, 33 and 34. As illustrated in Figure 1, the flexible fluid chamber 30 is inflated by means of a tubular extension 15 communicating with a pressure gauge 16 and passing through a further tubular extension 17, and a check valve 18, to a compressible bulb 19. The referred-to pin 20 secured to supporting plate 21 is supported at the anterior portion of the maxillary impression tray 12, and will contact the bearing plate 22 when the mandible of the patient is in approximate centric occlusal relationship. This pin 20 and supporting plate 21 are shown in side and top views, respectively, in Figure 2, while the bearing plate 22 is shown in detail in Figure 6.

To simplify the assembly of the apparatus, the bearing plate 22 is fastened to the anterior portion of the tray 10, the flexible fluid chamber 30 being attached to plate 22 through the fastening means 32, and 33, Figure 4. Similarly, the posterior portion of the arch-shaped flexible fluid chamber 30 may be secured to the corresponding portions of the mandibular impression tray 10 by means of two relating plates 50 and their securing pins 51 projecting through the openings 31 and 34, respectively, as clearly shown in Figure 7.

In making the denture impressions, the trays 10 and 12, together with the previously described apparatus, are inserted in the mouth and the patient instructed to close until the pin 20, mounted in the supporting plate 21, just touches the bearing plate 22. The patient is made conscious of pin 20 in contact with plate 22 through his sensory receptors, and he maintains this touch contact with his neuro-muscular system. With this physiological phenomenon now functioning, the flexible fluid chamber 30 is inflated by means of the bulb 19 up to a comfortable pressure which is approximately diastolic-vascular pressure. The action of the flexible fluid chamber 30 is to exert a uniform pressure against both bite rims of the respective trays 10 and 12 whereby controlled equalized pressure is exerted by the trays toward the mandibular and maxillary alveolar ridges 11 and 13.

As previously pointed out, the provision of the contact pin 20 and plate 22, together with the fluid chamber 30, is essential to correlate the sensory receptor nerve endings with a controlled and equalized force on the alveolar ridges. This controlled force is obtained through the neuro-muscular system of the patient and the flexible fluid chamber apparatus and permits the coordination of the physiologic principles and mechanical factors in such a manner that an equalized controlled force may be applied to the impression making, as well as in relating of mandibular and occlusal relations in the fabricated dentures to be subsequently described.

Without having the sensory receptor nerve endings, especially at the anterior region of the alveolar ridges adjacent the contact point 20 and a plate 22 properly coordinated to the use of the neuro-muscular system, the

6

patient could not maintain for hardly any moment of time, a controlled force. This maintaining of a controlled force by the patient can easily be upset by any extraneous material placed in the oral cavity because of its influence toward the sensory receptor nerve endings and their influence upon the neuro-muscular system. The early fatigue of muscle fibres in attempting to accommodate to a related position when trying to equalize a controlled force is avoided by the method and apparatus of the present invention.

Referring again to Figure 1, after the proper pressure has been recorded on gauge 16, either tray 10 or 12 may be removed, preferably mandibular tray 10, and treated with impression material 52. The tray is reinserted with the fluid chamber 30 at the recorded pressure and the mandibular impression taken. The maxillary tray 12 is then removed and similarly treated with impression material 53 and reinserted. After the impression taking material 52 and 53 has set, under the influence of the equalized pressure of chamber 30, it may be desirable to have the patient scribe a Gothic arch with the pin 20 on plate 22, whereby occlusal centric relation can be determined and any eccentric relations in harmony with the Gothic arch tracing may be related.

The dentist is now ready to commence the next step of establishing the mandibular relations. This may be done for centric, as well as eccentric mandibular positions and is accomplished by making use of the relating plates 50 on the mandibular tray and two corresponding relating plates 80 on the maxillary tray. These latter maxillary plates are shown in Figures 8 to 10.

In establishing the correct mandibular alveolar ridge relationship, the maxillary tray 12, to which the relating plates 80 are attached, is removed and a quick-setting material 81 applied thereto. The maxillary tray 12 is then reinserted in the patient's mouth and he is instructed to repeat the closure procedure as previously described, the flexible fluid chamber being maintained at its recorded pressure.

After the quick-setting compound 81 has hardened, the impression trays may be removed and master models made therefrom and positioned on an articulator. The hardened quick-setting material 81, together with the pin 20, will establish the exact relative relationship between the maxillary and mandibular master models under the controlled physiologic pressure as determined by the flexible fluid chamber. From the physiological relationships recorded, the master models may be coordinated on the articulator in such a manner that they will reflect the previous physiological factors obtained. From this coordinated articulator and master models, the dentures are thus easily constructed in harmony with all of the principles involved.

In connection with the third step, this invention provides a means for the coordination of occlusions of the dentures employing the principle of the flexible fluid chamber. To accomplish the precise occlusion coordination of the dentures, there are temporarily provided inner arch-shaped rim platforms attached to the inside curved surface of the upper and lower dentures, respectively, as shown in Figure 11 at 90 and 91, and in greater detail in Figures 12 and 14, respectively. Secured to either the upper inner rim 90 or lower inner rim 91 is another flexible fluid chamber 92 of somewhat smaller dimensions than the fluid chamber 30 previously employed in order to be accommodated within the artificial teeth 93, as best shown in Figures 11 and 15. As shown in Figure 15, for example, the inner rims 90 and 91 may be temporarily secured to the teeth 93 by means of a temporary bonding substance 94. Also temporarily secured to the anterior of the dentures is a pin 95 and corresponding bearing plate 96, as shown.

For coordinating the denture occlusions, the dentures are inserted in the patient's mouth as shown in Figure 11 and the flexible fluid chamber 92 inflated to the same

7

comfortable value recorded in the impression and registration methods. Thus, it is now possible to interpose this same physiologic force using the touch receptor system 95 and 96 in relation to the teeth. The proper relationship of the neuro-muscular system to the activation and force of the mandible is also obtained through the application of a uniform controlled force by the flexible fluid chamber 92. It is possible, accordingly, to correlate and coordinate centric occlusal relation and eccentric relations in harmony with this physiological force as related to the supporting structure and the functional movements of the mandible. Any fabricating defects in the dentures upsetting these relationships may thus be readily discovered and corrected.

It will thus be seen that we have provided a greatly improved method and apparatus for the fabrication of dentures. The invention is not to be thought of as limited, however, to the precise steps and apparatuses disclosed. Thus, for example, in the initial impression stage, the flexible fluid chamber 30 may be secured to the maxillary impression tray rather than the mandibular tray, if desired. Furthermore, the principles expounded are applicable as well to partial dentures and bridges, and it is contemplated that the invention will find much usage with single mandibular or maxillary dentures opposing a natural complement of teeth. Clearly, the securing of the flexible fluid chamber by splints or any other mechanical means of attachment may be accomplished, thereby allowing the principles to be applied to natural dentures wholly, or in part.

In the following claims, the phrase, "physiologic pressure corresponding to the diastolic cardio-vascular pressure characteristic of the patient" includes that pressure which is correlated to the sensory receptor nerve endings of the alveolar ridges for the particular patient, and which is controlled by the neuro-muscular system of the patient. Further, the term "impression tray" includes impression trays employed in adapting partial dentures, temporary bridges, and temporary dentures, as well as full dentures.

We claim:

1. The method of establishing mandibular relationships for adapting dentures comprising: placing impression trays over the alveolar ridges of a patient, inserting quick-setting material between opposed portions of said trays, uniformly subjecting substantially the entire area of the remaining opposing portions of said trays to a pressure substantially equal to the physiologic pressure corresponding to the diastolic cardio-vascular pressure characteristic of the patient, and maintaining said pressure until the quick-setting material has hardened.

2. The method of coordinating denture occlusions comprising the steps of: placing denture bases over the alveolar ridges of a patient, providing an anterior contact touch point between said bases, and uniformly subjecting substantially the entire opposing bite rims of said denture bases to a pressure substantially equal to the physiologic pressure corresponding to the cardio-vascular pressure characteristic of the patient as determined by said anterior touch contact.

3. The method of taking impressions for adapting dentures comprising the steps of: lining an impression tray with impression taking material, placing said tray over an alveolar ridge of a patient, uniformly subjecting substantially the entire area of the tray to a pressure acting in a direction substantially normal to the alveolar ridge; and adjusting said pressure to be substantially equal to the physiologic pressure corresponding to the diastolic cardio-vascular pressure characteristic of the patient.

4. The method of fabricating dentures, comprising the steps of: placing mandibular and maxillary impression trays over the corresponding alveolar ridges of a patient; providing an anterior contact touch point between said trays; uniformly subjecting substantially the entire area of opposed portions of said trays to a pressure acting substantially normally to the plane of said trays; adjust-

8

ing said pressure to a value substantially equal to the physiologic pressure corresponding to the diastolic cardio-vascular pressure characteristic of the patient as determined by said anterior touch contact; recording said pressure; lining one of said trays with impression taking material; reinserting said one tray with said pressure at said recorded value; and repeating the last mentioned two steps with the other of said trays.

5. The method of claim 4, including the additional subsequent steps of: inserting quick-setting material between opposed end portions of said trays; uniformly subjecting substantially the entire area of the remaining opposed portions of said trays to a pressure equal to said recorded pressure; and maintaining said pressure until said quick-setting material has hardened, whereby said hardened material will serve to establish the mandibular relationship in the subsequent fabrication of the denture bases and dentures.

6. The method of claim 5 including the subsequent steps of: temporarily providing said denture bases with an anterior touch contact point; placing said denture bases over the alveolar ridges of the patient; and uniformly subjecting substantially the entire opposing bite rims of the denture bases to said recorded pressure whereby occlusal coordination of said denture bases may be effected.

7. An apparatus for taking impressions for adapting dentures comprising in combination: an impression tray adapted to fit over the alveolar ridge of a patient's mouth, a flexible fluid chamber adapted to lie over substantially the entire surface of the bite rim of said tray, means for inflating said fluid chamber to exert uniform pressure on said tray in a direction substantially normal to said alveolar ridge; and means communicating with said fluid chamber for indicating said pressure.

8. An apparatus according to claim 7, including an anterior contact point secured to said tray whereby a given pressure substantially equal to the physiologic pressure corresponding to the cardio-vascular pressure characteristic of the patient can be indicated by the patient in response to his sense of touch of said contact point.

9. An apparatus for establishing the mandibular ridge relationship of a mandibular impression tray in the adapting of dentures comprising: an impression tray adapted to fit over the alveolar ridge of a patient's mouth, said tray being of a general arch-shape in configuration, as seen in plan view, the distal ends of the arch including quick-setting material supporting means; a flexible fluid chamber of substantially arch-shape configuration as seen in plan view adapted to lie on the bite rim surface of the said tray; a second tray having a similar configuration and a bite rim surface adapted to oppose said first tray; means on the distal ends of said second tray cooperating with said quick-setting material supporting means on said first tray to support; a quick-setting material and means for inflating said fluid chamber to a given pressure to maintain said first and second trays in a predetermined relationship for the length of time required for a quick-setting material between said quick setting material supporting means to harden.

10. An apparatus according to claim 9 in which said trays include an anterior contact point which together with said quick-setting material supporting means establish three points of registration between said trays.

11. An apparatus for coordinating denture occlusions for a patient comprising: a generally arch-shaped supporting rim element adapted to be detachably secured to the inner periphery of a mandibular denture, a flexible fluid chamber adapted to lie over a substantial area of said rim, a second generally arch-shaped rim element adapted to be detachably secured to the inner periphery of a maxillary denture, whereby said second rim element will be spaced from and opposed to said first rim and said flexible fluid chamber will be positioned between said rims; anterior contact points temporarily secured to

said trays; means for inflating said fluid chamber to subject said rims to a uniform pressure in directions substantially normal to the plane of the mandibular and maxillary dentures with said anterior contact points touching; and means for indicating when said pressure is substantially equal to the physiologic pressure corresponding to the diastolic cardio-vascular pressure characteristic of the patient.

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