

[54] **ORTHODONTIC ONLAY FOR LIGHT-WIRE TECHNIQUE**

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[22] Filed: **July 31, 1972**

[21] Appl. No.: **276,715**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 193,400, Oct. 28, 1971.

[52] U.S. Cl. 32/14 A

[51] Int. Cl. A61c 7/00

[58] Field of Search 32/14 A

References Cited

UNITED STATES PATENTS

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Primary Examiner—Robert Peshock

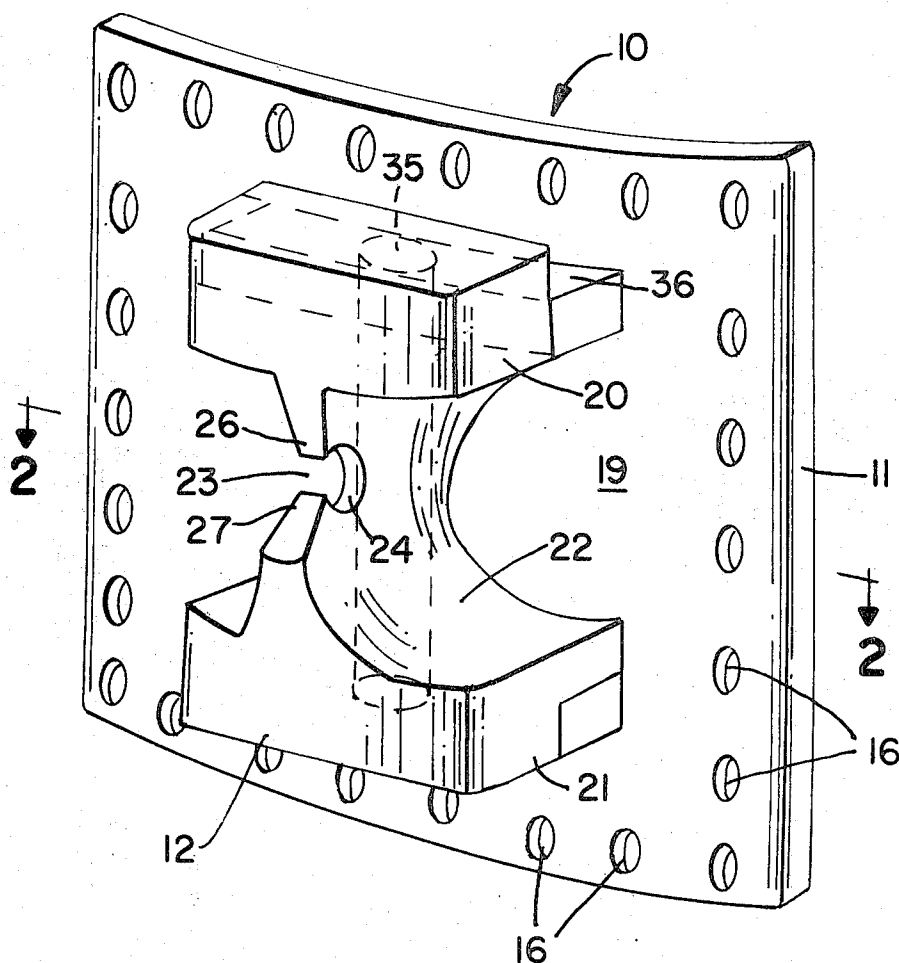
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[57]

ABSTRACT

An orthodontic onlay for use with a single arch wire in a light-wire technique. The onlay is an integral plastic member for direct cementing to a tooth. It has a curved base portion whose rear surface conforms to the cheek surface of a tooth and has a series of cement-holding openings leading therefrom. The front surface of this base portion provides a bracket portion having a snap-in notch with a narrow, generally circular seat for an arch wire. An entrance portion of the notch is formed by a pair of facing walls resilient enough so that while the entrance opening is normally substantially smaller in diameter than the arch wire, its walls spread apart when the arch wire is pressed against them, to admit the arch wire to the seat, and the walls then spring back to lock the arch wire in the seat. The onlay also has one or more vertical openings for anchoring control auxiliaries. In one form, notches adjacent the top and bottom of each opening enables tying ligature wires for additional control.

18 Claims, 12 Drawing Figures



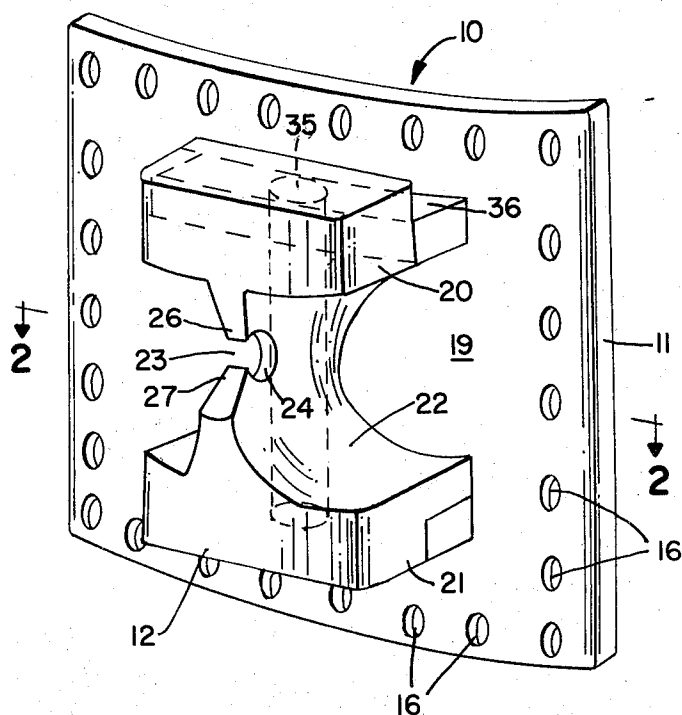


FIG - 1

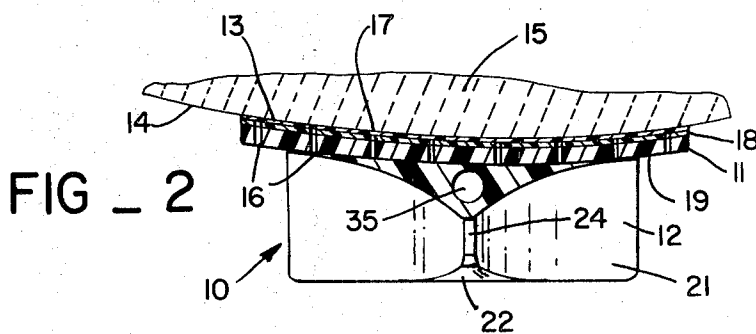


FIG - 2

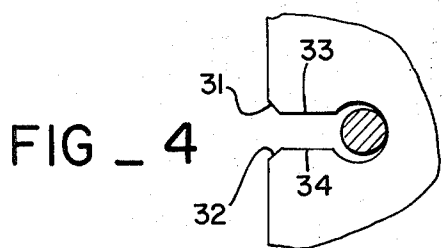


FIG - 4

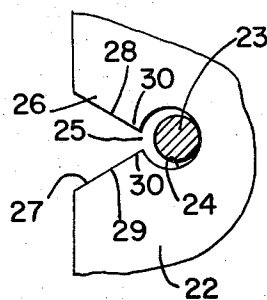


FIG - 3

FIG 5

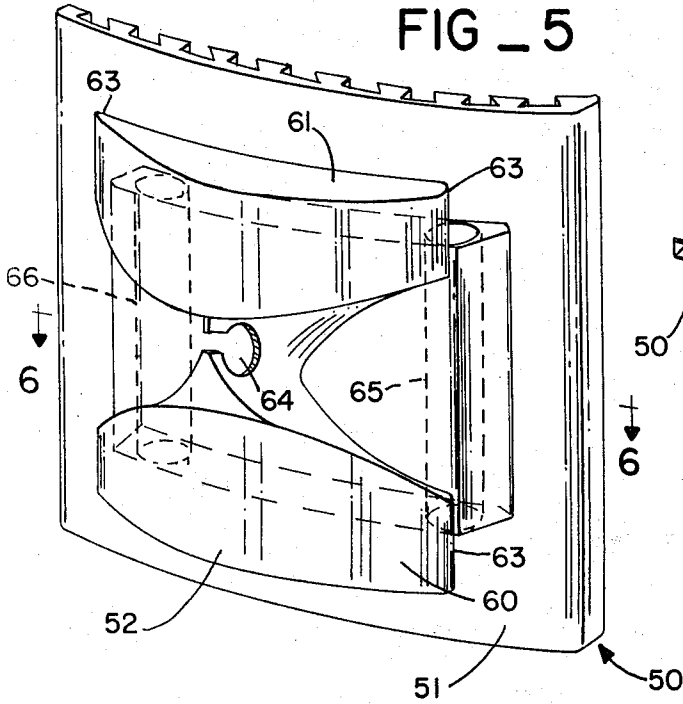


FIG 6

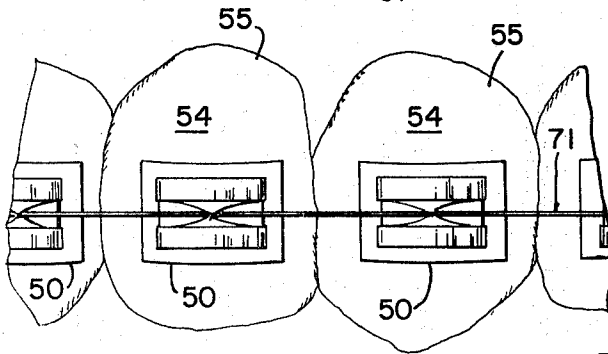
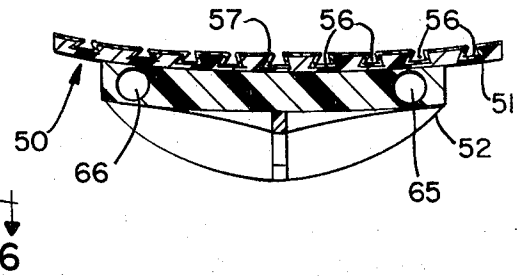


FIG 8

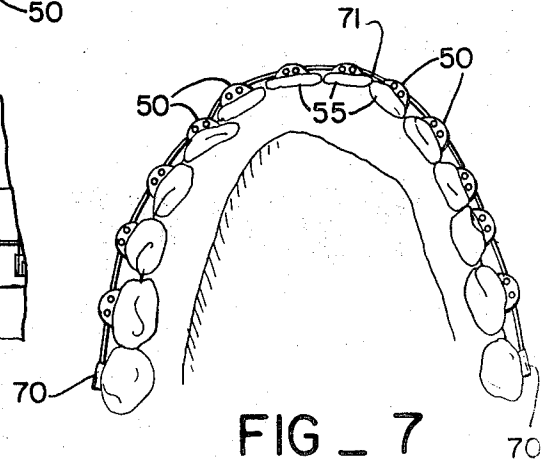


FIG 7

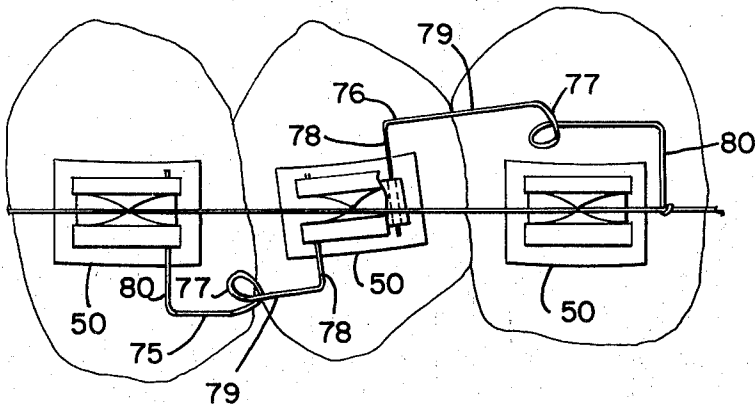


FIG 9

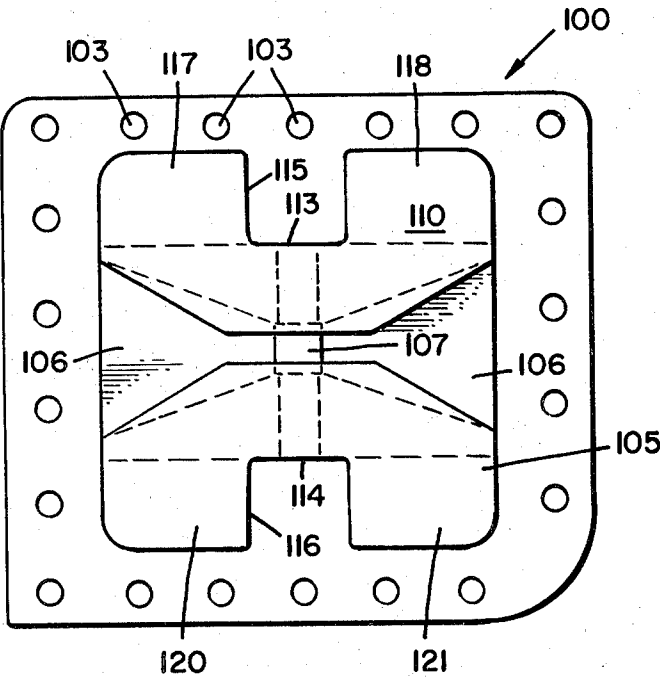


FIG_10

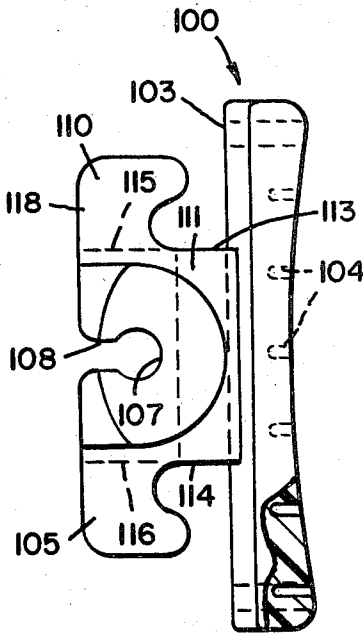


FIG_11

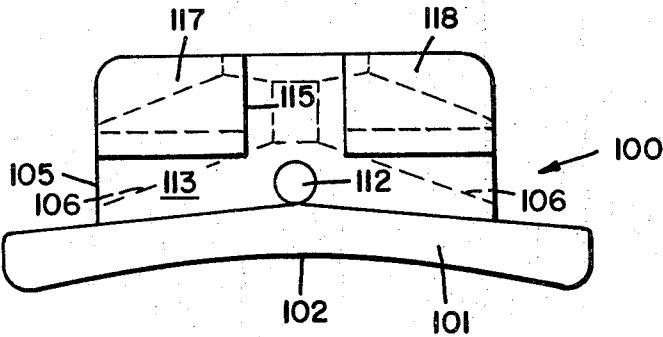


FIG_12

ORTHODONTIC ONLAY FOR LIGHT-WIRE TECHNIQUE

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part of application Ser. No. 193,400 filed Oct. 28, 1971.

BACKGROUND OF THE INVENTION

This invention relates to orthodontic onlays for use in the light-wire orthodontic technique. This onlay is characterized by (1) being rigid plastic attached directly to the tooth instead of being secured to a band, (2) the light arch wire being attached by a snap-in to a narrow, substantially point-contact circular oversize seat, so that no pins are used, and so that there is no binding at the seat, (3) integral provisions for the mounting of control auxiliaries, and (4) superior and inferior wings enabling tying of ligature wires, etc.

The light-wire technique has been known for some time, for example, see Kessling U.S. Pat. No. 2,915,824 and Begg U.S. Pat. Nos. 3,128,553 and 3,163,933. In this technique a single light, round arch wire is used. Less force is exerted on the tooth than in the older technique using a heavy square or round arch wire. It has been found possible to obtain results that are just as effective as, sometimes even more effective than, those obtained with heavy wires, and to do so with less discomfort to the user and better overall development.

The use of a light arch wire provides for a more resilient system than do the heavier arch wires, which are typically rectangular. In addition there is less friction between a round wire and an orthodontic bracket than with a rectangular wire, so that there can be much greater ease of movement of the teeth. In rectangular arch wire systems (e.g., see the Angle U.S. Pat. No. 1,553,797), constant binding occurs, and this results in much pain to the patient. By using a light arch wire, lighter forces of greater resilience can be applied and can act over a longer period of time. From a treatment standpoint, this enables treatments to be spaced about 6 weeks apart instead of having to be spaced only about 3 weeks apart.

Heretofore, the light-wire technique has generally been practiced exclusively with the use of bands and metal brackets secured to the bands. The bands themselves are well known to be uncomfortable, and the attachment of the light-wire heretofore has generally been accomplished (as in the Begg technique) by means of a pin. Recently some plastic brackets have been provided for direct cementation to the tooth, but the pinning technique is still used. Although these systems are operative, there has been a notable lack of control, and eventually the pin has to be replaced with various springs and auxiliaries. Every time the arch wire is pulled out, which happens about every 6 weeks, the orthodontist must pull all the pins and then repin the members. This quite laborious for each installation, and thereby may be numerous changes of the arch wire during treatment.

The pins which have been used are each a separate member and they must be continually inventoried, repurchased, and used. Pinning also has a marked disadvantage in that the pins trap food particles and often infringe on the patient's gum tissue. Worst of all, perhaps, the pins take a considerable amount of time to

place into the small slots available on prior-art brackets.

Some patents (including Wallshein U.S. Pat. Nos. 3,052,027 and 3,052,028 and Brader U.S. Pat. No. 3,327,393) have shown snap-in brackets, all of them metal except for Wallshein U.S. Pat. No. 3,052,027, which uses a hollow-rubber dome that has undesirable resiliency and give. All of these result in binding of the arch wire, preventing free adjustment, and all resulting in undesirable bracket forms.

It is most desirable to have a system which retains the use of light wires but at the same time avoids superfluous and time-consuming connecting procedures, whether by ligation in the edgewise technique or by pinning in the Begg technique. The present invention seeks to accomplish this. For example, it reduces the time required to secure an arch wire from about ten minutes to about one minute.

Among the objects of the present invention are to provide a technique which enables quicker installation and quicker removal, and which enables a more rapid change from one arch wire to another. Another object of the invention is to provide a less complicated and less expensive arrangement for practicing the light-wire technique, in which no pins are required and the light wire is snapped into the brackets.

Another object of the invention is to provide the patient with a more comfortable arrangement for practicing the light-wire technique, obviating the use of bands.

Another object of the invention is to improve greatly the esthetic effect. Clear plastic brackets or onlays can be nearly invisible from a few feet away and can thereby replace the "tin grin" common today.

Another object of the invention is to provide a technique in which auxiliaries are readily used in conjunction with the light-wire technique for "uprighting" which means, basically, holding the tip of the tooth and bringing the root back.

Another object of the invention is to provide a system for the light-wire technique which at the same time enables the use of ligature ties where necessary.

SUMMARY OF THE INVENTION

This invention comprises an orthodontic onlay for use with a single arch wire in the light-wire technique. This onlay is an integral plastic member and is directly cemented to a tooth. It can be the same color as the tooth or can be clear. A curved base portion has a rear surface that conforms to the forward surface of the tooth and a series of cement-holding openings leading therefrom. Its front surface provides a bracket portion having a wire-receiving slot giving access to a generally circular seat for an arch wire. The diameter of the circle is slightly greater than the diameter of the arch wire, enough so to allow to a round wire some freedom of movement which prevents frictional binding. The entrance portion lies between a pair of thin walls, which are resilient enough so that the entrance portion is normally substantially narrower than the diameter of the arch wire, and the arch wire is inserted by being snapped in: the two walls are forced apart to admit the arch wire to the seat and then spring back to lock the arch wire in the seat. No pinning is required, so that the installation time is much quicker, and changing from one arch wire to another takes only a few minutes. The arch wire can readily be bent as desired to produce the desired effects.

The onlay also comprises one or more openings for anchoring a control auxiliary. In one form of the invention, there is a single central vertical through opening of substantial length for this purpose, while in another form of the invention there are two spaced-apart openings, also extending vertically and for the same basic purpose. These circular columnar openings are preferably about 0.020 inches in diameter to receive the currently used uprighting springs, which are about 0.014 inches in diameter.

Other objects and advantages of the invention will appear from the following description of some preferred embodiments thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a greatly enlarged view in perspective of a dental onlay embodying the principles of the invention.

FIG. 2 is a fragmentary view in section taken along the line 2—2 in FIG. 1 and also showing a portion of the tooth to which the onlay of FIG. 1 is attached by cement.

FIG. 3 is an enlarged view in side elevation of the notch through and in which the arch wire is snapped in.

FIG. 4 is a view similar to FIG. 3 showing another form of snap-in notch.

FIG. 5 is a view in perspective of a modified form of an orthodontic onlay embodying the principles of the invention and having two vertical openings for receiving control auxiliaries.

FIG. 6 is a view in section taken along the line 6—6 in FIG. 5.

FIG. 7 is an occlusal view of an installed orthodontic system using the onlay of FIG. 5.

FIG. 8 is an enlarged fragmentary view in elevation of a portion of the system of FIG. 7.

FIG. 9 is a view similar to FIG. 8 showing the use of two auxiliaries for uprighting.

FIG. 10 is a view in front elevation of another modified form of onlay embodying the principles of the invention.

FIG. 11 is a view in side elevation of the onlay of FIG. 10, partly broken away and shown in section.

FIG. 12 is a top plan view of the onlay of FIGS. 10 and 11.

DESCRIPTION OF PREFERRED EMBODIMENTS THE ONLAY OF FIGS. 1-4

FIG. 1 shows in perspective an enlarged view of an orthodontic onlay 10 embodying the principles of the invention. The onlay 10 is an integral plastic member made of such plastic as methyl methacrylate, polystyrene, polycarbonate, polypropylene, polyvinyl fluoride, polyethylene, nylon, tetrafluoroethylene, or other suitably strong material. The plastic may be clear or may be tooth color and it should be substantially rigid, not giving to the force of the arch wire. It has a base portion 11 and a bracket portion 12. The base portion 11 has a rear surface 13 which is curved to conform to the curve of the front surface 14 of a tooth 15 to which the onlay 10 is affixed. When the tooth 15 has a double curve, the rear surface 13 of the base portion 11 of the onlay 10 has a double curve, too. The base portion 11 is also provided with a series of openings 16 leading from the rear surface 13 to help to retain and bond to a suitable cement 17. These openings 16 may be blind openings or recesses, but in FIGS. 1 and 2 they are

shown as through openings. A suitable epoxy type cement 17 may be used, so long as it is non-toxic. Also, the surface 13 may be given a plasma treatment, as described in my co-pending application Ser. No. 250,959, filed May 8, 1972, to provide a thin surface portion 18 that enhances adhesion of the cement 17 — often giving more than 10 times the adhesion of the same material untreated. This is not a coating but a treatment that rearranges the molecular structure of the surface portion.

The forward surface 19 of the base portion 11 may be parallel to the rear surface 13 or may be flat. In any event, the bracket portion 12 is integral with it and is constructed to hold the light arch wire securely at a constant distance away from the tooth 15, the arch wire later being bent as desired to produce corrective forces. The bracket portion 12 projects out from the base portion 11 and as shown, reinforcement may be provided by a relatively bulky upper portion 20 and a relatively bulky lower portion 21 between which lie a thinner tapered central portion 22 which is narrow where it meets the arch wire attachment for the sake of accuracy, and yet receives strength from the supporting members 20 and 21.

A notch 23 is provided for receiving the arch wire, which is snapped into a central circular seat 24 (see FIGS. 3 and 4) that preferably holds the arch wire fairly loosely in substantially a point contact. This point contact and the sizing of the seat 24 to be slightly larger in diameter than the arch wire greatly reduces binding. For example, an 0.018 inches arch wire is characteristically placed in a seat 24 having a diameter of 0.023 inches and width of 0.020 inches. The narrow width gives substantially point contact and the oversize diameter affords some freedom for the tooth to settle without binding. Access to the circular seat 24 is provided by an entrance opening 25, which in this example, may be 0.012 inches wide. Thus an upper wall 26 and a lower wall 27 are spaced apart from each other by a distance less than the diameter of the arch wire, and they are forced apart when the arch wire is pressed against them; then they snap back into place. They can thus yield resiliently even though made of rigid material. As shown in FIG. 3, this entrance opening 25 may have tapered edges 28 and 29 that lead in to a sharp vertex 30 or, as shown in FIG. 4, the notch may be somewhat deeper, and have outer splayed corners 31 and 32 leading to parallel walls 33 and 34, which may be somewhat wider apart than the narrowest portion of the FIG. 3 notch, but which are still closer together than the diameter of the arch wire and are resilient enough to move apart and then snap back upon the arch wire to hold it firmly in place.

The bracket portion 12 also is provided with a vertical through opening 35 of substantial length, open at each end to leave an open tube. As shown in FIGS. 1 and 2 this is a single cylindrical opening 35 that extends from top to bottom of a downwardly recessed portion 36 of the portion 12. This opening 35 can hold a control auxiliary, such as a spring member that is used in uprighting.

In use, the orthodontist cements each onlay 10 to a tooth, and when all the onlays 10 are in place he then snaps the arch wire in place. The ends of the arch wires may be held by conventional molar tubes (Cf. FIG. 7) and exert the desired force on the teeth. Auxiliaries are

inserted where needed for uprighting or for such other uses as are desired.

The cement 17 holds the onlay 10 firmly to the tooth, and yet the onlays 10 are easily removed with a suitable tool, described in another pending application of mine.

THE ORTHODONTIC ONLAY OF FIGS. 5-9

FIGS. 5-9 show a modified form of dental onlay 50 having many similarities to that already described. Here again, there is a base portion 51 and a bracket portion 52. The base portion 51 is again provided with a rear surface 53 that fits the front surface 54 of the tooth 55. The rear surface 53 in this instance is shown with parallel recesses 56 (FIG. 6), shaped like the dove-tails used in carpentry, for providing the engagement by the cement. This is another illustration of a way to have the surface provide extra hold for the cement. A plasma-treated portion 57 is again provided to enhance bond.

The bracket portion 52 is provided with bulkier upper and lower members 60 and 61 having curved ends 63 for comfort, and a snap-in notch 64 is provided for holding the arch wire. The notch 64 is basically the same as the notch 23 described in the onlay 10 of FIGS. 1-4.

The basic difference between the onlay 50 and the onlay 10 is that the onlay 50 has two vertical through openings 65 and 66, one at each end of the bracket portion 52 and again at the rear thereof behind the arch wire.

FIGS. 7 and 8 illustrate an installation of the device of FIG. 5, FIG. 7 being an occlusal view and showing molar tubes 70 at each end by which an arch wire 71 is secured. FIG. 7 shows the path of the arch wire 71 as it goes across a series of onlays 50, each embodying the principles of the invention, and each being like that of FIG. 5, though with somewhat different shape for each type of tooth. Substantially the same view could be used to represent the device of FIG. 1, except that there would be only one through opening 35, instead of the two openings 65 and 66 shown. FIG. 8 shows that the wire 71 is relatively undistorted.

FIG. 9 shows use of auxiliaries 75 and 76, members having one or two or three coils 77 of spring wire, each having a vertical post 78 which extends through one of the openings 65 or 66 and then each having horizontal portion 79 and another vertical anchor portion 80 which extends through the opening 65 or 66 of a neighboring onlay 50, as in the right hand side of FIG. 9, or is anchored to the arch wire 71 itself, as on the left side of FIG. 9. Either practice is proper, depending on circumstances.

FIGS. 10-12 show another modified form of plastic onlay 100 which embodies the principles of the invention. Its base portion 101 has a doubly curved rear surface 102, preferably given the plasma treatment. There are through openings 103 and blind openings 104 to increase adhesive area. A bracket portion 105 has tapering surfaces 106 leading to a generally circular seat 107 at an angle of about 20°, and an entrance notch 108 like that shown in FIG. 4 enables insertion of the arch wire.

The bracket portion 105 has a forward portion 110 and a rear portion 111 having a single vertical columnar tubular opening 112. The rear portion 111 has upper and lower shelves 113 and 114, and the forward portion is recessed by upper and lower rectangular

notches 115 and 116 extending down as far as the shelves and providing thereby two upper wings 117 and 118 and two lower wings 120 and 121. This structure enables tying ligature wires for additional controls, when necessary or desired. Also, the notches 115 and 116 can be used in conjunction with an insertion tool enabling ready positioning on the tooth when adhering it to the tooth.

While this onlay 100 allows great freedom of movement between the tooth-onlay combination and the arch wire, still on each side of the snap ring 107 the tapered surfaces 106 act as limits, by engaging greater surface areas with the arch wire if the wire is at an angle equal to or beyond that of the taper. Since the maximum root tip angle of 15° occurs in upper cuspids, tipping much in excess of this would require a retracing of movement of the teeth. In the present invention, frictional resistance to tipping beyond 20° occurs in any direction, due to the tapered walls 106 on each side of the ring 107 and friction builds up, applying a brake to excessive tipping. In this regard, this system is unique among systems using the light wire technique.

To those skilled in the art to which this invention relates, many changes in construction and widely differing embodiments and applications of the invention will suggest themselves without departing from the spirit and scope of the invention. The disclosures and the description herein are purely illustrative and are not intended to be in any sense limiting.

I claim:

1. An orthodontic onlay for use with an arch wire in a light-wire technique comprising a plastic member having a base portion for attachment to a tooth and an outwardly projecting bracket portion with a narrow seat for an arch wire, said bracket portion having a slot defined by a pair of walls for a snap-in entrance to said seat, said walls defining a slot narrower than said seat so that they may be forced apart by the wire when a wire is inserted or removed, the horizontal width of said bracket at said slot being substantially greater than the width of said seat.

2. The orthodontic onlay of claim 1 wherein the width of said seat is substantially the same as the diameter of the wire.

3. The orthodontic onlay of claim 1 having at least one vertical opening through said bracket portion for anchoring a control auxiliary.

4. The orthodontic onlay of claim 3 having a shelf at the top and bottom of said vertical opening and wings on each side of said bracket forward of said shelf and extending vertically therebeyond and separated from each other, for tying ligatures thereto.

5. The orthodontic onlay of claim 1 wherein said slot comprises an outer portion having converging surfaces leading to two parallel surfaces that lead into said seat.

6. The orthodontic onlay of claim 1 wherein said bracket portion includes tapered surfaces that converge toward each side of said seat.

7. The orthodontic onlay of claim 6 wherein the surface on each side of said seat slopes away therefrom in all directions at an angle of about 20°, thereby resulting in imparting a braking force of friction to the arch wire when it enters or leaves the seat in either direction at an angle of the same amount.

8. The orthodontic onlay of claim 1 wherein said bracket portion diverges laterally from each end of the walls defining said slot.

9. An orthodontic onlay for use with an arch wire in a light-wire technique comprising a plastic member to be directly cemented to a tooth and having a base portion with a rear surface that conforms substantially to the forward surface of the tooth to which it is to be cemented and a bracket portion with a generally circular narrow seat for an arch wire, said bracket portion having a slot defined by a pair of walls for a snap-in entrance to said seat, said walls defining a slot narrower than said seat so that they may be forced apart by the wire when a wire is inserted or removed, the horizontal width of said bracket at said slot being substantially greater than the width of said seat.

10. The orthodontic onlay of claim 9 wherein the width of said seat is substantially the same as the diameter of the wire.

11. The orthodontic onlay of claim 9 having at least one vertical opening through said bracket portion for anchoring a control auxiliary.

12. The orthodontic onlay of claim 11 having a shelf at the top and bottom of said vertical opening and wings on each side of said bracket forward of said shelf and extending vertically therebeyond and separated

from each other, for tying ligatures thereto.

13. The orthodontic onlay of claim 9 wherein said slot comprises an outer portion having converging surfaces leading to two parallel surfaces that lead into said circular seat.

14. The orthodontic onlay of claim 9 wherein said bracket portion includes tapered surfaces that converge toward each side of said seat.

15. The orthodontic onlay of claim 14 wherein the surface of each side of said seat slopes away therefrom in all directions at an angle of about 20°, thereby resulting in imparting a braking force of friction to the arch wire when it enters or leaves the seat in either direction at an angle of the same amount.

16. The orthodontic onlay of claim 9 wherein said bracket portion diverges laterally from each end of the walls defining said slot.

17. The orthodontic onlay of claim 9 wherein said plastic is clear plastic.

18. The orthodontic onlay of claim 9 wherein said plastic is tooth color.

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