



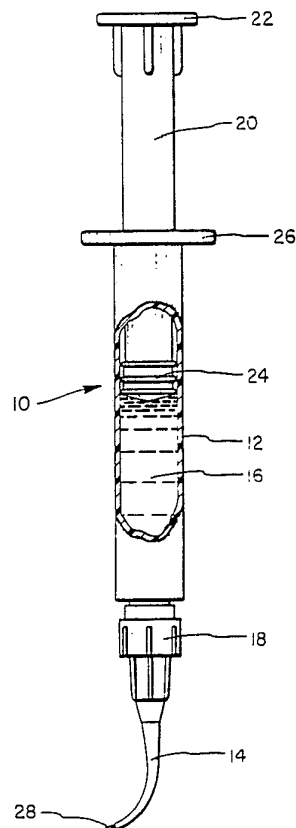
## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<b>(21) International Application Number:</b> PCT/US89/02844 <b>(22) International Filing Date:</b> 22 June 1989 (22.06.89)  <b>(30) Priority data:</b> 210,390                      22 June 1988 (22.06.88)                      US 369,597                      21 June 1989 (21.06.89)                      US  <b>(71) Applicant:</b> ULTRADENT PRODUCTS, INC. [US/US]; 1345 East 3900 South, Salt Lake City, UT 84124 (US).  <b>(72) Inventor:</b> FISCHER, Dan, E. ; 10444 Dimple Dell Road, Sandy, UT 84092 (US).  <b>(74) Agents:</b> NYDEGGER, Rick, D. et al.; Workman, Nydegger & Jensen, 1000 Eagle Gate Tower, 60 East South Temple, Salt Lake City, UT 84111 (US).		<b>(81) Designated States:</b> AT (European patent), AU, BE (European patent), CH (European patent), DE (European patent), DK, FI, FR (European patent), GB (European patent), IT (European patent), JP, KR, LU (European patent), NL (European patent), NO, SE (European patent).  <b>Published</b> <i>With international search report.</i> <i>With amended claims.</i>

**(54) Title:** DENTAL AGENT APPLICATOR

**(57) Abstract**

An apparatus for applying dental agents to tooth surfaces. The apparatus includes a syringe-type dispenser (12) for holding a quantity of dental agent and an applicator tip (14) having adjustable bristles (28) at one end. The applicator tip is curved to accommodate access to tooth surfaces undergoing restorative dental procedures. The bristles (28) are in communication with the syringe-type dispenser (12), thereby allowing the dental agent to be continuously applied to the tooth surfaces without the need to stop the procedure and rewet the applicator in a dental agent source. The syringe-type applicator permits accurate control of the amount of dental agent applied to the tooth surface. In this way, the tooth surface receives neither an excessive nor an insufficient amount of the dental agent. Moreover, the bristles (12) may be pushed in to permit the dental agent to be precisely applied to a very small tooth surface, such as pits and fissures, or pulled out to permit the bristles (14) to fan out for application of the dental agent to larger tooth surfaces.



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## DENTAL AGENT APPLICATOR

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BACKGROUND1. The Field of the Invention

The present invention relates to apparatus for applying dental agents to tooth surfaces. More particularly, the present invention allows a dentist to quickly and precisely apply a proper quantity of dental agent to tooth surfaces which have been prepared to receive the dental agent. The present invention is ideally suited for applying dental bonding agents, pit and fissure sealants, and other similar dental agents to tooth surfaces.

3. The Prior Art

Numerous dental agents play an important role in dental restorative techniques. For example, bonding agents are applied to tooth surfaces in order to firmly attach a restoration to the tooth. When the restoration is a composite resin restoration, the composition of the bonding agent is usually that of the matrix of the composite resin.

Before applying a bonding agent, the enamel around a cavity preparation is etched with acid. Acid etching of enamel creates micro-irregularities on the enamel surface.

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The resin in the bonding agent is usually diluted with monomers so that it has a low viscosity which can readily penetrate into the microscopic irregularities and undercuts produced by the acid etching. The bonding agent is then  
5 polymerized. It is believed that when the composite restorative resin is inserted into the cavity, it will polymerize to the bonding agent present on the cavity surface. In this way, better adaptation to the enamel walls of the cavity is achieved with improved mechanical  
10 retention of the restoration.

Various devices have been used in the art for applying dental bonding agents to tooth surfaces. One device used to apply dental bonding agents is a small porous sponge or swabbing material. In practice, a quantity of bonding  
15 agent is applied to a transfer pad. A sponge is then grasped with forceps and dipped into the bonding agent. The wetted sponge is then rubbed across the tooth surface in order to apply the bonding agent.

The small sponges are disposable to prevent cross-  
20 contamination. However, the sponges do not permit accurate application of the bonding agent. Frequently, the bonding agent is applied to surrounding surfaces which do not need treatment. Moreover, the rubbing action required to apply the bonding agent necessarily damages the fragile crystal-  
25 line surface structure of the tooth formed during acid

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etching. Once the crystalline surface structure of the tooth is damaged, its bondability is reduced.

Another existing device for applying bonding agent to tooth surfaces is a small disposable brush tip. Like the  
5 sponge, the brush tip must be held with forceps or some other holding device. The brush tip is then dipped into a quantity of bonding agent placed on a transfer pad.

Like the sponge, the brush tip is disposable. In addition, the brush tip does not damage the fragile crys-  
10 talline structure of the tooth surface produced by acid etching. However, like the sponge, the brush tip must constantly be rewetted by the bonding agent during the dental procedure. Moreover, the disposable brush tips used  
15 in the art usually have long bristles which do not form a fine tip. As a result, the bonding agent is often inadvertently applied to surrounding tooth surfaces.

Yet another device for applying bonding agents to tooth surfaces is a very fine paint brush. Such a brush  
20 can apply the bonding agent to tooth surfaces with precision and detail.

Despite its advantages, a paint brush must also be repeatedly dipped into a quantity of bonding agent during the procedure. In addition, a paint brush is difficult to properly sterilize and is usually nondisposable, thereby  
25 making it difficult for the dentist to maintain an aseptic

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environment. With the ever-increasing threat of Acquired Immune Deficiency Syndrome ("AIDS") in society, use of a nondisposable applicator which is also difficult to sterilize has become unacceptable.

5 Further, in each of the known devices for applying bonding agents to tooth surfaces, a quantity of bonding agent is placed on a transfer pad so that the device can be rewetted during the surgical procedure. Such a technique is not only wasteful, but it exposes the bonding agent to  
10 light, air, and airborne contaminants.

Moreover, time is often of the essence in applying bonding agents to tooth surfaces. As a result, it is important for bonding agents to be applied quickly and accurately. Thus, the need to constantly rewet the bonding  
15 agent applicator during the procedure is not only inefficient, but may reduce the effectiveness of the resulting bond between the restoration and the tooth surface.

#### BRIEF SUMMARY AND OBJECTS OF THE INVENTION

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The present invention seeks to resolve a number of the problems which have been experienced in the art, as identified above. More importantly, the apparatus of this invention constitutes an important advancement in the art  
25 of dental bonding agent applicators, as evidenced by the

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following objects and advantages realized by the invention over the prior art.

One object of the present invention is to provide apparatus and methods of applying dental agents to tooth  
5 surfaces which permit continuous application of the dental agent without the need to stop the dental procedure and rewet the applicator in a dental agent source.

Another important object of the present invention is to provide apparatus and methods of applying dental agents  
10 to tooth surfaces which permit accurate application of the bonding agent to the precise tooth area that needs treatment.

An additional important object of the present invention is to provide an apparatus for applying dental agents  
15 to tooth surfaces which may be disinfected and which is disposable, thereby enabling the dentist to maintain an aseptic environment.

Still another object of the present invention is to provide apparatus and methods of applying dental agents to  
20 tooth surfaces which permit the dental agent to be applied directly to the teeth from a sterile source not exposed to air, light, and airborne contaminants.

A further important object of the present invention is to provide apparatus and methods of applying dental agents  
25 to tooth surfaces which does not require the use of a

transfer pad.

Yet another important object of the present invention is to provide apparatus and methods of applying dental agents to tooth surfaces which give the dentist greater  
5 control over the flow of the dental agent to the tooth surface.

Another important object of the present invention is to provide apparatus and methods of applying dental agents to tooth surfaces which allow the dentist to apply the  
10 dental agent to small precise tooth locations.

A further important object of the present invention is to provide apparatus and methods of applying dental agents to tooth surfaces which allow the dentist to evenly apply the dental agent to broad tooth surfaces.

15 Additional objects and advantages of the invention will be apparent from the description which follows, or may be learned by the practice of the invention.

The present invention is directed to an apparatus for applying dental agents to tooth surfaces. The apparatus  
20 includes a syringe-type dispenser for holding a quantity of dental agent and a removable applicator tip having short bristles at one end. The applicator tip is curved to accommodate access to tooth surfaces undergoing restorative dental procedures. The short bristles are in communication  
25 with the syringe-type dispenser, thereby allowing the



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dental agent to be continuously applied to the tooth surfaces without the need to stop the dental procedure and rewet the applicator in a dental agent source.

The dental agent remains in a sterile receptacle until  
5 applied directly to the tooth surface. In this way, the dental agent is not exposed to light, air, and airborne contaminants. In addition, there is no need for a transfer pad.

The syringe-type applicator permits accurate control  
10 over the amount of dental agent applied to the tooth surface. Thus, the tooth surface receives neither an excessive nor an insufficient amount of the bonding agent. Moreover, the short bristles permit the dental agent to be applied to the tooth surface without damaging the fragile  
15 crystalline structure which may have been formed during acid etching.

The bristles within the novel brush-tipped applicator of the present invention may be pulled out or pushed into the applicator tip. This unique feature provides the  
20 important advantage of allowing the dentist to accurately apply the dental agent to small precise tooth locations when the bristles are pushed into the applicator tip. When the bristles are pulled out, the dentist is able to evenly apply the dental agent to broad tooth surfaces.

25

BRIEF DESCRIPTION OF THE DRAWINGS

In order to more fully understand the manner in which the above-recited advantages and objects of the invention are obtained, a more particular description of the invention will be rendered by reference to specific embodiments thereof which are illustrated in the appended drawings. Understanding that these drawings depict only typical embodiments of the invention and are therefore not to be considered limiting of its scope, the presently preferred embodiments and the presently understood best mode of the invention will be described with additional detail through use of the accompanying drawings in which:

Figure 1 is a side view of one presently preferred embodiment within the scope of the present invention with a cut-away portion illustrating the plunger assembly within the syringe barrel;

Figure 2 is a side view of the syringe barrel and plunger portion of the embodiment illustrated in Figure 1 with the applicator tip being replaced with a cap; and

Figure 3 is an enlarged perspective view of the applicator tip element of the present invention with a cut-away portion illustrating the brush tip feature of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Reference is now made to the drawings wherein like parts are designated with like numerals throughout.

5 Referring first to Figure 1, one presently preferred embodiment of the apparatus of the present invention is illustrated and generally designated 10.

Dental agent applicator 10 includes a syringe barrel 12 and applicator tip 14. Syringe barrel 12 is generally  
10 cylindrical in shape and is adapted for holding a quantity of dental agent 16.

In the embodiment of the present invention illustrated in Figure 1, applicator tip 14 is removable. Affixed to the lower end of syringe barrel 12 is a female luer-lock  
15 coupling 18. Removable applicator tip 14 is secured to syringe barrel 12 through coupling 18. Other means may be used to couple the applicator tip to the syringe barrel. For example, a screw fit or press-fit coupling mechanism is suitable.

20 In another embodiment within the scope of the present invention, applicator tip 14 is permanently secured to the syringe barrel. The applicator tip may be integrally molded as part of the syringe barrel or it may snap on irreversibly to the syringe barrel. In such an embodiment,  
25 the syringe barrel could be configured to hold only a

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sufficient quantity of dental agent for a single application. Thereafter, the device would be discarded.

Longitudinally slidable within syringe barrel 12 is plunger 20. Plunger 20 has at its proximal end a thumb disk 22 and at its distal end a plunger head 24. Plunger head 24 is constructed out of a resilient material such that its outer edge is contiguous with the inner wall of the syringe barrel 12. In addition, plunger head 24 is preferably constructed of a material which is non-reactive with dental agent 16.

At the proximal end of syringe barrel 12 are a pair of finger wings 26. Although conventional syringes function by placing two fingers on the finger wings 26 and depressing thumb disk 22 with the thumb, the present invention is preferably used by placing the fingers and thumb around syringe barrel 12 and depressing thumb disk 22 by the palm of the hand. This unique method of use gives the dentist greater control in applying the dental agent. Plunger 20 longitudinally enters syringe barrel 12. As a result, plunger head 24 presses against dental agent 16 causing the dental agent to flow out of syringe barrel 12 and through the removable applicator tip 14.

At the distal end of the removable applicator tip are a plurality of bristles 28 which form a brush. The bristles are preferably constructed of soft fibers which allow

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the bonding agent to be applied to the tooth surfaces without damaging the fragile crystalline structure formed by acid etching the surface or other similar preparative techniques. Soft nylon is one suitable material for  
5 constructing the bristles.

As shown in Figure 3, the bristles 28 are tightly packed in the distal end of the applicator tip 14. The bristles are preferably held in place due to friction among the bristles and with the inner wall of applicator tip 14.  
10 How tight bristles 28 fit within applicator tip 14 is a function of the bristle count and bristle diameter. The larger the bristle diameter, the fewer bristles will fit within applicator tip 14. The bristles should be packed just tight enough to allow dental bonding agent to flow  
15 between the bristles, but not so loosely that the bristles flow out applicator tip 14 along with the bonding agent.

Bristle size affects the flow of dental agent 16 between packed bristles. If the bristles have a large diameter, then voids exist between packed bristles through  
20 which the dental agent can flow. On the other hand, if the bristles have a small diameter, then very small voids exist between the packed bristles significantly limiting the available space through which the dental agent can flow. Thus, the larger the bristles, the easier it is to flow  
25 dental agent between packed bristles. In one currently

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preferred embodiment within the scope of the present invention, the bristle diameter is in the range from about 0.002 inches to about 0.005 inches, and preferably in the range from about 0.0025 inches to about 0.003 inches.

5           In another embodiment within the scope of the present invention, bristles 28 are held in place by slightly crimping applicator tip 14. In order to crimp the applicator tip, it is preferably constructed of a crimpable material, such as metal.

10           The bristles extend beyond the distal end of applicator tip 14 a distance in the range from about 1 mm to about 5 mm. The bristles extend within applicator tip 14 a distance sufficient to engage the inner wall of the applicator tip and hold them in place. In one preferred  
15 embodiment within the scope of the present invention, the bristles extend a distance in the range from about 5 mm to about 10 mm within the applicator tip.

The bristles form a small point at the distal end, thereby permitting accurate application of the dental agent  
20 to the tooth surface. In this way, the exact quantity of dental agent may be applied to the precise tooth surface that needs treatment and not to surrounding surfaces. The removable applicator tip is curved to facilitate application of the dental agent to hard-to-reach tooth surfaces.

25           In one embodiment of the present invention, the

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distance bristles 28 which extend beyond the distal end of applicator tip 14 may be manually adjusted by the dentist by either pushing the bristles further in or pulling them further out. Adjusting the length of the bristles gives  
5 the dentist even greater control in applying the dental agent. By pushing the bristles further within applicator tip 14, the dentist has more pinpoint control in applying the dental agent. By pulling the bristles further out from the applicator tip, the dentist can cause the bristles to  
10 fan out and accurately coat a larger tooth surface.

For example, when applying a dental bonding agent, it may be beneficial to grasp the bristles and lengthen the fibers in order to "soften" the bristles and allow them to fan out and evenly cover a larger area of the tooth with  
15 each stroke.

When a pit and fissure sealant is applied, it is advantageous to slide the bristles into the applicator tip, thereby shortening the bristle length from the tip and leaving only about 1 mm to about 2 mm of the bristle  
20 exposed. This has a stiffening effect on the bristles. Resin flows from the syringe through the brush tip and directly into the interfiber spaces of the brush. The chance for air bubbles is virtually eliminated. Smaller, more precise and desired quantities can be delivered to  
25 fissures than if large droplets are carried to the fissures

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on conventional dental instruments or dip-type brushes.

In addition, Figure 3 illustrates a male luer-lock fitting 30 on the applicator tip. The male luer-lock fitting is designed to engage female luer-lock coupling 18.

5 Should coupling 18 be constructed in a press-fit or screw-fit embodiment, then fitting 30 should be a corresponding press-fit or screw-fit embodiment so that the applicator tip may be removably attached to syringe barrel 12.

As illustrated in Figure 2, the applicator tip may be  
10 removed and replaced with a cap 32. In one embodiment of the invention, the syringe barrel may be marketed pre-filled with dental agent and capped with cap 32. Alternatively, the syringe barrel 12 may be filled with the dental agent by removing cap 32 and drawing the desired amount  
15 into the barrel.

In use, cap 32 is removed and replaced with applicator tip 14. After the dental agent is applied to the tooth surface, the applicator tip is removed and discarded. Cap 32 is then replaced, and the syringe barrel is stored  
20 until dental agent is needed in the future. If used properly, the syringe barrel should still be clean; nevertheless, the syringe barrel may be disinfected, if necessary.

Dental agent applicator 10 is constructed of easy to  
25 disinfect materials. The syringe barrel, plunger, cou-



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pling, and applicator tip are preferably constructed of rigid plastic, though other suitable construction materials such as glass or metal may be used. It is also important that the syringe barrel, plunger, coupling, and applicator tip be constructed of a material which will not react with dental agent 16. In addition, the dental agent should not adhere to the construction material.

Because many dental agents which could be suitably used within the scope of the present invention are often light sensitive, the dental agent applicator is generally constructed of an opaque material. Thus, the syringe barrel, applicator tip, plunger, and coupling are preferably constructed of black plastic. Different colored plastic may be used to identify the type of dental agent within the syringe barrel. Alternatively, printing or other identifying markings on the syringe barrel may be used to identify the type of dental agent. In addition, markings on the outer surface of the syringe barrel or plunger may be used to identify the volume of dental agent used or remaining.

The plunger within the syringe barrel permits controlled dispensing of the dental agent to the tooth surface. It will be appreciated that other means may be used to control the dispensing of the bonding agent. For example, the dental agent applicator may be adapted for capsule use or for squeeze-bulb use.

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Many dental agents may be applied to tooth surfaces using the apparatus within the scope of the present invention. Typical dental agents include dental bonding agents and sealants, such as dentin and pit and fissure sealants.

5 These dental agents need to be precisely applied to specific tooth surfaces in a very thin layer. Suitable dental agents should preferably have a viscosity low enough to flow through the small spaces between bristles 28, but not so low that the dental agent runs freely out the apparatus.

10 From the foregoing, it will be appreciated that the present invention provides apparatus and methods for applying dental agents to tooth surfaces which permit continuous application of the dental agent without the need to stop the dental procedure and rewet the applicator in a  
15 bonding agent source.

Additionally, it will be appreciated that the present invention further provides apparatus and methods for applying dental agents to tooth surfaces which permit accurate application of the dental agent to the precise  
20 tooth area that needs treatment.

Likewise, it will be appreciated that the present invention provides an apparatus for applying dental agents to tooth surfaces which may be disinfected and which is disposable, thereby enabling the dentist to maintain an  
25 aseptic environment.

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In addition, it will be appreciated that the present invention provides apparatus and methods for applying dental agents to tooth surfaces which permit the dental agent to be applied directly to the teeth from a sterile source not exposed to air, light, and airborne contaminants. As a result, the present invention does not require the use of a transfer pad.

It will also be appreciated that the present invention provides apparatus and methods of applying dental agents to tooth surfaces which give the dentist greater control over the flow of bonding agent to the tooth surface. In this way, a proper amount of dental agent is applied to the tooth surface, not an excessive or insufficient amount.

Additionally it will be appreciated that the present invention provides apparatus and methods of applying dental agents to tooth surfaces which allow the dentist to apply the dental agent to small precise tooth locations.

It will also be appreciated that the present invention provides apparatus and methods of applying dental agents to tooth surfaces which allow the dentist to evenly apply the dental agent to broad tooth surfaces.

The present invention may be embodied in other specific forms without departing from its spirit or essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not

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restrictive. The scope of the invention is, therefore, indicated by the appended claims rather than by the foregoing description. All changes which come within the meaning and range of equivalency of the claims are to be embraced  
5 within their scope.

What is claimed is:

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1. An apparatus for controlled application of a dental agent to a predetermined tooth surface, comprising:

reservoir means for holding a quantity of dental agent, said reservoir means being constructed of a chemically inert material with respect to the dental agent;

means for applying the dental agent to a desired location on the tooth surface, the proximal end of the applying means being in communication with the reservoir means such that the dental agent is applied onto the predetermined tooth surface by the distal end of the applying means, said applying means being generally tubular in shape and curved to facilitate application of the dental agent to the tooth surface;

brush means secured within the applying means such that a portion of the brush means extends sufficiently beyond the distal end of the applying means in order to provide for precise application of the dental agent to the predetermined tooth surface; and

means for controlled dispensing of the dental agent from the reservoir means to the distal end of the applying means in order to control the flow of the agent onto the predetermined tooth surface.

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2. An apparatus for applying a dental agent to a tooth surface as defined in claim 1, wherein the applying means is removably attached to the reservoir means.

5 3. An apparatus for applying a dental agent to a tooth surface as defined in claim 1, wherein the reservoir means comprises a syringe barrel and the controlled dispensing means comprises a plunger located within the syringe barrel for controlling the flow of the dental  
10 agent.

4. An apparatus for applying a dental agent to a tooth surface as defined in claim 1, wherein the brush means comprises a plurality of bristles secured within the  
15 distal end of the applying means, said bristles extending a distance from the distal end of the applying means in the range from about 1 mm to about 5 mm.

5. An apparatus for applying a dental agent to a  
20 tooth surface as defined in claim 1, wherein the brush means comprises a plurality of bristles secured within the distal end of the applying means, the distance said bristles extend from the distal end of the applying means being adjustable.

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6. An apparatus for applying a dental agent to a tooth surface as defined in claim 1, wherein the bristles are constructed of soft nylon having a diameter in the range from about 0.002 inches to about 0.005 inches.

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7. An apparatus for applying a dental agent to a tooth surface as defined in claim 1, wherein the dental agent comprises a dental sealant.

10 8. An apparatus for applying a dental agent to a tooth surface as defined in claim 1, wherein the dental agent comprises a pit and fissure sealant.

15 9. An apparatus for applying a dental agent to a tooth surface as defined in claim 1, wherein the dental agent comprises a dentin sealant.

20 10. An apparatus for applying a dental agent to a tooth surface as defined in claim 1, wherein the dental agent comprises a dental bonding agent.

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11. An apparatus for controlled application of a dental agent to a predetermined tooth surface comprising:

5 a reservoir for holding a quantity of dental agent, said reservoir being constructed of a chemically inert material with respect to the dental agent, and said reservoir being sufficiently opaque to prevent light-initiated activation of the dental agent;

10 a generally tubular-shaped member for applying the dental agent to a tooth surface, the proximal end of said tubular member being removably secured to and in communication with the reservoir such that the dental agent flows through the tubular member from the proximal end of the tubular member to the distal end  
15 of the tubular member, said tubular member being curved to facilitate application of the dental agent to the tooth surface;

20 brush means secured within the distal end of the tubular member so as to substantially fill at least a portion of the interior of the tubular member, said brush means permitting flow of the dental agent therebetween, at least a portion of said brush means extending sufficiently beyond the distal end of the  
25 tubular member in order to provide for precise ap-



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plication of the dental agent to the predetermined tooth surface; and

means for controlled dispensing of the dental agent, said dispensing means being capable of controlling the flow rate of the agent from the reservoir onto the predetermined tooth surface.

12. An apparatus for applying a dental agent to a tooth surface as defined in claim 11, wherein the tubular member is threadably attached to the reservoir.

13. An apparatus for applying a dental agent to a tooth surface as defined in claim 11, wherein the tubular member is attached to the reservoir with a luer-lock.

14. An apparatus for applying a dental agent to a tooth surface as defined in claim 11, wherein the tubular member is permanently secured to the reservoir.

15. An apparatus for applying a dental agent to a tooth surface as defined in claim 11, wherein the reservoir comprises a syringe barrel and wherein the controlled dispensing means comprises a plunger located within the syringe barrel for controlling the flow of the dental agent.

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16. An apparatus for applying a dental agent to a tooth surface as defined in claim 15, wherein the brush means comprises a plurality of bristles secured within the distal end of the tubular member, said bristles extending a distance from the distal end of the tubular member in the range from about 1 mm to about 5 mm.

17. An apparatus for applying a dental agent to a tooth surface as defined in claim 15, wherein the brush means comprises a plurality of bristles secured within the distal end of the tubular member, the distance said bristles extend from the distal end of the tubular member being adjustable.

15

18. An apparatus for applying a dental agent to a tooth surface as defined in claim 16, wherein the bristles are constructed of soft nylon having a diameter in the range from about 0.002 inches to about 0.005 inches.

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19. An apparatus for applying a dental agent to a tooth surface as defined in claim 11, wherein the dental agent comprises a dental sealant.

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20. An apparatus for applying a dental agent to a tooth surface as defined in claim 11, wherein the dental agent comprises a pit and fissure sealant.

5 21. An apparatus for applying a dental agent to a tooth surface as defined in claim 11, wherein the dental agent comprises a dentin sealant.

10 22. An apparatus for applying a dental agent to a tooth surface as defined in claim 11, wherein the dental agent comprises a dental bonding agent.

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23. An apparatus for controlled application of a dental agent to a predetermined tooth surface comprising:

5 a reservoir for holding a quantity of dental agent, said reservoir being constructed of a chemically inert material with respect to the dental agent, and said reservoir being configured to prevent initiation of reaction with respect to the dental agent prior to application on the predetermined tooth surface;

10 a generally tubular-shaped member for applying the dental agent to a tooth surface, the proximal end of said tubular member being in communication with the reservoir such that the dental agent flows through the tubular member from the proximal end of the tubular member to the distal end of the tubular member, said  
15 tubular member being curved to facilitate application of the dental agent to the tooth surface;

a brush, comprising a plurality of bristles secured within the distal end of the tubular member so  
20 as to substantially fill at least a portion of the interior of the tubular member, said brush permitting flow of the dental agent therebetween, at least a portion of said brush means extending sufficiently beyond the distal end of the tubular member in order  
25 to provide for precise application of the dental agent to the predetermined tooth surface; and

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means for controlled dispensing the dental agent, said dispensing means being capable of controlling the flow rate of the dental agent from the reservoir onto the predetermined tooth surface.

5

24. An apparatus for applying a dental agent to a tooth surface as defined in claim 23, wherein the plurality of bristles are packed within the distal end of the tubular member such that friction between the bristles and the  
10 tubular member secures the bristles in place.

25. An apparatus for applying a dental agent to a tooth surface as defined in claim 23, wherein the bristles are constructed of soft nylon having a diameter in the  
15 range from about 0.002 inches to about 0.005 inches.

26. An apparatus for applying a dental agent to a tooth surface as defined in claim 23, wherein the tubular member is removably attached to the reservoir.

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27. An apparatus for applying a dental agent to a tooth surface as defined in claim 26, wherein the tubular member is attached to the reservoir with a luer-lock.

5 28. An apparatus for applying a dental agent to a tooth surface as defined in claim 23, wherein the distance the bristles extend from the distal end of the tubular member is adjustable.

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29. An applicator tip for controlled application of a dental agent to a predetermined tooth surface, comprising:

a generally tubular-shaped member for applying dental agent to a tooth surface, the proximal end of said tubular member being configured to be removably attached to a syringe barrel holding a quantity of dental agent, said tubular member being curved to facilitate precise application of the dental agent to the predetermined tooth surface, and said tubular member being constructed of a chemically inert material with respect to the dental agent, and said tubular member being configured to prevent initiation of reaction with respect to the dental agent prior to application on the predetermined tooth surface; and

a brush, comprising a plurality of bristles adjustably secured within the distal end of the tubular member, said brush permitting flow of the dental agent therebetween, at least a portion of said brush extending sufficiently beyond the distal end of the tubular member in order to provide for precise application of the dental agent to the predetermined tooth surface.

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30. An apparatus for controlled application of a dental agent to a predetermined tooth surface, comprising:

5 a hollow barrel for holding a quantity of dental agent, said barrel being constructed of a chemically inert material with respect to the dental agent, and said reservoir being configured to prevent initiation of reaction with respect to the dental agent prior to application on the predetermined tooth surface;

10 a generally tubular-shaped member for applying dental agent to a tooth surface, the proximal end of said tubular member being removably secured to and in communication with the reservoir such that the dental agent flows through the tubular member from the proximal end of the tubular member to the distal end  
15 of the tubular member, said tubular member being curved to facilitate precise application of the dental agent to the predetermined tooth surface;

20 a brush, comprising a plurality of bristles secured within the distal end of the tubular member, said brush permitting flow of the dental agent therebetween, at least a portion of said brush extending sufficiently beyond the distal end of the tubular member in order to provide for precise application of  
25 the dental agent to the predetermined tooth surface



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and wherein the distance the bristles extend from the distal end of the tubular member being adjustable; and

5 a plunger, having a plunger head longitudinally movable within the barrel, said plunger being capable of controlling the flow rate of the dental agent from the barrel and onto the predetermined tooth surface.

31. An apparatus for applying a dental agent to a  
10 tooth surface as defined in claim 30, wherein the plurality of bristles are packed within the distal end of the tubular member such that friction between the bristles and the tubular member secures the bristles in place.

15 32. An apparatus for applying a dental agent to a tooth surface as defined in claim 30, wherein the bristles are constructed of soft nylon having a diameter in the range from about 0.002 inches to about 0.005 inches.

## AMENDED CLAIMS

[received by the International Bureau on 17 November 1989 (17.11.89);  
original claims 1-32 replaced by amended claims 1-22 (8 pages)]

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1. An apparatus for controlled application of a dental agent to a predetermined tooth surface, comprising:

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reservoir means for holding a quantity of dental bonding agent, said reservoir means being constructed of a chemically inert material with respect to the dental bonding agent and said reservoir means being sufficiently opaque to prevent light-initiated activation of the bonding agent;

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means for applying the dental bonding agent to a desired location on the tooth surface, the proximal end of the applying means being in communication with the reservoir means such that the dental bonding agent is applied under hydraulic pressure by the distal end of the applying means, said applying means being generally tubular in shape and curved to facilitate application of the dental agent to the tooth surface;

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brush means secured within the applying means and comprising a first portion which extends sufficiently beyond the distal end of the applying means in order to provide for application of the dental bonding agent to the predetermined tooth surface, and a second portion which extends into said distal end of the applying means so as to contact said bonding agent and so as to permit flow of said bonding agent through said brush means; and

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means for controlled dispensing of the dental bonding agent from the reservoir means to the distal end of the applying means in order to control the flow of the bonding agent onto the predetermined tooth surface.

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2. An apparatus for applying a dental agent to a tooth surface as defined in claim 1, wherein the applying means is removably attached to the reservoir means.

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3. An apparatus for applying a dental agent to a tooth surface as defined in claim 1, wherein the reservoir means comprises a syringe barrel and the controlled dispensing means comprises a plunger located within the syringe barrel for controlling the flow of the dental agent.

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4. An apparatus for applying a dental agent to a tooth surface as defined in claim 1, wherein the brush means comprises a plurality of bristles secured within the distal end of the applying means, said bristles extending a distance from the distal end of the applying means in the range from about 1/16 inch to about 5/16 inch.

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5. An apparatus for applying a dental agent to a tooth surface as defined in claim 1, wherein the brush means comprises a plurality of bristles secured within the distal end of the applying means, the distance said bristles extend from the distal end of the applying means being adjustable.

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6. An apparatus for applying a dental agent to a tooth surface as defined in claim 1, wherein the bristles are constructed of soft nylon having a diameter in the range from about 0.002 inches to about 0.005 inches.

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7. An apparatus for controlling application of a dental agent to a predetermined tooth surface comprising:  
a reservoir for holding a quantity of dental agent, said reservoir being constructed of a chemically inert material with respect to the dental agent, and said reservoir being sufficiently opaque to

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1 prevent light-initiated activation of the bonding  
agent;

5 a generally tubular-shaped member for applying  
the dental agent to a tooth surface, the proximal end  
of said tubular member being removably secured to and  
in communication with the reservoir such that the  
dental agent flows through the tubular member from the  
10 proximal end of the tubular member to the distal end  
of the tubular member, said tubular member being  
curved to facilitate application of the dental agent  
to the tooth surface;

brush means slidably secured within the distal  
end of the tubular member so as to substantially fill  
at least the distal end of the tubular member and so  
15 as to contact said dental agent within said distal end  
of the tubular member, said brush means thereby  
permitting flow of the dental agent therethrough and  
the length of said brush means extending beyond the  
distal end of the tubular member being slidably  
20 adjustable in order to provide for application of the  
dental bonding agent to the predetermined tooth  
surface using either a pinpoint-type application to  
the tooth surface or a fanned out, broad brush type  
application to the tooth surface as desired; and

25 means for controlling dispensing of the dental  
bonding agent, said dispensing means being capable of  
controlling the flow rate of the agent from the  
reservoir onto the predetermined tooth surface.

30 8. An apparatus for applying a dental agent to a  
tooth surface as defined in claim 7, wherein the tubular  
member is threadably attached to the reservoir.

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1           9. An apparatus for applying a dental agent to a  
tooth surface as defined in claim 7, wherein the tubular  
member is attached to the reservoir with a luer-lock.

5           10. An apparatus for applying a dental agent to a  
tooth surface as defined in claim 7, wherein the tubular  
member is permanently secured to the reservoir.

10           11. An apparatus for applying a dental agent to a  
tooth surface as defined in claim 7, wherein the reservoir  
comprises a syringe barrel and wherein the controlled  
dispensing means comprises a plunger located within the  
syringe barrel for controlling the flow of the dental  
agent.

15           12. An apparatus for applying a dental agent to a  
tooth surface as defined in claim 11, wherein the brush  
means comprises a plurality of bristles secured within the  
distal end of the tubular member, said bristles extending  
20 a distance from the distal end of the tubular member in the  
range from about 1/16 inch to about 5/16 inch.

25           13. An apparatus for applying a dental agent to a  
tooth surface as defined in claim 12, wherein the bristles  
are constructed of soft nylon having a diameter in the  
range from about 0.002 inches to about 0.005 inches.

30           14. An apparatus for controlling application of a  
dental agent to a predetermined tooth surface comprising:  
a reservoir for holding a quantity of dental  
agent, said reservoir being constructed of a  
chemically inert material with respect to the dental  
agent, and said reservoir being configured to prevent  
initiation of reaction with respect to the dental

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1 agent prior to application of the predetermined tooth surface;

5 a generally tubular-shaped member for applying the dental agent to a tooth surface, the proximal end of said tubular member being in communication with the reservoir such that the dental agent flows through the tubular member from the proximal end of the tubular member to the distal end of the tubular member, said tubular member being curved to facilitate application of the dental agent to the tooth surface;

10 a brush, comprising a plurality of bristles secured within the distal end of the tubular member so as to substantially fill at least the distal end of the interior of the tubular member and so as to contact the agent within said distal end, said brush thereby permitting flow of the dental agent therethrough, at least a portion of said brush extending sufficiently beyond the distal end of the tubular member in order to provide for application of the dental agent to the predetermined tooth surface;

15 and

20 means for controlling dispensing the dental agent, said dispensing means being capable of controlling the flow rate of the dental agent from the reservoir onto the predetermined tooth surface.

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15. An apparatus for applying a dental agent to a tooth surface as defined in claim 14, wherein the plurality of bristles are packed within the distal end of the tubular member such that friction between the bristles and the tubular member secures the bristles in place.

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16. An apparatus for applying a dental agent to a tooth surface as defined in claim 14, wherein the bristles

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1 are constructed of soft nylon having a diameter in the  
range from about 0.002 inches to about 0.005 inches.

5 17. An apparatus for applying a dental agent to a  
tooth surface as defined in claim 14, wherein the tubular  
member is removably attached to the reservoir.

10 18. An apparatus for applying a dental agent to a  
tooth surface as defined in claim 17, wherein the tubular  
member is attached to the reservoir with a luer-lock.

15 19. An applicator tip for controlled application of  
a dental agent to a predetermined tooth surface,  
comprising:

20 a generally tubular-shaped member for applying  
dental agent to a tooth surface, the proximal end of  
said tubular member being configured to be removably  
attached to a syringe barrel holding a quantity of  
dental agent, said tubular member being curved to  
facilitate precise application of the dental agent to  
the predetermined tooth surface, and said tubular  
member being constructed of a chemically inert  
material with respect to the dental agent, and said  
tubular member being configured to prevent initiation  
25 of reaction with respect to the dental agent prior to  
application on the predetermined tooth surface; and

30 a brush, comprising a plurality of bristles  
slidably secured within the distal end of the tubular  
member, said brush permitting flow of the dental  
agent through said bristles, and the length of said  
brush extending beyond the distal end of the tubular  
member being slidably adjustable in order to provide  
for application of the dental agent to the  
predetermined tooth surface using either a pinpoint-

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1 type application to the tooth surface or a fanned out,  
broad brush type application of dental agent to the  
tooth surface as desired .

5 20. An apparatus for controlled application of a  
dental agent to a tooth surface, comprising:

10 a hollow barrel for holding a quantity of dental  
agent, said barrel being constructed of a chemically  
inert material with respect to the dental agent, and  
said reservoir being sufficiently opaque to prevent  
light-initiated activation of the dental agent;

15 a generally tubular shaped member for applying  
the dental agent to a tooth surface, the proximal end  
of said tubular member being removably secured to and  
in communication with the reservoir such that the  
dental agent flows through the tubular member from the  
proximal end of the tubular member to the distal end  
of the tubular member, said tubular member being  
curved to facilitate precise application of the  
20 dental agent to the predetermined tooth surface;

25 a brush, comprising a plurality of bristles  
secured within the distal end of the tubular member so  
as to contact the dental agent therein, said brush  
permitting flow of the dental agent through said  
bristles, at least a portion of said brush extending  
sufficiently beyond the distal end of the tubular  
member in order to provide for application of the  
dental agent to the predetermined tooth surface; and

30 a plunger having a plunger head longitudinally  
movable within the barrel, said plunger controlling  
the flow rate of the dental agent from the barrel and  
onto the predetermined tooth surface.

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1           21. An apparatus for applying a dental agent to a  
tooth surface as defined in claim 20, wherein the plurality  
of bristles are packed within the distal end of the tubular  
member such that friction between the bristles and the  
5           tubular member secures the bristles in place.

          22. An apparatus for applying a dental agent to a  
tooth surface as defined in claim 20, wherein the bristles  
are constructed of soft nylon having a diameter in the  
10           range from about 0.002 inches to about 0.005 inches.

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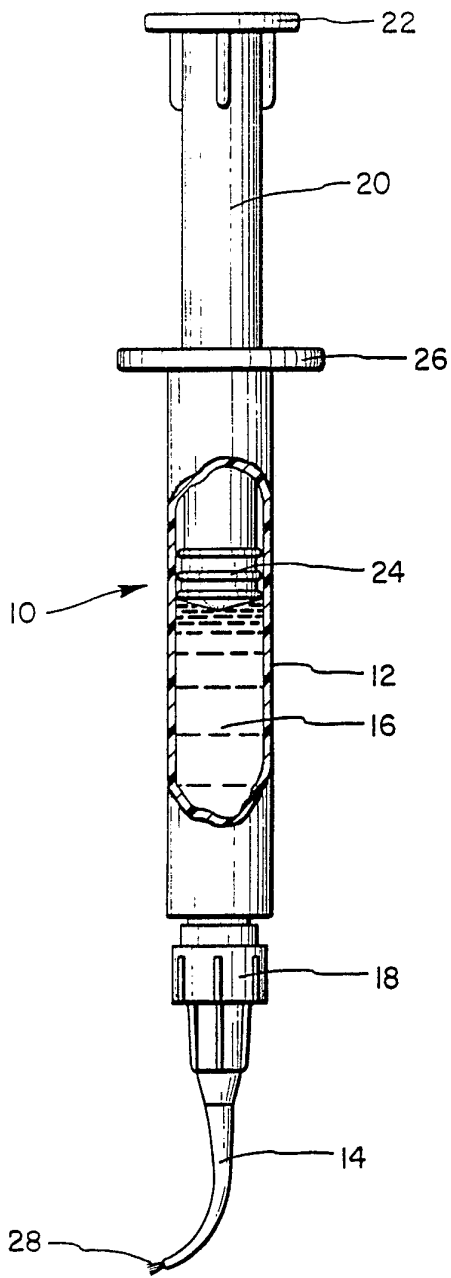


FIG. 1

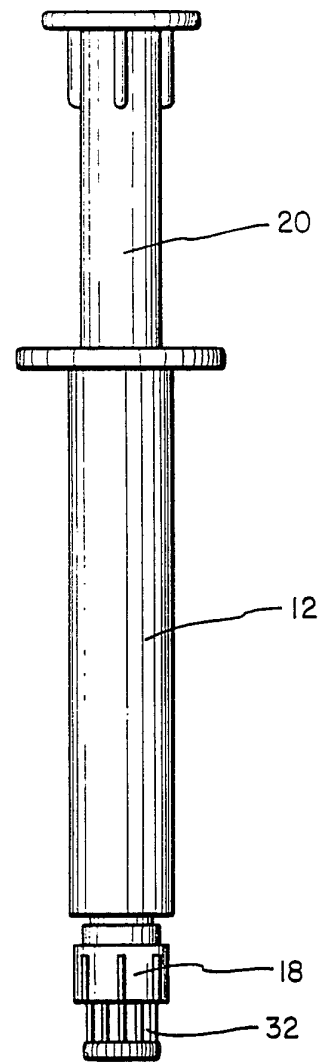


FIG. 2

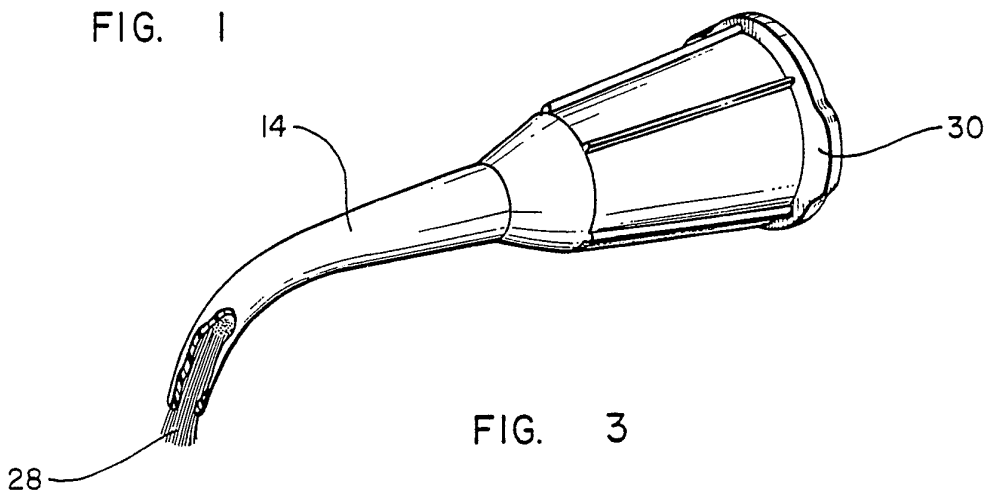
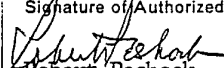


FIG. 3

# INTERNATIONAL SEARCH REPORT

International Application No. PCT/US89/02844

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (if several classification symbols apply, indicate all) <sup>6</sup>		
According to International Patent Classification (IPC) or to both National Classification and IPC		
IPC: (4) A61C 5/04		
U.S. CL. 433/90		
<b>II. FIELDS SEARCHED</b>		
Minimum Documentation Searched <sup>7</sup>		
Classification System	Classification Symbols	
U.S.	433/90,89; 604/3, 4,184,222; L32/73,74.5,15.	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched <sup>8</sup>		
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT</b> <sup>9</sup>		
Category *	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>
Y	US,A 2,104,651 (HOFFMAN) 04 January 1938 See page 2, column 1, lines 61-70.	1-23
Y,P	US,A 4,813,871 (FRIEDMAN) 21 March 1989 See entire document.	1-23
<p>* Special categories of cited documents: <sup>10</sup></p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&amp;" document member of the same patent family</p>		
<b>IV. CERTIFICATION</b>		
Date of the Actual Completion of the International Search		Date of Mailing of this International Search Report
07 Sept. 1989		<b>28 SEP 1989</b>
International Searching Authority		Signature of Authorized Officer
ISA/US		 Robert Peshock