

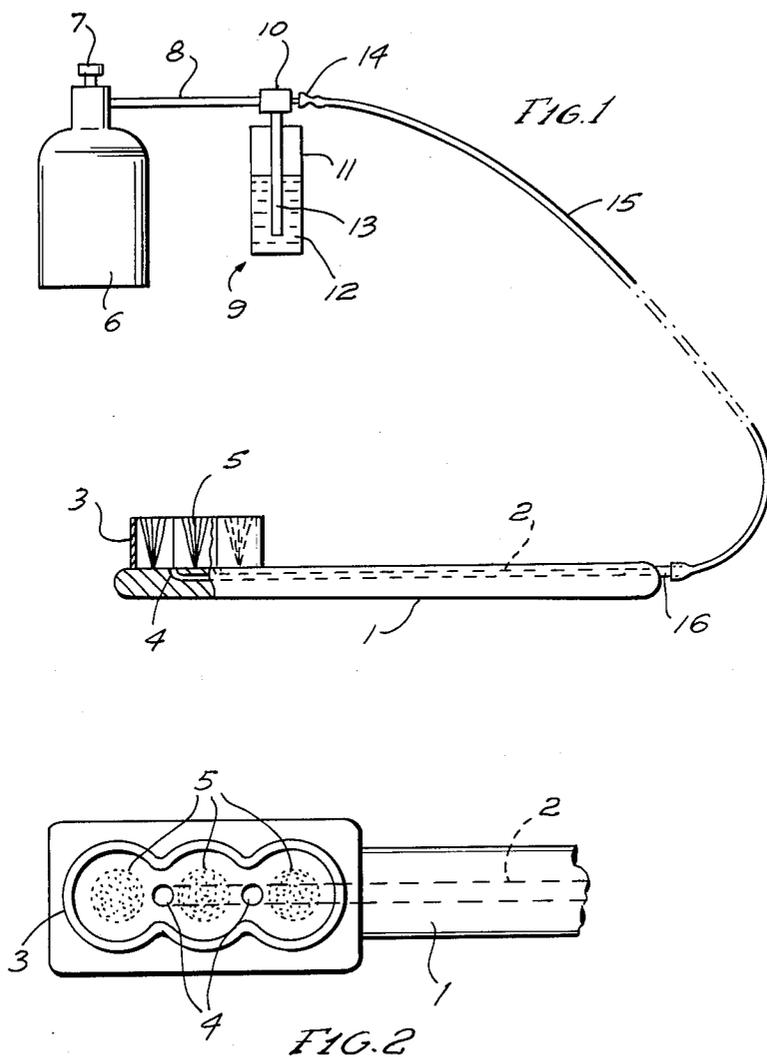
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TOOTH CLEANING TOOL

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**TOOTH CLEANING TOOL**  
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This application is a continuation-in-part of my co-pending application Serial Number 140,571, filed on September 25, 1961, and now abandoned.

This invention relates to dental hygiene and more particularly to a tool for cleaning teeth.

The commonly employed tooth brushes rely on mechanical scrubbing of tooth surfaces by flexible bristles of natural or synthetic material. The bristles of a brush are not well suited for removing foreign matter from deep recesses in and between teeth, and are inherently incapable of reaching the surface of teeth in openings which flare inwardly from an accessible aperture. They are therefore not capable of removing contaminants from periodontal pockets adjacent the roots of the teeth.

This well known limitation of conventional bristled tooth brushes has led to the development of a dentist's tool which projects a mixture of a cleaning or disinfecting liquid and of a gas, usually compressed air, in a jet. The mixture is propelled by the pressure of the gaseous component and can reach otherwise inaccessible portions of the teeth. Such a mixture of a gas and a liquid provides the only effective mechanical method of cleaning fixed dentures and orthodontic bands and appliances in the mouth of the wearer. It also is the only effective means of removing debris from periodontal (pyorrhoeic) pockets when access to the pockets is provided by other tools withdrawing the gums.

The dentist's jet cleaning tool is not suitable for daily use by a person cleaning his own teeth. To be effective, the jet must be aimed fairly accurately at the spot to be cleaned, and this is not readily feasible even with the aid of a mirror if the jet tool is handled by the person at whose teeth the jet is to be directed. Cleaning a periodontal pocket in the user's own gums is impossible with the tool.

The amount of the fluid mixture which is dispensed by the dentist's jet tool is usually small since only a small treated area needs to be treated if the tool is employed to flush out impurities. If the amount of material discharged were increased to provide for cleaning a complete set of teeth with an adequate margin of safety to take into account the inefficient use of the material due to poor aiming, the mouth cavity would be flooded.

The afore-described dentist's jet tool also does not lend itself for use with strong surface active cleaning materials which would otherwise be desirable. Too much foam would be formed upon expansion of the gaseous component of the cleaning mixture as the latter is discharged into the mouth.

It is the principal object of this invention to provide a tooth cleaning tool for use by the person whose teeth are to be cleaned, and utilizing the well recognized valuable properties of the afore-described dentist's jet tool, while avoiding the limitations inherent in the conventional dentist's tool when applied to the user's own teeth.

Another object is the provision of such a tooth cleaning tool which is readily aimed with accuracy at any desired portion of a set of teeth in the user's mouth.

A further object is the provision of a tool of the type described which thoroughly cleans natural and artificial teeth in the mouth of the wearer with a minimum amount of a cleaning mixture of a liquid with a gas.

Yet another object is the provision of a tooth cleaning tool which minimize or suppresses the formation of foam even when the cleaning mixture includes surface active ingredients.

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An additional object of the invention is the provision of a tool of the type described which permits the user quickly and completely to clean normally closed periodontal pockets in his own mouth.

5 A more specific object is the provision of a tool which gives simultaneous access to all portions of a normally closed periodontal pocket and directs a jet of a cleaning mixture into the pocket portions.

10 With these and other objects in view, the tooth cleaning tool of my invention consists basically of a hollow handle, a cup shaped dam of resiliently yieldable material mounted on the handle and communicating with the hollow interior of the handle through an orifice facing the open side of the cup, and means for discharging a mixture of a liquid and a gas through the orifice outward of the open side of the cup. Bristles are mounted on the handle in such a manner that their free ends are near the open side of the cup.

15 The exact nature of this invention as well as other features and advantages thereof will become more fully apparent as the disclosure is made in the following detailed description of a preferred embodiment of the invention as illustrated in the accompanying drawing in which:

20 FIG. 1 is a side elevational, partly sectional view of a tooth cleaning tool of the invention and of accessory equipment; and

25 FIG. 2 shows a detail of the apparatus of FIG. 1 in plan view.

30 The cleaning tool proper has a shape somewhat similar in outline to that of a conventional tooth brush. It includes an elongated handle 1 which is formed with a longitudinal conduit 2. A rubber dam 3 defines an elongated cup shaped cavity at the working end of the handle 1. The rubber dam has the shape of three short cylindrical tubes which have parallel axes aligned in a row and intersect each other. The cup formed by the dam 3 thus consists of four arcuate wall portions which angularly meet to form reinforcing ribs in the dam. The ribs extend from the handle 1 toward the open side of the cup.

35 The conduit 2 communicates with two orifices 4 in the handle 1 at the bottom of the cup formed by the dam 3. The orifices are aligned with the ribs in the dam 3 and are directed toward the open side of the cup shape. Three bristle tufts 5 are mounted on the working end of the handle 1 approximately centrally of the three intersecting tubular sections of the dam 3 and are spaced in the direction of elongation of the cavity. The free ends of the bristle tufts 5 are approximately flush with the flat rim of the dam 3 in the relaxed position of the latter as shown in FIG. 1.

40 The accessories used with the tooth cleaning tool proper include a pressure gas tank 6 equipped with a normally closed adjustable valve 7. A metal tube 8 connects the pressure tank 6 to an atomizer 9 having a head 10 and a container 11 in which a cleaning liquid 12 is held. A tube 13 draws liquid from the container into the atomizer head 10 in the usual manner when gas under pressure is admitted to the head through the tube 8.

45 The output side of the atomizer head 10 is equipped with a tubulature 14 on which one end of a flexible tube 15 is slipped. The other end of the tube is held on a nipple 16 on the end of the handle 1 by the resilience of the tube material. The nipple 16 communicates with the conduit 2 in the hollow handle 1.

50 The afore-described apparatus operates as follows:

55 The tank 6 is filled with a physiologically tolerated gas under pressure. Compressed air free from oil and other contaminants is quite suitable if the cleaning liquid 12 is insensitive to oxidation by atmospheric oxygen. Depending on the nature of the cleaning liquid, compressed nitrogen or a non-toxic fluorocarbon propellant may be pre-

ferred. The fluorinated hydrocarbons have the advantage of requiring relatively little tank space. Perfluorocyclobutane,  $C_4F_8$ , is an example of a fluorocarbon compound well suited for propellant use in the apparatus of my invention.

The pressure of the propellant gas in the tank 6 is applied to the atomizer head 10 when the valve 7 is opened. The gas emitted by the open end of the tube 8 in the atomizer head 10 draws cleaning liquid 12 from the container 11 and mixes with the liquid in a stream which is propelled through the flexible tube 15, the conduit 2, and outward through the orifices 4. It has been found that even with a tube 15 having an internal diameter of only one sixteenth of an inch and a length of four to five feet the material ejected through the orifices 4 is still an intimate mixture of the components.

The cleaning tool is employed in the same manner as a conventional tooth brush although its cleaning effect does not depend on the pressure exerted against the teeth and the gums by the tool, nor on the speed of the movement of the tool relative to the teeth being cleaned as is the case with a bristle brush. The bristle tufts 5 are of some assistance in dislodging relatively large food particles, but the major portion of the cleaning efficiency of my tool on the normally accessible tooth surfaces is due to the scrubbing effect of the mixture of gas and liquid discharged under pressure from the orifices 4.

The ability of such a mixture to remove the usual film adhering to the mucous membranes of the mouth, and equally to the teeth, is well known. The refreshing effect or carbonated beverages is partly due to the fact that bubbles of carbon dioxide released from the beverage as it passes through the mouth rise in the liquid by gravity and mechanically scrub the inner walls of the mouth. This effect is achieved in an even greater measure by my invention in which the mixture is discharged against the teeth to be cleaned under pressure and at appreciable speed. Excellent cleaning may be had by a combination of gas pressure and dimensions of the apparatus which will produce from upwardly directed orifices 4 a jet that will rise about two feet in the air, but it will be appreciated that the kinetic energy of the projected mixture is not critical and may be selected over a wide range as a matter of personal preference. The valve on the tank 6 provides an adjustment of the quantity and pressure of the ejected material, and the usual adjusting controls may be provided on the atomizer head 10.

The tool is guided over the teeth by contact with the dam 3. The spacing between the orifices 4 and the tooth or gum surface is thus always maintained at a predetermined value which varies only insignificantly as the dam is resiliently compressed. Movement of the dam 3 over portions of the gums adjacent the teeth provides the user with precise knowledge of the position of the tool without visual observation.

In the normal operative position of the tool, the open side of the cup defined by the dam 3 is closed by the surface to be cleaned. The dam is made of rubber or other elastomeric material of a hardness and thickness that permits the rim to be deflected by the internal pressure in the cup so as to open a gap between the teeth or gums and the dam rim, and to release the pressure. The maximum pressure prevailing inside the cup depends partly on the pressure applied on the handle 1, partly on the pressure setting of the valve 7, and partly on the elastic properties and dimensions of the elastomeric dam 3. The several variables may be modified at will over a wide range to meet personal requirements.

The cleaning tool of the invention is surprisingly effective when used with plain water as a cleaning fluid. It is believed that saliva initially trapped in the cavity of the dam 3 contributes somewhat to the detergency of the aqueous liquid in the cavity, but it can readily be observed that saliva is washed very rapidly from the cleaned area defined by the rim of the dam. A substantial improve-

ment in the cleaning efficiency is achieved by incorporating in an aqueous cleaning fluid small amounts of alcohol and of surfactants.

Any tendency of the cleaning mixture to foam is counteracted by the dam 3. The foam is broken as the material flows through the narrow gap between the dam rim and the tooth being cleaned. It is also believed that any foam generated is partially destroyed by impact against the surface being cleaned. Using several types of commercial mouth wash, I have found that no objectionable foaming occurs in the mouth even when the cleaning liquid forms a head of foam on mere shaking.

The cleaning effect produced with the cleaning tool of the invention cannot be duplicated by using bristled tooth brushes and the same mouth wash. The absence of the film which tenaciously clings to the tooth surfaces after brushing with ordinary tooth brushes gives a feeling of freshness to the mouth which is not readily had in any other manner.

When it is desired to clean periodontal (pyorrhoeic) pockets on the lingual side of teeth in the lower jaw by means of the tooth cleaning tool of my invention, the rim of the dam 3 is held with moderate pressure against the lingual faces of the tooth concerned while the handle 1 is approximately horizontal. The tool is then slowly moved downward while a jet of cleaning fluid and gas is projected from the orifices 4.

As the lower rim portion of the dam 3 passes downward over the gums on the lingual side of the tooth, it gently pulls the gum tissue away from the roots of the tooth, thereby opening the periodontal pockets for access by the cleaning jet. The tips of the bristles 5 partly project beyond the dam 3 into the relatively narrow and deep interproximal area between adjacent teeth. The axis of each projecting bristle is approximately horizontal and parallel to the opposite faces of the teeth in the area, and the bristles slide downward along the tooth faces during the downward movement of the cleaning tool. When they reach the top of the gums in the interproximal area, they displace the gums from the tooth surface, thereby opening any periodontal pockets which may exist between the teeth, and making them accessible to the cleaning action of the fluid jet.

The length of the bristled portion of the jet cleaning tool is sufficient to permit simultaneous action of the bristles on the gums in both interproximal areas flanking the same tooth, and the tool thus simultaneously cleans the portions of a periodontal pocket which extend over three faces of the tooth root. Such cleaning action is not readily available even to the dentist employing a cleaning jet and separate tools for opening the several pocket portions. When one pocket portion only can be cleaned at any one time, plus and other contaminants may migrate from a pocket portion which is in the process of being cleaned into another pocket portion previously cleaned. Unless each pocket portion is cleaned several times, sequential cleaning of the several portions of a periodontal pocket is ineffective. By simultaneously opening periodontal pockets on three sides of a tooth, I avoid migration of contaminants in most instances.

While the cleaning of periodontal pockets on the lingual side of lower teeth was described hereinabove by way of example, the tool may be used in a corresponding manner on the buccal face of the same tooth, and on the teeth of the upper jaw. In the relatively rare instance of a periodontal pocket having communicating portions on all sides of a tooth root, sequential application of the tool to the lingual and buccal tooth faces eliminates all contaminants. Since the interproximal areas are cleaned in both cleaning steps, migration of contaminants into the opposite face area is effectively prevented.

If several members of a family use cleaning tools of my invention, they may use a common gas tank 6 and atomizer 9 provided with a flexible tube 15. An individual cleaning tool is readily attached by slipping the

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free end of the tube 15 over the nipple 16 on the handle 1.

It will be appreciated that operativeness of my tooth cleaning tool depends largely on the use of a cleaning fluid and of a propellant gas which are not infinitely miscible. A liquid even when expelled under pressure from the orifices 4 cannot produce the cleaning effect of a two-phase mixture of a liquid with a gas. While there is a wide choice of propellant gases and cleaning liquids which may be employed with my invention, they should satisfy the requirement that the gas be at least partially insoluble in the liquid and present in the form of a separate phase as the mixture reaches the surface to be cleaned.

The amount of mixture which is employed for cleaning a set of teeth in the mouth varies as a matter of personal choice. It is quite readily possible, though, to clean a full set of teeth better than is possible with any conventional bristled tooth brush with the use of an amount of cleaning mixture that will require not more than one interruption of the cleaning process for the purpose of discharging accumulated liquid from the mouth. The gaseous component, of course, escapes freely. The mixture as it comes from a conventional atomizer head of the type used in the afore-mentioned dentist's tool consists of a very much greater volume of gas than of liquid, and liquid therefore does not rapidly accumulate in the mouth. It is a concomitant advantage of my cleaning tool that it makes very economical use of mouth wash liquid, if such liquid is employed.

While the operation of the tooth cleaning tool of the invention has been described with specific reference to teeth in the mouth, it is evident that the tool is equally useful in the cleaning of dentures removed from the mouth. The same tool may serve both purposes. It will usually be desirable to increase the gas pressure when cleaning dentures by suitable adjustment of the valve 7.

It should be understood, of course, that the foregoing disclosure relates to only a preferred embodiment of the invention and that it is intended to cover all changes and modifications of the example of the invention herein chosen for the purpose of the disclosure which do not constitute departures from the spirit and scope of the invention set forth in the appended claims.

What I claim is:

1. In a tooth cleaning tool, in combination, an elongated handle formed with a conduit therein; a dam member of yieldably resilient material mounted on a longitudinal end portion of said handle and defining an elongated cavity open in a direction transverse of the direction of elongation thereof, said conduit having an orifice in said cavity; a plurality of bristles mounted in said cavity on said handle in longitudinally spaced relationship and extending therefrom in said transverse direction; and pressure means for discharging a mixture of a liquid and a gas through said orifice in said transverse direction.

2. In a tool as set forth in claim 1, said pressure means including a source of a mixture of a liquid and a gas at least partially insoluble in said liquid, and connecting means for connecting said source to said conduit.

3. In a tool as set forth in claim 2, said connecting means including a first connector member on said source, a second connector member on said handle, and a tubular member having two spaced end portions respectively connected to said connector members and communicating with said connector members, said tubular member being releasably connected to at least one of said connector members.

4. In a tooth cleaning tool, in combination, an elongated handle formed with a conduit therein; a dam member of yieldably resilient material mounted on one longitudinal end portion of said handle and defining an elongated cavity opened in a direction transverse of the

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direction of elongation thereof; nozzle means in said cavity and communicating with said conduit for projecting a fluid in said transverse direction through said cavity; a plurality of bristles each having an end portion mounted on said handle in said cavity, said bristles being spaced from each other in said direction of elongation, said dam member having a rim portion about the open side of said cavity, said bristles each having another end portion substantially flush with said rim portion when said dam member is in the relaxed condition thereof; a supply of gas under pressure; a supply of liquid, said gas being at least partly insoluble in said liquid; atomizer means communicating with said liquid and gas supplies for producing a mixture of said gas and of said liquid under pressure; a first connector member on said atomizer means; a second connector member on the other longitudinal end portion of said handle and communicating with said conduit; and a tubular member connected to said connector members for transmitting said mixture of said gas and of said liquid from said atomizer means to said conduit, said tubular member being releasably connected to at least one of said connector members.

5. In a tool as set forth in claim 4, valve means for controlling the flow of said mixture from said atomizer means to said conduit.

6. In a tooth cleaning tool, in combination:

(a) an elongated handle formed with a conduit therein;

(b) a dam member of yieldably resilient material mounted on one longitudinal end portion of said handle and defining an elongated cavity having one open longitudinal side, said dam member having a rim portion about said open side of said cavity;

(c) nozzle means in said cavity and communicating with said conduit for projecting a fluid in a direction outward of said open side;

(d) a plurality of bristle tufts, each including a plurality of bristles, said tufts being spaced in said cavity from said nozzle means in opposite longitudinal directions, the bristles of each tuft having respective first end portions mounted on said handle in said cavity, and respective second end portions substantially flush with said rim portion when said dam member is in the relaxed condition thereof;

(e) a supply of gas under pressure;

(f) a supply of liquid, said gas being at least partly insoluble in said liquid;

(g) atomizer means communicating with said liquid supply and said gas supply for producing a mixture of said gas and of said liquid under pressure; and

(h) tubular means connected to said atomizer means and to the other longitudinal end portion of said handle for transmitting said mixture of said gas and of said liquid from said atomizer means to said conduit.

7. In a tooth cleaning tool as set forth in claim 6, reinforcing means in said dam member for selectively reinforcing the portions of said dam member aligned with said nozzle means transversely of the direction of elongation of said cavity.

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