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HYDRAULIC-FILAMENT DENTAL DEVICE

Filed April 17, 1967

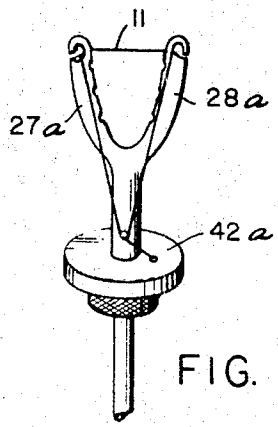

FIG. 1.

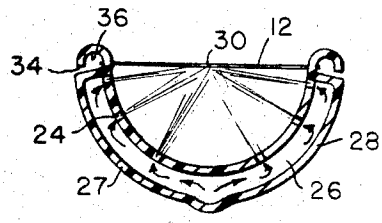

FIG. 4.

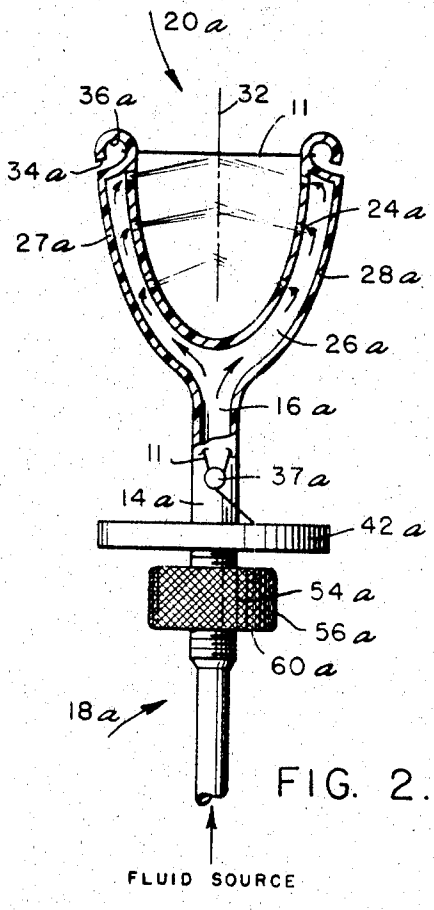

FIG. 2.

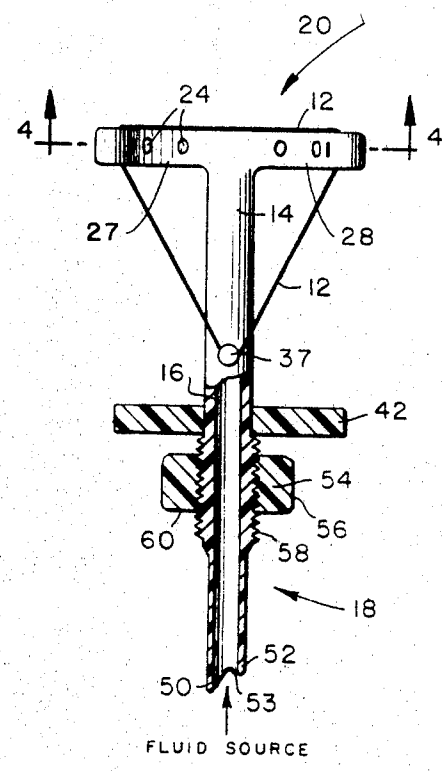

FIG. 3.

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HYDRAULIC-FILAMENT DENTAL DEVICE

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ABSTRACT OF THE DISCLOSURE

The invention is a hydraulic-filament dental device comprised of a tubular body having perforations at a downstream portion and adapted to connect to a fluid source at an upstream portion. Means are provided at the downstream portion to allow a filament device such as dental floss to be mounted thereon. The device is adapted to be used to clean the teeth by simultaneous mechanical and hydraulic actions.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

BACKGROUND OF THE INVENTION

Field of the invention

This invention is a hydraulic-filament device and more particularly an oral cleaning device which is able to clean mechanically and hydraulically.

Description of the prior art

For effective cleaning of the mouth two considerations are of utmost importance. The first is that food particles and other debris that lodge around the teeth must be removed. Secondly, dental plaque which becomes attached to and forms a coating upon the teeth must be effectively removed.

Dental debris is usually caused by chewing action whereby food particles and juices broken up during mastication are lodged in cavities and spaces about the teeth. Generally this debris is loosely packed and can easily be removed by such well known devices as the toothbrush, dental floss or by hydraulic means. Directing a stream of water with sufficient pressure to those areas in which the dental debris is located will usually be sufficient to dislodge the debris.

Dental plaque which is a complex bacterial type coating attached to a tooth is much more difficult to remove than dental debris. Removal entails something more than a jet or spray of water and will usually require some type of mechanical action. Such mechanical action is best afforded today by a toothbrush scrubbing the external and lingual surfaces of the teeth. Dental plaque which is attached to the interproximal tooth surfaces is currently best removed by dental floss, or other means which have the ability to get between the teeth and mechanically engage the plaque and forcibly rub it off the tooth surfaces.

The prior art has numerous examples of water spray devices for the purpose of directing a flow of liquid into the mouth. Certain drawbacks, however, become immediately apparent such as the fact that the water spray alone can only do part of an effective cleaning job because it is able only to remove that debris which is loosely situated on and between the teeth. The water spray devices will not be effective in cleaning dental plaque nor in cleaning debris which may have lodged more securely between the teeth. Devices having a weak single spray will be insufficient to even clean the loose debris from between the teeth; conversely, those devices which have

a harder spray or jet produce physical displeasures which unfortunately make their use undesirable and even act as a deterrent to the use of hydraulic cleaning devices. The major disadvantages inherent in the single jet dental nozzle is the inability of the user to confine the water jet to the dental structures. This results in impingement of the single jet stream upon the soft tissues of the floor of the mouth, tongue, cheeks, or throat which in turn results in such undesirable side effects as pain, gagging, nausea and even vomiting. Another drawback of the prior art devices is that they are not adapted to be used with other cleaning devices nor are they particularly adapted for use within a time element normally considered sufficient for cleaning the mouth.

SUMMARY OF THE INVENTION

The problems of the prior art have been eliminated by the present invention because it provides an effective cleaning tool which is adapted to remove debris from between the teeth hydraulically as well as provides a mechanical means for removing dental plaque. In addition, the device is extremely easy to use, inexpensive and interchangeable with other cleaning devices, thus the cleaning process is not, relatively speaking, time consuming. Our invention is able to act with other apparatus such as our "Stem Actuated Valve" described in a previously filed application to provide efficient and effective operation and thus assure maximum controllability of hydraulic pressure and direction of fluid flow. All this is accomplished by providing a hydraulic-filament device comprising a tubular body having a downstream portion and an upstream portion, the downstream portion being perforated and having means to mount a filament cleaning means such as dental floss. The upstream portion may be adapted to connect to a fluid source so that fluid may be introduced into the tubular body and sprayed from the perforations. The perforations are adapted and arranged so that fluid sprayed from one perforation will be intersected by fluid sprayed from another perforation.

An object of the invention is to provide a device which offers an effective cleaning mechanism without the usually accompanying pain or nuisance to the user.

Another object of the invention is to provide an oral hygiene device which is inexpensive but yet effective and extremely easy to use as well as interchangable with other dental apparatus so as to lessen the time necessary for a thorough cleaning.

A further object of the invention is to provide an oral hygiene device which successfully incorporates and combines mechanical and hydraulic cleaning action in one simple-to-use apparatus.

Still another object of the invention is to provide a hydraulic device for projecting two or more liquid jets that directionally converge in a plane toward a point or line.

A still further object of the invention is to provide a device to saddle a dental arch such that multiple of controllable fluid jets may converge in a plane transverse to the dental arch and upon a tooth and peridental tissues and/or interproximal tooth surfaces and spaces.

Other objects and many of the attendant advantages of the invention will become readily apparent as the disclosure is made in the following detailed description of a preferred embodiment of the invention, and as illustrated in the accompany drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is an isometric view of an embodiment of the invention.

FIG. 2 is a front partial section view of the embodiment shown in FIG. 1 and indicating the flow path of a fluid within the embodiment.

FIG. 3 is a front partial section view of another embodiment.

FIG. 4 is a plan section view taken along line **4—4** of FIG. 3 and illustrates the flow path of a fluid within the embodiment.

DESCRIPTION OF THE INVENTION

Referring now to the drawing, FIGS. 3 and 4 will be described in detail having reference numerals designate the parts throughout the two views. The embodiment shown in FIGS. 1 and 2 will have numerals identical to those used in FIGS. 3 and 4 to designate corresponding parts of the FIGS. 1 and 2 embodiment and, in addition, will have a small letter "*a*" following each numeral so as to help distinguish the two embodiments shown.

Our device comprises a tubular body **14** with its bore **16** running the length of the body from an upstream portion **18** to a downstream portion **20**. The upstream portion **18** is adapted to communicate with a fluid source from which fluid may be injected into the bore **16** of the tubular body. The downstream portion **20** has perforations **24** (six perforations are shown in FIGS. 1, 2, 3 and 4, but it is noted that this is not to be considered limiting as any reasonable number of perforations may be used) which may be in communication with the bore **16** by way of a conduit **26**. Downstream portion **20** may be comprised of two oppositely disposed legs, **27** and **28**, which may be generally U-shaped as shown in FIGS. 3 and 4, or generally Y-shaped as shown in FIGS. 1 and 2. As will be discussed below, the particular shape or disposition of the downstream portion may vary greatly as long as the desired results which are stated below are achieved.

It is desirable to have the perforations **24** so arranged that fluid ejected from a perforation in one leg of the U- or Y-shaped portion intersects fluid ejected from an opposing perforation located in the other leg of the U- or Y-shaped portion. Thus, it is seen that fluid jet from a perforation of leg **27** intersects a fluid jet from an opposing perforation of leg **28**. Likewise, the fluid ejected from a perforation of leg **27***a*, FIG. 2, intersects fluid ejected from an opposing perforation of leg **28***a*. It is noted that in the FIG. 4 embodiment the ejecting fluid from the several perforations intersects in each leg in the plane formed by the U-shaped end and meets at one location forming generally a point which is indicated by the numeral **30**. The embodiment shown in the FIG. 2 arrangement also has the fluid from the perforations intersecting in the plane which is formed by the Y-shaped end. However, the intersection may be at a number of points from which a line may be formed, such as illustrated by the line numbered **32**; that is, the fluid tends to impinge generally in a line (as opposed to the point intersection of the FIG. 4 embodiment).

The point intersection of the FIG. 4 embodiment offers a greater concentration of fluid at a single particular location and thus offers a greater fluid volume and force to dislodge dental debris located between the teeth and on dental surfaces straddled by the jets.

The line intersection of the FIG. 2 embodiment offers effective interproximal cleaning while minimizing the time required. In addition, the line intersection offers the further advantage of massaging the periodontal tissue around the teeth as it cleans. While it is shown in FIG. 2 that the fluid may intersect in a line and in FIG. 3 the fluid may intersect in a point, it is to be noted that the perforations may be designed so that the FIG. 2 embodiment may have a point intersection whereas the FIG. 3 embodiment may have a line intersection.

Regardless of the geometric shape of the intersection it is noted that a purposeful intersection is created so that the energy of any one particular stream of ejected fluid is substantially neutralized by the energy of an opposing stream of fluid so that one of the major disadvantages of the prior art is overcome; if the device should be positioned so that the fluid is no longer impinging upon the tooth or related periodontal membranes the ejected streams will intersect each other and break into a fine spray rather than forcefully impinge upon a delicate or sensitive part of the mouth such as a cheek, the tongue or the throat which, as mentioned earlier, may cause pain, gagging or vomiting.

The hydraulic-filament device may also comprise a filament cleaning means which may be dental floss **11**, FIG. 2, or a resilient element such as a rubber band **12**, FIG. 3. It is noted that with either of the above-mentioned fluid intersections, the dental floss or rubber band combines with the fluid to effectively clean by hydraulic and mechanical actions. The filament cleaning means supplies the necessary mechanical rubbing to remove loose debris as well as dental plaque.

The downstream portion **20** of the embodiments may also be disposed generally transverse to the upstream portion **18** of the tubular body as is shown in FIGS. 3 and 4. This relationship will facilitate the handling of our device in the mouth and thereby facilitate the cleansing of the teeth. However, the FIG. 2 embodiment has an advantage in that it can loop or position the dental floss or filament around the back molar teeth and reach otherwise difficult locations.

It is to be noted that the plane in which the legs **27** and **28** or **27***a* and **28***a* are located may be positioned in any angular relationship to the upstream portion **18** of the tubular body **14** and are not limited to the dispositions illustrated in FIGS. 2 and 3.

Means at the downstream portion **20** are provided for mounting the filament cleaning means. Any suitable mounting arrangement may be used with a preferred arrangement shown in FIGS. 3 and 4 as an example. Rubber band **12** may be received through opening **34** into hook depression **36**; one such depression is located at the end of each leg. A third mounting point may be lug **37** connected upstream of downstream portion **20** to body **14**. The FIG. 2 embodiment has a similarly constructed arrangement for mounting the dental floss **11**. The dental floss is received through opening **34***a* into hook depression **36***a*. A third mounting point may be lug **37***a*. In either embodiment the lug **37** or **37***a* is provided not only to help mount and position the dental floss or rubber band, but is provided as a means to create a sufficient tension in the dental floss or rubber band to allow its effective use. In this respect there may be several such lugs. It is to be noted that either the dental floss or a rubber band or any other similarly structured device may be used to clean the debris and plaque from between the teeth and that the FIG. 2 and FIG. 3 embodiments may be adapted to use either the rubber band or the dental floss or any other suitable material to serve the desired function. All that is desired is that the filament cleaning extend between the two legs so as to facilitate its use in a usual fashion.

Disposed about the tubular body **14** may be an annular flange **42**; the flange may be directly connected to or made integral with the tubular body. The placement of the flange is for the purpose of aiding a user in the proper operation of the device. The tubular body is controlled by holding the flange with the fingers which allows the device to be moved quite easily in a longitudinal direction and/or in a rotational direction. This allows a complete freedom of movement of the fluid jets within the mouth and enhances the adaptability and usefulness of the invention.

Our invention is adapted at its upstream portion **18** to be received by a hand-held valve which is disclosed in more detail in our abovementioned copending application entitled "Stem Actuated Valve." Since it is the stem which is received by the valve that actuates the valve to allow fluid flow, the upstream portion **18** is traversely slanted and notched so that when viewed in cross section as shown in FIG. 3 there is formed a longer arm **50** and

a shorter arm **52** with a notch **53** between (the FIG. 2 embodiment has an identical end). The reason for this particular structure is clearly explained in our copending application. The main concern is that the upstream portion of the invention and of other cleaning devices are identical and therefore interchangeable. This allows a quick and effective means to clean the mouth when used in concert.

Located between the flange **42** and the upstream portion **18** may be an adjustment nut **54** which may have a knurled surface **56**. The adjustment nut **54** is threaded to the tubular body **14** at **58** and is adapted to be rotated along the body in an upstream or downstream direction. The bottom surface **60** of the adjustment nut is adapted to abut with the downstream portion of the valve, which is more fully explained in our copending application, thereby regulating the distance that the tubular body is received by the valve; that is, if the adjustment nut **54** is in its furthest downstream position placing it close to flange **42**, the upstream portion **18** of the tubular body may be received more deeply into the valve before the surface **60** of the adjustment nut abuts the valve.

The flange **42***a*, FIG. 2, may be adapted to be a dental floss dispenser so that it may serve a dual function of storing and dispensing dental floss as well as a control means for the tubular body.

OPERATION

In operation our device provides an effective mechanical and hydraulic cleaning means which is extremely easy to manipulate, interchangeable with other cleaning devices, and not overly time consuming.

The dental floss **11** or rubber band **12** is mounted in place as shown in FIGS. 2 and 3. It is noted that a triangular configuration is formed. However, it is not essential that such a geometric configuration be formed since the main concern is a relatively taut line across the legs of the downstream portion so that any other geometric configuration fulfilling the desired result is acceptable. Our invention is then inserted into the valve connected to a fluid source. The fingers of the user's hand rest upon the flange **42** allowing simple longitudinal motion in an upstream direction to actuate or open the valve. Opening the valve causes a fluid to enter the bore **16** of the tubular body **14** and proceed under fluid source pressure to the downstream portion **20** where it will flow through conduit **26** and be ejected through the various perforations **24**.

Before actuation a user may place the invention in his mouth locating the dental floss **11** or rubber band **12** between two teeth. He then commences reciprocating motion of the filament in the usual fashion to remove debris while at the same time actuating the valve to cause a fluid to begin flowing which in turn achieves effective cleaning by simultaneous and combined action of the floss and hydraulic pressure. Several of the major features of our invention are the speed, the ease of use and the simplicity of operation.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

We claim:

1. A hydraulic-filament dental device comprising in combination:

a tubular body having a downstream portion and an upstream portion, the downstream portion of said body being perforated;

means at said downstream portion for mounting a filament cleaning means;

a filament teeth cleaning means coupled to said mounting means;

said tubular body downstream portion comprising two oppositely disposed legs, each leg having perforations such that fluid ejected from the perforations of one leg intersects fluid ejected from the perforations of the other leg; and

an annular flange disposed about and connected to said tubular body for facilitating handling of said tubular body.

2. Teeth cleaning apparatus for directing pressurized fluid onto the teeth while employing a dental filament for mechanically loosening dental plaque, said apparatus comprising:

an elongate tubular means having one of its end portions adapted to be coupled to a source of said fluid,

the other of its end portions being formed with means engaging a length of said dental filament for permitting the length to be held in a taut position extending normal to the longitudinal axis of said tubular means,

the end wall of said other end portion being closed and the side wall of said other end portion being perforated for projecting a fluid stream in the direction of said taut length of filament,

whereby said length of filament can be engaged with interproximal tooth surfaces and said teeth mechanically and hydraulically scrubbed in a simultaneous manner.

3. The apparatus of claim **2** wherein said tubular means has its one end portion formed as a tube and its other end portion formed into a pair of oppositely disposed tubular legs diverging outwardly from said tube,

said filament engaging and holding means being provided at the outer end of each of said legs, and

the side walls of each of said legs being provided with a plurality of said perforations,

said perforations being formed and positioned to cause the resulting fluid streams from both legs to converge medially of said legs for reducing the jet force of said streams.

4. The apparatus of claim **3** wherein said two legs are generally transverse to the longitudinal axis of said tube.

5. The apparatus of claim **3** wherein said perforations are disposed and directed for causing the fluid streams to converge in the plane of the longitudinal axis of said tube.

6. The apparatus of claim **3** wherein said perforations are disposed and directed for causing said fluid streams to converge at a point substantially on and medially of said taut filament.

References Cited

UNITED STATES PATENTS

1,573,749	2/1926	Ross	128—239
2,298,157	10/1942	Phillips	128—62
3,368,553	2/1968	Kirby	128—62

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