United States Patent

[11] 3,612,045

[72] Inventors **Frank E. Dudas**
Toronto, Ontario;
Ingo Glende, Downsview, Ontario; Geza Kardos, Burlington, Ontario; Edward V. Rippingille, Jr., Don Mills, Ontario, all of Canada

[21] Appl. No. **800,071**
[22] Filed **Feb. 18, 1969**
[45] Patented **Oct. 12, 1971**

[73] Assignee **Dudas Juypers Rowan Limited**
Toronto, Ontario, Canada
by said Frank E. Dudas, Ingo Glende and Geza Kardos

[54] **PULSATING DENTAL SYRINGE**
2 Claims, 11 Drawing Figs.

[52] **U.S. Cl.** **128/66**
[51] **Int. Cl.** **A61h 9/00**
[50] **Field of Search** 128/66, 62; 4/145; 222/129.2, 130; 239/61, 102

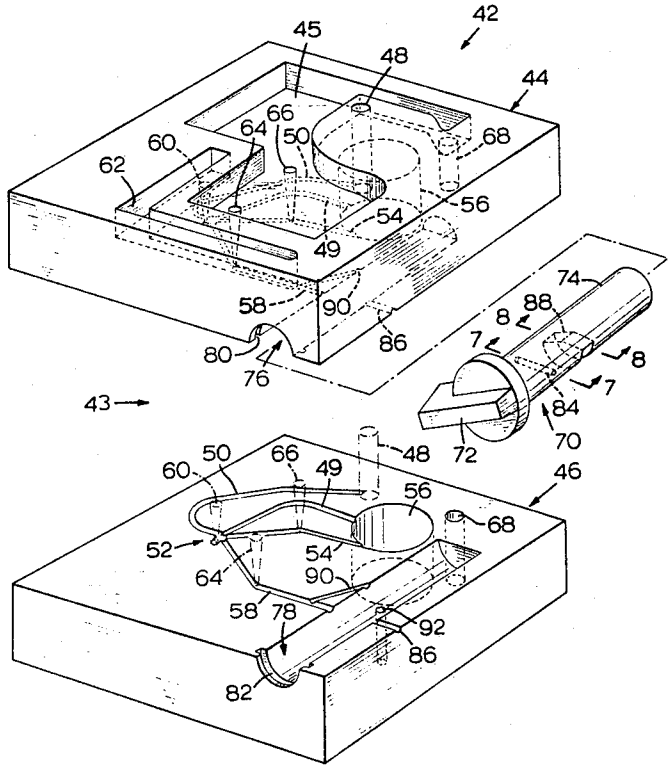
[56] **References Cited**

UNITED STATES PATENTS

3,480,008	11/1969	Chao	128/66
3,496,933	2/1970	Lloyd	128/66
3,507,275	4/1970	Walker	128/62 UX

Primary Examiner—L. W. Trapp
Attorney—Rogers, Bereskin & Parr

ABSTRACT: A hygenic dental syringe having a fluidic oscillator for producing pulsations of water for cleansing the mouth and massaging the gums. The device includes a reservoir for mouthwash, and means for mixing the mouthwash with the main stream of water passing through the device.



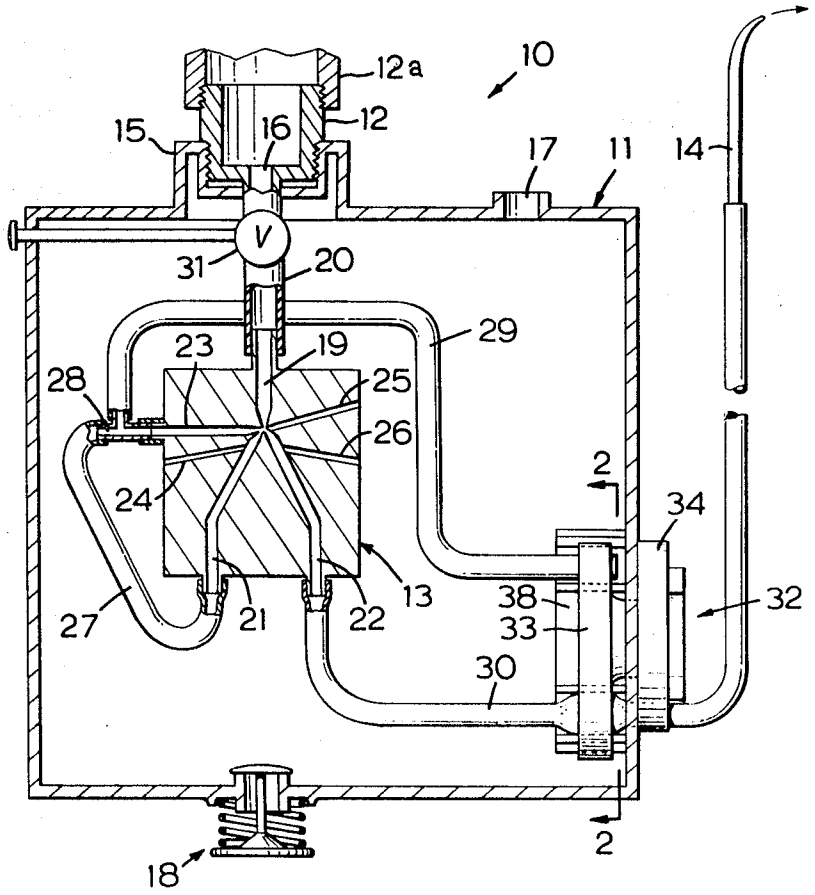


FIG. 1

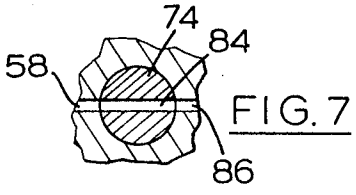


FIG. 7

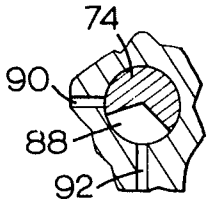


FIG. 8

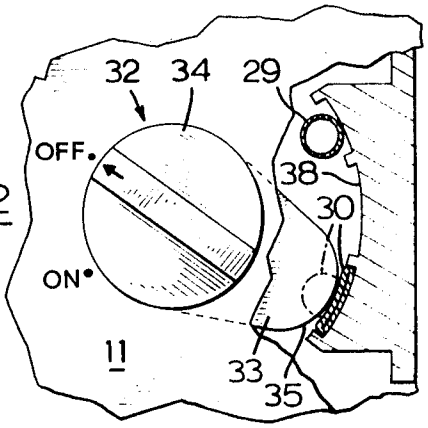


FIG. 2

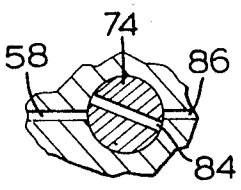


FIG. 9

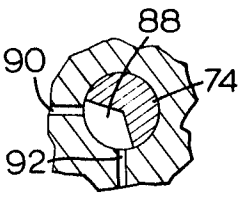


FIG. 10

INVENTORS
FRANK E. DUDAS
INGO GLENDE
GEZA KARDOS
EDWARD V. RIPPINGILLE, JR
BY Rogers, Bereskin, & Parr

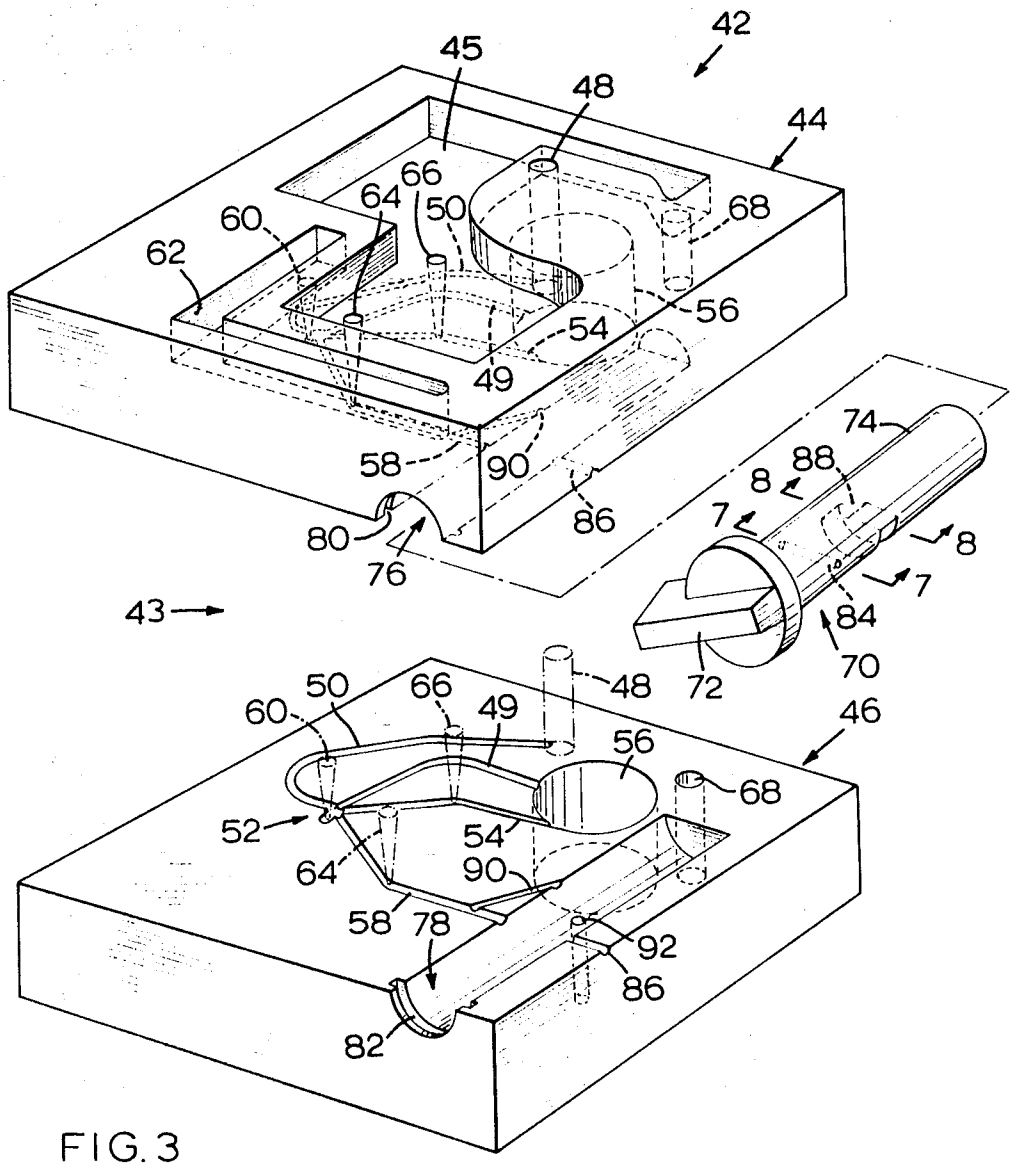


FIG. 3

INVENTORS
FRANK E DUDAS
INGO GLENDE
GEZA KARDOS
EDWARD V. RIPPINGILLE, JR
BY *Rogers, Bereskin, & Parr*

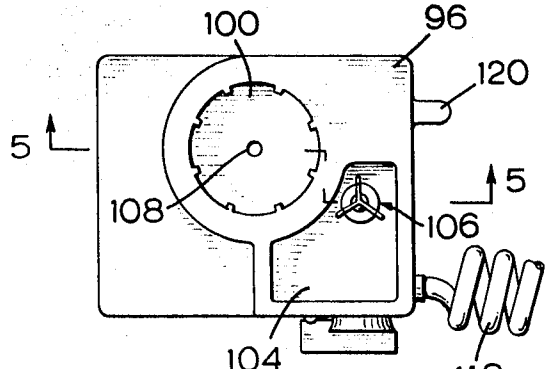


FIG. 4

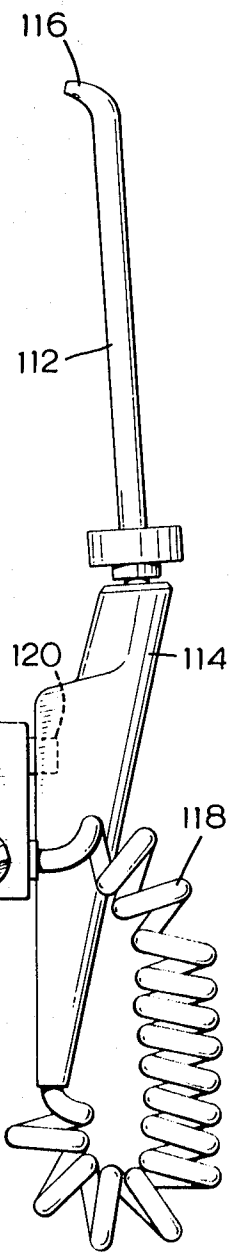


FIG. 6

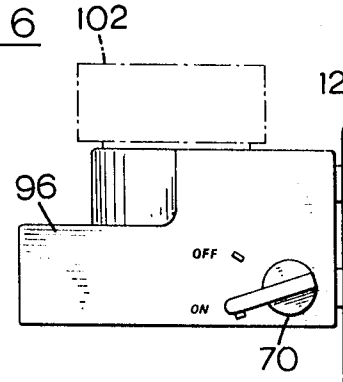
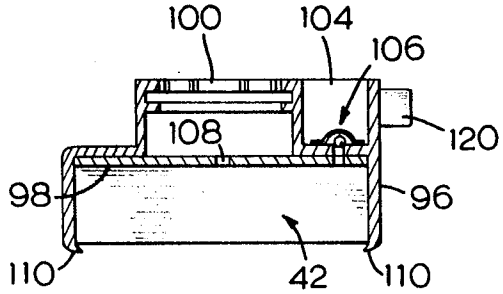
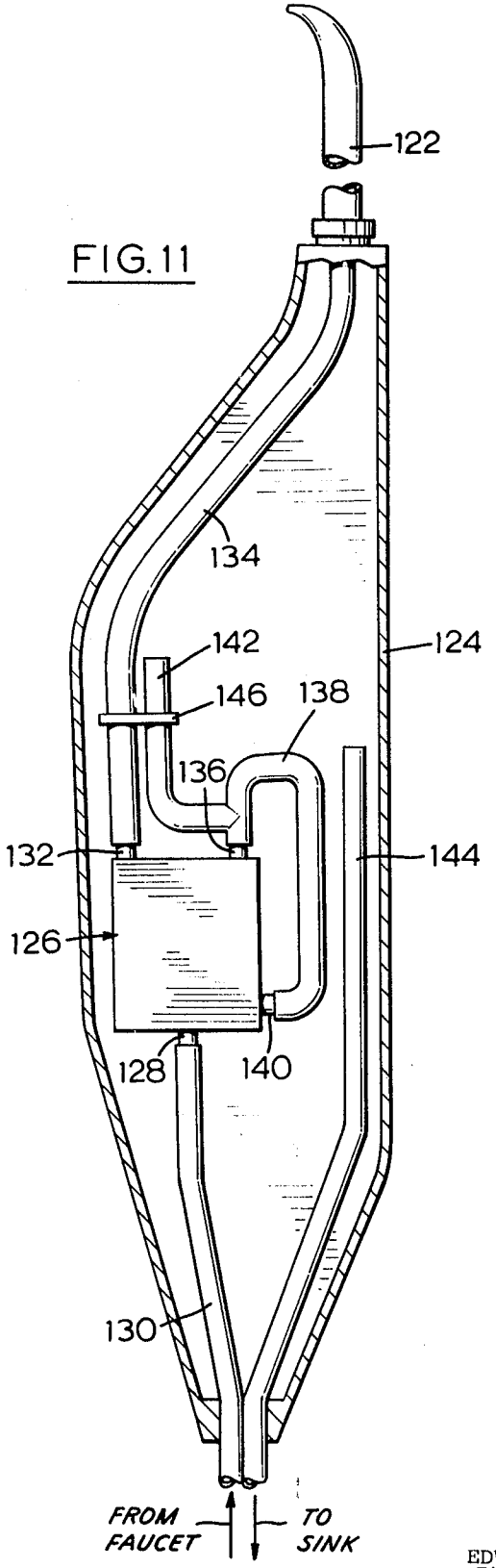


FIG. 5



INVENTORS
FRANK E. DUDAS
INGO GLENDE
GEZA KARDOS
EDWARD V. RIPPINGILLE JR.
BY Rogers, Bereskin, & Parr

FIG. 11



INVENTORS
FRANK E. DUDAS
INGO GLENDE
GEZA KARDOS
EDWARD V. RIPPINGILLE, JR.
BY Rogers, Bereskin, & Parr

PULSATING DENTAL SYRINGE

This invention relates to a hygenic dental appliance for cleaning the mouth and teeth and massaging the gums.

Appliances of the above kind are becoming increasingly popular in the home as an adjunct to toothbrushes. Such appliances are used in cleaning the oral cavity (primarily spaces between the teeth) to remove food particles not easily dislodged by a toothbrush, and for massaging the gums. It has been found desirable to direct the spray of water into the mouth in pulses rather than a continuous stream, because pulses of water appear to provide more effective cleaning and massaging action. A representative kind of such pulse-type appliances utilizes an electric motor and a pump to produce water pulses of the required pressure.

The present invention does not require electricity or any moving parts to produce the water pulses; instead, it utilizes the pressure of tap water as the source of power and a fluidic oscillator to produce the required water pulses. A fluidic oscillator is a device which is capable of producing periodic recurrent changes in fluid flow. The theory and operation of a number of such devices is given in an article which appeared in the June 24, 1965 addition of Machine Design, pages 154–180, as well as in Canadian Pat. No. 674,665 for example.

Objects of the present invention are to provide a hygenic dental appliance of the kind described that does not require electricity for operation, that uses no moving parts to produce water pulses, and which is reliable, comparatively simple to manufacture, and efficient.

In drawings illustrating a preferred embodiment of the invention,

FIG. 1 is a somewhat diagrammatic front sectional view of one embodiment of a dental appliance according to the invention;

FIG. 2 is a side view of a portion of the appliance shown in FIG. 1, partly broken away to show a switch, shown in a section taken along line 2–2 of FIG. 1;

FIG. 3 is an exploded perspective view of a fluidic oscillator designed for use with another embodiment of the invention illustrated in FIGS. 4–10;

FIG. 4 is a plan view of a housing of the latter embodiment;

FIG. 5 is a sectional view taken on line 5–5 of FIG. 4;

FIG. 6 is a side view of the housing shown in FIG. 4 with a nozzle attached;

FIG. 7 is a sectional view taken along line 7–7 of FIG. 3 with a control knob in an open position;

FIG. 8 is a sectional view taken along line 8–8 of FIG. 3 with the control knob in the open position;

FIG. 9 is a sectional view similar to FIG. 7 with the control knob in a closed position;

FIG. 10 is a sectional view similar to FIG. 8 with the control knob in the closed position; and

FIG. 11 is a somewhat diagrammatic sectional view of yet another embodiment.

Referring to FIG. 1, a hygienic dental appliance is generally indicated by reference numeral 10, and it includes a housing 11, a coupling 12 for attaching the housing 11 to the faucet of a bathroom sink or the like, a fluidic oscillator 13, and a nozzle 14.

The housing 11, which is intended to be filled with water when in use, is provided with an annular collar 15 which surrounds an opening 16, an overflow opening 17 in its upper surface, and a spring-loaded drain valve 18 in its lower surface. The shape of the housing is optional. The coupling 12 is connected to the housing 11 at the collar 15, and it is designed to fit the end of a faucet 12*a*. Many bathroom sink faucets currently in use have internal or external threads at their outer ends which can be utilized for connection to the coupling 12. Other forms of couplings could be employed to fit each particular kind of faucet, whether the faucet has threads or not. The coupling 12 is open at both ends and it serves as a conduit to bring water from the faucet 12*a* into the housing 11 through the opening 16.

The fluidic oscillator 13 has an inlet channel 19 that is connected to the opening 16 by means of a tube 20, two outlet channels 21, 22, a control channel 23, and vents 24, 25 and 26. Each of the channels of the fluidic oscillator terminates in a narrow pipe to which flexible tubing can be attached. The outlet channel 21 is connected to the control channel 23 by means of a length of tubing 27 and a T-shaped coupling 28. A bypass tube 29 is connected at one end to the coupling 28, and its opposite end terminates near the bottom of the housing 11. The outlet channel 22 is connected to the nozzle 14 by means of a length of flexible tubing 30. A valve 31 may be provided in the tube 20 for controlling the pressure of water entering the fluidic oscillator 13.

The fluidic oscillator shown in FIG. 1 is known as a monostable multivibrator, or simply a monostable, because it has only one stable state. Water which flows into the inlet channel 20, in the absence of feedback, emerges only from the outlet 21. With feedback, however, the flow is temporarily diverted into the other output channel 22, because the flow of water in the control channel 23 breaks the Coanda effect and the momentum of the water in the control channel 22 deflects the main stream of water from its favored outlet channel 21 into the outlet channel 22. When such switching occurs, however, the flow of water in the control channel 23 ceases and the main stream of water reverts to the outlet channel 21. The vent 25 prevents the main stream of water from remaining in the outlet channel 22. The operation is repetitive, and the result is that water flows through the outlet channel 22 in discrete pulses of predetermined duration and frequency depending upon the constants of the fluidic oscillator 13. The pressure of the water entering the fluid oscillator 13 must be sufficient to ensure that the velocity of the water in the control channel 23 is sufficient to switch the main flow from the outlet 21 to the outlet 22.

FIG. 2 shows a switch 32 for controlling the appliance 10. The switch 32 comprises a pivotable lever 33 having an exposed outer end 34 which can be grasped to operate the switch, and a blunt end 35 (on the inside of the housing 11) which compresses either the tube 29 or the tube 30, depending upon position of the lever 33. The tubes 29 and 30 are held in position against a curved flange 38 that is formed integrally with the housing 11. The switch 32 is shown in FIG. 2 in the off position with the tube 30 closed so that no water can pass to the nozzle 14. Referring to FIG. 1, in the off position of the switch 32 the water entering the inlet channel 19 then flows in a steady stream through the outlet 21 and then enters the bypass tube 29. Since the tube 29 is open in this position of the switch 32, water issues from the end of the tube 29, fills the housing 11 and exits the housing 11 through the overflow opening 17. In the "on" position of the switch 32, the lever 33 compresses the pipe 29 to effectively close it and at the same time the tube 30 is opened. The fluidic oscillator thereupon will begin to oscillate, and discrete water pulses will emerge from the nozzle 14.

The nozzle 14 is formed with a narrow tip and it has an orifice of a diameter capable of forming a stream of water of small cross section. The nozzle is shaped to permit the water to be directed against the teeth and gums for the ejection of food particles (particularly particles between the teeth which are difficult to reach with a toothbrush) and for massaging the gums.

The embodiment illustrated in FIGS. 3–10 also employs a monostable to produce water pulses, but in this case the elements of the appliance (particularly the housing) are very compact. In addition, provision is made for mouthwash to be mixed with the water issuing from the monostable.

Referring now to FIG. 3, the monostable is generally indicated by reference numeral 42, and it is composed of two halves 44 and 46 each of which is formed with narrow elongated depressions which mate with one another when the halves 44 and 46 are fastened together to thereby form the necessary water channels. Water enters the monostable 42 through an inlet bore 48 and proceeds along inlet channel 50 to a junction 52 from whence it normally flows into an outlet channel 54. A reservoir 56 is connected to the outlet channel

54, and it effectively delays the water flow before allowing it to pass into a control channel 49. The reservoir 56 eliminates the need for a fairly long length of feedback tube to produce water pulses of the desired frequency. The water emerging from the control channel 49 at the junction 52 deflects the water flow from the outlet channel 54 and switches it to the outlet channel 58. An L-shaped channel 62, which is intended to contain mouthwash, is connected with the junction 52 by means of a control vent 60. As in the case of the monostable 13 described above, the water flow is rapidly switched back and forth between the outlet channels 54 and 58. Thus, discrete pulses of water will issue from the outlet channel 58, but in this case the water will be mixed with mouthwash. Vents 64 and 66 allow some of the water to rise from the outlet channels 58 and 54 respectively into a reservoir 45 from which excess water can pass downwardly through an overflow bore 68.

The flow of the water through the monostable is controlled by a switch 70 which has an outwardly protruding handle 72 and a cylindrical body 74. The halves 44 and 46 of the monostable 42 are formed with semicylindrical grooves 76 and 78 which together provide a cylindrical recess that is dimensioned to accommodate the body 74 of the switch 70. Grooves 80 and 82 in the halves 44, 46 combine to form a seat for an O-ring to seal the switch 70. An opening 84 extends through the body 74 of the switch 70, and it is positioned to be in line with the open end of the outlet channel 58 and with the inner end of a channel 86 of the monostable 42. In addition, the body 74 is provided with a recess 88 which is positioned to communicate with the open end of a channel 90 which leads from the outlet channel 58 to the wall of the cylindrical recess formed by the grooves 76, 78. A narrow channel is formed in the half 46 at right angles to the axis of the groove 78. One end of the channel 92 is opposite the open end of the channel 90, and the other end of the channel 92 opens on the opposite side of the half 46.

The operation of the switch 70 will now be described with reference to FIGS. 3 and 7–10. In FIGS. 7 and 8, the switch 70 is in the open position. In this position, the outlet channel 58 is joined to the channel 86 by the opening 84 in the body 74 of the switch 70, so that water is free to issue from the outer end of the channel 86. Also, as shown in FIG. 8, the solid portion of the body 74 is opposite the outer end of the channel 90 so that no water can pass from the channel 90 to the channel 92.

In FIG. 9 the switch 70 is in the closed position and the opening 84 is no longer in line with the channels 58 and 86 so that water cannot pass from the channel 58 to the channel 86. In addition, the recess 88 of the body 74 is now in position to permit water to pass from the channel 90 to the channel 92 from whence it flows out of the monostable 42 to the drain of the sink. The monostable 42 continues to oscillate even when the switch 74 is in the closed position but the water issuing from the monostable is diverted into the channel 92 and hence no water issues from the channel 86.

The monostable 42 is housed in a compact housing 96 shown in FIGS. 4 to 6. The housing 96 contains the monostable 42, a plate 98 for sealing the reservoir 45 in the half 44, and a recess 100 for receiving one end of a coupling 102 (shown in chain-dotted outline in FIG. 6) that is used for connecting the housing 96 to a faucet. A recess 104 for mouthwash or the like has a ball valve 106 through which mouthwash in the recess 104 can enter the L-shaped channel 62 in the half 44. An opening 108 in the plate 98 allows water from the faucet to enter the monostable 42 through the inlet bore 48 in the half 44. The monostable 42 is attached to the housing 96 by any convenient means, such as by rolling the edge of the housing 96 about the bottom of the monostable 42 as indicated by reference numeral 110 in FIG. 5. A nozzle 112 includes a handle portion 114 designed to be held easily in the hand, and a tip portion 116 for directing the stream of water or water/mouthwash mixture into the mouth. A flexible tube 118 connects the channel 86 of the monostable to the nozzle 112. A protrusion 120 on the housing 96 is received in a recess of corresponding shape formed in the handle portion 114 to permit the nozzle 112 to be hung on the housing 96.

The appliance shown in FIG. 11 is generally similar to the appliance shown in FIG. 1 except that the nozzle is provided with an enlarged handle which houses the fluidic oscillator. Referring to FIG. 11, a nozzle 122 is attached to a hollow handle 124, and a fluidic oscillator 126 is positioned inside the handle 124. The fluidic oscillator 126 has an input 128 to which is attached a length of tubing 130 the opposite end of which is coupled to the faucet of the sink (not shown). An outlet 132 is connected to the nozzle 122 by a length of tubing 134, and an outlet 136 is connected by a length of tubing 138 to a control inlet 140. A short length of tubing 142 is connected to the tubing 138 near the outlet 136, and overflow water is drained to the sink by means of a tube 144. A switch 146 shown diagrammatically is used for controlling the flow of water to the nozzle 122. The switch 146 is similar in operation to the switch 33.

The velocity of the water pulses issuing from the nozzle of the appliance is preferably approximately 25 ft./sec. The pressure of water supplied to homes in most localities is usually sufficient to provide velocities of approximately this order of magnitude. The maximum velocity that can be used depends on the individual user; some people can tolerate higher velocities than others. Generally the mouth becomes more tolerant to higher velocities after the appliance has been used for some time.

Although the invention has been described and illustrated with reference to a monostable fluidic oscillator, it will be understood that numerous other fluidic oscillators known in the art are also suitable, provided they can be connected to produce water pulses. Although discrete pulses are preferred, pulsations of water in a continuous stream could also be employed. Discrete pulses are commonly produced by "digital" fluidic devices known by the following terms: bistable, wall attachment, edgetone, induction, flow diverter, focused jet and turbulence. Pulsations (as opposed to discrete pulses) are produced by "proportional" fluidic devices known by the following terms: stream interaction, double leg elbow, vortex and impact modulator.

What we claim as our invention is:

1. A hygienic dental appliance comprising:
a housing having a reservoir for mouthwash,
pulsing means in said housing for producing pulsations in a flow of liquid passing through said pulsing means, said pulsing means having an inlet and an outlet, said pulsing means being operable by liquid pressure,
means for connecting said pulsing means to a source of liquid under sufficient pressure to produce said pulsations,
means for mixing the contents of said reservoir with said flow of liquid, and
a nozzle coupled to the outlet of said pulsing means, said nozzle having an orifice of a diameter capable of forming a stream of liquid of small cross section, and said nozzle being shaped to permit said liquid to be directed against the teeth and gums for the ejection of food particles and for massaging gum tissue.

2. A hygienic dental appliance as claimed in claim 1 wherein said source is a faucet of a sink or the like, and wherein said liquid is water.