Jan. 7, 1969 J. W. KALBFELD 3,420,228

MASSAGING AND CLEANING DENTAL SYRINGE

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Fig. 1.

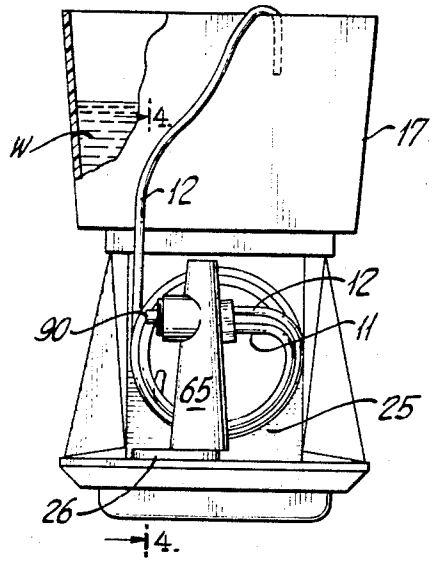
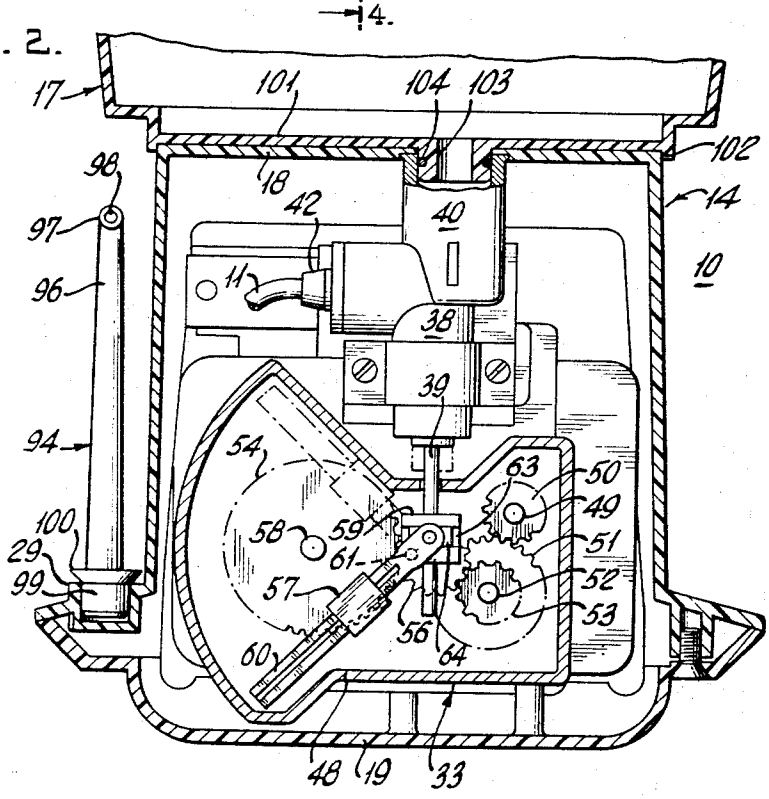


Fig. 2.



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Fig. 3.

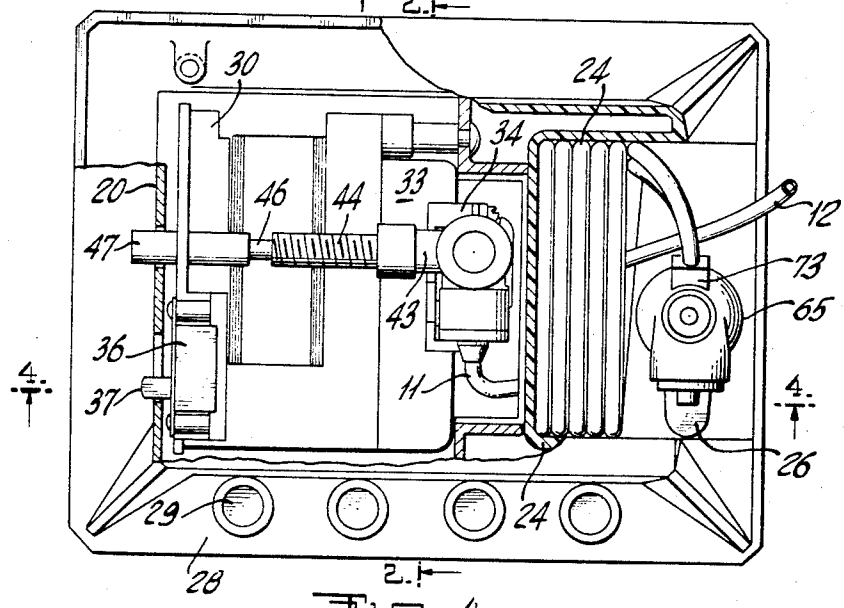
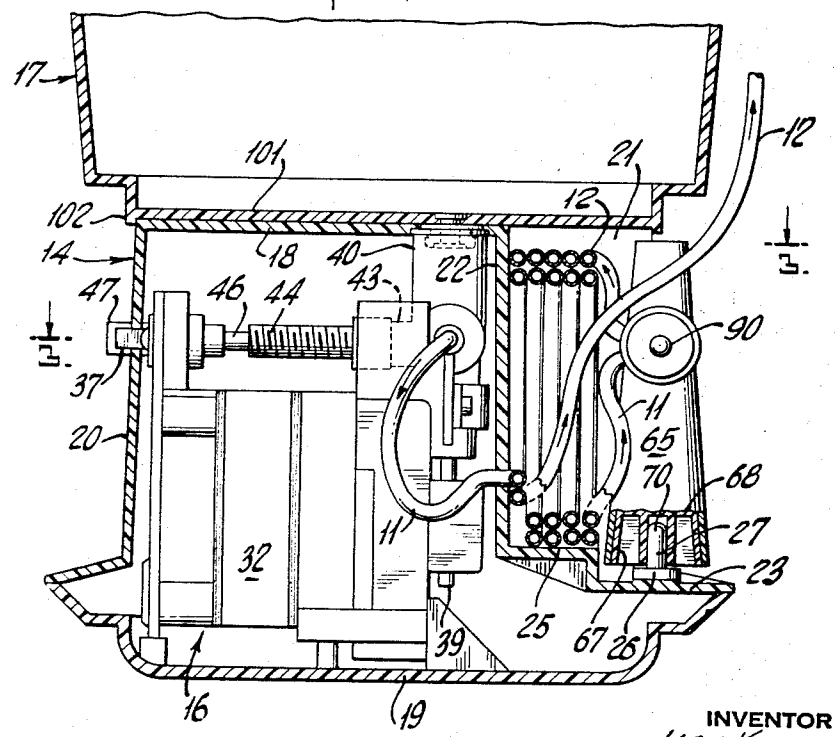


Fig. 4.



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Fig. 5.

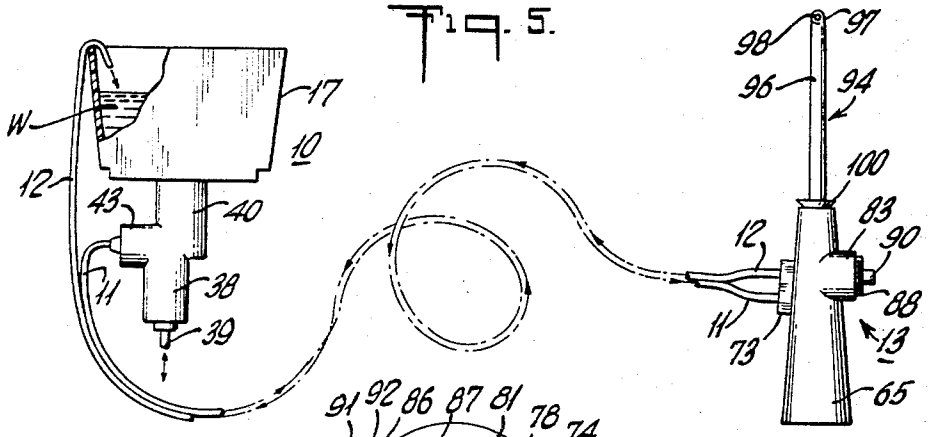


Fig. 7.

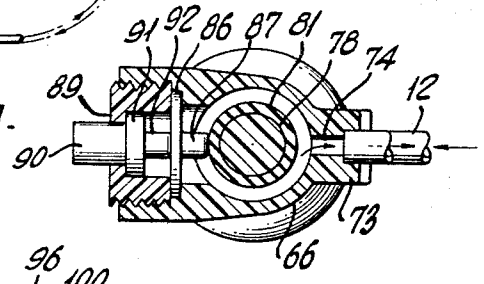


Fig. 6.

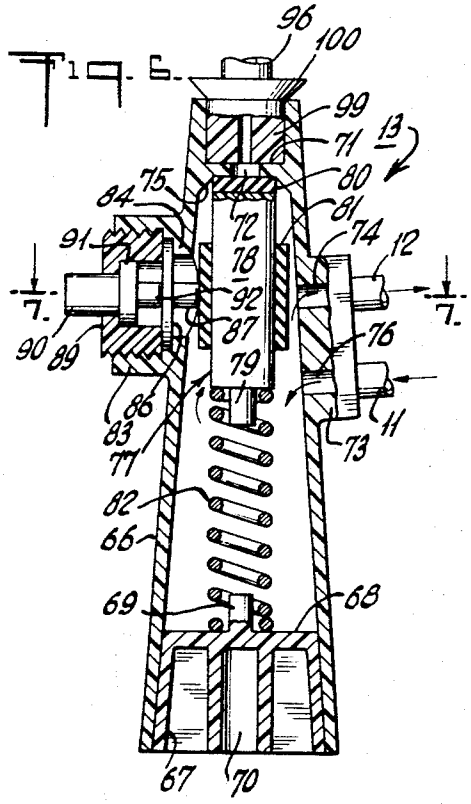
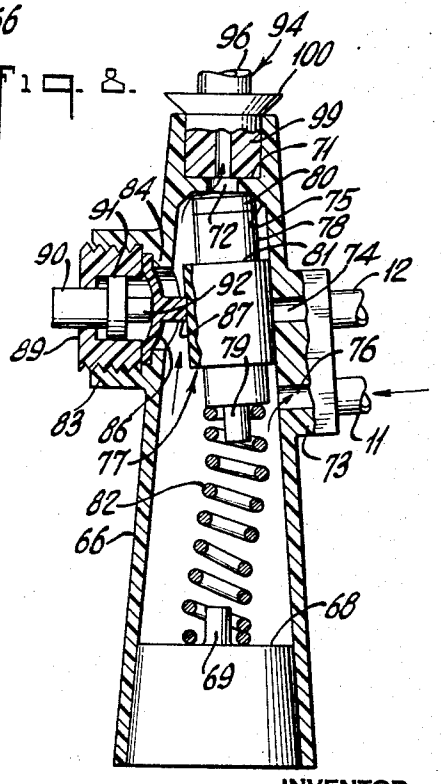


Fig. 8.



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MASSAGING AND CLEANING DENTAL SYRINGE

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U.S. Cl. 128—66 9 Claims
Int. Cl. A61h 9/00; A61c 17/02

The present invention relates generally to improvements in treating devices and methods, and it relates particularly to an improved dental cleaning and gum massaging apparatus and method employing a pulsating water jet.

The use of pulsating jets of water for the treatment of the oral cavity, particularly for massaging the gums and cleaning the teeth, is well known. Pulse frequencies from several hundred to many thousands of cycles per minute have been effectively employed; however, the pulsating jet cleaning and massaging devices heretofore available possess numerous drawbacks and disadvantages. Among those drawbacks are their inconvenience, lack of versatility and inefficiency.

It is, therefore, a principal object of the present invention to provide an improved oral cleaning apparatus.

Another object of the present invention is to provide an improved dental cleaning and gum massaging apparatus and method.

Still another object of the present invention is to provide an apparatus of the above nature characterized by its efficiency, reliability and convenience of use.

The above and other objects of the present invention will become apparent from a reading of the following description taken in conjunction with the accompanying drawings, wherein:

FIGURE 1 is a front partially fragmentary view of an apparatus embodying the present invention, illustrated in an erected position;

FIGURE 2 is a vertical sectional view thereof taken along line 2—2 in FIGURE 3;

FIGURE 3 is a horizontal sectional view taken along line 3—3 in FIGURE 4;

FIGURE 4 is a sectional view taken along line 4—4 in FIGURES 1 and 3;

FIGURE 5 is a front elevational view of the reservoir, pump and nozzle sections in extended positions;

FIGURE 6 is a vertical sectional view of the nozzle handle asembly shown in a nozzle valve closed position;

FIGURE 7 is a sectional view taken along line 7—7 in FIGURE 6; and

FIGURE 8 is a view similar to FIGURE 6 shown in a nozzle valve open position.

In a sense, the present invention contemplates the provision of a device for cleaning and massaging the oral cavity comprising a nozzle, a source of liquid, and pump means connected between said nozzle and said source of liquid for periodically delivering said liquid under pressure to said nozzle for predetermined intervals separated by dormant intervals, the period of the dormant interval being at least twice that of the delivery interval.

According to a preferred form of the present apparatus the pump means is a piston pump driven through a quick return motion translating mechanism by an electric motor so that the quick return stroke of the motion translating mechanism drives the pump piston in its advance or pressure stroke. The pump and drive are housed in a casing, and the pump has its inlet connected to an open topped tank separably mounted on the casing. The pump outlet is connected by way of an adjustable throttle valve and a tube to the nozzle through a three way valve housed

in the nozzle handle, the valve having outlets connected to the nozzle and to a reservoir return tube, the outlets being selectively opened.

Another feature of the present invention resides in the provision of a three way valve which comprises a valve housing including a first end wall and a side wall, and provided with an inlet port, a first outlet port in said end wall and a second outlet port in said side wall, a valve member positioned in said housing and resiliently longitudinally urged toward a position with a first end face thereof in closing engagement with said first outlet port and a side face spaced from and exposing said outlet port and swingable about said housing end wall to a position opening said first outlet port and closing said second outlet port, and a manipulatable member projecting through said valve housing into engagement with said valve member for controlling said valve member.

Referring now to the drawings, which illustrate a preferred embodiment of the present invention, reference numeral **10** generally designates the pump and reservoir section which is connected by way of a pair of side by side joined flexible tubes **11** and **12** to a nozzle section **13**, tubes **11** and **12** being of the self collapsing helically biased type and being separated at their inner ends. The pump and reservoir section **10** comprises a molded plastic multipart casing **14** in which a pump, motor, drive and control are housed, and an open topped tank or reservoir **17** which is separably mounted atop casing **14** and alternatively functions as a casing closure cap.

Casing **14** includes a top wall **18** provided with a circular aperture, a bottom wall **19**, a sidewall **20** at one end thereof and is provided with a tube and nozzle handle open ended housing cavity **21** in the opposite end thereof which is defined by an end wall **22**, a stepped platform wall **23** positioned above bottom wall **19** and front and rear walls **24**. A saddle **25** is formed in the bottom rear of cavity **21** to support the contracted tubes **11** and **12**. Pivoted to an end of the lower outer section of platform wall **23** is a horizontally swingable arm **26** provided adjacent its free end with an upstanding projection or pin **27** for releasably engaging the nozzle handle. In order to house a plurality of nozzle elements a ledge **28** is located along the lower front part of the casing **14** and is provided with a plurality of longitudinally spaced sockets **29**.

The pump and drive assembly **16** is mounted on casing bottom wall **19** and includes a mounting frame **30**, an electric motor **32** secured to the mounting frame **30**, a quick return motion translating mechanism **33** and a pump **34** suitably rigidly associated with motor **32**. Motor **32** is of any conventional type and is connected by way of a switch **36** supported by the mounting frame **30** to a power cord for connecting the motor **32** to a source of energizing current, the switch **36** being provided with a control button **37** projecting through an opening slot in the casing and wall **20**.

Pump **34** is of the conventional piston type and includes a vertical cylinder **38** provided with a cooperating vertically slidable piston having a piston rod **39** depending from and connected thereto and restricted with the piston to an axial vertical movement. As is conventional, piston pump **38** has an inlet and an outlet provided with check valves permitting the flow of fluid only into the inlet and out of the outlet. An open topped tubular coupling member **40** projects upwardly from the pump cylinder **38** and communicates with the pump inlet, coupling **40** registering with and engaging the circular aperture in casing upper wall **18**. The inner end of tube **11** is connected by means of a suitable coupling **42** and by way of a flow adjusting or throttle valve **43** to the outlet of pump **34**. Valve **43** includes a valve housing integrally formed with pump cylinder **40** and is of any conventional con-

struction, and is provided with a rotatable threaded valve stem **44** engaging a tapped section of the valve **43** and having an axial adjusting shaft **46** engaged by a knob **47** which projects through an aperture in casing wall **14**. Thus the back pressure to the pump **34**, and hence the liquid outlet flow, may be adjusted by means of the valve **43**.

An essential feature of the present apparatus is the manner in which piston pump **34** is driven whereby the interval or time of the forward or pressure stroke thereof is only a minor fraction of the time of the full cycle thereof, that is the time between identical points on the pump cycle so that the pump delivery interval is less than, and advantageously less than half of the pump nondelivery or dormant interval. This mode of operation is advantageously effected by coupling piston rod **39** to the motor **32** by way of the quick return transmission **33**, transmission **33** being so coupled to piston rod **39** and so driven that the quick return stroke of transmission **33** corresponds to the pressure or advance stroke of piston rod **39**.

Specifically, transmission **33** includes a housing **48** having an opening in its upper wall through which piston rod **39** projects. Drive shaft **49** of motor **32** projects into housing **48** through an end wall thereof and has affixed thereto a pinion gear **50** located in housing **48**. Gear **50** engages a larger gear **51** mounted on a shaft **52** and having rotatable therewith a smaller gear **53**. Gear **53** is coupled to a large gear **54** mounted on a shaft **58** by way of an intermediate idler gear **56**, gears **50, 51, 53, 56** and **54** defining a gear reducing train from motor shaft **49** to gear **54**.

A guide sleeve **57** is eccentrically mounted on gear **54** and is rotatable about a central diametric axis thereof parallel to shaft **58**. Secured to piston rod **39** is a block **59** having formed therein a transverse channel **63** slidably engaging a bar **64** which has pivoted thereto one end of a connecting rod **60**. The rod **60** slidably engages sleeve **57** and is pivoted between its ends by a fixed pin **61**. Motor shaft **49** is rotated in a direction to rotate the gear **54** clockwise as viewed in FIGURE 2, whereby the pressure stroke interval of the piston rod **39** is a minor fraction, advantageously between ⅓ and ¼ and preferably about ¼ of a single rotation of gear **54**, and hence of a full cycle of pump **34**. The interval of the pressure stroke of piston rod **39** is advantageously between .025 and .075 second. Moreover, the speed of the motor is such that pump **34** is operated at between 200 and 580 cycles per minute, perferably between 530 and 580 cycles per minute. The dormant or non-pressure interval of pump **34** should be between .077 and .225 second and advantageously between .077 and .085 second. It should be noted that the pump frequency and pressure and dormant intervals may be adjusted by varying the pump back pressure by means of valve **43**. Moreover, while quick return mechanism **33** described above may be employed to great advantage, other types of quick return mechanisms may be employed including cams and the like.

Nozzle section **13** includes a tubular hollow handle or valve housing **65** having a slightly upwardly tapered peripheral wall **66**, closed at its bottom end by a correspondingly tapered cup shaped plug **67**. Plug **67** includes an inner end wall **68** having an upwardly directed axial projection **69**, and is provided with a depending axial socket **70** adapted to engage mounting projection **27**. An end partition **71** is positioned below the upper edge of peripheral wall **66** and defines, with the upper border of the wall **66**, a nozzle engaging socket. Partition **71** is provided with a central opening **72** defining a valve first outlet port and is surrounded by a bottom tapered peripheral border **75**. Integrally formed with wall **66** below partition **71** is a block **73** having upper and lower radial bores **74** and **76** formed therein communicating with the interior of valve housing **65** and defining a second outlet port and an inlet port respectively. The outer end of pipe **11** is connected to inlet port **76** and the outer end of pipe **12** is connected to outlet port **74** in any suitable manner.

Located in valve housing **65** is a longitudinally extending valve member **77** including a relatively rigid axially extending body member **78** shorter and of lesser diameter than the minimum inside diameter of valve housing **65** and having a depending axial projection **79** corresponding to bottom projection **69**. A disc-shaped washer or gasket **80** of an elastomeric material and of the diameter of the upper edge of border **75** is affixed to the upper end face of valve body **78**, and a tubular sleeve **81** of an elastomeric material encircles body member **78** at the level of the outlet port **74**. A helical compression spring **82** has its opposite ends engaging projections **69** and **79** and is entrapped between the confronting faces of the valve body member **78** and plug end wall **68** to resiliently urge valve member **77** axially into closing engagement with first outlet port **72** and to maintain the valve sleeve **81** out of engagement with outlet port **74**.

A radially projecting tapped collar **83** having an inner peripheral shoulder **84** is integrally formed with peripheral wall **66** at the level of and opposite outlet port **74**. A sealing disc **86** of elastomeric material nests in collar **83** and rests on shoulder **84** and is provided with an inwardly directed integrally formed axial projection **87** which bears on sleeve **81**. Screw engaging collar **83** is a cup shaped plug **88** having a centrally apertured end wall **89**. An axial push button **90** projects through apertured end wall **89** and terminates at its inner end in an enlarged circular base **91** which slideably registers with plug **88** and is provided with an axial inwardly directed projection **92** bearing centrally on the outer face of elastomeric disc **86**. Thus, depression of push button **90** effects the inward movement of the projections **92** and **87** and the deformation of disc **86** thereby to switch valve member **77** from the position shown in FIGURE 6 in which outlet port **72** is closed and outlet port **74** is open to the position shown in FIGURE 8 wherein outlet port **72** is open and outlet port **74** closed. Release of button **90** under the influence of the spring **82** and the differential hydraulic pressure and area effects the return of valve member **77** to the position shown in FIGURE 6.

A replaceable nozzle unit **94** includes an elongated tubular shank **96** terminating at its outer end in an angulated outlet section **97** having a transversely directed outlet nozzle opening **98**. The inner end of tubular shank **96** has affixed thereto an axially bored plug **99** formed of an elastomeric material, and releasably engages the upper socket of the handle member **65** to permit the replaceable coupling of a nozzle unit **94** to the handle member **65** in communication with the valve outlet port **72** and prevent separation thereof under operating conditions. Plug **99** is provided with an enlarged peripheral head **100** to facilitate the manipulation thereof.

The tank **17** includes a flat rectangular bottom wall **101** of the dimensions of the top surface of casing **14**, said wall **101** having a depending peripheral lip **102** which engages the casing upper border to properly position tank **17** on casing **14** in the erected position of the apparatus. The peripheral wall of tank **17** is upwardly outwardly tapered so that the inverted tank can serve as a mating cover for the loaded casing **14** to facilitate the storage of the apparatus. Formed in the bottom wall **101** is a depending tubular coupling nipple **103** which projects through the aperture in casing wall **18** and releasably engages pump coupling **40**. An elastomeric O-ring **104** registers with a peripheral groove in the nipple **103** to provide a water tight connection between the tank **17** and pump **34**.

Considering now the operation of the apparatus described above, in the stored condition tubes **11, 12** are retracted into a helix nesting in cavity **21**, while the nozzle handle, with the nozzle detached, is mounted on the pin **27** and arm **26** is swung inwardly, as shown in FIGURES 1 to 4 of the drawings. Nozzle elements **94** are positioned

in the cavities **29** and the inverted tank **17** is applied as a cover over and encloses casing **14**.

In employing the appaartus, the inverted tank **17** is raised from the casing **14**, erected and mounted on the casing **14** with the nipple **103** in mating engagement with coupling member **40** and the power cord is connected to a source of current. Tank **17** is then loaded with water W, the nozzle socket or handle **65** retracted and removed from pin **27**, and a nozzle element **94** plugged into the handle socket. The inner end of pipe **12** is hooked over the upper edge of tank **17** and switch **36** is closed to energize the motor **32** and drive the pump piston in the manner previously described with a pressure stroke forming a minor fraction of the pump cycle. The apparatus is now ready for use, water intermittently delivered by pump **34** through the tube **11** into handle **65** being returned through the port **74** and tube **12** to tank **17**. Nozzle **94** is then directed toward the desired area of the oral cavity and button **90** depressed to swing valve member **77** whereby to open port **72** and close port **74**. The water is thus delivered in intermittent pulses to the nozzle **94** and the area to be massaged and cleaned is swept by the resulting pulsating water jet to effect the massaging of the gums and the cleaning of the teeth.

In order to effect a massaging of the gums, the surface thereof should be periodically compressed and released to permit at least a partial rebound thereof. Inasmuch as the water jet pressure may be quite high the compression of the jet exposed gum area is effected much more rapidly than a corresponding rebound. Accordingly, a high increase in efficiency is achieved by permitting a longer interval for the gum rebound than for its compression under the influence of the water jet. A further increase in efficiency is effected by reason of a decrease in the loading of the motor **32** since the pump pressure interval is decreased and a smaller motor consuming less power may be employed.

While there has been described and illustrated a preferred embodiment of the present invention, it is apparent that numerous alterations, omissions and additions may be made without departing from the spirit thereof.

I claim:

1. A dental treating device comprising a nozzle, a source of liquid, and pump means connected between said nozzle and said source of liquid for periodically delivering said liquid under pressure to said nozzle for predetermined intervals separated by dormant intervals, the period of said dormant interval being at least twice that of said delivery interval whereby exposure of a gum area to the intermittent liquid jets from said nozzle provides an interval between successive jets allowing gum rebound at least twice the interval during which said gum area is under jet pressure.

2. The treating device of claim **1**, whereby the period of said dormant interval is at least $\frac{1}{15}$ of a second.

3. The treating device of claim **1**, wherein the frequency of said pump means is between 200 and 580 cycles per minute.

4. The treating device of claim **1**, wherein the time of said dormant interval to said delivery interval is between .077 and .225 second.

5. The dental treating device of claim **1**, wherein said pump means comprises a piston pump and drive means for reciprocating said piston with the pressure stroke thereof being less than $\frac{1}{3}$ of the full reciprocation cycle.

6. The dental treating device of claim **5**, wherein said drive means comprises an electric motor and a quick return motion translating mechanism coupling said piston to said motor and oriented and driven to effect the piston pressure stroke during the quick return stroke of said mechanism.

7. The dental treating device of claim **1**, including a handle supporting said nozzle, a three-way valve carried by said handle and including an inlet port and a pair of outlet ports, said pump means including an inlet connected to said source of liquid and an outlet, a first tube connecting said pump outlet and said valve inlet port, a second tube connecting a first of said valve outlets to said liquid source, the second of said valve outlets being connected to said nozzle, and a manipulatable valve member movable into positions selectively closing said valve outlet ports.

8. The dental treating device of claim **7**, including spring means normally urging said valve member to a position closing said second outlet port.

9. The treating device of claim **7**, including an adjustable throttle valve connected between said pump outlet and said first tube.

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