# United States Patent [19]

**Kovach**

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[54] **DENTAL CLEANING AND MASSAGING DEVICE**


[76] Inventor: **Leslie J. Kovach,** 880 Fifth Ave., New York, N.Y. 10021



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[52] **U.S. Cl.** ..... **128/66,** 128/62 A
[51] **Int. Cl.** ..... **A61h 9/00**
[58] **Field of Search** ..... 128/62 A, 66, 230



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*Primary Examiner*—Lawrence W. Trapp
*Attorney, Agent, or Firm*—William R. Liberman



[57] **ABSTRACT**

A dental cleaning and massaging device includes an elongated hollow hand-held member divided by a partition into an upper water reservoir and a lower compartment, and an elongated nozzle is plugged into a socket in the upper side wall of the hand-held member and is angularly adjustable about transverse and longitudinal axes. A motor driven piston pump is housed in the lower compartment, the pump cylinder being connected to the nozzle by way of a passageway leading to the socket and to the reservoir by way of a check valve which is opened by the pump suction stroke. A stop member in the path of the check valve is adjustable to limit the closed position of the check valve and hence the pressure volume and velocity of the water jet from the nozzle.


**14 Claims, 8 Drawing Figures**

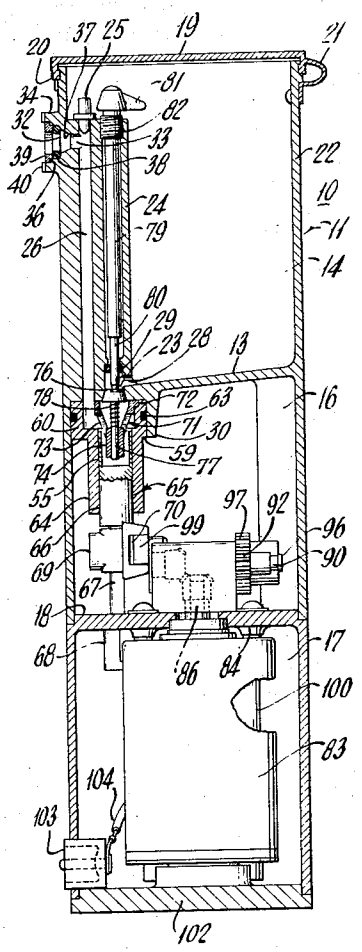


Fig. 1.

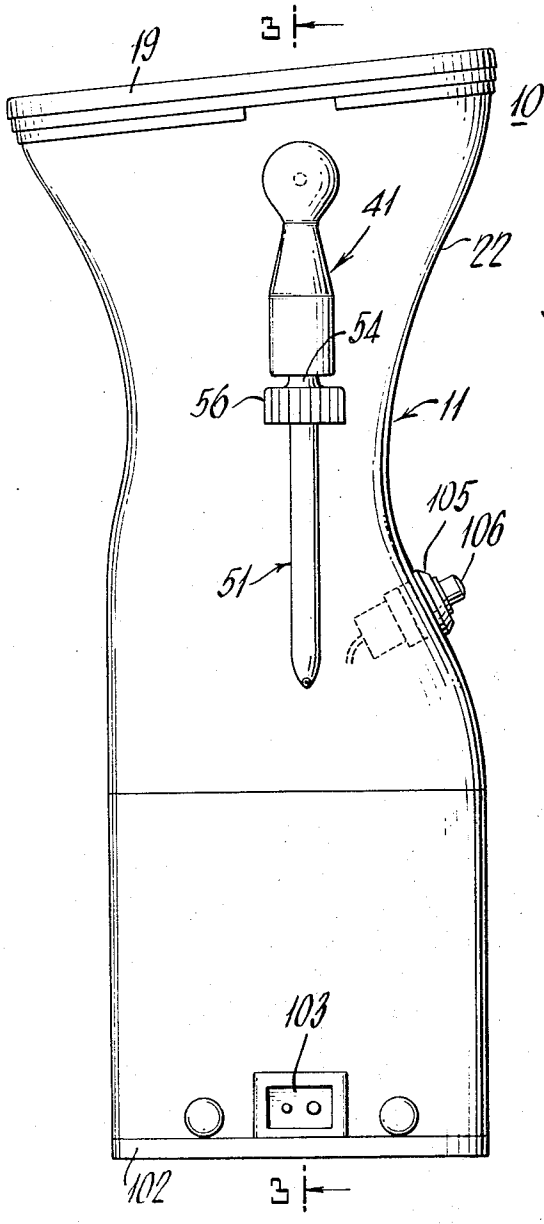



Fig. 2.

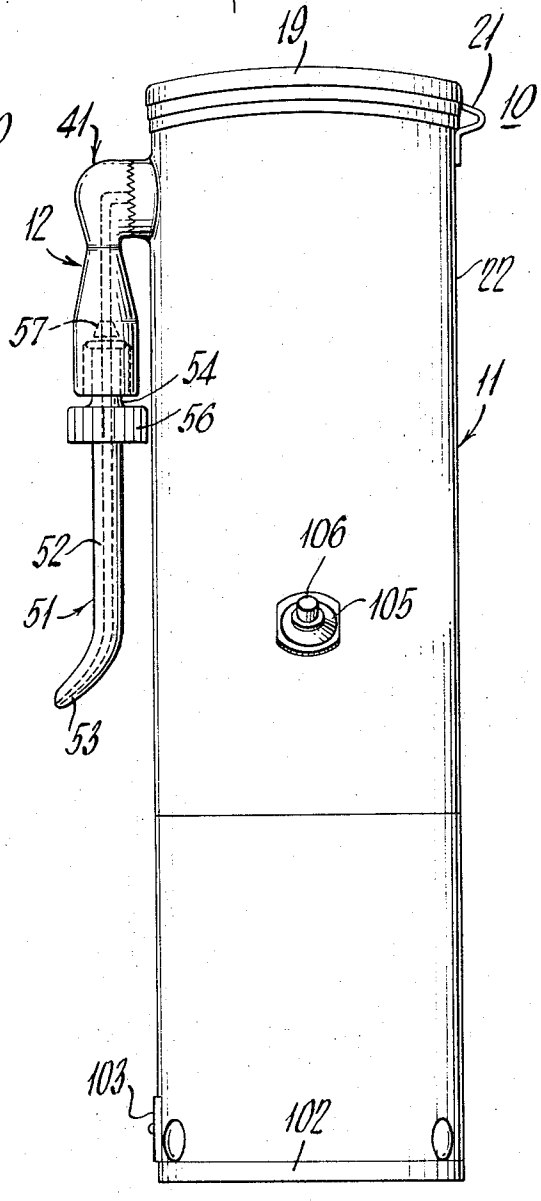



Fig. 4a.

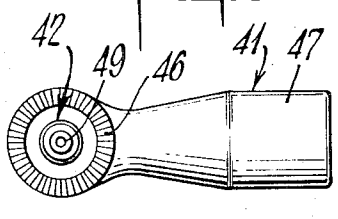



Fig. 4.

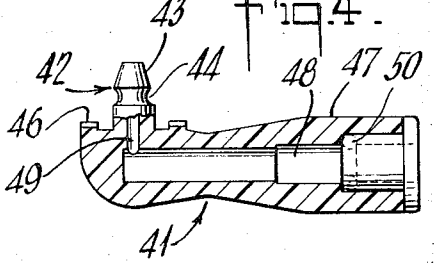


Fig. 3.

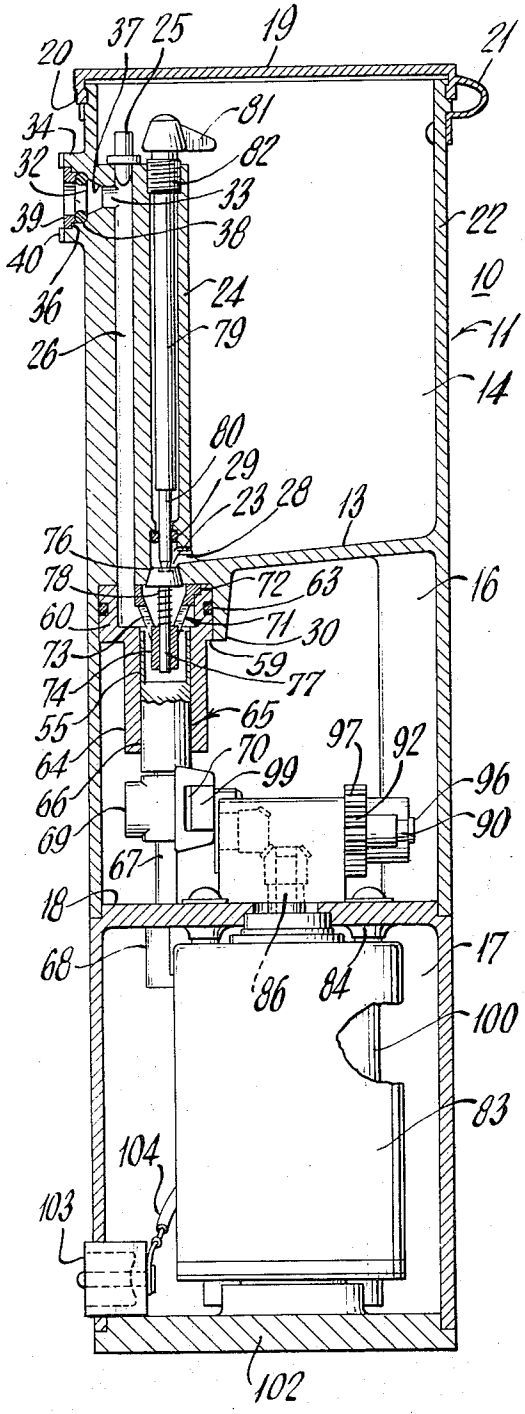



Fig. 3a.

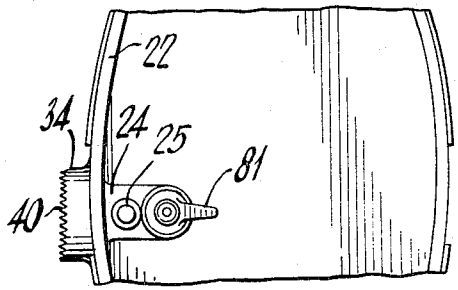



Fig. 5.

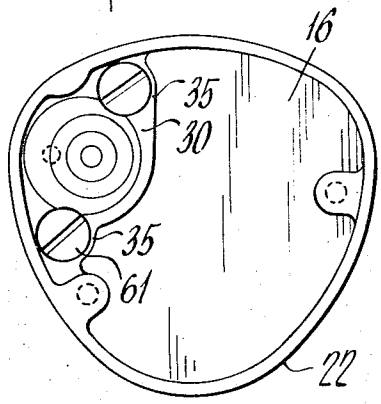
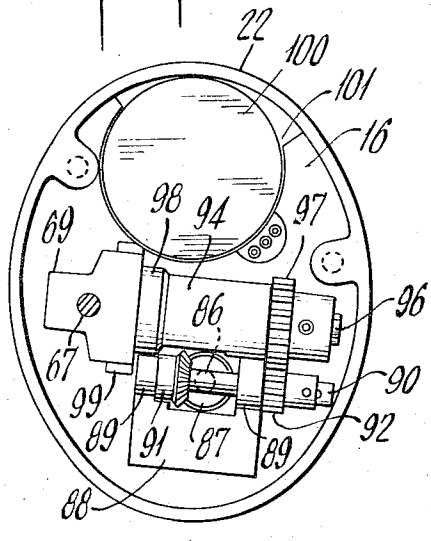



Fig. 6.



# DENTAL CLEANING AND MASSAGING DEVICE

## BACKGROUND OF THE INVENTION

The present invention relates generally to improvements in dental cleaning and massaging devices and it relates particularly to an improved device for the cleaning of teeth by use of a liquid jet.

A common method for cleaning the teeth is by means of a fine, high-velocity water jet directed onto the dental area to be cleaned. The water jet is also employed for massaging the gums since the jet produces a pressure in the region of the gums subjected to the jet and the successive application and relief or variation of such pressure effects a massaging action of the gums. Many forms of water jet dental cleaning devices have been employed and proposed but these possess many drawbacks and disadvantages, particularly when used domestically as distinguished from professionally. A conventional apparatus includes a water tank, an electrically driven pump and a hand-held nozzle connected to the pump outlet by a pressure hose. This apparatus is expensive, bulky and highly inconvenient requiring the use of an electrical outlet with its attendant drawbacks.

## SUMMARY OF THE INVENTION

It is, therefore, a principal object of the present invention to provide an improved dental cleaning and massaging device.

Another object of the present invention is to provide an improved water jet type of dental cleaning and massaging device.

Still another object of the present invention is to provide an improved battery-powered water jet type of dental cleaning and massaging device which is self-contained in a hand-held housing.

A further object of the present invention is to provide an improved device of the above nature characterized by its compactness, reliability, ruggedness, efficiency, convenience of use, high effectiveness, versatility and adaptability.

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 which illustrate a preferred embodiment thereof.

In a sense, the present invention contemplates the provision of a dental treating device comprising a hollow hand-held member provided with a liuid reservoir, a nozzle mounted on the body of the member, a reciprocating pump mounted in the handle and including an expansion chamber communicating with the nozzle, and means providing communication between the cylinder and the reservoir and including a check valve located between the cylinder and said expansion chamber and movable between closed and open positions and urged toward an open position in response to the suction stroke of the pump, control means for adjustably limiting the closed position of the check valve, and means for driving the pump. Another feature of the present invention resides in the structure wherein the nozzle is provided with a transversely projecting tubular plug which rotatably engages a socket located in the handle wall and communicating with the pump, the nozzle being angularly adjustable about its longitudinal axis in the plus and being angularly adjustable about the longitudinal axis of the socket.



In the preferred form of the improved device the handle is provided with a compartment below the reservoir and separated from the reservoir by a horizontal partition. The pump is a reciprocating piston pump, the cylinder being mounted on the partition underface and connected to the nozzle by way of a passageway and to the reservoir by a valve seat-defining port in the partition with which the check valve element registers and is spring urged toward engagement therewith. A stop member is located above the valve element to adjustably limit its closing position and hence the water jet pressure, volume and velocity. A battery and the electric motor are located in the compartment and the motor drive shaft is connected to a crank shaft by a right angle gear transmission, the crank shaft being coupled to the piston rod by way of a cross head.

The improved dental cleaning and massage device is rugged, simple and reliable, easy and convenient to use, compact and of great versatility.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front elevational view of the improved device of the present invention.

FIG. 2 is a side elevational view thereof;

FIG. 3 is a vertical section along the line 3—3 of FIG. 1, with the nozzle removed;

FIG. 3*a* is a fragmentary plan view of FIG. 3 with the cover removed;

FIG. 4 is a longitudinal section through the nozzle plug member;

FIG. 4*a* is a plan view of the nozzle plug member

FIG. 5 is a horizontal section along the line 5—5 of FIG. 3; and

FIG. 6 is a horizontal section along the line 6—6 of FIG. 3.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings which illustrate a preferred embodiment of the present invention reference numeral **10** generally designates the improved dental cleaning device which comprises a hollow hand-held member **11** which houses a water reservoir, pump and the pump energizing system, and a nozzle assembly **12** angularly adjustably mounted on the upper outer face of member **11**. Said member **11** is partially constricted below the top thereof and is divided by a transverse partition **13** into an upper reservoir **14** and a lower pump and power housing compartment including an upper section **16** and a lower section **17** divided by a horizontal mounting plate **18**. Member **11** is formed of two units, an upper unit which includes reservoir **14**, upper section **16** and partition **13** and a lower unit which includes lower section **17** and mounting plate **18**, the units being suitably secured end to end by bolts registering with openings in plate **18** and engaging tapped bores in vertical ribs on the inside face of the reservoir walls.

Reservoir **14** is open at its top and is provided with a separable closure cap **19** including a skirt wall **20** having a depending self hinge **21** formed therewith and suitably secured to the top border of the reservoir peripheral wall **22**. A valve seat-defining circular port **23** is formed in partition **13** proximate an edge thereof and is provided with an upwardly converging frustoconical

face, partition 13 being upwardly inclined from port 23. Extending upwardly from port 13 and integrally formed with reservoir wall 22 is a bar 24 which reaches a point below the top of reservoir 11 and has formed therein an outlet passage defining a first outer vertical bore 26 and a second inner vertical bore 27 whch is internally threaded at its upper end. Bore 27 is coaxial with port 23 and has a bottom side inlet opening 28 communicating with reservoir 14 and an inside shoulder above opening 28 which entraps an O-ring 29.

Depending from and integrally formed with the underface of partition 13 and extending from and integrally formed with wall 22 is a pump support member 30 which has a vertical bore open at its bottom and communicating with port 23 and bore 26 and is provided with wing sections 35 having tapped vertical bores. The top of bore 26 is closed by a plug 25 and a socket 32 is formed in reservoir wall 22 proximate the upper end of bore 26 and communicates therewith by a transverse bore 33. An annular projection 34 is formed on the outside face of wall 22 coaxial with bore 33 and has a stepped inside face 36 joined at its inner periphery to the face of bore 33 by an inwardly converging conical face 37. An O-ring 38 is located in socket 32 and abuts a shoulder separating faces 36 and 37. Ring 38 is locked in position by an externally stepped retaining ring 39 engaging the outer border of face 36. The outside annular face 40 of projection 34 is provided with radial serrations along its full perimeter.

Nozzle member 12 comprises an elbow shaped inner plug unit 41 having formed proximate its end a transversely projecting tubular nipple 42 provided with a tapered tip 43 having a peripheral groove 44 at its base. Coaxially surrounding the base of nipple 42 and rearwardly and radilaly spaced therefrom is an outwardly directed, serrated annular face 40. In the socket inserted position of plug 41, nipple 42 mates the socket 32 with O-ring 38 tightly engaging groove 44 and the serrated surfaces 40 and 46 are in engagement to prevent the rotation of plug 41 in socket 32. The anguler position of plug 41 and nozzle member 12 may be angularly adjusted by retracting plug 41 from socket 32, turning nozzle member 12 to the desired position and then reinserting plug 41.

An arm 47 extends from the inner end of plug 41 and includes a multiple stepped longitudinal bore 48 communicating with the transverse nipple bore 49 and an O-ring 50 engages an annular inside shoulder at the base of the outermost stepped portion of bore 49. A tubular nozzle element 51 having a fine longitudinal bore includes an elongated section 52 terminating at its outer end in an inclined tapered leg 53 and is suitably secured at its inner end to a tubular coupling member 54 provided with a knob 56. Coupling member 54 includes at its inner end a nipple 57, similar in construction to nipple 42 which releasably engages the outer socket defining end of bore 48 with O-ring 50 engaging the peripheral groove in nipple 57 to effect a liquid tight seal. Nozzle element 51 is thus angularly adjustable about its longitudinal axis as well as about a transverse axis.

A reciprocating piston type pump comprises a body member 59 including an upper sleeve section 60 nesting in the vertical bore in support 30 and locked in position by a pair of washers engaging the coplanar underfaces of sleeve 60 and support section 30 and a pair of screws 61 which engage the washers and the tapped bores in wings 35. A liquid tight seal is effected by an O-ring registering with a peripheral groove in sleeve 60 and engaging the inside face of the bore of support section 30. Depending from and integrally formed with sleeve 60 is a vertical cylinder 64 of lesser inside and outside diameters than those of sleeve 60 and eccentric to sleeve 60 and coaxial with port 23.

A piston 65 reciprocatingly telescopes cylinder 64 and includes a lower solid cylindrical section 66 having a coaxial bore in its lower port and a thin peripheral skirt wall 55 projecting above section 66 and of slightly greater outside diameter than section 66 to effect a liquid tight seal with the inside face of cylinder 64. A piston rod 67 is secured in the well of piston section 66 and extends downwardly into vertical sliding engagement with a sleeve 68 integrally formed with and depending from mounting plate 18. A crosshead 69 is mounted on piston rod 67 directly below piston 65 and is provided with a horizontal track-defining groove 70.

A check valve support spider 71 is located in sleeve section 60 and includes a stepped upper annulus 72 which matingly engages a correspondingly shaped shoulder formed in the upper inner border of sleeve section 60 and is coaxial with port 23. Peripherally spaced and downwardly converging arms 73 depend from annulus 72 and support at their bottoms an integrally formed slide bearing sleeve 74 likewise coaxial with valve seat-defining port 23, sleeve 74 projecting into the upper part of piston 65 when the latter is in its raised position.

A frustoconical valve member 76, having an upwardly converging face, registers with and mates the valve seat face of port 23. Depending from and secured to valve member 76 is a coaxial rod 77 which slidably engages sleeve 74, and a helical compression spring 78 encircles rod 77 and is entrapped between the confronting faces of sleeve 74 and valve member 76 to bias valve member 76 toward engagement with valve seat 23.

In order to control the pressure, velocity and volume of the water jet discharge of nozzle 12 a vertically adjustable control rod 79 extends coaxially through bore 27 and terminates at its bottom in a shank 80 of reduced diameter which is in water tight slidable engagement O-ring 29. The tip of shank 80 is slightly tapered and bears on the base of a shallow well formed in the top face of valve member 76. A lever knob 81 is provided with a depending hub-defining externally threaded sleeve 82 which engages the internally threaded upper border of bore 27, and the upper end of rod 27 rests in and is affixed to sleeve 82. Rod 79 and valve member 76 are so related that, when knob 81 is at a predetermined high pressure designated position, rod 79 is raised to a point permitting the full closing of valve member 76, that is in closing engagement with valve seat 23, and with the clockwise turning of knob 81, the rod 79 is lowered correspondingly to limit the upward movement of valve member 76 so that there is an adjustable passage or opening in the check valve when the valve member 76 is in its raised position as limited by the stop-defining control rod 79.

An electiic motor 83 is vertically positioned in lower compartment section 17 and is bolted to the underface of mounting plate 18 spaced therefrom by integrally formed depending spacers 84. Drive shaft 86 of motor

83 projects upwardly through an opening in mounting plate 18 and has suitably affixed thereto a bevel gear 87. A horizontal U-shaped bearing block 88 is supported atop mounting plate 18 and includes a pair of side arms 89 positioned on opposite sides of bevel gear 87. A transverse shaft 90 extends between and is journalled in side arms 89 above and across bevel gear 87 and a second bevel gear 91 is keyed to shaft 90 and meshes with bevel gear 87 to provide a right angle transmission. Also keyed to shaft 90 along the outside face of a side arm 89 remote from crosshead 69 is a gear 92.

A bearing block 94 is located atop and is integrally formed with mounting plate 18 and has a horizontal bore formed therein, the axis of which is parallel to shaft 90 and intercepts the axis of piston rod 67. Journalled in block 94 and projecting beyond opposite ends thereof is a shaft 96 having affixed to an end thereof remote from piston rod 67 a gear 97 which meshes with gear 92. A crankshaft 98 is affixed to the end of shaft 96 opposite gear 97 and is provided with an eccentric slide or follower member 99 which slidably engages track 70 in crosshead 69 and rockably engages the eccentric pin on crankshaft 98. In the raised position of piston 65 as effected by crankshaft 98 the upper edge of piston skirt wall 55 is at the level of the top edge of cylinder 64.

A cylindrical rechargable battery 100, such as of the nickle cadmium type, is housed in compartments 16 and 17 and extends through an arcuate opening 101 formed in mounting plate 18 and extending to the edge thereof. A bottom lid 102 registers with and closes the bottom opening of handle 11 and is suitably retained in its closed position. Mounted on the lower border of the peripheral wall of member 11 is a polarized two terminal socket member 103 which is externally accessible, each of the socket terminals being connected by a respective insulator covered conductor 104 to corresponding contact elements engaging the opposite poles of battery 100. An externally accessible normally open push button switch 105 is mounted on wall 22 proximate the lower part of the restricted portion thereof and is connected between one pole of battery 100 by way of an associated battery contact element and one terminal of motor 83, the other terminal of motor 83 being connected to the opposite battery pole by way of a respective contact element. A locking element is provided for releasably locking the push button 106 of the switch 105 in its retracted switch open position to prevent the inadvertent closing thereof.

Considering now the operation of the improved dental cleaning and massaging device 10, the lid 19 is swung open thus providing access to knob 81 and reservoir 14. Knob 81 is then rotated to the desired jet pressure, that is to its extreme counterclockwise position abutting plug 25 in which position the rod 79 is fully raised and the valve member 76 is thus permitted to engage the valve seat 23 under the influence of spring 78 to close the check valve completely or to its extreme clockwise position abutting the opposite face of plug 25, in which latter position the rod 79 is at its lowermost position to limit the upward movement of valve member 76 to its maximum stop limited spaced position from valve seat 23 thus providing a maximum return flow passage between cylinder 64 and reservoir 14 during the pump pressure stroke. Intermediate positions of knob 81 effect intermediate raised positions of valve member 76 and return passages of corresponding intermediate flow cross sections. Reservoir 14 is then filled with water or any desired solution and the lid 19 is then snap-closed to effect a liquid tight seal of the reservoir. Nozzle 12 is then unplugged from the socket 32 turned to any desired upright position about the axis of socket 32 and plugged into the socket, being retained in the present position by the mating serrated surfaces 40 and 46. The nozzle 51 is also adjusted about its longitudinal axis. The device 10 is grasped, the nozzle 51 directed at the area to be cleaned and the unlocked switch button 10 depressed to close the battery motor circuit and energize the motor 83 which drives the pump, reciprocating piston 65 by way of the right angle gear transmission and the crankshaft and crosshead.

With the downward or suction stroke of the piston 65 there is sufficient suction to open valve member 76 and draw liquid from the reservoir 14 which is under some head into the pump chamber even in the absense of a check valve in the pump outlet by reason of the back pressure normally effected by bore 26 and the restricted passageway through the nozzle 12. Upon the upward or pressure stroke of piston 65, valve member 76 is raised under the influence of spring 78 and the pump pressure. If the knob 81 is adjusted for maximum pressure, valve member 76 completely closes during the piston pressure stroke to deliver all of the liquid through bore 76 during the pump pressure stroke. However, when knob 81 is adjusted for lower pressure the valve member 76 does not completely close during the piston pressure stroke so that a predetermined fraction of the liquid is returned to the reservoir 14 during the pressure stroke through port 23, the fraction depending on the adjustment of knob 81 and the valve opening during the piston pressure storke, The jet pressure, velocity and volume are accordingly adjusted.

It has been found that a piston frequency between about 1,750 and 2,500 cycles per minute is most effective, the optimum being between 1,800 and 2,000 cycles per minute, for example, 1,900 cycles per minute and the drive motor and motion transmission accordingly selected and designated. The above procedure can be repeated when desired, the water in reservoir 14 being replenished when necessary. When the charge of the battery 100 is consumed the battery may be recharged merely by coupling it to a suitable charging device by way of the socket 103 and a mating polarized plug of the charging device. In storing device 10 the nozzle 12 is rotated in the manner described above to a position along the handle 11 and the switch button 106 locked in its retracted position.

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 hollow handle member provided with a liquid reservoir and a compartment positioned below said reservoir and a partition separating said reservoir and compartment, a nozzle mounted on said handle, a reciprocating pump mounted in said handle member and including a cylinder mounted on said partition and communicating with said nozzle, and a piston reciprocable in said cylinder, and means providing communication between said cyl-

inder and said reservoir and including a check valve located between said cylinder and said expansion chamber and movable between closed and open positions and urged toward an open position in response to the suction stroke of said pump, control means for adjustably limiting the closed position of said check valve, and means for driving said pump and including an electric motor having a drive shaft and a rotary-to-reciprocating motion translation transmission connecting said drive shaft to said piston.

**2.** The dental treating device of claim **1,** wherein said check valve comprises a valve seat and valve member movable longitudinally between advanced and retracted positions toward and away from engagement with said valve seat, and exposed to said cylinder to be retracted under the influence of said pump suction stroke, and said control means includes a stop member limiting the closed position of said valve member between a position in engagement with said valve seat and a predetermined distance from said valve seat.

**3.** The dental treating device of claim **2,** wherein said stop member comprises a rod having an inner end confronting a face of said valve member exposed to said reservoir and a threaded section, and said control means includes a fixed member provided with a tapped bore engaging said threaded section and a knob mounted on the outer end of said rod.

**4.** The dental treating device of claim **1,** wherein said partition has a valve seat defining port formed therein and said cylinder is mounted on and depends from said partition with its upper end registering with said port, and said check valve comprises a valve member movable upwardly and downwardly toward and away from closing engagement with said port, and spring means normally urging said valve member upwardly.

**5.** The dental treating device of claim **4,** wherein said pressure control means comprises a stop member located above and in the vertical path of said valve member, and means for vertically adjusting the position of said stop member.

**6.** The dental treating device of claim **1,** including a horizontal mounting plate located in said compartment between the top and bottom thereof, a sleeve positioned on said mounting plate coaxial with said piston, a vertical piston rod slideably engaging said sleeve and connected to said piston, said transmission including a cross head fixed to said piston rod, a crank shaft having an eccentric follower engaging said cross head, and means connecting said crank shaft to said motor drive shaft.

**7.** The dental treating device of claim **6,** wherein said motor is mounted on the underface of said mounting plate and said transmission is supported on the top face of said mounting plate.

**8.** The dental treating device of claim **7,** wherein the bottom of said compartment is provided with a separable lid providing access to said compartment, and comprising a battery housed in said compartment, and means including an externally accessable switch connecting said battery to said motor.

**9.** The dental treating device of claim **1,** wherein said nozzle is angularly adjustable about a transverse axis.

**10.** A dental treating device comprising a hollow handle member provided with a liquid reservoir, an elongated longitudinally extending nozzle mounted on said handle and angularly adjustable about a transverse axis, a pump mounted in said handle and including an inlet and an outlet, means including a check valve connecting said pump inlet to said reservoir, means defining a passageway connecting said pump outlet to said nozzle, said passageway terminating in a socket exposed at an outer face of said handle member, a tubualr plug projecting transversely from the base of and communicating with said nozzle and rotatably engaging said nozzle, means including an electric motor housed in said handle for driving said pump, a battery separably housed in said handle, and means including a switch connecting said motor to said battery.

**11.** The dental treating device of claim **10,** including means for releasably locking said nozzle in a preselected angular position.

**12.** The dental treating device of claim **11,** wherein said locking means are defined by mating radially serrated annular surfaces formed on confronting surfaces surrounding and concentric with said socket and plug.

**13.** The dental device of claim **10,** wherein said plug and socket are in separable engagement.

**14.** The dental device of claim **10** wherein said nozzle is angularly adjustable in said plug about the longitudinal axis of said nozzle.

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