United States Patent

[11] **3,578,884**

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[73] Assignee **General Electric Company**

[54] **ORAL HYGIENE APPARATUS**
9 Claims, 7 Drawing Figs.

[52] **U.S. Cl.** **417/317,** 128/66
[51] **Int. Cl.** **F04d 21/02,** A61h 9/00
[50] **Field of Search** 103/41, 38, 40, 42, 25, 35; 128/66; 417/317; 230/28, 30, 31, 24

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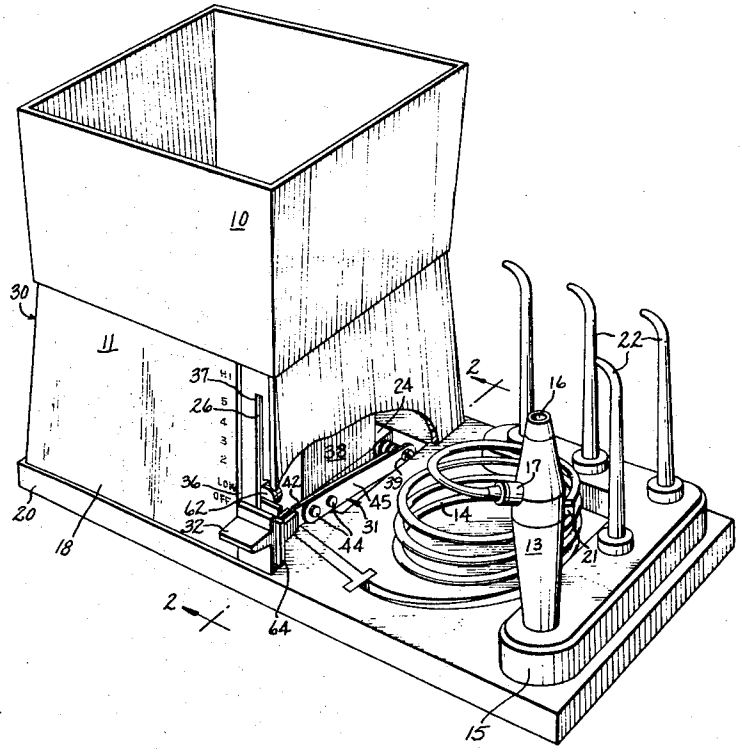
ABSTRACT: The disclosure herein concerns an improvement for oral hygiene apparatus of the variable pressure pulsed liquid jet type. The oral hygiene apparatus has a single control that regulates the amount of liquid pressure and actuates the motor switch only when the pressure setting is on low, thus permitting the use of a motor that has a lower starting than run torque, such as a shaded pole motor, with a minimum starting torque capacity.



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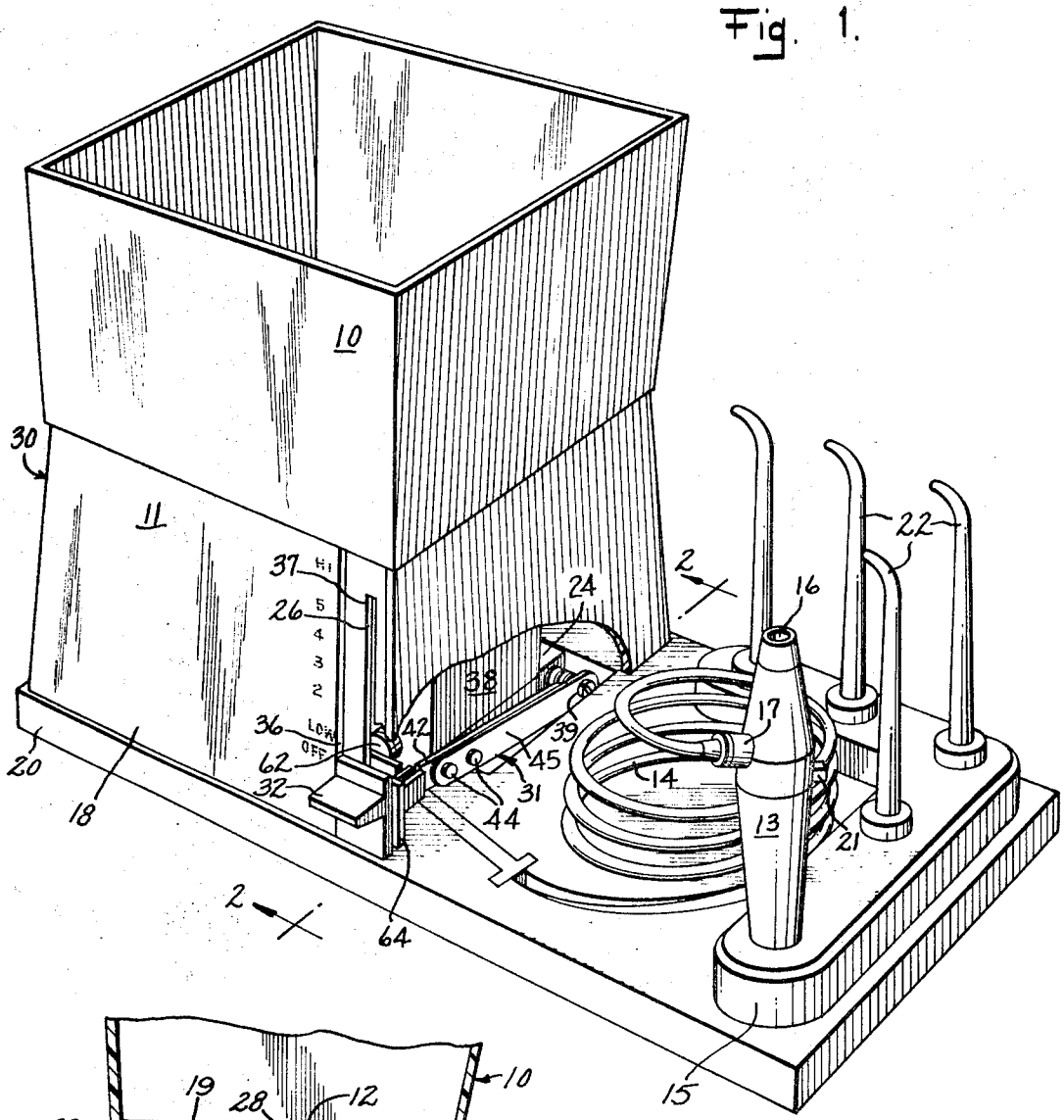
SHEET 1 OF 2

Fig. 1.



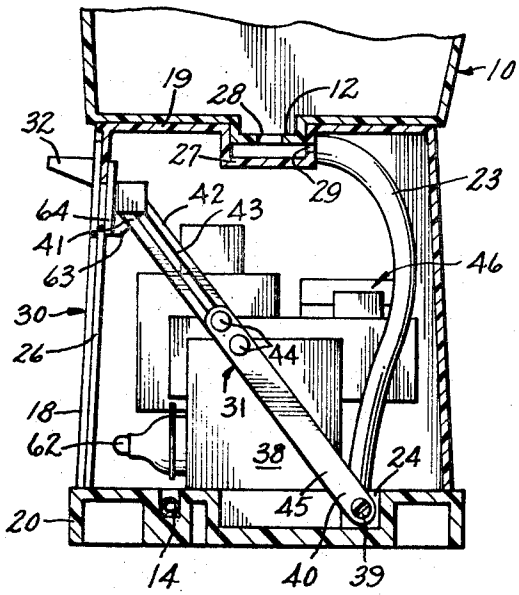


Fig. 2.

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Fig. 3.

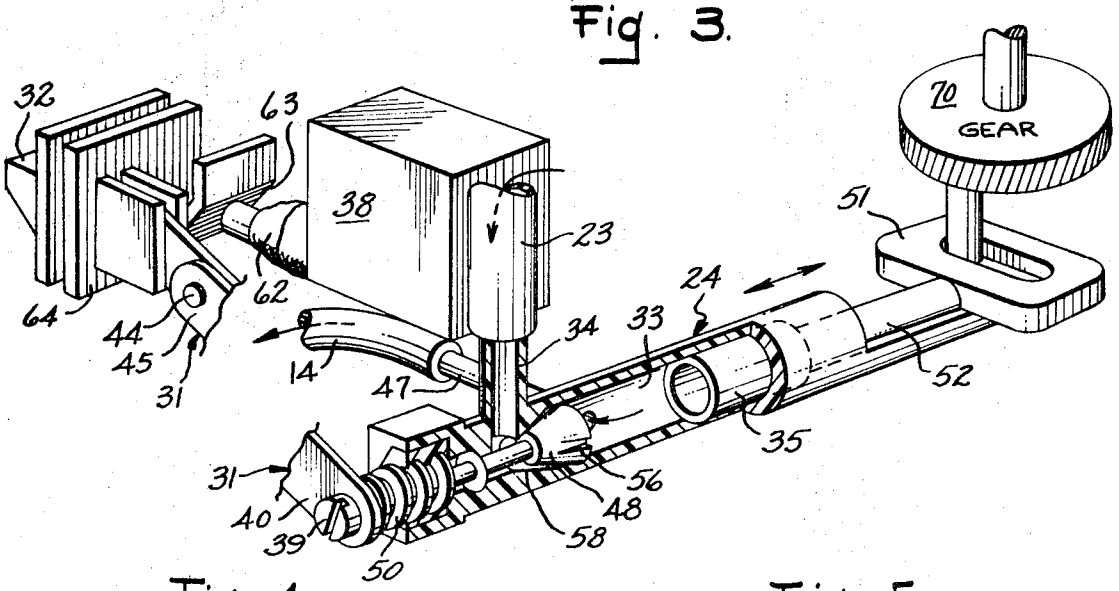


Fig. 4.

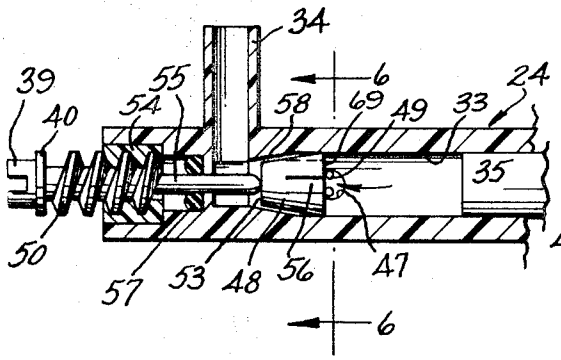


Fig. 5.

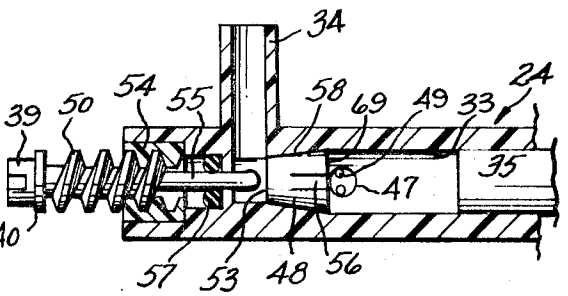


Fig. 6

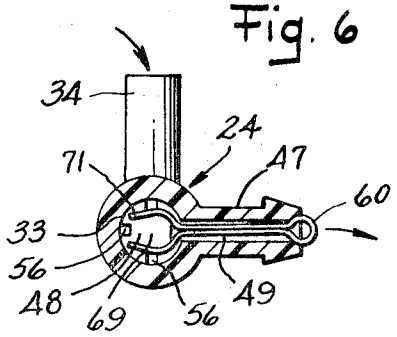
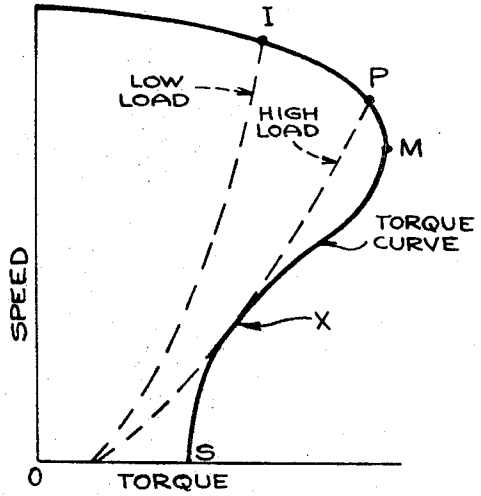


Fig. 7.



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ORAL HYGIENE APPARATUS

BACKGROUND OF THE INVENTION

This invention relates to oral hygiene apparatus of the liquid jet type used for cleaning teeth and massaging the gum tissues.

Oral hygiene apparatus for producing a small jet of liquid comprising pulses of liquid discharged at substantial velocity may be used for cleaning the teeth and gums. The method of cleaning teeth by a jet of liquid is particularly beneficial for users that have intricate or fragile dental braces and appliances. One form of apparatus for practicing this method of cleaning the teeth and gums includes a pump with a reciprocating piston arranged in the pump cylinder. To produce the jet of pulsating liquid, the piston applies pressure during its forward stroke to liquid drawn into the pump cylinder during the rearward stroke. The pump is provided with a means of adjusting the amount or intensity of the liquid pressure.

Oral hygiene apparatus of this type commonly has its own reservoir for supplying the liquid used in the apparatus system. The reservoir is filled with the desired liquid, such as water or an oral cleansing solution, and is placed in such a manner that it communicates with the pump, and the liquid is introduced into the pump. During the forward stroke of the piston, the liquid leaves the pump under pressure by means of a conduit that carries the pulsating water to a hand nozzle for discharge from the apparatus system. Such apparatus normally is designed so that the amount of liquid pressure will be in the range of 20 to 90 p.s.i.

Oral hygiene apparatus used heretofore have a switch for starting the apparatus by energizing the electric motor which drives the pump piston. A separate control for the user to regulate the amount of liquid pressure discharged from the apparatus system is also provided. There is, therefore, an independent switch for energizing the motor and a separate control for regulating the amount of pressure, which control does not affect or actuate the switch. Such an arrangement presents difficulties for two reasons. In the case of oral hygiene apparatus of previous design, it often happened that the apparatus was started by the user energizing the motor, with the liquid pressure control inadvertently positioned on a high-pressure setting. The result of such an occurrence in an incompressible liquid system, as involved here, is that the motor is prevented from obtaining its proper speed unless the motor employed is one which has a starting torque of sufficient capacity to overcome the load conditions of the apparatus when the pressure setting is on high. If the motor is prevented from reaching its proper speed, the life of the motor is detrimentally affected. Oftentimes the motor will overhead and eventually burn out. Moreover, from the standpoint of the user's comfort, even if a motor of sufficient torque capacity is used, it is undesirable to have the initial use of the oral hygiene apparatus set on the high pressure setting.

By my invention, there is provided an improved oral hygiene apparatus that has a control means that allows the use of a motor with a lower starting than run torque with a minimum starting torque capacity, and it also assures that the apparatus is started at a low liquid pressure setting.

SUMMARY OF THE INVENTION

In accordance with this invention, there is provided oral hygiene apparatus that includes a motor, liquid pump, and a control means for the user to regulate the amount or intensity of the liquid pressure discharged from the apparatus system. The oral hygiene apparatus also includes a liquid reservoir for supplying the necessary liquid to the apparatus system and a nozzle with connecting conduit for directing the pulsating jet stream of liquid into the user's mouth for cleaning the teeth and gums. The liquid pressure is achieved by means of a pump assembly utilizing a reciprocating piston within a cylinder or pressure chamber of the pump that applies the necessary pressure to the liquid in the pump chamber to produce a stream of pulsed jets of liquid that are carried from the pump through a connecting conduit to the nozzle and ultimately discharged from the apparatus system. The pressure is regulated by a valve within the pump pressure chamber that is controlled by screw means which may be turned clockwise or counterclockwise to vary the position of the valve. A control knob accessible to the user from outside the oral hygiene apparatus housing may be manually moved, which in turn through linkage connecting the knob and screw means regulates the amount of liquid pressure by controlling the valve. The control knob also controls a switch for energizing the electric motor. By having the motor switch positioned such that it cannot be switched off or deactuated without first adjusting the liquid pressure to the low setting assures that when the apparatus is used the next time the motor switch can only be actuated to energize the motor when the liquid pressure setting is low. By this arrangement, I have found that an electric motor that has a lower starting than run torque, such as a shaded pole motor, with a minimum starting torque capacity may be used effectively. The starting torque capacity of the motor need by only slightly in excess of that necessary under normal operating conditions to accommodate the apparatus load requirements when the control means is adjusted for low pressure liquid discharge.

It is an object of this invention to provide an improved apparatus for use in oral hygiene that produces a high velocity liquid jet for cleaning the teeth and gums.

It is also an object of this invention to provide oral hygiene apparatus with control means that may have the liquid pressure regulated and the motor switch actuated to energize the motor only when the control means is adjusted for low pressure liquid discharge.

It is another object of this invention to provide an oral hygiene apparatus of the pulsed water jet type that may utilize a motor with a lower starting than run torque and in particular a shaded pole motor of minimum starting torque capacity for the apparatus load requirements

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of my oral hygiene apparatus with a broken-away portion showing the control assembly.

FIG. 2 is an end elevation view of my oral hygiene apparatus with the housing, reservoir, and base shown in section.

FIG. 3 is a partially sectioned perspective view of the liquid pump assembly and control assembly.

FIG. 4 is the pressure chamber portion of the liquid pump assembly shown in section and the pressure adjusting valve arrangement when in the low-pressure position.

FIG. 5 is the pressure chamber portion of the liquid pump assembly shown in section and the pressure adjusting valve arrangement when in the high-pressure position.

FIG. 6 is a sectional view of the pump pressure chamber taken on line 6–6 of FIG. 4.

FIG. 7 is a curve showing the relationship speed to torque of a shaded pole motor.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, the apparatus illustrated in FIGS. 1 and 2 comprises a reservoir 10 placed on top of a housing 30 for a motor pump assembly indicated generally at 11. The reservoir provides a means of supplying liquid to the apparatus system. The liquid may, of course, be any liquid the user desires, such as water or an oral cleansing solution. The liquid is introduced into the underlying pump assembly 24 by a conduit 23 leading from a recess 27 in the housing 30 that is adapted to engage a boss 12 in the bottom of the reservoir 10. The liquid from the reservoir 10 passes through an opening 28 in the boss 12 into the recess 27 then through an exit opening 29 in the sidewall thereof into conduit 23 and into the pump assembly 24. A flexible plastic discharge tube 14 carries the liquid under pressure from the pump to a hand nozzle 13. The tube 14 is secured to the hand nozzle 13 by a coupling 17. The hand nozzle 13 is designed to be manipulated by hand to

direct the high velocity liquid jet discharged from the nozzle 13 against the teeth and the gum tissue. The hand nozzle 13 includes a switch 21 that may be used for stopping the liquid from being discharged from the nozzle. The nozzle 13 has an outlet coupling 16 for receiving individual removable and rotatable nozzle tips 22. The removable nozzle tip may be attached to the hand nozzle 13 when the oral hygiene apparatus is being used by any suitable fitment. Otherwise, when not in use the tip is stored in bracket 15 as shown in FIG. 1. Several nozzle tips are normally supplied so that the users, such as a family, may each have one for their personal use.

A motor pump assembly 11 shown in FIGS. 1 and 2 has a housing 30, which in the form illustrated is molded from a suitable plastic, and has sidewalls 18 and a top 19. The front sidewall of the motor pump housing 30 has on the right-hand side a vertical graduated scale and a slot 26 adjacent and parallel to the scale in which a control knob 32 is slidingly movable. The graduated scale indicates generally the amount of liquid discharge pressure starting at the bottom end 36 of the slot in the low position and extending vertically upwardly through transition intermediate ranges to the upper end 37 of the slot to the high position. Immediately below the indicated low position, there is an off position.

The housing 30 is attached to the oral hygiene apparatus base 20 by any convenient means. Within the housing and also attached to the base 20 is an electric motor 46 with a motor switch assembly 38 for energizing the motor. In close proximity to the motor and also secured in place on the base 20 is a pump assembly 24 of the reciprocating piston type, with the piston being driven by the electric motor 46 through any appropriate drive-connecting means.

The amount of liquid pressure discharged from the apparatus system is controlled by a screw 50 that projects from the end of the pump assembly 24 and has a slotted head 39. By turning the screw clockwise or counterclockwise, a valve inside the pump assembly 24 is so positioned that the pressure of the liquid discharge is controlled, as will be discussed in detail later. Interconnecting the slotted screw 39 and the control knob 32 is linkage 31. The linkage comprises two rigid members of similar length. One member 42 has a central longitudinally extending opening or slot 43 nearly its length. The other rigid member 45 carries two spaced fixed rivets 44 that pass through the opening 43 in rigid member 42 and are headed or upset, thereby joining the two rigid members to each other. While the linkage is rigid, it is also extendable along its longitudinal axis to compensate for the varying distance between the slide knob and the stationary pump assembly as the knob is moved vertically within the confines of slot 26 by the user. The end portion 40 of rigid member 45 grips the screw 50 tightly, while the end portion of rigid member 42 is loosely attached to the slide knob and is free to rotate. By this linkage arrangement, as the slide knob is moved up and down in the housing slot 26, rigid member 45 is caused to be correspondingly raised and lowered with respect to the base 20 and is pivoted about the screw 50. Since the rigid member 45 grips the screw 50 tightly, the screw is caused to turn clockwise or counterclockwise as the slide knob 32 is moved up and down.

With reference to FIGS. 3, 4, 5, and 6, the liquid pump and liquid pressure control means will be described in detail. In FIGS. 3, 4, and 5, the pressure chamber 33 of the pump assembly 24 is shown in cross section. The liquid enters the pump assembly 24 by gravity flow from the reservoir through conduit 23 which is attached to an intake port 34 leading into the pressure chamber 33. The pressure chamber of the preferred embodiment of the oral hygiene apparatus is cylindrically shaped and has within it a reciprocating piston 35 with a piston rod 52 joined to yoke 51 that is in driven connection with an electric motor. The driven connection is normally a gear train, represented as 70 in FIG. 3, that reduces the rate of rotation of the motor shaft to the desired amount of piston strokes. During the operation of the pump assembly when the piston is moved rearwardly within the pressure chamber, liquid is drawn into the pump chamber through the intake 34 to fill the chamber. During the forward movement of the piston, the liquid within the pressure chamber has pressure applied to it and is forced to leave the pressure chamber through the outlet port 47. The piston should operate such that there is a good fluid seal between the piston and the pressure chamber. I have found that a rolling diaphragm made of flexible material, such as an elastomer, and having a frustoconical shape with the larger end attached to the cylinder and the smaller end to the piston, works quite satisfactorily. Attached to the outlet port 47 is plastic tubing 14 that carries the liquid under pressure to the hand nozzle for discharge from the apparatus system. Such a pump produces an intermittent or pulsating stream of liquid under considerable pressure. The preferred embodiment of my oral hygiene apparatus is constructed so that the frequency rate of the liquid pulsation produced by this system will be around 2,000 per minute, and the amount of liquid pressure will be manually adjustable from about 20 to 90 p.s.i.

With particular reference to FIGS. 4 and 5, the valve means by which the amount of liquid pressure may be adjusted will be described. The liquid from the reservoir 10 is drawn into the pump through intake port 34 at the conical-shaped forward end 58 of the pressure chamber as the piston 35 moves rearwardly within the pressure chamber. Valve 48 is lifted from its seated position during the inrush of liquid, but is retained in operable position by means of a valve retainer 49. Without a means of retaining the valve in an operable position, it could travel too far within the pressure chamber and interfere with the functioning of the liquid pump. Valve 48 is also conically shaped and complementary with the shape of the forward end 58 of the pressure chamber. When the piston 35 moves toward the front of the pressure chamber, valve 48 is caused to seat by the liquid pushing against rear face 69 of the valve, and when seated it prevents any liquid from passing beyond the valve in the direction of the intake port 34, thus forcing the liquid under pressure out of the pressure chamber through the outlet port 47. The amount of liquid pressure delivered through the outlet port may be adjusted by preventing valve 48 from completely seating, thereby allowing some of the liquid under pressure to escape back into the inlet port 34 during the forward movement of the piston. The more liquid permitted to escape back into the inlet port, the less pressure there is applied to the liquid passing through the outlet port 47.

As shown in FIG. 4, seating of valve 48 may be prevented by screw 50 that carries an integrally attached projection 55 which protrudes into the forward end 58 of the pressure chamber 33 and contacts the front face 53 of valve 48. FIG. 4 represents the valve and screw position under the lowest liquid pressure condition where the valve 48 is unseated to its maximum extent. The valve 48 is provided with several passages 56 through a portion of its conically shaped surface to enable the liquid from the pressure chamber 33 to flow past the valve 48 back into the inlet port 34 when the valve is unseated. The passages 56 on the surface of valve 48 are constructed such that the closer the valve is to being seated, the more restricted the passages become, thereby reducing the amount of liquid permitted to flow past the valve into the inlet port 34. FIG. 4 represents the position of the valve and screw under the highest pressure condition wherein the valve is fully seated. Backflow of liquid past the valve 48 is prevented, in this instance since the passages 56 are sealed by the wall of the conical forward end 58 of the pressure chamber, and as a result the liquid passing through outlet port 47 is under maximum pressure. With finger projection 55 passing through the wall of the pressure chamber of the pump, the opening should be sealed against leakage. An O-ring 57 prevents such leakage yet allows the finger to rotate ar d move inwardly and outwardly of the pressure chamber.

By turning the screw 50 counterclockwise, it will travel in stationary guide bushing 54 inwardly of the pump, thus carrying the finger projection 55 with it until the end of the finger

projection contacts front face 53 of the valve 48. By continuing the inwardly movement of the screw and finger projection, the valve is unseated by pushing it toward the rear of the pressure chamber, and the valve is prevented or blocked by the finger projection from being seated even during the forward pressure applying thrust of the piston. Turning the screw 50 clockwise withdraws the finger projection 55, thus allowing the valve to seat, as shown in FIG. 5, when the piston is moving forward.

FIG. 6 is a cross-sectional view of the pressure chamber of the pump taken along line 6–6 of FIG. 4. This particular figure shows how valve 48 is retained in operable position within the conical portion 58 of the pressure chamber by means of a valve retainer 49. The valve retainer 49 is a spring clip that is maintained in position in the throat of the outlet port 47 in the pressure chamber. One end of the valve retainer is continuous and formed in the shape of a loop 60 slightly larger than the inside diameter of the outlet port 47. The opposite end 71 of the valve retainer 61 is bifurcated and extends into the pressure chamber 33 to act as a stop means to prevent the valve 48 from moving too far from the conical portion 58 during the inrush of liquid into the pressure chamber during rearward movement of the piston.

With particular reference to FIG. 3, there is within the pump and motor housing a switch assembly 38 that controls energizing the motor. This particular switch is a normally biased on switch in that there is a plunger 62 which will actuate the switch, as by making the necessary contacts when the plunger is in its extended position. Conversely, when the plunger is depressed to overcome the normally biased on condition, the switch is deactuated. On the control knob 32 interiorly of the motor and pump assembly housing, there is a cam element 63 integrally formed therewith which comes in contact with the plunger 62 when the control knob 32 is in the low-pressure position. By moving the control knob vertically downwardly to the off position indicated on the graduated pressure-indicating scale, the cam element 63 causes the plunger 62 to be depressed by camming action. In the off position, the base 64 of the control knob abuts the base 20 of the oral hygiene apparatus and is prevented from traveling any further in the downwardly direction. Therefore, as long as the control knob is in this position, the switch will not be actuated, and the motor cannot be energized. Only when the knob is vertically raised, will the switch be actuated and the motor started, because the biased plunger 67 is permitted to extend itself and make the necessary electrical contact. It should be noted that with this arrangement, when the motor is energized the control knob is in the low-pressure setting. Therefore, there is positive assurance that the motor switch can only be actuated to energize the motor when the control means is adjusted for low-pressure liquid discharge.

The electric motor used in my oral hygiene apparatus is one with a lower starting than run torque, such as a shaded pole motor. Shaded pole motors are popular for driving loads needing only a low starting torque motor, such as fans. Shaded pole motors are particularly desirable for such applications because they operate quietly and are the simplest and most inexpensive of single phase induction motors. Shaded pole motors have a continuous solid copper loop around a small portion at each salient pole. This shorted loop, or shading coil, causes the reaction necessary to give the motor its starting torque. The coil produces only moderate torque, and upon starting the motor the torque is quite low but does increase as its speed increases. Because of these torque characteristics, shaded pole motors have limited application.

One of the problems in designing a liquid pumping system, such as in the case of oral hygiene apparatus, wherein the liquid is incompressible, the motor furnishing the drive means for the piston of the liquid pump must have a starting torque sufficient to overcome the load of the system in which it is used. The higher the liquid pressure setting for the apparatus system, the greater the starting torque load on the motor. The performance curve of a shaded pole motor is shown in FIG. 7, with the motor torque plotted against the increase in speed of the rotation of the motor shaft. It is noted from the curve that upon initially starting the motor, the torque is at a very low value, as represented by point S. As the speed of the motor increases, the motor torque increases until it reaches a fairly high speed and maximum torque represented by point M. Beyond the speed at which maximum torque is achieved, the torque decreases. The line designated Low Load represents the torque load of the liquid pump apparatus when the liquid pressure is minimum or on the low setting, and the High Load line is when the liquid pressure is maximum or on the high setting. The torque load line for the apparatus and the motor torque curve should intersect each other only once and as close to a right angle as possible for that represents a motor that will function properly under the torque load at normal operating conditions, taking into account the usual manufacturing tolerances and voltage variations. From the torque curve in FIG. 7, it can be seen that such a condition exists with the Low Load line at point I. In the case of the High Load line, however, it intersects the motor torque curve at two points, X and P. The tangential intersection of the High Load line and the torque curve at point X is at low motor speed. When this occurs, the motor will usually continue to operate, but only at the speed indicated by Point X. The motor will not obtain its correct speed of operation. The result is that the efficiency of the motor is reduced, and the life of the motor is detrimentally affected. Usually the motor will overheat and eventually burn out.

My apparatus is controlled, as discussed above, such that the apparatus load that the motor torque must overcome without inducing motor failure is that represented as the Low Load line in FIG. 7. Because of the unique control incorporated in my oral hygiene apparatus, the motor switch is actuated to energize the motor when the liquid pressure is adjusted for low-pressure discharge. Therefore, an electric motor with a low starting than run torque may be used, particularly a shaded pole motor with minimum starting torque capacity under Low Load conditions of the apparatus. I have found that an alternating current, shaded pole induction motor of the open construction type having two poles, a squirrel cage rotor, and a five-eighths inch stack of laminations, performs quite satisfactorily in my oral hygiene apparatus.

In the operation of my oral hygiene apparatus, the user will insert a power plug into a proper outlet for providing electric current to the electric motor. The control knob 32 will be in the off position at the bottom of slot 26. The reservoir 10 is filled with liquid and in place on top of the motor pump housing 30 for supplying liquid to the apparatus system. The control knob 32 is raised vertically from the off position to the low-pressure position which allows the biased plunger 62 to extend itself and actuate the switch 38, thereby energizing the electric motor. The motor through a gear train 70 drives the piston 35 in a reciprocating motion within the pressure chamber 33. With the control knob at the low-pressure setting, the screw 50 and finger projection 55 unseat the valve 48 and prevent it from reseating at this pressure setting. During the rearward movement of the piston, liquid is drawn into the pressure chamber. The piston during its forward movement applies pressure to the liquid in the pressure chamber, thereby forcing a portion of the liquid out the outlet port 47, through the tubing 14, for ultimate discharge from the apparatus system by the nozzle 13. A portion of the liquid will also back flow past unseated valve 48 into the inlet port 34. The user may increase the liquid pressure by moving slide knob 32 vertically upwardly in slot 26, which raises rigid member 45 of the linkage 31 away from the base 20 of the apparatus and causes the screw 50 to turn clockwise, thus withdrawing finger projection 55 from from the pressure chamber. By withdrawing finger projection 55, the valve 48 can move in the direction of being seated, thereby restricting the amount of liquid flowing past the valve 48 to the inlet port 34, thus increasing the pressure of the liquid passing through the outlet port 47. When use of the oral hygiene apparatus is

to be discontinued, the user moves the control knob vertically downwardly to the off position. By so doing, the cam element **63** depresses the plunger **62** to deactuate the switch **38** and turn the electric motor off. If desired, the reservoir may then be emptied, inverted, and placed over the tubing, hand nozzle, and nozzle tips adjacent the motor and pump housing as a dust cover.

The foregoing is a description of the preferred embodiment of the invention, and variations may be made to the apparatus without departing from the spirit of the invention, as defined in the appended claims.

I claim:

1. In an oral hygiene apparatus of the variable pressure liquid jet type, the improvement comprising:

a. a liquid pump assembly having a pumping piston;
b. a motor having a lower starting than run torque;
c. motor switch means for energizing said motor;
d. drive means connecting said motor and piston; and
e. a single control means that variably adjusts the liquid pressure output of the pump from low to high and actuates the motor switch only when said control means is adjusted for low-pressure liquid discharge.

2. The improvement in oral hygiene apparatus in accordance with claim **1**, wherein the motor is of the shaded pole type and has a starting torque capacity slightly in excess of the torque load requirements of the apparatus when the control means is adjusted for low-pressure liquid discharge.

3. The improvement in oral hygiene apparatus in accordance with claim **1**, wherein the motor switch means is of the plunger type that is actuated to energize the motor when the plunger is extended, and deactuated when the plunger is depressed.

4. The improvement in oral hygiene apparatus in accordance with claim **3**, wherein the control means includes a manually operated control with a cam element that depresses the plunger in the off position and releases the plunger when adjusted for low-pressure liquid discharge.

5. In an oral hygiene apparatus of the variable pressure pulsed liquid jet type, the improvement comprising:

a. a liquid pump assembly having a chamber, an intake port and an outlet port for said chamber, a piston for applying pressure to liquid in said chamber, and an adjustable valve for regulating the amount of liquid pressure;
b. a shaded pole motor;
c. motor switch means for energizing said motor;
d. drive means connecting said motor and piston; and
e. control means including:
  aa. a manually operated control that deactuates the motor switch in the off position and actuates the motor switch at a low liquid pressure position;
  bb. means for adjusting said valve; and
  cc. means connecting said manually operated control and said valve adjusting means, whereby said valve is adjusted in response to operation of said control.

6. The improvement in oral hygiene apparatus in accordance with claim **5**, wherein the motor switch is of the plunger type that is actuated to energize the motor when the plunger is extended and deactuated when the plunger is depressed, and the manually operated control has a cam element that depresses the plunger in the off position and releases the plunger at a low liquid pressure position.

7. The improvement in oral hygiene apparatus in accordance with claim **5**, wherein the motor has a starting torque capacity slightly in excess of the torque load requirements of the apparatus when the control means is adjusted for liquid pressure.

8. The improvement in oral hygiene apparatus in accordance with claim **5**, wherein the valve is between the inlet port and outlet port and the liquid pressure is adjusted by the valve controlling the amount of liquid flowing past the valve into the inlet port when the pressure is applied to the liquid in the chamber.

9. The improvement in oral hygiene apparatus in accordance with claim **6**, wherein the means for adjusting the valve is a screw that is movable inwardly and outwardly of said chamber in response to rotation.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,578,884 Dated May 18, 1971

Inventor(s) Chester F. Jacobson

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 8, line 28, should read -- low liquid pressure. --

Signed and sealed this 21st day of December 1971.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Acting Commissioner of Patents