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[54] **WATER SUPPLY SYSTEM FOR DENTAL INSTRUMENTS**

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Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 154,092, June 17, 1971, Pat. No. 3,719,594, which is a continuation-in-part of Ser. No. 852,293, Aug. 22, 1969, Pat. No. 3,636,735.

[52] **U.S. Cl.** **32/22,** 4/263

[51] **Int. Cl.** **A61c 11/00**

[58] **Field of Search** 32/22, 26, 1, 23; 210/24, 210/190; 4/263

[56] **References Cited**

UNITED STATES PATENTS

1,783,688	12/1930	Wurlod	4/263
3,204,767	9/1965	Borochaner	210/190
3,385,441	5/1968	Lyall	210/190

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Assistant Examiner—J. Q. Lever
Attorney, Agent, or Firm—Arthur A. Jacobs

[57] **ABSTRACT**

A water supply system for dental instruments wherein an ion exchange unit is provided between the water supply and the instruments for the purpose of either softening or demineralizing the water, or both. Means are provided for reactivating the ion exchange bed either by passing a regeneration material through the bed or by using a replaceable cartridge containing a fresh ion exchange bed.

7 Claims, 7 Drawing Figures

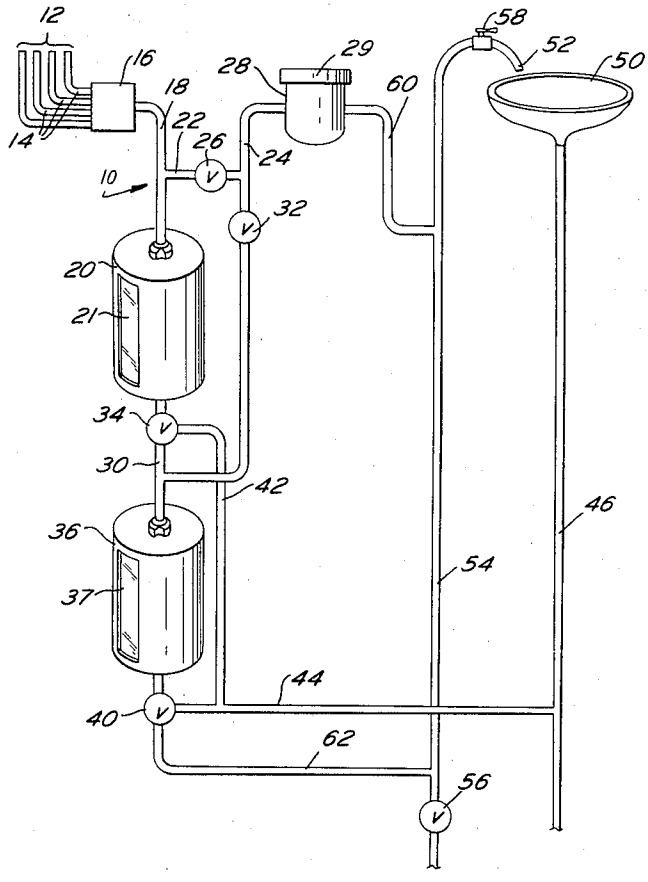
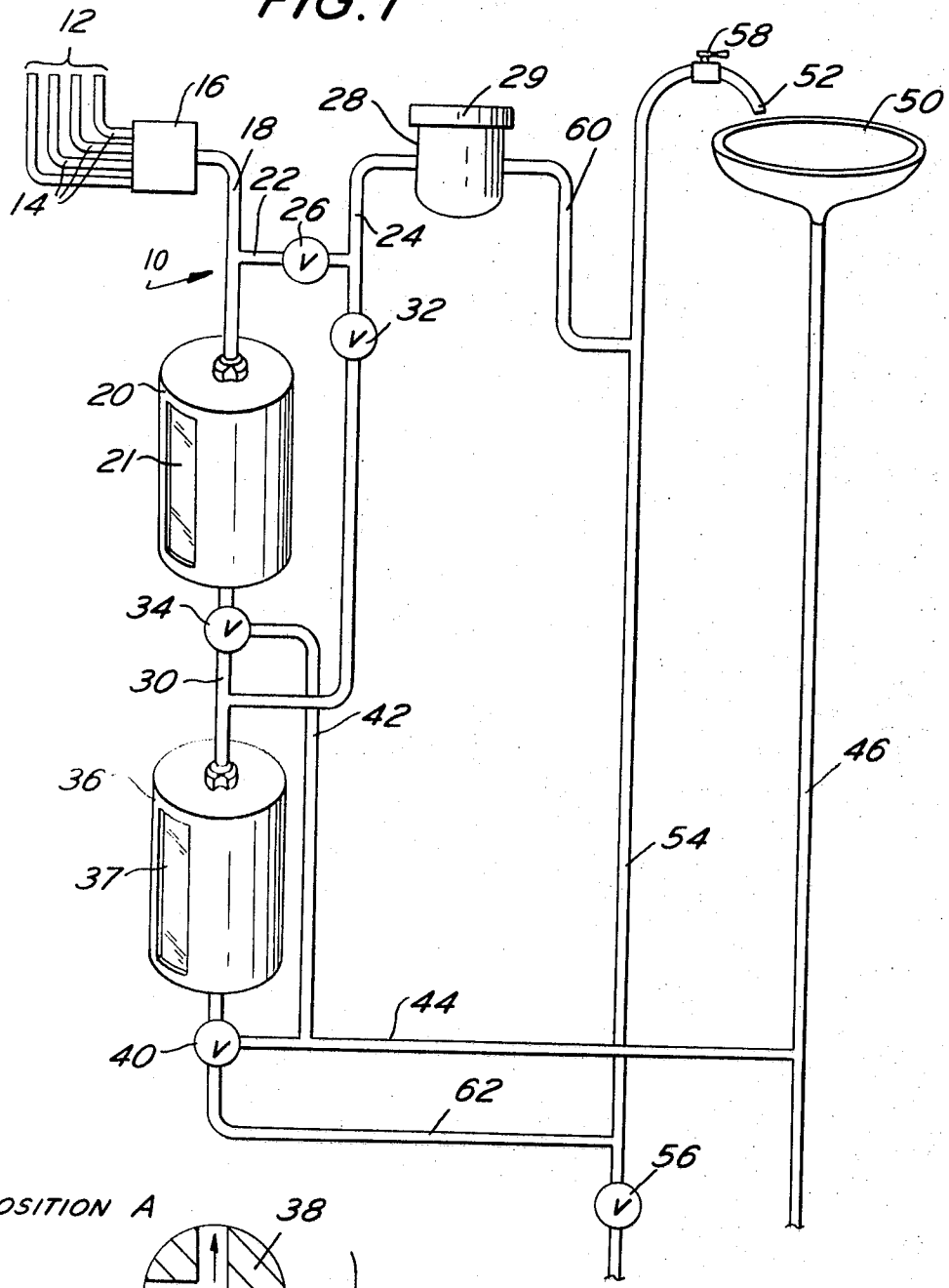


FIG. 1


12
16
18
14
22
26
24
28
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21
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42
36
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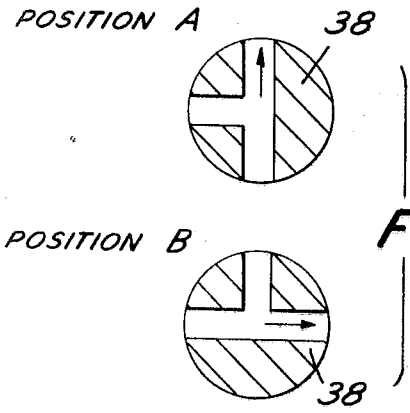
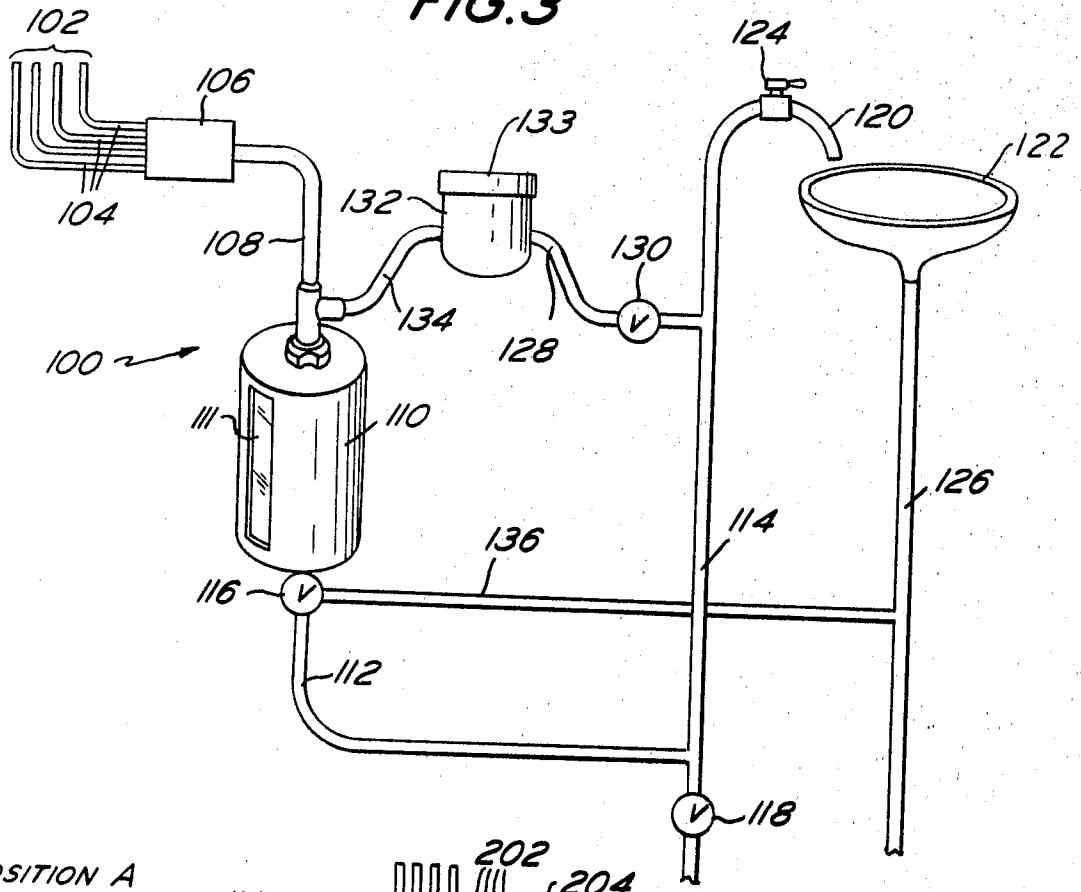

POSITION A
38
POSITION B
38

FIG. 2

FIG. 3



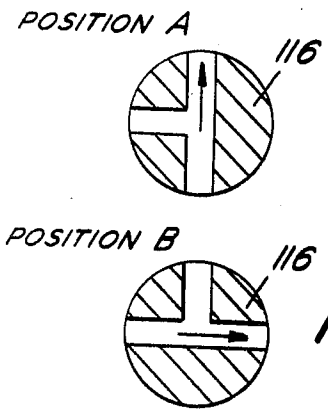


FIG. 4

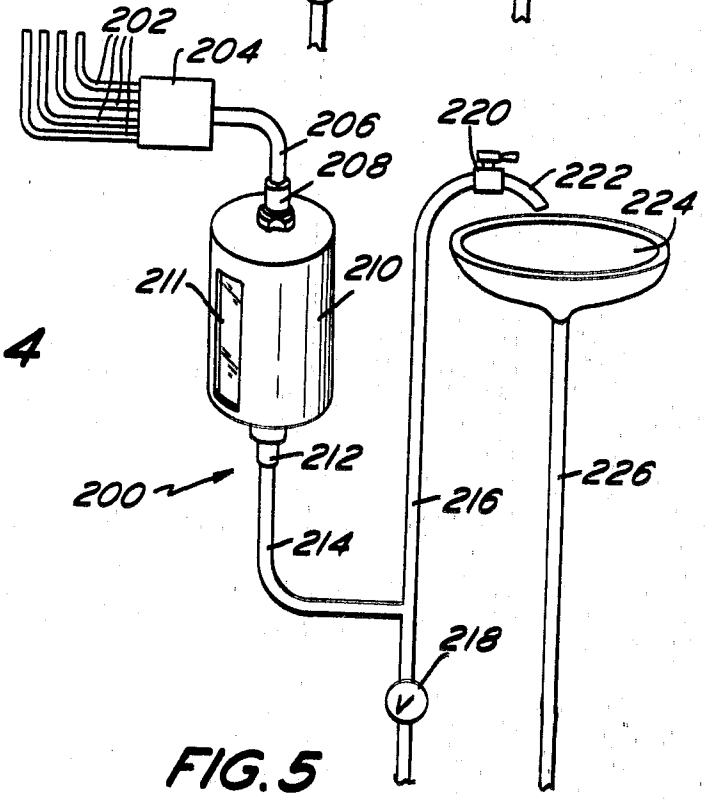
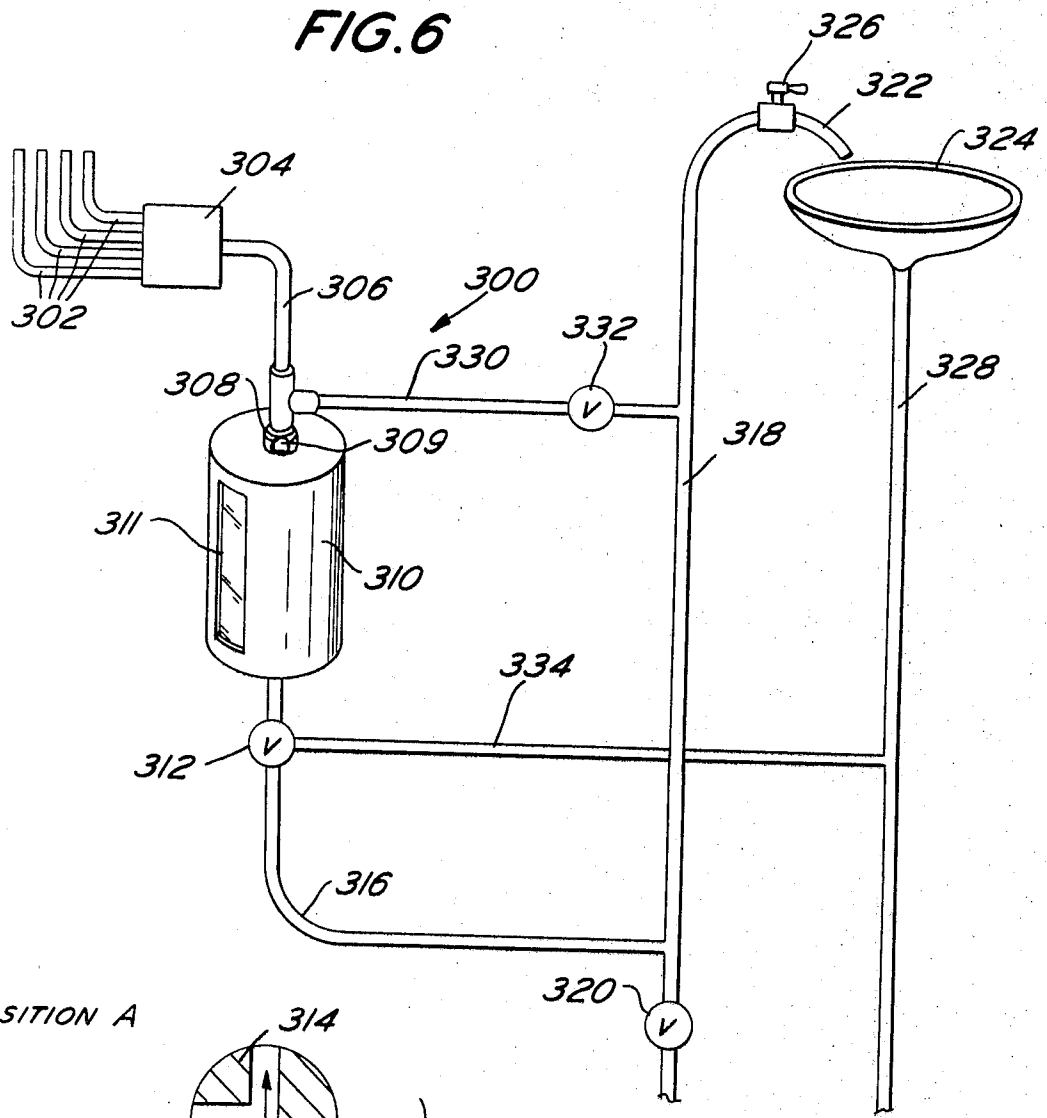


FIG. 5

FIG.6


326
322
324
304
306
300
302
332
330
328
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309
318
311
310
334
312
316
320
V

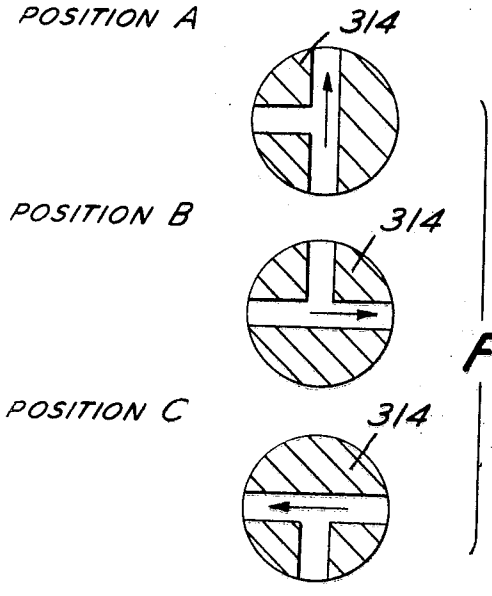

POSITION A
314
POSITION B
314
POSITION C
314

FIG.7

WATER SUPPLY SYSTEM FOR DENTAL INSTRUMENTS

This application is a continuation-in-part of copending application Ser. No. 154,092, filed June 17, 1971 now U.S. Pat. No. 3,719,594 which is, in turn, a continuation-in-part of application Ser. No. 852,293, filed Aug. 22, 1969 which issued as U.S. Pat. No. 3,636,735, dated Jan. 25, 1972.

This invention relates to a water treating system for dental instruments and it particularly relates to a system of this type wherein the treatment takes the form of either water softening, water demineralization or both.

Many dental instruments such as hand drills, syringes, water-picks and the like, require the use of flowing water. This water is ordinarily taken directly from the house or office water system. Most natural waters contain a lesser or greater degree of hardness caused by contaminants in the water such as calcium carbonate, magnesium carbonate, iron, iron oxide, etc. These hard water contaminants, after a certain period of use, tend to clog the instruments and sometimes even the conduits leading thereto. Furthermore, they may often interfere with or even contaminate the amalgams and other materials used by the dentist in the patient's mouth.

It is one object of the present invention to overcome the above disadvantages, by providing a water treatment system interposed between the source of natural water and the dental instruments whereby contaminants in the water are largely removed before the water reaches the dental instruments. Another object of the present invention is to provide a system of the aforesaid type which is relatively simple in construction, easy to use and easy and inexpensive to maintain.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following description when read in conjunction with the accompanying drawings wherein:

FIG. **1** is a diagramatic view of a system embodying the present invention wherein the water is both softened and demineralized by means of anionic and cationic ion-exchange means.

FIG. **2** is a sectional view showing the two positions of the control valve in the system of FIG. **1.**

FIG. **3** is a diagramatic view of a system embodying the present invention wherein the water is merely softened by the use of an anionic ion-exchange means.

FIG. **4** is a sectional view showing the two positions of the control valve in the system of FIG. **3.**

FIG. **5** is a diagramatic view of a cartridge-type system substituted for the system of FIG. **3.**

FIG. **6** is a diagramatic view of a system embodying the present invention utilized only for demineralization wherein a cationic ion-exchange agent is used.

FIG. **7** is a cross-sectional view of the three positions of the control valve in the system of FIG. **6.**

Referring in greater detail to the figures of the drawings wherein similar reference characters refer to similar parts, there is shown in FIG. **1** a system, generally designated **10,** comprising a plurality of dental instruments indicated schematically at **12.** These instruments may be of any type requiring water, as for example, a syringe, one low-speed hand drill and two high-speed hand drills. The instruments **12** are provided with conduits **14** leading to a manifold **16.** The manifold **16** may contain a selector valve (not shown), of standard type, to selectively apply the water to the desired instruments.

The manifold **16** is connected to a conduit **18** leading into the top of an anionic resin container **20** having a transparent window **21.** Alternatively, the entire container may be constructed of transparent plastic or other suitable transparent material. A gauge may also be optionally provided on the outer surface of the container. Above the container **20,** the conduit **18** is connected to a conduit **22** leading into a conduit **24.** Interposed in the conduit **22** is a valve **26.** The conduit **24** leads from a regeneration container **28,** having a removable cap **29,** to a conduit **30,** and this conduit **24** is provided with a valve **32** between its connection with the conduit **22** and its connection with the conduit **30.**

The conduit **30** leads from a valve housing **34,** below the container **20,** into the top of a cation resin container **36** having a transparent slot **37.** This container may also be made wholly transparent and may be provided with a gauge, if so desired. The valve housing **34** encompasses a control valve **38** such as shown in two positions in FIG. **2.** A valve housing **40** is similarly provided below the container **36** and is provided with a control valve (not shown) identical to the valve **38** in housing **34.**

A drain duct **42** leads from valve housing **34** into a drain duct **44** which leads from valve housing **40** into a drain pipe **46.**

The drain pipe **46** extends from an expectorant bowl **50,** of standard design, to a drainage outlet (not shown). Above the bowl **50** is the outlet end **52** of a stand pipe **54** leading from a source of tap water. A standard type of shut-off valve **56** is provided at the lower end of pipe **54** and a spigot valve **58** is provided in the pipe adjacent the outlet end **52** above the bowl **50.** A conduit **60** extends from the container **28** into the pipe **54** and a conduit **62** extends from the bottom of valve housing **40** into the pipe **54.**

In normal use, the valve **56** is opened and the valves **26** and **32** are closed, while the valves in valve housings **34** and **40** are in position A shown in FIG. **2.** Water then flows from the source through conduit **62** and through the cationic and anionic ion-exchange beds, through the conduit **18,** through the manifold **16** to the particular instrument or instruments designated as **12.** During this passage, the water is both softened and demineralized.

When it is necessary to regenerate the anionic and cationic beds, the following procedure is used: In the first step, the valve **56** is closed, the valve **26** is opened, the valve **32** is closed, the valve **38** in housing **34** is placed in position B shown in FIG. **2** and the similar valve in housing **40** is in position A as shown in FIG. **2.** The cap **29** is then removed from container **28** and a caustic, such as sodium hydroxide or the like, is inserted into container **28,** after which the cap is closed. Water flows from the source through conduit **54** and conduit **60,** through the container **28,** to form a caustic solution. This solution then flows down by gravity through conduits **24** and **22** into the container **20.** The caustic solution continues to flow through container **20,** regenerating the bed, and then flows through drain line **42** and drain line **44** to the drain pipe **46.** The valve **56** is maintained open for a predetermined time for re-

generation and flushing. Thereafter, the water supply is stopped by closing valve **56** and valve **26** is closed, valve **32** is opened, valve **38** in housing **34** is sent into position A and the valve in housing **40** is set in position B. The cap **29** on container **28** is opened and an acid solution, such as HCl or the like, is inserted. The cap **29** is then closed and the valve **56** is opened. Water then flows through pipe **54** and conduit **60** to container **28** and the resulting aqueous acid solution flows through valve **32** in line **24** and through conduit **30** into container **36.** It flows through the cationic bed in container **36** for a predetermined time to obtain regeneration and flushing and passes through drain line **44** to drain pipe **46,** after which the valve **56** is closed. The valve **56** is then opened, the valves **26** and **32** are closed and the valves in housings **34** and **40** are placed in position A, so that the system is now again in position for normal use.

FIGS. **3** and **4** illustrate a system for only water softening. This system, generally designated **100,** comprises instruments **102** connected through conduits **104** to a manifold **106** similar to manifold **16.** A conduit **108** leads from manifold **106** to the top of an ion-exchange resin container **110** having a transparent window **111.** Here, too, the container may, optionally, be made entirely transparent and a gauge may optionally be provided. A conduit **112** leads from the bottom of container **110** into a stand pipe **114,** a valve **116** being interposed in the conduit **112.** The valve **116** is shown in two positions, A and B, in FIG. **4,** this valve acting as the control valve in the systems.

The pipe **114** is connected at its lower end to a source of tap water through a supply valve **118,** while, at its upper end, pipe **114** is provided with a curved outlet end **120** positioned over an expectorant bowl **122.** A spigot valve **124** is provided adjacent the outlet end **120.** A drain pipe **126** descends from bowl **122,** leading to drainage.

A conduit **128** leads from pipe **114,** through a valve **130,** to a regeneration container **132** having a removable closure cap **133.** Leading from the opposite side of container **132** is a conduit **134** that connects with conduit **128.** A drain line **136** connects the valve **116** with pipe **126.**

In operation, during normal use, the valve **118** is open, the valve **116** is in position A and the valve **130** is closed. The water flows from pipe **114** through conduit **112,** valve **116,** container **110** and line **108,** to the manifold **106.**

When regeneration is required, valve **118** is closed, valve **116** is placed in position B and valve **130** is opened. The cap **133** is removed from container **132,** a regeneration material, such as sodium chloride or the like, is inserted, and the cap **133** is closed. Valve **118** is then opened, and the flow is through conduit **128,** and valve **130** to the container **132,** from where the salt solution flows through conduit **134** and through container **110** where it regenerates the ion-exchange resin bed. It then passes through valve **116** to drain line **136** and then to drainage pipe **126.** After a predetermined interval to allow regeneration and flushing, the water is turned off by valve **118** and valve **116** is placed in position A. The system is now again ready for use.

In FIG. **5** there is shown a system of a simplified type. This system, generally designated **200,** comprises the conduits designated **202** leading to the dental instruments (not shown) from a manifold **204** similar to those described above. Leading from the manifold **204** is an elbow pipe **206** having an externally threaded connector **208.** This connector **208** is adapted to releasably receive a threaded bushing mounted on the top of a cylindrical cartridge **210** having a transparent window **211.** Again, a wholly transparent cartridge may be used, as may also a gauge. A similar connecting means to that shown at **208** is provided at **212** on an elbow pipe **214.** The pipe **214** leads into a stand pipe **216** connected at its lower end to a source of tap water through a valve **218.** A spigot valve **220** is provided at the upper end of pipe **216** adjacent to a curved outlet and **222** positioned above an expectorant bowl **224.** A drain pipe **226** leads from the bowl **224** to drainage.

In this system, with valve **218** open, the water flows through pipe **214** and through the cartridge **210,** containing an ion-exchange resin bed, to the pipe **206** and then to the manifold **204.** When the ion-exchange resin is shown to be exhausted as determined by a change of color seen through window **211,** the cartridge **210** is removed and is replaced by a new cartridge.

This cartridge system can be used either for the anionic or cationic resin bed. It can also be used for a mixture of both the anionic and cationic resins. Such mixtures are commercially available and are, for example, sold under the name "Ionac NM-65" by the Ionac Chemical Sybron Corporation, Birmingham, New Jersey.

In FIGS. **6** and **7** there is shown a system, generally designated **300,** which is used with a cationic ion-exchange resin and which comprises conduits, designated **302,** leading from dental instruments to a manifold **304** similar to those described above. The manifold **304** is connected by a conduit **306** to a housing **308,** which is in direct fluid communication with a container **310** having a transparent window **311.** Here, too, the container may be made entirely transparent, and a gauge may also optionally be provided. The housing **308** is provided with a feed inlet **309** at its side. At the bottom of container **310** is a valve housing **312** containing a valve **314** shown in various positions in FIG. **7.** A conduit **316** leads from the valve housing **312** to a standpipe **318.** The pipe **318** is connected to a source of tap water at its lower end and a supply valve **320,** is interposed therein. At its upper end, the pipe **318** is provided with a curved outlet **322** situated over an expectorant bowl **324.** A spigot **326** is provided adjacent the outlet **322.**

The bowl **324** is provided with a drain pipe **328** leading to drainage. A conduit **330** leads from the housing **308** to the standpipe **318** and a valve **332** is interposed in this conduit **330.** A conduit **334** leads into the drain pipe **328** from the valve housing **312.**

In normal operation, the valve **320** is opened and water flows through conduit **316** and through valve **312,** which is in position A, as shown in FIG. **7,** through the ion-exchange resin in container **310,** through housing **308,** and through conduit **306** to the manifold **304.** During this flow, valve **332** is closed.

For regeneration, valve **320** is closed, valve **332** is opened, and valve **314** is in position B. An acid solution is then fed through inlet **309** in housing **308** after the valve **314** has been repositioned to position C. After the required amount of acid has been inserted, it is retained in the container **310** for a predetermined interval of time sufficient to regenerate the cationic ion-exchange resin in container **310.** Then valve **314** is

placed in position B, valves **320** and **332** are opened, and the spigot valve **326** is also opened. The water now flows through conduits **318** and **330** to the housing **308** and then down through container **310** to valve **314** from which it passes through drain line **334** to the drain pipe **328.** The spigot **326** is open to permit water to blend with the acid solution being ejected through the outlet **332** in order to dilute the acid as it flows through the drain. The flushing action proceeds until the correct color is indicated through window **311,** at which time, the spigot valve **326** is closed, the valve **332** is closed and the valve **314** is set to position A. The system is now again ready for use.

The invention claimed is:

1. A water supply system for dental instruments comprising at least one container holding a bed of ion-exchange material, at least one water-utilizing dental instrument in fluid communication with said container, a water-supply conduit leading from a source of water to said container, said conduit having a selectively-operable shut-off valve and also having an outlet leading to an expectorant bowl, a drain pipe leading to drainage from said expectorant bowl, and means for reactivating the ion-exchange bed when it nears exhaustion.

2. The system of claim **1** wherein said means for reactivating comprises a chamber positioned above said container, said chamber being constructed to hold renewable amounts of an ion-exchange regenerating material, said chamber being in fluid connection with said conduit leading from the source of water, and also being in fluid connection with said container, and said container being in selective fluid connection with said water-supply conduit and with a drainage conduit through a selectively-positioned control valve, said drainage conduit being in fluid connection with said drain pipe.

3. The system of claim **2** wherein there are two containers, one of said containers holding an anionic ion-exchange bed and the other holding a cationic ion-exchange bed, said regeneration chamber being in selective fluid communication with each of said containers, and a separate control valve in operative connection with each container.

4. The system of claim **3** wherein said containers are linearly arranged to permit flow of water from said water-supply conduit through both containers when the respective control valves are arranged in predetermined positions.

5. The system of claim **1** wherein said container is a replaceable cartridge, and said means for reactivating comprises releasable connections between said cartridge and conduits leading respectively from said water-supply conduit and from said dental instrument, a cartridge having an exhausted ion-exchange bed being replaceable by a cartridge having a fresh bed.

6. The system of claim **1** wherein said container is provided with a regeneration feed inlet housing at one end, said housing being in fluid communication with said container and having a feed inlet for receiving fluid regeneration material, said housing also being in fluid communication with said water-supply conduit, a control valve at the opposite end of said container, and conduit means connecting said control valve to said water-supply conduit and to said drain pipe, said control valve being selectively adjustable to open or close communication between both of said last-mentioned conduits and said container.

7. The system of claim **1** wherein said container is at least partially transparent.

* * * * *