Feb. 4, 1969 J. E. HIERS 3,425,808

SOLID REGENERATING MINERAL DISSOLVER

Original Filed June 4, 1962 Sheet 1 of 3

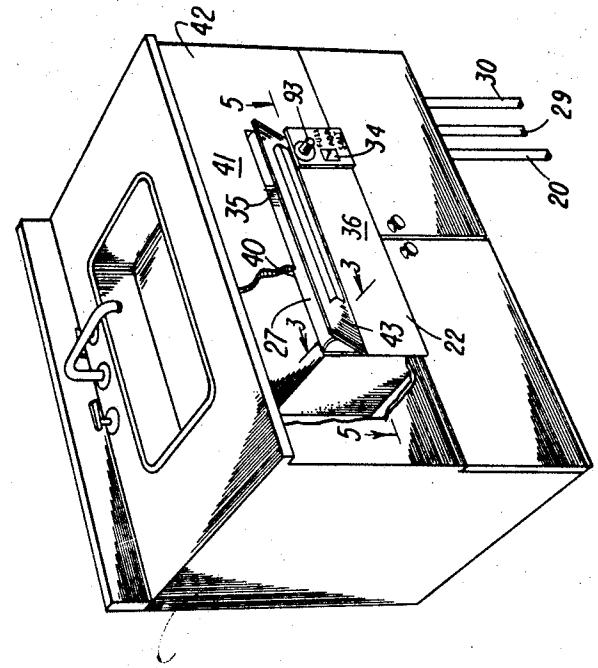

FIG. 2

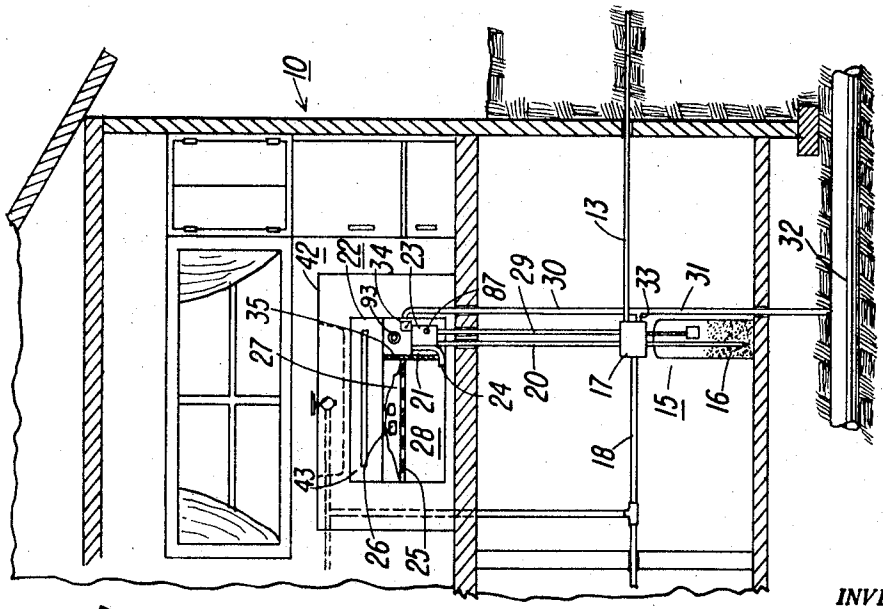

FIG. 1

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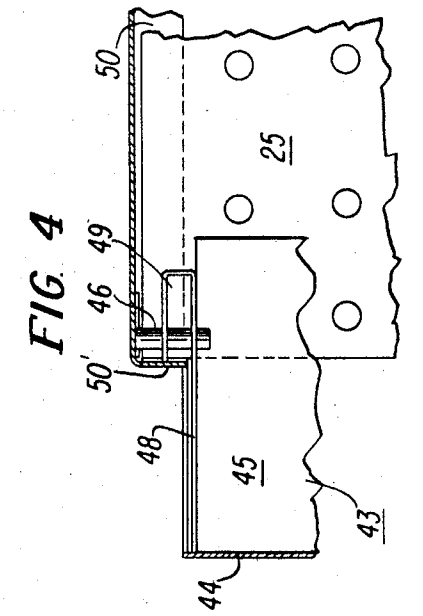


FIG. 4

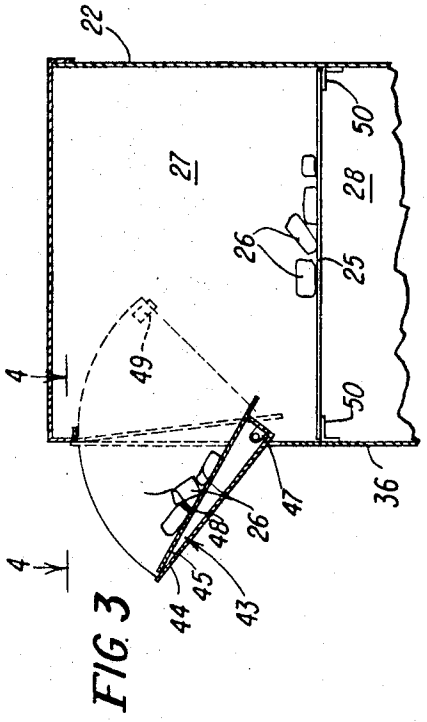


FIG. 3

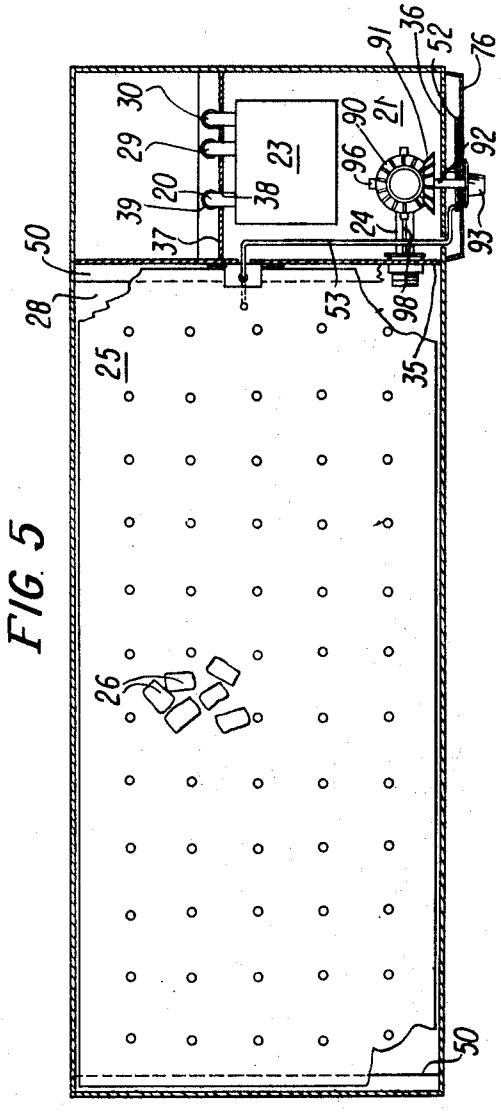


FIG. 5

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SOLID REGENERATING MINERAL DISSOLVER

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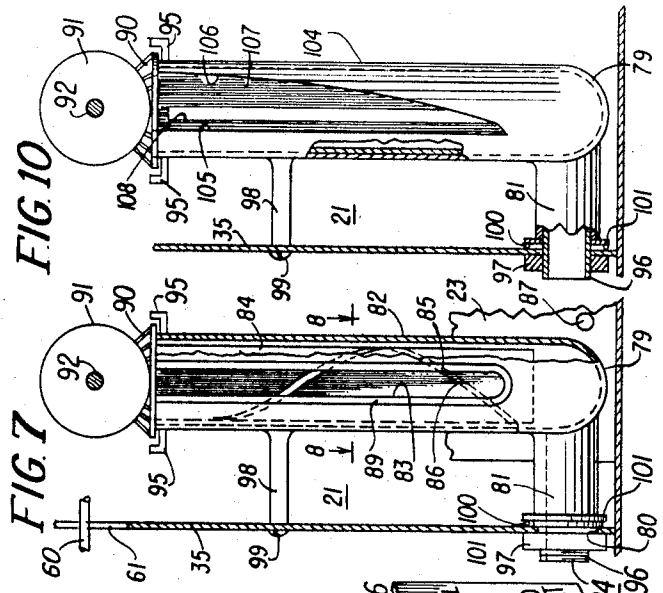

FIG. 10



FIG. 7

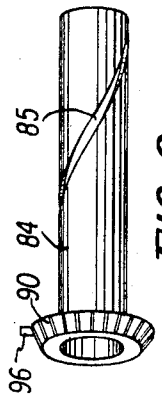

FIG. 9

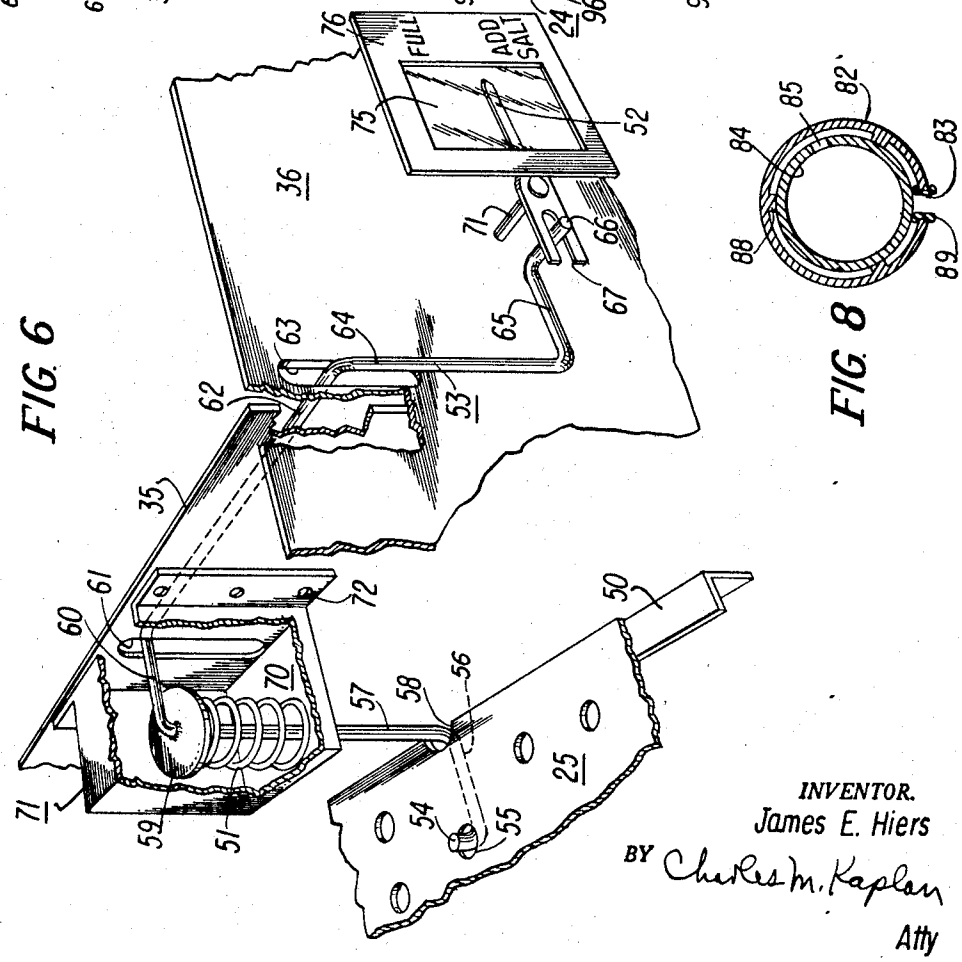

FIG. 6



FIG. 8

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United States Patent Office 3,425,808 Patented Feb. 4, 1969



3,425,808

# SOLID REGENERATING MINERAL DISSOLVER

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Original application June 4, 1962, Ser. No. 199,764, now Patent No. 3,253,891. Divided and this application Sept. 20, 1965, Ser. No. 488,708

U.S. Cl. 23—267 11 Claims

Int. Cl. B01d *15/06*; B01j *1/06*

This application is a division of my copending application Ser. No. 199,764, filed June 4, 1962, now U.S. Patent 3,253,891, and assigned to the same assignee as this invention.

This invention relates to water conditioning, and more particularly to regenerating mineral and liquid containers of the type usable in the systems disclosed by Benjamin H. Kryzer in the United States Patent 3,253,713, titled, "Water Conditioning System," filed concurrently herewith on June 4, 1965, and assigned to the same assignee as this invention.

The regenerating mineral and liquid container in water softening systems of the type described in the above-mentioned Kryzer patent may be located in an area of normal activity in a dwelling. This enables the occupants of the dwelling to observe the container frequently as they go about their ordinary daily routine, and thus reminds the occupants to check the supply of undissolved regenerating mineral to ensure an adequate amount for proper operation of the system. Since it is desirable for the occupants to be able to ascertain when the solid mineral supply has been used up without opening of the container one aspect of my invention concerns improved means for indicating this condition externally of the container by employing movable means for supporting the solid mineral, and external indicating means operatively connected to the movable supporting means.

Another desirable feature for regenerating mineral containers is ease of access for replenishing the solid mineral supply. In some installations it is undesirable that the entire container be moved in order to attain access for filling because liquid in the container may be sloshed over the sides. Furthermore, movable containers require that relatively expensive flexible pipes be employed for liquid flowing into or out of the container. According to another aspect of my invention, easy access is attained without the aforementioned difficulty by exposing a front panel of the container and providing a pivotable portion of the front panel that exposes the mineral compartment for access, while the rest of the container remains stationary.

It is also desirable to provide water softeners with an adjustable control for regulating the amount of regenerating liquid used during the regenerating cycle, without the necessity for re-setting automatic flow control and timing devices. In the past this has been accomplished by employing flexible or pivotable tubes having a vertically adjustable end whose location determined the volume of concentrated mineral solution used during the regeneration cycle; this expedient was undesirable because it required a relatively long tube to achieve a wide range of control, and this required that a large amount of space be left unoccupied to permit pivoting of the long tube. Another arrangement that overcame the above-mentioned space difficulty was to employ a rotatable tube concentric with a stationary tube, with the tubes having distinct, non-continuous openings mating at spaced vertical locations; this expedient had the disadvantage that it achieved only a stepped control, rather than continuous control over a complete range. According to another aspect of my invention continuous control is attained by providing one of the concentric tubes with a substantially vertical slot



and by providing the other tube with an opening that spirals along its side wall.

It is, therefore, an object of my invention to provide improved regenerating mineral and liquid container for water conditioning systems.

Another object is to provide means for indicating externally of a regenerating mineral container the amount of solid mineral in the container.

Another object is to provide solid regenerating mineral containers for water conditioning systems with means for externally indicating when the solid mineral supply has been exhausted..

Another object of the invention is to provide relatively compact means for achieving continuous regulation between predetermined limits of the volume of concentrated regenerating liquor used in water conditioning systems.

Another object is to provide a solid regenerating mineral container of water conditioning systems in which access to the solid mineral compartment is facilitated.

Another object is to provide an integral container assembly having components that cooperate in achieving one or more of the above objectives.

Other objects and advantages of the invention will be apparent from the specification, drawing, and claims, and the scope of the invention will be pointed out in the claims.

In the drawing:

FIGURE 1 is a schematic, partially cross sectional, elevational view of a dwelling having a water conditioning system of the type in which my invention may be used.

FIGURE 2 is a perspective, partially broken-away view of a regenerating mineral container installation in accord with the teachings of my invention.

FIGURE 3 is an enlarged cross sectional view taken along the line **3**—**3** in FIG. 2.

FIGURE 4 is an enlarged cross sectional top plan view taken along the line **4**—**4** in FIG. 3.

FIGURE 5 is an enlarged cross sectional top plan view taken along the line **5**—**5** in FIG. 2.

FIGURE 6 is a perspective, partially broken-away, schematic view of the components of an indicator in accord with my teachings.

FIGURE 7 is an enlarged partially broken-away elevational view showing flow control means in accord with my teachings.

FIGURE 8 is a top plan cross sectional view taken along the line **8**—**8** in FIG. 7.

FIGURE 9 is an isometric view on a reduced scale of a hollow tube employed in the flow control means of FIG. 7.

FIGURE 10 is a partially broken-away elevational view of another embodiment of flow control means in accord with my teachings.

Referring now to the drawing, FIG. 1 shows a house-type dwelling **10** having a water softening system of the type described in the aforementioned Kryzer patent application. Briefly, the operation of such a system is as follows:

Hard water entering through the pipe **13** is conditioned by water softening means **15** to remove hardness causing minerals therefrom. The softening means **15** may include a bed **16** of conventional water softening minerals such as zeolite. The operating cycles of the softening means **15** may be controlled by a master valve **17**, which, for example, may be the type disclosed in U.S. Patent 3,215,273, and assigned to the same assignee as this invention. During the softening cycle, the valve **17** causes hard water from pipe **13** to flow through the bed **16** and then through a soft water supply pipe **18** to various places in the dwelling **10** where the softened water will be used. After the hard water has substantially exhausted the softening ability of the bed **16**, a suitable timing mechanism

associated with the valve 17 causes hard water to bypass the bed 16 for use in the dwelling, while regeneration of the bed takes place. During the regeneration cycle, hard water is diverted through a raw water inlet pipe 20 in a mixing compartment 21 in liquid-tight regenerating mineral and liquid container means 22. This may be accomplished through the use of fluid-drawing and flow-controlling means 23, such as a float type aspirator valve of the type disclosed in United States Patent 3,185,302 of Benjamin H. Kryzer, issued May 25, 1965 and assigned to the same assignee as this invention.

The container means 22 may include a substantially horizontal movable, perforated platform 25 for supporting solid regenerating mineral, such as salt tablets 26. Access to the interior of the container means may be achieved by a pivotable door 43, as more fully described hereafter. The platform 25 defines an upper solid regenerating mineral compartment 27 and a lower concentrated liquor compartment 28. A partition 35 isolates the mixing compartment from the rest of the container. Water from the pipe 20 flows through conduit means 24 into the compartments 27 and 28 to dissolve the solid mineral 26 to produce a concentrated regenerating liquor. During the regenerating cycle, the means 23 causes the concentrated liquor to flow from the compartment 28 through conduit 24 into mixing compartment 21, where it is diluted with water from the conduit 20 so as to produce the regenerating liquid, which flows through an outlet pipe 29 into the bed 16 and there regenerates the water softening minerals in the known manner. The container means 22 may include means 93 for controlling the amount of concentrated liquor flowing into the compartment 21, as more fully described hereafter. After a predetermined amount of regenerating liquid has flowed through the bed 16, the bed is backwashed and water is caused to flow into the compartments 27 and 28 to produce the concentrated liquor for the next regeneration cycle.

The container means 22 may include an overflow pipe 30 so that in case malfunctioning causes excessive liquid to flow, the liquid will be discharged into a waste line 31 which empties into the sewer 32 from the dwelling 10, rather than overflowing into the dwelling. The master control valve 17 also has a waste discharge line 33 emptying into the sewer 32 for discharge of the used regenerating liquid and backwash flow. The container may be provided with means 34 for visibly indicating the amount of regenerating mineral therein, as more fully explained hereafter.

FIGS. 2–4 show in greater detail the construction of the container means 22 that permits easy access to the mineral compartment 27 for replenishing the supply of solid mineral. The container 22 is mounted in an opening 40 in a substantially vertical panel 41 of suitable supporting means in a dwelling 10, such as a kitchen sink cabinet 42. Access to the compartment 27 is attained by pivoting outwardly from the panel 41 a door 43 that forms a portion of the container's front panel 36.

The door 43 may include an outer facade portion 44 and an inner slide portion 45, which acts as a chute for diverting the salt tablets 26 into the chamber 27, where they come to rest on platform 25. The door 43 is pivoted on hinge pins 46 secured to side walls of the container. Slots 47 provided in side portions 48 of the door receive the pins 46 and act as the bearings for the door assembly. A tab 49 is provided on the side portion 48 for acting as a stop by engaging an inwardly directed portion 50 of the container in order to hold the door at a suitable angle such as about 45° for causing the salt tablets to slide onto the platform 25. Thus, on pivoting the door 43 outwardly from the panel 41 and engaging the stop 49 against portion 50, the portion 45 acts as a chute onto which salt tablets can be dropped, whereupon they will slide into the compartment 27 and come to rest on the platform 25.

Since only the door 43 need be moved to load the container with mineral, the pipes 20, 29 and 30 can be made from conventional rigid materials, rather than having to be flexible as in situations where the entire container is movable. As shown in FIG. 5, the mixing compartment 21 may include a partition 37 having holes 38 which the pipes 20, 29, and 30 pass through at a height above the uppermost level reached by liquid in the compartment 21. Thus, the holes 38 and the holes 39, through which the pipes leave the container, need not have liquid-tight seals.

FIGS. 5 and 6 illustrate means for indicating externally of the container the amount of solid regenerating mineral in the container, in order to alert the occupants of a dwelling when the solid mineral supply has been exhausted. The platform 25 may rest on suitable supports, such as channels 50 attached to the sides of the container. Sufficient clearance is provided around the periphery of the platform 25 so that it is vertically movable. The platform 25 is operatively connected to resilient biasing means such as a compression spring 51, and to an externally visible pointer 52 by means of a motion transmitting member 53. The member 53 has an upwardly extending terminal end 54 passing through an opening 55 in the platform 25, and a portion 56 which passes beneath the platform 25 for supporting same. A portion 57 passes upwardly through a recess 58 and also passes through the spring 51; an abutment 59 is attached to the portion 57 so as to rest on the spring 51. A portion 60 then passes sideways through an elongated slot 61 in the partition 35. A portion 62 passes along the partition 35 and then through an elongated slot 63 in the front panel or wall 36 of the container. A portion 64 passes downwardly along the front wall, and is connected to a portion 65 which terminates in an outwardly directed end 66 which is connected to the pointer 52 by being inserted into a slot 67.

The lower end of spring 51 is supported by a bottom wall 70 in a receptacle 71, which is removably attached to the wall 35 by any suitable means such as screws 72. The dimensions of the various elements are such that when a spring 51 is not compressed by the weight of mineral tablets on the platform 25, the supporting portion 56 holds one end of the platform slightly above one supporting channel 50. It is thus apparent that as salt tablets are placed on the platform 25 their weight causes the platform to move downwardly; this draws the member 53 downwardly and causes the abutment 59 to compress the spring 51 against the bottom wall 70. Downward movement of the member 53 causes the pointer end 67 to move downwardly, which causes its visible end 52 to pivot upwardly about a pivot axis 71. As water flowing into the compartment 27 dissolves the mineral tablets and thereby decreases their weight, the spring 51 expands and pulls the platform 25 upwardly. Upward movement of the member 53 pivots the pointer 52 downwardly indicating the salt has been dissolved. By proper calibration of the spring and pointer assembly, the pointer 52 will point to the "Add Salt" indication on the outside of the container when all of the mineral tablets have been dissolved. Thus the indicating means of my invention functions in the manner of a spring scale, since the weight of the mineral tablets serves to compress a spring which causes a pivoted pointer to move along a scale. The pointer 52 may be viewed through a window 75, such as glass plate covering an opening in a facade 76, which defines a protected space adjacent to the front wall 36 of the container.

As will be apparent to those skilled in the art, the provision of means indicating externally of the container when the solid regenerating mineral within the container has been exhausted may be accomplished by expedients other than a moving pointer. For example, the end 66 of the member 53 may be employed to close a movable contact in an electric circuit and thus turn on a colored light or sound an audible alarm such as a bell to indicate that the solid mineral supply has been exhausted.

FIGS. 5 and 7–9 illustrate a preferred embodiment of means which defines liquid flow conduit 24 and also provides the means for regulating the quantity of concen-

trated regenerating liquor flowing from the concentrated liquor compartment **28** into the mixing compartment **21**, and thus controls the amount of the regenerating liquid flowing into the bed **16** during the regeneration cycle. A hole **80** is provided at the bottom of the partition **35**, and a hollow pipe **81** passes through the hole **80** and has one end secured to a hollow outer cylindrical tube **82**. The tube **82** has a closed bottom end **79** and is provided with a substantially vertical slot **83** in its side wall. A hollow inner cylindrical tube **84** is telescopically received within the tube **82** so as to be rotatably supported thereby. The tube **84** has an opening **85** spiralling along a portion of its side wall. As shown in FIG. 7, the vertical slot **83** and spiral opening **85** coincide to define a passage **86** through which liquid flows from the interior of the tube **82** into the compartment **21**, from where it can enter or leave the means **23** through one or more openings **87** in the lower end thereof.

As shown in FIG. 8, a plurality of projections **88** on the interior surface of the tube **82** provides means for positioning the tube **84**. A fluid-tight seal between the tubes **82** and **84** is achieved by means of a channel shaped gasket **89** that lines the peripheral edge of the vertical slot **83** and is compressed against the inner wall of the tube **82** by the outer wall of the tube **84**. Thus the passage **86** is the only opening in the flow-controlling means through which liquid can flow into or out of the compartment **21**.

As stated previously, the tube **84** is rotatably supported by the tube **82**. This is accomplished by securing a bevel gear **90** to the upper end of the tube **84**. The peripheral edge of the gear **90** extends beyond the tube **82** and so that the underside of the gear rests on the upper end of the tube. The gear **90** mates with a gear **91** attached to a shaft **92** which protrudes through an opening in the front wall **36** and facade **76**. A knob **93** is attached to the outer end of the shaft **92** and protrudes from the exterior of the container. Turning of the knob **93** rotates the gear **91** which, in turn, rotates the gear **90**, and with it the attached tube **84**. As the tube **84** rotates, a different portion of the spiral opening **85** is brought into a position mating with the vertical slot **83**. Since the various portions of the spiral opening **85** occupy different vertical locations along the side of the tube **84**, this rotation causes the passage **86** where the slot and groove coincide to move vertically. The vertical location of the slot **86** controls the volume of liquid flowing into the compartment **21** from the compartment **28** because flow will be stopped when the level of liquid in the compartment **28** is identical to the vertical location of the passage **86**. The spiral opening **85** is continuous along the side of the tube **84**, so continuous control at an unlimited number of positions is attainable between an upper and a lower limit determined by the terminal ends of the spiral opening **85**.

To ensure proper calibration of the slot **83** and opening **85**, a pair of upstanding ears **95** are attached to the outside of the tube **82**. A projection **96** it attached to the gear **90** so that rotation of the gear **90** will be prevented in either direction when the projection **96** engages either of the ears **95**.

The tube assembly is securely held in place by providing threads **96** on one end of the pipe **81** and threading a nut **97** thereon. A projection **98** extends from one side of outer tube **82**, and a screw **99** is passed through the partition **35** into the projection. A fluid-tight seal at the hole **80** is achieved by compressing an O-ring gasket **100** between the partition **35** and a shoulder **101** that extends from the pipe **81**.

FIG. 10 shows another embodiment of flow-regulating means **30** in accord with my teachings. The features identical to those of the embodiment of FIGS. 7–9 have been given the same number as used in the foregoing description. The inner and outer tubes mate to define the fluid flow passage in a different manner in the FIG. 10 embodiment. An outer tube **104** has a relatively large slot **105** that has one edge **106** which spirals around a portion of the tube. An inner tube **107** is provided with a substantially vertical slots **108**.

The inner tube **107** is attached to a bevel gear **90** that rotatably supports same on the outer tube **104** and otherwise functions as described with reference to FIGS. 7–9. Thus, rotation of the inner tube **107** will cause different portions of the vertical slot **108** to be closed off by the edge **106** of the tube **104**. This will regulate the flow of fluid into the chamber **21** in the same manner described previously with reference to the embodiment of FIGS. 7–9.

As shown in the broken-away portion of the FIG. 10, the inner and outer tubes may be machined to close tolerances so as to have a very tight fit, thereby eliminating the need for sealing means, such as the gasket **89** employed in the embodiment of FIGS. 7–9.

An important feature of a container employing externally visible indicating means as described with reference to FIG. 6 and flow-controlling means as described with reference to FIGS. 7–10, is that openings such as **61** and **63** through which the connecting means **53** passes must be above the uppermost vertical location reached by the passage **86**, defined by the coinciding slots in the flow-controlled means. This will ensure that the only passage for fluid from the chamber **28** into the chamber **21** is through the passage **86** where the tubes mate.

It has thus been shown that by the practice of my invention a container for solid regenerating mineral in a water softening system may be provided with a door that serves as an inclined chute for loading solid mineral therein and thus provides easy access for loading of the container. Since the door is movable, liquid in the container will not be sloshed out of the container when it is opened for loading. Solid mineral placed on the chute will be slid onto a movable platform that is connected through suitable means to an external indicator for alerting occupants of a dwelling when the supply of solid mineral has been exhausted. Means for controlling the flow of concentrated regenerating liquor into a mixing compartment has been provided by a compact arrangement that allows continuous control between predetermined limits.

The means for attaining easy access to the container, the means for providing an external indication of the amount of mineral in the container, and the means for controlling the flow of fluid have been arranged in an integral container assembly in which they cooperate rather than interfere with each other. This is accomplished by locating the elongated openings through which pass the connecting means of the indicator assembly above the highest point reached by the coinciding slots in the flow-regulating means, and by locating the chute-door assembly of the container above the movable part of the indicating means.

It will be understood, of course, that while the forms of the invention herein shown and described constitute preferred embodiments of the invention, it is not intended herein to illustrate all of the equivalent forms or ramifications thereof. It will also be understood that the words used are words of description rather than of limitation, and that various changes may be made without departing from the spirit or scope of the invention herein disclosed, and it is aimed in the appended claims to cover all such changes as fall within the true spirit and scope of the invention.

What is claimed is:

**1.** In a water conditioning system of the type in which water flows over solid regenerating mineral and dissolves same to provide an expendable concentrated regenerating liquor solution, thereby consuming said mineral and necessitating replenishment thereof, the combination comprising:

(I) an integral container assembly comprising:

(A) movable means for supporting said solid mineral,

(1) said movable means dividing said container into an upper solid mineral compartment and a lower concentrated liquor compartment,

(B) partition means defining a mixing compartment,

(1) a raw liquid inlet and a regenerating liquid outlet in said mixing compartment,

(C) means for regulating the quantity of concentrated regenerating liquor flowing from said concentrated liquor compartment into said mixing compartment comprising:

(1) a pair of hollow tubular members, one of which is telescopically recieved in the other,

(2) conduit means providing a liquid flow path from said concentrated liquor compartment into the interior of one of said tubular members which has a closed bottom end,

(3) one of said members having a substantially vertical slot therein,

(4) the other of said members having an opening spiralling along its side wall,

(5) said slot and said opening being aligned to define an outlet passage into said mixing component for concentrated regenerating liquor flowing into said member having a closed bottom end,

(6) one of said members being rotatable,

(7) rotation of said rotatable member causing different portions of said slot and opening to be aligned so that the vertical location of said outlet passage is adjustable, and the quantity of concentrated liquor flowing into said mixing compartment is thereby controllable,

(D) means for indicating externally of said container when said solid mineral has been consumed,

(E) motion transmitting means passing through an opening in said partition means and operatively connecting said movable means to said indicating means,

(F) said opening in said partition means being located above the highest vertical location of said outlet passage, and

(II) panel means having an opening therein receiving a portion of said container so as to expose a front wall of said container assembly, and

(A) a portion of said front wall being pivotable away from said panel means so as to expose said solid mineral compartment for loading.

**2.** In a water conditioning system of the type in which water flows over solid regenerating mineral and dissolves same to provide an expendable concentrated regenerating liquor solution, thereby consuming said mineral and necessitating replenishment thereof, the combination comprising:

(I) an integral container assembly comprising:

(A) substantially horizontal perforated platform means for supporting said solid mineral,

(1) said platform dividing said container into an upper solid mineral compartment and a lower concentrated liquor compartment,

(B) partition means defining a mixing compartment,

(1) a row liquid inlet and a regenerating liquid outlet in said mixing compartment,

(C) means for regulating the quantity of concentrated regenerating liquor flowing from said concentrated liquor compartment into said mixing compartment comprising:



(1) a pair of hollow tubular members, one of which is telescopically received in the other,

(2) conduit means providing a liquid flow path from said concentrated liquor compartment into the interior of one of said tubular members which has a closed bottom end,

(3) one of said members having a substantially vertical slot therein,

(4) the other of said members having an opening spirally along its side wall,

(5) said slot and said opening being aligned to define an outlet passage into said mixing compartment for concentrated regenerating liquor flowing into said member having a closed bottom end,

(6) gear means rotatably supporting one of said members,

(7) rotation of the rotatable member causing different portions of said slot and opening to be aligned so that the vertical location of said outlet passage is adjustable, and the quantity of concentrated liquor flowing into said mixing compartment is thereby controllable,

(D) means for indicating externally of said container when said solid mineral has been consumed,

(E) resiliently biased motion transmiting means passing through vertically elongated opening in said partition means and operatively connecting said movable means to said indicating means,

(F) said elongated opening being located above the highest vertical location of said outlet passage, and

(II) panel means having an opening therein receiving a portion of said container so as to expose a front wall of said container assembly,

(A) a portion of said front wall defining a door pivotable away from said panel means so as to expose said solid mineral compartment for loading, and

(B) an inner surface of said door providing a chute for directing solid mineral onto said platform.

**3.** In a water conditioning system of the type in which water flows over solid regenerating mineral and dissolves same to provide an expendable concentrated regenerating liquor solution, thereby consuming said mineral and necessitating replenishment thereof, an integral container assembly comprising:

(I) movable means for supporting said solid mineral,

(a) said movable means dividing said container into an upper solid mineral compartment and a lower concentrated liquor compartment,

(II) partition means defining a mixing compartment,

(III) means for regulating the quantity of concentrated regenerating liquor flowing from said concentrated liquor compartment into said mixing compartment comprising:

(a) a pair of hollow tubular members, one of which is telescopically received in the other,

(b) conduit means providing a liquid flow path from said concentrated liquor compartment into the interior of one of said tubular members which has a closed bottom end,

(c) one of said members having a substantially vertical slot therein,

(d) the other of said members having an opening spiralling along its side wall,

(e) said slot and said opening being aligned to define an outlet passage into said mixing compartment for concentrated regenerating liquor

flowing into said member having a closed bottom end,

(f) rotation of said rotatable member causing different portions of said slot and opening to be aligned so that the vertical location of said outlet passage is adjustable, and the quantity of concentrated liquor flowing into said mixing compartment is thereby controllable,

(IV) means for indicating externally of said container when said solid mineral has been consumed,

(V) motion transmitting means passing through an opening in said partition means and operatively connecting said movable means to said indicating means, and

(VI) said opening in said partition means being located above the highest vertical location of said outlet passage.

4. In a water conditioning system, an integral regenerating mineral and liquid container assembly mountable in an opening in a panel with a front portion thereof exposed, said assembly comprising:

(I) a mixing compartment and a separate regenerating mineral compartment within said container,

(II) a raw liquid inlet and a regenerating liquid outlet in said mixing compartment,

(III) said exposed front portion of said container being pivotable away from said panel to expose said mineral compartment for loading with solid mineral,

(IV) means for regulating the quantity of liquid flowing from said mineral compartment into said mixing compartment comprising:

(a) a pair of hollow tubular members, an inner one of which is telescopically received in an outer member,

(b) conduit means into the interior of one of said tubular members which has a closed bottom end providing a liquid flow path between said mineral and mixing compartments,

(c) one of said members having a substantially vertical slot therein,

(d) the other of said members having an opening spiralling along its side wall,

(e) a plurality of projections on the interior surface of said outer member positioning said inner member therein,

(f) gasket means in said slot compressed between said inner and outer members for preventing liquid flow therebetween,

(g) said slot and said opening being aligned to define an outlet passage into said mixing compartment for liquid flowing into said member having a closed bottom end,

(h) one of said tubular members being rotatable, and

(i) rotation of said rotatable member causing different portions of said slot and opening to be aligned so that the vertical location of said outlet passage is adjustable, and the quantity of lquid flowing into said mixing compartment is thereby controllable.

5. In a regenerating mineral container for a water conditioning system having a concentrated regenerating liquor compartment, the improvement in means for regulating the quantity of concentrated regenerating liquor flowing from said compartment comprising:

(a) an outer hollow tubular member having an open upper end defining a bearing surface, and an inner tubular member having an open bottom end telescopically received by said outer member,

(b) said outer member having a closed bottom end, and conduit means connected to the interior thereof providing the only liquid flow path out of said concentrated liquor compartment,

(c) one of said members having a slot therein,

(d) the other of members having an opening spiralling along its side wall,

(e) said slot and said opening being aligned to define an outlet passage for concentrated regenerating liquor flowing through said conduit means,

(f) said inner member having a gear secured to the upper end thereof, a portion of said gear extending outwardly beyond said inner member and being rotatably supported by said bearing surface, said portion supporting said inner member so that its bottom end is elevated above said bottom end of said outer member,

(g) means for rotating said gear and thereby rotating said inner member, and

(h) rotation of said inner member causing different portions of said slot and opening to be aligned so that the vertical location of said outlet passage is adjustable, and the quantity of concentrated liquor flowing from said compartment is thereby controllable.

6. In a regenerating mineral container for a water conditioning system having a concentrated regenerating liquor compartment, the improvement in means for regulating the quantity of concentrated regenerating liquor flowing from said compartment comprising:

(a) an outer hollow tubular member having an open upper end defining a bearing surface, and an inner tubular member having an open bottom end telescopically received by said outer member,

(b) said outer member having a closed bottom end, and conduit means connected to the interior thereof providing the only liquid flow path out of said concentrated liquor compartment,

(c) one of said members having a slot therein,

(d) the other of members having an opening spiralling along its side wall,

(e) said slot and said opening being aligned to an outlet passage for concentrated regenerating liquor flowing through said conduit means,

(f) said inner member having a generally horizontal gear secured to the upper end thereof, a portion of said gear extending outwardly beyond said inner member and being supported by said bearing surface for rotation about a generally vertical axis,

(g) a generally vertical gear mating with said generally horizontal gear, means supporting said generally vertical gear for rotation about a generally horizonal axis located above said bearing surface, rotation of said generally vertical gear causing rotation of said inner member, and

(h) rotation of said inner member causing different portions of said slot and opening to be aligned so that the vertical location of said outlet passage is adjustable, and the quantity of concentrated liquor flowing from said compartment is thereby controllable.

7. In a regenerating mineral container for a water conditioning system having a concentrated regenerating liquor compartment, the improvement in means for regulating the quantity of concentrated regenerating liquor flowing from said compartment comprising:

(a) an outer hollow tubular member having an open upper end defining a bearing surface, and an inner tubular member having an open bottom end telescopically received by said outer member,

(b) said outer member having a closed bottom end, an conduit means connected to the interior thereof providing the only liquid flow path out of said concentrated liquor compartment,

(c) one of said members having a slot therein,

(d) the other of members having an opening spiralling along its side wall,

(e) said slot and said opening being aligned to define an outlet passage for concentrated regenerating liquor flowing through said conduit means,

(f) said inner member having a generally horizontal gear secured to the upper end thereof, a portion of said gear extending outwardly beyond said inner member and being supported by said bearing surface for rotation about a generally vertical axis,

(g) a generally vertical gear mating with said generally horizontal gear, means supporting said generally vertical gear for rotation about a generally horizontal axis located above said bearing surface, rotation of said generally vertical gear causing rotation of said inner member, and

(h) rotation of said inner member causing different portions of said slot and opening to be aligned so that the vertical location of said outlet passage is adjustable, and the quantity of concentrated liquor flowing from said compartment is thereby controllable.

**8.** In a regenerating mineral container for a water conditioning system having a concentrated regenerating liquor compartment, the improvement in means for regulating the quantity of concentrated regenerating liquor flowing from said compartment comprising:

(a) an outer hollow tubular member having an open upper end defining a bearing surface, and a rotatable inner tubular member having an open bottom end telescopically received by said outer member,

(b) said outer member having a closed bottom end, and conduit means connected to the interior thereof providing the only liquid flow path out of said concentrated liquor compartment,

(c) one of said members having a slot therein,

(d) the other of members having an opening spiralling along its side wall,

(e) a plurality of projections on the interior of said outer member engaging said inner member so as to position said inner member within said outer member,

(f) gasket means in said slot compressed between said inner and outer members for preventing liquid flow therebetween,

(g) said slot and said opening being aligned to define an outlet passage for concentrated regenerating liquor flowing through said conduit means, and

(h) means for rotating said inner member, and rotation of said inner member causing different portions of said slot and opening to be aligned so that the vertical location of said outlet passage is adjustable, and the quantity of concentrated liquor flowing from said compartment is thereby controllable.

**9.** In a regenerating mineral container for a water conditioning system having a concentrated regenerating liquor compartment, the improvement in means for regulating the quantity of concentrated regenerating liquor flowing from said compartment comprising:

(a) an outer hollow tubular member having an open upper end defining a bearing surface, and an inner tubular member having an open bottom end telescopically received by said outer member,

(b) said outer member having a closed bottom end, and conduit means connected to the interior thereof providing the only liquid flow path out of said concentrated liquor compartment,

(c) one of said members having a slot therein,

(d) the other of members having an opening spiralling along its side wall,

(e) a plurality of projections on the interior of said outer member engaging said inner member so as to position said inner member within said outer member,

(f) gasket means in said slot compressed between said inner and outer members for preventing liquid flow therebetween,

(g) said slot and said opening being aligned to define an outlet passage for concentrated regenerating liquor flowing through said conduit means,



(h) said inner member having a gear secured to the upper end thereof, a portion of said gear extending outwardly beyond said inner member and being rotatably supported by said bearing surface, said portion supporting said inner member so that its bottom end is elevated above said bottom end of said outer member,

(i) means for rotating said gear and thereby rotating said inner member, and

(j) rotation of said inner member causing different portions of said slot and opening to be aligned so that the vertical location of said outlet passage is adjustable, and the quantity of concentrated liquor flowing from said compartment is thereby controllable.

**10.** In a regenerating mineral container for a water conditioning system having a concentrated regenerating liquor compartment, the improvement in means for regulating the quantity of concentrated regenerating liquor flowing from said compartment comprising:

(a) an outer hollow tubular member having an open upper end defining a bearing surface, and an inner tubular member having an open bottom end telescopically received by said outer member,

(b) said outer member having a closed bottom end, and conduit means connected to the interior thereof providing the only liquid flow path out of said concentrated liquor compartment,

(c) one of said members having a slot therein,

(d) the other of members having an opening spiralling along its side wall,

(e) a plurality of projections on the interior of said outer member engaging said inner member so as to position said inner member within said outer member,

(f) gasket means in said slot compressed between said inner and outer members for preventing liquid flow therebetween,

(g) said slot and said opening defining an outlet passage for concentrated regenerating liquor flowing through said conduit means,

(h) said inner member having a generally horizontal gear secured to the upper end thereof, a portion of said gear extending outwardly beyond said inner member and being supported by said bearing surface for rotation about a generally vertical axis,

(i) a generally vertical gear mating with said generally horizontal gear, means supporting said generally vertical gear for rotation about a generally horizontal axis located above said bearing surface, rotation of said generally vertical gear causing rotation of said inner member, and

(j) rotation of said inner member causing different portions of said slot and opening to be aligned so that the vertical location of said outlet passage is adjustable, and the quantity of concentrated liquor flowing from said compartment is thereby controllable.

**11.** In a regenerating mineral container for a water conditioning system having a concentrated regenerating liquor compartment, the improvement in means for regulating the quantity of concentrated regenerating liquor flowing from said compartment comprising:

(a) an outer hollow tubular member having an open upper end defining a bearing surface, and an inner tubular member having an open bottom end telescopically received by said outer member,

(b) said outer member having a closed bottom end, and conduit means connected to the interior thereof providing the only liquid flow path out of said concentrated liquor compartment,

(c) one of said members having a slot therein,

(d) the other of members having an opening spiralling along its side wall,

(e) a plurality of projections on the interior of said

outer member engaging said inner member so as to position said inner member within said outer member,

(f) gasket means in said slot compressed between said inner and outer members for preventing liquid flow therebetween,

(g) said slot and said opening being aligned to define an outlet passage for concentrated regenerating liquor flowing through said conduit means,

(h) said inner member having a generally horizontal bevel gear secured to the upper end thereof, a portion of said gear extending outwardly beyond said inner member and being supported by said bearing surface for rotation about a generally vertical axis, said horizontal bevel gear tapering toward said generally vertical axis, said portion supporting said inner member so that its bottom end is elevated above said bottom end of said outer member;

(i) a generally vertical bevel gear mating with said generally horizontal bevel gear, means supporting said generally vertical bevel gear for rotation about a generally horizontal axis located above said bearing surface, rotation of said generally vertical bevel gear causing rotation of said inner member, and

(j) rotation of said inner member causing different portions of said slot and opening to be aligned so that the vertical location of said outlet passage is adjustable, and the quantity of concentrated liquor flowing from said compartment is thereby controllable.

**References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 1,956,101 | 4/1934 | Le Noir | 251—248 X |
| 2,030,332 | 2/1936 | Spear | 251—248 X |
| 2,032,524 | 3/1936 | Bobrick | 23—267 X |
| 3,073,674 | 1/1963 | Rudelick | 23—272.6 X |
| 3,089,508 | 5/1963 | Schulze | 23—267 X |
| 3,190,726 | 6/1965 | Rudelick | 23—272 X |

FOREIGN PATENTS

| | | |
|---|---|---|
| 514,031 | 2/1955 | Italy. |

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U.S. Cl. X.R.

23—272, 311; 137—577; 177—225; 210—86, 190