

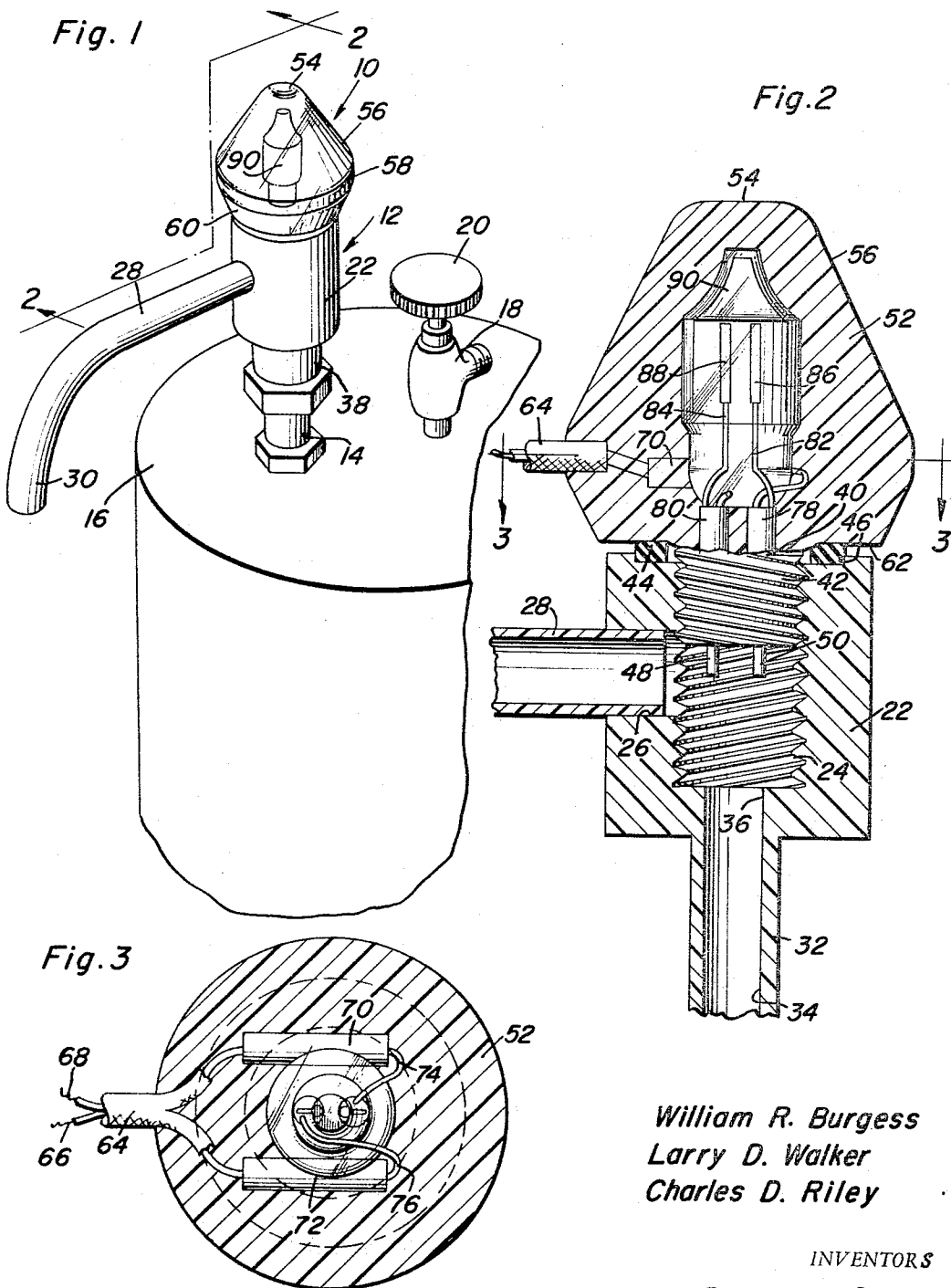
Aug. 8, 1967

W. R. BURGESS ET AL
DEMINERALIZER SERVICE UNIT WITH
ENCAPSULATED LIGHT CIRCUIT

3,334,745

Filed March 15, 1966

2 Sheets-Sheet 1



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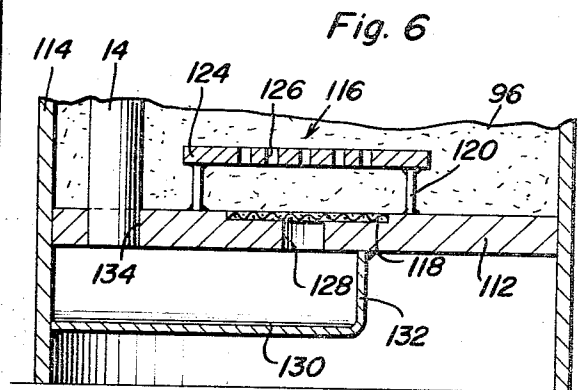
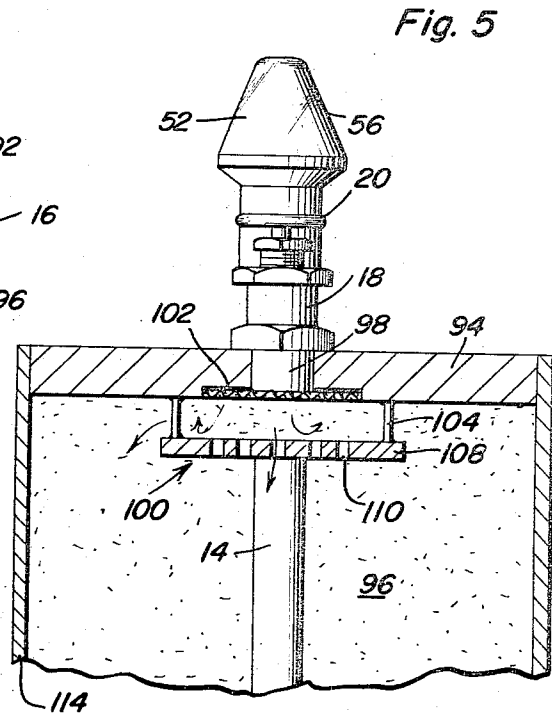
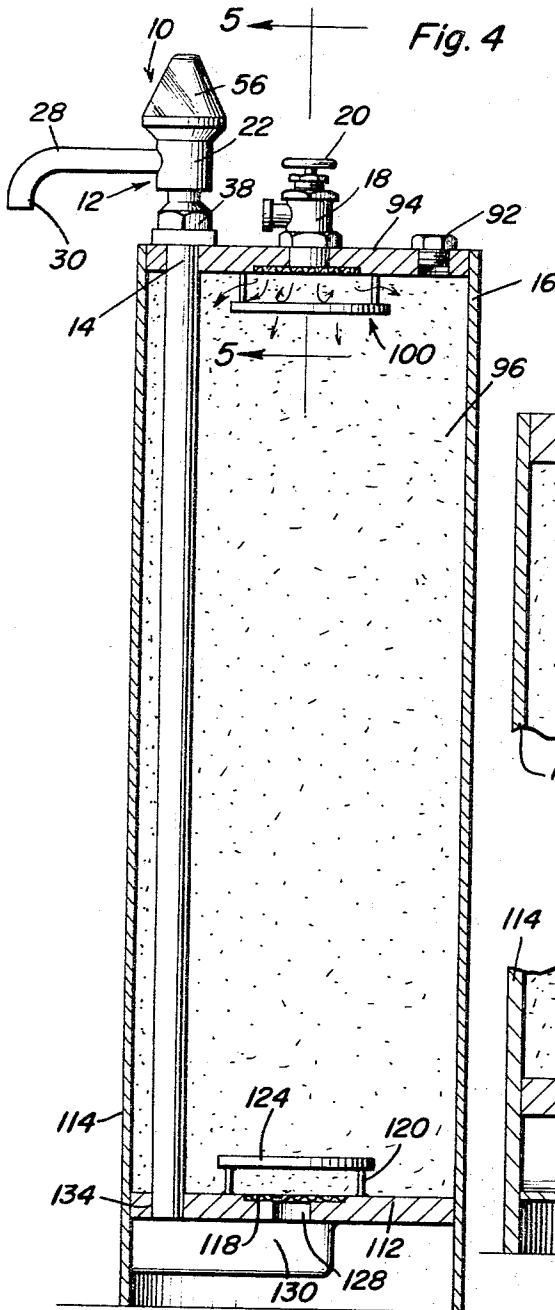
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DEMINERALIZER SERVICE UNIT WITH ENCAPSULATED LIGHT CIRCUIT

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8 Claims. (Cl. 210—93)

This application is a continuation-in-part of copending application Serial No. 257,170, filed February 8, 1963 for Encapsulated Light Circuit for Demineralizers, now abandoned.

The present invention generally relates to a water demineralizer service unit having an improved electrical end point circuit incorporated therein for indicating by energizing a signalling light the end point of useful life of the demineralizer service unit.

An object of the present invention is to provide a demineralizer service unit having an encapsulated light circuit combined with the discharge spout of the demineralizer service unit which incorporates a novel construction in order to provide complete enclosure of all component parts of an electrical end point circuit and to provide each part with maximum protection from all possible sources.

Another object of the present invention is to provide a demineralizer service unit having an encapsulated light circuit in which the encapsulated mass of material is orientated around the lamp to effectively protect the lamp and without causing damage to the lamp due to normal shrinkage of the encapsulating material when forming the encapsulated light circuit.

A further object of the present invention is to provide an encapsulated electrical end point light circuit for a demineralizer service unit having a screw-threaded base with spaced electrodes projecting axially therefrom thus providing an efficient method of orientating the electrodes into the flow path of the demineralized water as it leaves the demineralizer at the discharge spout.

Another important object of the present invention is to provide an encapsulated light circuit for water demineralizer service units which is completely moisture-proof, dustproof and is protected against vibration and shock with the encapsulating material enabling the lamp, in this case a neon glow lamp, to be completely visible and further constructed with resistance units incorporated as an integral part of the encapsulation which itself is constructed of a fireproof and heat-resistant material.

Still another object of the present invention is to provide a demineralizer service unit of the type employing a mixed bed of ion exchange resins having diffuser arrangements at the water inlet at the upper end thereof and the treated water outlet at the bottom thereof with the outlet tube extending upwardly through the service unit within the confines of the wall thereof so that the external periphery of the service unit is substantially free of obstructions thereby providing a compact unit which is easily handled with the encapsulated light circuit being orientated at the top of the outlet tube or pipe and forming a component part of the discharge spout thereby providing a demineralizer service unit having an encapsulated light circuit which is quite simple in construction, easy to interchange the signal light, electrode and resistance unit, safe in operation and relatively inexpensive to manufacture.

Yet another important object of the present invention is to provide a demineralizer service unit having an encapsulated light circuit which substantially eliminates possibility of tampering with the circuit but yet allows for ease of replacement and substitution of the encapsulated assembly thereby enabling different end points of de-

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ionized water to be obtained. The arrangement of the electrodes orientated adjacent to each other enables the use of higher resistance values in the circuit for determination of higher end point or specific resistance values of deionized water.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

FIGURE 1 is a perspective view of the upper portion of a demineralizer service unit illustrating the encapsulated light circuit mounted thereon;

FIGURE 2 is a vertical sectional view taken substantially upon a plane passing along section line 2—2 of FIGURE 1 illustrating the structural details of the encapsulated light circuit;

FIGURE 3 is a transverse, plan sectional view taken substantially upon a plane passing along section line 3—3 of FIGURE 2;

FIGURE 4 is a vertical sectional view of the service demineralizer illustrating the orientation of the diffusers, the outlet tube and the encapsulated light circuit;

FIGURE 5 is a detail sectional view, on an enlarged scale, taken substantially upon a plane passing along section line 5—5 of FIGURE 4 illustrating further structural details of the water inlet diffuser; and

FIGURE 6 is a detail sectional view, on an enlarged scale, illustrating the treated water diffuser.

Referring now specifically to FIGURES 1—3 of the drawings, the numeral 10 generally designates the encapsulated light circuit mounted on a discharge spout assembly 12 attached to the upper end of an upwardly extending discharge tube or pipe 14 which extends upwardly from the top of a water demineralizer service unit 16 similar to that illustrated in copending application Ser. No. 697,649, filed Nov. 20, 1957, for Apparatus for Preparing Mineral-Free Water, now abandoned. The demineralizer 16 also includes a water inlet 18 at the top thereof provided with a manual valve 20.

The discharge spout includes a body 22 which may be of cylindrical configuration and which has an internally threaded longitudinal bore 24 extending from the upper surface thereof to a point spaced from the bottom surface. Communicating with the central portion of the threaded bore 24 is a lateral aperture or bore 26 receiving a spout tube 28 having a downturned outer end portion 30 which forms a discharge spout for the demineralizer. The body 22 and the spout or tube 28 are preferably constructed of plastic material and are bonded together in a waterproof manner by any suitable bonding material such as a plastic resin or the like. Depending from the bottom end of the body 22 is a tube 32 having a longitudinal bore 34 extending therethrough which is a continuation of the short longitudinal bore 36 in the body 22 which communicates with the lower end of the threaded bore 24. The bore 36 and the bore 34 are of the same cross-sectional area and the tube 32 may be of unitary construction with the body 22. The tube 32 is of rigid material as is the tube 28 and the tube 32 may be received in a packing and securing nut assembly 38 which will secure the tube 32 detachably to the discharge pipe 14 in a manner for communicating the internal bore 24 with the discharge pipe 14 for receiving the deionized and demineralized water from the demineralizer 16.

The encapsulated light circuit is for the purpose of determining the conductivity of the demineralized water and the determination of such conductivity is made in the water passing through the bore 24 into the discharge tube spout 28. The encapsulated light circuit includes a base

40 provided with external threads 42 in screw-threaded engagement with the internally threaded bore 24. The length of the base 40 is such that the lower end thereof is generally coincident with the top edge of the spout tube 28, so that the base will not interfere with the flow of demineralized water to the discharge spout 28. An annular sealing O-ring gasket 44 is received in a recess 46 in the upper surface of the body 22 which acts to retain the gasket and effect a better seal thereby providing a completely waterproof and moisture proof seal.

Depending from the bottom end of the base 40 is a pair of electrodes 48 and 50 which are spaced apart a predetermined relation and which are of a predetermined length for projecting into the water flow passage to measure the conductivity of the water as it is discharged to the spout tube 28.

Disposed above and unitary with the base 40 is a transparent body 52 of plastic material which is provided with a flat top surface 54 and a frustoconical side wall portion 56 which terminates in a rather narrow vertical band or wall portion 58 and below the vertical peripheral wall portion 58 is a frustoconical portion 60 which gets smaller in diameter and terminates in a flat bottom surface 62 which merges with base 40 and engages the top surface of the sealing ring 44 thus forming a seal between body 22 and end point light body 52.

In actual fabrication, a single piece is formed which includes body 52 and base 40. Milled glass fibers are introduced into the mold solution and the bottom of the mold is partially filled with this mixture. Immediately thereafter, clear mold solution is added to the mold after which solidification occurs. Of course, the electrodes, lamp and resistance elements are also put in place as the assembly is formed. Thus, the base 40 is made opaque due to the glass fibers which provide additional strength to the base 40 and the threaded area thereof. Body 52 remains clear so that the light can be readily observed.

Extending laterally inwardly of the body 52 at the peripheral wall portion 58 is an electrical conductor 64 having a male plug (not shown) on one end thereof for insertion into a suitable source of electricity such as a female type household socket for the purpose of supplying electrical energy to the light circuit, and to cause the lamp to glow continually. The conductor 64 includes two electric wires or conductors 66 and 68 which branch off into generally parallel relation to each other and are connected to resistance elements 70 and 72 respectively. This orientation is clearly illustrated in FIGURE 3 and the resistance element 70 is connected to the electrode 50 by virtue of a conductor 74 while the resistance element 72 is connected to the electrode 48 by a similar conductor 76. The conductors 74 and 76 are received in an insert of plastic material designated by the numerals 78 and 80 respectively. Also extending through the inserts 78 and 80 are conductors 82 and 84 which are connected with and provided with the electrodes 86 and 88 at the upper end thereof and which are disposed in the transparent glass lamp 90 which is filled with neon gas for purposes of illumination. When the conductivity of the water flowing between the electrodes 48 and 50 is at a predetermined level establishing an electrical potential between the electrodes 86 and 88, the neon light or lamp 90 ceases to glow.

The lamp 90 is received within the interior of the body 52 which is generally conical shaped. This particular construction or shape enables the plastic encapsulating material to shrink as it cures without damage to the light bulb. The bottom of the light bulb or lamp 90 is disposed above the resistor elements 70 and 72 so that the resistance elements are completely encapsulated within the plastic material of the body and this is also true of the conductors 74 and 76 as well as the conductors 82 and 84 up to the point where they enter the lamp 90. The point of entrance of the conductors 82 and 84 is of

course sealed and the neon gas within the bulb is prevented from escaping.

The demineralizer 16 includes a closure plug 92 in the top wall 94 to enable removal of and replacement of resin bed 96 which completely fills the demineralizer 16 and includes cation exchange resins and anion exchange resins.

The resin bed 96 is disposed adjacent the top wall 94 and the water inlet 18 includes a nipple 98 which extends through the top wall 94 and is communicated with an interior of a diffuser assembly generally designated by the numeral 100. The diffuser assembly 100 includes a circular screen member 102 cemented in a recess in the top wall 94. A plurality of supporting pins 104 disposed in encircling relation to the screen 102 are secured to wall 94 and support a circular plate 108 of larger diameter than the screen 102 and the plate 108 has a plurality of apertures 110 therein so that water introduced into the demineralizer 16 is fanned outwardly laterally when it strikes plate 108 with some of the water passing through the openings 110 so that water will enter the resin bed 96 over a substantial area thereof for substantially reducing channelization of the water through the resin bed 96.

The demineralizer 16 also includes a bottom wall 112 spaced upwardly from the bottom of the peripheral wall 114 which defines the tank for the resin bed 96. An outlet diffuser assembly 116 is provided on the bottom wall 112 for enabling inlet of water from the resin bed 96 throughout the circumferential extent of the diffuser assembly 116.

The diffuser assembly 116 includes a circular screen 118 cemented in a recess in the bottom wall 112. A plurality of supporting pins 120 are rigid with and upstand from the bottom wall 112 in encircling relation to screen 118. A circular plate 124 is mounted on the pins 120 and is of greater diameter than the screen and is provided with a plurality of openings 126 therein which operate in the same manner as the inlet diffuser.

Extending through the bottom wall 112 is an outlet 128 orientated centrally of screen 118 and which is communicated with a radially extending horizontal tubular or channel member 130 welded to bottom wall 112 at one end and to peripheral wall 114 at the other end. The end of tubular member 130 which underlies outlet 128 has an end wall 132 forming a closure therefore. The lower end of the treated water discharge pipe or tube 14 extends down through an opening 134 in the bottom wall 112 in a sealed manner such as by welding.

The diffuser assemblies 100 and 116 may be supported from the top and bottom walls respectively in any suitable manner and the upper end of the discharge pipe or tube 14 is attached to the tubular body by the previously mentioned packing nut 38 or any other suitable means.

The body or housing 52 provides a completely enclosed and tamper-proof assembly which is a very important safety measure and provides maximum protection. The detection of trace dissolved solids in high quality water can only be determined accurately in a closed system such as provided in the present construction. It is well known that carbon dioxide in air will ionize in the water thus reducing the resistance to say nothing about other contamination from dirt, dust and the like. Thus, the completely closed system of the present invention eliminates these problems and further provides a durable and serviceable item for use with various water pressure systems and the like. The particular shape and configuration of the body 52 also enables the encapsulating material to shrink as it cures without causing damage to the lamp and at the same time furnishes protection around the neon lamp. Further, it is quite easy to unscrew the encapsulating body 52 from the body 22 for purposes of changing the light circuit to provide resistance elements having different qualities thereby enabling the device to be em-

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ployed with demineralizer service units requiring various end point water quality.

The lamp circuit of the present construction provides the lamp in parallel with the liquid and electrodes so that the lamp burns when the water is mineral free. Thus, a "light-out" situation in the present invention indicates some required action to be taken. While the disclosure relates the end point light directly with the mixed-bed demineralizer service unit, the encapsulated end point light may also be used at a point removed from the deionizer on a line connected with the deionizer effluent. This is easily accomplished by placing a T fitting in the plastic effluent pipe which has an opening therein similar to that employed in body 22. Also, the end point light may be used in a separate-bed demineralizer by employing a T fitting similar to that mentioned above and the T may be connected directly to the anion unit outlet or at a point on the discharge pipe at or near the point of use.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention as claimed.

What is claimed as new is as follows:

1. A demineralizer service unit of the mixed bed ion exchange resin type having a treated water discharge tube extending therefrom, an encapsulated light circuit communicated with said tube and comprising a body of transparent material, means on said body for detachable supporting engagement with the discharge tube, a pair of electrodes extending from said body in spaced relation for immersion in the water passing along the flow path in the discharge tube for measuring the conductivity thereof, a lamp encapsulated in said body, a source of electrical energy extending into said body including two electrical conductors continuously connected to a source of electrical energy, a resistance element in each of the electrical conductors and being completely encapsulated within said body and being electrically connected to the electrodes projecting from the body for retaining the lamp energized as long as the conductivity of the water remains below a predetermined point.

2. The structure as defined in claim 1 wherein said demineralizer includes a top wall, a bottom wall, a peripheral wall interconnecting said top and bottom walls, a mixed bed of ion exchange resins between the top and bottom walls, a water inlet in the top wall, a water outlet in the bottom wall, an inlet water diffuser assembly on the top wall, an outlet water diffuser assembly on the bottom wall, said discharge tube being communicated with the water outlet diffuser assembly and extending upwardly through the bottom wall, resin bed and top wall within the confines of the peripheral wall.

3. The structure as defined in claim 2 wherein each of said diffuser assemblies includes a screen member, a plate spaced from the screen member and being of a larger perimeter, said plate having apertures therein for enabling passage of water through the various openings in the plate and laterally over the periphery of the plate.

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4. The structure as defined in claim 1 wherein said means on said body for detachable supporting engagement with the discharge tube includes a base having an externally screw-threaded surface, said discharge tube having an adapter connected thereto having a screw-threaded socket for receiving the screw-threaded base of said body.

5. The structure as defined in claim 4 wherein said adapter has a discharge spout connected thereto, and a sealing gasket disposed between the adapter and the body for sealing the water flow path.

6. The structure as defined in claim 5 wherein said body being constructed of plastic material with oppositely disposed upwardly and downwardly tapering frusto-conical side wall portions, said lamp being disposed within the interior of the body and being substantially smaller in cross-sectional area for providing a relatively thick wall for the body to enable normal shrinkage thereof without damage to the lamp, the bottom surface of said body being substantially flat with the threaded base extending from the center thereof with the flat surface engaging said sealing gasket, said adapter having a recess in the surface thereof opposed to the flat surface of the body for receiving the opposite surface of the gasket for retaining the gasket in position and forming a seal between the body and adapter, the base and lower portion of the body being reinforced with fibrous material to strengthen the base and lower portion of the body, the upper portion of the body being completely transparent to enable observation of the lamp.

7. The structure as defined in claim 1 wherein said discharge tube is disposed within the confines of the demineralizer thereby retaining the peripheral wall of the demineralizer free of obstructions.

8. An end point quality indicator light for a water demineralizing system having a flow path comprising a body of transparent material, a lamp encapsulated in said body, electrical conductors extending into said body and being electrically connected with the lamp, resistance elements in each of said conductors and encapsulated in said body, a pair of electrodes partially encapsulated in said body and partially projecting therefrom for positioning in the water flow path, said electrodes being electrically connected with the lamp, conductors and resistance elements to retain the lamp illuminated until the conductivity of the water engaging the electrodes reaches a predetermined point, and means on said body for detachably and sealingly mounting the body in relation to the flow path with the electrodes in the water flow path.

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