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DRAW-OFF COCK AND TEMPERATURE COMPENSATED CONDUCTIVITY CELL FOR DISTILLED WATER

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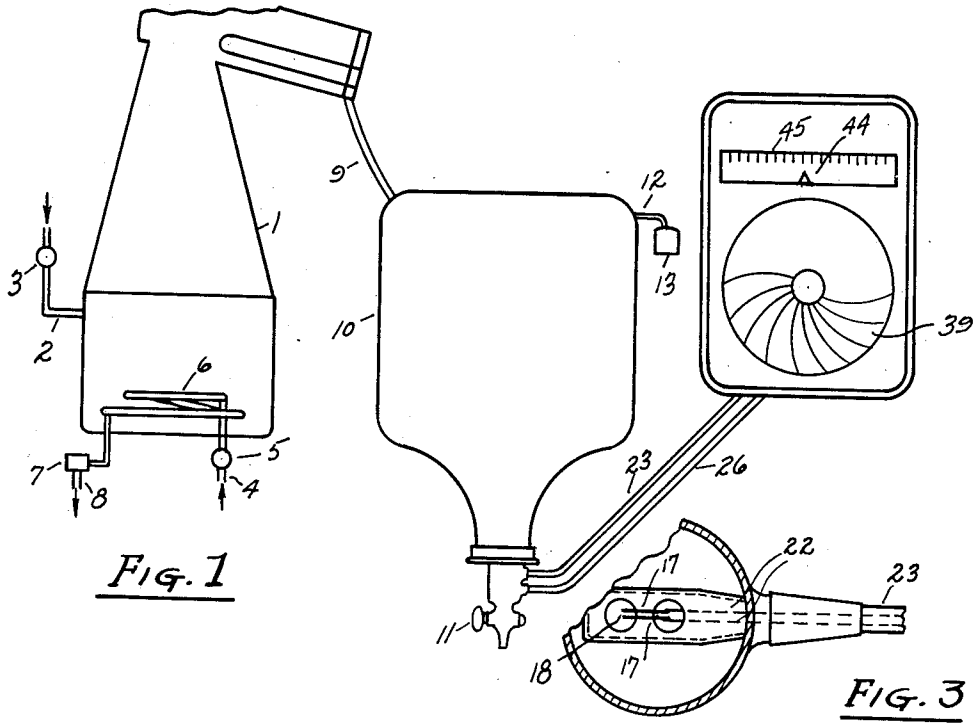


FIG. 1

FIG. 3

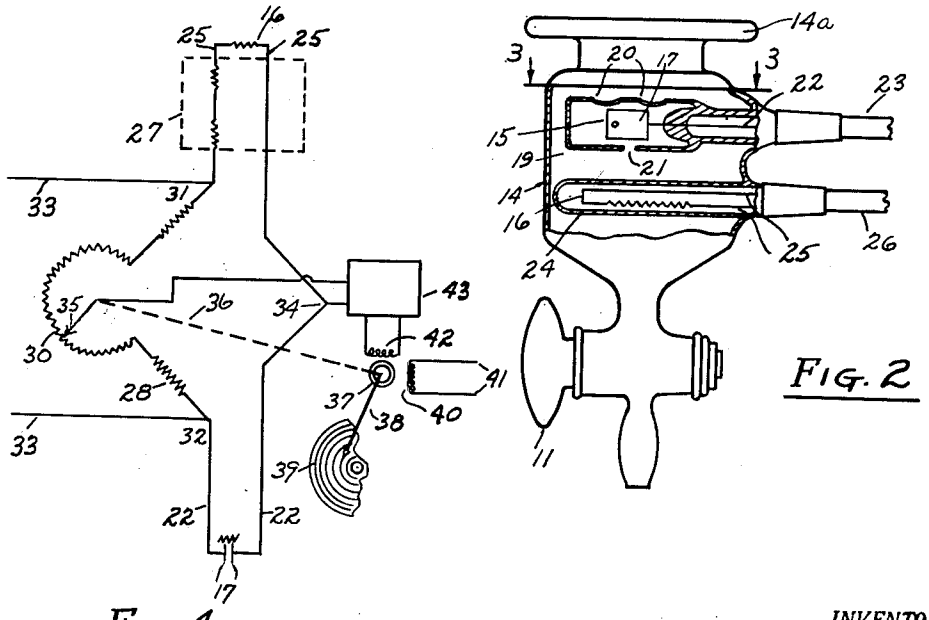


FIG. 4

FIG. 2

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DRAW-OFF COCK AND TEMPERATURE COMPENSATED CONDUCTIVITY CELL FOR DISTILLED WATER

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1 Claim. (Cl. 175—183)

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It is important that distilled water for medical purposes be of high purity and while water of such purity can be obtained by careful distillation, the purity is not long retained during storage because water dissolves chemicals from the glass storage bottles and carbon dioxide from the air. The resistance of the water is an indication of its purity, high specific resistance corresponding to high purity. Chemically pure water has a specific resistance of 6 megohms, but water of from 400,000 to 800,000 ohms specific resistance is of sufficient purity for most purposes. The specific resistance varies with termperature, and the actual resistance at any temperature must be corrected for temperature variation.

This invention is intended to provide the user with an indication of the purity of water being withdrawn for use from a still or storage bottle. Features include the incorporation of a conductivity cell and a temperature compensating resistance in the draw-off cock so the user can be sure that the water withdrawn for use is of the required purity and can discard any water which is of less than the required purity. Further objects and advantages appear in the specification and claim.

In the drawing, Fig. 1 is a diagrammatic view of a distilled water system; Fig. 2 is an enlarged view, partly in section of the draw-off cock; Fig. 3 is a section on line 3—3 of Fig. 2; and Fig. 4 is a control diagram for the bridge.

In the drawing, 1 diagrammatically indicates a still, 2 being the water supply controlled by a valve 3, and 4 being the steam line controlled by a valve 5 and supplying steam to a heating coil 6 submerged in the water and draining through a trap 7 to a drain line 8. The output of distilled water from the still flows through a tube 9 into the upper end of a storage bottle 10 having a draw-off cock 11 at the bottom. A breather tube 12 provided with an air filter 13 prevents contamination of the water. The parts so far described are or may be of conventional construction.

Despite the precautions taken to obtain water of high purity from the still, impurities are picked up so that the water stored in the jar 10 gradually looses its purity. It is not enough to know that water of the required purity is being discharged through the tube 9 from the still output. There is a possibility that residual water stored in the jar 10 may be contaminated so that the water taken off from the draw-off cock may be of lesser purity than that delivered by the still. The problem of insuring the delivery of water of

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the required purity from the draw-off cock 11 is further complicated by the fact that the water varies substantially in temperature depending upon whether the water has been stored for a substantial time in the jar 10 or whether it has been practically delivered direct from the still. Since the resistivity of the water varies substantially with temperature, approximately 10,000 ohms per degree F., it will be appreciated that a substantial difference in actual resistivity of the water taken from the draw-off cock 11 can be obtained in actual practice.

In the present invention, the draw-off cock 11 has directly above it a chamber 14 containing a water conductivity cell 15 and a temperature compensating resistance 16. The draw-off cock and chamber comprise a unitary assembly which is connected by a coupling 14a to the distilled water supply. The conductivity cell comprises spaced platinum electrodes 17 which are accurately spaced apart by a glass spacer 18. The plates 17 are housed in a glass chamber or well 19 having relatively large inlet openings 20 in the top and a small drain opening 21 in the bottom. With water stored in the bottle 10 the electrodes 17 are always surrounded and in full contact with the fluid. However, on occasion the cock may be opened and water drawn directly from the flow from the still. The purpose of the small drain opening in the bottom is to insure that the chamber 19 is always full of water even though the rate of draw-off of water from the draw-off cock 11 exceeds the rate of delivery of water by the still. This means that the plates 17 are always fully submerged in water whenever the still is operating, even though the draw-off cock 11 is wide open and of greater capacity than the supply. The chamber 19 is sealed into the side wall of the chamber 14 and the actual resistance between the spaced plates 17 appears across leads 22 which extend outside the chamber to a conductor cord 23. By this location of the conductivity cell 17, all of the water flowing out the draw-off cock, or at least a representative sample of such water, flows between the plates 17 so that the resistance between the plates is an indication of the purity of the water. Directly below the conductivity cell 17 is located the temperature compensating resistance 16 which is encased in a glass envelope 24 filled with a suitable heat transfer liquid so that the temperature of the resistor 16 quickly responds to the temperature of the water flowing over the outside of the envelope 24. The resistor 16 has leads 25 connected to a conductor cord 26. Satisfactory tempera-

ture compensating resistors 16 are available under the trade name "Thermistor."

The measurement of the actual resistivity of the water flowing between the plates 17 and the compensation of the actual resistivity for the temperature of the water is obtained by the use of a bridge in which the conductivity cell 17 constitutes one arm, the temperature compensating resistance 16 together with a network 27 constitutes another arm and the remaining two arms of the bridge comprise fixed resistors 28 and 29 connected by a slide-wire resistance 30. Power is supplied to the end terminals 31 and 32 of the bridge from a power line 33. The error signal appears across the mid-terminals 34 and 35, the terminal 35 being a contact on the slide-wire 30 connected by a drive shaft 36 to a motor 37. The motor 37 also is connected to drive a pen arm 38 cooperating with a recording chart 39 so that the position of the pen arm 38 corresponds to the position of the slide-wire contact 35. The motor 37 is conveniently a two-phase motor having one field winding 40 connected to a power supply 41 and the other fielding winding 42 connected through an amplifier 43 to the terminals 34 and 35 across which the error signal appears. As the resistance of the water flowing between the plates 17 changes and the resistance of the temperature compensating resistance 16 changes, the error signal appearing across the terminals 34 and 35 causes the motor 37 to rotate in the direction to bring the bridge into balance. This balance point is determined by the position of the slide-wire contact 35 and appears on the recording chart 39 by the position of the pen arm 38. The details of the operation of such a bridge are well-understood and are only diagrammatically illustrated. A suitable bridge is available under the trade name "Bristol Dynamaster."

Since the resultant position of the pen arm 38 and of the slide wire contact 35, which always occupies a corresponding position, depends upon both the resistance between the plates 17 of the conductivity cell and the resistance of the temperature compensating resistance 16, the resultant indication of the pen arm corresponds to the actual resistance of the water between the plates 17 compensated for the temperature of the water as reflected in the resistance of the temperature compensating resistance 16. The position of the pen arm 38 accordingly corresponds to the resistance or purity of the water corrected for variations in temperature.

In the use of the device, the operator can see by the position of the pen arm the purity of the water directly at the draw-off cock 11. If the storage jar 10 has been standing for some time without any water being drawn off, it may be that the water will have dissolved chemicals so that it will not be of the required purity. As the draw-off cock is opened, the operator has a continuous indication of the purity of the water flowing out the cock and if the water rises to the required purity, it may be used. This permits the operator to discard water of less than the required purity and to at all times know that the water being taken out of the draw-off cock is the required purity.

The device is very convenient to use since the temperature compensating resistance 16 responds quickly to the temperature of the water and the motor 17 always maintains the bridge at or near the balance point so that the position of the pen arm 38 reliably indicates the purity of the water being drawn off. The human element is eliminated since no adjustment need be made. The information given is not only how well the still is operating, but what purity water is actually being withdrawn for use. This prevents the inadvertent use of impure water due to long storage in the jar 10 or contamination of the filter 13 or for any other reason.

While the recording chart 39 is desirable in order that a continuous record may be kept for control purposes, for the convenience of the operator, an indicating pointer 44 cooperating with a scale 45 is provided. It is usually more convenient for the operator to observe the pointer 44 rather than to read the chart 39.

The apparatus is useful for other liquids, for example saline solutions, where conductivity is a measure of quality or purity or concentration.

What is claimed as new is:

A combined draw-off cock and temperature compensated conductivity cell for distilled water comprising a chamber having at its upper end a coupling for connection to a distilled water supply and at its lower end a draw-off cock whereby all of the water drawn off passes through the chamber, a glass well in the chamber in the path of the flow of water through the chamber, said well having an inlet at the top and a drain at the bottom, spaced electrodes in the well for measuring the conductivity of the water, a glass envelope in the chamber directly below the well, so the water being drawn off flows over the outside of the envelope, a temperature compensating resistance in the envelope, and a heat transfer liquid within the envelope, said temperature compensating resistance balancing the change in resistance of the water between the electrodes so that a measuring instrument connected to the electrodes and to the compensating resistance measures the conductivity of the water compensated for variations in temperature.

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