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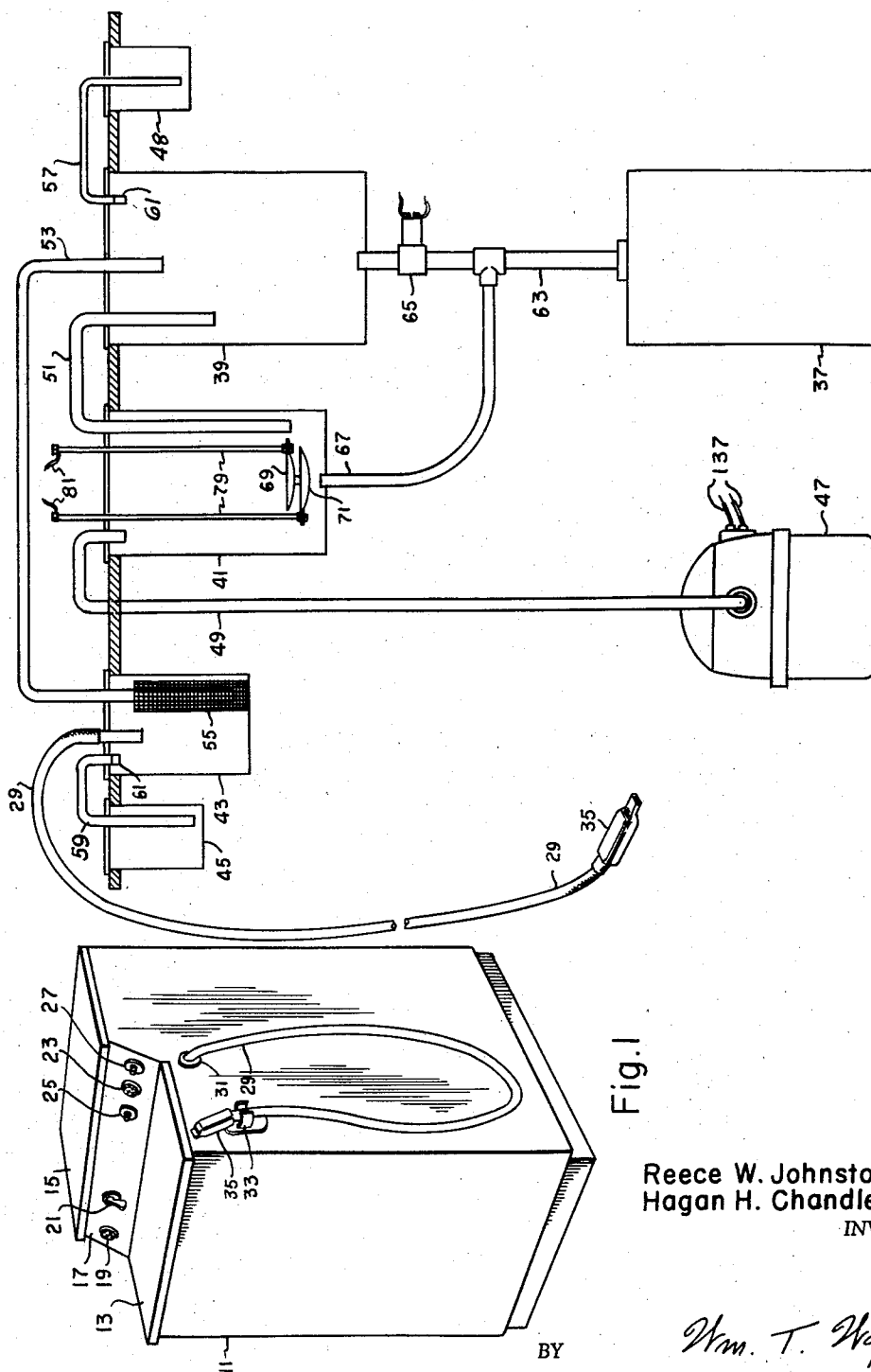
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DENTAL VACUUM APPARATUS

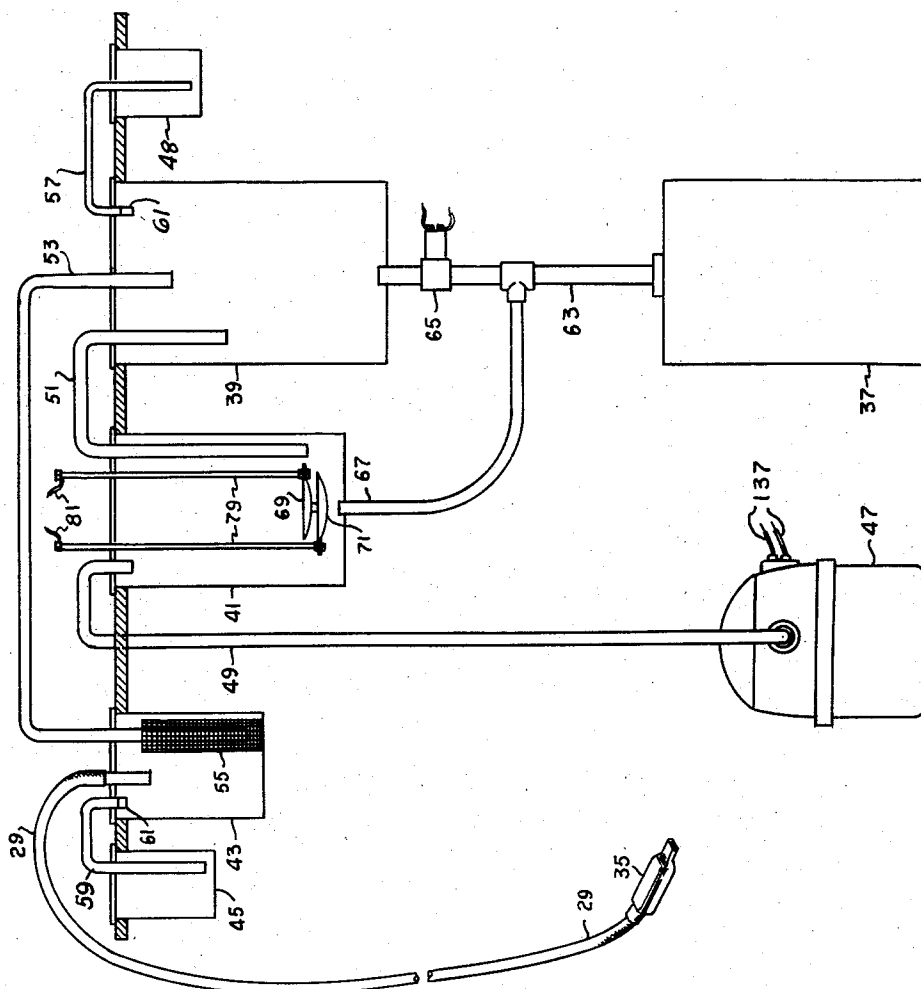
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2 Sheets-Sheet 1



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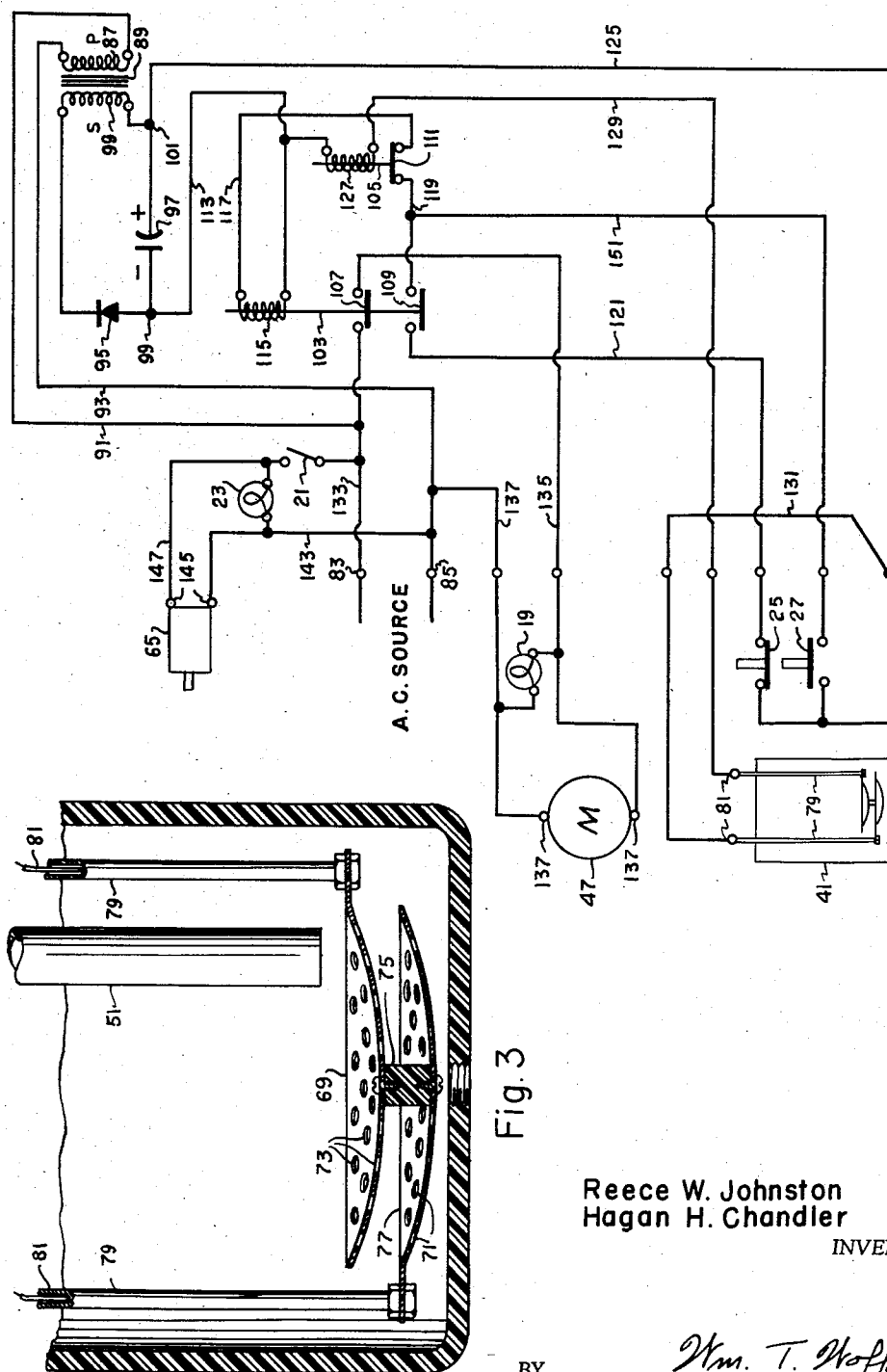


Fig. 3

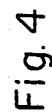
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1

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DENTAL VACUUM APPARATUS

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6 Claims. (Cl. 32—33)

Our invention relates to dental vacuum apparatus of the large air volume low vacuum type designed for effectively removing and storing waste material and fluid from the mouth of a patient during dental operations.

Broadly stated, it is the object of our invention to provide improved dental vacuum apparatus of the type above mentioned.

Another object of our invention is to provide improved and effective means for deodorizing the vacuum system.

Another object of our invention is to provide means for automatically cleaning certain of the vessels of the vacuum system.

Another object of our invention is to provide an improved fluid responsive safety shut-off arrangement for the vacuum system.

Another object of our invention is to provide an improved arrangement to prevent clogging of the vacuum system.

Another object of our invention is to provide an improved electrode arrangement for a fluid responsive switch.

These and other objects are effected by our invention as will be apparent from the following description taken in accordance with the accompanying drawings, forming a part of this application, in which:

Fig. 1 is a schematic perspective view showing a cabinet housing for the dental vacuum apparatus of our invention;

Fig. 2 is a schematic diagram showing the arrangement of a dental vacuum system incorporating our invention;

Fig. 3 is an enlarged partial section view showing details of electrodes of a liquid level cut-off device in accordance with our invention; and

Fig. 4 is a schematic circuit diagram of the electrical system of dental vacuum apparatus in accordance with our invention.

The cabinet 11 shown by Fig. 1 is an upright rectangular box-housing having a split level top surface comprising a front shelf 13 and an elevated rear shelf 15, with a control panel surface 17 sloping upwardly and rearwardly from the rear of the front shelf to the front of the rear shelf. At the left side of the control panel is a first indicator light 19 and a first control switch 21, and at the right side is a second indicator light 23 flanked by second and third control switches 25, 27, the functions of which will be hereinafter explained. A vacuum pick-up flexible conduit 29 extends outside a cabinet from an opening 31 in the cabinet right side, and its free end portion is removably received by a hanger bracket 33 mounted on the same side of the cabinet. The free end of the pick-up conduit is equipped with a conventional appropriately shaped end fitting 35. It is understood that a double pick-up conduit may be used if desired. The system comprises a plurality of closed containers which are herein denominated the storage 37, collector 39, liquid level cut-off 41, gold trap 43, isotonic solution 45, and detergent-deodorant 48, respectively. The containers are preferably, though not necessarily cylindrical in shape

2

and made of heavy plastic material. The cabinet 11 is provided with an inner horizontal partition (not shown) at a level just below the pick-up conduit opening 31. All of the containers except the storage container are suspended from openings in the horizontal shelf. The storage container 37 is mounted on the floor of the cabinet 11 directly beneath the collector container 39 and is arranged to be easily removable for emptying. Also mounted on the cabinet floor is a vacuum pump 47, which is in the form of a centrifugal blower driven by an electric motor designed to produce high volume air flow and a vacuum up to approximately five inches of mercury. Also enclosed by the cabinet are the various components of the electric control system. Tracing the vacuum system from the pump 47, there is a first conduit 49 extending from the pump upward through the horizontal partition, over, and into the liquid level cut-off container 41, terminating near the top of the said container. A second conduit 51 extends from near the bottom of the liquid level cut-off container 41 upward through its top, over and down into the collector container 39, terminating just above the center level of said container. A third conduit 53 extends from a point above the termination of the second conduit 51 in the collector container 39 up through its top, over and down into the gold trap container 43, terminating near the bottom thereof. The pick-up conduit 29 terminates inside the gold trap container 43 near its top. A gold trap filter which is a fine mesh screen in the shape of a cylinder closed at the lower end, and is removably placed over the end of the third conduit 53 which extends down into the gold trap container 43. A fourth conduit 57 extends from just inside the collector container up and over and down into the detergent-deodorizer container 48, terminating adjacent the bottom of the latter. A fifth conduit 59 extends from just inside the gold trap container 43 to an isotonic solution container 45, terminating adjacent the bottom of the latter. The fourth and fifth conduits are each provided with a plug 61 at the collector container and isotonic solution container ends, respectively, which plug 61 has a small opening therein for a purpose to be hereinafter described. A first drain conduit 63 communicates between the bottom of the collector container 39 and the top of the storage container 37. A solenoid valve 65 is interposed in the drain conduit 63 just below the collector container. A second drain conduit 67 communicates between the bottom of the liquid level cut-off container 41 and the first drain conduit 63 below the solenoid valve 65. Suitable sizes for the containers would be about 1 gallon for the collector and storage containers, 1 quart for the liquid level cut-off and gold trap containers, and 1 pint for the detergent-deodorizer and isotonic solution containers. All containers are, of course, suitably sealed at the top to maintain the vacuum. The conduit material is preferably thin walled plastic. Conduit fittings, not specifically shown, in the form of suitable L's and T's, are also preferably plastic. The liquid level cut-off container 41 is provided with a pair of electrodes 69, 71 (see Fig. 3), each in the form of a circular concave dish having perforations 73 therein. The electrodes are held in parallel spaced relation by a small spacer cylinder 75 of plastic insulating material which is disposed between the electrodes at their center. Each electrode is fixed to an end of the spacer by a small screw. The electrodes 69, 71 are disposed with their concavity apex downward. Each electrode is provided with a lip 77 at its outer edge portion to which an electrode support 79 is fixed. Each electrode support is a plastic conduit which extends upward and out of the top of the container 41, and is fixed to the container top. The electrode lead 81 is carried inside the electrode support con-

duit. Electrodes are preferably spaced about $\frac{3}{8}$ inch apart.

The electrical system for the dental vacuum apparatus of our invention is shown by Fig. 4. Conventional 110 volt commercial line power is made available from a source (not shown) at input terminals 83, 85. Line power is connected in series with the primary winding 87 of a step down transformer 89 via leads 91, 93. A rectifier 95 and a smoothing capacitor 97 are connected in series with the secondary winding 99 of the transformer, thus providing a direct current power source of approximately twenty-four volts at the capacitor terminals 99, 101. The direct current source provides power for a pair of motor control solenoid relays, herein referred to as the motor "on" and the motor "off" relays 103, 105 respectively. The motor "on" relay 103 is provided with a pair of normally open contacts, termed the motor "on" contact 107 and the interlock contact 109, respectively. The motor "off" relay 105 has a single normally closed contact 111. A circuit may be traced from one terminal 99 of the direct current source via lead 113 in series with the motor "on" relay coil 115, via lead 117, through the contact 111 of the motor "off" relay 105, via lead 119 through the interlock contact 109 of the motor "on" relay 103, via lead 121 through a normally closed single pole push button switch 25, and via lead 125 back to the other terminal 101 of the D.C. source. Another circuit may be traced from the negative terminal 99 of the D.C. source via the lead 113 in series with the motor "off" relay coil 127, via lead 129 in series with the electrode terminals, and via lead 131 and 125 back to the positive terminal 101 of the direct current source. Another circuit may be traced from one terminal 83 of the alternating current source via lead 133 through the motor "on" contact 107 of the motor "on" relay 103, via lead 135 in series with the motor terminals 137, and via lead 139 back to the other terminal 85 of the alternating current source. A motor "on" indicator light 19 is connected across the motor terminals 137. Another circuit may be traced from one terminal of the alternating current source 85 via lead 143 in series with the drain solenoid terminals 145, via lead 147 through the drain solenoid single pole switch 21, and back to the other terminal 83 of the alternating current source. A drain solenoid "on" indicator light 23 is connected across the terminals 145, of the drain solenoid 65. Another circuit may be traced from the positive terminal 101 of the direct current source via lead 125 in series with the normally open push button switch 27, via lead 151 in series with the contact 111 of the motor "off" relay 105, via lead 117 in series with coil 115 of the motor "on" solenoid 103 and via lead 113 back to the negative terminal 99 of the direct current source.

In operation the vacuum pump motor 47 is energized by momentarily depressing the motor "on" push button switch 27, which energizes the motor "on" solenoid 103, closing the motor circuit and also locking the motor "on" solenoid in the energized state through the interlock contact 109. The vacuum system is now in operation and fluid picked up from the patient's mouth is drawn into the gold trap container 43, and any particles of gold or other precious metals or debris that may be picked up are trapped in the container. The gold trap screen 55 prevents particles from leaving the gold trap, and also prevents clogging of the vacuum system. The gold trap container is kept practically empty by drawing of the fluid via the third conduit 53 into the collector container 39. The collector container may be periodically emptied into the storage container 37 by merely closing the drain solenoid switch 21. Should the liquid level rise to the level of the termination of the second conduit 51 in the collector container 39, it will then be drawn into the liquid level cut-off container 41, and when it reaches the level of the upper electrode 69 in the liquid level cut-off container, the electrodes will act

as a switch closing the circuit to energize the motor "off" solenoid 105 which will open its contact 111 to open the motor circuit and shut down the vacuum system. When automatically shut down by action of the liquid level cut-off device, the system may again be started only by depressing the motor "on" button 27, and then only if sufficient liquid has been removed from the liquid level cut-off container 41. It should be noted that the liquid level cut-off container is provided with a continuously open drain line 67 to the storage container 37. The size of this drain line is made such that liquid will drain at a slower rate than it is drawn into the liquid level cut-off container, so that the liquid level will rise in the liquid level cut-off container and yet when the vacuum system is shut-down, will quickly and automatically drain so that the system may be turned on again immediately after the collector container has been drained. When the system is on and operating normally, it may be turned off by simply depressing the motor "off" push button switch 25, which opens the circuit of the motor "on" solenoid 107.

The structure and arrangement of the electrodes in the liquid level cut-off container is quite advantageous. In prior art arrangements, difficulty has been experienced first in achieving reliable and positive liquid level cut-off action, and secondly in rapidly returning the electrodes to the normal state to allow the system to be restarted immediately after being shut down by the liquid level cut-off device. Both of these difficulties have been obviated by the arrangement of our invention. Another important feature of our invention is the detergent-deodorizer arrangement. The detergent-deodorizer container 48, as the name implies, carries a solution containing both a detergent and a deodorizing agent. This solution is drawn into the collector container 39 by action of the vacuum through the small opening in the plug 61 hereinbefore mentioned. The solution is drawn into the liquid level cut-off container 41 when it is active, and is passed into the storage container 37 through the drain conduits. The action of the vacuum air flow in the collector container and the liquid level cut-off container produces a scouring action causing the detergent to effectively maintain both of these containers in a state of cleanliness such that they seldom need to be removed. It is to be understood that if desired the detergent and the deodorizing agent could be drawn independently from separate containers. The purpose and function of the isotonic solution container is to provide a constant small supply of isotonic solution in the gold trap container to dissolve blood clots which would otherwise tend to clog the vacuum system. It should be noted that the gold trap screen 55 extends up high on the third conduit 53 and has some side clearance, which insures free flow of air even when the screen is clogged and also prevents particles from getting inside the screen.

Although we have shown our invention in only one form it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various changes and modifications without departing from the spirit thereof.

We claim:

1. Dental vacuum apparatus comprising a gold trap container, a collector container, a liquid level cut-off container, and a storage container, each said container being sealed substantially vacuum tight, a high volume air flow low vacuum type pump, an air conduit connecting said pump to said liquid level cut-off container, an air conduit connecting said liquid level cut-off container with said collector container in such manner that the fluid will be drawn into said liquid level cut-off container after it reaches a predetermined level in said collector container, an air conduit connecting said gold trap container with said collector container in such manner that the gold trap container will be maintained at a low fluid level, a flexible

5

pick-up air conduit connected to said gold trap container, means for selectively draining said collector container into said storage container, and means for draining said liquid level cut-off container into said storage container.

2. Dental vacuum apparatus comprising a gold trap container, a collector container, a liquid level cut-off container, a storage container, and a detergent-deodorizer container, each said container being sealed substantially vacuum tight, a high volume air flow low vacuum type pump, an air conduit connecting said pump to said liquid level cut-off container, an air conduit connecting said liquid level cut-off container with said collector container in such manner that fluid will be drawn into said liquid level cut-off container after it reaches a predetermined level in said collector container, an air conduit connecting said gold trap container with said collector container in such manner that the gold trap container will be maintained at a low fluid level, a flexible pick-up air conduit connected to said gold trap container, an air conduit connecting said detergent-deodorizer container with said collector container, means for selectively draining said collector container into said storage container, and means for draining said liquid level cut-off container into said storage container.

3. Dental vacuum apparatus comprising a gold trap container, a collector container, a liquid level cut-off container, a storage container, and an isotonic solution container, each said container being sealed substantially vacuum tight, a high volume air flow low vacuum type pump, an air conduit connecting said pump to said liquid level cut-off container, an air conduit connecting said liquid level cut-off container with said collector container in such manner that fluid will be drawn into said liquid level cut-off container after it reaches a predetermined level in said collector container, an air conduit connecting said gold trap container with said collector container in such manner that the gold trap container will be maintained at a low fluid level, a flexible pick-up air conduit connected to said gold trap container, an air conduit connecting said isotonic solution container with said gold trap container, means for selectively draining said collector container into said storage container, and means for draining said liquid level cut-off container into said storage container.

4. Dental vacuum apparatus comprising a high volume air flow low vacuum type pump, a fluid collector container sealed to be substantially vacuum tight, air conduit means connecting said pump with said collector container, a fluid

6

pick-up device, a substantially vacuum tight gold trap container, air conduit means connecting said device with said gold trap container, air conduit means connecting said gold trap container with said collector container, a substantially vacuum tight auxiliary container for isotonic solution, and air conduit means connecting said auxiliary container with said gold trap container.

5. Dental vacuum apparatus comprising a high volume air flow low vacuum type pump, a substantially vacuum tight fluid collector container, a substantially vacuum tight storage container, a substantially vacuum tight liquid level cut-off container, a pick-up device, air conduit means connecting said pump with said liquid level cut-off container, air conduit means connecting said liquid level cut-off container with said collector container in such manner that fluid will be drawn into said liquid level cut-off container after it reaches a predetermined level in said collector container, air conduit means connecting said pick-up device with said collector container, means for selectively draining said collector container into said storage container, electrodes disposed in said liquid level cut-off container, and means for continuously draining said liquid level cut-off container into said storage container at a rate less than that at which fluid is drawn into said liquid level cut-off container.

6. Dental vacuum apparatus comprising a high volume air flow low vacuum type pump, a fluid collector container sealed to be substantially vacuum tight, air conduit means connecting said pump with said collector container, a fluid pick-up device, a substantially vacuum tight gold trap container, air conduit means connecting said gold trap container with said collector container and including a conduit portion extending down into said gold trap container and terminating adjacent the bottom of same; a gold trap filter screen having a closed bottom and side-walls conforming generally to the shape of the outer wall of said conduit portion, said filter screen resting on the bottom of said gold trap container and surrounding and spaced from said conduit portion over a substantial portion of its length in said gold trap container, a substantially vacuum tight auxiliary container for isotonic solution, and air conduit means connecting said auxiliary container with said gold trap container.

References Cited in the file of this patent

UNITED STATES PATENTS

1,209,846	Kells	Dec. 26, 1916
2,784,717	Thompson	Mar. 12, 1957