

March 12, 1957

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2,784,717

EVACUATIVE SUCTION APPARATUS

Filed Nov. 29, 1954

FIG. 1.

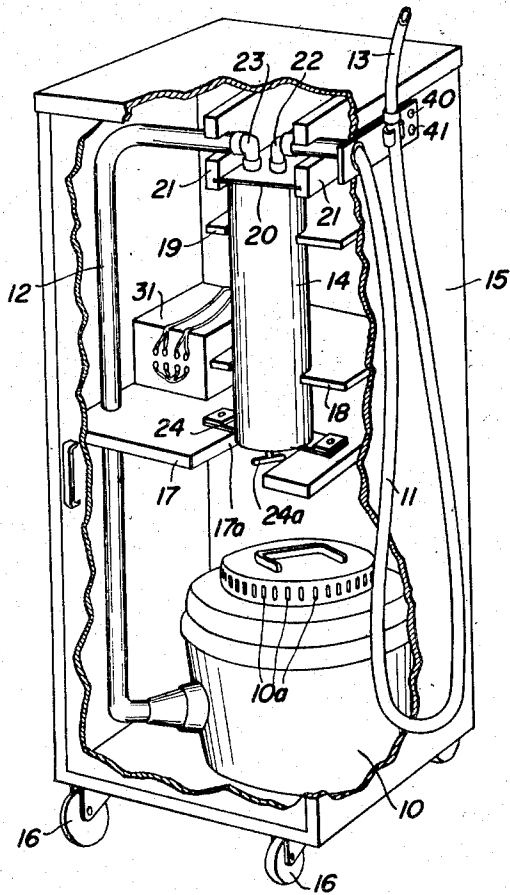


FIG. 2.

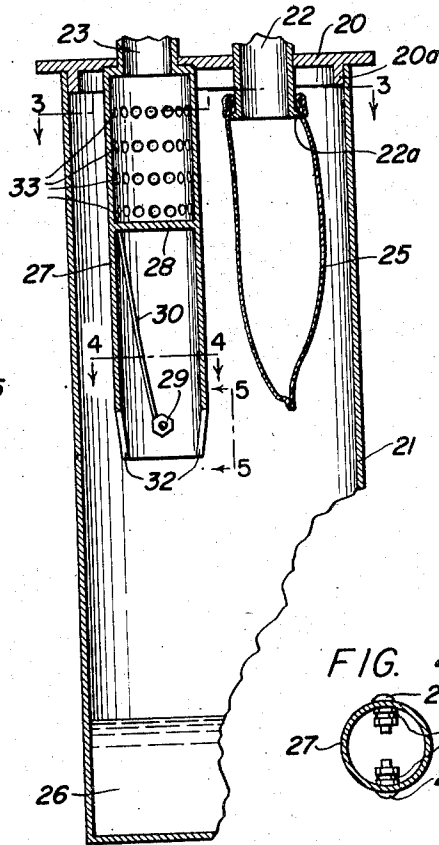


FIG. 4.

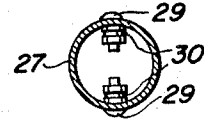


FIG. 3.

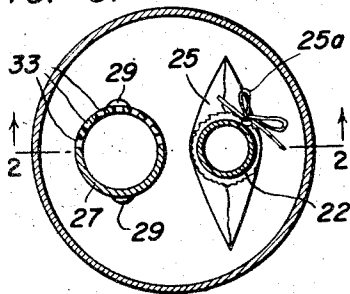


FIG. 5.

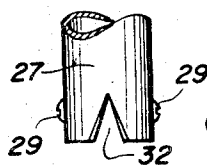
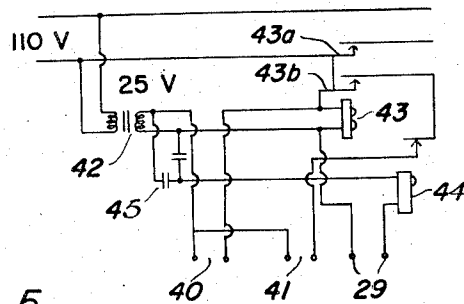


FIG. 6.



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EVACUATIVE SUCTION APPARATUS

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Application November 29, 1954, Serial No. 471,734

9 Claims. (Cl. 128-276)

This invention relates to apparatus useful for evacuative purposes, particularly in connection with medical and dental procedures.

In my copending application for U. S. patent Serial No. 411,510, filed February 19, 1954, and entitled "Method of Dentistry and Apparatus Therefor," I have disclosed a method and apparatus particularly applicable to routine dental work being carried out in the mouth of a patient, but also applicable to surgery generally. Such method involves application of a wash liquid to the operative field during the course of operative procedures, and the simultaneous withdrawing of a stream of air from the vicinity of such operative field in quantity and at a flow rate sufficient to entrain therein the applied wash liquid and accumulating debris, so as to evacuate the same and provide a visually clean working area for the dentist or surgeon during the course of the operation and relief for the patient from the debris which would otherwise accumulate.

My present invention concerns the apparatus utilized in the carrying out of the method, and constitutes an improvement in certain respects on the apparatus specifically set forth in my said copending application. It is also concerned with providing apparatus of a mobile nature requiring no rigid plumbing connections or other permanent installation tie-in with the establishment where used.

One of the improved features of the present apparatus is the provision of a flexible, perforate bag as the air filter means in the entrapment device interposed between the suction means and the fluid-conducting tube applied to the patient.

Another improvement resides in the provision of positive means for automatically shutting off operation of the apparatus if and when liquid in the entrapment device rises above a predetermined maximum level.

The mobile character of the present invention is achieved by the provision of a catch receptacle of considerable capacity as the entrapment device, the same being combined with a liquid-level-responsive control device of peculiarly effective character.

Thus, principal objects of this present invention are to provide structural improvements in my original apparatus, making for more efficient operation and less likelihood of mechanical troubles; and to provide for mobility and convenience in the installation and use of the apparatus.

Further objects and structural and functional features of this invention will become apparent from the following detailed description of the particular preferred embodiment illustrated in the accompanying drawing.

In the drawing:

Fig. 1 represents a view in perspective of the apparatus assembled in a readily mobile cabinet for positioning as desired adjacent a dental chair, surgical operative table, or other location where its use is desired, portions of the door and of the top wall and one of the side walls of

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the cabinet being broken away to reveal the construction and relative placement of the working components of the apparatus;

Fig. 2, a detail view in central longitudinal section taken through the catch receptacle and associated structure of Fig. 1 (see the line 2-2, Fig. 3), the view being drawn to a greatly enlarged scale;

Fig. 3, a detail view in horizontal section taken on the line 3-3 of Fig. 2;

Fig. 4, a similar view taken on the line 4-4 of Fig. 2;

Fig. 5, a detail view in elevation taken on the line 5-5 of Fig. 2; and

Fig. 6, a wiring diagram showing the electrical control circuit for the automatic shut-off means.

Referring now to the drawing:

In accordance with the disclosure of my aforementioned copending application Serial No. 411,510, the evacuative suction apparatus includes a suction power unit 10; fluid-conducting tube means, comprising a flexible hose 11 and a conduit 12, serving to connect an intake nozzle 13 with the suction power unit 10; and a liquids and solids entrapment device, here embodying a catch receptacle 14, interposed between the hose 11 and the conduit 12.

It is advantageous that the suction power unit 10 and the catch receptacle 14, together with their appurtenant devices, be housed within a cabinet 15, which may be provided with caster wheels 16 to facilitate movement of the entire apparatus from place to place in the dental office as required.

For the sake of convenience in mounting, and in emptying as is required from time to time, the catch receptacle 14 is firmly but removably mounted in position within the cabinet 15 by means of a shelf 17 and spaced shelf-like supports 18 and 19, the latter being recessed, as indicated, to snugly receive the receptacle.

The receptacle 14 is conveniently formed of a plastic or other suitable material in elongate cylindrical form having its upper end open. A close fitting cover 20 is rigidly secured in spaced brackets 21 overhanging the receptacle-receiving shelf 17 and supports 18 and 19. Elbow pipe fittings 22 and 23 pass through cover 20 in fixed relationship therewith, as indicated in Fig. 2, providing connections for the hose 11 and conduit 12, respectively. Such hose and conduit, together with their respective connection fittings, are accommodated by appropriate recesses in the brackets 21.

The catch receptacle 14 is adapted to be slipped into place under its fixed cover 20, and, to facilitate installation and removal relative to the depending circular flange 20a of such cover, see Fig. 2, the shelf 17 is deeply recessed, as at 17a, and a pivoted spanning element 24, provided with a clamping screw 24a, is employed as a direct support for the bottom of the receptacle.

It is the purpose of the catch receptacle 14 to relieve the flow of evacuated air of as much of the entrained liquids and solids as possible, without interrupting the continuity of air flow, and to retain such removed materials pending periodic emptying of the receptacle.

Both for the purpose of conveniently salvaging valued materials, such as precious metals, and for cushioning the blast of the incoming air flow, it is desirable to install a closed filter bag 25 of suitable porous fabric or the like, for example, cotton flannel, over the end of connection fitting 22. While solids are caught in the bag, air and liquid pass freely therethrough, the liquid collecting as a body 26 at the bottom of the receptacle, and the thus cleansed air passing out through connection fitting 23 into and through the discharge conduit 20 and into and through suction power unit 10, to an ultimate discharge through exit openings 10a of such power unit.

The filter bag 25 is advantageously equipped with a

drawcord 25a about its open mouth, and the lower end of the fitting 22 is preferably flanged outwardly, as indicated at 22a, in order to simplify removal and replacement of such filter bag and to insure that it remains securely in place during the operation of the apparatus.

I have found it advantageous to provide for automatically shutting off the suction power unit when the liquid 26 in the receptacle rises to a predetermined level, and, furthermore, to provide for guarding against too great humidity of the air passing out of the receptacle, and have accomplished both of these purposes by a device 27 installed over the entrance to outflow fitting 23.

As illustrated in Fig. 2, the device 27 preferably takes the form of an elongate hollow cylinder, divided intermediate its length by a partition 28. Below the partition, the tube is open; and a pair of binding posts 29 are provided adjacent the open bottom. Connected to such binding posts, internally of the tube, are respective electrical leads 30, which pass through walls of catch receptacle 14 and make suitable electrical connection, conveniently at a junction box 31, Fig. 1, with electrical relay means or other suitable arrangement for controlling the supply of current to the motor of the suction power unit 10.

The binding posts 29 serve as electrodes, and the lower end of tube 27 is notched, as at 32, to provide positive access of the body of water 26 to such electrodes as it rises about the lower end of the tube. The control circuit embodying the two leads 30 is constructed and arranged in any suitable manner, for example, as shown in the wiring diagram of Fig. 6, so that completion of the circuit across the electrodes 29, by means of the rising body of water 26, will cut off the supply of current to the motor of the suction power unit.

Above the partition 28, the tube 27 is perforated by a multitude of relatively small openings 33, providing shielded and diffused access to the discharge conduit 12 for the air passing into the receptacle 14 by way of the evacuative hose 11.

It will be observed that the filter bag 25 cushions the blast of debris-carrying air entering the catch receptacle 14, and acts, in effect, as a diffuser therefor.

The outlet tube 27, closed as it is except for the perforations 33, provides for diffused outflow of cleansed air from the interior of catch receptacle 14, thereby inhibiting to a considerable extent the formation of strong eddy currents and other undesirable turbulence within the catch receptacle. Such shielded and diffused outflow provided by tube 27 also tends to minimize the amount of moisture carried by the cleansed, outflowing air.

The suction power unit 10 is advantageously a powerful turbine type of air-motivating blower or fan, such as is embodied in certain modern vacuum cleaners, all as set forth in my said copending patent application.

A preferred control circuit for suction power unit 10 is illustrated by the wiring diagram of Fig. 6, wherein manually actuated, on-and-off, push-button switches 40 and 41, respectively (see also Fig. 1), are so arranged as to enable the suction power unit to be turned on and off at the will of the operator.

The suction power unit is supplied with electrical current from the customary 110 volt line, as indicated. The control circuit is supplied with a lower voltage through step-down transformer 42. A double-pole, normally open, control relay 43, connected in the control circuit, has one of its poles 43a interposed in the electrical supply line, and its other pole 43b interposed in an auxiliary circuit comprehending the spaced electrodes 29 and an especially sensitive, normally closed relay 44. A rectifier condenser 45 supplies the auxiliary circuit with direct current, which enables the spaced electrodes 29 to effectively exercise a control function in closing the auxiliary circuit when the body of liquid 26 within catch receptacle 14 has risen too high.

The inverted V-shaped notches 32 at the lower end

of tube 27 insure proper electrical interconnection of the electrodes 29 as the level of the body of liquid in the catch receptacle rises to control-exercising height during operation of the apparatus. Thus, the system is protected from flooding by waste liquid accumulating in the catch receptacle.

While the filter bag arrangement and the automatic cut-off are particularly advantageous for the manually emptied catch receptacle 14 of the presently disclosed mobile apparatus, it should be realized that they may also be advantageously employed with the more permanent type of installation shown specifically in my earlier-filed and presently copending application Serial Number 411,510, afore-referred-to. Under such circumstances, the filter bag replaces the filter arrangement 53-55 in the catch receptacle 21, and appropriate changes are made in the air-outflow arrangement of such receptacle for accommodating the outflow tube 27, here shown.

Whereas this invention is here illustrated and described with respect to a particular preferred construction, it should be understood that various changes may be made without departing from the inventive concepts set forth herein and the scope of the claims which here follow.

I claim:

1. In evacuative suction apparatus which includes a suction power unit, fluid-conducting tube means leading into said suction power unit, and an entrapment device including a catch receptacle interposed in said tube means intermediate the length thereof; the combination with said entrapment device of control means including mutually spaced electrodes disposed at a predetermined upper level in said catch receptacle, for shutting off the power to said suction power unit when the body of liquid within said catch receptacle tends to exceed said predetermined level.

2. The combination recited in claim 1, wherein there is included a cabinet which houses the apparatus; wherein the catch receptacle comprises a cover securely mounted horizontally in said cabinet, and a receptacle proper which is removable and replaceable with respect to and under said cover; wherein the fluid-conducting tube means connects with the catch receptacle through said cover; and wherein means are provided for securing said receptacle proper in close-fitting relationship with and under said cover.

3. The combination recited in claim 2, wherein the securement means for the receptacle proper comprises a shelf in the cabinet below the normal installed position of the receptacle proper, and a hand screw clamping assembly supported by said shelf and operative in upwardly clamping relationship with respect to said receptacle proper.

4. The combination recited in claim 1, wherein the control means comprises a tube depending within the catch receptacle from an upper portion thereof, the upper end of said tube being open and having that portion of the fluid-conducting tube means which extends from the catch receptacle to the suction power unit connected thereto, the lower end of said tube being also open, and a partition being provided intermediate the length of said tube for dividing the lower portion thereof from the upper portion thereof, port means in the wall of the said upper portion of the tube establishing communication between the interior of said upper portion of the tube and the interior of said catch receptacle, the electrodes being secured to and spaced apart at the lower open end of said tube, and an electrical control circuit for supplying power to the suction power unit, said electrodes being connected into said control circuit for opening said circuit when electrically interconnected by liquid within said catch receptacle.

5. The combination recited in claim 4, wherein the electrodes are spaced upwardly from the lower open end of the tube, and wherein opposing notches are provided

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in the margin of the lower end of the tube, said notches lying between said electrodes and extending at least to the level thereof.

6. The combination recited in claim 1, wherein the entrapment device includes a filter for evacuated air entering the catch receptacle from the fluid-conducting tube means, said filter being disposed in side-by-side relationship with the control means.

7. The combination recited in claim 6, wherein the filter means is a removable and replaceable, porous bag.

8. In combination with evacuative suction apparatus which includes a suction power unit, fluid-conducting tube means leading into said suction power unit, and an entrapment device interposed in said tube means intermediate the length thereof; a catch receptacle forming part of said entrapment device, said tube means having an inflow connection and an outflow connection with

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said catch receptacle; and a removable and replaceable, porous bag attached to and covering the inflow opening of said inflow connection.

9. In evacuative suction apparatus which includes a suction power unit, fluid-conducting tube means leading into said suction power unit, and a catch receptacle interposed in said tube means intermediate the length thereof so that said tube means has an inflow connection and an outflow connection with said catch receptacle; the combination with said catch receptacle of a removable and replaceable porous bag attached to and covering the inflow opening of said inflow connection.

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