Jan. 23, 1962 E. O. THOMPSON 3,017,886

EVACUATIVE SUCTION APPARATUS

Original Filed July 18, 1955

FIG. 1.

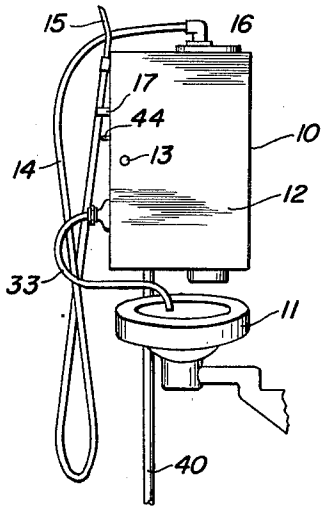


FIG. 2.

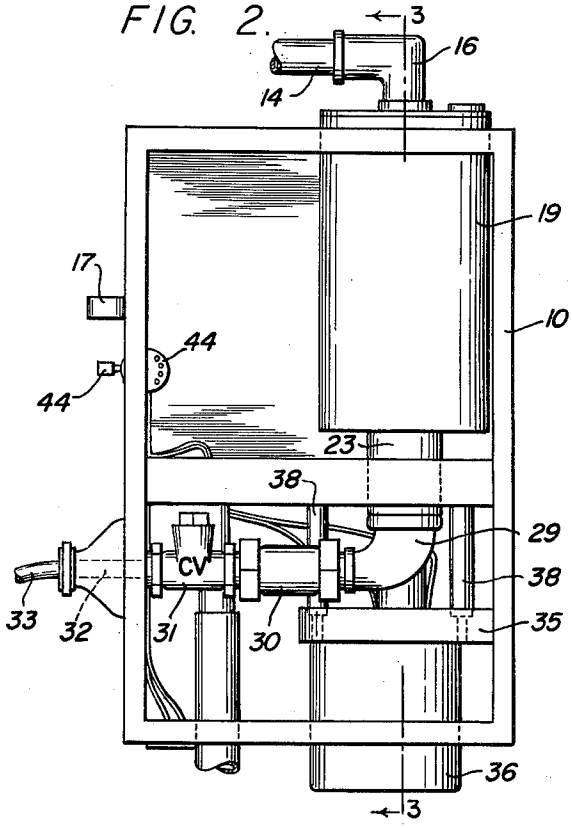


FIG. 3.

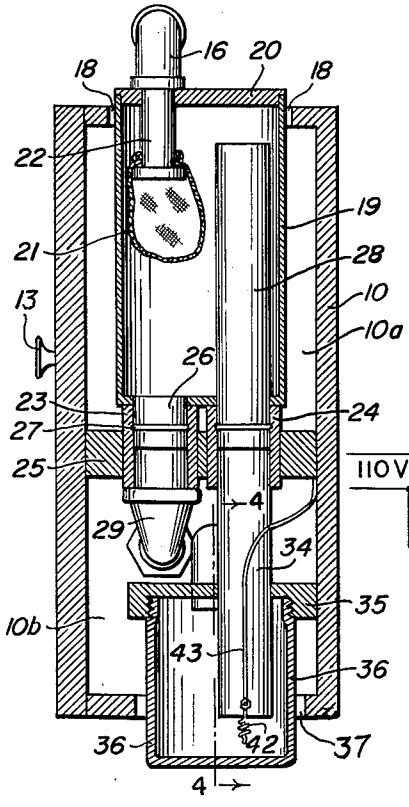


FIG. 4.

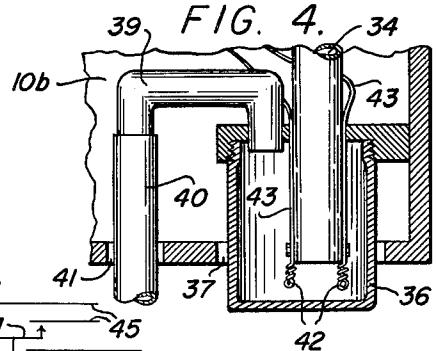
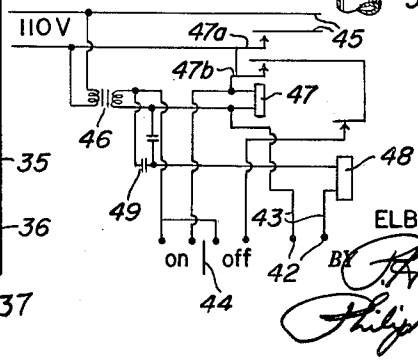


FIG. 5.



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EVACUATIVE SUCTION APPARATUS

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Continuation of application Ser. No. 522,590, July 18, 1955. This application Apr. 30, 1958, Ser. No. 736,654
14 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 many advantages for both doctor and patient. Among such advantages are the provision of 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.

In my copending application for U.S. patent Serial No. 471,734, filed November 29, 1954, and entitled "Evacuative Suction Apparatus," now patent number 2,784,717, I have disclosed improvements on the apparatus of my first-mentioned patent application, Serial No. 411,510, and have disclosed apparatus which is of a mobile nature requiring no rigid plumbing connections or other permanent tie-in with the establishment where used.

My present invention is directed toward further improvements in the apparatus, and is concerned especially with providing greater convenience of installation and maintenance, greater safety to working mechanism, and lower cost for both apparatus and installation.

One of the objects of the present invention is to provide for direct drainage of the liquid components of evacuative washings, while still effectively providing for automatic shut-off of the apparatus when there is danger of carrying liquid over into the suction fan unit.

Another object is to provide maximum safety against damage to component parts of the apparatus, with a minimum encumbrance of the working area and at minimum installation expense and inconvenience.

A novel structural feature resides in the provision of an auxiliary catch receptacle housing the shut-off control mechanism and serving as a supplemental trap for liquid carried by the evacuative air stream. Another novel feature, merely mentioned as a possibility in my first patent application, is the correlation of the evacuative system with a dental cuspidor for the purpose of handling drainage without the necessity of a plumbing connection.

These and other objects and features of the invention will be more fully discussed in connection with the particular preferred specific embodiment illustrated by way of example in the accompanying drawing.

In the drawing:

FIG. 1 represents a front perspective view of a major portion of the installation of the invention, showing the tie-in with a customary dental cuspidor;

FIG. 2, a front elevation drawn to an enlarged scale and showing the working mechanism of FIG. 1 as it appears with the door of the cabinet removed;

FIG. 3, a vertical section taken on the line 3—3 of FIG. 2;

FIG. 4, a fragmentary vertical section taken on the line 4—4 of FIG. 3; and

FIG. 5, a wiring diagram representing the shut-off control circuit.

Referring to the drawing:

For the sake of compactness and working convenience, the suction fan unit (not shown, but corresponding in construction to those illustrated in my afore-referred-to copending applications for patent) is positioned at any convenient location within or outside the dentist's office. The electrical connection panel (not shown) is likewise positioned at some convenient location remote from the immediate working area surrounding the dental chair and associated equipment.

Other portions of the apparatus are housed within a cabinet 10, which is advantageously fastened to a wall or other support in the immediate vicinity of the dental cuspidor 11. Such cabinet 10 is preferably equipped with a door 12, that may be manually swung open and closed by use of a handle 13 equipped with a spring or friction catch (not shown) of well known type.

The evacuation hose 14 is equipped at one of its ends with an intake nozzle 15, and extends exteriorly of the cabinet from a connection through pipe fitting 16 with working components disposed interiorly of the cabinet. It is normally retained, constantly available for use, by means of a clip holder 17 projecting from one side of the cabinet.

Within the cabinet 10 and projecting upwardly through an aperture 18, FIG. 3, in the top wall thereof is a principal catch receptacle 19. Such catch receptacle is conveniently fabricated in cylindrical form from rigid plastic material, as in the earlier forms of the apparatus, so as to be largely self-cleaning and noncorrosive. A removable cover 20 affords access to the interior for the purpose of periodically removing and cleaning filter bag 21, which latter serves to catch and retain any solid matter evacuated with the washings during the carrying out of the method described in my copending application Serial No. 411,510.

Filter bag 21 is removably attached to the lower end of a terminal pipe fitting 22, that is attached to and depends from elbow pipe fitting 16. Such pipe fitting 22 passes through cover 20, and serves to connect evacuative hose 14 in flow communication with the interior of catch receptacle 19.

Two nipples 23 and 24 are snugly received by corresponding apertures of a horizontal partition wall 25 within cabinet 10. Nipple 23 serves to receive a short drain pipe stem depending from securement to catch receptacle 19, liquid-tight sealing between the two being achieved by a rubber ring gasket 27. Nipple 24 similarly serves to receive the depending stem of a standpipe 28 which is fitted into and rigidly secured to catch receptacle 19. Nipples, drain pipe stem, and standpipe are advantageously all rigid plastic tubing.

Snugly inserted within the lower end of nipple 23 is drain piping, including an elbow pipe fitting 29, that connects through an intermediate pipe coupling 30, FIG. 2, check valve 31, and a terminal pipe coupling 32 to a drain pipe extension 33. Such drain pipe extension 33 conveniently bends into discharge relationship with the interior of dental cuspidor 11, thereby providing for ultimate passage of waste liquid into the soil pipe of the building without special plumbing connection therewith. While this is very advantageous from the standpoint of installation expense, the drain piping may, if desired, connect directly with the plumbing system of the building.

Snugly inserted within the lower end of nipple 24 is a depending extension 34 of standpipe 28.

Partition wall 25 divides the interior of cabinet 10, horizontally, into an upper compartment 10*a* and a lower compartment 10*b*. Catch receptacle 19 is positioned within the upper compartment 10*a*. Standpipe extension 34 depends deeply within lower compartment 10*b*.

Supported within lower compartment 10*b* by screw-threaded engagement with a fixedly mounted cover 35 is an auxiliary or supplemental catch receptacle 36. Such catch receptacle 36 depends through and projects downwardly from an accommodating opening 37 provided in the bottom wall of cabinet 10. Thus, its bottom portion may be manually grasped from outside the cabinet, for rapid and convenient unscrewing of such auxiliary catch receptacle and removal and replacement thereof through opening 37.

The cover 35 for auxiliary catch receptacle is fixedly mounted in predetermined position by means of rigid hangers 38, FIG. 2, depending from fixed securement in partition wall 25. Standpipe extension 34 extends therethrough in fluid-tight relationship therewith, as does also one end portion of a U-shaped pipe fitting 39, to whose other end is connected a suction conduit 40. Such suction conduit 40 leads through an accommodating opening 41 in the floor of cabinet 10 to a connection (not shown) with the suction fan unit.

In the operation of the device, the suction fan unit creates a strong suction effect within the conduit 40, which manifests throughout the entire system. A liquid and debris entraining stream of air is established in advance of and is sucked into the orifice of inflow nozzle 15, as described in my prior applications for patent, and passes through evacuative conduit or hose 14, pipe fittings 16 and 22, filter bag 21, principal catch receptable 19, standpipe 28, and standpipe extension 34, into auxiliary catch receptacle 36.

Solid debris, such as drillings, amalgam chips, and other products and waste from operative work on a patient undergoing dental or surgical treatment, is caught by filter bag 21, which latter is removed and emptied from time to time. Liquid passes through the permeable walls of the filter bag, and tends to drop to the bottom of principal catch receptacle 19.

During operation of the suction fan unit, with consequent forceful passage of a suction air stream through the apparatus, check valve 31 is closed by reason of the pressure differential existing interiorly and exteriorly of the system. Accordingly, there is no loss of working suction, nor is there backflow through discharge line 33. Liquid accumulates in the bottom of catch receptacle 19 during periods of operation of the suction fan unit, and automatically drains through drain nipple 26 whenever the suction fan unit is not in operation.

Principal catch receptacle 19 is of sufficiently great capacity to hold, within its interior below filter bag 21, an excess of liquid over that withdrawn during any normal working period, and, ordinarily, the air stream passing down through standpipe 28 and standpipe extension 34 will carry very little, if any moisture. Nevertheless, auxiliary catch receptacle 36 is provided as a safety factor against damage to the suction fan unit.

At the lower end of standpipe extension 34 are secured mutually spaced electrodes 42, which are electrically connected by respective insulated wires 43 to an electrical control circuit embodying electrical relay means or other suitable equipment for controlling the supply of current to the motor of the suction fan unit.

The electrical control circuit and control apparatus associated therewith, see FIG. 5, are preferably similar to what is illustrated and described in my afore-mentioned patent application Serial No. 471,734, and include a manually actuated, on-and-off switch 44 (see also FIGS. 1 and 2), permitting the motor of the suction fan unit to be conveniently turned on and off by the operator.

The motor of the suction fan unit is electrically connected across power leads 45 for supply of operating current from a standard 110 volt line, as indicated.

The control circuit is supplied with a lower voltage through step-down transformer 46. A double-pole, normally open, control relay 47, connected in the control circuit, has one of its poles 47*a* interposed in the electrical supply line, and its other pole 47*b* interposed in an auxiliary circuit comprehending the spaced electrodes 42 and an especially sensitive, normally closed, single pole relay 48. A rectifier condenser arrangement 49 supplies the auxiliary circuit with direct current, which enables the spaced electrodes 42 to effectively exercise a control function in closing the auxiliary circuit if and when a body of liquid collects on the bottom of auxiliary catch receptacle 36 and rises to the level of the spaced electrodes 42.

It will be noted that, in this illustrated embodiment, drainage from principal catch receptacle 19 discharges directly into the dental cuspidor 11, and that no plumbing work is involved in the installation of the apparatus.

The essential characteristics of the suction power unit, flow conduits, and inflow nozzle are preferably as described in my prior applications for patent above referred to. Such suction power unit may be appropriately referred to as an electric motor-operated blower, and, it will be noted, conduits 28, 34, 39, and 40 provide means connecting the chamber means (chambers 19 and 36) in air communication with the intake side of such blower. The entire apparatus may be spoken of as a power-operated, dental aspirator unit, hose 14 serving as the aspirator conduit.

The present application is a continuation of my allowed copending application Serial No. 522,590, filed July 18, 1955, and now abandoned, entitled "Evacuative Suction Apparatus."

Whereas this invention is here illustrated and described with respect to specific embodiments thereof, it should be realized that changes may be made within the scope of the following claims, without departing from the essential contributions which I have made to the art.

I claim:

1. In combination with exacuative suction apparatus which includes a suction power unit, fluid-conducting tube means leading into said suction power unit, and an entrapment device embodying a catch receptacle interposed in said tube means intermediate the length thereof; a drain line leading from said catch receptacle; check valve means interposed in said drain line for closing said line when the suction power unit is operating and for opening said line when said power unit is idle; an auxiliary entrapment device embodying a second catch receptacle interposed in said tube means between the first-named entrapment device and said suction power unit; and control means disposed at a predetermined level in the auxiliary catch receptacle for shutting off operation of said suction power unit if and when a body of liquid collects within the auxiliary catch receptacle to the height of said predetermined level.

2. The combination recited in claim 1, wherein there is additionally included a cabinet in which the princpal and the auxiliary entrapment devices are housed; the catch receptacle of the principal entrapment device is provided with a removable top cover and projects upwardly and exteriorly of said cabinet through an opening provided therefor; the auxiliary catch receptacle is removably provided with a top cover rigidly attached to said cabinet therewithin; and said auxiliary catch receptacle depends from and exteriorly of the cabinet through an accommodating opening provided in the latter, so that it can be removed from engagement with its cover by manipulation exteriorly of the cabinet.

3. The combination recited in claim 8, wherein the drain means includes drain piping within the cabinet, the catch receptacle of the principal entrapment device includes an exteriorly depending, drain pipe stem in addition to the suction pipe stem, and the socket-type mating

structure includes a mating connection between said drain pipe stem and said drain piping; and wherein a check valve is interposed in said drain piping, said check valve being arranged to close under influence of suction within the tube means and to open under the influence of gravity flow of liquid from said catch receptacle.

4. The combination recited in claim 3, wherein the cabinet is adapted to be installed adjacent a dental cuspidor, and wherein the drain piping is provided with an extension exteriorly of the cabinet adapted for discharge placement relative to the dental cuspidor.

5. Evacuative suction apparatus comprising a cabinet; a horizontal partition within said cabinet dividing the interior of the latter into an upper compartment and a lower compartment; a closed, principal catch receptacle disposed in the upper compartment; a closed, auxiliary catch receptacle disposed in the lower compartment; an evacuative suction conduit extending into communication with the upper part of the principal catch receptacle; a suction conduit having one of its ends leading into the upper part of the auxiliary catch receptacle and having its other end adapted for connection to a suction power unit; a standpipe extending between the principal and the auxiliary catch receptacles through said partition, said standpipe extending into the upper part of said principal catch receptacle; a drain pipe leading from the bottom of said principal catch receptacle; a check valve in said drain pipe arranged to close under the influence of suction within said principal catch receptacle and to open under the influence of gravity flow of liquid from said principal catch receptacle; and control means, including a liquid-level-responsive device disposed at a predetermined level in said auxiliary catch receptacle, said control means being arranged to shut off operation of the suction power unit if and when a body of liquid collects within said auxiliary catch receptacle to the level of said liquid-level-responsive device.

6. The combination recited in claim 5, wherein the liquid-level-responsive device comprises mutually spaced electrodes secured to the lower end of the standpipe, and wherein the control means comprises an electrical control circuit for supplying power to the suction power unit, said electrodes being connected into said control circuit for opening said circuit if and when electrically interconnected by liquid within the auxiliary catch receptacle.

7. In evacuative suction apparatus which comprises a suction power unit, fluid-conducting tube means leading into said suction power unit, and an entrapment device embodying a catch receptacle interposed in said tube means intermediate the length thereof, the improvement comprising a drain line leading from said catch receptacle; check valve means interposed in said drain line for closing said line when the suction power unit is operating and for opening said line when said power unit is idle; an auxiliary entrapment device interposed in said tube means between the first-mentioned entrapment device and said suction power unit, said auxiliary entrapment device including a catch receptacle auxiliary to the first-mentioned catch receptacle; and control means disposed at a predetermined level in said auxiliary catch receptacle for shutting off operation of the said power unit if and when a body of liquid collects within said auxiliary catch receptacle to the height of said predetermined level.

8. In evacuative suction apparatus which includes a suction power unit, fluid-conducting tube means leading thereinto, and an entrapment device embodying a catch receptacle interposed in the tube means intermediate the length thereof, the improvement comprising an auxiliary entrapment device embodying an auxiliary catch receptacle interposed in said tube means between the principal catch receptacle and the suction power unit; a cabinet housing the principal and the auxiliary entrapment devices, with the principal catch receptacle projecting upwardly and exteriorly of said cabinet through an opening provided therein and having a removable cover; drain means for the principal catch receptacle; a suction standpipe within the principal catch receptacle and having a stem depending exteriorly therefrom; socket-type mating structure within the cabinet in flow communication with a portion of said tube means that leads into the auxiliary receptacle, for affording rapid connection and disconnection of the principal catch receptacle with respect to said portion of the tube means; and control means disposed at a predetermined level in the auxiliary catch receptacle for shutting off operation of said suction power unit if and when a body of liquid collects within the auxiliary catch receptacle to the height of said predetermined level.

9. In evacuative suction apparatus which includes a suction power unit, fluid-conducting tube means leading thereinto, and an entrapment device embodying a catch receptacle interposed in the tube means intermediate the length thereof, the improvement comprising an auxiliary entrapment device embodying an auxiliary catch receptacle interposed in said tube means between the principal catch receptacle and the suction power unit; a cabinet housing the principal and the auxiliary entrapment devices; a cover for the auxiliary catch receptacle, said cover being fixedly secured within the cabinet in position adapted to be engaged from below by the auxiliary catch receptacle in attaching relationship therewith, said cabinet having an accommodating opening in its bottom wall, and said auxiliary catch receptacle when attached to its cover depending through said opening exteriorly of said cabinet a distance sufficient to enable manual grasping thereof for removal and replacement with respect to said cover; drain means for the principal catch receptacle; and control means disposed at a predetermined level in the auxiliary catch receptacle for shutting off operation of said suction power unit if and when a body of liquid collects within the auxiliary catch receptacle to the height of said predetermined level.

10. In evacuative suction apparatus which includes a suction power unit, fluid-conducting tube means leading thereinto, and an entrapment device embodying a catch receptacle interposed in said tube means intermediate the length thereof, the improvement comprising an auxiliary entrapment device embodying an auxiliary catch receptacle interposed in said tube means between the principal catch receptacle and the suction power unit; drain means for the principal catch receptacle; mutually spaced electrodes disposed at a predetermined level in said auxiliary catch receptacle; 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 if and when electrically interconnected by liquid at said predetermined level in the auxiliary catch receptacle.

11. A power-operated dental aspirator unit comprising a housing, an electric motor-operated blower, chamber means, means providing air communication between said chamber means and the intake side of the blower, an aspirator conduit leading from the exterior of the housing to the chamber means, said chamber means being adapted to receive and collect liquid and debris drawn through the aspirator conduit, means controlling operation of said blower and operable in accordance with a predetermined liquid level in said chamber means to stop said blower, and means for automatically opening and discharging from said chamber means, when said blower is not operating, liquid and debris collected by said chamber means.

12. A dental aspirator according to claim 11, wherein the means for discharging the liquid and debris from the chamber means comprises a drain outlet in said chamber means and valve means controlling said drain outlet.

13. A dental aspirator according to claim 12, wherein the valve means is a normally open check valve which is adapted to close by the suction effect produced in the chamber means when the blower is operating and to open upon cessation of such operation.

14. In evacuative suction apparatus which includes a

suction power unit, fluid-conducting tube means leading thereinto, and an entrapment device embodying a catch receptacle interposed in said tube means intermediate the length thereof, the improvement comprising an auxiliary entrapment device embodying an auxiliary catch receptacle interposed in said tube means between the principal catch receptacle and the suction power unit; drain means for the principal catch receptacle; liquid-level responsive means disposed at a predetermined level in said auxiliary catch receptacle; and vacuum cut-off means controlled by said liquid-level responsive means.

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