# United States Patent [19]

**Malmin**

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[54] **AIR STERILIZER AND CONTROL MEANS**


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[52] **U.S. Cl.** ..... **21/74 R,** 21/53, 55/279

[51] **Int. Cl.** ..... **A61l 9/00,** F24f 3/16

[58] **Field of Search** ..... 21/53, 74 R; 55/279, 55/420, 424, 425, 426, 427; 98/DIG. 1; 137/527; 15/414



[56] **References Cited**

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| | | | |
|---|---|---|---|
| 1,832,565 | 11/1931 | Lawrence et al. | 55/279 X |
| 2,209,054 | 7/1940 | Doud et al. | 21/74 R X |
| 2,941,265 | 6/1960 | Isenberg et al. | 21/53 X |
| 3,094,400 | 6/1963 | Blanton | 55/279 X |
| 2,630,920 | 3/1953 | Kerr | 55/420 X |
| 3,113,853 | 12/1963 | Verhagen | 55/420 X |
| 3,444,581 | 5/1969 | Daneman | 15/414 X |



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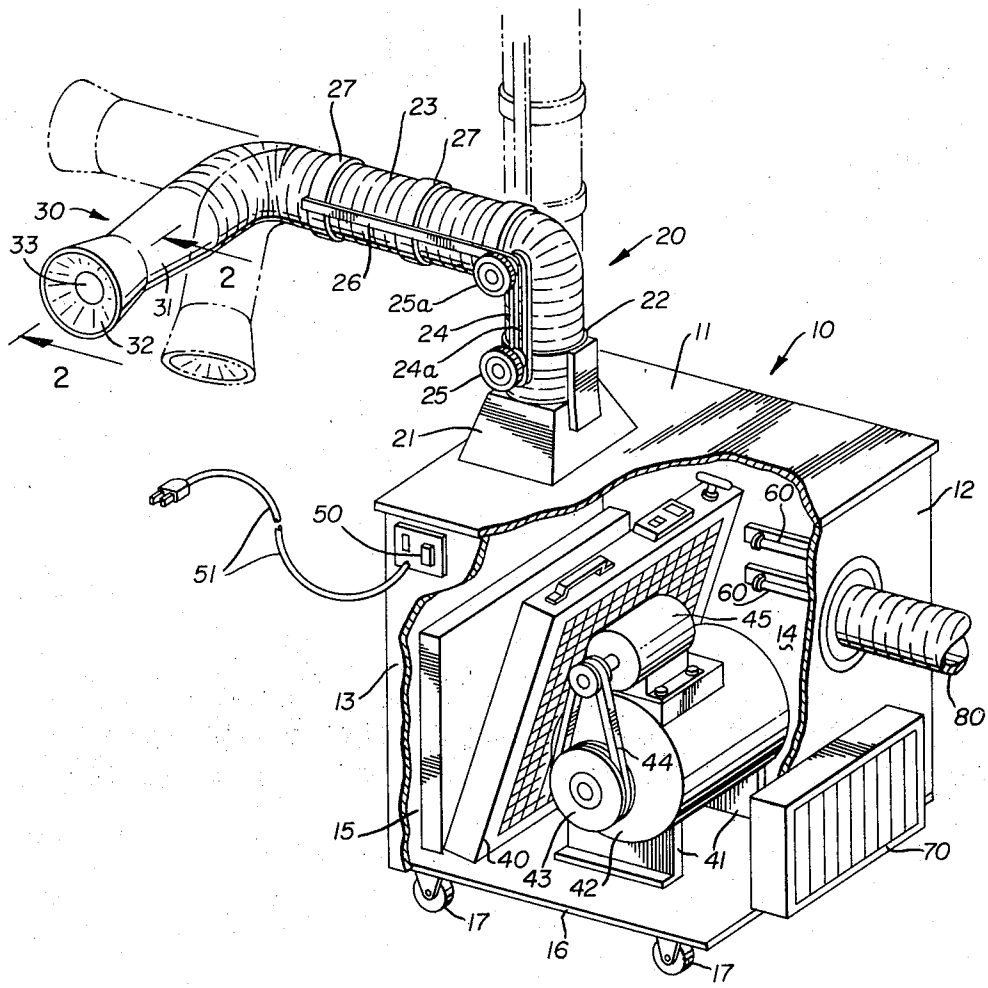
[57] **ABSTRACT**

Means for sterilizing and controlling aerosol clouds generated during either dental or medical operations. A vacuum intake is provided which is disposed in the vicinity of the cloud and may be either fixed or movable as desired. The intake is connected to a sterilizing chamber which contains filter means and ultraviolet or infrared light sources that are intended to sterilize the cloud, which is drawn into the chamber through the intake means. Exhaust means are also provided and may either lead to an entirely external environment or may be used to recirculate the air following its purification and sterilization back into the operating room. Disposable liners may be provided on the intake means to avoid further contamination of the operating environment.


**6 Claims, 6 Drawing Figures**



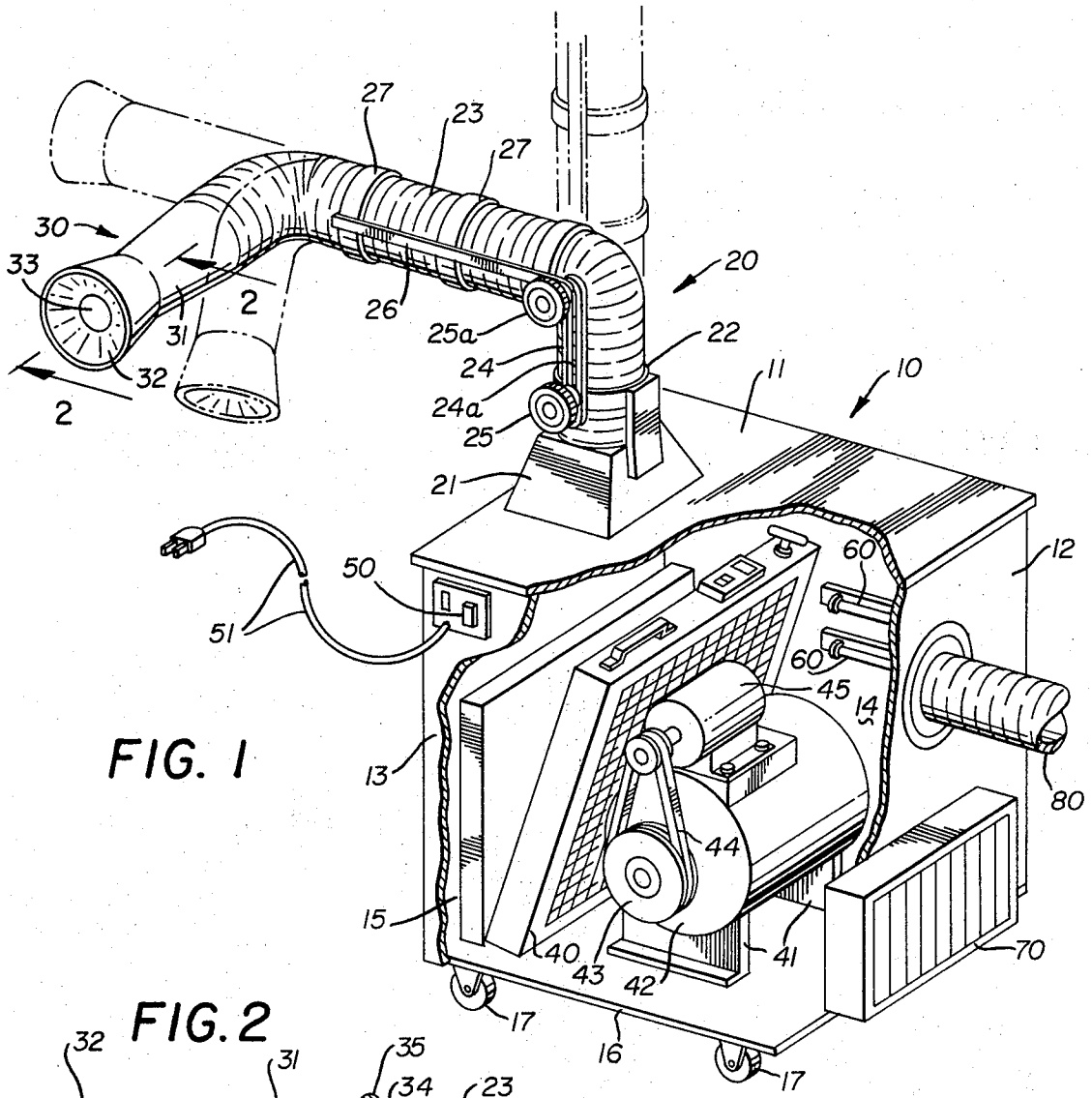



FIG. 1

FIG. 2

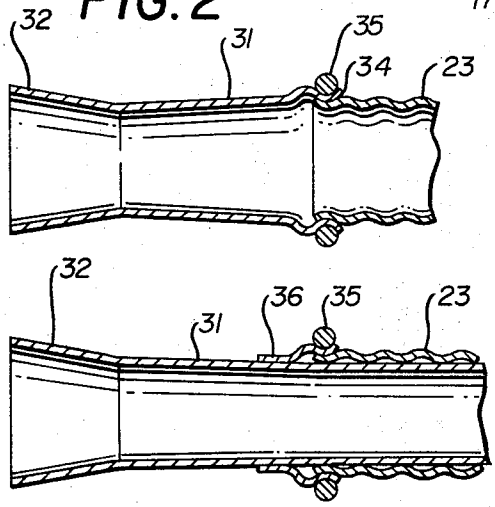



FIG. 3

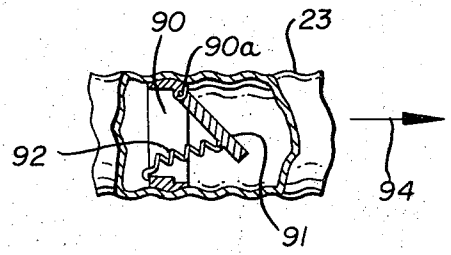



FIG. 6

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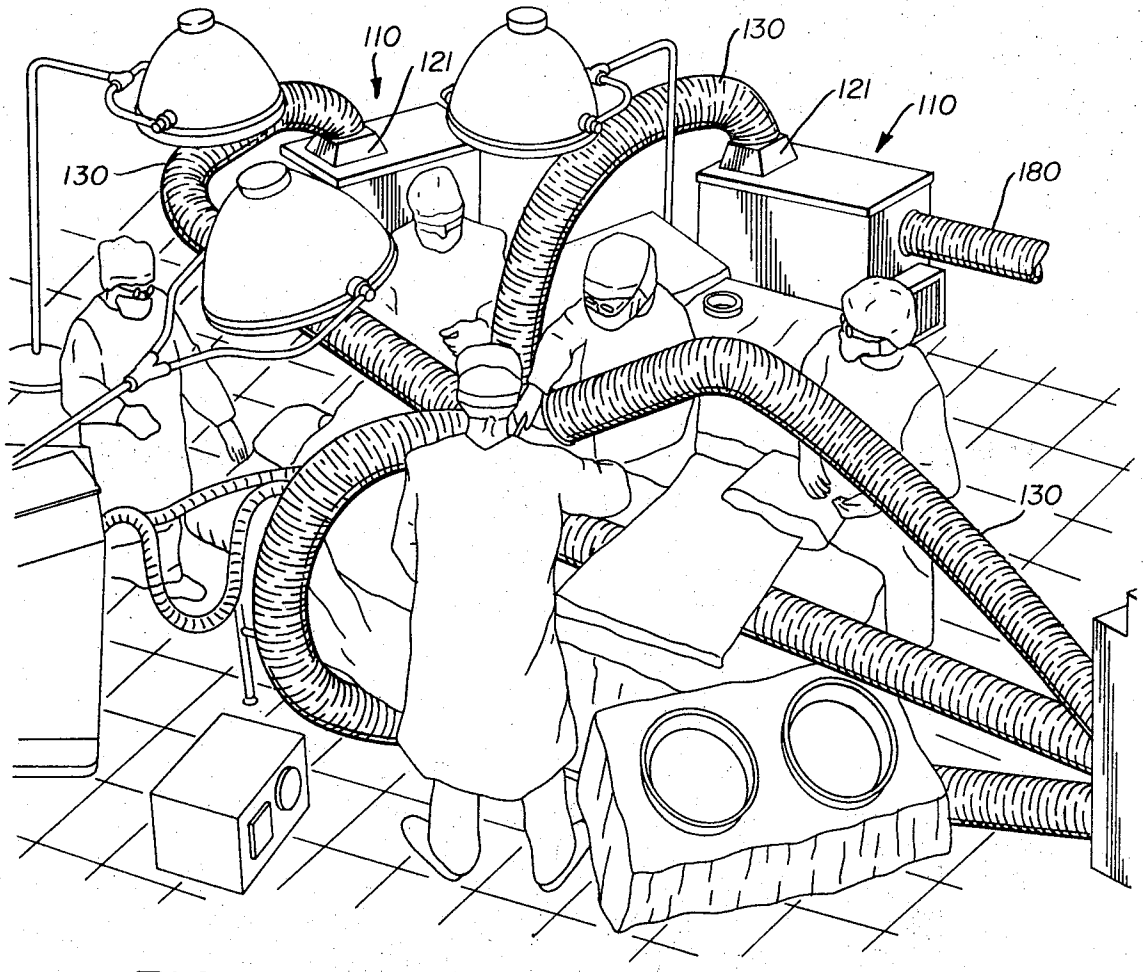


FIG. 4

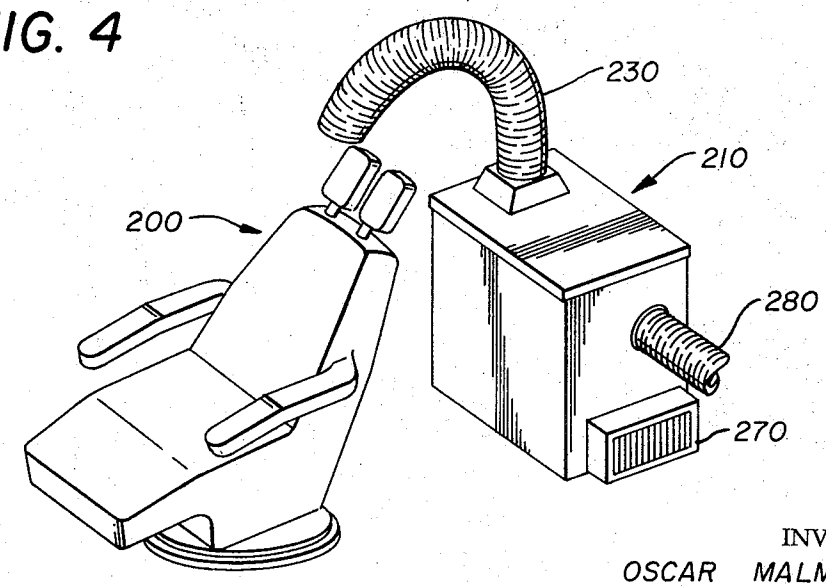


FIG. 5

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# AIR STERILIZER AND CONTROL MEANS

## BACKGROUND OF THE INVENTION

This invention relates in general to a means for sterilizing and controlling aerosol clouds formed in the immediate vicinity of either a dental or medical operation.

In performing dental operations, for example, when high speed hand pieces, drills, or ultrasonic tooth-scaling devices are employed, it has been discovered that extremely dangerous aerosol clouds are produced. The cloud will contain all forms of bacteria indigenous to the respiratory tract, the oral cavity, and the upper reaches of the gastro-intestinal tract.

The clouds so formed in a dental operation would also contain oil, particles of tooth material such as enamel, and infected decayed tooth structure, all of which would be atomized to such an extent that they are capable of reaching the terminal cells of the lungs. The threat of contamination or infection exists with regard to the dental operator, the dental assistant, and the patient as well.

Similarly, in a medical application where, for example, curtaining and laminar air flow techniques are utilized, eddies and air turbulence are created which conceivably can create a similar hazard by circulating air from the floor, which would contain bacteria, up into a vortex created around any object in the path of the air flow, such as for example the equipment and the personnel involved, and thence into the surgical field of the operation. This can easily lead to post-operative infections.

Actually, the desired objectives in dental and medical operations are reversed in that in the medical usage, the idea is to prevent bacteria from the surrounding air or environment from reaching and contaminating the operating zone, while in dentistry the idea is to prevent bacteria in the operating zone, namely the mouth, from spreading into the surrounding air and contaminating it.

As will be pointed out, however, both of these objectives, while seemingly at cross purposes to each other, can be achieved with Applicant's novel sterilizing and controlled means.

## DESCRIPTION OF THE PRIOR ART

The following prior art is known to Applicant:

| | |
|---|---|
| Doud | U.S. Pat. No. 2,209,054 |
| Scofield | U.S. Pat. No. 2,935,156 |
| Berly | U.S. Pat. No. 2,945,554 |
| Stein | U.S. Pat. No. 2,885,641 |
| Blanton | U.S. Pat. No. 3,094,400 |
| Chamberlain | U.S. Pat. No. 3,422,600 |

While most of the above-noted art discloses various air purification or sterilization devices, all of them are believed incapable of accomplishing the specific objectives of Applicant. Thus, it is believed that Doud U.S. Pat. No. 2,209,054 would blow the contaminated air across the operating area, while Chamberlain U.S. Pat. NO. 3,422,600 would actually disperse the aerosol cloud more widely. Most of these references also require the mechanism to be located at some distance from the operating zone and involve moving air currents, which would be uncomfortable to both the dentist or surgeon and the patient, as well as having the effect of dispersing the cloud which is contrary to the objectives of the invention.



## SUMMARY OF THE INVENTION

It has been found that the above-noted contamination problems can be obviated by providing a vacuum intake which can be disposed in proximity to the operating area and which is connected to a sterilizing means which are, in turn, connected to an exhaust means.

The intake will preferably include the utilization of a tube which can either be entirely disposable or which can utilize a disposable liner, and which is capable of being located as close as possible to the operating area. The tube and/or liner can be either fixed, as would probably be the case in a medical operation, or movable, which would probably be preferable in a dental application.

A suction or vacuum-creating means is provided to draw the cloud into the tube and thus into a sterilizing means which would utilize commonly available devices, such as filters, precipitators, and ultraviolet or infrared light for air sterilization purposes.

The exhaust means, which are also connected to the sterilizing means, can either lead back into the environment of the operating room so that the air is recirculated following its purification or can lead to an entirely external, remote environment.

Accordingly, production of an air sterilizing and control means of the character above-described becomes the principal object of this invention, with other objects thereof becoming more apparent upon a reading of the following brief specification considered and interpreted in view of the accompanying drawings.

## OF THE DRAWINGS

FIG. **1** is a perspective view partially broken away showing a possible form of the overall sterilizing and control means.

FIG. **2** is a sectional view taken on the line **2—2** of FIG. **1** showing a disposable liner.

FIG. **3** is a view similar to FIG. **1** showing a modified version of the disposable liner.

FIG. **4** is a perspective view showing application of the overall sterilizing and control means in a medical environment.

FIG. **5** is a perspective view showing the overall sterilization and control means in a dental environment.

FIG. **6** is a partial sectional view showing means for closing off the vacuum tube when not in use.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring first to FIG. **1**, it will be noted that the overall device includes a cabinet **10**, intake means **20**, switching means **50**, air purification means **40** and **60**, and exhaust means **70** and **80**.

Considering again FIG. **1** for a detailed description of the cabinet **10**, it will be noted that the cabinet includes a top **11**, four side pieces **12**, **13**, **14**, and **15**, and a bottom **16**. These are joined together in conventional fashion and form a substantially enclosed chamber. Also mounted on the bottom **16** of the cabinet **10** are a plurality of casters **17,17** which enable the cabinet to be easily moved as desired.

Considering next then the intake means **20**, it will be noted that a mounting **21** is disposed on the top **11** of cabinet **10**. A flexible tube **23** is secured to the mounting **21** by a collar **22**. Also mounted on the collar **22** is a brace **24** which has a pair of handles **25**, **25***a* threaded

therein for adjustment purposes. Top handle **25***a* also is secured to a second brace **26** which is, in turn, secured by welding or other means to a plurality of support bands **27,27** which encircle tube **23** for support purposes. In this fashion by loosening knob **25**a, for example, the brace **26** and the extension of the handle **25**a can be moved within the slot **24***a* of brace **24** to thus adjust the angular condition of the projecting portion of the tube **23.**

Secured to the outboard end of the tube **23** is an extension **30** which has a body **31** and a mouthpiece **32** and a through opening therein **33.** This mouthpiece may be secured to the end of the tube **23** by an elastic band **35** which snaps over a grooved end **34** of the body **31,** as clearly shown in FIG. **2.** Alternatively, a separate ring **36** can be provided and again an elastic band **35** snaps over a grooved area on ring **36,** as shown in FIG. **3.** Furthermore, a threaded connection could be provided or a simple friction fit could be provided, with any of these alternatives being within the scope of the intended invention.

Additionally, the tube **23** has been described as being flexible, and it could also be disposable so that the entire tube could be discarded following use. Alternatively only the nozzle or mouthpiece **30** would be disposable so that only this portion of the intake means, which is the portion in closest proximity to the operating area, would be discarded following use.

Considering next the interior chamber of the cabinet **10,** it will be noted that a filter **40** is provided, with this filter being any one of a number of commonly available filters, such as the electrostatic precipitators for example. Also mounted internally of the cabinet **10** is a motor **42** which is supported on supports **41,41** and has a belt drive **43,44** to operate a suction or intake fan **45** or other suitable means for creating a negative pressure. This fan will draw the aerosol cloud from the operating area through the tube **23** and into the interior of the cabinet **10.**

Also mounted on wall **14** of the cabinet are ultraviolet lights **60,60** which could also be infrared lights if desired.

An exhaust **70** is provided on the wall **12,** and the exhaust **70** illustrates the form which would exhaust the purified air back into the operating room environment. An alternative form is also shown in FIG. **1,** and this is exhaust tube **80** which would lead completely outside of the operating environment.

All of the electrical components, such as the filter, the motor, the fan, and the lights, are operated by switch **50** which is connected to a suitable source of electric power by the cord **51.**

No detail has been shown with regard to wiring as this is believed to be well within the skill of anyone normally skilled in this art.

In order to establish the environment in which the invention is utilized, attention is called to FIGS. **4** and **5** which show utilization in both a medical and dental environment.

Considering first FIG. **4,** it will be noted that there are a plurality of portable sterilizing means **110,110** illustrated as being scattered around the operating room and having the tubes **130,130** secured to the sterilizing means as at **121** and extended into and surrounding the operating area.

The exhaust **180,** of course, leads out of the immediate operating environment, as described above. The precise manner of positioning the tubes **130,130** is somewhat of a matter of choice, but the principle is to surround the operating zone of the patient with a multiplicity of vacuum tubes or hoses of large diameter. These tubes can come in from any direction and, in fact, could be suspended from directly overhead although this is not illustrated. Furthermore, while portable sterilizing units **110,110** are illustrated, it is to be understood that the tubes could lead completely out of the room to an externally located sterilizing unit.

Considering FIG. **5,** much the same can be said here in that the tube **230** leads from the sterilizing unit **210** to a position in proximity with the operating area of the patient which, of course, in the dental application would be the head or face. Again a portable unit is illustrated, but it is possible to have the unit **210** permanently installed beyond the confines of the operating room and in that fashion accomplish the objectives of the invention.

In use or operation of the device shown in FIG. **1,** it is simply necessary to position the mouthpiece or funnel **30** in close proximity to the operating area. In the case of a dental operation, probably only one tube would be required. In the case of a medical operation, it is preferred that a plurality of tubes be utilized so as to, in effect, surround the operating area. Once the mouthpiece or funnel **30** has been placed in the above-noted position, the switch **50** is actuated. This will start the motor **42** and the intake fan **45.** It will also activate the filter **40** if it is of the electrostatic type. Furthermore, the ultraviolet lights **60,60** would also be activated.

Thus, as the cloud is formed during the operation, the same is drawn in through the opening **33** of the mouthpiece **30,** through the tube **23,** and into the interior of the cabinet **10** where it is acted upon by the filter **40** and the lights **60,60** before being exhausted from the interior of the cabinet either through the exhaust **70** back into the atmosphere or through the exhaust **80** into a completely separate environment, such as outdoors for example.

It will also be noted that FIG. **6** illustrates a means for controlling the vacuum in the tube **23.** Thus, in FIG. **6** tube **23,** which is broken away in section, shows an inner rigid band **90** to which is pinned a door or closure member **91.** This member **91** is pinned at **90**a for pivoting movement relative of the rib member **90** and is attached to that member also by spring **92.** In this fashion when the vacuum, which would normally pull in the direction of the arrow **94,** is activated, it will pull the door or closure member **91** to the open position. This, of course, permits the overall apparatus to function as described above. When the vacuum is shut off, however, the spring **92** will pull the closure member **91** down into closed position, thereby closing off the tube and preventing inadvertent contamination.

It should be noted that while the switch **50** is shown located on the cabinet **10** per se, it would be possible in a dental application, for example, to have the device actuated by the dental handpiece holder or by a foot-operated controller in proximity to the patient's chair. Similarly in a medical application it would be activated by foot or knee-operated switch to provide even greater convenience to the surgeon.

While a full and complete description of the invention has been set forth in accordance with the dictates of the Patent Statutes, it should be noted that modifica-

tions can be resorted to without departing from the spirit hereof or the scope of the appended claims.

What is claimed is:

1. Means for sterilizing and controlling an aerosol cloud or ambient room air from an operating area, comprising;

A. means for creating a vacuum;

B. at least one flexible and adjustable intake tube having one end operatively associated with said means for creating a vacuum and its opposed end disposed adjacent said operating area;

C. sterilizing means associated with said intake tube and including

1. at least one filter and

2. at least one ultraviolet light source;

D. means disposed internally of said intake tube for automatically closing off said tube upon inactivation of said means for creating a vacuum; and

E. exhaust means disposed at a point remote from said operating area;

F. said means for creating a vacuum drawing air from said operating area through said intake tube and said sterilizing means to said exhaust means.

2. The means of claim 1 wherein said exhaust means communicate with an external environment.

3. The means of claim 1 further characterized by the presence of a disposable mouthpiece releasably received on the end of said tube that is disposed adjacent said operating area.

4. Means for sterilizing and controlling an aerosol cloud or ambient room air in an operating area, comprising;

A. a portable housing;

B. means carried by said housing for creating a vacuum;

C. at least one flexible and adjustable intake tube having one end secured to said housing and its opposed end disposed adjacent said operating area;

D. sterilizing means carried by said housing and including

1. at least one filter and

2. at least one ultraviolet light source;

E. means disposed internally of said tube for automatically closing off said tube upon inactivation of said means for creating a vacuum; and

F. exhaust means carried by said housing disposed at a point remote from said operating area;

G. said means for creating a vacuum drawing air from said operating area through said intake tube and said sterilizing means to said exhaust means.

5. The means of claim 4 wherein said exhaust means communicate with an external environment.

6. The means of claim 4 further characterized by the presence of a disposable mouthpiece releasably received on the end of said tube that is disposed adjacent said operating area.

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