

[54] **OPERATING THEATRES**

[75] Inventor: **Frederick Hugh Howorth**, Chorley, England

[73] Assignee: **Howorth Air Conditioning Limited**, Bolton, England

[22] Filed: **July 16, 1973**

[21] Appl. No.: **379,858**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 216,693, Jan. 10, 1972, abandoned.

[52] U.S. Cl. **128/1 R, 98/33 R, 98/40 D**

[51] Int. Cl. **A61b 19/00**

[58] Field of Search **128/1 R, 1 B, 191; 98/40 C, 40 D, 32, 33 R, 33 A, 36; 239/553.3, 590.3**

[56] **References Cited**

UNITED STATES PATENTS

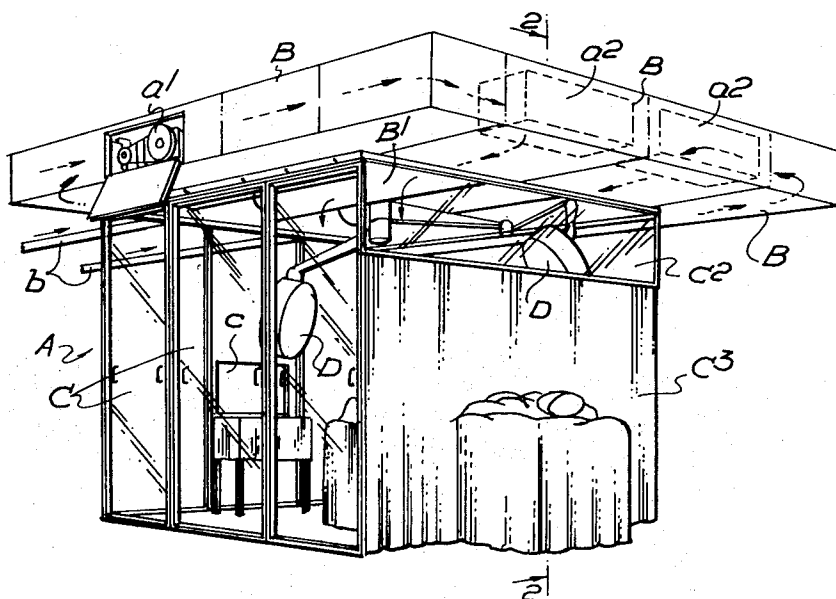
3,602,212 8/1971 Howorth 128/1 R

Primary Examiner—Richard A. Gaudet
Assistant Examiner—Henry J. Recla
Attorney, Agent, or Firm—Norris & Bateman

[57] **ABSTRACT**

An operating theater comprising a chamber closed at the top by a ceiling surrounded by a plenum chamber provided with ducts through which sterile air is drawn from outside the chamber and discharged vertically downwards from tubes of porous textile material having along the bottom of each section inserts of a knitted fabric of greater air permeability than the remaining tube wall to give directional control of the air flow, a rail being mounted on the underside of the plenum chamber from which are suspended on three sides removable interchangeable panels extending from the rail to a floor and on the fourth side a curtain to give access for an operating table and patient, with means for extracting contaminated air from the patient.

5 Claims, 4 Drawing Figures



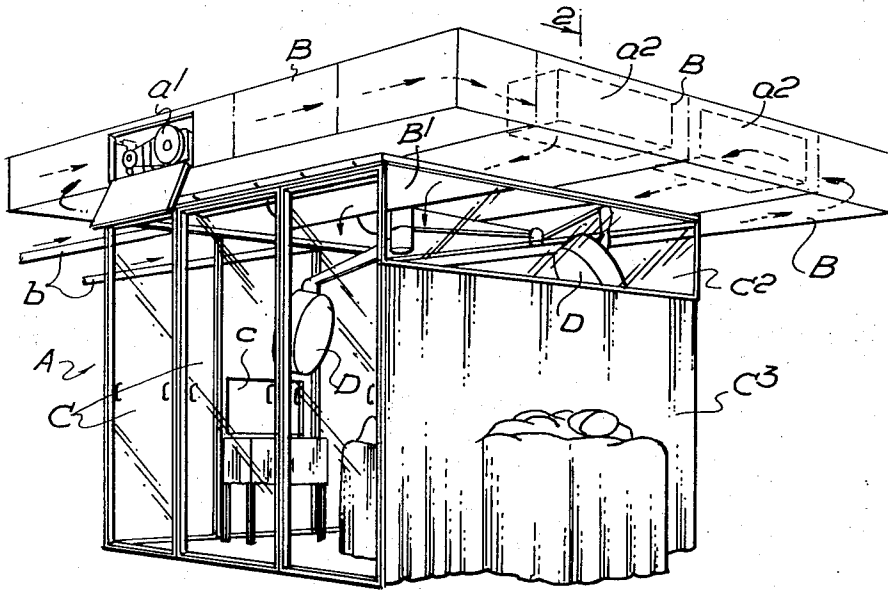


FIG. 1

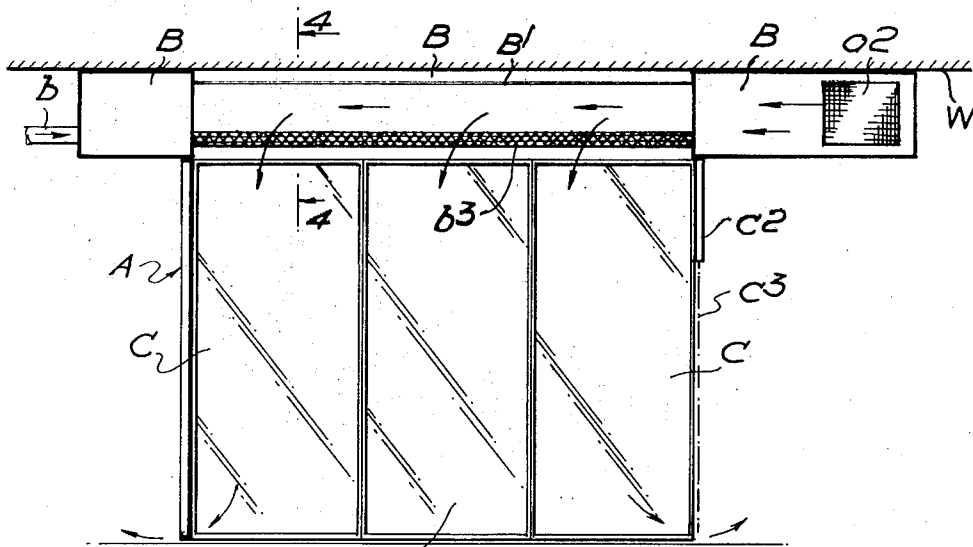


FIG. 2

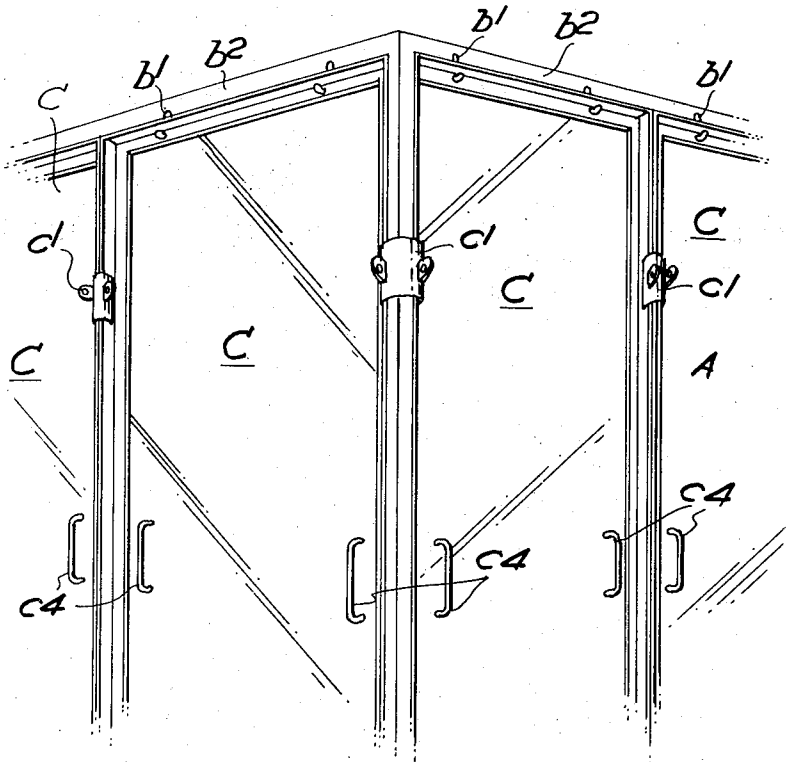


FIG. 3

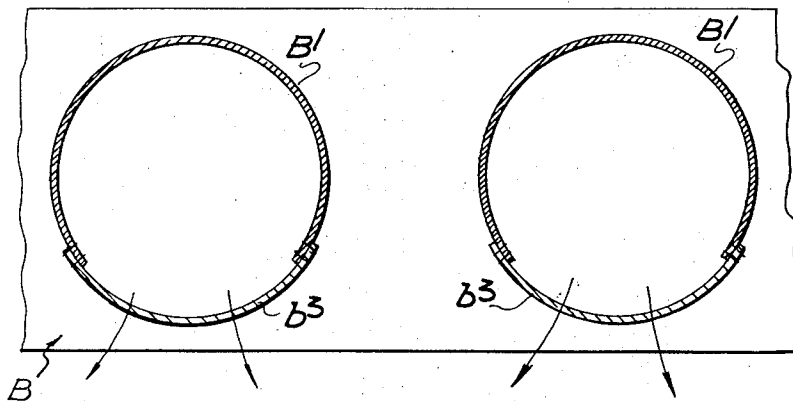


FIG. 4

OPERATING THEATRES

This is a continuation-in-part of copending Ser. No. 216,693 filed Jan. 10, 1972, now abandoned.

This invention relates to improvements in operating theaters of the type disclosed in applicant's U.S. Pat. No. 3,602,212 dated 31 Aug. 1971.

U.S. Pat. No. 3,602,212 discloses apparatus for providing an operating theater that comprises a chamber having ceiling means, side walls depending therefrom and a floor, said ceiling means having defined therein an opening for the admission of sterile air into the chamber from a sterilizing filtering and humidifying air conditioning plant, the sterile air being discharged from tubes of porous material.

The present invention is directed mainly to the provision of special air distribution tubes for obtaining evenly distributed air flow within the chamber in such apparatus, and this is a major object.

In some hospitals or like buildings temperature and/or humidity conditioned air is circulated throughout from a main system, and in the preferred embodiment of the invention, instead of providing a separate air conditioning plant, air is drawn into ducts of plenum chambers surrounding a ceiling for the chamber or compartment from the atmosphere surrounding the transparent chamber or compartment and circulated through the tubes for discharge vertically downwards through the chamber or compartment, rails being mounted on the underside of the plenum chamber from which removable interchangeable panels are suspended to be readily assembled and dismounted.

A further object of the invention is to provide a novel combination an enclosure, ducts and a fan forming a plenum chamber suspended from above for drawing sterile air from outside the enclosure, rails mounted on the underside of the unit to define the operating chamber of compartment, panels suspended from the rails on three sides of the enclosure, a further panel suspended from the rail on the fourth side of the enclosure and a curtain suspended from that panel to give access to the chamber or compartment for the operating table and patient and means on the table for exhausting contaminated air from the patient to ensure that no contaminated air shall be present in the chamber or compartment.

The invention will be described in the preferred embodiment with reference to the accompanying drawings:

FIG. 1 is a perspective view of the chamber or compartment;

FIG. 2 is a section on line 2—2 FIG. 1;

FIG. 3 is a perspective view of one corner of the chamber or compartment;

FIG. 4 is a section enlarged on line 4—4 of FIG. 2.

PREFERRED EMBODIMENTS

An operating theater is reduced in area by an enclosure A having transparent walls to provide a chamber or compartment of a size to accommodate a portion or all of the operating table and patient and the team carrying out the operation, sterile air being passed downwards through the chamber or compartment in a laminar or piston flow to change the air in the compartment substantially 300 times per hour, and to provide the team and the patient with an air extraction system from

their robes to remove air exhaled by the team and so prevent it from contaminating the air in the compartment as described in my earlier Patent above identified.

Air for supplying the enclosure A is drawn into ducting B forming a plenum chamber from the atmosphere surrounding the compartment by one or more fans a^1 . The air passes along the ducting B at each side of the enclosure through filter sections, humidity and temperature control sections and acoustic sections (not illustrated) to the front of the enclosure as shown by the arrows in FIG. 1 and is then directed by headers a^2 into discharge diffuser tubes B^1 from which it is delivered vertically downwards into the operating compartment to provide the laminar flow therethrough.

The ducting B and the side by side diffuser tubes B^1 form an enclosed header unit which may be suspended from the ceiling of a room in which the operating chamber is housed. Rails b^2 are secured to the underside of the header unit to determine the outline of the operating compartment.

The diffuser tubes B^1 form plenum tubes so arranged that they are in proximity to each other as shown in FIG. 4 and to the ceiling wall W at the top of the enclosure to enable both background lighting and an operating light to be fixed to the operating room ceiling in the usual way.

The previous diffuser tubes B^1 are made of resilient textile material which acts as a non-return valve as disclosed in said U.S. Pat. No. 3,602,212 so protecting the clean side of the bacteria filter as the air under pressure passes outwards through the tubes and when the pressure is cut off the pores in the tubes close. Where the tubes are composed of only one consistency of textile material, as disclosed in said Patent, giving equal permeability circumferentially of the tubes, the areas between adjacent tubes and between the outer tubes and the sides of the enclosure become high velocity zones, and the areas below each of the tubes become low velocity zones, thereby providing uneven flow patterns. In order to counteract this, substantially two thirds of each tube perimeter is made of low permeability and the remaining approximately one third of higher permeability as shown in FIG. 4 thereby producing more uniform velocity flow zones and an evenly distributed laminar flow. Preferably the unit area permeability of section b^3 is about 5 - 10 times that of the remaining tube wall.

Referring to FIG. 4, the diffuser tubes B^1 are of a self-supporting porous textile material formed from strips of the material laterally bent into a main sector of cylindrical shape and which secured therealong has a bottom sector of an open mesh knitted fabric b^3 that passes air therethrough more freely than the rest of each tube to provide directional outlet for the major volume of sterile air which is thereby directed downwards into the chamber or compartment whilst preventing the formation of streams which might create draughts. The sector at b^3 is therefore a porous textile material of much greater air permeability than the remaining part of each tube, and by selecting textile materials of different relative permeabilities for the main tube wall and sector b^3 predetermined air flow condition can be obtained. When the supply of air to the tubes B^1 is cut off pores of the main sector and the knitted strips b^3 contract and prevent air from the chamber or compartment passing back into the tubes.

Three sides of the enclosure A are enclosed by a plurality of panels C suspended on pegs b^1 projecting from the rails b^2 , the pegs b^1 passing through holes along the upper edges of the panels which extend to adjacent the floor level. The panels C are interchangeable and can be erected and dismantled in a matter of minutes. One of the panels C otherwise identical with the other panels C is formed with an aperture or hatch c and with a shelf to provide a table for the reception of trays of instruments for the operating team. The fourth or front side of the enclosure is closed by an upper panel C^2 suspended on the pegs b^1 and with a curtain C^3 suspended from the lower edge of the panel C^2 as shown in FIG. 1 to allow for the entry of an operating table containing the patient or sufficient of the table and patient for the operation.

The panels are provided with handles c^4 .

The panels C are connected together along the sides and at the corners by spring clips c^1 . A lamp or lamps D or a cluster of lamps supported from the ceiling are pivotally mounted in the chamber or compartment to provide illumination for the operation.

It is now normal practice in operations to cover those parts of the patients body which are not affected during the operation and an extractor or extractors are mounted on the operating table in a position or positions under the cover or covers where it is anticipated that contaminated air or bacterial contamination may be disseminated from the patient.

The extractor may be in the form of a shallow disc having a perforated top, or connected by a flexible pipe to a high speed vacuum pump to extract air from the vicinity of the patient or the flexible pipe may be provided with a perforated end cap through which the air is drawn.

The pipe lines for the extractors from the surgeon's or team's masks may be plugged into a panel arranged inside or outside the operating compartment and the extractor pipe from the patient may be plugged into this panel.

The panel is connected to a high speed vacuum pump by a further pipe line, valves being provided for cutting off the suction to each plug on the panel when not required.

The plugging in of the flexible pipe may be arranged to open the valve which closes automatically when the plug is withdrawn.

A set of controllable dampers give an infinitely variable volume of air. These dampers are electrically remote controlled by a rehostatic controller, operated on instructions from the surgeon inside the chamber or compartment.

The panels C and C^2 may be detached from the rails b and removed when their use in the main operating theatre is not required without disturbing the air supply installation.

It has been found that operations carried out in a

compartment as above described reduce the possibility of bacterial or virus infection during the operation and that over some 500 operations infection has fallen to 0.6% and the colonies of bacteria per cubic foot of air to 0.2 % which is the limit of accuracy of the checking apparatus.

What I claim is:

1. In an operating theater that comprises a chamber having side walls surrounding an operating table and associated equipment, means at the upper end of the chamber for discharging sterile air with substantially uniform flow downwardly within the chamber comprising a plurality of side-by-side tubes of porous textile material, each extending transversely across the chamber and connected to a source of sterile air under pressure, said tubes each and having a lower wall section of appreciably greater air permeability than the remaining wall, said lower wall section of each tube extending about one third the circumference and providing directional outlet flow of the major volume of sterile air.

2. In the operating theater defined in claim 1, said lower wall section of each discharge tube being a longitudinal strip of open mesh knitted fabric.

3. In the operating theater defined in claim 1, said lower wall section having a unit area permeability about 5 - 10 times that of the remaining tube wall.

4. An operating theater comprising means defining a suspended sterile air providing plenum chamber providing a ceiling for said theater, means including a fan mounted on said plenum chamber for drawing surrounding air into said plenum chamber, a plurality of rails secured upon the bottom of said plenum chamber defining means and defining the perimeter of the theater enclosure, a plurality of vertical panels suspended from said rails cooperatively defining the side walls of said theater enclosure, one of said panels being vertically smaller than the others and having a curtain suspended therefrom for access to said enclosure, and means for directionally downwardly discharging said sterile air into said enclosure comprising a plurality of discharge tubes extending laterally across the upper part thereof and connected to receive sterile air from said plenum chamber under pressure derived from said fan, said discharge tubes being of porous fabric of the type wherein the pores are of changing size depending on the air pressure therein and having a lower wall section of appreciably greater air permeability than the remaining wall, said lower wall section of each tube extending about one third the circumference and providing directional outlet flow of the major volume of sterile air.

5. In the operating theater defined in claim 4, said plenum chamber being suspended from and closely adjacent a ceiling wall, and said tubes extending closely adjacent to each other and to said ceiling wall and said panels.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,824,987 Dated July 23, 1974

Inventor(s) FREDERICK HOWORTH

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

On the first page the foreign application priority data was omitted. Please insert the following after the application number:

Foreign Application Priority Data

January 25, 1971	Great Britain	3082/71
May 20, 1971	Great Britain	16133/71
June 12, 1971	Great Britain	27632/71

Signed and sealed this 3rd day of December 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents