

[54] ANAESTHETIC GAS SAFETY EQUIPMENT

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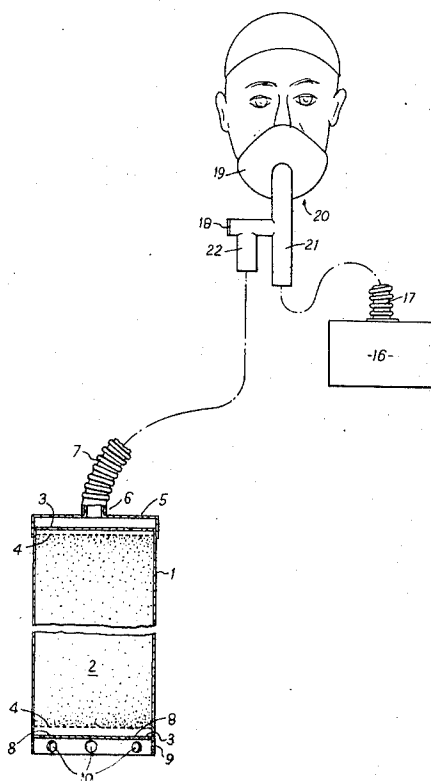
[57] ABSTRACT

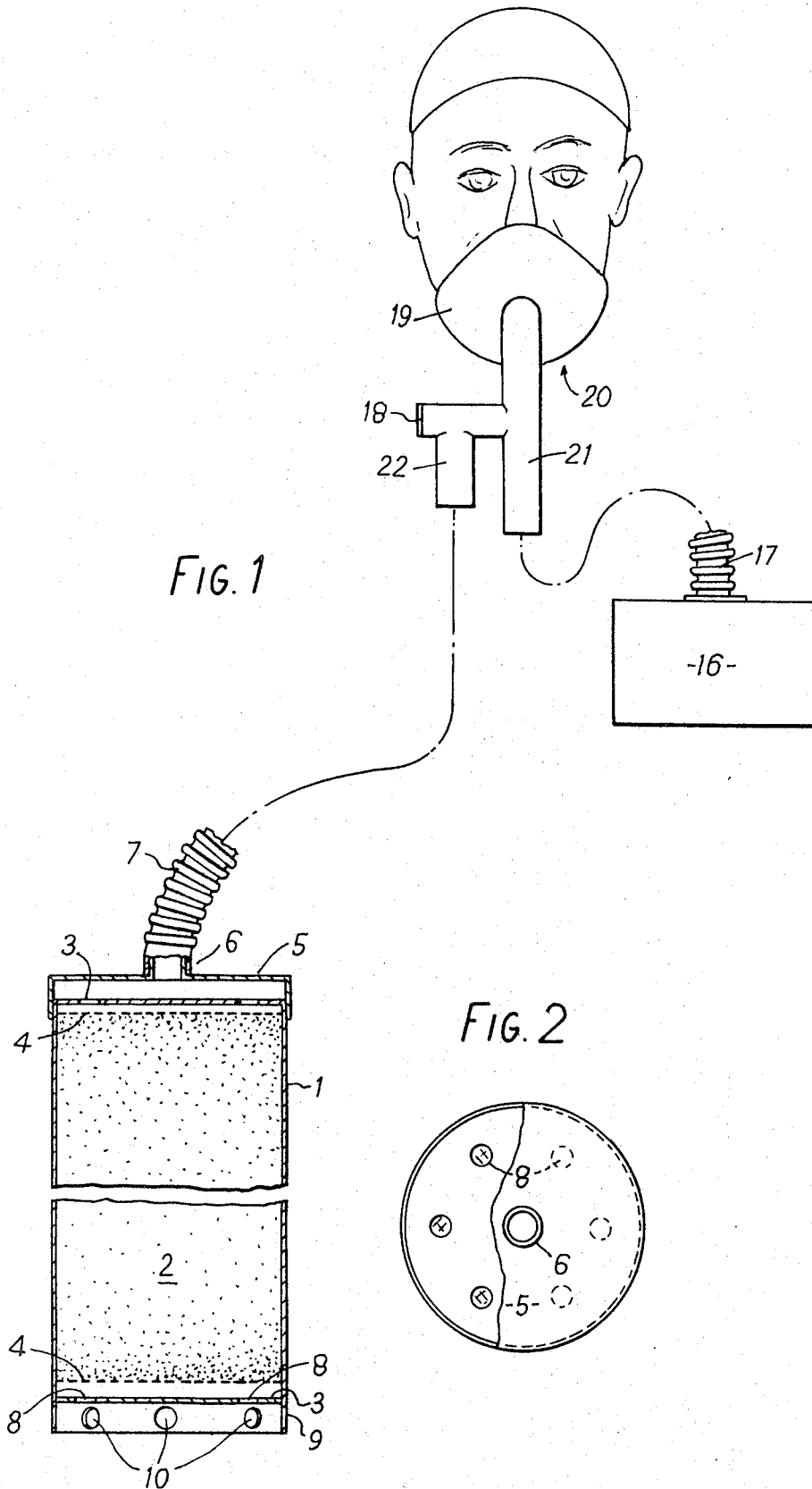
To provide a safe environment for operating theatre occupants whilst anaesthetic gas is administered to a patient, exhaled gas from the patient is passed through a replaceable, man-transportable absorber unit to absorb the anaesthetic gas employed.

The absorber unit comprises a cylindrically walled hollow drum having radial end walls; a central inlet in one end wall, the other end wall being provided with a plurality of angularly spaced apertures; a perforated retainer spaced inwardly from each end wall; and a predetermined fixed quantity of absorber material retained by and between the two perforated retainer plates, said material comprising carbon activated to absorb anaesthetic gas exhaled by the patient.

In use, the weight of the absorber unit increases as exhaled anaesthetic gas is absorbed therein, and when the absorber unit attains a predetermined increased weight it is replaced by a fresh unit.

3 Claims, 2 Drawing Figures





ANAESTHETIC GAS SAFETY EQUIPMENT

BACKGROUND OF THE INVENTION

This invention is concerned with gas purification and relates to the provision of gas purification devices for use preferably in conjunction with gas supply apparatus in small enclosed working areas, such as for example a hospital operating theatre.

The administration of anaesthetic gases to patients undergoing surgery in hospital operating theatres has for long given rise to the problem of gas escaping to atmosphere with the patient's breath, which may contain a percentage, e.g., 1-2 percent of pure unabsorbed anaesthetic gas. In the short term, although it is preferable to avoid it, such escaped gas causes few problems, but it will be appreciated that the theatre staff and attendants may well be exposed to the gas over long periods. In such circumstances the continued exposure to exhaled gas is a definite hazard, and the side effects of this are thought to be considerable although their actual manifestation is not fully known at this time. Furthermore if the exhaled anaesthetic gas is merely passed to atmosphere it may create a fire hazard since it is usually combustible gas and heavier than air.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a gas purification device which is relatively cheap to produce, robust in construction, and capable of removing from the patient's exhalations specific components considered harmful, with particular reference to anaesthetics such as halothane, methoxyflurane and trichloroethylene, whereby a relatively safe environment for operating theatre occupants, might be provided.

According to one aspect of the present invention, a gas purification device comprises an impermeable container holding a quantity of activated carbon, two opposed ends of the container being perforated to permit the passage of vapour and one of said ends in addition having means for the connection thereto of a feed-hose through which vapour may be passed into the container.

According to another aspect of this invention there is provided anaesthetic gas safety equipment comprising

- i. delivery means to administer anaesthetic gas to a patient, said delivery means having a gas inlet and a gas outlet,
- ii. a first flexible conduit having one end connected to said gas inlet,
- iii. anaesthetic gas supply means connected to the other end of said first flexible conduit,
- iv. a second flexible conduit having one end connected to said gas outlet, and
- v. a man-portable anaesthetic gas absorber unit comprising:
 - a. a cylindrically walled hollow drum having radial end walls,
 - b. a central inlet in one end wall releasably coupled to the other end of said second flexible conduit, the other end wall being provided with a plurality of angularly spaced apertures,
 - c. a first perforated retainer sheet spaced inwardly from said one end wall,

d. a second perforated retainer sheet adjacent said other end wall and between it and the first perforated retainer sheet, and

e. a predetermined fixed quantity of absorber material between said first and second perforated retainer sheets and retained thereby, said material comprising carbon activated to absorb anaesthetic gas exhaled by the patient.

According to yet another aspect of this invention there is provided a method of providing a safe environment for operating theatre occupants whilst anaesthetic gas is administered to a patient, wherein exhaled gas from the patient is passed through a replaceable man-transportable absorber of the anaesthetic gas employed.

BRIEF DESCRIPTION OF THE DRAWINGS

By way of example, a preferred embodiment of the invention will now be described with the aid of the accompanying drawings in which

FIG. 1 shows equipment embodying the invention connected to a patient, the equipment having a device, shown substantially enlarged and in cross-section, for absorbing anaesthetic gas exhaled by the patient to purify the patient's exhaled gases; and

FIG. 2 is one end view, partly in section, of the inflow side of the device.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A patient 15 in an operating theatre is supplied with anaesthetic gas such as halothane, methoxyflurane or trichloroethylene from a regulatable source of supply 16 via a flexible hose 17 coupling the supply 16 to an inlet 21 of an anaesthetics administrator 20. The supply 16 is a conventional trolley-borne arrangement in which the anaesthetic is mixed with a carrier gas. The administrator 20 comprises a valve device 18 (e.g., the "Penlon Duct/Expiratory Valve" sold by Shirley Aldred & Co. Ltd. of Worksop, Nottinghamshire, England) and a mask 19 over the patient's face, or (not shown) a catheter passing down into the patient's throat. The valve device 18 has a lightly loaded relief valve member therein with an inhaling outlet into the mask 19 (or catheter), and an exhaling outlet 22 releasably coupled by another flexible hose 7 to an absorber unit 1 standing in the theatre. During patient inhalation, the valve device 18 operates to permit anaesthetic gas to pass to the patient from the supply 16 via hose 17 and inlet 21, and simultaneously to prevent gas passing in either direction through administrator outlet 22 (the exhaling outlet of the valve device 18). During patient exhalation, the valve device 18 operates to permit exhaled gas from the patient to pass via outlet 22 and hose 7 to the absorber unit 1, and simultaneously to prevent gas passing in either direction through the inlet 21. Operation of the valve device 18 is effected unassisted and automatically by the patient's own breathing rhythm.

The absorber unit 1 comprises a cylindrical container constructed of strong cardboard with an exterior skin of impermeable plastics material; such a combination is commercially available. The container 1 is filled with one kilogram of activated carbon 2, and this is retained between the perforated end-pieces 3 of the container 1 by a screen of woven nylon mesh 4, co-extensive with each perforated end-piece 3, which retains the acti-

vated carbon but permits the passage of vapour with minimal interference. One end of the container 1, designated the inflow end, is provided with a tight-fitting lid 5. This has a central neck-portion 6 (preferably a British Standard male connection) over which is push-fitted one end of tube 7.

In use, the patient 15 exhales vapour that is contaminated with anaesthetic gas and this passes down tube 7, thence onto the surface of the perforated endpiece 3. Between the exit from tube 7 and the perforated disc 3 a space is provided to allow the vapour to spread evenly over the whole of the disc area. Perforations 8 (FIG. 2) are disposed suitably (e.g., angularly spaced) to spread the vapour evenly over the surface of the carbon within the container and avoid channelling there-through. The vapour then passes through the carbon. In doing so, the anaesthetic agent is absorbed by the activated carbon, and the purified vapours which at this point have had the anaesthetic agent removed but which still consist of the carrier gases, escape to atmosphere via the mesh and perforations at the exit, or outflow, end of the container. If desired, further perforations (not shown) may be placed in the wall of the container 1 close to the top and bottom rim thereof, i.e., at the level of the mesh.

The woven nylon mesh referred to in the embodiment may be replaced by any suitable openwork material, e.g., metal mesh.

A purification device of the 1 kilogram capacity (described herein by way of example only) would be capable of accepting and cleaning the vapour exhaled by one day's average intake of patients in an operating theatre, but might well retain its cleansing properties for a longer period depending on the gas concentrations used and the number of patients treated. Since the retained gas in the carbon may well be in the form of moisture having a noticeable weight, the device can be weighed from time-to-time (or continuously supported by a balance) and replaced when a predetermined weight-limit is reached.

Although the present invention has been described with particular reference to its use in a hospital operating theatre, it will be appreciated that use will be found for it in any confined area where anaesthetic gases need to be removed from exhalations. Also, the size, capacity and external finish of the container may be varied as desired. The lower part of the wall 1 of the container may be extended as shown at 9, to raise the mesh at the exit portion of the container clear of the ground: perforations 10 may be made in the extension 9.

It will be appreciated that the provision of gas spaces or chambers above and below the activated carbon 2,

and the particular arrangement of the central inlet 6 and angularly spaced outlets 8 in relation thereto, maximize the ability of the activated carbon 2 to absorb anaesthetic without channelling. For example a unit 1 approximately 9 inches high by 5½ inches diameter may, in normal clinical usage, provide between 6 and 18 hours of halothane absorption before the outflow gas from apertures 8, 10 reaches 0.05 percent halothane.

It will be understood that the above description of the present invention is susceptible to various modification changes and adaptations.

What is claimed is:

1. Anaesthetic gas safety equipment comprising

- i. delivery means to administer anaesthetic gas to a patient, said delivery means having a gas inlet and a gas outlet,
- ii. a first flexible conduit having one end connected to said gas inlet,
- iii. anaesthetic gas supply means connected to the other end of said first flexible conduit,
- iv. a second flexible conduit having one end connected to said gas outlet, and
- v. a man-portable anaesthetic gas absorber unit comprising:
 - a. a cylindrically walled hollow drum having radial end walls,
 - b. a central inlet in one end wall releasably coupled to the other end of said second flexible conduit, the other end wall being provided with a plurality of angularly spaced apertures,
 - c. a first perforated retainer sheet spaced inwardly from said one end wall,
 - d. a second perforated retainer sheet adjacent said other end wall and between it and the first perforated retainer sheet, and
 - e. a predetermined fixed quantity of absorber material between said first and second perforated retainer sheet and retained thereby, said material comprising carbon activated to absorb anaesthetic gas exhaled by the patient.

2. Anaesthetic gas safety equipment according to claim 1, comprising a cylindrical, drum-support-skirt extending axially away from said other end wall in line with the cylindrical wall of said drum, said drum-support-skirt being apertured to permit passage therethrough of patient-exhaled gas now substantially free of anaesthetic.

3. Anaesthetic gas safety equipment according to claim 1, wherein said second perforated retainer sheet is spaced inwardly from said other end wall.

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