TIGHT ENCLOSURE FOR THE TREATMENT OF A PATIENT IN A CONFINED ATMOSPHERE

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References Cited
UNITED STATES PATENTS
3,272,199 9/1966 Matthews..................... 128/1 R
3,051,164 8/1962 Trexler....................... 128/1 R
3,670,718 6/1972 Brendgord.................. 128/1 R

FOREIGN PATENTS OR APPLICATIONS
1,152,604 5/1969 Great Britain ............... 128/1 R

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ABSTRACT
An enclosure for the treatment of patients has a rigid frame covered with a flexible at least partially transparent plastic material to surround a bed. Half suits are attached to openings in the sides of the enclosure for use by attendants. Movable panels adjacent the half suits in the enclosure may be placed in horizontal position for work surfaces adjacent the bed. Air locks are provided for emergency admission to the enclosure and for admitting the patient thereto. The enclosure has means for forced ventilation and adjustment of atmospheric pressure within the enclosure.

3 Claims, 11 Drawing Figures
TIGHT ENCLOSURE FOR THE TREATMENT OF A
PATIENT IN A CONFINED ATMOSPHERE

BACKGROUND OF THE INVENTION

Very often it is necessary, for medical treatment, to put a patient into an enclosure bacteriologically separated from the surrounding atmosphere. This need occurs either because we want to protect ourselves from a person who suffers of a serious contagious disease, or, quite to the contrary, because certain treatments make a person more receptive to the biological contamination which is carried in the surrounding atmosphere, and therefore it is the patient we then try to protect from the pathological germs from the outside world.

To this date, in order to treat someone under these conditions, we have been using rooms which are as tight as possible, taking into account that several times during the day someone has to enter into said room in order to take care of the patient as well as to bring his food. These entries are made through an air lock chamber which each time inevitably puts the atmosphere in which the patient is living in contact with the surrounding one, and also puts the attendant in direct contact with the patient. Thus the risk of transferring the pathogenic germs to one side or the other always exists, although the air lock chambers include a sterilizing device (air shower, ultra violet rays...).

The object of the present invention is a tight enclosure for treating a patient in a confined atmosphere which reduces the inconveniences mentioned above in a simple manner and at the same time has some additional advantages which will be described further on.

SUMMARY OF THE INVENTION

This tight enclosure for the treatment of a patient in a confined atmosphere comprises essentially the following features:

a rigid structure which represents the room itself,
a bed located inside said room,
connected with said structure, tight flexible walls, whereby certain parts of them at least are transparent, and define the treatment area as such, means for insuring the ventilation and the regulation of pressure inside the enclosure, means to reach the patient, to administer treatments, to introduce and extract from the enclosure the materials and food.

It is easy to understand one of the immediate advantages obtained by having, according to the invention, the walls of the treatment enclosure made of a material which at the same time is tight, transparent and flexible, whereby preferably a plastic flexible film is used such as a vinyl polychloreide of a thickness proportionate to the resistance which the walls are supposed to have or a complex flexible film obtained by calendering two simple flexible films of different nature. Such a material guarantees a perfect tightness relative to bacteria and pathogenic germs in general. Since such a wall is transparent to light and sound, the patient who lives inside of this enclosure can see and hear everything that goes on outside and therefore does not suffer any feeling of claustrophobia which sometimes overcomes patients confined for too long in an enclosed room. It is understood that it is desirable but not compulsory to have the flexible walls of the treatment enclosure be transparent over their whole surface. Nevertheless, it might also be necessary in some cases to make said walls of flexible surfaces partly opaque and partly transparent and this still falls within the scope of the invention. The usage of a complex film allows combining, with a supporting film, another thin film with desirable properties, such as, for example, the absence of odors. Since the material used is flexible, it allows the external operators to approach the bed of the patient or the use of any other apparatus or device located within the enclosure by using tight suits of a known type.

Based on the utilization of the tight treatment enclosure, it can be used with a lower or higher than normal pressure. In both cases, classical and known means are used to assure the maintenance of a constant pressure inside the enclosure as well as the ventilation of the atmosphere in which the patient lives. Bacteriological filters, generally made of paper with small pores, are used in the ventilation circuits in order to obtain a bacteriological tightness of the enclosure of treatment with respect to the surrounding atmosphere.

According to a first embodiment of the invention, these means of intervention comprise at least one working surface of a panel tightly connected to the flexible wall, hinges on the rigid structure and is movable between and at rest position, where it coincides with the lateral vertical wall of the room, and working position, inside the room, where it is placed horizontally against the edge of the bed at its height, said panel being equipped with transfer devices free of bacteriological contamination and having an opening over which a tight half suit is affixed.

In a preferred embodiment of this working surface, the panel hinged on the rigid structure constitutes one of the two sides of a flexible frame with two equal sides, hinged following three horizontal parallel axes at the bedside, wherein the first axis is connected with a ball slide mounted in a sliding manner around a vertical pole which has a rigid structure, the second axis coincides with the common generatrix at the two sides of the frame and the third is connected near the floor and on the bottom of the bed, to the rigid structure. A stop is used to block the slide on the vertical pole in a position which corresponds to the horizontal unfolding of the hinged panel.

The operator enters the tight half suit connected with the working surface and stands in the center of the working surface and inside the rigid structure but outside the treatment enclosure as such, the lower part of the operator, which has changed its shape according to the invention in order to allow immediate access to the bedside of the patient. The tight suit has interchangeable tight gloves by means of which the operator performs all the manual actions necessary for the care of the patient. Different transfer devices are held by openings made on the working surface, and in the central standing position are within reach of the operator's hand. The advantage of this first variation of a means of intervention is that it does not use any external surface to the rigid basic structure, and it therefore is economical to install.

On the other hand, when the working surface is unfolded horizontally, it occupies the entire free space between the bed of the patient and the wall of the enclosure.

According to a second embodiment of the invention, the means for intervention are constituted by at least...
one appendix of the flexible wall, outside of the actual room, which communicates with the enclosure, and is closed tightly by a movable panel around a horizontal axis connected to the rigid structure between a vertical at rest position, where it coincides with the lateral wall of the room, and a working position, outside the room, where it is set horizontally against the edge of the bed at the height of the bed, said movable panel thus having an opening onto which a tight half suit is affixed. The movable panel unfolds in this instance outside of the rigid structure which forms the room and thus constitutes, in a certain way, a cumbersome factor outside the rigid structure. This external appendix, if it is located on the longitudinal axis of the bed, also fulfills another very important function, since it is through the opening on the movable panel, when the tight half suit is not in place, that the patient is introduced into the enclosure by using known means such as, for instance, a tight air lock chamber, so that the transfer is done free of any bacteriological contamination.

Finally, according to another characteristic of the present invention, the tight enclosure is provided with a rapid means of intervention for emergency cases when the doctor decides that the need of intervention is more important than the consequences of a limited risk of bacteriological contamination. This means of rapid intervention can be for instance an air lock chamber composed of one parallelepiped chamber with flexible walls, the external and internal walls of which are provided with zippers, one of them being made tight by means of adhesive tape. A preferred construction of the air lock chamber is provided with means for sterilizing to a desired degree the volume of air which inevitably is exchanged between the enclosure and the surrounding atmosphere at each passage. These means of sterilization can be an air shower or a sterilization shower of ultra violet rays. According to another variation, the means of rapid intervention are a tight suit connected to the wall of the enclosure by an access passage, the walls of which are continuous with those of the enclosure and those of the tight suit. This last variation avoids the introduction of a contaminated volume of air into the enclosure.

REFERENCE TO THE ACCOMPANYING DRAWINGS

The invention will be better understood from the following description of the preferred embodiments of construction of the isolated enclosure for treatment of a patient in a confined atmosphere, the description of which will be made with reference to the accompanying drawings in which:

FIGS. 1a, 2a, 3a and 4a show in a plan view different combinations possible of a working surface and of the external appendix used around the enclosure of the present invention;

FIGS. 1b, 2b, 3b and 4b are vertical sections on the lines BB of FIGS. 1a, 2a, 3a and 4a;

FIG. 5 is a total view in isometric perspective of a tight enclosure for treatment, which includes two working surfaces of FIG. 2a and one appendix of changeable shape;

FIG. 6 is a transverse section on the line VI—VI of FIG. 7 of a working surface which unfolds according to the present invention; and

FIG. 7 is a view in the direction of arrow F in FIG. 6 of the operator standing in his half suit for intervention and, on the actual working surface which is in an unfolded position, the different transfer devices which are used for introducing and extracting material or food from the enclosure.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In FIGS. 1 to 4, reference 1 indicates the tight and flexible wall of the actual treatment enclosure. Each enclosure contains a bed 2, an air lock chamber for rapid intervention 3, and a number of working surfaces 4 and/or external appendices 5.

In FIGS. 1b, 2b, 3b and 4b, working surfaces 4 and the external appendices 5 are in an unfolded position (solid lines). The initial at rest position is shown in dotted lines which show the change of shape undergone by the tight flexible wall when the means of intervention are used.

The interesting aspect of these different figures is that they illustrate that, with these two means of intervention which are the working surface 4 and the external appendix 5, it is possible to build, according to the particular needs, any geometrical configuration desired, for the tight treatment enclosure where the bed of the patient is set up. The choices may depend on many circumstances. Some depend on the particular condition of the patient, whereas others depend on financial considerations concerning the surface on the floor occupied by the rigid base structure that defines the room as such. FIGS. 1b, 2b, 3b and 4b show that the floor occupation and the free space around the bed of the patient, when the working surfaces 4 are in at rest position, are in direct relationship. The structures of FIGS. 2a and 2b are most complete and best balanced since they include two working surfaces 4 situated at each side of the bed 2 and one external appendix 5 located at the head of the patient which permits simultaneously the intervention of three operators around the patient.

The structure of FIGS. 3a and 3b are the optimal solution when little space on the floor is available and it is desired to have two persons intervene at the side and at the head of the bed.

FIGS. 4a and 4b represent an extreme case when the patient is completely immobilized. It is then useless to locate anything around the bed to allow the patient to move. In the tight enclosure of these figures, the only means of intervention is an external appendix 5 located on one of the lateral sides of bed 2 which includes outside of the only opening provided for the tight suit, a device 6 for transfer without bacteriological contamination. A door, located at the head of the bed, may be used for introducing the patient into the enclosure.

FIG. 5 is an isometric perspective of a tight enclosure for treatment including rigid structure 7 and the tight, transparent and flexible wall of the enclosure. Wall 1, not clearly seen in FIG. 5 due to its transparency, is affixed on the rigid structure 7 by stay-plates 8 which hold it in place, particularly when the enclosure is in a low pressure or high pressure atmosphere. In this figure, the structure of rigid base 7 is made of metallic pipes assembled according to known procedures, in order to form the chamber itself. The tight transparent and flexible wall 1 defines the tight enclosure and may be a flexible film of polyvinyl chloride of 30/100 mm thickness, assembled by high frequency welding. The dimensions of the room, seen in FIG. 5, are the follow-
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ing: length 2m95, width 2m85, height 2m45. This gives the patient a confinement volume of 20 m³.

Bed 2 is located in the middle of the enclosure and on either lateral side of the bed 2 there is a working space, one space 4 is shown in at rest position and space 4a is shown unfolded in working position with an operator in the half suit 9. In FIG. 5, an external intervention appendix 5 is shown with a parallelepiped flexible wall close on the bottom in a tight manner through a moveable panel 10 hinged on axis 46, connected to rigid structure 7. Moveable panel 10 is shown in FIG. 5 in a horizontally unfolded position and is maintained in this position by ropes 11. An opening 12 is provided to which is tightly affixed a half suit for intervention 13. In its unfolded position the moveable panel 10 is approximately at the level of the bed 2 of the patient and consequently permits an easy access to the head and the bust by the operator in suit 13. In its at rest position, panel 10 of the external appendix 5 is vertically fixed against the vertical wall of the rigid structure 7. In this position, it is used, after replacing the suit by a transferring device free of contamination, to introduce the patient into the enclosure.

In the enclosure of FIG. 5 are also shown the entry and exit pipes for the ventilation of the enclosure at 14 and 15. Each pipe 15 opens into a metallic box 16 which contains bacteriological filters, one box being located on top of external appendix 5. The tight enclosure of FIG. 5 also includes an air lock chamber 16 for rapid introduction in emergency cases comprising a parallelepiped chamber, either internal or external of enclosure 1 and both walls, internal and external, are closed by zippers, one of which at least is airtight. These zippers are not shown in FIG. 5 in order not to encumber the drawings.

Wall 1 of the enclosure also includes a manometer 17 for closely monitoring the evolution of the internal pressure as well as that of the tight and self-closing passages 18 for the introduction of particular fluids for special treatment.

On panel 4 can be seen, besides opening 19 which is used for mounting the intervention suit 20, two lateral openings 21 and 22 for locating transferring devices free of bacteriological contamination for passing through wall 1 material and food needed by the patient and the performing of the different cares which the condition of the patient requires. Suit 20, which is in the at rest position, is held by rope 23 attached at 24 to the upper part of the rigid structure 7.

In FIG. 6, which is an elevation on line VI—VI of FIG. 7, the construction detail can be seen of working surface and its half suit. According to the present invention, the working space 4 has a panel 25 joined tightly by welding 26 to the transparent and flexible wall 1. Panel 25 hinges on the rigid structure 7 at horizontal axis 27 connected to a moveable ball slide 28 for vertical motion along a post 29 of the rigid structure 7 between two positions. One at rest position is shown in solid lines in FIG. 6 with working surface 4 vertical and parallel to the wall of the enclosure. An intermediate position 4b is shown in dotted lines and the working position 4a is shown in dotted lines in FIG. 6. Panel 25 is part of a flexible frame 30 and is one of two equal slides hinged on the three horizontal axes 27, 31 and 32 parallel to the edges of the bed. Two of these axes 27 and 32 are, respectively, joined to ball slide 28 and to the floor at a point located at the foot of the bed with respect to the axis 32. The third axis 32 is free and can move over the surface of a circular cylinder which has axis 32 as an axis. The second side 33 of frame 30 is located between axis 31 and 32 and is of an equal length to that of panel 25, since in unfolded position 33a, it acts as a vertical crutch supporting working surface 4.

A counterweight 34 exerts through a cable 35 a constant upward force on ball slide 28 to balance the weight of the structure of working surface 4 described above.

Opening 19 of panel 25, according to the invention, supports a tight suit 20 which is part of wall 1 and is kept in place in at rest position by rope 23 hooked onto the ceiling 24 of the rigid structure 7. This suit can be of any known type. It is advantageous, particularly when the treatment enclosure is under lower pressure than the surrounding atmosphere, that the suit have a doublewall. In this case a pipe system 36 feeds air to suit 20. A locking system, not shown, locks slide 28 and the flexible frame 30 in place, when the enclosure is at low pressure, since the frame would have a tendency to unfold under the effect of the low pressure. A stop 37 blocks slide 28 when working surface 4 is in unfolded position 4a.

It is understood that, at the time of unfolding of the working surface 4, wall 1 of the enclosure, which is secured in a tight manner to the moveable frame at its ends 38, 39 and 40 (FIG. 5), must accompany the moveable frame in its displacement. Since wall 1, although flexible, is not elastic, an expansion pocket indicated at 41, is mounted on the lateral wall of the enclosure to allow the displacement of the wall from position 1 to position 1a (FIG. 6).

The functioning of the structure of FIG. 6 for displacement of the working surface 4 is as follows. Starting at the at rest position shown in solid lines in FIG. 6, the operator who wishes to enter suit 20 exerts a vertical push on ball slide 28 to bring it into the intermediate position 28b with the assistance of counterweight 34 whose mass is chosen in proportion to the pressure difference between the inside of the enclosure and the surrounding atmosphere which pressure difference produces a considerable force in proportion to the involved surface, said force being exerted, in one direction or the other, on working surface 4. When the system reaches the intermediate position 4b shown in dotted lines in FIG. 6, it is easy for the operator to enter suit 20 and a slight push on the working table causes the ball slide 28 to return to its initial position where it lodges against stop 37 which, with vertical frame 33a, stabilizes working space 4 in unfolded position 4a.

In FIG. 7, working surface 4a is shown in unfolded position, an operator having entered the suit 20 in working position. In panel 4 are orifices 21 and 22 where two transfer devices are inserted free of bacteriological contamination, which are shown are two containers of a known type 44 and 45 provided with double doors. Those containers are, equipped with a closing device as described in French Pat. No. 1,346,486 of Nov. 8, 1962, granted to the Commissariat a l’Energie Atomique. These two containers allow the introduction of different implements such as dressings and previously sterilized instruments without breaking the bacteriological tightness of the tight enclosure and the surrounding atmosphere.

What I claim is:
1. Enclosure or room for treatment of a patient in a confined atmosphere, comprising:
a basic rigid structure defining the room,
a bed inside said room,
tight and flexible partially transparent walls connected to said structure defining the treatment enclosure,
means for ventilating and regulating the pressure inside the enclosure,
intervention means to reach the patient, to provide his care and to introduce or take out of the enclosure materials and food, said intervention means including at least one working surface, connected to said flexible wall, hinged to said rigid structure and movable between an at rest position parallel to a lateral wall of the room and a horizontal working position inside the room against the edge of said bed at the height of said bed, transfer devices for said surface free of bacteriological contamination, an opening in said walls adjacent said surface and a half suit for intervention secured around said opening, said surface being a panel hinged to said rigid structure forming one side of a flexible frame having two equal sides hinged on three horizontal parallel axes adjacent the edge of said bed, a ball slide slidably mounted on a vertical post of said rigid structure, one of said axes being connected to said slide, the second of said axes merging in the common generatrix at the two sides of said frame, the third of said axes being connected adjacent the lower end of the bed to said rigid structure and a stop for said slide on said vertical post at the horizontal position of said panel.

2. Enclosure or room for treatment of a patient in a confined atmosphere, comprising a basic rigid structure defining the room, a bed inside said room, tight and flexible partially transparent walls connected to said structure defining the treatment enclosure, means for ventilating and regulating the pressure inside the enclosure, intervention means to reach the patient, to provide his care and to introduce or take out of the enclosure materials and food, said intervention means including at least one working surface connected to said flexible wall, hinged to said rigid structure and movable between an at rest position parallel to a lateral vertical wall of the room and a horizontal working position inside the room against the edge of said bed at the height of said bed, transfer devices for said surface free of bacteriological contamination, an opening in said walls adjacent said surface and a half suit for intervention secured around said opening and at least one external, substantially parallelepipedal appendix of said flexible wall outside the room, an opening in one face of said appendix and said wall communicating with said enclosure, a movable panel closing said opening, a horizontal hinge for said panel joined to said rigid structure for rotation of said panel between a vertical at rest position parallel to the wall of the room and a horizontal working position inside the room level with and against the edge of said bed, an opening in said movable panel and a half suit for intervention secured about said opening.

3. Enclosure according to claim 2, including a rapid intervention air lock chamber in one of said walls.