W. & J. MEYER.

APPARATUS FOR CONDUCTING THORACIC OPERATIONS.

APPLICATION FILED JULY 28, 1911.

1,013,800. Patented Jan. 2, 1912.

4 SHEETS—SHEET 1.

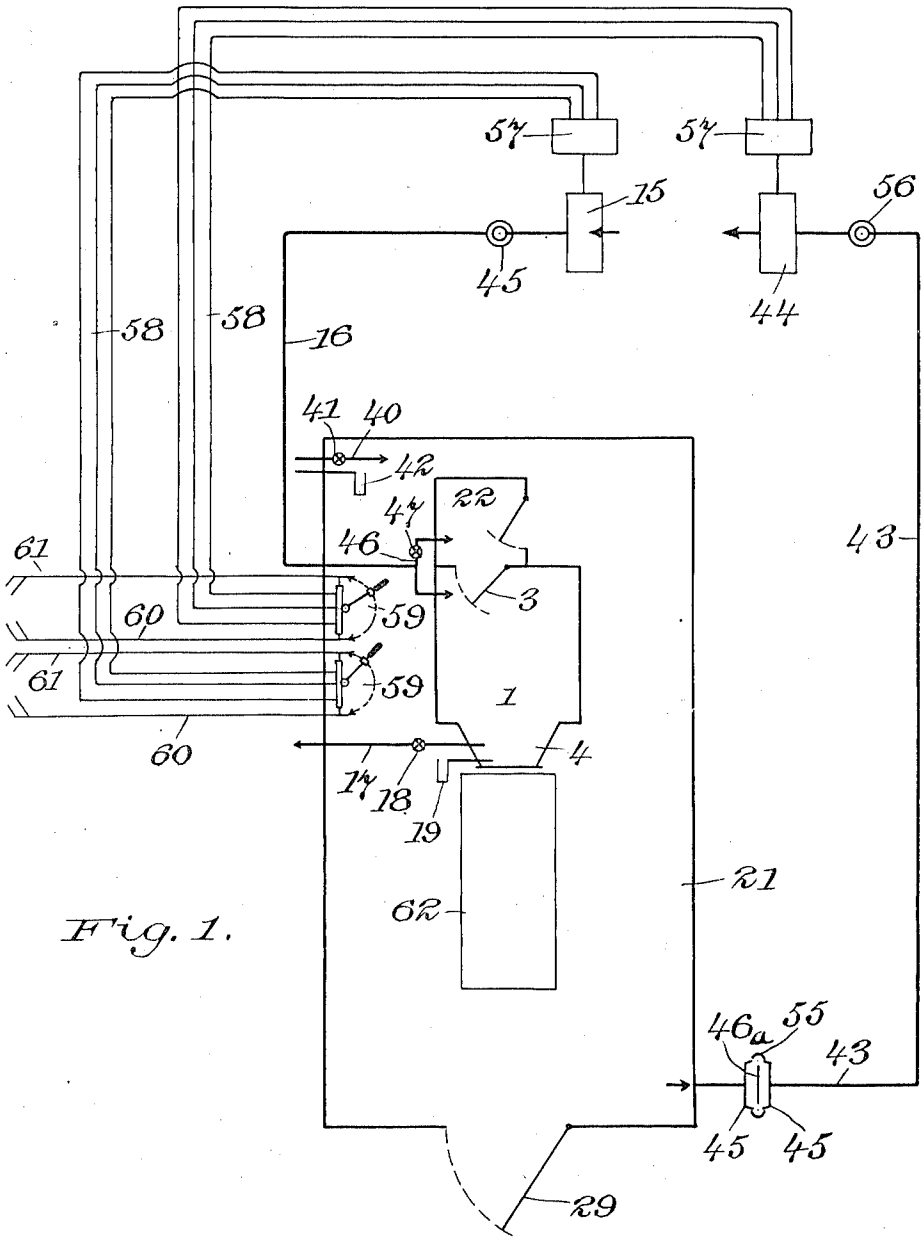

Fig. 1.

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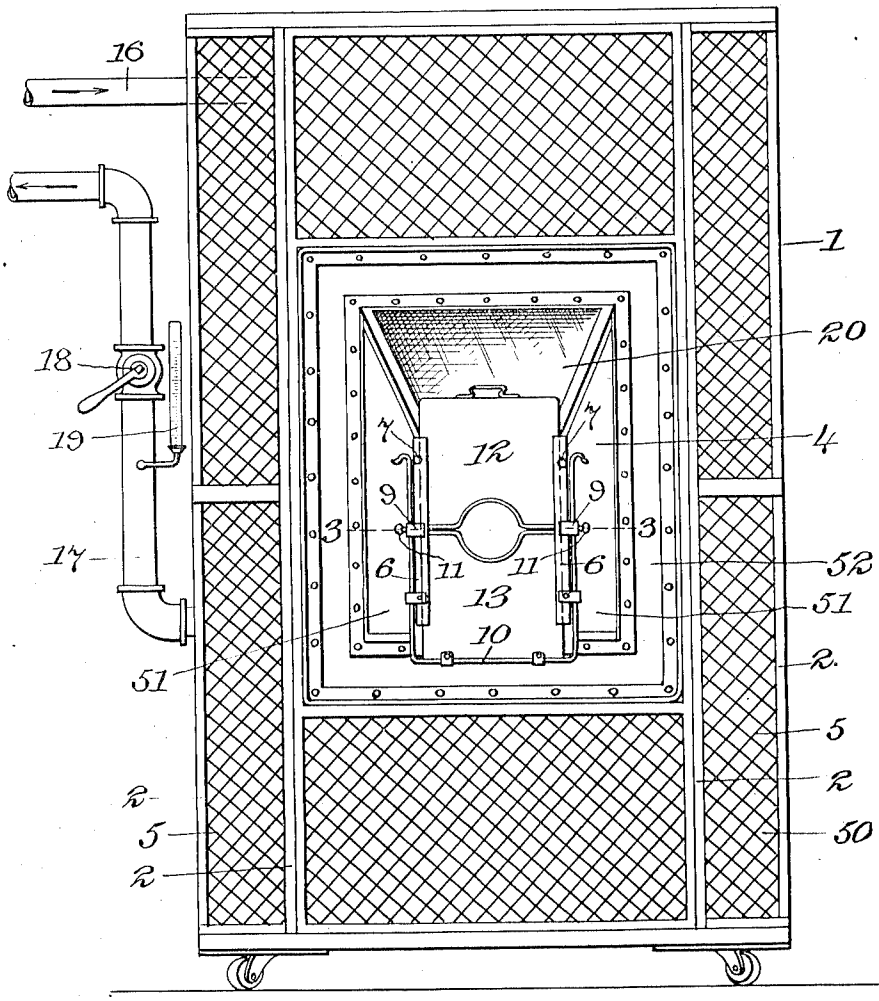
4 SHEETS—SHEET 2.

Fig. 2.



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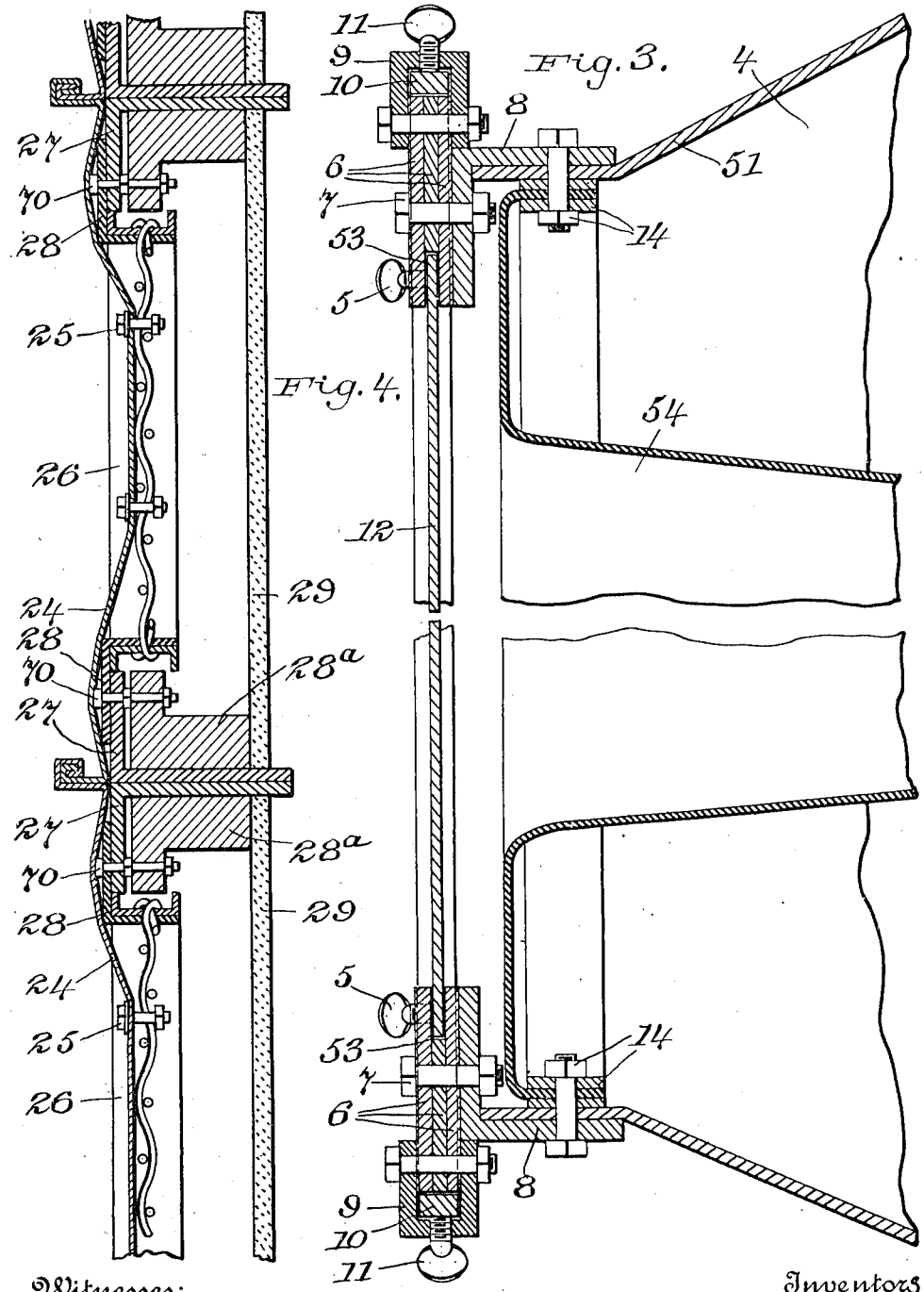

Fig. 3.

Fig. 4.

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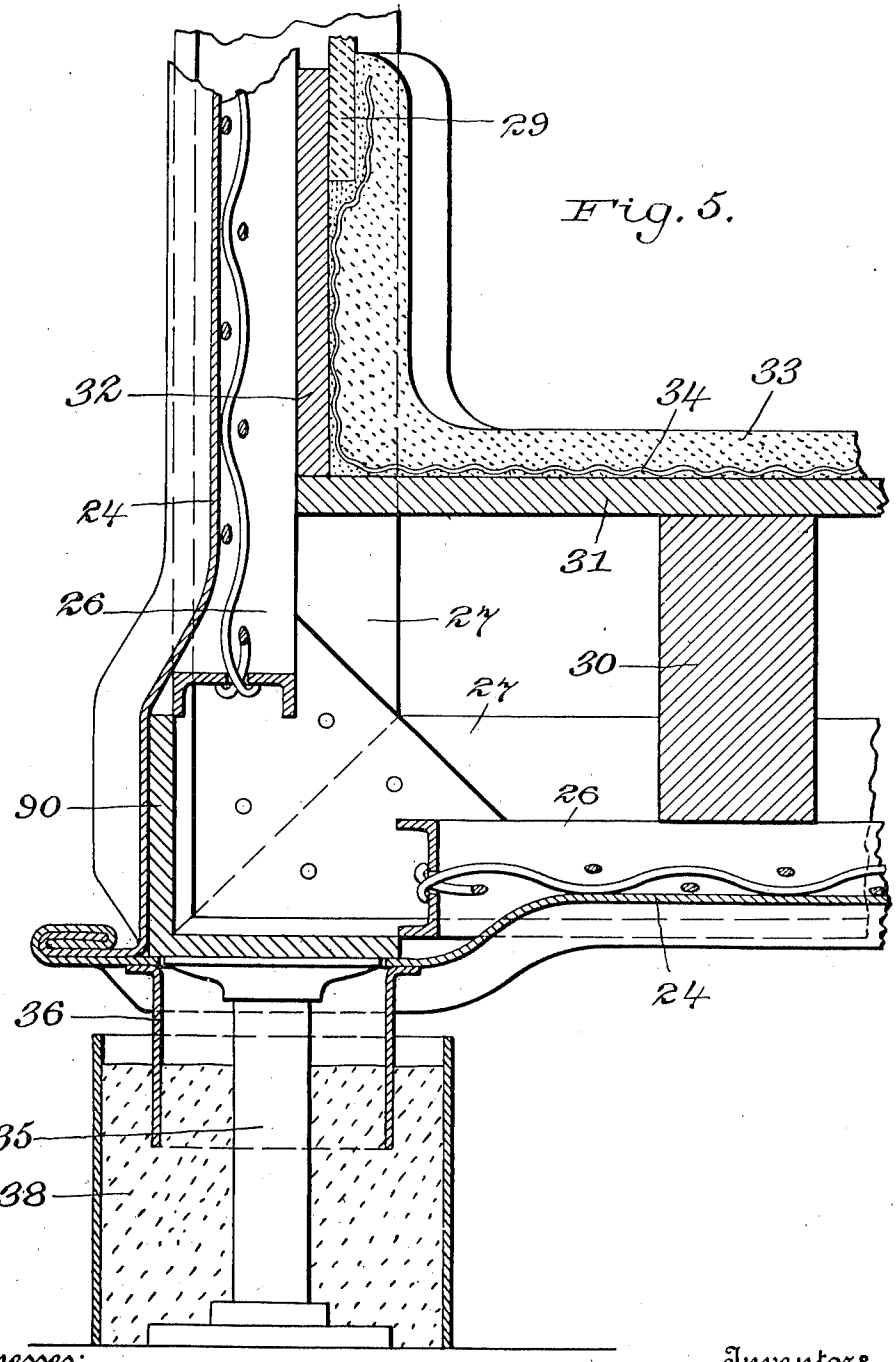

Fig. 5.

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UNITED STATES PATENT OFFICE.

WILLY MEYER AND JULIUS MEYER, OF NEW YORK, N. Y., ASSIGNORS TO THE PEOPLE OF THE UNITED STATES.

APPARATUS FOR CONDUCTING THORACIC OPERATIONS.

1,013,800. Specification of Letters Patent. Patented Jan. 2, 1912.

Application filed July 28, 1911. Serial No. 641,149.

To all whom it may concern:

Be it known that we, WILLY MEYER and JULIUS MEYER, citizens of the United States of America, residing at New York city, borough of Manhattan, county and State of New York, have invented certain new and useful Improvements in Apparatus for Conducting Thoracic Operations, of which the following is a specification.

Our invention relates generally to apparatus for producing, maintaining and regulating different air pressures in airtight chambers, and more specifically consists in improved apparatus for constructing separate airtight chambers in which the body and head respectively of a patient may be conveniently maintained under different air pressures during a surgical operation on the body, while the patient is under the influence of an anesthetic.

It is well known that if the thorax of a living being is opened by an incision sufficient to permit entrance of air thereto through said incision, the lungs collapse and the being dies. It has been recently discovered that under said conditions the physiological condition can be approximately maintained if the air pressure to which the opened thorax of the patient is subjected is made less than that of the air which he breathes; the collapse of the lungs does not then occur, and under these conditions extensive operations on the thorax may be safely conducted. To accomplish this, it has been proposed to place the head of the patient in a separate chamber in which the air pressure above the tension of the exterior atmosphere may be maintained, or to place the body of the patient in such a chamber in which a pressure is maintained below that of the exterior atmosphere into which the head of the patient projects. In the apparatus produced prior to our invention for this purpose the operation has to be finished under the kind of pressure, above or below atmospheric pressure, under which it is begun. It is moreover conducted with some difficulty, because of the cramped position of the surgeon and assistants, the impossibility of his seeing the face of the patient, impossibility of convenient communication with the assistant administering the anesthetic, who is in another compartment, impossibility of any one entering or leaving the operating room when a partial vacuum exists therein except through an air lock, without collapsing the lungs of the patient, and difficulty in properly controlling the air pressure. Where these difficulties have been in part avoided in previous constructions, the administration of the anesthetic has been rendered more complicated.

We have invented an improved apparatus which overcomes these difficulties and enables the most extensive thoracic operation to be performed with the same ease and safety as any other operation of the same magnitude not requiring the special atmospheric conditions above referred to.

The best form of apparatus embodying our invention at present known to us is shown in the accompanying three sheets of drawings in which,

Figure 1 is a diagrammatic plan view of our apparatus assembled. Fig. 2 is a front elevation of the structure forming the anesthetizing cabinet. Fig. 3 is a detail horizontal section on line 3—3 of Fig. 2 through the head box. Fig. 4 is a detail horizontal section showing the construction of the wall of the operating chamber, and Fig. 5 is a detail vertical section of a portion of the wall and floor.

Throughout the drawings like reference characters indicate like parts.

1 is the positive differential pressure cabinet or anesthetizing cabinet composed of a number of panels built up of iron frames 2, and wire cloth of diamond mesh 5, sides, top and bottom. In the rear is the door 3 opening into an air lock 22, constructed in the same manner as cabinet 1, and from the front projects the head box 4 which opens toward room 1. Inside of this structure forming the anesthetizing room and against the walls thereof is supported a bag of india rubber or other flexible airtight material 50, which, of course, has holes for the head box 4 and the door 3 and has an airtight connection to the structure around these holes. The air lock is made airtight in the same manner. The head box has at its front a panel provided with vertical grooves or guides 53, 53, in which are mounted two shutters 12 and 13 which have their meeting edges cut away in a semicircular manner so as to produce a circular opening. The vertical guides 53, 53, are formed by three

metal strips 6, 6, 6, held together by bolts 7, 7, and fastened to angle irons 8, 8, by said bolts 7. On the outer edges of the strips are clips 9, 9, which serve as guides for the bent rod 10 which is adjustably held therein by set screws 11, 11. This rod passes under the lower shutter 13 and supports same. The upper shutter may be held in any position by set screws 5, 5. The collar 54 is fastened to angle iron frame 8, 8, by bolts and strips, as shown at 14, 14.

The body of the head box is formed of the metal plates 51, and glass plate 20. It is fastened to the metal panel 52 set in the front wall of the anesthetizing room and tapers outward. Its bottom is horizontal. The front part of the head box comprising the rubber collar and the slides for the shutters we have also constructed as an independent frame that as a whole can be fastened to or be taken out of the head box. By making collars 54 of varying widths we can thus adapt the apparatus quickly to use on children or adults by a change of frames.

21 is the negative differential pressure chamber or operating room. It consists of an iron structure composed of cord angles 90, rectangular angle iron frames 27 arranged at convenient distances apart, of wire screens supported by them and closing the spaces between them and of two end walls, built of angle iron uprights and wire screens, also of top and bottom brace angles between side and end walls.

An air tight covering is placed outside of the structure. The form shown in Fig. 4 is made up of strips 24, of sheet copper, the edges of which are overlapped and treated in any desired manner to make air tight joints. To prevent the noise which would be produced by the buckling of these sheets under variations of pressure, we attach them to the wire mesh by bolts 25, 25. The manner in which the walls, roof and floor of the operating room 21 are built up is illustrated in Figs. 4 and 5. The wire mesh is fastened to channel iron frames 26. These are fastened to angle iron uprights 27, 27, and to similar members forming the top and bottom of the structure by angle clips 28, and bolts 70. In the angle iron uprights are placed wooden strips 28^a, 28^a, to which are fastened inner panels 29, 29, of any fireproof, sanitary board. Wooden floor beams 30 rest on the angle irons at the bottom of the structure, and support a wooden flooring 31. On this floor and baseboard 32, is placed a cement covering 33 reinforced by expanded metal 34. The air space between the copper and the panel boards and floor communicates by openings with the inner air space of the chamber. The whole structure is supported on legs 35. Around each leg the copper sheathing is cut away and a thimble 36 soldered to it. This thimble extends down into a box filled with molten sulfur 38, or other airtight material.

Such being the details of our preferred construction the general arrangement and operation can be explained with reference to the diagram, Fig. 1. A pump 15 supplies air through pipe 16 and muffler 45 to the anesthetizing cabinet 1. This air escapes from the room 1 through pipe 17 leading from a point near the bottom of the head box and having a valve 18 with a gage 19 located in the outer chamber 21, the pipe 17 leading through said chamber to the outer air. The air pipe 16 has a branch 46 extending to the air lock 22, controlled by valve 47. A pipe 40 admits air to room 21 and is provided with a valve 41 and gage 42 located inside chamber 21. An air pipe 43 leads from the other end of room 21 through muffler 56 to the intake of pump 44. This pipe 43 has a sound interrupter composed of the tube enlargements 45, 45, between which is placed disk 46^a and which are connected by india rubber strip 55 or some other flexible sound deadening material.

The pumps 15 and 44 are each driven by electric motors 57, 57, which are connected by wires 58, 58, to switch boards 59, 59, in the operating room 21. Current is supplied to these switch boards both from house circuit connection 60 and connections 61, 61, to the mains in the street or other source of supply so that in case one fails the other can be drawn upon. For the purpose of obtaining power reserve we may use a number of small units to take the place of either of the single outfits 57—44, and 57—15. One set of these smaller units is operated on house current and another set at the same time, on the other current. The breaking down of one suction set, for instance, will cut down the ventilation of room 21, but the set continuing to run on the other current is sufficient to maintain the proper working of the apparatus, and the necessary difference of pressures.

In using our invention the patient is brought in through door 29 and placed upon any suitable operating table 62 in such position that his head projects through the flexible collar 54 into head box 4 and is therefore in the anesthetizing room 1. The head is there supported in any convenient manner, not shown, and the anesthetizer and his assistant sit therein and administer the anesthetic to the patient. The flexible collar 54 having been fastened about the patient's neck and the doors closed, the patient's head and the anesthetizers are so inclosed in an airtight structure. The motor connected to the pressure pump 15 being set in operation by manipulation of its switchboard, air will enter the anesthetizing room in a constant

stream directed against the top thereof, passing out through exhaust pipe 17. The anesthetizers are placed in this current of fresh air. They are not affected by the vapors of the anesthetic, which, being applied at the exhaust opening, pass right out through the same after use upon the patient. With this ventilation of the anesthetizing cabinet at atmospheric pressure the operation begins and proceeds until in due course the surgeon requires a difference in pressure between the inside and the outside of the cabinet. Atmospheric pressure prevailing outside, the pressure is raised within the cabinet above atmosphere by throttling exhaust pipe 17 by means of valve 18, the ventilation of the cabinet continuing at the same time without interruption. The difference in pressure produced is indicated by gage 19 and the valve is set to the gage reading called for by the surgeon.

So far it is evident that the outer structure might be dispensed with and the anesthetizing cabinet and its accessories alone used as an independent positive differential pressure cabinet. It is so used. But the required difference in pressure can also be produced by continuing to ventilate the anesthetizing cabinet at atmospheric pressure and producing a partial vacuum in room 21. The apparatus heretofore described lends itself to this purpose, the necessary reduction of pressure in the operating room 21 being produced by suction pump 44 set into operation by its motor and switchboard connections. Said pump sucks the air from the chamber 21 through the pipe 43. The same quantity of air flows into room 21 through pipe 40 as is taken out through pipe 43 and room 21 is thus ventilated at atmospheric pressure. This ventilation is started some time prior to the beginning of the operation. Partial vacuum is obtained in room 21 by throttling pipe 40 by means of valve 41, the ventilation of room 21 continuing at the same time without interruption. The reduced pressure thereby produced is indicated by gage 42, and the reduction below normal atmospheric pressure can thereby be determined. Atmospheric pressure prevailing also in room 1, gage 19 will show the same reading as gage 42. The valve 41 is set to the gage reading called for by the surgeon. By manipulating valves 18 and 41 at the same time during the ventilation of rooms 1 and 21, the required difference in pressure may also be built up of part vacuum and part pressure. This discloses another reserve of the apparatus, for, should the pressure pump outfit fail, then the difference in pressure is maintained by the suction outfit, and vice versa. The possibility of going from pressure to suction and from suction to pressure while maintaining and without interrupting the prevailing difference in pressure, obviates the use of an air-lock for room 21, because door 29 can be opened at any time during the operation after going to atmospheric pressure in room 21. This same feature also enables the subjecting of the patient successively to pressure, partial vacuum or a combination of both without interrupting at any time the existing difference in pressure and without change in the position of either patient or staff.

The flexible non-resonant connection 55 between the two sections of pipe 43 serves to prevent the noise of the pumps and motors being transmitted through the metal of the pipes to the operating room. The mufflers 45 and 56 are designed to break up the flow of the currents of air and prevent the noises of such air currents being transmitted through the air in the pipes to the operating and anesthetizing rooms.

The pane of glass 20 affords convenient means for the operating surgeon to view the face of the patient at all times and the surgeon can also talk to the persons in the anesthetizing cabinet through the rubber diaphragm formed by the sides thereof, while the projecting out of the head box from the anesthetizing cabinet gives elbow room to the surgeon and the assistant facing him and enables the placing of further assistants to the left of the surgeon and to the right of the assistant facing him. To do away with the upholding of the patient's arm by an assistant, horizontally adjustable hooks (not shown) have been arranged in front of the cabinet from which the arm is suspended.

The shutters 12 and 13 being adjustable in vertical grooves, the position of the operating table may be varied to bring the body of the patient to the desired height and inclination.

By properly manipulating valves 18 or 41 to produce alternate variations of pressure in either the operating or the anesthetizing cabinet, artificial respiration of the patient may be produced.

We do not consider as part of our invention all the features of construction hereinbefore described, but

We do claim as new:

1. A surgical apparatus comprising in combination two chambers of airtight construction having an opening between through which the head of a patient may project, and means for increasing the air pressure in one chamber above that of the atmosphere, and for reducing the air pressure in the other chamber below that of the atmosphere.

2. A surgical apparatus comprising in combination two chambers of airtight construction having an opening between through which the head of a patient may

project, and means for varying the air pressures in both chambers.

3. A surgical apparatus comprising in combination two chambers of air tight construction having an opening between through which the head of a patient may project, and means for increasing the air pressure in one chamber above that of the atmosphere, and for reducing the air pressure in the other chamber below that of the atmosphere, said means comprising an air pump having its discharge port connected with the first chamber and a second air pump having its intake connected with the second chamber, motors for driving said pumps, means for controlling the outflow of air from the first chamber and means for controlling the inflow of air to the second chamber.

4. A surgical apparatus comprising in combination two chambers of air tight construction having an opening between through which the head of a patient may project, and means for increasing the air pressure in one chamber above that of the atmosphere, and for reducing the air pressure in the other chamber below that of the atmosphere, the walls of the first chamber being formed of an open framework and a covering of flexible airtight material inside said framework, and the walls of the second chamber being formed of a similar framework and a covering of airtight material outside of said framework.

5. In a surgical apparatus the combination of an airtight chamber having an opening in one of its walls, a tapering head box projecting therefrom, said head box having an opening through which the head of a patient may be inserted into said head box, means for supporting the body of the patient outside of said chamber, an air inlet, an air outlet, means for forcing a stream of air through the inlet and means for varying the cross section of the outlet whereby the air pressure in the chamber may be varied.

6. In a surgical apparatus a chamber of air tight construction having a tapering head box projecting outwardly from one side, said head box having an opening through which the head of a patient may be inserted into the chamber while the body of the patient is outside of the chamber.

7. In a surgical apparatus a chamber of airtight construction having a tapering head box projecting from one side, said head box having an opening through which the head of a patient may be inserted into the chamber while the body of the patient is outside of the chamber, said head box having a pane of glass inserted in its upper side.

8. A surgical apparatus comprising in combination two chambers of air tight construction having an opening between through which the head of a patient may project, and means for increasing the air pressure in one chamber above that of the atmosphere, and for reducing the air pressure in the other chamber below that of the atmosphere, each of said chambers being provided with a door opening to the outer air.

9. A surgical apparatus comprising in combination two chambers of air tight construction having an opening between through which the head of a patient may project, and means for increasing the air pressure in one chamber above that of the atmosphere, and for reducing the air pressure in the other chamber below that of the atmosphere, the first chamber being located within the second chamber.

10. A surgical apparatus comprising in combination two chambers of air tight construction having an opening between through which the head of a patient may project, and means for increasing the air pressure in one chamber above that of the atmosphere, and for reducing the air pressure in the other chamber below that of the atmosphere, each of said chambers being provided with a door opening to the outer air, the first chamber being located within the second chamber.

11. In a surgical apparatus the combination with an operating table of a chamber of airtight construction located at the end of the table, and a head box on said chamber whose outer face is of approximately the same width as the table, and having means for inserting the head of the patient into the chamber.

12. In a surgical apparatus the combination with an operating table of a chamber of airtight construction located at the end of the table, and a head box on said chamber whose outer face is of approximately the same width as the table, and having means for inserting the head of the patient into the chamber, said means comprising a tapering head box projecting outwardly and provided with an opening the size of the patient's neck.

13. A surgical apparatus comprising in combination two chambers of air tight construction having an opening between through which the head of a patient may project, and means for increasing the air pressure in one chamber above that of the atmosphere, and for reducing the air pressure in the other chamber below that of the atmosphere, the first chamber forming a compartment of the second chamber.

14. In a surgical apparatus the combination with an operating table of a chamber of air tight construction located at the end of the table, a head box projecting from the chamber and having an opening adjacent to

the table, and two shutters closing said opening provided with corresponding semi-circular cutaway portions.

15. In a surgical apparatus the combination with an operating table of a chamber of air tight construction located at the end of the table, a head box projecting from the chamber and having an opening adjacent to the table, and two shutters closing said opening provided with corresponding semi-circular cutaway portions, said shutters being vertically adjustable.

16. In a surgical apparatus the combination with an operating table of a chamber of air tight construction located at the end of the table, a head box projecting from the chamber and having an opening adjacent to the table, and two shutters closing said opening provided with corresponding semi-circular cutaway portions, together with a collar of flexible airtight material adapted to fit around the neck of a patient projected into the head box, and rest against the shutters.

17. In a surgical apparatus the combination of a structure forming an airtight chamber adapted to serve as a narcotizing room, an opening in one side through which the head of a patient may be inserted, an operating table outside of the structure on which the body of the patient may rest, and means for making an airtight connection between the walls of the chamber and the neck of the patient.

18. In a surgical apparatus the combination of a structure forming an airtight chamber adapted to serve as a narcotizing room, an opening in one side through which the head of a patient may be inserted, an operating table outside of the structure on which the body of the patient may rest, and means for making an airtight connection between the walls of the chamber and the neck of the patient, the walls of the chamber comprising a sound conducting section whereby the operating surgeon by the table can converse with the narcotizer inside the structure.

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