

APPARATUS FOR TREATING CERTAIN DISEASES OF THE HUMAN BODY.

Patented May 1, 1917.

1,224,180.



By Mercer B. Blount
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1,224,180.

Fig. 2.

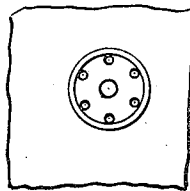


Fig. 7.

Simon Lake

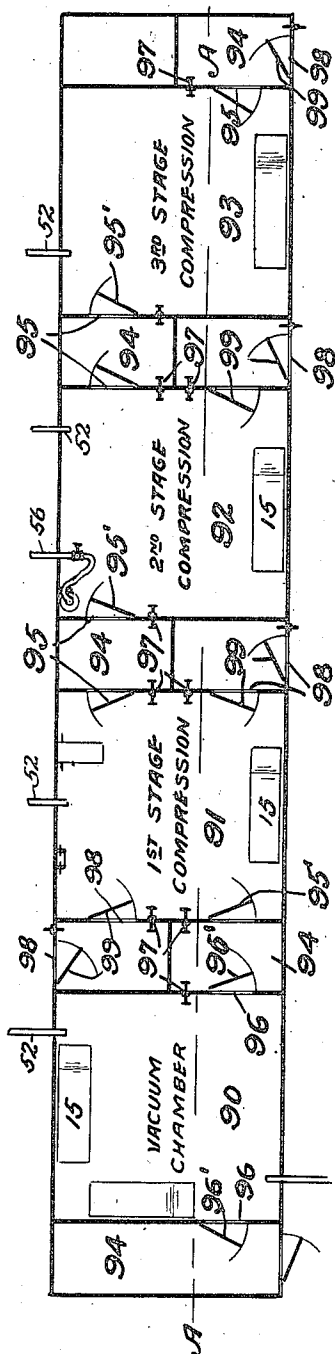
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5 SHEETS—SHEET 3.

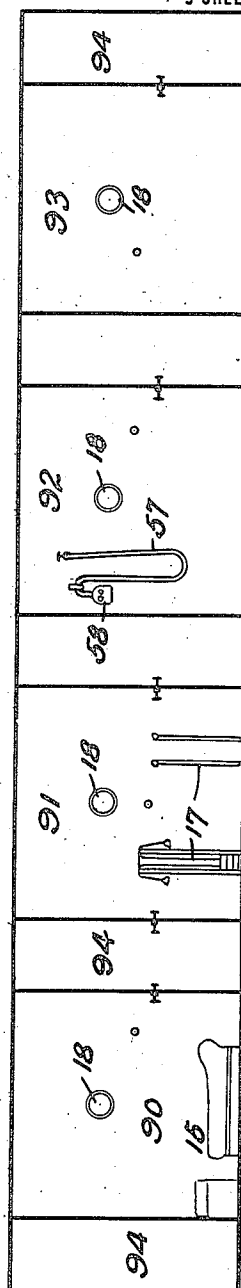
Fig. 4.



Witnesses

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Fig. 5.



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APPARATUS FOR TREATING CERTAIN DISEASES OF THE HUMAN BODY.

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5 SHEETS—SHEET 4.

Fig. 8.

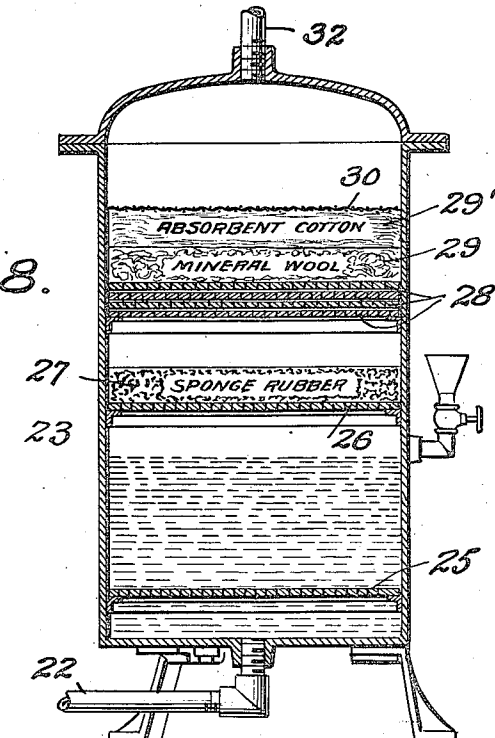
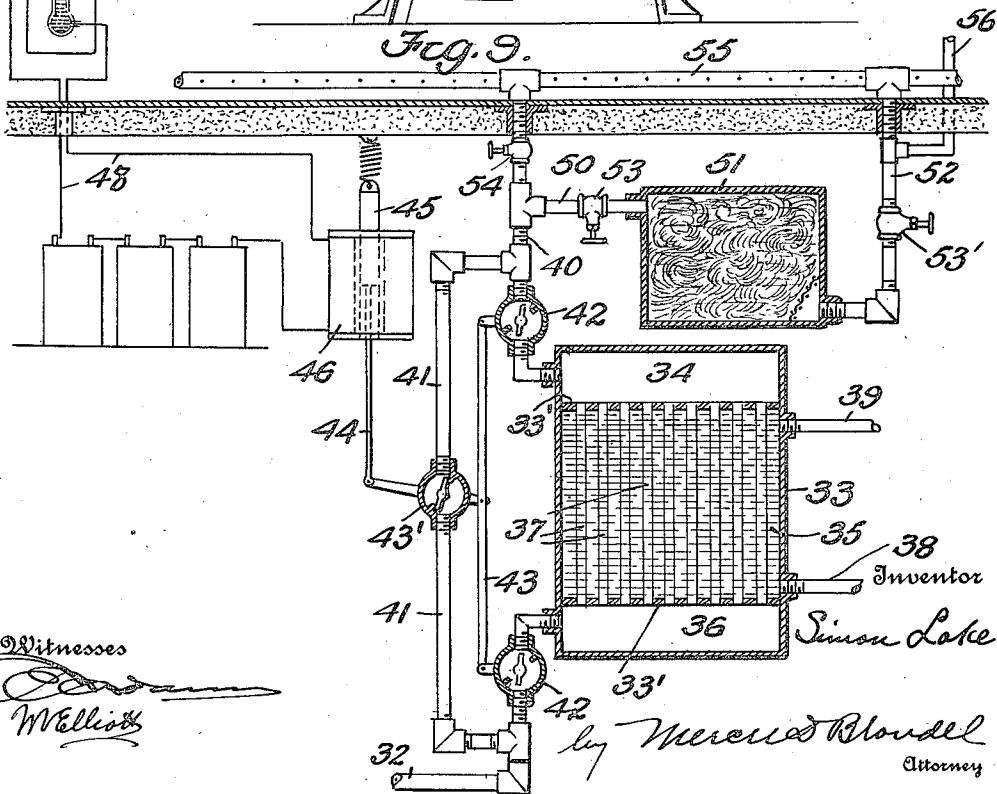


Fig. 9.



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5 SHEETS—SHEET 5.

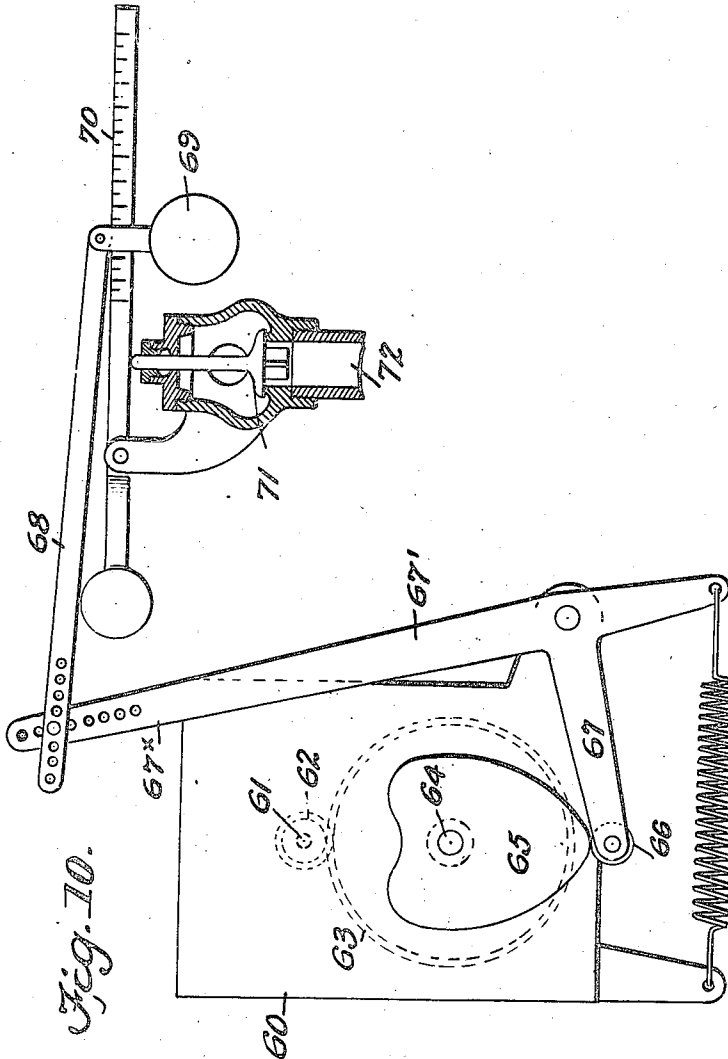


Fig. 10.

Witnesses

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UNITED STATES PATENT OFFICE.

SIMON LAKE, OF MILFORD, CONNECTICUT.

APPARATUS FOR TREATING CERTAIN DISEASES OF THE HUMAN BODY.

1,224,180.

Specification of Letters Patent.

Patented May 1, 1917.

Application filed June 6, 1913. Serial No. 772,118.

To all whom it may concern:

Be it known that I, SIMON LAKE, a citizen of the United States, residing at Milford, in the county of New Haven and State of Connecticut, have invented Apparatus for Treating Certain Diseases of the Human Body, of which the following is a specification.

The object of the invention is to provide an improved method of and apparatus for treating certain diseases of the human body.

It is authoritatively acknowledged that high altitudes are best adapted for persons afflicted with pulmonary diseases since the rareness of the atmosphere requires unusual effort on the part of the person to breathe into the lungs sufficient quantities of air to keep the system supplied, this extra effort causing the air to come into contact with the diseased cells that are not reached through ordinary breathing in lower altitudes.

Briefly, my method consists in subjecting a patient to gradually increasing pressures of pure air, which air may contain medicinal properties, or with alternate gradually increasing air pressures and gradual reductions of pressures below that of the atmosphere, whereby to subject a person to forced respiration so that in the treatment of lung diseases, for example, greater quantities of pure oxygen, or air having curative or palliative properties, are forced into the lungs and into contact with the diseased cells than is possible through natural breathing or inhaling even in high altitudes.

The apparatus employed in the treatment consists in a suitable chamber capable of being rendered air-tight; in a source of compressed air supply connected with the chamber; in means for creating a vacuum in the chamber; in means for purifying and drying the air; in means for treating the air with curative properties suitable for the treatment of the particular disease; in means for either warming or cooling the air before it is admitted to the chamber, and in means for automatically regulating and maintaining a uniform pressure in and the temperature of the chamber. The invention further consists in certain novel features of construction, combination and arrangement of parts as will be hereinafter described and claimed.

In the drawings, illustrating the inven-

tion, in the several figures of which like parts are similarly designated, Figure 1 is a diagrammatic view illustrating the invention. Fig. 2 is a vertical longitudinal section drawn through the compression chamber. Fig. 3 is a horizontal section of the chamber. Fig. 4 is a diagrammatic view illustrating a building constructed with a vacuum chamber and a series of compression chambers. Fig. 5 is a longitudinal section drawn on the line A—A of Fig. 4. Fig. 6 is a vertical section drawn through one of the valves and its seat which are arranged in the walls between the chamber or chambers and the communicating air-locks. Fig. 7 is a face view of one of the valve seats. Fig. 8 is a vertical section drawn through the air purifier and drier. Fig. 9 is a diagrammatic sectional view of the air cooling and heating apparatus, the medicine chest wherein the air is treated before being admitted to the chamber, and showing in elevation the apparatus for regulating the supply of air to the chamber. Fig. 10 is a diagrammatic view illustrating the relief valve and its operating mechanism. Fig. 11 is a sectional view of the relief valve arranged in the wall of the chamber.

The numeral 1, Figs. 1, 2 and 3, designates a chamber adapted to be rendered air-tight, and which is preferably constructed of sheet metal plates 2 and channel-beams 3, the beams being arranged over and around the chamber to add stiffness to the structure. The chamber is covered with cement or concrete 4 to further stiffen the structure and to prevent changes of temperature in the chamber owing to external atmospheric conditions. Inside, the chamber is painted with cork paint, or other suitable non-conducting material, to prevent sweating of the plates and to thus keep the chamber dry.

Built upon one side of the chamber 1 is an air-lock 5 which is also constructed of metal plates and covered with concrete or cement and painted inside with cork paint in the same manner as the chamber 1. The air lock 5 communicates with the chamber 1 through a door-way 6 which is controlled by an inwardly swinging door 6' and one of its vertical walls is formed with a door-way 7 which is controlled by an inwardly swinging door 7'. The doors 6' and 7' are provided with openings that are controlled by valves 9 and 8, respectively, the valve 9 110

permitting the inlet into the air-lock of the compressed air from the chamber 1 so as to counterbalance the pressure in said air-lock when entrance to the chamber 1 is to be effected, while the valve 8 permits of a gradual reduction of the pressure in said air-lock when leaving the chamber 1. This arrangement of the air-lock and the valves serves the double purpose of avoiding waste of the compressed air when entering or leaving the chamber 1 and also of avoiding the danger, either to the patient or attendant, of being subjected to sudden changes of pressure. In entering the chamber 1 when pressure is contained therein, the person first enters the air-lock 5 and closes and locks the door 7', the valve 9 in the inner door 6' is then opened slightly or "cracked" to allow the compressed air in the chamber 1 to gradually enter the air-lock, then when enough air has been admitted to the air-lock to counterbalance the pressure in the chamber 1, the inner door (6') is opened when entrance to the chamber may be had. Upon leaving the chamber 1, one first enters the air-lock, closes and locks the door 6' and closes the valve 9, the valve 8 is then cracked to permit the air in the air-lock to gradually escape into the atmosphere to thus gradually reduce the pressure to that of the atmosphere when the door 7' may be opened and exit effected.

Adjacent to the air-lock 5 is a small air-lock 10 that also opens into the chamber 1 and is employed for the passage of food and other articles to the chamber. The communication between the chamber 1 and the air-lock 10 is controlled by an inwardly swinging door 11 and the opening to the air-lock from the exterior of the chamber is controlled by an inwardly swinging door 12. Suitable fastenings 13 are provided for the doors 6', 7', 11 and 12 whereby they may be drawn to their seats to provide air-tight joints. The purpose of the small air-lock is to avoid excessive use of the compressed air in the chamber when articles are passed to and from the same.

The chamber 1 is provided with suitable windows 14, preferably in the form of dead-lights, and with a bed or couch 15, a chair 16 and other living accessories. If desirable suitable exercising apparatus 17 may be arranged in the chamber so that the patient may take light exercise. 18 designates pressure gages arranged within the chamber, one of which has its inlet tube extended through the wall of the chamber into the outside atmosphere while the other is connected direct to the chamber whereby the patient may readily ascertain the internal and external pressures. In practice a gage 18' will be arranged exteriorly of the chamber with its inlet tube connected to the chamber so that the pressure within the chamber

may be ascertained from the exterior. The gages are contained in suitable air-tight cases 19 so as not to be effected by external pressures.

Air under pressure is supplied to the chamber 1 from a reservoir 20 located adjacent to the chamber. The reservoir 20 is supplied with air from a suitable compressor 21, as shown. Extending from the top of the reservoir 20 is a pipe 22 which leads to the bottom of a purifying and drying tank 23 adapted for holding hygroscopic and purifying substances through which the air passes on its way to the chamber. The tank is partly filled with sulfuric acid or other dehydrating liquid and below the level of the liquid is arranged a perforated partition 25. Above the level of the liquid is arranged a second perforated plate 26 upon which is held a layer of sponge rubber 27, and a short distance above the sponge rubber are a series of slightly spaced perforated plates 28, upon the top plate of which is held a layer of mineral wool 29 upon which is a layer of medicated cotton 29'. A wire screen 30 of fine mesh is laid upon the cotton to hold it in place and to prevent it being blown through the outlet from the tank by the air passing through the latter. As shown the connection 22 from the reservoir 20 is connected to the bottom of the tank 23 so that as the air enters the tank it passes up through the liquid and through the perforated partition 25, the latter serving to break the solid column of air and divide it into a number of small streams which pass up through the liquid above the partition 25, then through the partition 26, through the pores of the sponge rubber 27, then through the perforations of the plates 28, through the mineral wool 29 and the medicated cotton 29', and then through the wire screen to finally pass out of the tank through a pipe 32 extending from the top thereof. If desired I may arrange a layer of oxygen generating substance (not shown) in the tank in order to enrich the air passing therethrough.

From the purifier and drier 23 the air is led through the pipe 32 to a temperature regulating apparatus which consists of a tank 33 having partitions 33' arranged therein adjacent to its upper and lower end which divide the tank into an upper chamber 34, an intermediate chamber 35 and a lower chamber 36, the chambers 34 and 36 being thrown into communication by a series of pipes 37 which extend through the partitions 33' so that as the air enters the lower chamber 36 it will pass up through the pipes 37 into the chamber 34. The chamber 35 is designed to be filled either with hot water or ammonia to either heat or cool the pipes 37 and consequently the air passing there-through as conditions may necessitate. The

hot water or ammonia is led into and from the tank through pipes 38 and 39, respectively, extending from suitable sources of supply (not shown). The upper end of the tank 33 is connected to the compression chamber 1 through a pipe 40 which is connected to the pipe 32 leading into the lower end of the tank by a by-pass 41 and between the connections of the by-pass with the pipes 32 and 40, and the latter's connection with the tank 33, the said pipes 32 and 40 are provided with butterfly-valves 42 the levers of which are connected by a link 43, which is also connected to the operating lever of a valve 43' interposed in the by-pass 41. By this arrangement of the by-pass and the valves in the pipes 32 and 40 the air from the purifier and drier may be directed into the heating or cooling tank 33 before entering the chamber 1 or led direct into the latter chamber as desired. The lever of the valve 43' has its free end connected by rod 44, of non-magnetic material, extending from the plunger 45 of a solenoid 46 located convenient to the by-pass 41, and arranged within the chamber 1 is a thermostat 47 which is connected to the solenoid 46 by current wires 48 in one of which is interposed a series of suitable batteries as shown in Figs. 1 and 9. By this arrangement if the temperature in the chamber 1 exceeds a certain degree the solenoid will be energized and its plunger 45 caused to be moved downwardly to thereby close the valves 42 and open the valve 43' thus cutting off the flow of air through the temperature regulating apparatus and causing it to flow direct into the chamber 1 from the purifier and drier 23.

Extending from the pipe 40 is a branch pipe 50 which leads to what I prefer to call a medicine chest 51 which is adapted to hold any suitable medicaments or materials having medicinal properties with which it is desired to impregnate the air that is led into the chamber 1. A pipe 52 leads from the medicine chest 51 to the chamber 1, and the pipes 50 and 52 are provided with hand operated valves 53 and 53' respectively whereby to control the flow of the air through said chest.

54 indicates a hand operated valve arranged in the pipe 40 between the outlet of said pipe and the connection of the pipe 50 therewith. As shown in Fig. 9 the pipes 40 and 52 have their discharge ends connected to a distributing pipe 55 arranged horizontally in the chamber and which is formed with a plurality of small perforations throughout its length. In practice the perforations are preferably arranged in the upper side of the pipe so as to avoid a draft blowing on the occupant of the chamber. A branch pipe 56 may be extended from the pipe 52 into the chamber 1 and to its inner end may be connected a flexible hose 57 to

the free end of which is connected a helmet 58 to be worn by the patient so that he may be forced to breathe only medicated air during his occupancy of the chamber or at such times as may be found necessary.

In order to secure the desired pressure in the chamber and to carry off all exhalations and thus keep the chamber supplied with fresh pure air, or medicated air, I provide the following apparatus. Arranged in a casing 60 conveniently located to the chamber 1, is a suitable motor, preferably a clock mechanism (not shown) on the driving shaft 61 of which is mounted a pinion 62 which meshes a gear wheel 63 whose shaft 64 carries a double involute cam 65 which operates on a roller 66 carried by one arm 67 of a bell-crank lever 67' journaled to the casing 60. To the arm 67* of the lever is connected a link 68 to the outer end of which is connected a weight 69 slidably supported on a scale-beam 70 pivoted intermediate its ends to a bracket arm extending from the casing of a relief valve 71 in such relation to the valve that the beam will always rest upon the stem of the valve to thus normally hold it to its seat. The valve 71 is arranged in a pipe 72 extending from the chamber 1 to a vacuum motor 73 and between the valve 71 and the motor the pipe is provided with a three-way valve 74 which is designed to be set to direct the flow of air passing through the pipe either to the vacuum pump or to the atmosphere. The operation of this feature of the invention is as follows: We will assume that the chamber 1 is under pressure and is to be constantly supplied with charges of fresh air or medicated air, and that the foul air is to be withdrawn during the entire time the chamber is occupied. The three-way valve 74 is first set to discharge into the atmosphere, the motor of the casing 60 is then set in motion to operate the cam 65 which will rock the bell-crank lever 67' to move the weight 69 back and forth along the scale beam 70 and thus vary the seating weight or pressure on the valve 71 so that the moment the weight 69 reaches a position on the scale beam where the seating weight of the valve will be less than the pressure in the chamber 1 the valve will be unseated and a certain quantity of the air in the chamber thus allowed to escape. Now the moment the valve 71 is opened a portion of the air will escape through the pipe 72, the valve 71 and the three-way valve 74 into the atmosphere, and at the same time additional charges of fresh air will be admitted to the chamber through the pipe 55 which not only keeps the chamber charged with pure air but also follows up the shifting weight on the scale beam to accommodate the variable pressures in the chamber. This arrangement of the movable weight also insures against excessive pressures being put

upon the chamber as it will be understood that even should the motor for operating the bell-crank lever be not running the moment the pressure in the chamber exceeds that of the weight upon the valve 71, the latter will be automatically unseated to allow a quantity of the air in the chamber to escape until the pressure or weight upon the valve overcomes the pressure in the chamber. It will be further understood that during the time the cam is in operation the weight 69 will be moved back and forth along the scale beam so as to permit of the valves being opened and closed intermittently to therefore gradually vary the pressures in the chamber without sudden changes and consequent injurious effects to the patient.

If it should be desired to let the pressure in the chamber fall below that of atmospheric pressure I provide the chamber 1 with an inwardly opening spring seated valve 80 which may be set so as to open to the atmosphere when the desired partial vacuum in the chamber is secured to thus avoid too great a reduction of pressure in the chamber below that of atmosphere, it being understood that when the air in the chamber has been exhausted to a certain degree the valve 80 will be automatically opened to admit air to the chamber to counterbalance that withdrawn therefrom. I then adjust the valve 74 to establish communication between the chamber 1 and the vacuum motor so that when the motor is operated the air will be withdrawn from the chamber until the desired vacuum is secured.

So far as described the method of operation is as follows: Assuming the patient is afflicted with tuberculosis and is to be put under conditions similar as to temperature, rarity of air and so forth as exists in certain high and dry altitudes. It is recognized that high and dry altitudes at about freezing temperature are best adapted for the treatment of pulmonary diseases and that at an altitude of about 10500 feet the air pressure is about 9.80 pounds per square foot against 14.7 pounds at sea level. The temperature regulator is first connected either with a hot water or ammonia supply according to the locality and the temperature of the weather in which the apparatus is located so as to accordingly regulate the temperature of the chamber and to maintain the temperature therein at about 32 degrees, Fahrenheit. The air is then turned on to flow into the chamber 1 and the thermostat regulated to operate the valves to direct the flow of air either through the temperature regulator 33 or direct from the purifying and drying tank. The relief valve mechanism is then set in motion and the three-way valve set to connect the chamber 1 with the vacuum pump so that when the latter is operated the air will be withdrawn to cause a

vacuum in the chamber corresponding to the pressure of air at an altitude of 10500 feet. The person to be treated then enters the chamber 1 through the air-lock 5 as previously explained where he remains for various intervals of time according to the nature of the disease and the treatment being accorded. Now should it be desired to put the patient under pressure to thus force him to breathe into the lungs greater quantities of air than he would through natural breathing under a vacuum, I cut off the communication of the chamber 1 with the vacuum pump or motor and adjust the three-way valve 74 to discharge into the atmosphere and then connect the chamber 1 with the air reservoir 20 to admit air under pressure to the desired degree to the said chamber. The weight 69 is then adjusted on the scale beam to permit the unseating of the valve 71 the moment the desired pressure in the chamber is secured thus avoiding excessive pressure being put upon the chamber 1. It may be stated here that the pipe 22 leading from the reservoir 20 is provided with a hand operated valve 22' by which the escape of the air from the reservoir is controlled. The motor is then started to operate the cam 65 to move the weight 69 back and forth on the scale beam to thus automatically permit the valve 71 to be unseated at variable pressures in the chamber 1 which allows certain quantities of the air in the chamber to escape and fresh air admitted during the entire time the chamber is occupied thus keeping the chamber constantly supplied with fresh pure air. If it should be desired to impregnate the air with medicaments possessing healing qualities, the valves 53 and 54 are adjusted to direct the flow of air through the medicine chest as described.

In Figs. 4 and 5, I illustrate a slightly different arrangement of the chamber 1. In this construction the building is constructed with a vacuum chamber 90 and a series of compression chambers 91, 92 and 93, each having an ante-room 94, forming an air-lock, each of which communicates with its adjacent compression chamber or chambers through door-ways 95 controlled by doors 95' as shown. The vacuum chamber 90 also communicates with its adjacent air-locks through door-ways 96 controlled by doors 96'. Valves 97, similar in construction to the valves 8, are arranged in the partitions between the several chambers and their communicating air-locks for equalizing the pressure in the several chambers and air-locks when entering or leaving the chambers. The purpose of this construction and arrangement of the chambers is to permit of the simultaneous treatment of one or more persons and also to permit of a person being treated with various degrees or stages of compression. In this arrangement of the

compression chambers the patient first enters the chamber 91 wherein a pressure is maintained only a few degrees above the atmosphere and where he remains until thoroughly accustomed to the pressure, then from this, the first stage compression chamber, he enters the second chamber wherein a higher compression is maintained, and from this chamber he enters the third stage compression chamber where he remains for the prescribed time. It is, of course, understood that in entering and leaving the chambers the same method is followed as that described in reference to the air-lock 5 and the chamber 1. It will also be understood that the chambers 91, 92 and 93 are connected with a compression pump and the chamber 90 connected with a vacuum pump in the same manner as described with reference to the chamber 1. Also with these chambers the various apparatus for treating the air are employed as with the chamber 1. I have not thought it necessary, however, to illustrate the connections of the various apparatus and show the building only in diagram. Exit may be had from any one of the air-locks direct to the exterior of the building through door-ways 98 controlled by inwardly swinging doors 99, as shown.

From the foregoing it will be seen that I provide an exceedingly simple apparatus that may be conveniently arranged in any locality which will give a person the advantages of high and dry altitudes and with such an apparatus I also gain the advantage of forcing a greater percentage of oxygen and pure air or air containing medicinal properties, into the lungs and into contact with the diseased cells than is possible through natural breathing or inhaling even in high altitudes.

While I described my apparatus and method of treating tuberculosis diseases I do not desire to be understood as limiting the use of the apparatus to the treatment of this disease. In my experience in subaqueous operations I have had occasion to observe and study the effects of air pressures on different persons and as it is well known that men following the diver's vocation are usually healthy and possess great vitality although they are often called upon to work in very unhealthy localities, I believe from my observations that many diseases may be beneficially treated by the method of treatment above described.

What I claim is:—

1. Therapeutic apparatus, comprising a substantially air-tight chamber, means for creating a pressure within the chamber at variance with the surrounding atmospheric pressure, a valve controlling communication between the interior of the chamber and the surrounding atmosphere, and mechanism for opening the valve at regular intervals.

2. Therapeutic apparatus, comprising a substantially air-tight chamber, means for creating a pressure within the chamber at variance with the surrounding atmospheric pressure, a valve controlling communication between the interior of the chamber and the surrounding atmosphere, means normally holding the valve seated, and mechanism for intermittently relieving the valve of the action of the seating means to admit of its opening at regular intervals.

3. Therapeutic apparatus, comprising a substantially air-tight chamber, means for creating a pressure within the chamber at variance with the surrounding atmospheric pressure, a valve controlling communication between the interior of the chamber and the surrounding atmosphere, a pivoted beam engaging the valve, a weight slidable upon the beam and normally tending to hold the valve closed, and means sliding the weight on the beam to admit of the valve opening at regular intervals.

4. Therapeutic apparatus, comprising a substantially air-tight chamber, means associated with the chamber for creating a pressure therein above the normal atmospheric pressure surrounding the chamber, other means for reducing the pressure within the chamber below the normal surrounding atmospheric pressure, valves for maintaining a predetermined pressure within the chamber, a relief valve, and means for intermittently operating the relief valve at regular intervals.

5. Therapeutic apparatus, comprising a substantially air-tight chamber, means for creating a pressure therein above the normal atmospheric pressure surrounding the chamber, and a relief valve automatically operated at regular intervals for establishing communication between the interior of the chamber and the surrounding atmosphere.

6. Therapeutic apparatus, comprising a substantially air-tight chamber, means for creating a pressure within the chamber at variance with the surrounding atmospheric pressure, a pipe for supplying air to the chamber, means for treating the air supplied to the chamber, branch pipes connecting the air treating means with the main pipe, valves in the main and branch pipes, means connecting the valves for simultaneous operation, and valve operating means including an element located within the chamber and affected by the change in the atmospheric conditions thereof, to automatically operate the valves.

7. Therapeutic apparatus, comprising a substantially air-tight chamber provided with automatic pressure controlling valves and pressure indicating means, an air lock to admit of safe ingress to and egress from the said chamber, said air lock having inlet and outlet doors and valves to establish com-

munication between the lock and chamber
and between the lock and surrounding at-
mosphere, means for supplying compressed
air to the chamber and treating such air as
5 required, means for positively exhausting
the air from the chamber to reduce the pres-
sure therein as desired, a valve controlling
communication between the chamber and the
surrounding atmosphere, and means for

positively operating the last-mentioned valve 10
at predetermined intervals.

In testimony whereof I have hereunto set
my hand this 5th day of June, A. D. 1913.

SIMON LAKE.

Witnesses:

ALBERT M. WOLFE,
W. V. ELLIOTT.