Aug. 24, 1937. G. R. DUNCAN 2,091,034

APPARATUS FOR THERMAL TREATMENT

Filed May 6, 1935 2 Sheets-Sheet 1

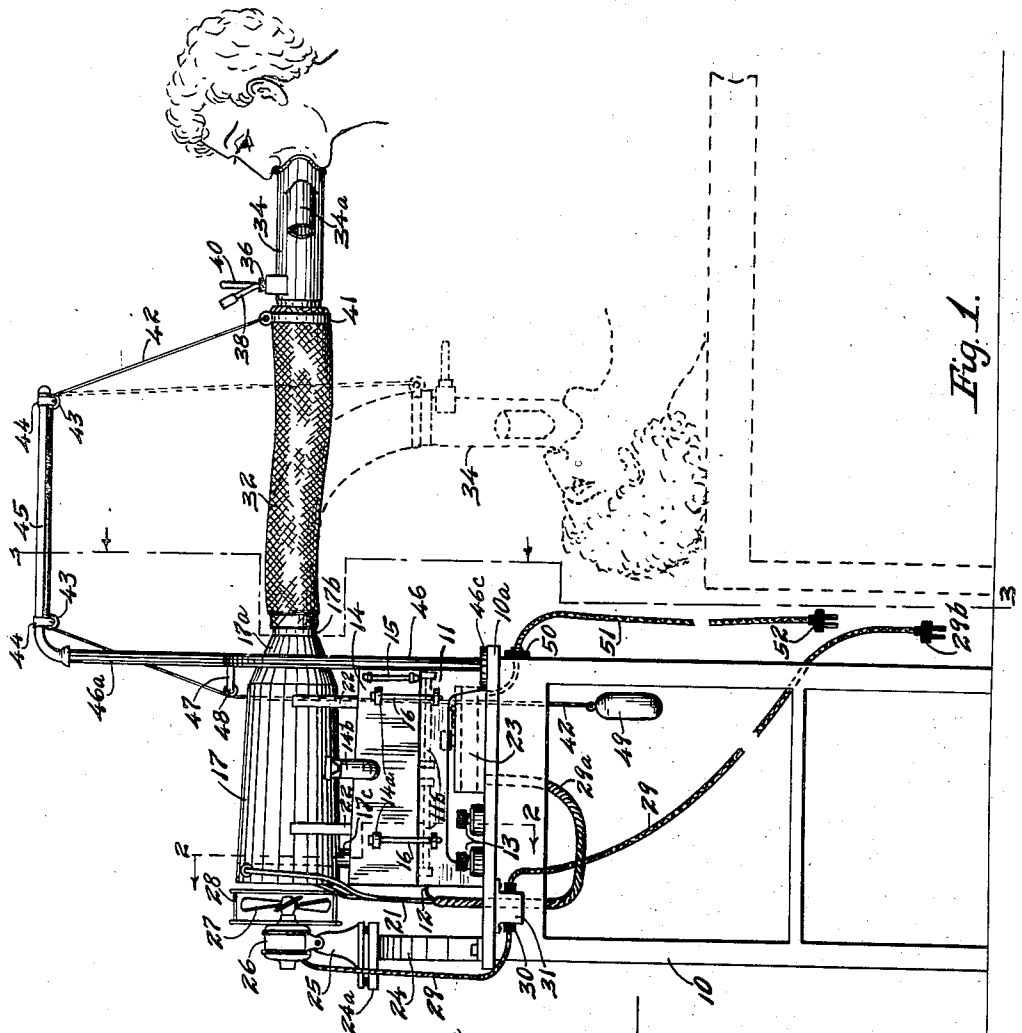


Fig. 1.

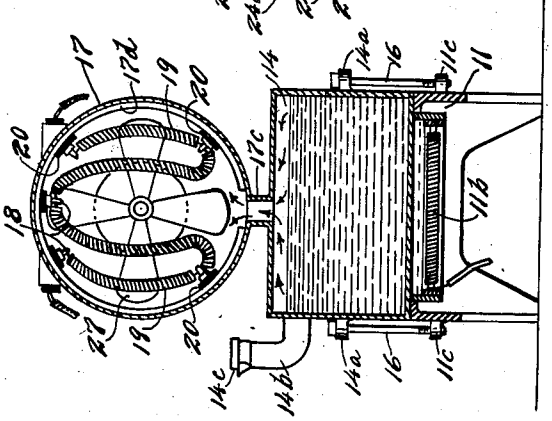


Fig. 2.

Inventor
GEORGE R. DUNCAN
By Chas. C. Reif
Attorney

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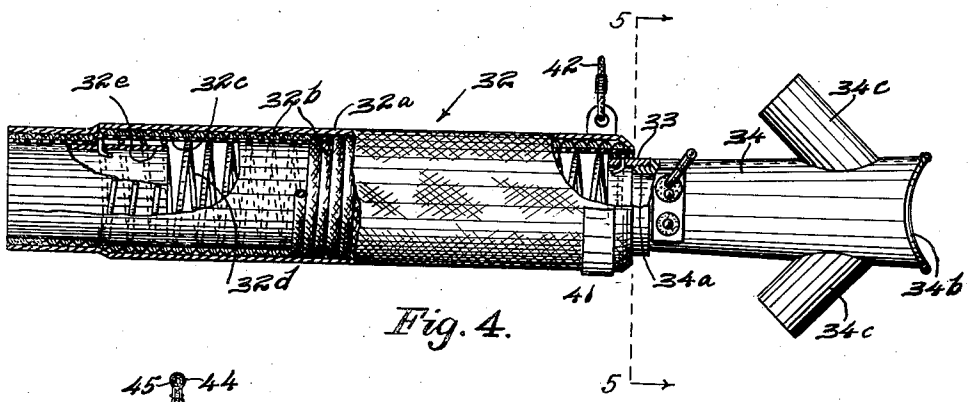


Fig. 4.

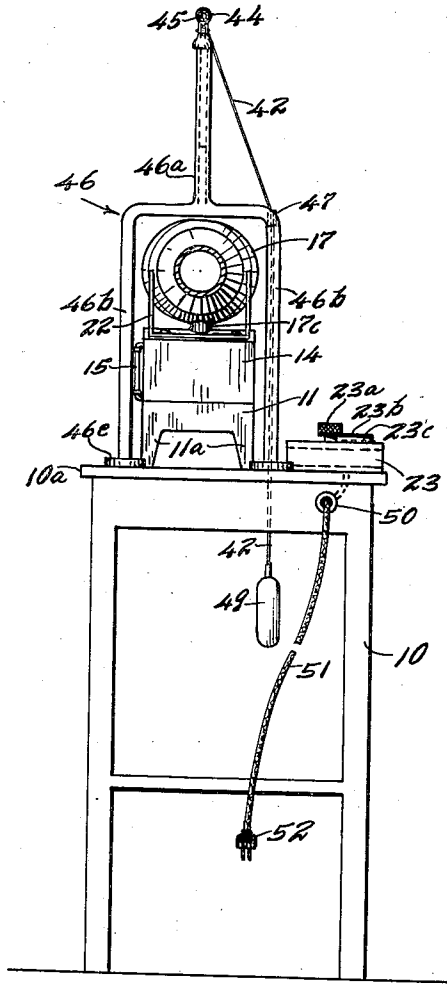


Fig. 3.

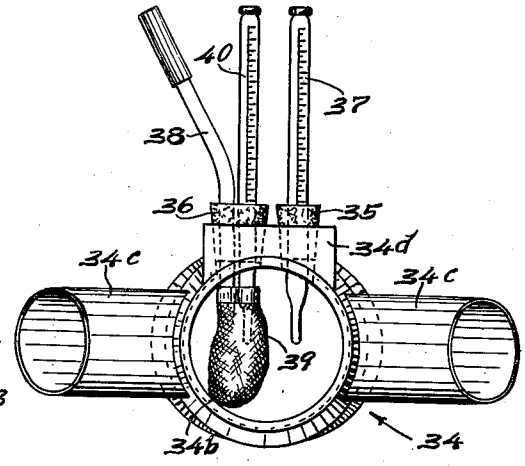


Fig. 5.

Inventor
GEORGE R. DUNCAN
By Chas. C. Reif
Attorney

Patented Aug. 24, 1937 2,091,034

UNITED STATES PATENT OFFICE

2,091,034

APPARATUS FOR THERMAL TREATMENTS

George R. Duncan, Oak Terrace, Minn.

Application May 6, 1935, Serial No. 19,922

8 Claims. (Cl. 128—192)

This invention relates to an apparatus for raising body temperatures and particularly to a device for raising the temperature of the pulmonary organs or lung tissues. While the apparatus may have various applications it is designed more specifically for the treatment of tuberculosis.

It has been determined that the human type of tubercle bacilli will not grow at certain temperatures. Robert Koch reported no growth on cultures of tubercle bacilli when they were incubated at a temperature of 42 degrees C. or 107.6 degrees F. Experiments carried on at Glen Lake Sanatorium and the Department of Medicine of the University of Minnesota, with the former of which the applicant is connected, have shown that pulmonary tuberculosis can be checked and the patient improved when the disease is treated by hyperpyrexia. Several methods were used to induce the fever including the recently produced electrical methods. It was found, however, that treatment by hyperpyrexia was very debilitating to the patient, especially if the disease was somewhat far advanced. The applicant continued the efforts, however, to secure an increased lung temperature and these efforts resulted in the production of the present apparatus.

It is an object of this invention to provide an apparatus by means of which the temperature of the pulmonary organs or tissues may be considerably increased and the growth of the tubercle bacilli arrested.

It is a further object of the invention to provide an apparatus for raising the temperature of the lungs without any debilitating effect on the patient and without discomfort to the patient.

It is another object of the invention to provide an apparatus by means of which a mixture of heated air and vapor may be introduced into the lungs of the patient, other means preferably being provided for indicating the temperature of the said mixture and for regulating the temperature thereof.

It is more specifically an object of the invention to provide an apparatus comprising means for providing a mixture of heated air and vapor, a flexible tube through which the mixture is passed and a mouthpiece adapted to fit over the mouth of the patient, together with means for indicating the wet and dry bulb temperature of the mixture in the mouthpiece and means for regulating the temperature of said mixture.

These and other objects and advantages of the invention will be fully set forth in the following description made in connection with the accompanying drawings, in which like reference characters refer to similar parts throughout the several views and in which:—

Fig. 1 is a view in side elevation of the apparatus, indicating two positions relative to the patient in which the device may be used;

Fig. 2 is a vertical section on line 2—2 of Fig. 1 as indicated by the arrows;

Fig. 3 is a vertical section taken on line 3—3 of Fig. 1 as indicated by the arrows;

Fig. 4 is a plan view of a flexible tube and mouthpiece used, certain parts being broken away and others shown in horizontal section; and

Fig. 5 is a view in front elevation of the parts shown in Fig. 4 as seen from the right of said figure.

Referring to the drawings, a device is shown comprising a table 10 having a top portion 10*a* of rectangular shape in plan and having a flat top. A stove 11 is mounted on the top 10*a*, the same being shown as having end legs 11*a* resting on said table. While any type of stove or heater may be used, in the embodiment of the invention illustrated the stove 11 is shown as of the electrical type having hot plates or heating elements 11*b*. Electrical conductors 12 extend to the heating elements 11*b* and the hot plates 11*b* are respectively controlled by switches 13 by means of which the heat may be turned on or off or the amount of heat regulated. Disposed over the stove 11 is a reservoir or tank 14 adapted to contain water and while this tank might be variously formed, in the embodiment of the invention illustrated it is shown as rectangular in horizontal and vertical cross section and supported upon stove 11. The top of the tank 14 is shown as higher at its left hand end than at its right as seen in Fig. 1. Tank 14 is adapted to contain water and a water gauge 15 is shown at one side thereof. Tank 14 is also provided with a pair of outwardly extending lugs 14*a* at each side and headed bolts 16 extend through these lugs and are threaded into lugs 11*c* projecting from the sides of stove 11. These bolts hold the tank 14 firmly in place. Tank 14 is provided at one side with a filling spout 14*b* projecting outwardly and upwardly therefrom and closed by a suitable cap 14*c*. A casing 17 is disposed above the tank 14, the same being shown as cylindrical in form and slightly tapered toward its right hand end as seen in Fig. 1, said casing having a portion 17*a* at one end of frusto-conical form terminating in a cylindrical portion 17*b*. Casing 17 is connected adjacent one end to the tank 14 by the connecting portion 17*c* which is also adjacent the higher end of tank 14 and extends from the top thereof. The larger

end of casing 17 is open and the same has therein adjacent said end a ring 17d secured to the inner side of the casing and from which project members 18 in the form of pins or studs forming supports for a heating element 19, which element is insulated from ring 17d and casing 17 by the insulating members 20. The heating element 19 is shown as of the electrical type and is supplied with electrical current by the conductors 21. Casing 17 is supported by three-sided brackets 22 having their horizontal portions secured to the top of tank 14. A rheostat 23 is supported upon table 10 at one side of stove 11 and is adapted to regulate the current for conductors 21 and heating element 19. Said rheostat is shown as having a handle or knob 23a by means of which its contact arm 23b is moved over the various resistance contacts 23c.

A bracket 24 is secured adjacent one end of table top 10a, the same having a flat top 24a upon which is supported a motor bracket 25 carrying a motor 26 to which is attached a fan 27. Said fan is shown as surrounded with a protecting casing 28 of openwork formation. The motor 26 is supplied with current by a conductor 29 which preferably has therein a fixed resistance 30, the same being shown as being carried in a bracket 31 secured to the under side of table top 10a. Conductors 12 and 21 are shown as housed in a suitable conduit 29a. Conductor 29 is in the form of a cord and has a plug 29b connected to its end adapted to be secured in an electrical socket forming a source of current supply. A flexible tube 32 is provided and this tube at one end fits over the portion 17b of casing 17. While the tube 32 could be variously made, in the embodiment of the invention illustrated it is shown as comprising an outer layer 32a of fabric such as canvas beneath which is a layer of asbestos rope 32b which is wound on a tube 32c of some waterproof material such as rubber. Within the tube 32c is disposed a light coiled spring 32d. A sleeve or cylindrical member 32e is disposed within spring 32d at one end and this is in direct contact with portion 17b. The member 32e will be made of some heavy paper or cardboard material and will preferably be waterproof. The tube 32d is shown as having a slightly reduced portion where it fits over the portion 17b. The end of tube 32 opposite the portion 17b has mounted therein a metal ring 33 interiorly threaded at its outer end. The ends of spring 32d are shown as secured in members 32e and 33. A mouthpiece member 34 is provided having a reduced portion 34a at one end exteriorly threaded to be screwed into member 33, the outer surfaces of members 33 and 34 being substantially flush. Member 34 flares slightly towards its free end and has a concave oblong or spheroidal edge about which is fitted a piece of soft yielding material such as sponge rubber. Member 34 has branches 34c projecting from each side thereof towards its attached end, the same communicating with the interior of member 34. A block 34d extends across the top of member 34 and the same is apertured to receive the tapered plug members 35 and 36 respectively which may be made of some yielding material such as rubber or cork. A dry bulb thermometer 37 extends through plug 35 into the interior of the mouthpiece 34. A tube 38 extends through plug 36 into the interior of member 34 and has secured thereto a fabric sack 39. A wet bulb thermometer 40 also extends through plug 36 and has its bulb portion disposed in the sack 39. A ring 41 is clamped around tube 32 adjacent the mouthpiece 34, the same having an eyelet portion at its top to which is secured a flexible member or cord 42 extending upwardly and running over pulleys 43 carried in small U-shaped clips or brackets 44 supported upon a rod-like bracket 45 extending horizontally over tube 32 and having its rear end bent downwardly and rotatably mounted upon the upper end of the vertically extending portion 46a of a bracket 46. Bracket 46 has side portions 46b extending downwardly at either side of casing 17 and having flanges 46c at their lower ends which will be attached to the table top 10a by suitable fastening means such as screws. Portion 46a is of tubular form and bracket 45 has a reduced portion extending downwardly into and rotatable in portion 46a. It will be seen that bracket 46 has a horizontal portion (connecting the upper ends of portions 46b) from the central part of which portion 46a extends upwardly and rearwardly and from which at one side thereof extends a small bracket 47. A pulley 48 is mounted in bracket 47 and cord 42 runs over this pulley, said cord having a weight 49 at its end. Cord 42 extends through the table top 10a in passing downwardly from pulley 48 so that weight or counterweight 49 is disposed beneath said table top. A bushing 50 is secured in one end of table 10 through which extends a conductor cord 51 having thereon a usual connecting plug 52 adapted to be connected in a suitable electric socket to secure a current supply.

In operation, water will be placed in the tank 14 and the device will be suitably connected to a source of electric current by plug 52. Water will also be supplied through the tube 38 to the bag or sack 39 which will contain a suitable absorbent material so that the bulb of thermometer 40 is always in contact with a wet or saturated material. Bag 39 is of porous material so that air can readily permeate the same. The patient can be disposed in operative relation to the machine either in standing position or in a reclining position. The latter position is indicated in dotted lines in Fig. 1. The edge 34b of the mouthpiece is arranged to closely fit the face about the mouth as shown in Fig. 1 so that an airtight seal is effected. Plugs 29b and 52 will be connected to suitable electric sockets forming a source of current supply. The switches 13 will be operated to turn on the stove so that the water in tank 14 will be heated. Hot vapor or steam will be produced and this will pass upwardly into the casing 17. Heat is supplied to the heating element 19 and fan 27 is operated. When the air and vapor are suitably supplied in casing 17, the apparatus will be applied to the patient. The heating effect can be regulated both on the stove and by rheostat 23 controlling heater 19 so that the desired temperature of the mixture of hot air and vapor can be obtained. The most suitable temperature as now determined by experiment is a temperature of 156 degrees F. indicated on the dry bulb thermometer 37 and a temperature of 120 degrees F. on the wet bulb thermometer 40. Undesirable effects are produced if the temperatures are much higher than those indicated. Temperatures have been used in experiments as high as 128 degrees F. on the wet bulb thermometer. The maximum limit on the wet bulb thermometer as at present indicated is 123 degrees F. and

even this temperature is apt to cause some blistering of the lips or skin of the face. The patient breathes the mixture of hot air and vapor which is supplied and the surplus over that which the patient can consume passes out through the portions 36c of the mouthpiece. The rheostat 23 is within reach of the patient should he desire to regulate the temperature. The weight of the tube 32 and mouth piece 34 is counterbalanced by the weight 49.

From the above description it is seen that applicant has provided a simple and efficient apparatus for raising the temperature of the lungs or pulmonary tissues. This acts to stop the growth of the tubercle bacilli and to stop the progressive development of the disease. Very beneficial results have been obtained. The rise in the lung temperature is clearly indicated by a bronchial irritation when the temperature of the mixture of air and vapor is slightly higher than that desired. After the patient has had the machine applied for some time he begins to sweat very positively, indicating the reception of heat. As stated, very improved conditions have been brought about in the patients by the use of the apparatus.

The device is simple and compact and has been developed so that it can be used with great comfort by the patient. The various controls have been worked out so that the desired conditions as to temperature and humidity can be secured and maintained. The function of the vapor supplied to the air is to prevent evaporation from the internal tissues. If dry air were supplied it would be difficult to raise the temperature of the lungs as the evaporation of moisture would counteract the heat supplied by the air. The device has been amply demonstrated in actual practice and found to be very successful and efficient.

It will, of course, be understood that various changes may be made in the form, details, arrangement and proportions of the parts, without departing from the scope of applicant's invention, which generally stated, consists in a device capable of carrying out the objects above set forth in the parts and combinations of parts disclosed and defined in the appended claims.

What is claimed is:

1. A device for increasing the temperature of the lungs having in combination, a casing having an open end, a heater disposed in said casing, a fan at said open end of said casing for delivering air into said casing, a water reservoir below said casing having a connection leading into said casing, a heating means for heating said reservoir to cause vapor to pass into said casing, means for regulating said heater to control the degree of heating of said vapor and air, an elongated flexible tube secured at one of its ends to the other end of said casing and having a mouthpiece at its other end adapted to cover the mouth of the patient whereby he may breathe said air and vapor whereby said vapor and air are heated in said casing and forced therethrough by said fan to said mouthpiece, said mouthpiece having an outlet for surplus air.

2. The structure set forth in claim 1 and wet and dry bulb thermometers disposed in said mouthpiece for indicating the temperature of said air passing therethrough.

3. A device for increasing the lung temperature having in combination, a casing through which air is passed, a heating device for said air, a water reservoir or boiler beneath said casing having a passage connecting the same to said casing intermediate the ends thereof, means for heating said reservoir to produce vapor or steam which passes through said passage to said casing, means for regulating said heating means, means for regulating said heating device to control the degree of heat of said air, a flexible conduit leading from said casing to convey said mixture of air and vapor to the patient for breathing, a mouthpiece secured to the end of said conduit and movable means for supporting and counter-balancing said conduit and mouthpiece so that it can be variously moved and adjusted to the patient.

4. A device for increasing the lung temperature having in combination, means for heating a mixture of air and water vapor, means for regulating said means to control the degree of heat of said mixture, a conduit connected to said means, a member connected to said conduit formed at one end as a mouthpiece to fit about the mouth of the patient whereby said mixture is delivered to the oral cavity for breathing and having means for discharging the excess of said mixture over that breathed by the patient and means for supporting said conduit and member for vertical and horizontal movement.

5. A device for increasing the lung temperature having in combination, means for heating a mixture of air and water vapor, means for regulating said means to control the degree of heat of said mixture, a conduit connected to said means, a member connected to said conduit formed at one end as a mouthpiece to fit about the mouth of the patient whereby said mixture is delivered to the oral cavity for breathing and having means for discharging the excess of said mixture over that breathed by the patient, a supporting member above said conduit swingable about a vertical axis and a flexible member depending from said supporting member and connected to said first mentioned member.

6. A device for increasing the lung temperature having in combination, means for heating a mixture of air and water vapor, means for regulating said means to control the degree of heat of said mixture, a conduit connected to said means, a member connected to said conduit formed at one end as a mouthpiece to fit about the mouth of the patient whereby said mixture is delivered to the oral cavity for breathing, a supporting member above said conduit swingable about a vertical axis, a flexible member depending from said supporting member and connected to said first mentioned member and a counterweight secured to said flexible member whereby said conduit and first mentioned member may freely be moved vertically.

7. A device for increasing the temperature of the pulmonary organs having in combination, a water container, means for heating said container to produce water vapor, a casing above said container, a conduit connecting said casing and container to convey said vapor thereto, means for forcing air into said casing, heating means in said casing for heating said air and vapor, means for regulating said heating means to control the degree of heat of said air and vapor, a flexible conduit connected to one end of said casing to which said heated air and vapor are delivered, a mouthpiece adapted to surround the mouth of the patient secured to the other end of said conduit and means adjacent said mouthpiece for determining the temperature of said vapor and air delivered thereto.

8. A device for increasing the temperature of the pulmonary organs in the treatment of tuberculosis having in combination, an open-ended casing, a heater in said casing, means adjacent one end of said casing for forcibly delivering air into the open end of said casing, an elongated flexible tube at the other end of said casing, a water reservoir beneath said casing, means for heating said reservoir to produce water vapor, a connection between said reservoir and casing for delivering said water vapor to said casing between said first mentioned means and said tube, means for regulating said heater to control the degree of heat of said air and vapor, a mouthpiece secured to the end of said tube remote from said casing for surrounding the mouth of the patient to deliver said heated air and vapor to said patient, the volume of said heated air and vapor being greatly in excess of that required for normal breathing, said mouthpiece having an outlet means for said excess air and temperature indicating means adjacent said mouthpiece for indicating the temperature of said air and vapor.

GEORGE R. DUNCAN.