No. 654,185. Patented July 24, 1900.

A. V. M. SPRAGUE.

METHOD OF THERAPEUTICAL TREATMENT OF PARTS OF THE HUMAN BODY AND APPARATUS THEREFOR.

(Application filed Feb. 18, 1897.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

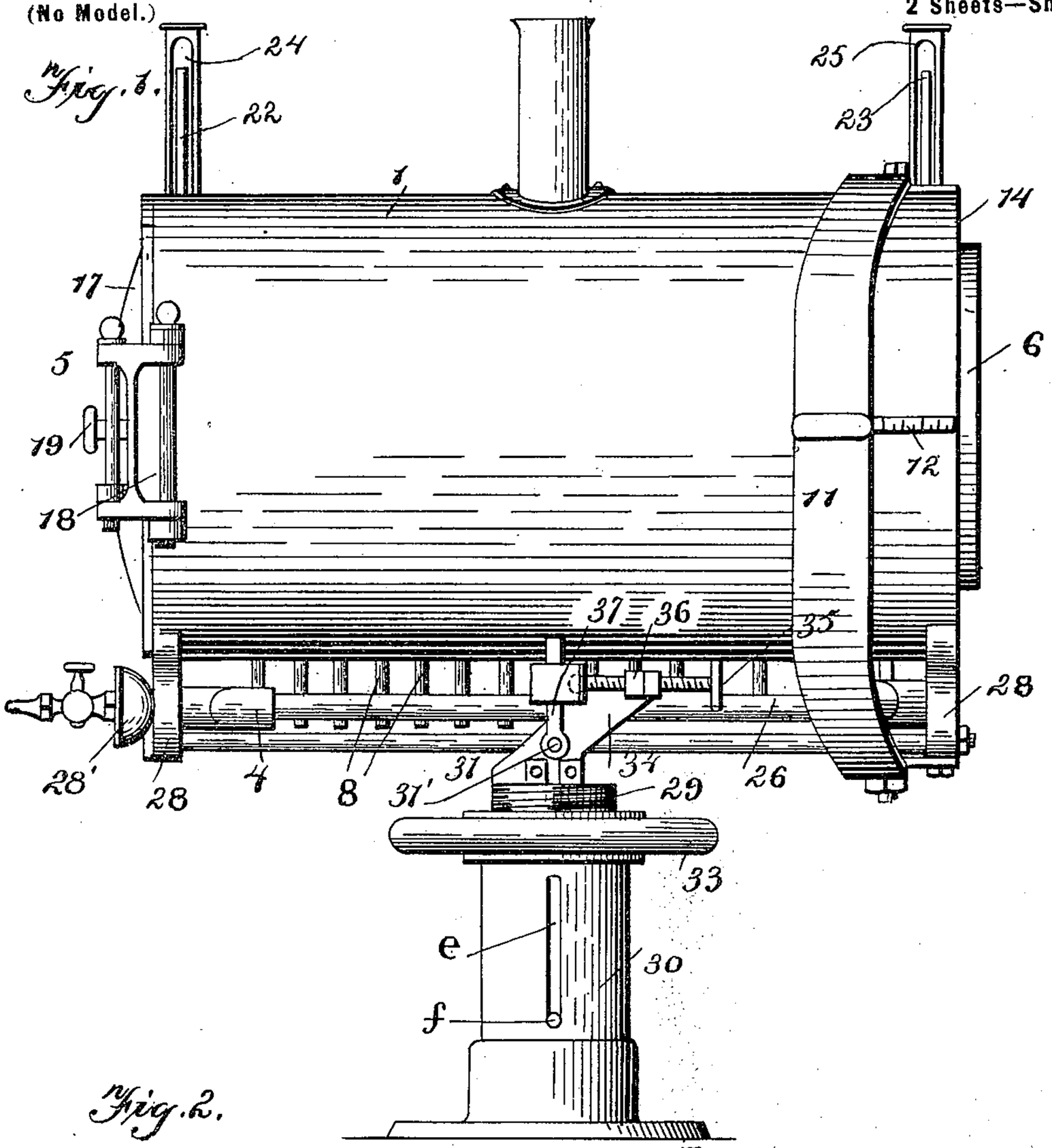

Fig. 2.

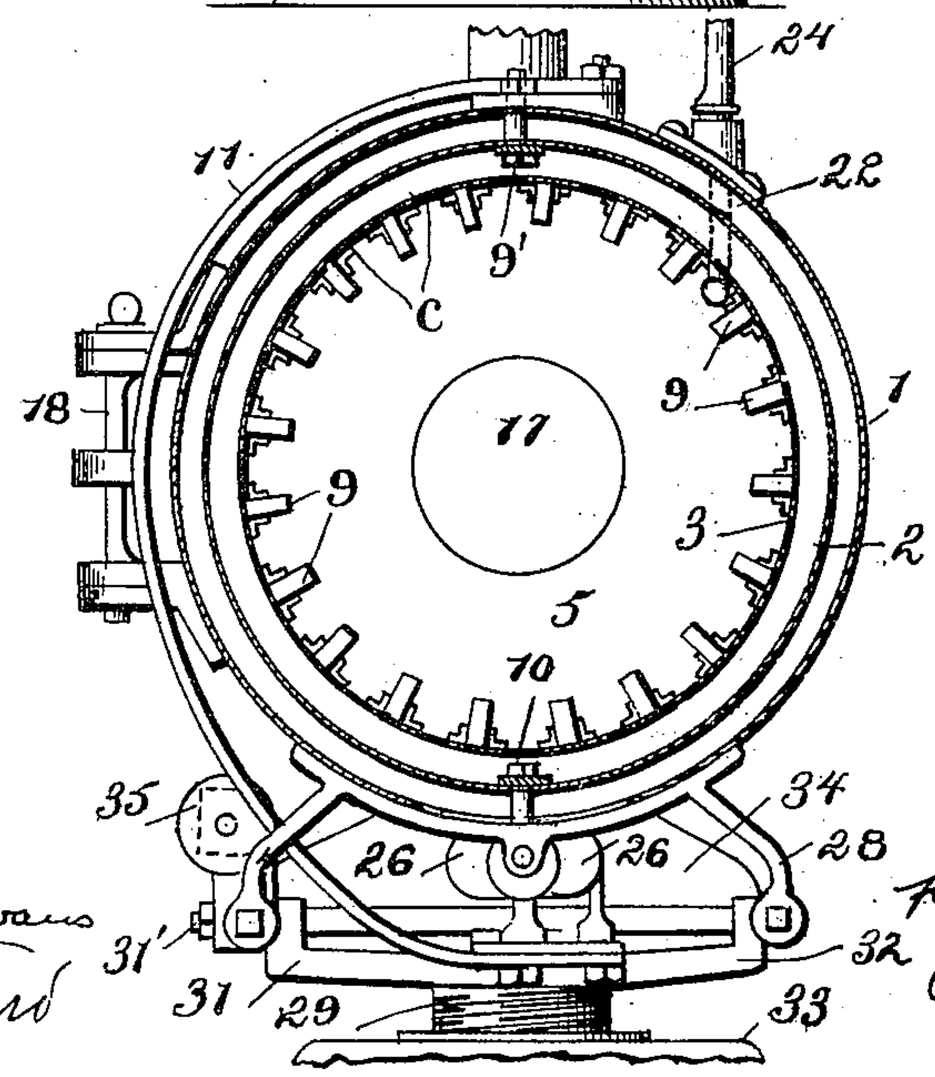

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Fig. 3.

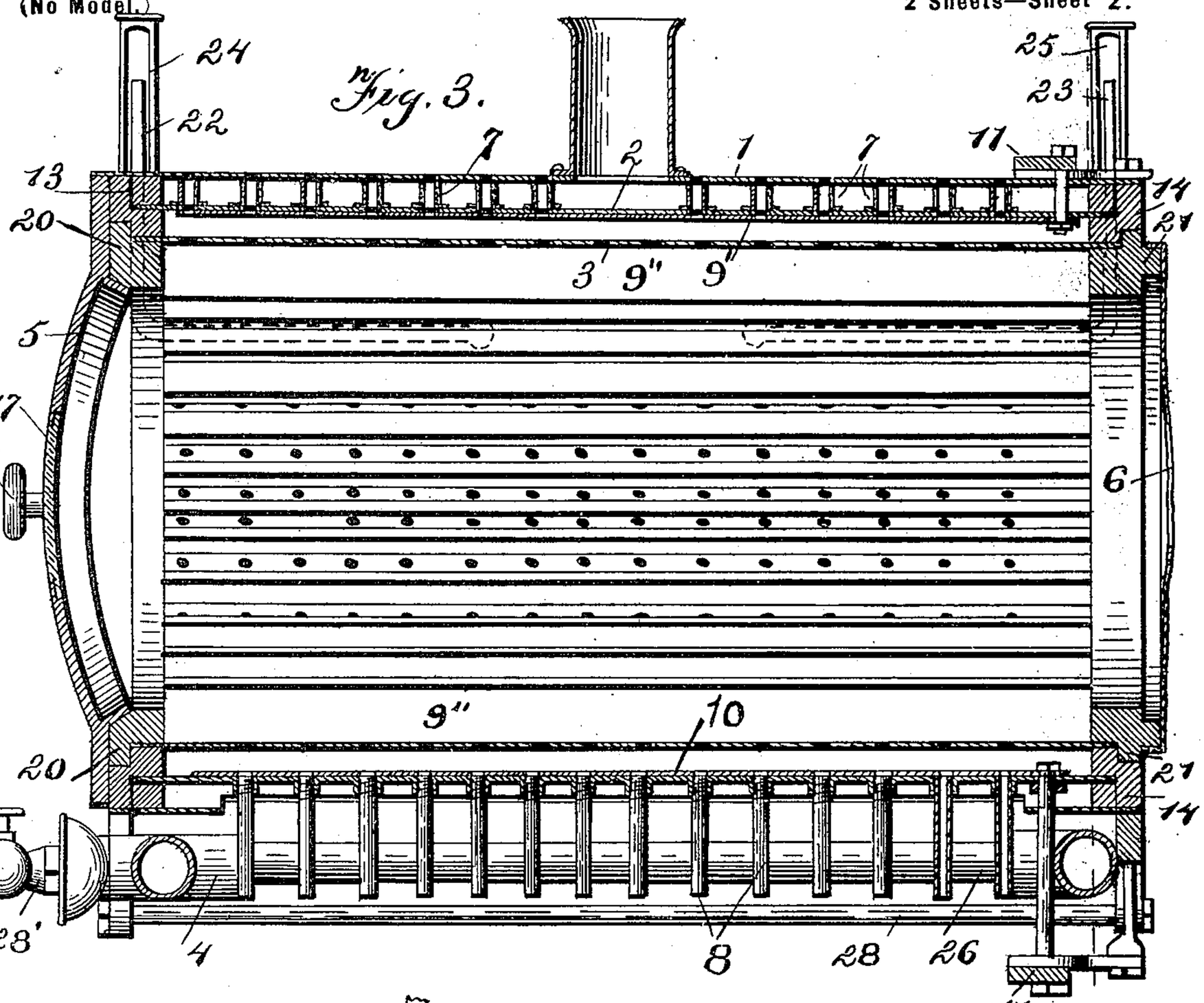
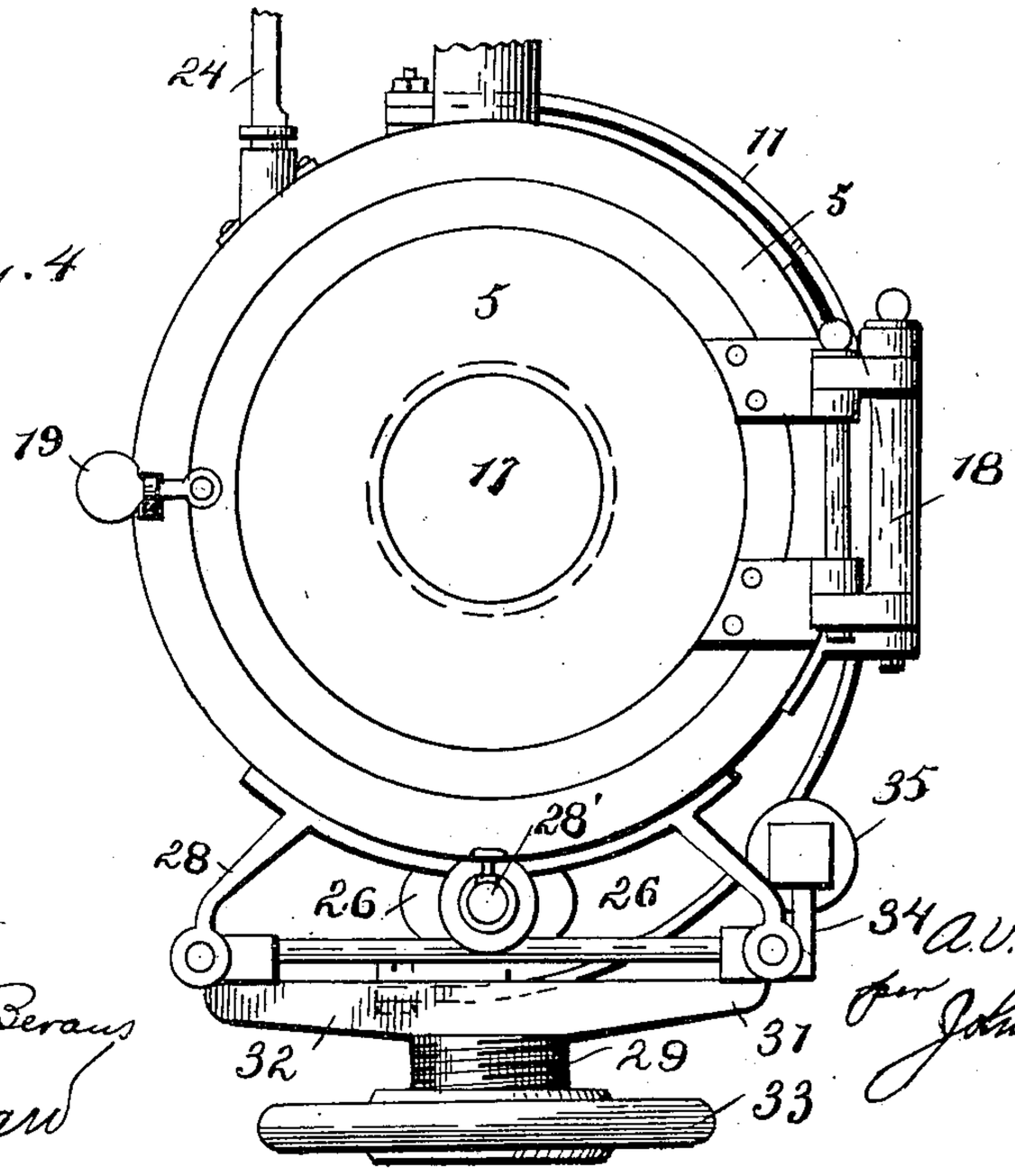


Fig. 4



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UNITED STATES PATENT OFFICE.

AUSTIN V. M. SPRAGUE, OF NEW YORK, N. Y.

METHOD OF THERAPEUTICAL TREATMENT OF PARTS OF THE HUMAN BODY AND APPARATUS THEREFOR.

SPECIFICATION forming part of Letters Patent No. 654,185, dated July 24, 1900.

Application filed February 18, 1897. Serial No. 623,935. (No specimens.)

To all whom it may concern:

Be it known that I, AUSTIN V. M. SPRAGUE, a citizen of the United States, residing at New York, (Brooklyn,) in the county of Kings and State of New York, have invented certain new and useful Improvements in Methods of Therapeutical Treatment; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention is a method of therapeutical treatment of parts of the human body wherein the effects of heat are utilized to produce beneficial results in certain classes of diseases, such as rheumatism, gout, and other kindred ailments. I employ heated air as the medium from which the heat units are taken in carrying out my method of treatment; but this, broadly, is no new step in the art, hot air having been, in fact, used from time immemorial to alleviate the pains and aches attendant upon this class of diseases, and various kinds of apparatus have been constructed in the efforts to secure successful results in the use of hot air. Before the date of my invention, however, the remedial effects of air at high temperatures were not appreciated, or if appreciated were not attained, because the generally-accepted supposition that such temperatures could not be utilized for a length of time and at a degree sufficient to insure the success of the treatment without the destruction of the tissues of or other injury to the member being operated upon discouraged any efforts in this direction. Upon a careful investigation of this subject I discovered that the perspiration that will be caused to exude from the pores of the skin of the part being treated when high temperature is employed will be evaporated, and it will more or less laden the surrounding body of air with moisture. Now it is well known that as between perfectly-dry air or moisture-laden air the latter is a relatively-good conductor of heat. I concluded, therefore, that as the perspiration that is induced when a member is subjected to the action of air at high temperature results in rendering the air more or less humid it was this which had heretofore prevented the treatment with hot air at a temperature appreciably above 212° Fahrenheit and of sufficient duration to insure its success. If the moisture-laden envelop or layer of air surrounding the part being treated could be removed as fast as it was produced and before it could act to conduct heat units in superabundant quantities from the main body of relatively-dry air onto said part, success would follow the effort to safely maintain the high temperature. I therefore proposed to take away the layer or thin body of air in contact with the limb as fast as it became moisture-laden and before its temperature could be raised to the danger-point. This I found could be accomplished by subjecting the limb to the action of moving increments of dry air heated to the desired temperature, so as to displace the moisture-laden envelop or layer of air as fast as it is produced, and it is this that constitutes, essentially, the all-important step of my improved method of treatment.

That higher temperatures can be maintained where the part undergoing treatment is constantly subjected to the action of moving increments of relatively-dry air than where it is treated to the action of air having no appreciable movement has been practically demonstrated by me. In apparatus which I have constructed for maintaining a current of dry air it is possible to raise the temperature as high as 350° Fahrenheit, whereas in an apparatus in which the air is practically still a degree but comparatively little above 212° Fahrenheit marks the attainable temperature. I account for the differences between the old and new methods as follows: In the first place it has been shown by Tyndall (in his *Heat as a Mode of Motion*, published by D. Appleton, New York, 1881) that temperatures somewhat above 212° Fahrenheit can be endured by a living body, because a considerable quantity of the sensible heat that would otherwise result in a destruction of the tissues of the body were it not a living one is converted into latent heat, being mainly expended in augmenting the functions of the organs of that body. Now when the temperature is raised to and maintained for an arbitrary length of time at approximately a degree of temperature as high as that which I consider adequate to a successful treatment

if the moisture-laden envelop of air which is created is permitted to remain as it conducts the heat quickly from the body of heated air onto the part undergoing treatment the units of heat will be collected in a concentrated state on said part and increase in quantity faster than the blood in its circulation can carry them off for distribution to other parts of the body; but if (assuming the temperature to remain the same) said moisture-laden envelop of air is removed as fast as it is produced and in its stead is substituted a moving layer or thin body of relatively-dry air—*i. e.*, that portion of the air which may be considered as existing interposed between the main body thereof and the part undergoing treatment—the delivery of the heat units from said moving layer as its groups of increments approach and pass out of proximity to the limb is manifestly an action relatively slower and more in coincidence with the action of the blood in its function of distributing said heat units to other parts of the body before they can accumulate in a concentrated state. Indeed, that this is so much of the heat remaining sensible is evidenced by the fact that I am able to considerably raise above the normal the temperature of the blood, a thing heretofore deemed almost impossible through the medium of an artificial agency, for it is a well-known fact that the temperature of the blood is constant during all variations of the thermometric conditions of the atmosphere. In other words, the difference is that, on the one hand, the infinitely-thin layer of moisture-laden air acts to conduct the heat units rapidly from the inexhaustible supply that the continually-heated surrounding body of air constitutes, whereas, on the other hand, the thin layer of dry air can supply heat units only so fast as its component groups of increments can approach and discharge themselves, for this layer if dry cannot conduct heat units from the main body of heated air to any appreciable extent. However, whatever may be the theory for the difference the fact yet remains that the difference exists, considerably-higher temperatures being maintainable where my method is employed than where any of the old methods is employed.

I now proceed to describe one form of apparatus whereby my improved process can be carried into effect. However, I do not herein claim this apparatus, the same being duly protected in my Patent No. 601,684, of April 5, 1898. This apparatus is clearly shown in the accompanying drawings, wherein—

Figure 1 is a side elevation of the apparatus. Fig. 2 is a view in cross-section on the line *x x* of Fig. 3, portions of the apparatus being shown in elevation. Fig. 3 is a longitudinal sectional view of the apparatus, and Fig. 4 is a rear view of the apparatus.

The apparatus consists of three casings 1, 2, and 3, which are concentrically arranged. The outer or intermediate casings form a flue for the passage of a heat vehicle flowing from any convenient source—as, for instance, the products of combustion arising from a gas-burner 4, which is situated just below an opening in the bottom of the outer casing 1. The intermediate casing is the casing for the hot air, and it is provided at one end with a door 5 and at the other end with a flexible covering 6, which may be drawn about the limb of the patient in such a manner as to prevent the escape of the hot air at that point. This casing is provided with ventilative tubes 7 8, which are suitably secured thereto and which extend beyond the outer wall of the apparatus, so as to receive cool air from the atmosphere below and discharge hot air into the atmosphere above. The upper tubes communicate with openings in the outer casing, while the lower tubes hang pendent between the separated edges of the plate which forms the outer casing. The inner casing 3 is provided with numerous perforations *c*. This casing is adapted to contain the patient's limb, and it is perforated in order that a perfect ventilation may be insured. The air from the tubes 7 8 will thus enter and pass out of the casing 3 at various points, and will also not only carry off the vapor from the evaporation of the perspiration from the patient's limb, but will completely surround the limb, so as to form an insulation which will protect it from the highly-heated vapors.

Pads 9, of felt or other soft material which is incapable of conducting heat to any appreciable degree, are arranged longitudinally, circumferentially, or radially within the casing 3 and between its perforations. These pads are shown in the drawings as longitudinally arranged; but I do not wish to be limited to this arrangement.

The admission and emission of air are regulated by slide-dampers 9 10, which are situated adjacent to the inner ends of the ventilative tubes 7 8, respectively. These slide-dampers are connected with an operating-lever 11, which spans the outer cylinder or casing and is suitably pivoted thereto. A gage 12 is secured to the outside of said outer casing, so that the lever 11 and the slide-dampers which it operates may be regulated thereby. The slide-dampers being both connected to the same lever are thus made simultaneously adjustable.

The escape of the products of combustion arising from the burner is permitted through a chimney situated in the top of the outer casing.

The respective casings are secured to the annular headpieces 13 and 14, which carry the door 5 and the flexible covering 6. The door has a glass panel or bull's-eye 17, which permits the operator to view the interior of the apparatus and visually determine any excess of vapor that is present. Said door is also provided with suitable hinges 18 and a keeper 19, which when the door is shut will insure its closely fitting a ring 20, which is

arranged within the headpiece 13. The flexible covering 6 is secured to a ring 21, which fits within the annular headpiece 14.

Thermometers 22 and 23 extend from the interior of the casings 3 to the outside of the apparatus, where they are suitably protected by casings 24 and 25. A portion of each thermometer lies parallel to the inner wall of the casing 3, and the free end of the thermometer extends vertically through a passage-way (not shown) in the annular headpieces and the rings carried thereby, said thermometers being supported as well as protected by the pads which project from the wall of the casing on either side of the thermometer.

Situated just below the opening in the outer casing is the above-mentioned burner 4, having two parallel tubes 26 and 27, which are perforated and extend substantially the length of the apparatus. These burners receive an adequate supply of commingled air and gas from an ordinary Bunsen-burner mixing device 28′, which communicates with said parallel tubes.

The entire apparatus is supported upon a frame 28, secured to the outer casing. This frame is supported by a base 30, having a vertical tubular portion, within which an externally-threaded pedestal 29 is adapted to reciprocate. The pedestal carries the arms 31 and 32, upon which the frame for the apparatus is pivotally mounted, and said pedestal is operated by an internally-threaded hand-wheel 33, which rests upon the top of the tubular portion of the base. A slot *e* in the tubular portion receives a projection *f* on the pedestal, so as to limit the movement of the latter up or down. An extension 34, integrally connected to the arm 31, carries a hand-screw 35, which operates in the internally-threaded bushing 36 on the extension. A lever 37 is rigidly connected to the axis 31′ of the frame 28 and the hand-screw 35 is connected to the lever by a ball and-socket-joint.

The combination of elements last described comprises a device by which the apparatus may be oscillated, and thus rendered capable of being tilted to various inclinations.

In the use of this apparatus the casings are adjusted to the proper height and inclination and the limb of the patient is inserted, the door being closed and the flexible covering drawn closely about the limb. When the burner or other heating apparatus is put into operation and if the heat arising therefrom is sufficient, the limb of the patient will begin to perspire to some extent. This perspiration becoming heated and vaporized must be carried off in order not to scald the limb, as above stated. The slide-dampers controlling the admission and emission of air to and from the apparatus are therefore manipulated by means of their lever, and by observations at the bull's-eye in the door they are regulated accordingly.

It is of course possible that the heat may become unbearable to the patient, though the air within the casing is kept perfectly dry. For this reason the thermometers may be frequently consulted and the supply of heat governed accordingly by regulating the flow of gas to the burner. This will seldom be found necessary, however, because, as aforesaid, the temperature within the apparatus may rise to 350° Fahrenheit without injury, provided the operator carefully regulates the flow of the fresh air to and from the apparatus.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The method of treating a part or parts of the human body which consists in subjecting the same to the action of a current of dry air, the temperature of which is above the boiling-point of water, and maintaining said current so as to carry off the moisture from said part or parts, substantially as set forth.

2. The method of treating a part or parts of the human body, which consists in subjecting the same to the action of a continuous current of dry air, the temperature of which is above the boiling-point of water, and maintaining said current so as to continuously carry off the moisture from said part or parts as rapidly as it is generated, substantially as set forth.

3. The method of treating a part or parts of the human body, which consists in subjecting the same to the action of moving increments of dry air, the temperature of which is above the boiling-point of water, so as to heat said part or parts, and remove the moisture therefrom, substantially as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

AUSTIN V. M. SPRAGUE.

Witnesses:
W. T. MOAT,
GEO. A. SMITH.