M. L. SEVERY.

APPARATUS FOR TREATING DISEASE.

APPLICATION FILED DEC. 28, 1912.

1,188,565.

Patented June 27, 1916.

3 SHEETS—SHEET 1.

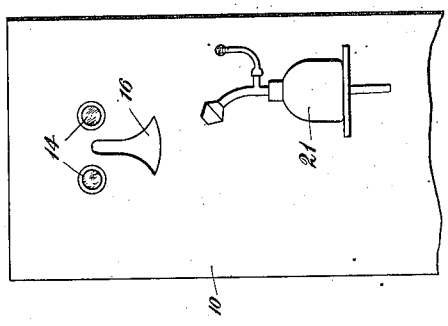


Fig. 2.

Fig. 1.

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3 SHEETS—SHEET 2.

Fig. 3.

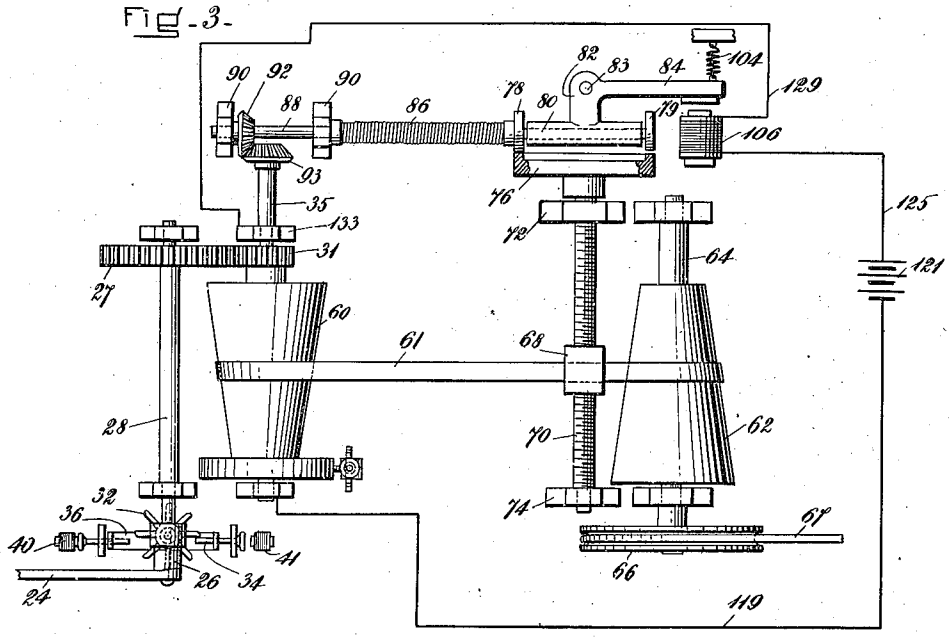


Fig. 4.

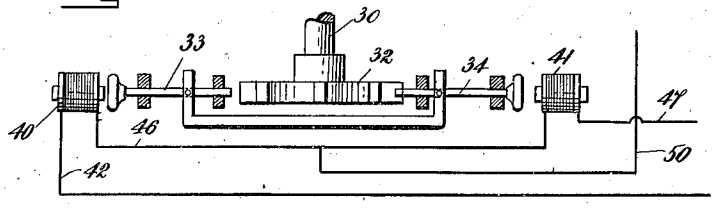


Fig. 5.

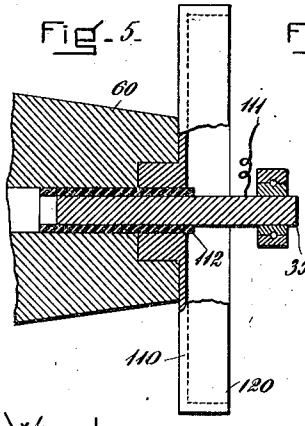
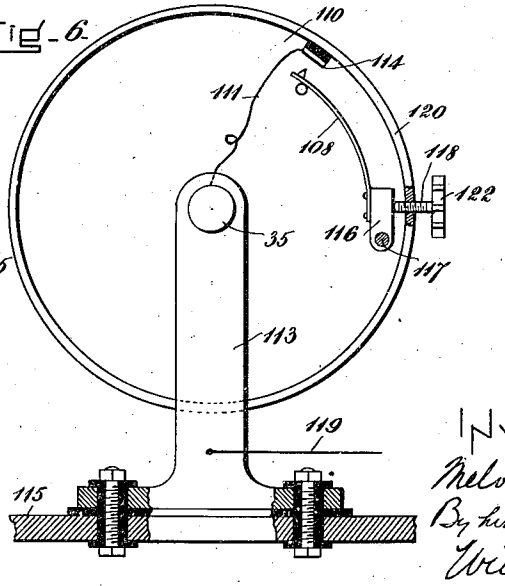


Fig. 6.



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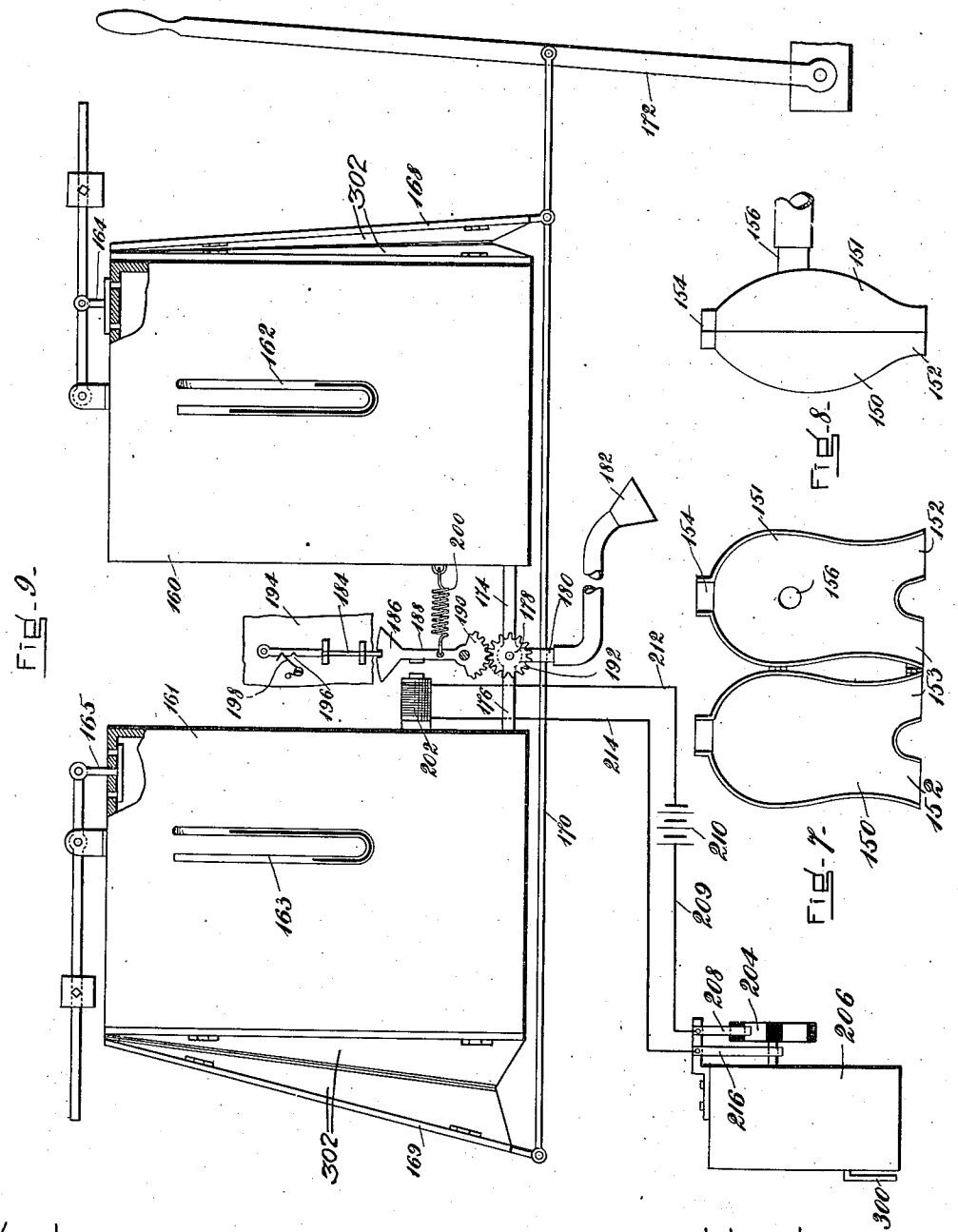
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3 SHEETS—SHEET 3.



WITNESSES=

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UNITED STATES PATENT OFFICE.

MELVIN L. SEVERY, OF ARLINGTON HEIGHTS, MASSACHUSETTS, ASSIGNOR TO SEVERY MANUFACTURING COMPANY, OF BOSTON, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

APPARATUS FOR TREATING DISEASE.

1,188,565. Specification of Letters Patent. Patented June 27, 1916.

Application filed December 28, 1912. Serial No. 738,981.

To all whom it may concern:

Be it known that I, MELVIN L. SEVERY, of Arlington Heights, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Apparatus for Treating Disease, of which the following is a specification.

This invention pertains to the treatment of various human ailments and diseases, and consists in novel apparatus for that purpose.

Better to make clear the character of the apparatus, the nature of the treatment may be briefly and generally stated to consist in subjecting different portions of the human anatomy alternately to increase and reduction of pressure, the frequency of such alternations, or the degree of pressure and pressure limits, or both, being varied as conditions render expedient. The treatment further consists in progressively varying such conditions, or any of them, without interrupting the continuity of the treatment.

In many instances, as in cases of drowning, suffocation, strangling, and the like, the lungs are alternately inflated and deflated mechanically, and like treatment is resorted to where breathing is imperfect either as to frequency or fullness of respiration. Where the usual or customary respiration of a patient is imperfect, a proper rate and depth of breathing may be established and rendered habitual by thus mechanically filling and exhausting the lungs, first at the rate and depth of breathing to which the patient is accustomed, and later and very gradually approximating the ideal rate and depth. The practicability of accomplishing such result I have established in actual practice in a number of instances.

Other ailments or diseases may be ameliorated or eradicated through the use of the same apparatus so applied and operated as to produce a very gentle or subtle action in the nature of a mechanical massage applied to the torso or to the limbs of patients, and varied in the particulars and in the manner above indicated.

The apparatus whereby this treatment is effected comprises means for producing either internally or externally, or both internally and externally, such alternating pressure; and further, means whereby the range and the frequency of pressure variation, either or both, may be controlled and rendered delicate and gradual, such variations or either of them being ordinarily effected without interrupting the continuity of action of the apparatus.

In the accompanying drawings Figure 1 is a sectional side elevation, partly diagrammatic, of a preferred illustrative embodiment of my invention, the detent supports and detents being shown turned 90° from their actual position to permit proper tracing of circuits, Fig. 2 is a fragmentary view in elevation of the exterior of one wall of the cabinet, Fig. 3 is a plan view of this form of the device with the cabinet and its circuit connections omitted, the detents and their supports being here shown in proper position, Figs. 4, 5 and 6 are details of controlling mechanism to be described, Fig. 7 is a view in elevation of a modified form of receiver open, Fig. 8 is a similar view of the same closed, and Fig. 9 is a sectional side elevation, partly diagrammatic, of a modified form of the invention, designed chiefly, but not exclusively for resuscitation.

It is of great importance to the successful use of the apparatus that its action simulate as nearly as possible, the natural processes or bodily functioning of the patient; that it be very gentle and hence not liable or apt to render the patient nervous, tense or unconsciously resistant; and that it shall not in any way interrupt such natural functionings.

As illustrated in Figs. 1 to 6 a preferred form of apparatus for carrying out my invention comprises a receiver 10, in the form of a cabinet as shown in Figs. 1 and 2, large enough to admit a person and provided with a door 12, which is suitably packed about the edges to make it practically air-tight. A pair of glazed windows 14 for the eyes and an aperture 16 for the nose and mouth, are provided in one of the walls of the cabinet, said aperture 16 being suitably padded, so that the face of the patient can be placed against this opening to close it tightly and leave the nose and mouth freely exposed to the outside atmosphere. By means of a bellows 18, or any other suitable means, communicating through an opening 19, the pressure of the air in the receiver is alternately increased and decreased in exact time with the patient's normal breathing

period, save where that period is wrong or the heart action is to be changed. This change of pressure is not only rhythmical and in proper time, but it is of an amount exactly suited to the subject, and this amount may be varied from no difference of pressure at starting to the maximum amount advisable for the patient to take, and in like manner it may be insensibly decreased to a point of no change. The form of this change, that is,—the pressure curve, may be anything desired, but the pressure curve I have found to give excellent satisfaction is that produced by the revolution of a crank. If other curves be desired they can be secured by changing the crank motion to a suitably plotted cam motion, or in any other well known way.

The receiver 10 is provided with a manometer tube 20 to indicate the pressure within the receiver, and a sliding window or safety valve 22 is also provided to prevent an excess of pressure from being maintained by the bellows 18. This sliding door or window is capable of being worked from the inside of the cabinet and is adapted to change the pressure of the air within the same. This may be used by the patient in starting up, for the purpose of neutralizing the pressure variation to a degree until he has gotten in proper step with the device and is breathing perfectly comfortably. If the pressure within the receiver 10 is objectionable to the ears they may be suitably covered or plugged. An atomizer 21 may be mounted on an outside wall of the receiver 10 and discharge into the outside atmosphere, whereby the latter may be humidified or medicated and an ozonizer 23 may be placed outside of the receiver to ozonize the air.

The bellows 18 are connected by a connecting rod 24 to an adjustable crank pin 26 on a shaft 28. This crank is arranged to be adjusted by means of a screw 30 carried by a frame 29 on the shaft 28. The screw 30 is provided on one end with a star-wheel or friction wheel 32, which coöperates with a pair of detents 33 and 34 mounted on opposite ends of a slidable bar 36 supported in a suitable bracket. When one of the detents is in engaging position with respect to the teeth of the star wheel, the other detent is out of engaging position. As the star or friction wheel revolves bodily with the rotating crank disk or frame 29, its teeth or periphery engage the detent, if any, which is in engaging position, and the wheel is turned thereby to impart a partial rotation to the screw 30 in one direction at each revolution thereof. The rotation of the star wheel 32 causes the screw 30 to turn, thereby moving the crank pin 26 in or out according to the direction in which the screw is turned. When it is desired to turn the screw in the opposite direction, the other detent is brought into play and the one previously in engaging position is moved away.

The detents 33 and 34 are controlled by electro-magnets 40, 41, said detents acting as armatures for the magnets. The magnet 40 is connected by a wire 42 to a stationary contact-member 44, and by a wire 46 to the magnet 41, and the magnet 41 is connected by a wire 47 to a stationary contact-member 48. The wire 46 is connected by a wire 50 to one pole of a battery 51, the other pole of which is connected by a wire 52 to a switch-arm 54, which is adapted to make contact with either of the contact-members 44 and 48, and is mounted on the interior of the cabinet 10. When the switch arm 54 is in engagement with the contact-member 44 the magnet 40 becomes energized to draw the detent 33 toward it, or out of engaging position, and draws the detent 34 into engaging position with respect to the star wheel 32. When the switch arm 54 is in engagement with the contact-member 48 the magnet 41 becomes energized to draw the detent 34 toward it, and the detent 33 is drawn into engaging position with respect to the star or friction wheel 32.

Thus by manipulating the switch-arm 54, the star-wheel detents are so controlled that said wheel is rotated step-by-step in the desired direction to correspondingly rotate the screw 30 to vary the position of the crank pin 26, and consequently vary the stroke of the connecting rod 24. This varies the range of pressure change produced within the cabinet 10 by the bellows 18. A pair of safety valves 20^a and 20^b are provided at the top of the casing to limit the pressure below and above that of the atmosphere.

It will be noted that only a small amount of power is necessary to operate these bellows, by reason of the fact that whatever power is necessary to open the bellows is almost wholly given back when the bellows are allowed to collapse, since all that is being done is to vary the pressure of a confined body of air. All that is necessary is to provide a fly-wheel sufficient to store energy from one phase to another, and then a very small motor will suffice to run it. This is an important consideration where the device is to be used as a preventive treatment over periods of considerable length.

The shaft 28 is provided with a gear 27 meshing with a pinion 31 on a parallel shaft 35, having a cone pulley 60 over which a belt 61 passes to a reversed parallel cone pulley 62 on a shaft 64, the latter having a driving pulley 66 which is rotated by a belt 67 connected to any suitable source of power. The speed of the device is altered by shifting the belt 61 on the pulleys 60 and 62 by means of a shifter 68, which is moved back and forth by a screw 70 rotatable in suitable bearings 72 and 74. The

screw 70 is provided on one end with a disk 76, which is adapted to be engaged by a pair of friction wheels 78 and 79 on a shaft 80 journaled in a rocking frame 82, fulcrumed at 83 and provided with a laterally extending arm 84. The shaft 80 is connected by a flexible shaft 86 to a jack shaft 88 journaled in bearings 90 and provided on one end with a bevel gear 92. The bevel gear 92 meshes with a bevel gear 93 on a shaft 35, to drive said shaft.

The shaft 35 rotates at a comparatively high speed, whereas the shaft 28 connected to the bellows 18 rotates at a comparatively slow speed. In order to ascertain the speed of the device a pointer 94 is provided, one end of which moves over a scale 95, and the other end of which is connected to a sleeve 96 slidable on a shaft 98 and connected to a centrifugal governor 100. The shaft 98 is provided with a bevel gear 102 which also meshes with the bevel gear 93.

The friction wheels 78 and 79 are controlled by a spring 104 and magnet 106, both of which act upon the arm 84 of the rocking frame 82. When the spring 104 pulls the arm 84 upward the wheel 78 is brought into contact with the disk 76 to rotate the latter in one direction and with it the screw 70 to move the shifter 68 in one direction, thereby shifting the belt 61 along the pulleys 60 and 62 to increase the speed of the device. When the magnet 106 is energized it attracts the arm 84, overcoming the spring 104, thus bringing the wheel 79 into contact with the disk 76, whereby the latter is rotated in the opposite direction and with it the screw 70 to move the shifter 68 in a direction opposite to that set forth above, thereby shifting the belt 61 along the pulleys 60 and 62 to decrease the speed of the device.

The energization of the magnet 106 is controlled by an adjustable contact arm 108 carried by a disk 110 on the shaft 35. The disk 110 is insulated from the shaft 35 by an insulating sleeve 112, and carries a fixed contact-member 114 insulated therefrom, which coöpérates with the adjustable contact arm 108. The contact arm 108 is mounted on a block 116 pivoted at 117 on the disk 110. The free end of said arm is arranged to be adjusted by a screw 118 threaded through the rim 120 of the disk 110, to determine the speed at which said arm will engage the contact-member 114. The contact member 114 is connected by a wire 111 to the shaft 35, which is in electrical contact with the bearing standard 113 insulated from the frame 115 and connected by a wire 119 to one pole of a battery 121, the other pole of which is connected by a wire 125 to the magnet coil 106. The magnet coil 106 is connected by a wire 129 to a bearing standard 133 mounted on the frame 115. From this bearing the circuit is through the shaft 35, cone 60, disk 110, to contact arm 108.

The screw 118 is provided on its outer end with a star or friction wheel 122, similar to that described above, and adapted to coöperate with detents 123 and 124 controlled by electro-magnets 126 and 127. If desired, the screw 118 may be provided with a toothless friction wheel instead of the star wheel. The magnet 126 is connected by a wire 128 to a stationary contact-member 130 and by a wire 131 to the magnet 127. The magnet 127 is connected by a wire 132 to a stationary contact 134, and the wire 131 is connected by a wire 136 to one pole of a battery 138, the other pole of which is connected by a wire 140 to a switch arm 142, which is adapted to make contact with the stationary contact-members 130 and 134 and is mounted on the interior of the cabinet 10. By manipulating the switch arm 142, the detents 123 and 124 are actuated to be brought into the path of the arms of the star wheel 122 in the manner explained above with respect to the star or friction wheel 32. When the contact-arm 108 engages the contact-member 114 the circuit through the magnet 106 is closed, and this continues closed until the belt shifter 68 has shifted the belt 61 sufficiently to reduce the speed of the shaft 35 sufficiently to enable the contact-arm 108 to move away from the contact 114, and thereby break the circuit through said magnet 106. Thus by manipulating the switch arm 142 the rapidity of variation of pressure or the breathing periodicity is regulated in accordance with the special needs of the patient.

As illustrated in Figs. 7 and 8 the receiver comprises a casing resembling a torso composed of two halves 150, 151 hinged together at one edge and provided with two branches 152, 153 at their lower ends, which, when closed surround the thighs and are padded to form air-tight joints about them. The upper end of this casing is provided with an opening 154 for the neck of the patient, and this opening is also padded to form a tight joint about the neck. The rear member of the casing is provided with an opening or branch 156 which is adapted to be connected to any suitable pressure changing device, such for example as the bellows 18. With this form of receiver the head of the patient is entirely exposed to the atmosphere and consequently the ear drums are not subjected to external variations of pressure as in the cabinet 10.

The torso being placed in either form of receiver above described, is subjected to a pressure which varies rhythmically in exact accord with the normal breathing, and is of an amount variable to suit the exact needs of the case. I get, therefore, a de-

lightful sense of relaxation and deep breathing, and put the muscles and lung tissues in such a condition that when the treatment ceases the deep breathing continues, and this deep breathing is of the abdominal type, even though the patients may have the thoracic habit of breathing. The thorax being protected by bony structure, the abdomen is first acted upon and the breathing can be felt in some cases clear down the back to below the kidneys, for all the visceral organs are affected. The variations in the pressure within the receiver induce movements of the human organism without any muscular effort and with a delightful sense of well-being. Where it is desired to use the device for chest development, I sometimes place a restraining belt about the abdomen in order to force the patient to expand and contract thoracically thus enlarging the bust development.

As illustrated in Fig. 9 the modification of my invention which is particularly adapted for use in cases of resuscitation, comprises a pair of chambers 160, 161, the former being kept at a pressure above the atmosphere, and the latter at a pressure below the atmosphere. They are provided with manometer tubes 162, 163 for indicating the pressure therein, and safety valves 164, 165 for preventing an excessive rise or fall of the pressure in the respective chambers. A pair of bellows 168, 169, are connected to the chambers 160 and 161, respectively, and these bellows are connected to a rod 170 which is attached to an operating lever 172. This lever is shown as adapted for manual operation, although any form of actuating mechanism for the bellows may be employed.

The chambers 160 and 161 are connected by pipes 174 and 176, respectively, to a two-way valve 178, the latter being connected by a pipe 180 to a funnel 182 adapted to be placed over a patient's face. The two-way valve is normally held against operation by a detent 184 which is adapted to engage in a notch formed in a sector 186 provided at the upper end of a lever 188, the lower end of which lever is provided with a gear sector 190 meshing with a gear 192 on the stem of said two-way valve. The detent 184 is slidably mounted on a plate 194, and is provided with notches 196 adapted to receive a spring catch 198 by which it is held up when drawn out of the recess in the sector 186.

When the detent 184 is drawn out of engagement with the sector 186, the lever 188 is free to be actuated by a spring 200 and a magnet 202, alternately in opposite directions, said lever acting as an armature for said magnet. The energization of said magnet is controlled by a switching device comprising a commutator 204 governed by a clock train 206 of the balance wheel type with a regulator 300 capable of wide adjustment. The commutator 204 engages a contact brush 208, connected by a wire 209 to one pole of a battery 210, the other pole of said battery being connected by a wire 212 to the magnet 202, said magnet being also connected by a wire 214 to a brush, 216, which is in engagement with the shaft of the commutator 204. The magnet 202, when energized, attracts its armature 188 and opens the two-way valve to afford communication between one of the chambers 160, 161 and the funnel 182, and when said magnet is deënergized the spring 200 opens said valve to place the other of said chambers in communication with said funnel. Thus it will be seen that the chambers 160 and 161 are placed alternately in direct communication with the lungs of the patient, and these alternations bear a definite timed relation with respect to the particuar function sought to be revived, which time relation is variable by the adjustment of the regulator 300. It will be noted that this form of my invention is particularly applicable to unconscious persons, whereas my preferred form is of more general application and dispenses with the use of the funnel over the face of the patient, thus obviating any nervous disturbance due to placing a cone over the mouth and nose of the patient.

By my preferred method of treatment every pore of the body inclosed in the chamber is alternately cupped and pressed, giving not only an impalpable massage, but having their contained gases subjected to pressure variations greatly assisting their excretory functions and materially improving the circulation and oxygenation of the blood. Where a member, as a limb, is to be massaged in this way, that portion only may be placed in a receiver and then the pressure variation may be many times greater than where the lungs are to be acted upon. In this manner, with sufficient pressure change, conditions of insufficient circulation may be treated with marvelous results. I have not shown chambers especially constructed to take various members of the body as such construction is well within the skill of any mechanic after what I have already shown. In the modified form of the invention these valuable cupping and massage attributes are lacking.

The sides of the bellows 18, 168 and 169 are provided with wooden slats or strips 302, which are hinged to the front and back walls of the bellows and are glued to the fabric comprising the flexible walls. These strips part on the line of the crease in the flexible wall and they are for the purpose of preventing outward bellying of the bellows on the inward stroke thereof.

While the several actuating and control

mechanisms here shown and described are those which I have used in practice and deem best suited to the purpose, it is to be understood that any equivalent devices may be substituted therefor without departing from the spirit or scope of my invention, and the claims hereinafter made are to be read and interpreted with this understanding.

What I claim is:—

1. An apparatus of the character described, comprising in combination, a receiver adapted to inclose the body or member to be treated; means for alternately raising the pressure above and reducing it below atmospheric pressure; valves adapted to limit the increase and reduction of pressure; and means independent of said valves for varying the range of pressure within the limits for which said valves are set, during operation of the pressure increasing and reducing means.

2. An apparatus of the character described, comprising in combination, a receiving chamber; means for alternately increasing and decreasing the pressure within said chamber; means for limiting such increase and decrease; and means for controlling the frequency of alternate increase and decrease in pressure, said controlling means being operable by the user of the apparatus while within the receiving chamber and during continuing operation of the apparatus.

3. An apparatus of the character described, comprising in combination, a chamber; means for alternately increasing and decreasing the pressure within said chamber; a driving mechanism; connections between the driving mechanism and the pressure-increasing and decreasing means; and means for varying the relation of said driving and connecting means during continuing operation of the apparatus to vary the range of pressure.

4. An apparatus of the character described, comprising in combination, a chamber; means for alternately raising and lowering the pressure within said chamber; a prime motor; a shaft connected with and serving to actuate the pressure-raising and lowering mechanism; variable speed gear interposed between the prime motor and the shaft; and automatic mechanism controlling said variable speed gear and serving through such control to maintain a constant speed of the shaft notwithstanding changes in the speed of the prime motor.

5. An apparatus of the character described, comprising in combination, a chamber; means for alternately raising and lowering the pressure within said chamber; a shaft connected with and serving to actuate said pressure-varying means; a prime motor; variable speed gear interposed between and connecting the prime motor and the shaft; electromagnetic devices controlling the variable speed mechanism and serving to maintain constant the speed of the driven member thereof; a centrifugal circuit closer carried by said driven member and forming part of the circuit of said electromagnetic control devices; and electromagnetic means under control of the user of the apparatus, serving to adjust the centrifugal circuit closer and thereby to determine the normal speed of the driven member.

In testimony whereof I have affixed my signature, in presence of two witnesses.

MELVIN L. SEVERY.

Witnesses:
EDWARD S. CROCKETT,
ESTHER R. PRUSSIAN.