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APPARATUS FOR PRODUCING ARTIFICIAL RESPIRATION.

APPLICATION FILED APR. 14, 1915.

1,202,126. Patented Oct. 24, 1916.

Fig. 1

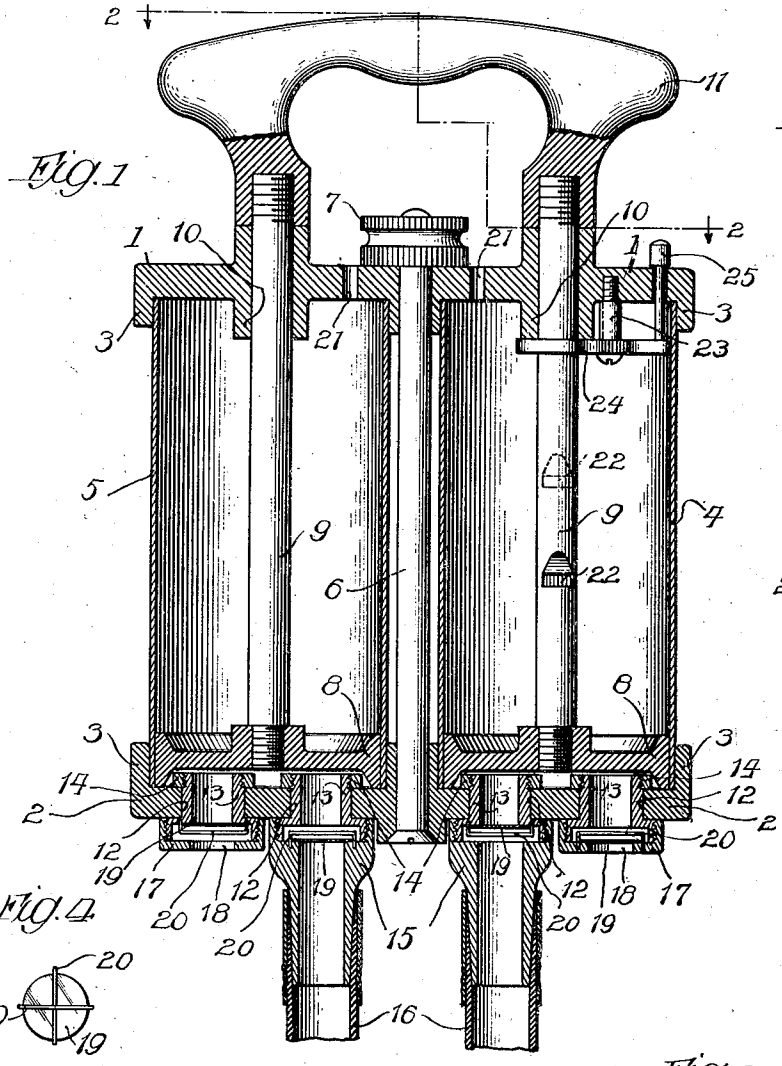


Fig. 3

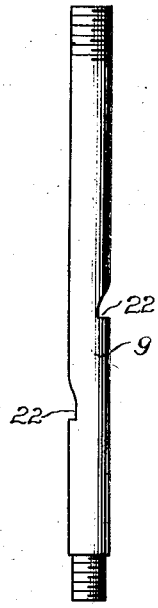
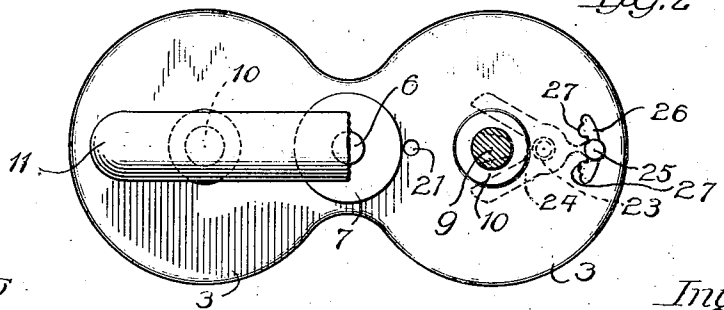


Fig. 4

Fig. 2



Witness

Inventor

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By Wm. C. Bell Atty.

UNITED STATES PATENT OFFICE.

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APPARATUS FOR PRODUCING ARTIFICIAL RESPIRATION.

1,202,126. Specification of Letters Patent. Patented Oct. 24, 1916.

Application filed April 14, 1915. Serial No. 21,260.

To all whom it may concern:

Be it known that I, WILLIAM E. TULLAR, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Apparatus for Producing Artificial Respiration, of which the following is a specification.

This invention relates to an apparatus for producing artificial respiration, whereby oxygen-containing gas may be forced into and carbon-dioxid or other wastes products withdrawn from the lungs of a patient alternately, the purpose being to simulate and thereby stimulate spontaneous breathing. In the use of apparatus of this character it is essential that as soon as the patient revives sufficiently to breathe spontaneously he should be given an opportunity to do so without delay. The principal defect of apparatus heretofore suggested for the purpose is that in order to allow spontaneous breathing the straps, which are customarily used to hold the mouth and nose piece in position, must be removed, the character of the apparatus being such that the patient is unable to breathe therethrough. This consumes an appreciable amount of time and frequently the patient, having shown ability to breathe spontaneously, collapses before the mouth and nose piece can be removed. The reviving operation must then be repeated and is frequently unsuccessful. It requires expert judgment in operating such an apparatus to determine exactly when the mouth and nose piece should be removed and inasmuch as the apparatus is of necessity frequently used by relatively inexperienced persons it will be apparent that an apparatus which allows spontaneous breathing without removal of the mouth and nose piece attains a desirable but hitherto impossible result.

It is the object of my invention to provide a sterilizable apparatus for producing artificial respiration, whereby the patient is allowed to breathe spontaneously at any instant without removing any of the parts and in which the operation of artificially supplying oxygen-containing gas to and withdrawing waste products from the lungs may be instantly resumed should the patient fail to breathe spontaneously as expected.

A further object of my invention is the provision of novel means for measuring the quantity of oxygen-containing gas delivered to the lungs of the patient.

Further objects and advantages of the invention will be apparent as it is better understood by reference to the following specification when read in connection with the accompanying drawing in which—

Figure 1 is a vertical section through the apparatus; Fig. 2 is a horizontal section on the line 2—2 of Fig. 1; Fig. 3 is a detail in elevation of one of the plunger rods, and Fig. 4 is a detail of one of the valves.

Referring to the drawing, 1 and 2 indicate respectively the upper and lower plates which may be of any suitable material, for example aluminium, and which are provided with circular flanges 3 to support the cylinders 4 and 5, the cylinders being held in proper relation with the upper and lower plates by means of a bolt 6 disposed therebetween and secured by a nut 7. Within the cylinders 4 and 5 the plungers 8 are disposed and connected by plunger rods 9, slidably mounted in suitable bearings 10 in the plate 1, with an operating handle 11. The cylinder 4 is intended to supply oxygen-containing gas to the lungs of the patient while the cylinder 5 is intended to withdraw carbon-dioxid or other waste products from the lungs of the patient, the operation alternating as in spontaneous breathing. Each cylinder is provided with a valved outlet and inlet. In order that the patient may breathe spontaneously through the apparatus it is necessary that these valves be extremely light and sensitive for the reason that the power exerted by the lungs, particularly when in exhausted condition, is comparatively feeble. I, therefore, provide valves comprising disks of relatively light material, preferably mica, although other materials, such as aluminium, for example, may be employed. The construction and arrangement of the valves is as follows: The lower plate 2 is provided with a pair of openings 12 adjacent the ends of each of

the cylinders 4 and 5. In these openings the tubes 13 are disposed and secured by means of nuts 14 threadedly engaging the inner ends of the tubes. The nipples 15 are threadedly mounted on the outer ends of one of the tubes 13, leading to each of the cylinders 4 and 5. The nipples 15 constitute the outlet from the cylinder 4 and the inlet to the cylinder 5, respectively, and are connected by suitable flexible members 16 to the mouth and nose piece (not shown) well-known in the art. Threadedly mounted on the outer ends of the remaining tubes 13 are the caps 17 having openings 18 therein. The openings 18 constitute the inlet to the cylinder 4 and the outlet from the cylinder 5, respectively. The valves comprise the disks 19 adapted to seat against the outer ends of the tubes 13 in the outlets from the respective cylinders and against shoulders formed within the nipple 15 and the cap 17 in the inlets to the respective cylinders. The disks 19 are maintained in coöperative relation with their respective seats by means of crossed wires 20 secured within the valve chambers. Vents 21 are provided in the upper plate 1 providing free access of air to the portions of the cylinders above the plungers 8, permitting the plungers to operate freely.

The operation of my device will, it is believed, be apparent without further description of the structure thereof. By reciprocating the handle 11 the plungers 8 are moved in the cylinders 4 and 5. As the plunger 8 moves downwardly in the cylinder 4, the oxygen-containing gas therein is forced outwardly past the disk 19 and thence through the nipple 15 and flexible connecting members 16 to the mouth and nose piece and the lungs of the patient. Simultaneously the gaseous contents of the cylinder 5 are expelled through the outlet. Upon the upward movement of the plungers 8 a fresh supply of oxygen-containing gas is drawn into the cylinder 4 through the inlet thereto, while carbon-dioxid or other waste products are simultaneously drawn into the cylinder 5 from the lungs of the patient through the mouth and nose piece, flexible connecting members 16 and nipple 15, past the valve 19. The operation of the handle is timed by the operator to correspond to the normal rate of spontaneous breathing. As will be readily understood the lungs of the patient are alternately filled with oxygen-containing gas and relieved of waste products exactly as if the patient was breathing.

As the lungs of persons of different size vary in capacity it is desirable that the quantity of oxygen-containing gas supplied be carefully measured and remain constant throughout the operation of the apparatus. This is readily accomplished by the following mechanism: One of the plunger rods 9 is provided with a pair of oppositely disposed slots 22, the upper walls of which slope outwardly to form cam surfaces. Pivoted on a stud 23, secured to the upper plate 1, is a bifurcated member 24 provided with an operating handle 25 extending upwardly through a slot 26 in the upper plate 1. By grasping the handle 25 and moving it to engage with one of the notches 27 at either end of the slot 26 the bifurcated member 24 may be moved about its pivot so that one or the other of the arms is so disposed as to engage the corresponding slot 22 as the plunger rod 9 moves upwardly. The bifurcated member 24 has sufficient resiliency in the portion adjacent the handle 25 to allow the arms thereof to turn about the pivot while the operating handle is in engagement with either of the notches 27. As will be readily understood the intake movement of the plunger 8 in the cylinder 4 will be limited by engagement of the member 24 with one or the other of the slots 22. Upon downward movement of the plunger rod the cam surface forming the upper portion of the slot 22 will free the member 24 from the slot 22. By disposing the operating handle 25 midway between the ends of the slot 26, as indicated in Fig. 2, neither of the bifurcated portions of the member 24 will be disposed to engage the slots 22 and the plungers 8 will be permitted to make a full upward stroke. By the means described three adjustments of the quantity of oxygen-containing gas supplied to the lungs of the patient are permitted.

It will be understood from the foregoing that I have perfected an apparatus which not only overcomes the fundamental defect in apparatus previously suggested for the purpose, but which provides additional and advantageous features which have not heretofore been suggested. The use of disks of light material to control the inlets and outlets from the valves allows the patient to breathe directly through the apparatus since the valves are so sensitive that they may be operated by the lungs of an exhausted patient. This is in itself an advance in the art which is of the greatest importance since the apparatus meets a requirement which can not be met by any apparatus heretofore suggested for the purpose and many lives will unquestionably be saved by reason of the novel features of the apparatus as set forth herein. I have found that the particular means employed for measuring a quantity of oxygen-containing gas supplied to the lungs is particularly adapted to accomplish the desired result in the type of apparatus herein described, the gas being measured with great precision and the mechanism be-

ing simple and not subject to disarrangement. A further advantage in the present form of apparatus is that it is constructed entirely of materials which may be thoroughly sterilized before use.

It is obvious that various changes may be made in the form, construction and arrangement of the parts without departing from the spirit and scope of the invention or sacrificing any of its material advantages, the form hereinbefore described being merely a preferred embodiment thereof.

I claim:

1. In an apparatus of the character described, the combination of means for supplying oxygen-containing gas to and withdrawing waste and other products from the lungs of a patient comprising a pair of cylinders, plungers therein and means for operating said plungers, an outlet from and an inlet to each of said cylinders, and a disk of relatively light material loosely maintained in bodily movable relation to each of said outlets and inlets and adapted to alternately close and open said outlets and inlets, the weight of said disks being such that they are readily operable by the lungs of the patient to permit spontaneous breathing.

2. In an apparatus of the character described, the combination of means for supplying oxygen-containing gas to and withdrawing waste and other products from the lungs of a patient comprising a pair of cylinders, plungers therein and means for operating said plungers, an outlet from and an inlet to each of said cylinders, a disk of relatively light material loosely maintained in bodily movable relation to each of said outlets and inlets and adapted to alternately close and open said outlets and inlets, the weight of said disks being such that they are readily operable by the lungs of the patient to permit spontaneous breathing, and adjustable means for limiting the intake movement of one of said plungers, whereby the effective volume of the corresponding cylinder may be varied to measure the quantity of oxygen-containing gas delivered to the lungs of the patient.

3. In an apparatus of the character described, the combination of means for supplying oxygen-containing gas to and withdrawing waste and other products from the lungs of a patient comprising a pair of cylinders, plungers therein and means for operating said plungers, an outlet from and an inlet to each of said cylinders, a disk of relatively light material loosely maintained in bodily movable relation to each of said outlets and inlets and adapted to alternately close and open said outlets and inlets, the weight of said disks being such that they are readily operable by the lungs of the patient to permit spontaneous breathing, means for retaining said disks in operative position, and a resilient means adapted to coöperate with one of said plungers to adjustably limit the intake movement thereof, whereby the effective volume of the corresponding cylinder may be varied to measure the quantity of oxygen-containing gas delivered to the lungs of the patient.

4. In an apparatus of the character described, the combination of means for supplying oxygen-containing gas to and withdrawing waste and other products from the lungs of a patient comprising a pair of cylinders, plungers therein and means for operating said plungers, an outlet from and an inlet to each of said cylinders, a disk of relatively light material loosely maintained in bodily movable relation to each of said outlets and inlets and adapted to alternately close and open said outlets and inlets, the weight of said disks being such that they are readily operable by the lungs of the patient to permit spontaneous breathing, and an adjustable pivotally mounted resilient member adapted to coöperate with one of said plungers to limit the intake movement thereof, whereby the effective volume of the corresponding cylinder may be varied to measure the quantity of oxygen-containing gas delivered to the lungs of the patient.

5. In an apparatus of the character described, the combination of means for supplying oxygen-containing gas to and withdrawing waste and other products from the lungs of a patient comprising a pair of cylinders, plungers therein and means for operating said plungers, an outlet from and an inlet to each of said cylinders, a disk of relatively light material loosely mounted in bodily movable relation to each of said outlets and inlets and adapted to alternately close and open said outlets and inlets, the weight of said disks being such that they are readily operable by the lungs of the patient to permit spontaneous breathing, means for retaining said disks in operative position, spaced slots in one of said plungers on opposite sides thereof, the upper walls of which provide cam surfaces, and an adjustable pivotally mounted resilient member adapted to engage one of said slots to limit the intake movement thereof, whereby the effective volume of the corresponding cylinder may be varied to measure the quantity of oxygen-containing gas delivered to the lungs of the patient.

6. In an apparatus of the character described, the combination of means for supplying oxygen-containing gas to and withdrawing waste products from the lungs of a patient, comprising a pair of cylinders, plungers therein and means for operating said plungers, an outlet and an inlet to each

of said cylinders, valves in said outlets and inlets adapted to alternately close and open said outlets and inlets, spaced slots in one of said plungers, the upper walls of which provide cam surfaces, and an adjustable pivotally mounted bifurcated member, having a resilient adjusting arm, said bifurcated member being adapted to engage one or the other of said slots, depending on its angular position, as said plunger moves upwardly to limit the movement thereof, whereby the quantity of oxygen-containing gas delivered to the patient may be measured.

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Witnesses:
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