

United States Patent

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- [50] **Field of Search**..... 128/145.6,
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[56]

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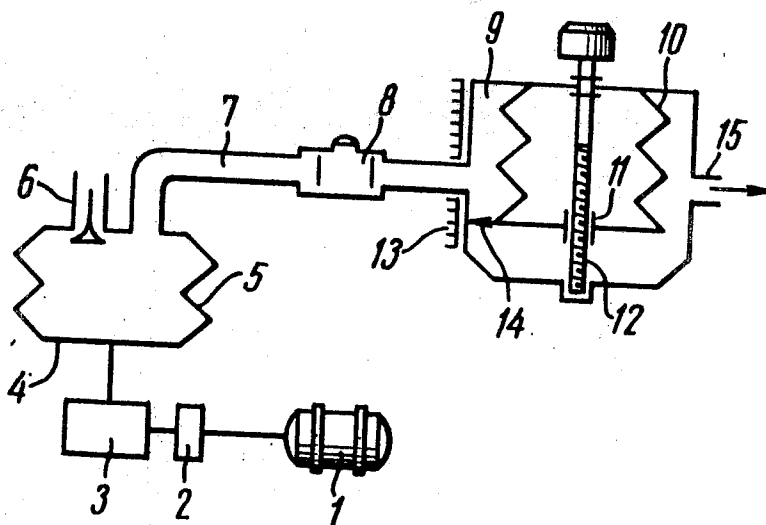
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- [54] APPARATUS FOR ARTIFICIAL VENTILATION OF LUNGS**
2 Claims, 1 Drawing Fig.

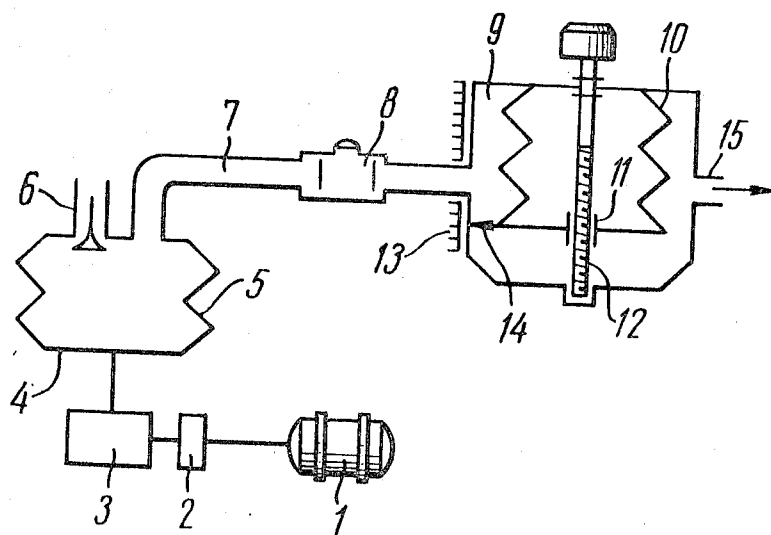
- [52] U.S. Cl..... 128/145.6
[51] Int. Cl..... A62b 7/00

ABSTRACT: Apparatus for the artificial ventilation of the lungs of a patient comprises a pipe line which is successively supplied with constant volumes of gas and which contains a gas-distributing joint having inspiration and expiration channels, the joint being connected to an auxiliary chamber connected to the patient and containing a bellows whose extension is manually adjustable to vary the size of the space between the chamber and bellows.



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APPARATUS FOR ARTIFICIAL VENTILATION OF LUNGS

The present invention relates to devices for ensuring external breathing of a human being in case of insufficiency or complete cessation of respiration and, mainly, to apparatus for ensuring artificial ventilation of the lungs through active blowing of gas mixtures into the patient's lungs.

Known in the art is apparatus for artificial ventilation of the lungs, e.g. those of the Swedish Angstrom company. This apparatus operates at a constant frequency in the following way. A piston stroke inside a power cylinder produces an air pressure, which is transmitted into a pressurized bell containing a respiration bag connected to the patient's lung via a respiration network. The design of the apparatus provides for a complicated system of regulation of the ventilation parameters, and considerable time is required to prepare and keep the apparatus going. Regulation of the cycle of breathing frequency is effected with the aid of an intricate system of a variator, while the value of breath volume is established by dividing a preset minute ventilation by an artificial ventilation frequency, since to maintain adequate ventilation it is necessary to vary either the volume or the frequency, or both parameters together.

In view of the fact that the blowing of gas into the lungs results in diverse haemodynamic shifts, variations in the ventilation parameters cause, in turn, a readaptation of the organism and its compensatory mechanisms, which is extremely undesirable.

An object of the invention thus consists in providing an apparatus for artificial ventilation of the lungs, which ensures stable, i.e. adequate, ventilation for a long period of time without varying either volume or frequency (and, consequently, the pressure).

Another object of the invention is to provide a device permitting recovery of part of the expired CO_2 back into the lungs thus to secure prevention of hypocapnia.

These and other objects can be achieved by improving the power and respiration units of the apparatus.

The invention consists in providing an auxiliary chamber of a variable volume between a gas-distributing joint and an outlet piping of the apparatus, wherein the gas contained in it can be effectively mixed with an incoming portion of the gas mixture.

It is desirable to provide the auxiliary chamber with a bellows coupled with a mechanism for regulating its volume.

It is also desirable to adapt the auxiliary chamber for regulation of the volume up to a value somewhat exceeding the volume of an inspiration.

The invention will be more apparent from the following exemplary embodiment thereof and the appended drawing, the sole figure of which shows a block diagram of the apparatus for artificial ventilation of the lungs.

An electric motor 1 via a reducing gear 2, which has a permanent mechanism ratio, and a gear 3 displaces the lower movable cap 4 of a bellows 5. The mechanism 3 crank- or cam-type construction transforms the rotary motion of the rotor of the electrical motor into a reciprocal motion of the lower cap 4 of the bellows, the latter having an invariable amplitude of motion. The stationary cap of the bellows is fitted with an inlet valve 6. A hose 7 leading to the patient is also connected to bellows cap 6, and a gas-distributing joint 8 of respiration-valve type normally used in anaesthetic-respiratory installations is provided at the end of said hose 7. Attached close to said joint 8 is an auxiliary variable chamber 9 housing

a displacing bellows 10 on whose movable lower cap a nut 11 is fastened. During the turn of a lead screw 12 secured against axial displacement the displacing bellows 10 becomes expanded or compressed, thus varying the effective volume of the auxiliary chamber 9. Calibrated on a sidewall of the vessel is a scale 13 on which a pointer 14 linked with the movable cap of the displacing bellows 10 indicates the effective volume of the auxiliary chamber 9.

The apparatus is operated as follows:

The bellows 5 actuated by the electric motor 1 via the reducing gear 2 and the gear 3 feeds a gas mixture into the hose 7 in portions invariable in volume, for instance 500 ml, and at a constant frequency, e.g. 40 cycles per minute. During the inspiration phase, a portion of the gas mixture passes through the hose 7 and valve 8 into the auxiliary chamber 9 of variable volume, wherein it becomes mixed with some portion of the gas mixture remaining inside the chamber 9 after the previous expiration. Then, this gas mixture travels to the patient through an outlet piping 15.

During the expiration phase, the respiratory volume of the gas from the patient's lungs passes in succession through the outlet piping 15 of the apparatus, the variable volume auxiliary chamber 9 and goes to the gas-distributing joint 8 from where it may be released to the ambient atmosphere.

Remaining in the chamber 9 is some portion of the expired gas with a rather high content of CO_2 (3—4 percent). During the next inspiration, this remaining portion of the gas mixture becomes mixed with a new portion of the gas and gets into the lungs.

Thus, hypocapnia prevention is attained.

The apparatus of the above design can be lighter and more compact than similar apparatus of known types. Its adjustment to a required mode of ventilation is made simpler and achieved with the aid of a single adjusting mechanism, i.e. the lead screw 12, varying the effective volume of the chamber 9 through movement of the displacing bellows 10.

As the operation at high frequencies is accompanied by a more intensive diffusion and mixing of the gas in the patient's respiratory tract, the maximum volume of the auxiliary chamber 9 must be somewhat larger than that of inspiration.

The installation and regulation of the apparatus operation is as follows:

The apparatus is connected with the patient by means of an intubation tube or a mask, i.e., in a conventional manner; the minimum volume of the variable volume auxiliary chamber 9 is set and the apparatus is activated; then the volume of said chamber is gradually expanded until the ventilation is adequate.

We claim:

1. Apparatus for the artificial ventilation of the lungs of a patient, said apparatus comprising: a pipe line; means for successively feeding invariable volumes of gas into said pipe line; a gas-distributing joint in said pipe line, which has inspiration and expiration tracts; an outlet piping leading to the patient; and an auxiliary chamber connected between said gas-distributing joint and said outlet piping for effective mixing of the gas contained in said chamber with the incoming volumes of said gas, said auxiliary chamber including a distributing bellows therein and means for manually adjustably setting the extension of said bellows for regulating the volume of the space between the bellows and said chamber.

2. An apparatus as claimed in claim 1, in which the auxiliary chamber is adapted for the regulation of its volume up to a value somewhat exceeding the volume of inspiration.