March 25, 1924. 1,488,442

H. W. C. SCHRÖDER

ARTIFICIAL BREATHING APPARATUS

Filed Aug. 18, 1921

Fig. 1

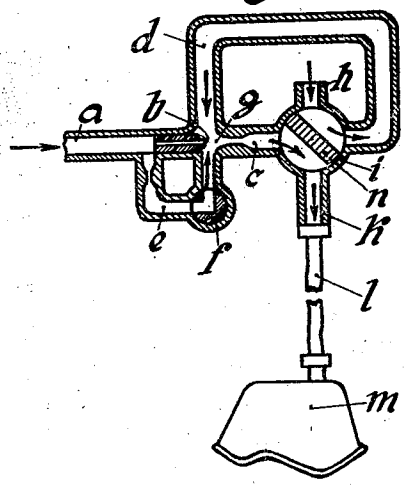


Fig. 2

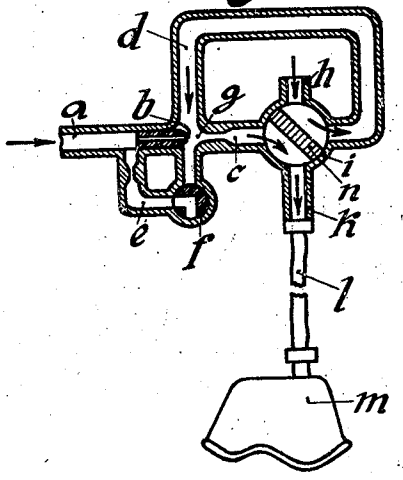


Fig. 3

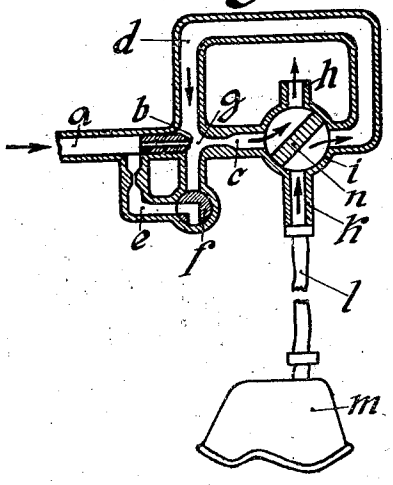
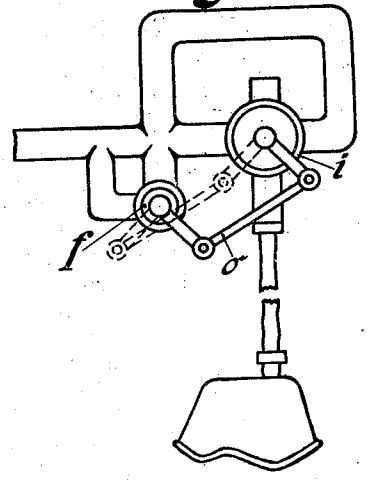


Fig. 4



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UNITED STATES PATENT OFFICE.

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ARTIFICIAL-BREATHING APPARATUS.

Application filed August 18, 1921. Serial No. 493,483.

(GRANTED UNDER THE PROVISIONS OF THE ACT OF MARCH 3, 1921, 41 STAT. L., 1313.)

To all whom it may concern:

Be it known that I, HANS WILHELM CHRISTIAN SCHRÖDER, a German citizen, residing at Lubeck, Germany, have invented certain new and useful Improvements in Artificial-Breathing Apparatus, for which applications for patents have been filed in Germany, December 22, 1917, Patent No. 309,258; Austria, October 31, 1918, patent not yet issued; and Hungary, November 23, 1918, Patent No. 76,008, and of which the following is a specification.

The present invention relates to improvements in artificial breathing apparatus of the type disclosed by Letters Patent in the United States granted under No. 1,136,517 on the 20th April, 1915, in which there is provided means for producing respiratory pressure gas (oxygen), a circulating pipe in connection with the said means, a breathing pipe, and an air-socket in communication with the atmosphere, an injector device (nozzle and cone) in the circulating pipe adapted to engender a gas current, and a reversing member also in said circulating pipe and adapted to establish communication either between the injector and the breathing pipe while maintaining the circulation of the air entering through the air socket in order to direct a current of gas and air into the breathing pipe to cause inspiration, or between the injector and the air socket while maintaining the circulation between the breathing pipe and the air socket in order to direct a current of gas and exhaled air into the atmosphere to cause expiration.

The object of the improvements is to further develop the apparatus disclosed in the above cited patent in such a way as to be adapted for supplying, in cases of severe poisoning (by carbon monoxide for example), the respiratory organs of the patient with additional oxygen that is to say, with an oxygen-air mixture very rich in oxygen without increasing the total volume of the oxygen-air supply above that previously admitted.

According to the present invention the object aimed at is attained by providing a valve controlled by-pass adapted to admit, in addition to the oxygen supplied by the injector nozzle, additional oxygen directly into the apparatus without passing through the said nozzle. The by-pass being arranged with relation to the injector-device (nozzle and injector cone) in such a manner that it branches off from the oxygen supply pipe in front of the nozzle and discharges into the circulating pipe at a place either between the nozzle and the injector cone or in the rear of the latter, whereby the additional oxygen entering into the circulating system forces or holds back a part of the air otherwise sucked into the circulating pipe, this portion of air so held back being replaced by the additional oxygen supplied through the by-pass. By means of the controlling valve in the by-pass the supply of additional oxygen can be regulated according to requirements or shut off entirely.

The invention is illustrated more diagrammatically in the drawing in which—

Figure 1 shows as a constructional example in section an apparatus to be worked by an injector device (nozzle and cone) for the production of artificial breathing, with a valve controlled by-pass for the nozzle. The apparatus is represented as adjusted for the pressure stage of the breathing with the by-pass open.

Figure 2 is a similar view to Figure 1, except that the by-pass is closed.

Figure 3 corresponds to Figure 2, except that the apparatus is reversed for the suction stage of the breathing.

Figure 4 shows the breathing apparatus in elevation, with the control-valve of the by-pass positively connected to the reserving device for the breathing apparatus, so that it is operated conjointly therewith.

A pipe *a* supplies oxygen under pressure which issues from the narrow bore nozzle *b* and produces a pressure somewhat above atmospheric in the injector cone *c* and a pressure somewhat below atmospheric in the circulating pipe *d*, preferably in the form of a rectangle as shown. Oxygen under pressure can also be supplied through a by-pass *e* and a valve *f* into the injector chamber *g* which additional oxygen, however, does not produce any suctional action on the air but on the contrary, owing to the arrangement of the air inlet opening of the by-pass *e* op-

posite the sucking branch of the circulating pipe *d*, partially forces back the amount of air drawn in by the action of the nozzle *b* through the air socket *h* into the branch *d* and holds it back therein.

When additional oxygen is not supplied (see Figure 2) the current of air pursues its way during the inspiration stage in the well known way as follows. By the suctional action of the oxygen rushing through the nozzle *b* atmospheric air is drawn into the socket *h* of the casing *i* of the reversing valve *n* and into the circulating pipe *d* and after admixture with the working oxygen in the injector cone *c* is supplied through the breathing pipe *k*, the flexible pipe *l* and the mask *m*, to the respiratory organs at a pressure slightly above atmospheric. When now the valve *f* of the by-pass is opened (see Figure 1), a definite volume of additional oxygen flows into the injector chamber *g*, partially bars the admission of the outer air and mixes with the working oxygen from the nozzle *b* and the rest of the air drawn in from outside in the injector cone *c*. This mixture is then very rich in oxygen and flows as above at a pressure slightly above atmospheric and the same total volume to the mask *m*.

Now in order that no unnecessary waste of oxygen may take place during the expiration stage (see Figure 3), the valve *f* of the by-pass *e* is to be closed during this time. This provision is also very convenient for the reason, that the suctional action produced by the nozzle *b* shall be fully utilized on the respiratory organs during the expiration stage. The shutting off of the valve *f* must take place simultaneously with the reversal of the rotary valve *n* in the casing *i*. The valves *f* and *n* are therefore positively connected with each other by a system of levers *o*, an example of this construction being shown in Figure 4.

If the reversal of the valve *n* be effected mechanically or automatically the reversal of the valve *f* may also be effected by separate rods without any positive connection being provided with the reversing valve *n*.

The by-pass with the controlling valve for the additional oxygen may also be provided in apparatus in which separate inhaling and exhaling pipes lead from the casing *i* of the reversing device to the mask.

It can easily be seen that the present arrangement of the by-pass constitutes an important improvement, as it is now possible, particularly in severe cases of asphyxiation, to treat the patient with the necessary increased amount of oxygen, without altering the method of working itself.

I claim:

1. In an artificial breathing apparatus of the kind described, a circulating system, a conduit for delivering respiratory gas thereto for admixture with air in said system, and a valve-controlled by-pass connected with said system and conduit at points upon opposite sides of the point of connection of said conduit with said system and adapted to supply additional respiratory gas to said circulating system whereby the proportion of gas is increased without increasing the volume of the gas and air mixture.

2. In an artificial breathing apparatus of the kind described, an oxygen supply pipe, a breathing pipe, a circulating pipe in communication with said pipes and with the atmosphere, an injector device adapted to cause a respiratory gas current through the circulating pipe, a reversing member in the circulating pipe for directing either a current of gas and air into the breathing pipe to cause inspiration or a current of gas and exhaled air into the atmosphere to cause expiration, and a valve controlled by-pass for the injector device whereby additional respiratory gas is passed directly into the circulating system of the apparatus.

3. In an artificial breathing apparatus of the kind described, a circulating pipe, an injector-cone communicating therewith, a valve controlled by-pass adapted to supply additional respiratory gas directly into said circulating pipe, the said by-pass discharging at a place in the front or in the rear of the injector-cone.

4. In an artificial breathing apparatus of the kind described, a circulating pipe, a device for reversing the direction of flow therein, a by-pass connected with said pipe, a controlling device in said by-pass and means for positively connecting the reversing device of the circulating pipe with the controlling device of the by-pass, and adapted to operate the said devices simultaneously.

5. In an artificial breathing apparatus of the kind described, a circulating conduit connected with the atmosphere, a gas conduit for delivering respiratory gas to said circulating conduit, a breathing conduit, a by-pass for supplying additional gas to said circulating conduit, a valve controlling the connection between the circulating conduit and breathing conduit, a valve controlling said by-pass, and means connecting said valves for operating the same concurrently in predetermined relation.

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Witnesses:

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