Dec. 8, 1931. J. A. HEIDBRINK 1,835,157

FILTERING ATTACHMENT FOR ANÆSTHETIZING MACHINES

Filed Oct. 25, 1928 2 Sheets-Sheet 1

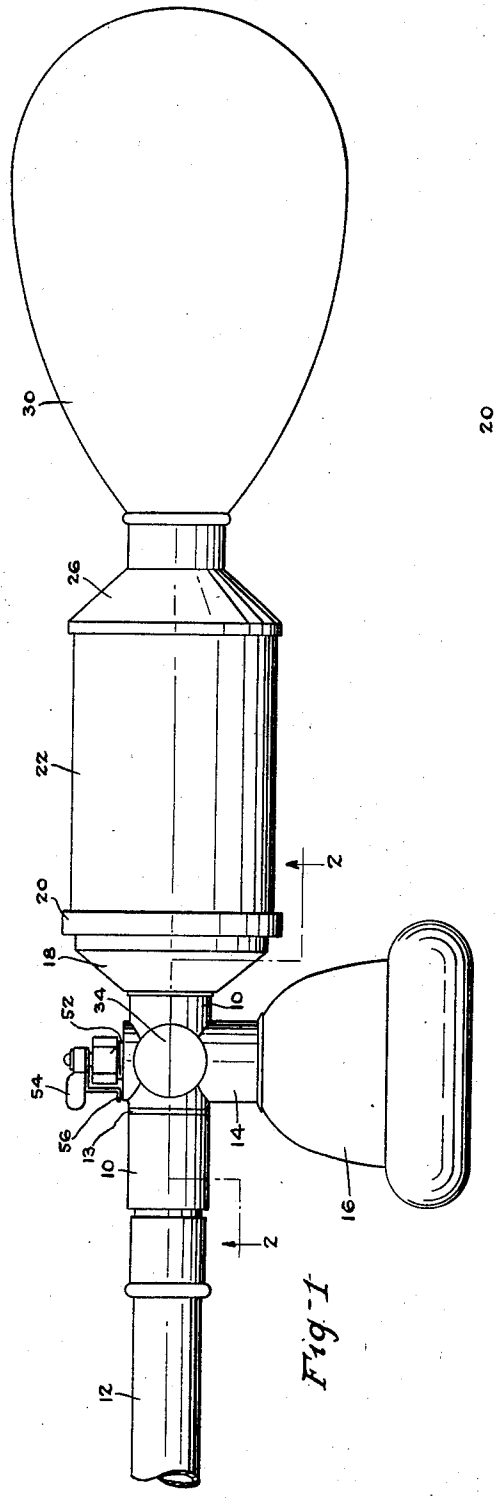


Fig. 1

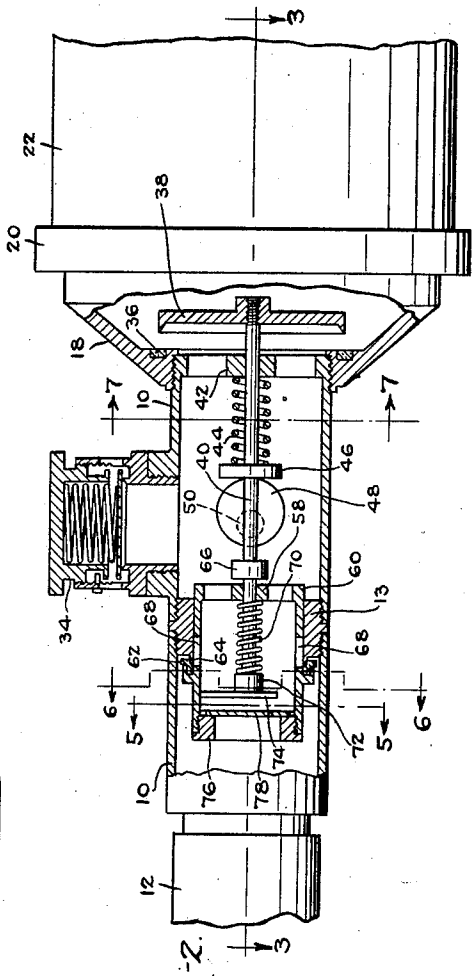


Fig. 2.

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Filed Oct. 25, 1928 2 Sheets-Sheet 2

Fig-3

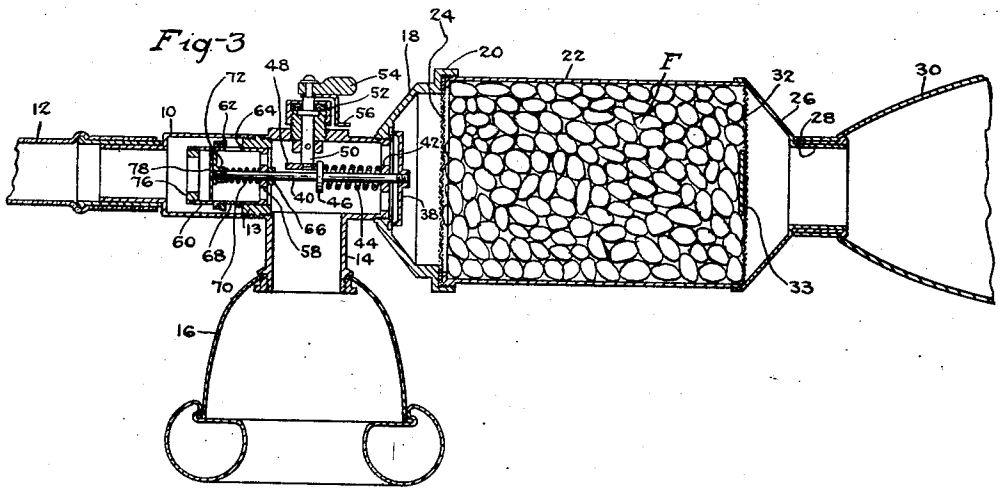


Fig-4

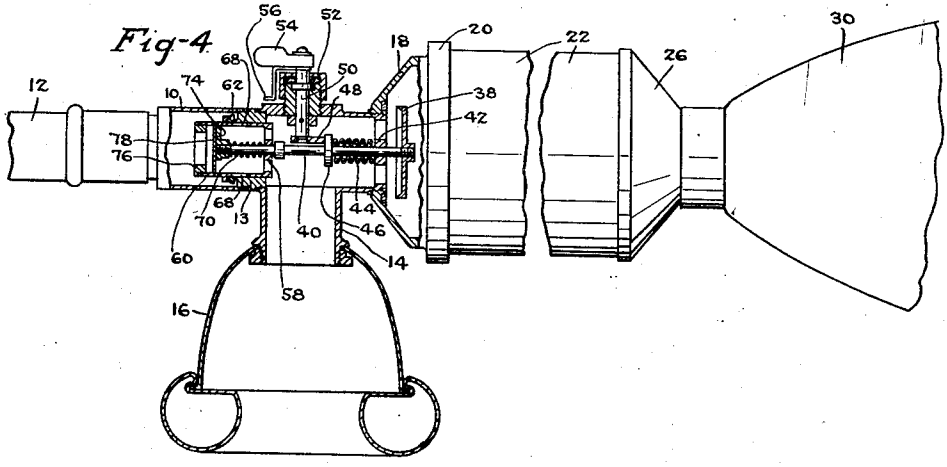


Fig-5

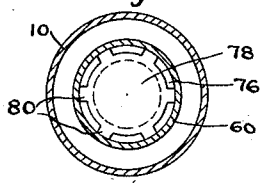


Fig-6

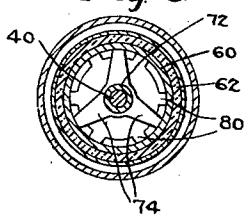
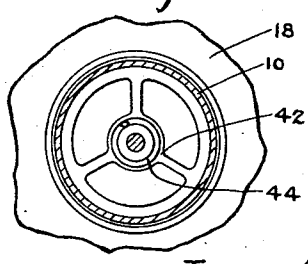


Fig-7



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UNITED STATES PATENT OFFICE

JAY A. HEIDBRINK, OF MINNEAPOLIS, MINNESOTA

FILTERING ATTACHMENT FOR ANÆSTHETIZING MACHINES

Application filed October 25, 1928. Serial No. 314,999.

My invention relates to filtering attachments for anæsthetizing machines for the purpose of filtering from the gas exhaled by the patient, impurities such as carbon dioxid thrown off with the exhaled gas as waste products of body metabolism. The gas thus purified may be breathed over again by the patient and repeatedly purified and again breathed in. Since anæsthetic gases are expensive, economy in the use thereof is desirable. In the manner above stated, two or three gallons of gas such as nitrous oxid which is unchanged by its excursion through the body, may be used to produce anæsthesia for an hour or more. It is common practice among anæsthetists, even with a filter not in use, to supply the patient with less volume of gas than is sufficient to supply breathing so that there will be some rebreathing of exhaled gas containing carbon dioxid, the object being to stimulate respiration with the carbon dioxid thus retained, it being well known that carbon dioxid is a respiratory stimulant. In filtering devices now commonly used, all the exhaled gas must pass through the filter and substantially all of the carbon dioxid is removed so that there is practically no rebreathing of carbon dioxid. An object of my invention is to provide a device that will function in connection with rebreathing for removing a predetermined amount of carbon dioxid from the gas exhaled by the patient before the gas is again inhaled. It is well known as above stated that in administering gaseous anæsthetics, it is usually desirable to supply some carbon dioxid to the patient in order to stimulate respiration. Since carbon dioxid is expelled from the lungs of the patient, rebreathing as commonly employed provides a means for furnishing the patient with carbon dioxid. It is found however that under different conditions, and for different patients, it is extremely desirable to be able to readily vary the amount of carbon dioxid which is supplied and sometimes it may even be advisable to remove the carbon dioxid as fast as it is expelled from the lungs before the gas is rebreathed. I have, therefore, devise the attachment herein disclosed embodying a filter for the carbon dioxid which may be quickly set for removing amounts of carbon dioxid from the exhaled gas varying from zero up to substantially complete removal. Many anæsthetists introduce carbon dioxid in definite amounts run from separate tanks to the reservoir or breathing bag of the anæsthetizer hereinafter called the anæsthetizer bag for stimulating the patient's respiration. Therefore another object of my invention is to be able to admit carbon dioxid to said anæsthetizer bag and have this carbon dioxid pass from this bag to the patient without coming into contact with the purifying material which would absorb the carbon dioxid. Another object of my invention is to provide means for quickly changing from purifying gas as above described to supplying the patient with a continuous volume of fresh gas from the anæsthetizer and vice versa.

The full objects and advantages of my invention will appear in connection with the detailed description thereof, and the novel features of my inventive idea will be particularly pointed out in the claims.

In the accompanying drawings which illustrate a practical embodiment of my invention, Fig. 1 is a top plan view of the attachment. Fig. 2 is a sectional elevational view on an enlarged scale taken on the line 2—2 of Fig. 1. Fig. 3 is a view in section on the line 3—3 of Fig. 2 on the same scale as Fig. 1. Fig. 4 is a view corresponding in a general way to Fig. 3 but showing some of the parts operated into a different position. Fig. 5 is a view in cross-section on the line 5—5 of Fig. 2. Fig. 6 is a view in cross section on the line 6—6 of Fig. 2. Fig. 7 is a view in cross section on the line 7—7 of Fig. 2.

My device includes a casing 10, one end of which is connected by a tube 12 with any suitable form of anæsthetizing machine adapted to mixed gases for anæsthetizing purposes. As shown, the casing 10 is made in two parts held together on the inside by a threaded ring 13. The casing 10 has a tubular extension 14 to which an inhaler 16 is attached. A conical member 18 is secured to the end of the casing 10 opposite the end to which the tube 12 is attached. The outer

end of the conical member 18 carries an internally threaded annular flange 20 to which one end of a cylinder 22 is secured, this end holding a screen 24 in place as shown in Fig. 3. Secured to the outer end of the cylinder 22 there is a conical member 26 terminating in a cylindrical portion 28 to which an auxiliary rebreathing bag 30 is attached, this bag being hereinafter referred to as the filter bag. A screen 32 is held in place at the outer end of the cylinder 22, this screen having a disklike deflector 33 secured to its central portion. The space between the two screens is filled with filtering material which will absorb carbon dioxid, the impurity in exhaled anæsthetic gases. A material suitable for this purpose consists of what is commonly known as soda-lime, which is in medium sized crystals. This material is indicated by letter F in Fig. 3. The side of the casing 10 is provided with an adjustable exhaling valve 34 of well known construction. The conical member 18 is provided with an internal groove for receiving a ring or gasket 36 which constitutes a seat for a plunger valve 38 secured to the forward end of a rod 40 which extends slidably through a spiderlike support 42 carried by the casing 10. A coiled spring 44 interposed between the support 42 and an enlargement 46 on the rod 40 tends to hold the valve 38 in closed position as shown in Fig. 3. The enlargement 46 is engaged by a cam 48 secured to the inner end of a shaft 50 rotatably held in a packing gland 52 secured to the casing 10. An operating handle 54 is secured to the outer end of the shaft 50 which also carries a pointer 56 for the purpose of indicating the extent of opening and closing of the valve 38. The rear portion of the rod 40 extends slidably through a spiderlike support 58 carried by the forward end of a sleeve 60 slidably supported in the ring 13. As best shown in Fig. 2, the outside of the sleeve 60 carries a ring valve 62 adapted to cooperate with a valve seat 64 formed on the rear of the ring 13. An enlargement 66 secured to the rod 40 engages the member 58 carried by the sleeve 60 when the valve 38 is in closed position as shown in Fig. 3 and this engagement moves the sleeve rearwardly so that the ring valve 62 is moved off its seat. It should be noted that there is a space between the ring valve 62 and the inside of the casing and that the sleeve contains perforations 68 ahead of the ring 62 so that when the parts are in the position of Fig. 3, the filter is closed off and free passage is allowed in both directions between the inhaler and the anæsthetizing machine. The gas exhaled by the patient cannot now pass through the filtering material F to the filter bag 30. In this manner, the anæsthetizer functions in all respects as though the filter was not attached. It is during this use that the exhaling valve 34 functions to permit the escape of exhaled gases. Also when any fresh gases are being supplied from the anæsthetizer while the filter is functioning, the exhaling valve 34 is set so as to cause this valve to remain closed until the filter bag becomes filled or distended to the desired extent. A coiled spring 70 surrounds the rod 40, being interposed between the member 58 and an enlargement 72 secured to the rear end of the rod. When the cam 48 is moved from the position of Fig. 3, into the position of Fig. 4, the valve 38 is opened and the sleeve 60 is moved forwardly so as to close the valve which is constituted by the ring 62. The spring 70 holds the sleeve 60 forwardly resiliently at this time so that the valve 62 is closed even in case it should become worn. The enlargement 72 on the rear end of the rod 40 carries radially extending fingers 74 while the rear end of the sleeve 60 carries an inwardly projecting ring 76. A flapper valve 78 is placed in the sleeve 60 between the ring 76 and the fingers 74. This valve is in the form of a disk having a number of spaces located between radial projections 80 whose ends have free sliding engagement with the inside of the sleeve 60. When the patient inhales with the cam 48 in the position shown in Figs. 2 and 4, gas passes to the inhaler from the bag 30 and may also pass to the inhaler from the anæsthetizer since the valve 78 is sucked into the position shown in Fig. 4 so that gas can pass through the spaces located between the projections 80. However, when the patient exhales, the valve 78 is forced back against the ring 76 as shown in Fig. 2 so that all of the exhaled gas passes through the filtering material F to the bag 30, it being noted that the spaces between the projections 80 do not extend inwardly as far as the inner margin of the ring 76 so that the valve is closed when moved into this position.

The operation and advantages of my invention will be readily understood in connection with the foregoing description. When the device is set in the position shown in Fig. 3 with the valve 38 closed, there is no filtering of the exhaled gas and the anæsthetizer functions as though its tubing were connected directly to an inhaler having the usual exhaling valve. When the device is set in the position shown in Figs. 2 and 4, the patient inhales from the bag 30 gas which has passed twice through the filtering material F and he can also inhale some gas directly from the anæsthetizer past the flapper valve 78 but none past the valve 62. The flapper valve 78 is of light construction and opens readily at the beginning of the inhalation to admit gas from the anæsthetizing bag since this valve opens with less resistance than the resistance offered by the filtering material to the passage of gas therethrough. When the anæsthetizer bag is exhausted, the remainder

of the inhalation is taken from the filter bag 30. In this manner, any fresh gas such as carbon dioxid coming from the anæsthetizer reaches the patient without passing through the filtering material which absorbs carbon dioxid. Since it requires some time to collect carbon dioxid from the patient's breathing, it is considered by some anæsthetists that it is preferable to supply carbon dioxid from a tank more quickly and in more definite amounts than can be done by relying upon rebreathing. When the patient exhales with the device in the position shown in Figs. 2 and 4, the exhaled gas passes out through the filtering material to the bag 30, the flapper valve 78 closing as shown in Fig. 2 and preventing any of the exhaled gas from passing back to the anæsthetizing machine, the valve 62 remaining closed. It will be understood that the device provides for removing amounts of carbon dioxid from the exhaled gas varying from zero up to substantially complete removal, since when the valve 38 is being opened, the valve ring 68 is being correspondingly closed and vice versa. The proportion of the exhaled gas which is subjected to the action of the filtering material is indicated by the position of the pointer 56. My filtering attachment may be used with any suitable anæsthetizing machine such as shown for instance in reissue Patent No. 15,874 to Jay A. Heidbrink dated July 22, 1924.

I claim:

1. A filtering attachment for anæsthetizing machines comprising a casing, an inhaler connected to said casing only, a filter at one end connected to said casing, a filter bag connected to the other end of said filter only, a valve controlling only the passage between said casing and said filter, a connection for connecting said casing with the anæsthetizing machine, a valve controlling the passage between said connection and said casing, and means for operating said valves to open one of them in the ratio by which the other is closed and vice versa.

2. A filtering attachment for anæsthetizing machines comprising a casing, an inhaler connected to said casing only, a filter connected at one end to said casing, a filter bag connected to the other end of said filter only, a valve controlling only the passage between said casing and said filter, a connection for connecting said casing with the anæsthetizing machine, a valve controlling the passage between said connection and said casing, means for operating said valves to open one of them in the ratio by which the other is closed and vice versa, and a valve for said machine connection operating independently of said second valve adapted to be opened by suction produced by inhalation and closed by pressure produced by exhalation.

3. A filtering attachment for anæsthetizing machines comprising a casing, an inhaler connected to said casing only, a filter connected at one end to said casing, a filter bag connected to the other end of said filter only, a plunger valve controlling the passage between said casing and said filter, a connection for connecting said casing with the anæsthetizing machine, a sliding sleeve interiorly spaced within said casing, a ring valve secured around said sleeve, said sleeve having perforations in advance of said ring valve, a rod to which said plunger valve and said sleeve are attached, a cam for controlling the position of said rod whereby one of said valves is opened in the ratio by which the other is closed and vice versa, and a valve for said machine connection operating independently of said ring valve adapted to be opened by suction produced by inhalation and closed by pressure produced by exhalation.

4. A filtering attachment for anæsthetizing machines comprising a casing, an inhaler connected to said casing only, a filter connected at one end to said casing, a filter bag connected to the other end of said filter only, a plunger valve controlling the passage between said casing and said filter, a connection for connecting said casing with the anæsthetizing machine, a sliding sleeve interiorly spaced within said casing, a ring valve secured around said sleeve, said sleeve having perforations in advance of said ring valve, a rod to which said plunger valve and said sleeve are attached, a cam for controlling the position of said rod whereby one of said valves is opened in the ratio by which the other is closed and vice versa, and a flapper valve in said sleeve adapted to be opened by suction produced by inhalation and closed by pressure produced by exhalation.

In testimony whereof I hereunto affix my signature.

JAY A. HEIDBRINK.