Dec. 31, 1929. J. A. HEIDBRINK 1,741,233

FILTERING ATTACHMENT FOR ANÆSTHETIZING MACHINES

Filed Aug. 17, 1927 4 Sheets-Sheet 1

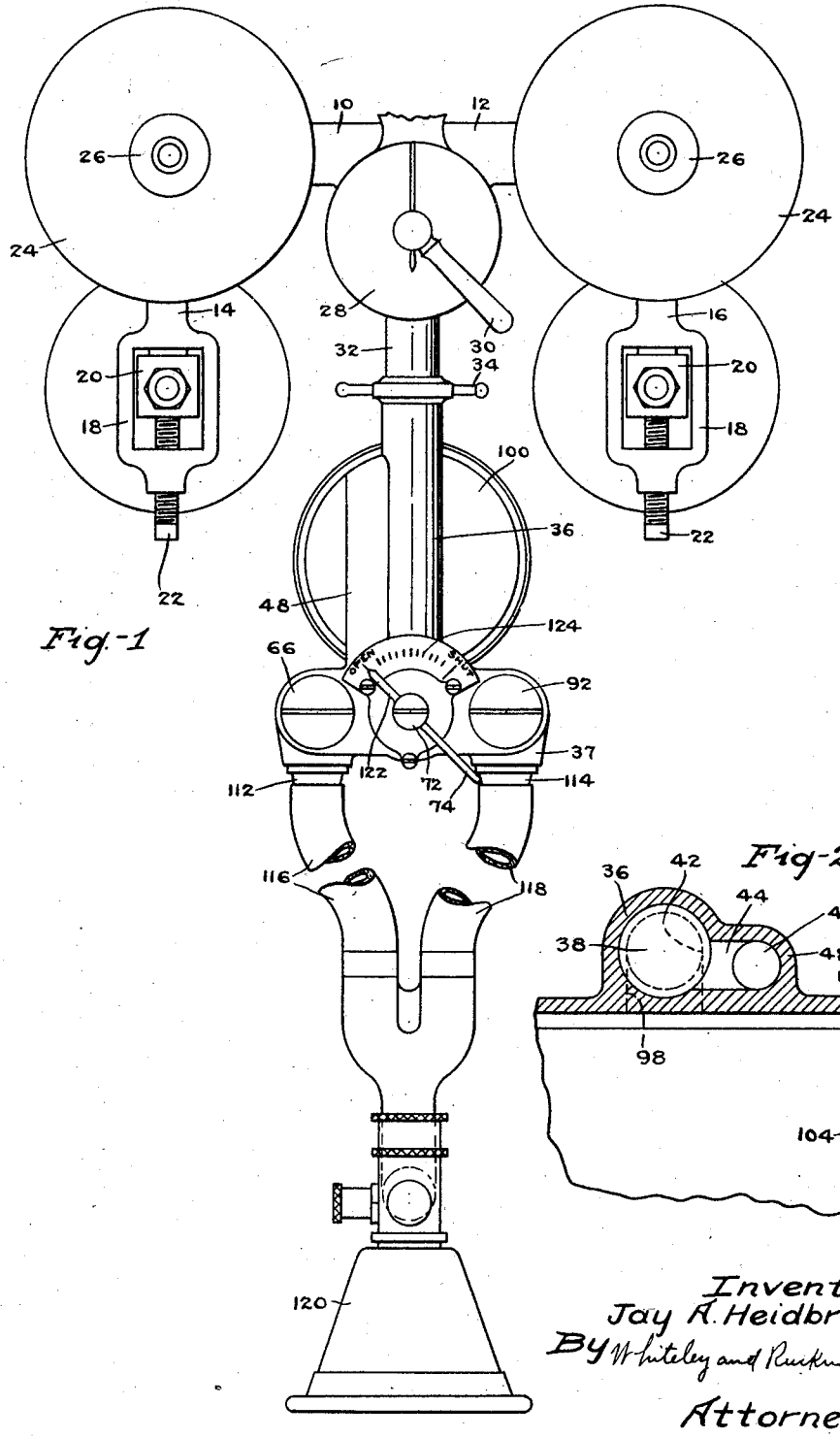

Fig. 1

Fig. 2.

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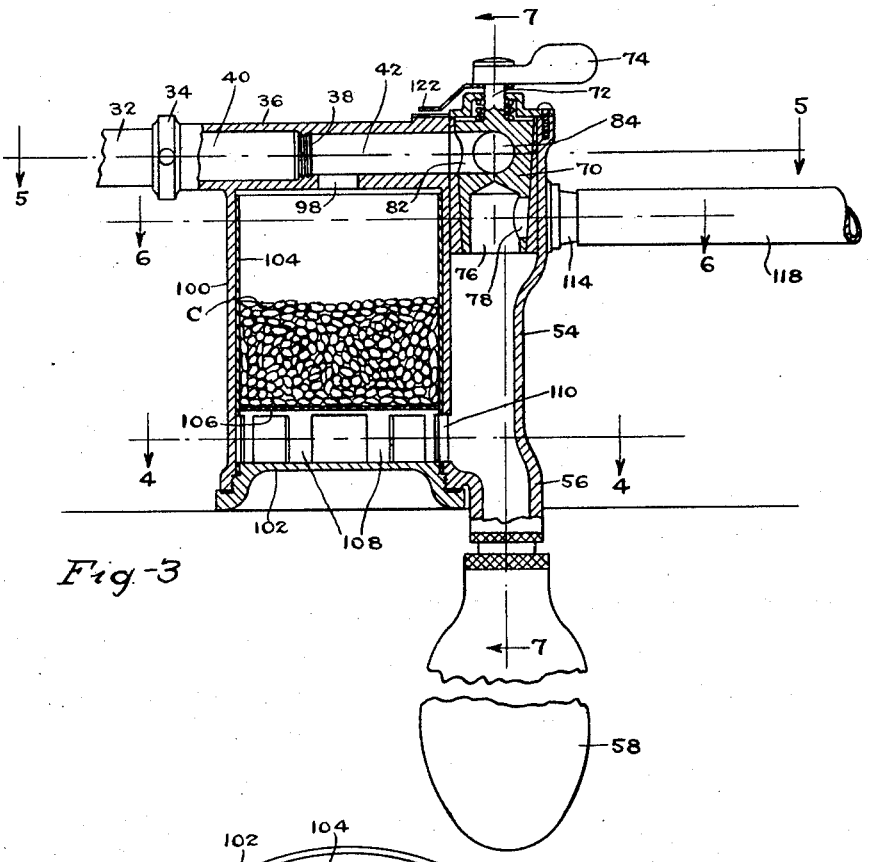

Fig-3

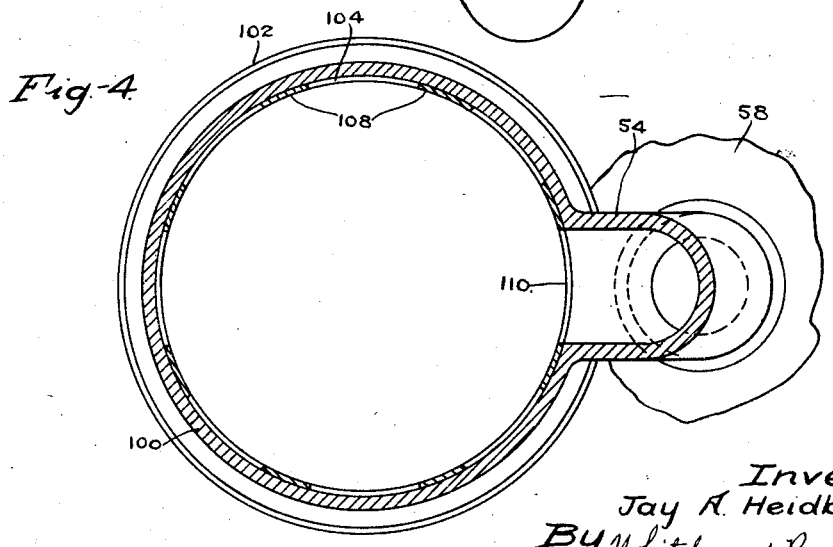

Fig-4

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Fig.-5

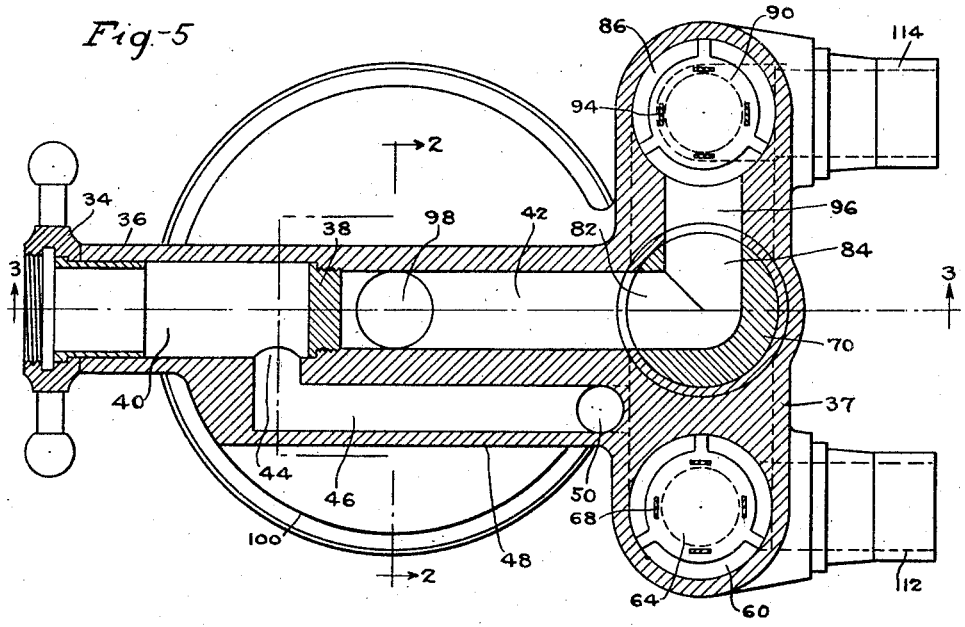
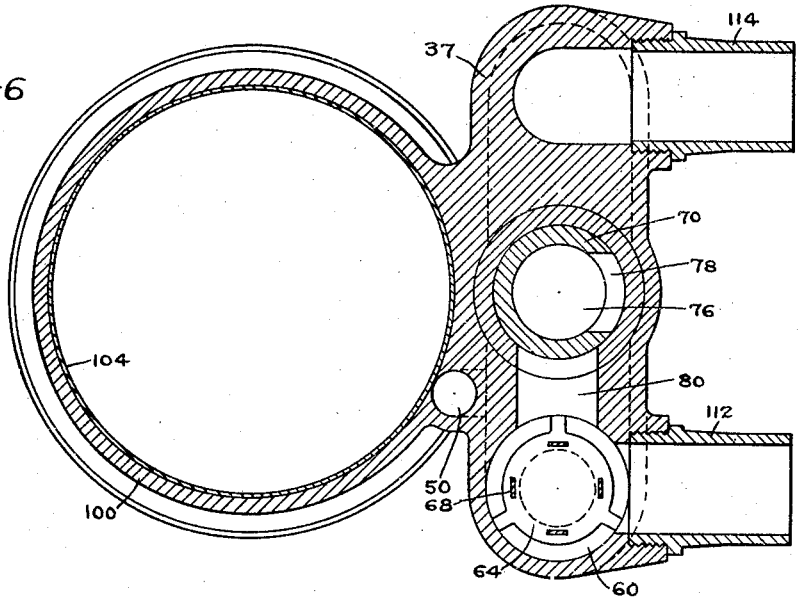


Fig.-6



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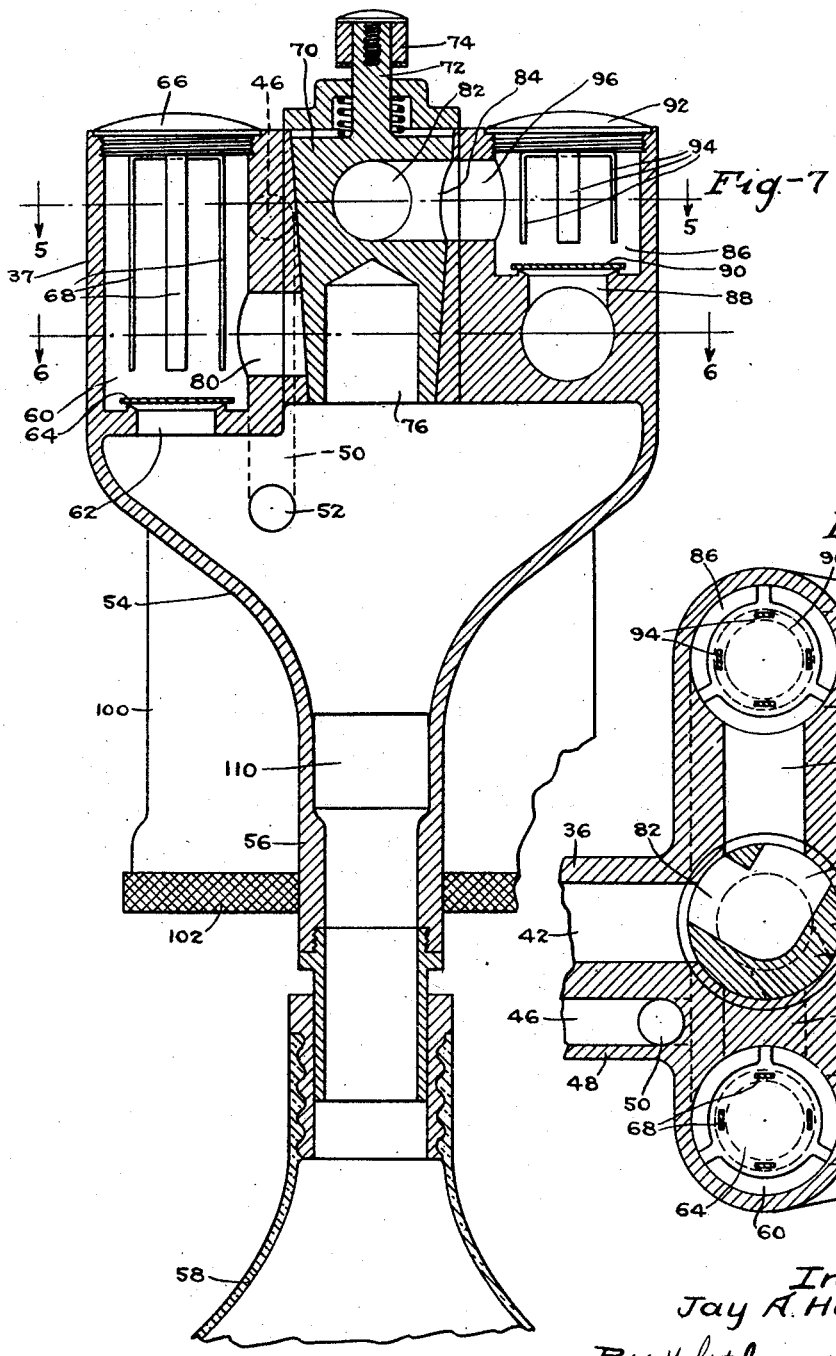

Fig.-7

Fig.-8

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UNITED STATES PATENT OFFICE

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FILTERING ATTACHMENT FOR ANÆSTHETIZING MACHINES

Application filed August 17, 1927. Serial No. 213,529.

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 used, all the exhaled gas must pass through the filter and all carbon dioxid is removed so that there is 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 gas 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. I have 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, devised 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 rebreathing bag for stimulating the patient's respiration. Therefore, another object of my invention is to be able to admit to the rebreathing bag, carbon dioxid and have it pass to the patient before it comes 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 the 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 claim.

In the accompanying drawings which illustrate one form in which my invention may be embodied,—

Fig. 1 is a top plan view of the device attached to an anæsthetizing machine. Fig. 2 is a fragmentary view in section on the line 2—2 of Fig. 5. Fig. 3 is a view in section on the line 3—3 of Fig. 5. Fig. 4 is a view in section on the line 4—4 of Fig. 3. Fig. 5 is a view in section on the line 5—5 of Figs. 3 and 7. Fig. 6 is a view in section on the line 6—6 of Figs. 3 and 7. Fig. 7 is a view in section on the line 7—7 of Fig. 3. Fig. 8 is a view similar to Fig. 5 but showing the rotatable valve turned into a different position.

Referring to the drawings, and first, more particularly, to Fig. 1, my device is shown connected to a well-known form of anæsthetizing machine in which there are a pair of arms 10 and 12 supported in suitable manner and which carry cross arms 14 and 16, respectively. The ends of these cross arms are provided with yokes 18 within which the heads 20 of gas containers are secured by screws 22. In the particular form shown, the gas containers on one side are intended for holding oxygen and the ones on the other

side for holding an anæsthetizing gas such as nitrous oxid. The cross arms 14 and 16 contain passageways with which the gas containers are adapted to be placed in connection in the usual way. These passageways are provided with pressure control devices 24 of well-known construction which are provided with regulating screws 26. The gases mixed in regulated quantities pass to a valve casing 28 containing a rotatable valve operating by a handle 30 in the usual manner. Extending forwardly from the valve casing is a hollow projection 32 to which my attachment is applied, the end of this projection being threaded to receive a coupling device 34 rotatably held upon one end of a tubular member 36 of a casting designated in general by the numeral 37. The direct passage through the tubular member 36 is blocked by by a screw plug 38 so as to form two separated passageways 40 and 42. The passageway 40 communicates through a lateral port 44 with a passageway 46 formed in a member 48 projecting out from the side of the member 36. The passageway 46 at its front discharges into a vertical passageway 50 having a port 2 at its bottom, as shown in Fig. 7, which opens into the interior of a hollow member 54 converging to form a neck 56 to which a rebreathing bag 58 is secured. Above the member 54 the casting at the left-hand side is provided with a chamber 60 having an opening 62 adapted to communicate with the interior of the hollow member 54, this opening being controlled by an upwardly-opening disc valve 64 of light weight. The chamber 60 is closed at the top by a screw plug 66 which carries downwardly-extending strips 68 to prevent the disc 64 from being displaced too far from its seat. The middle portion of the casting contains a vertical downwardly-tapering hole in which a rotatable plug valve 70 is fitted. This valve has an upwardly-projecting stem 72 to which a handle 74 is secured. The lower portion of the valve 70 is hollowed to produce a compartment 76, which opens at the bottom into the hollow member 54. The compartment 76 is provided with a lateral port 78 which is adapted to register with a port 80 with which the chamber 60 is provided, as best shown in Fig. 6. The upper portion of the valve 70 is provided with an angular passageway having two portions extending at right angles to each other to form two ports 82 and 84 which are spaced above the port 78 but angularly disposed with relation thereto, as will be evident from Fig. 8. At the side of the casting opposite the chamber 60 the casting is provided with a chamber 86, as best shown in Fig. 7, having an opening 88 at its bottom controlled by an upwardly-opening disc valve 90 of light weight. The chamber 80 is closed at the top by a screw plug 92 which carries downwardly-extending strips 94 to prevent the disc 90 from being displaced too far from its seat. The port 84, as will be obvious from Figs. 5 and 8, is adapted to register with a passageway 96 communicating with the chamber 86, while the port 82 is adapted to register with the passageway 42 previously referred to. The passageway 42 has a port 98 in its lower side which opens into a cylinder 100 extending down from the upper portion of the casting. The lower end of this cylinder is provided with a screw closure 102, on removal of which access may be had to the interior of the cylinder. This cylinder contains a cup 104 having a screen-like bottom 106 below which are feet 108 which support the screen above the closure 102 so that free passage for gas may be had from the cup through a port 110 into the hollow member 54 and into the rebreathing bag 58. The cup 104 is provided for containing filtering material which will absorb carbon dioxid. 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 the letter C in Fig. 3. The chamber 60 communicates with a forwardly-extending nipple 112, while below the level of the disc valve 90 there is a forwardly-extending nipple 113 in communication with the opening 88. Tubes 116 and 118 are fitted on the nipples 112 and 114, respectively, and these tubes, at their forward ends, are united and attached to an inhaler 120, which may be of well-known construction. Secured to the valve stem 72 in line with the handle 74, there is a pointer 122 which, upon turning of the valve 70, is caused to register with graduations 124 on a dial, as shown in Fig. 1. In this figure, when the pointer registers with the left-hand graduation, the passage from the inhaler to the filtering material is entirely open while direct passage from the inhaler to the rebreathing bag is entirely closed. When the pointer is in registration with the right-hand graduation, the passage from the inhaler to the filtering material is entirely shut, while direct passage from the inhaler to the rebreathing bag is entirely open. In the latter case the machine functions as though the filter is not present. The dial may be accurately graduated by setting the valve 70 so that the gas is divided into two equal parts and then marking the position of the pointer on the dial as half way graduation. The other graduations may be similarly determined in accurate manner.

The operation and advantages of my invention will now be readily understood. Assuming that the pointer is in the midway position, the valve 70 occupies the position shown in Fig. 8. When the patient now exhales, half of the exhaled gas has a tendency to pass from the inhaler through the tube 118 and nipple 114, then through the opening 88 past

the valve 90 and through the ports 84 and 82 into the passageway 42 and down through the port 98 to the filtering material C, which removes the carbon dioxid. The gas thus treated continues on into the rebreathing bag. The other half of the exhaled gas has a tendency to pass through the tube 116 and nipple 112, then through the ports 80 and 78 to the chamber 76 in the lower portion of the valve 70 and down into the rebreathing bag, where it mingles with the portion from which the carbon dioxid has just been removed. When the patient inhales, this valve 90 closes and prevents gas being drawn back through the filtering material and through the tube 118. The disc valve 64, however, will open so as to permit free flow of the mixed gas from the rebreathing bag through the tube 116 to the inhaler. If the rotary valve 70 be turned so as to bring the pointer into the open position shown in Fig. 1, then this valve will occupy the position shown in Figs. 5 and 6, so that there is a free open passage for the exhaled gas through the ports 84 and 82, as will appear from Fig. 5. As will be apparent from Fig. 6, the port 78 at this time is entirely out of register with the port 80, so that none of the exhaled gas can pass back directly to the bag. In this position, therefore, all of the exhaled gas which is forced into backward position is subjected to the action of the filtering medium before reaching the bag. When the patient now inhales, the gas from the bag will go past the disc valve 64 and through the tube 116 to the inhaler. Assuming now that the rotary valve 70 is turned so as to bring the pointer into the shut position indicated at the right in Fig. 1, it will be apparent from an inspection of Fig. 8 that port 82 is entirely shut off from communication with the passageway 42. The port 78 will, however, be brought into complete registration with the port 80, so that when the patient exhales there is a tendency to force all of the exhaled gas directly back into the rebreathing bag. With this setting of the valve there is no filtering of the exhaled gas. It is obvious that by placing the pointer on the proper graduation marks various proportionate amounts of the exhaled gas will be filtered, such as one-quarter and three-quarters.

I claim:

A filtering attachment for anæsthetizing machines comprising an inhaler, a valve casing, two tubes connecting said casing directly with said inhaler, a hollow member extending downwardly from said valve casing, a rebreathing bag secured to the lower end of said hollow member, a receptacle secured at the rear of said hollow member containing covering material for absorbing carbon dioxid, the bottom of said receptacle having an opening into said hollow member, a rotatable valve in said casing, said valve having a passageway cooperating with one of said tubes for passing variable proportions of the exhaled gas to said filtering material before reaching said bag and said valve having a second passageway cooperating with the other of said tubes for passing the rest of the exhaled gas directly to said bag, and a tubular member extending rearwardly from said valve casing for connection with sources of gas supply, said tubular member having two compartments, one of which provides a passageway directly from the source of supply into said downwardly extending member and the other of which provides a passageway from said valve to the top of said filtering receptacle.

In testimony whereof I hereunto affix my signature.

JAY A. HEIDBRINK.