Aug. 21, 1934. G. CORNETTO 1,971,131

APPARATUS FOR PURIFYING AND REGENERATING AIR

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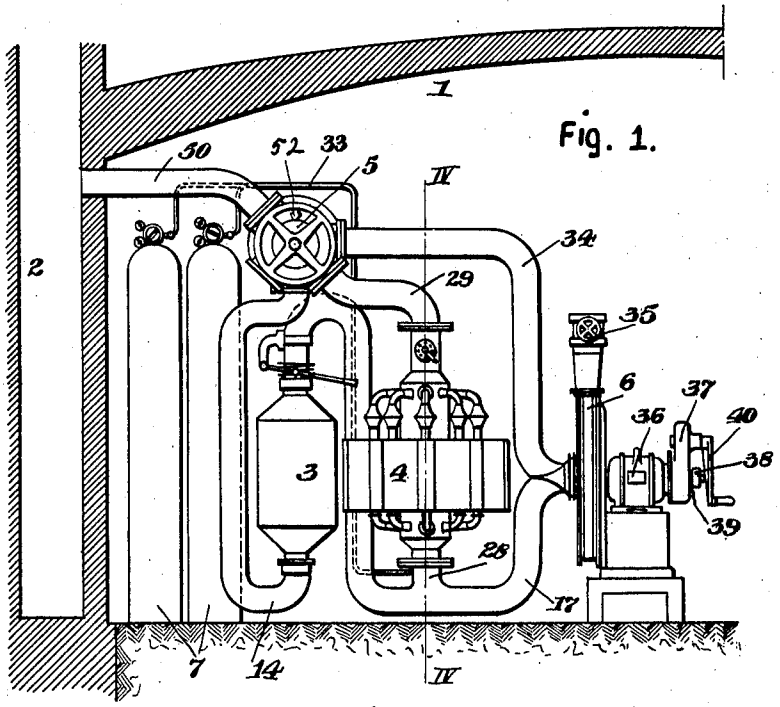
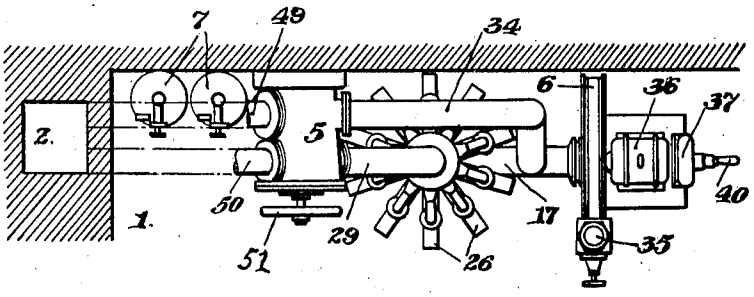


Fig. 1.

Fig. 2.



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Fig. 3

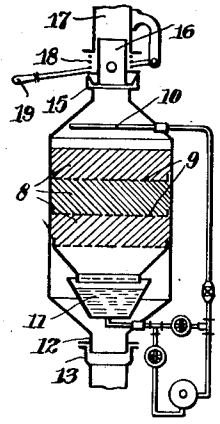


Fig. 6.

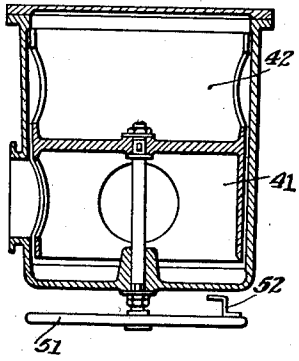
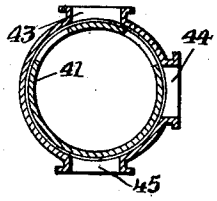


Fig. 7a.



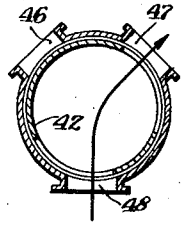
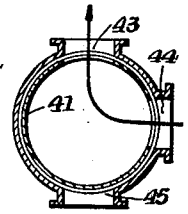


Fig. 7b

Fig. 8a.



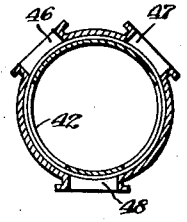


Fig. 8b

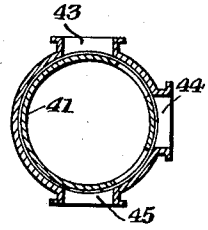


Fig. 9a.

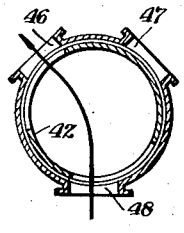


Fig. 9b.

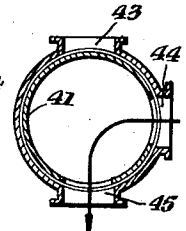


Fig. 10a.

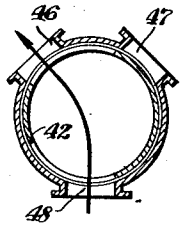


Fig. 10b.

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Fig. 4

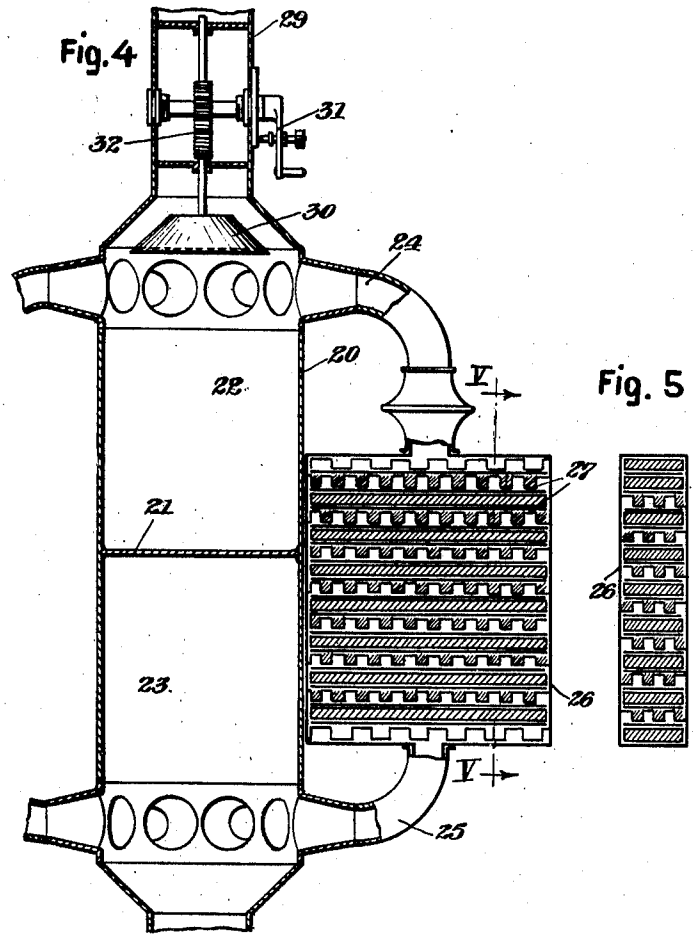


Fig. 5

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Patented Aug. 21, 1934 1,971,131

UNITED STATES PATENT OFFICE

1,971,131

APPARATUS FOR PURIFYING AND REGENERATING AIR

Giuseppe Cornetto, Turin, Italy

Application January 6, 1933, Serial No. 650,574
In Italy January 13, 1932

6 Claims. (Cl. 183—9)

This invention has for its object a system of collective defense against poisonous gases, more particularly in case of war gas-attacks on civilian population or troops, to be used instead of individual masks.

According to this invention a forced aeration appliance is arranged in a confined space adapted to receive the population during gas-attacks, such as shelters, undergrounds, rooms, buildings and the like, said appliance being adapted to counteract the poisonous gases and create in said space a pressure slightly exceeding the atmospheric pressure for the purpose of preventing penetration of the vitiated air through the unavoidable air-ways (gaps, holes, etc.). The aerating appliance according to this invention comprises a purifying filter provided with means for submitting the air to a preliminary cleaning and adapted to free the outer air from particles of dust and poisonous gases before its flowing into the shelter or the like; a regenerator to render the air contained in the confined space suitable for breathing, said air being caused to flow in closed circuit, fresh air being from time to time taken from the outside and passed through the filter to make up for the unavoidable leaks, and a multiple valve of special construction serving to insert at will the filter or the regenerator into the circuit.

The air circulation is ensured by means of a fan generally operated by a motor. For the purpose of preventing any stoppage in the work of the apparatus owing to damages or interruption of the line in case of an electric motor, particularly during war actions, the fan according to this invention is provided with means for hand operation through a handle and multiplying gear, which may be connected to the driving shaft when required.

The annexed drawings show by way of example a constructional form of the arrangement according to this invention.

Fig. 1 is a general elevation view of the apparatus fitted in an underground chamber.

Fig. 2 is a plan view thereof.

Fig. 3 shows the filter in axial vertical section.

Fig. 4 is an axial vertical section of the regenerator on line IV—IV of Fig. 1.

Fig. 5 is a section on line V—V of Fig. 4.

Figure 6 shows the multiple control valve.

Figs. 7*a* to 10*b* are diagrammatic sections of the multiple valve in various working positions.

Referring to the drawings, 1 is an underground confined space adapted for instance to shelter the tenants of the building during a gas-attack. Said space is provided with openings with closure means (windows, doors) sufficiently air-tight to ensure a certain excess of pressure therein.

Said confined space communicates with the outside through the chimney 2 and the circulation apparatus constituted by a filter 3, a regenerator 4, a multiple valve 5, a fan 6 and oxygen tanks 7.

The filter consists of a set of superposed filter masses 8 (Fig. 3) supported by perforated partitions 9 secured to the filter casing. A jet of cleaning liquid is sprayed on the upper layer and passes through the filtering masses and is collected in a container 11, from which it is returned to the sprayer 10 by means of a pump or injector. Water may be used as cleaning liquid for removing the particles of dust and dissolve the gaseous impurities soluble in water or suitable solvents adapted to remove particular poisonous gases from the air thus ensuring a thorough purifying of the air.

The filter is so fitted on the line that water circulates in it in counter-current relation to the liquid and is formed in such a way as to be easily and quickly removed for replacement or cleaning. For the said purpose the filter is provided at its lower part with a nipple 12 which may be connected airtight to a sleeve joint 13 of a pipe 14 thus placing this latter in communication with a multiple valve 5 and at its upper part with a sleeve joint fitting airtight in a collar of a tube 16 telescopically mounted in the suction conduit 17 of a fan 6. A spring 18 serves to maintain the collar of the pipe 16 in engagement with a sleeve joint 15, a handle 19 serves to raise the pipe 16 and disengage the filter, which can be quickly removed.

The regenerator 4 comprises a tubular body 20 divided by a partition 21 into two superposed compartments 22 and 23. Both ends of said tubular body carry circular sets of bent nipples, an upper set 24 and a lower set 25. Between said two nipples receptacles 26 are inserted, which contain the substance adapted to regenerate the vitiated air.

Said receptacles are made of tin sheet and contain superposed undulated wire nets 27, the reacting substance being filled in every other groove. The grooves of one layer are arranged perpendicularly to the grooves of the adjacent layer, so that the air passing through the receptacles is finely subdivided and uniformly distributed on the whole area of each receptacle thus making a close contact with the reacting substance.

The lower end of the body 20 is connected to the suction pipe 17 through a branch 28, while

the upper end is connected to the multiple valve 5 through a conduit 29, in which a control conical valve 30 is fitted; said valve may be operated from the outside by means of a handle 31 and a rack 32. A nozzle (not shown for the sake of simplicity) is fitted in the lower end of the generator and is connected by means of a tube 33 with an oxygen bottle 7; it is thus possible to mix the quantity of oxygen required for breathing with the air purified but lacking oxygen.

The fan 6 is directly connected with the multiple valve 5 by means of a branch 34 of the suction conduit and carries a flow control 35 at the end of its outlet opening.

Said fan is operated by means of an electric motor 36, the shaft of which can be connected with the driven shaft of a multiplying gear 37 through a clutch 38 operable by means of a lever 39. The driven shaft of said gear carries a handle 40, through which the fan may be manually operated in the case of electric current interruption.

The multiple valve 5 is provided with two rotating valves 41 and 42 in a single piece controlling the apertures 43, 44, 45 and 46, 47, 48 respectively. The aperture 43 communicates with the regenerator 4 through a conduit 9; the aperture 44 communicates with the space it is desired to aerate; the aperture 45 communicates through a conduit 49 with the chimney 2; the aperture 46 communicates with the suction conduit of the fan 6 through a branch 34; the aperture 47 communicates with the filter 3 through the conduit 14 and finally the aperture 48 communicates with the chimney 2 through a conduit 50.

The rotation of the double rotating valve is effected by hand through a control hand wheel 51 carrying a pointer 52 showing the different positions of the valves. These latter may assume four different positions, diagrammatically shown in Figs. 7*a* to 10*b*, each of said figures showing the transversal section of the two rotating valves displaced one with regard to the other in the plane of the drawing.

When the rotating valves 41 and 42 are in the position shown in Figs. 7*a* and 7*b* the apertures 47 and 48 communicate through the rotating valve 42, the rotating valve 41 being closed. In this case the air is forced in through the filter 3 and discharged from the confined space through the usual means (vents, gaps, etc.) owing to the slight excess of pressure produced in the space by the fan.

By rotating the hand wheel 51 through an angle of 45° (Figs. 8*a* and 8*b*) the valve 42 assumes its closed position, while the valve 41 places the aperture 44 in communication with the aperture 43.

In this way the suction side of the regenerator 4 is placed in communication with the space and an aeration in closed circuit takes place, that is, the air in the room is caused to circulate from the generator 4 to the confined place and from this latter through the apertures 44 and 43 again to the generator, where it separates the carbonic acid and other impurities and becomes enriched with oxygen. The confined space is perfectly isolated from the outside.

By rotating the hand wheel 51 through a further angle of 45° (Figs. 9*a* and 9*b*) the valve 41 assumes its closed position while the valve 42 places the apertures 46 and 48 into communication with each other. In this position the fan 6 is in direct communication with the chimney 2 through the conduits 34 and 50 and supplies therefore natural air into the confined space thus obtaining a simple renewal effect, the excess of air being discharged from the confined space through the vents, gaps, etc.

A further rotation of the hand wheel 5 carries the rotating valves into the position shown in (Figs. 10*a* and 10*b*, in which the valve 41 places the apertures 44 and 45 in communication and the valves 42 places the apertures 46 and 48 in communication with each other. In this way aeration is still effected with natural air taken from the chimney 2, however the outlet instead of through the usual means (vents, gaps, etc.) is effected through the valve 41 and pipe 49 to the chimney 2.

The four cases examined and shown are those generally occurring in the practice; it is clear however that the multiple valve 5 could be provided with other apertures and conduits to cause moistened air, oxygen and other air purifying gas to circulate.

What I claim is:

1. An apparatus for continuously purifying air for collective defence against poisonous gas, comprising in combination with a confined space, a fan, a filter for purifying the inflowing air, a regenerator for the air in the confined space, a multiple valve, conduits for connecting the filter, regenerator and multiple valve with the suction side of said fan, conduits for connecting said filter and said regenerator with said multiple valve, apertures in said multiple valve in communication with the confined space and the outside, said multiple valve being so formed that the filter, regenerator, confined space and outside may be at will placed in circuit with the fan, and a controllable outlet conduit connected with the pressure side of said fan.

2. In an apparatus for purifying air for collective defence against poisonous gas, as claimed in claim 1, in which said multiple valve comprises a cylindrical casing having a set of apertures the axis of which lies in a plane perpendicular to the axis of the cylindrical casing and a further set of apertures the axis of which lies in a plane parallel to the former, a double rotating valve fitted in said casing, so that one of said valves controls a set of apertures and the other the other set of apertures simultaneously.

3. An apparatus for purifying air for collective defence against poisonous gas, comprising in combination with a confined space, an air regenerator constituted by a cylindrical body, a transversal partition in said body forming two separate compartments, circular sets of bent nipples at the ends of said body, a circular set of receptacles containing a substance regenerating the vitiated air fitted between said bent nipples, a fan for causing the air in the confined space to circulate continuously through said regenerator.

4. An apparatus for purifying air for collective defence against poisonous gas, comprising in combination with a confined space, a fan, a filter constituted by a casing, transverse perforated partitions in said casing, filtering masses on said partitions, a sprayer on the upper layer of said filtering masses and means to convey a dissolving liquid in a continuous manner to said sprayer for purifying the air in counter-current through said casing, an air regenerator constituted by a cylindrical body, a transverse partition in said body forming two separate compartments, circular sets of bent nipples at both ends of said body, a circular set of receptacles containing a substance regenerating the vitiated air fitted be-

tween said bent nipples, a multiple valve, conduits for connecting in parallel the filter, regenerator and multiple valve to the suction side of said fan, conduits for connecting said filter and said regenerator to said multiple valve, apertures in said valve communicating with the confined space and outer air, said multiple valve being so formed that the filter, regenerator, confined space and outside may be at will placed in circuit with the fan, and an outlet conduit connected with the fan pressure side.

5. An apparatus for purifying air for collective defence against poisonous gas, comprising, in combination with a confined space, a fan, a motor connected to the fan, a hand operated mechanism, a clutch for connecting at will said mechanism to the shaft of said motor, a filter for purifying the inflowing air, a regenerator for the air in the confined space, a multiple valve, conduits for connecting the filter regenerator and multiple valve with the suction side of said fan, conduits for connecting said filter and regenerator with the multiple valve, apertures in said valve communicating with the confined space and outer air, said multiple valve being so formed that the filter, regenerator, confined space and outside may be at will placed in circuit with the fan, and a controllable outlet conduit connected with the pressure side of the fan.

6. In an apparatus for purifying air for the collective defence against poisonous gases, as claimed in claim 1, in which said filter comprises a case, sleeve joints easily disconnectable for attaching said case air tight to said suction conduit, perforated partitions in said case, filtering masses on said partitions, a sprayer on the upper layer of said filtering masses, and means to continuously convey a dissolving liquid to said sprayer for purifying the air in counter current to said air.

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