Nov. 13, 1923. 1,474,205

R. P. MASE

GAS MASK

Filed Oct. 11, 1921 3 Sheets-Sheet 1

FIG.1.

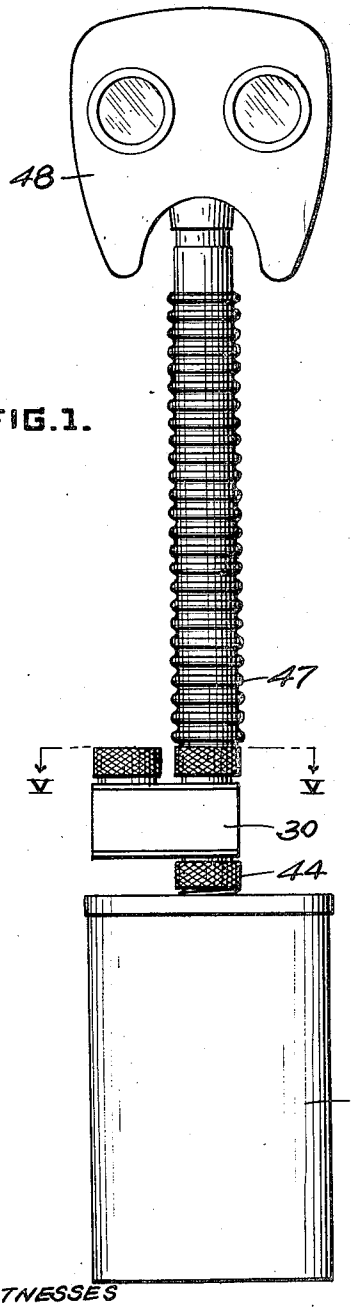


FIG.6.

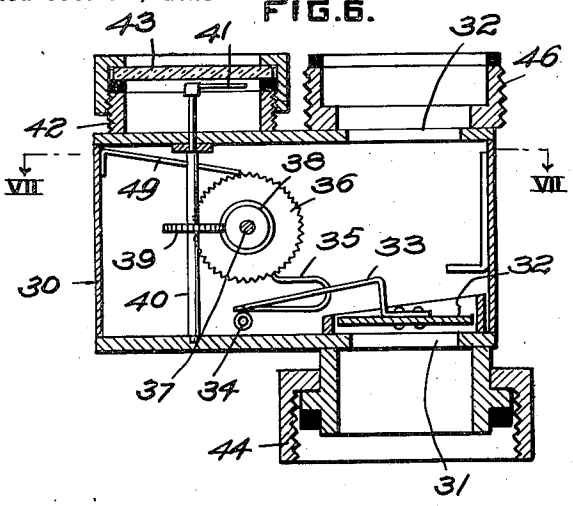


FIG.5.

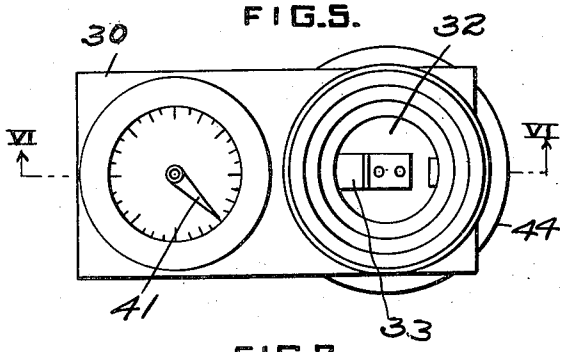
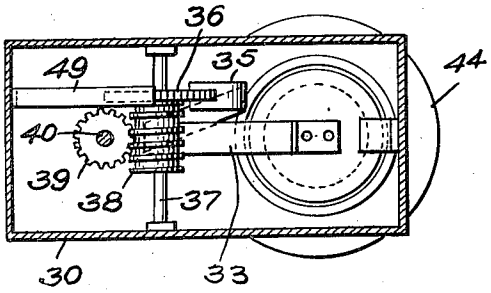


FIG.7.



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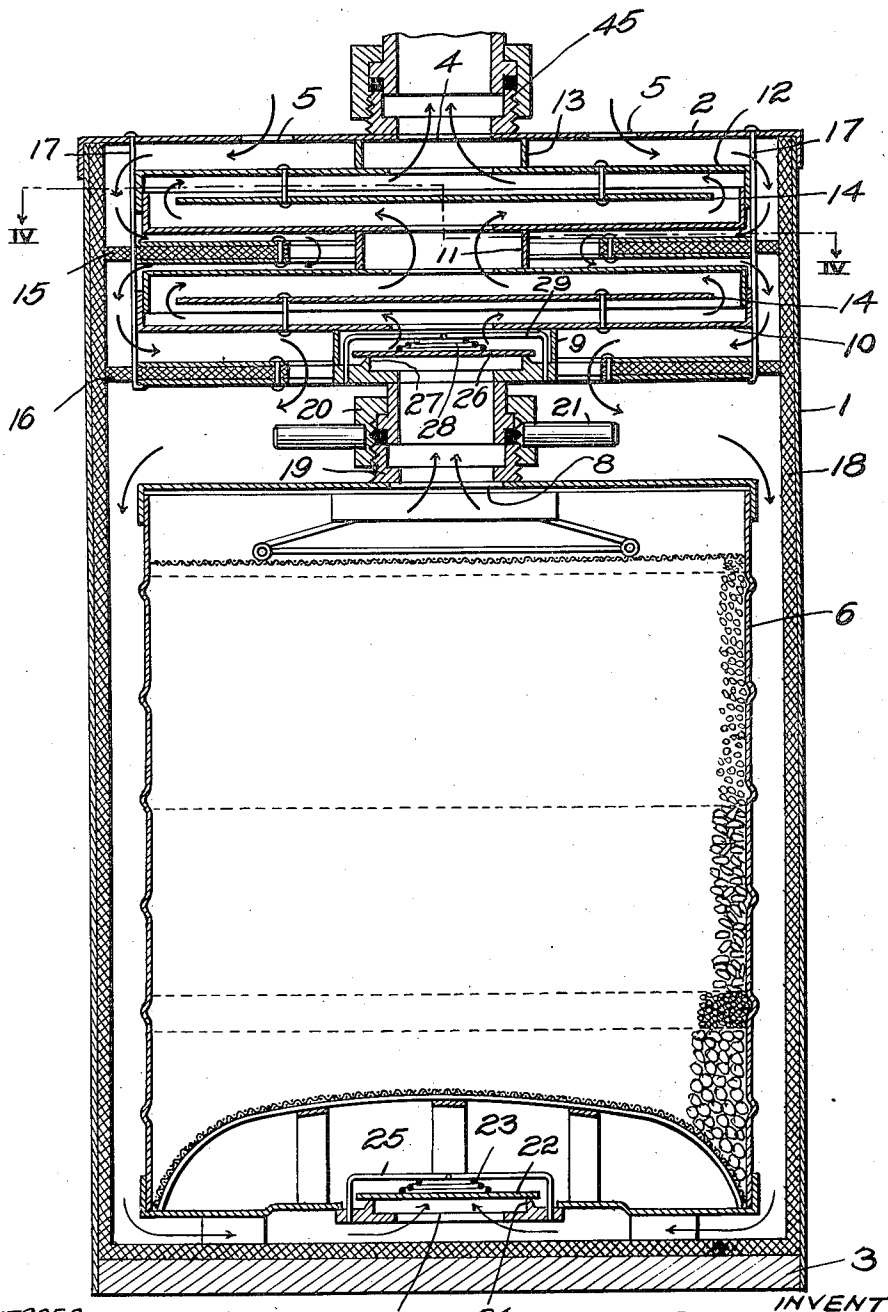
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FIG. 2.



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GAS MASK

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FIG.3.

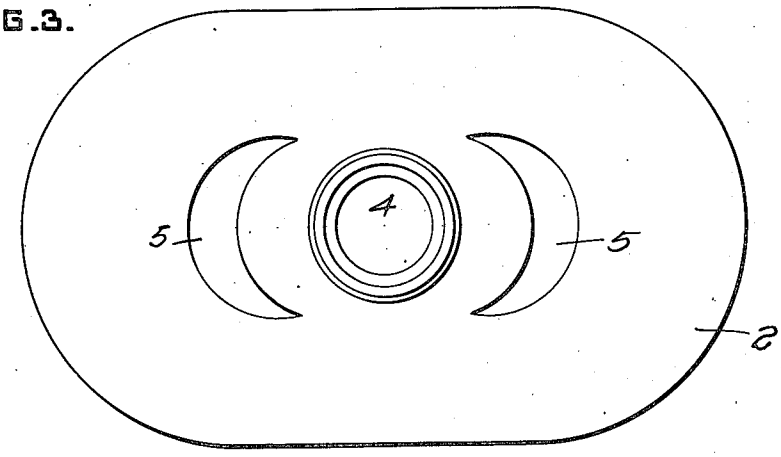


FIG.4.

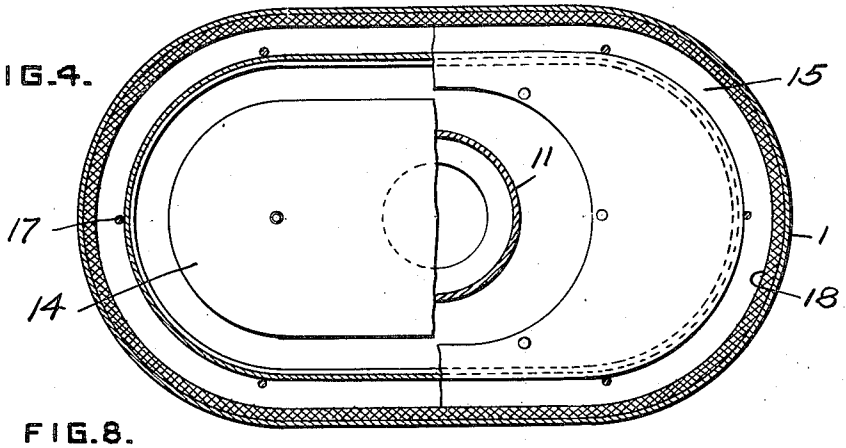


FIG.8.

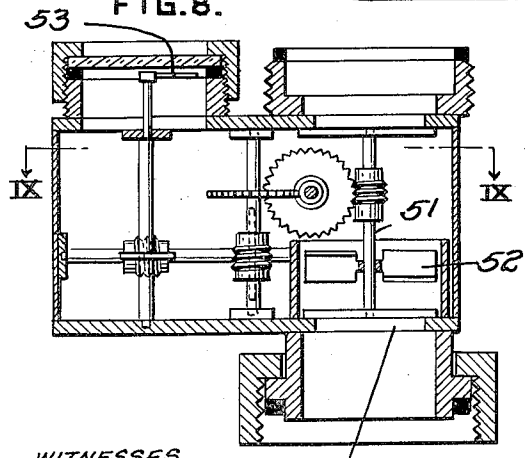
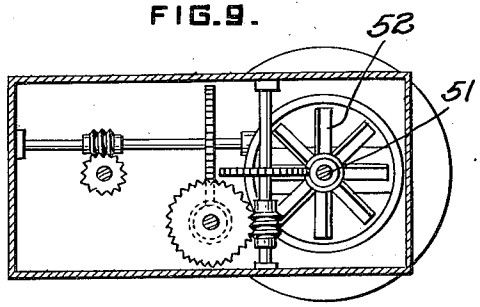


FIG.9.



WITNESSES

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Patented Nov. 13, 1923. 1,474,205

UNITED STATES PATENT OFFICE.

ROSCOE P. MASE, OF WILKINSBURG, PENNSYLVANIA, ASSIGNOR TO MINE SAFETY APPLIANCE COMPANY, OF PITTSBURGH, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

GAS MASK.

Application filed October 11, 1921. Serial No. 507,083.

To all whom it may concern:

Be it known that I, ROSCOE P. MASE, a citizen of the United States, and a resident of Wilkinsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Gas Masks, of which the following is a specification.

The invention relates to gas masks, and the object thereof is to improve their construction and consequent operation. Further and more specific objects of the invention are to provide a gas mask in which an exchange of heat is effected between the incoming contaminated air and the outgoing purified air; a mask in which the purifying materials are protected against the action of air when the mask is not in use, and a mask in which the extent of use of the purifying material is indicated so that new or fresh purifying material may be substituted when required.

The invention is illustrated in the accompanying sheets of drawings of which Fig. 1 is an outside view of a gas mask; Fig. 2 a vertical sectional view to enlarged scale through the air-purifying portion of the mask; Fig. 3 a plan view of the portion shown in Fig. 2; Fig. 4 a transverse sectional view taken on the broken line IV—IV Fig. 2; Fig. 5 a plan view to enlarged scale of a use-indicating device, the plane of view being indicated by the line V—V Fig. 1; Fig. 6 a sectional view taken on the line VI—VI Fig. 5; Fig. 7 a sectional view taken on the line VII—VII Fig. 6; Fig. 8 a view corresponding to Fig. 6 illustrating a modification of construction; and Fig. 9 a sectional view taken on the line IX—IX Fig. 8.

One feature of the invention has to do with the provision of a gas mask in which there is an exchange of heat between the incoming and outgoing air to the end that the air-purifying material or materials may be maintained at a substantially elevated temperature at which they function more effectively, and also that the outgoing purified air to be breathed may have its temperature reduced after having passed through and become heated by the purifying material. To such end the air-purifying portion of the mask comprises an outer casing having an air inlet and an air outlet, and an air-purifying canister within the casing provided also with an air inlet and an air outlet communicating, respectively, with the casing inlet and outlet. Between the outlets of the canister and casing there is arranged a heat-exchanging apparatus whereby the outgoing air is caused to flow adjacent to the interior surface of an extended wall forming a conduit connecting-member between the two outlets, and whereby the incoming air is caused to flow adjacent to the exterior faces of such wall.

In the illustrative embodiment of this feature of the invention, shown particularly in Figs. 2, 3 and 4, the outer casing is shown as having a side wall 1, a removable top 2 and a bottom 3. The air inlet and outlet are preferably both located in the top 2, there being indicated an air outlet 4 at the central portion of the top and two air inlets 5 arranged one on each side of the outlet. Within the casing there is a canister 6 adapted to be charged with various materials for purifying air, the particular material used depending upon the specific use to which it is desired to put the mask. The canister is provided preferably at its bottom with an air inlet 7 and at its top with an air outlet 8, the body of air-purifying material being arranged between the inlet and outlet in such manner that the air passes through it.

The heat exchanger includes alternately arranged narrow and wide chambers, the walls of which form a conduit between the canister and casing outlets. A narrow portion 9 adjacent to the canister outlet joins a widened portion 10 above which there is a narrow portion 11. As many wide and narrow portions may be provided as are desirable, the heat exchanger shown herein including a second wide portion 12 and an adjoining narrow portion 13 adjacent to the outlet 4. Within the wide portions 10 and 12 there are arranged baffle plates 14 for causing air to take a circuitous path between the canister and casing outlets so that the air may flow adjacent to the inner surface of the extended heat-exchanger walls. To cause the incoming air to flow adjacent to the exterior faces of the extended walls, the heat-exchanger is provided with baffles 15 and 16 which form with the exterior of the heat-exchanger and the interior of the cas-

ing a circuitous passageway adjacent to the walls of the heat-exchanger. The line of flow of the purified air from the canister outlet 8 to the casing outlet 4 is indicated by the arrows inside the heat-exchanging portions 9, 10, 11, 12 and 13, and likewise, the path of the incoming air is indicated by arrows on the outside of said portions and between them and the baffles 15 and 16. After the incoming air passes through the heat-exchanger it flows downwardly through the casing 1 between its inner surface and the exterior of the canister to the canister inlet 7, the canister being spaced from the casing wall to afford such passage-way for the air.

The heat-exchanging apparatus is preferably connected to the casing top or cover 2 by means of rods 17. To prevent incoming air from flowing between the side wall 1 of the casing and the outer edges of the baffles 15 and 16, these baffles are preferably constructed of pliable pads of felt, fabric or the like, the outer edges of which press against an interior felt lining 18 of the casing. A union coupling may be provided for attaching the canister to the heat-exchanger, the former being provided with an exteriorly threaded sleeve 19 adjacent to the outlet 8, and the latter with a union coupling nut 20 having radially disposed gripping members 21. In assembling the air-purifying portion of the mask, a canister 6 is attached to the heat-exchanger while the top 2 of the casing is removed. Thereafter, the canister, heat-exchanger and top of the casing are, as a unitary structure, inserted in the casing 1. The apparatus may then be connected to a conduit leading to a face piece.

The materials with which canisters are charged for the purpose of removing various gases from air to be breathed deteriorate by the passage of air through them. To prevent air from flowing into the canister in any position while the apparatus is not in use, both the inlet and outlet of the apparatus are provided with delicately operating check valves which are normally held closed by springs. The check valve for the inlet may be arranged adjacent to the canister inlet 7 and may comprise a suitable plate 22 urged by means of a spring 23 against a valve seat 24 surrounding the inlet 7, spring 23 being backed by means of a gage 25. The check valve for preventing flow of air into the canister through the outlet of the apparatus may be arranged at the inlet of the heat-exchanger. This check valve may be similar to that at the inlet of the canister and may comprise a plate 26 held against a valve seat 27 by means of a light spring 28 acting between the plate and a cage 29. These check valves form but slight resistance to breathing when the apparatus is in use, and prevent air from entering the canister through either the inlet or outlet in all positions of the apparatus when it is not in use.

When gas masks are used for a considerable period of time, the air-purifying materials become less active and finally become incapable of purifying the air. In masks for some purposes (for example, carbon monoxide masks) it is impossible for the user to discern when the air-purifying material is not adequately purifying the air. In such masks the period of usefulness of a canister may be reckoned in terms of the amount of air passing through the purifying material, and this may be approximated by the number of breaths that a user takes through the material. One feature of the present invention has to do with the provision of means for visually indicating the extent of use to which the mask has been put so that when it has been used to the safety limit, the user may substitute a fresh canister for the one that has been in use. In the illustrative embodiment of this feature of the invention two forms of indicators are shown, in one of which the number of breaths which a user takes through the purifying material is indicated, and in the other of which the indication of the use is more nearly in proportion to the volume of air breathed through the material.

The first-mentioned form of indicating apparatus is illustrated in Figs. 5, 6 and 7 and comprises a casing 30 provided with an air inlet 31 and an air outlet 32. In a position adapted to normally close the inlet 31 there is a light weight plate 32 attached to a strip 33 which is bent around spindle 34. The free end of strip 33 is bent into the form of a pawl 35 adapted to engage successively the teeth of a ratchet wheel 36 keyed to a spindle 37. This spindle is provided with a worm shaft 38 which meshes with a worm wheel 39 keyed to a spindle 40, one end of which is provided with an indicator finger 41. The upper portion of the casing is provided with a suitable housing 42 in which there is clamped a transparent plate 43 on which a scale may be cut or through which a scale may be read. Casing 30 is provided with a union coupling nut 44 adapted to engage a sleeve 45 formed on the top 2 of the casing, and it is also provided with a threaded sleeve 46 adapted to be connected to a conduit 47 leading to a face piece 48.

In the use of this type of indicator, each inhalation causes plate 32 to rise above the inlet 31 with the result that pawl 35 advances ratchet wheel 36. This ratchet is held against reverse movement by means of a suitable delicate spring 49 attached to the casing and engaging the ratchet teeth in the manner illustrated. The movements of the ratchet wheel are geared down so that the indicator finger 41 is turned very slowly.

By observing the position of the indicator, the user of the mask may determine when a new canister should be substituted for the one in use.

The second form of apparatus for indicating the extent of use to which the breathing apparatus has been put is illustrated in Figs. 8 and 9, and differs from that just explained in that the indicating hand is actuated more nearly in proportion to the volume of air flowing through the apparatus. Adjacent to the inlet 50, and parallel to the line of flow of the air through it, there is a rotatable spindle 51 provided with propeller vanes 52 arranged to cause the spindle to rotate when air flows through the inlet. By a suitable arrangement of reducing gears clearly illustrated in the drawings the rotation of spindle 51 causes an indicator finger 53 to advance in a manner similar to that explained with reference to the apparatus of Figs. 5, 6 and 7. The indicators are essentially flow meters, serving to indicate the amount of air caused to flow through the breathing apparatus.

According to the provisions of the patent statutes, I have described the principle and operation of my invention together with an illustrative embodiment thereof. However, I desire to have it understood that, within the scope of the appended claims, my invention may be practiced by other forms of construction than that specifically shown and described.

I claim:

1. An air-purifying apparatus comprising an outer casing provided with an air inlet open to the atmosphere and an air outlet, an air-purifying canister within the casing provided with an air inlet and an air outlet communicating respectively with said casing inlet and outlet, and means in the casing for bringing the air that enters the casing into heat-exchanging relation with the purified air that leaves the canister.

2. An air-purifying apparatus comprising an outer casing having its top provided with an air inlet open to the atmosphere and an air outlet, an air-purifying canister in the lower portion of the casing and provided with an air inlet communicating with said casing inlet and further provided with an air outlet, a baffled conduit member connecting the canister outlet with the casing outlet and having extended walls against which purified air flowing from the canister through the casing outlet is directed, and means within the casing for directing the incoming air against the outer faces of the extended walls of said conduit member.

3. An air-purifying apparatus comprising an outer casing having a top provided with an air inlet open to the atmosphere and an air outlet, an air-purifying canister arranged within and spaced from the interior of said casing and provided with an air inlet in its bottom and an air outlet in its top communicating, respectively, with said casing inlet and outlet, and means in the casing for bringing air that enters the casing into heat-exchanging relation with the purified air that leaves the canister, the incoming air after passing through said heat-exchanging means flowing through the space between the interior of the casing and the exterior of the canister to the inlet of the canister.

4. An air-purifying apparatus comprising an outer casing having its top provided with an air inlet open to the atmosphere and an air outlet, an air-purifying canister within the casing provided with an air inlet communicating with the casing inlet and provided with an air outlet, a heat-exchanger connected to said canister and casing outlets and provided interiorly with baffles for causing the purified air to flow through a circuitous path from the canister outlet to the casing outlet, said heat-exchanger being further provided exteriorly with baffles extending to the wall of the casing and forming with the walls of the casing and heat-exchanger a circuitous path through which the incoming air flows to the canister inlet.

5. In a gas mask, the combination of a face piece, an air-purifying apparatus provided with an air inlet and an air outlet, a conduit connecting said outlet with the face piece, and means arranged in the line of flow of air from said inlet to the face piece for indicating the extent of use to which the air-purifying apparatus has been put.

6. In a gas mask, the combination of a face piece, an air purifier provided with an air inlet and an air outlet, a conduit connecting said outlet with the face piece, and a flow meter having an inlet connected to the outlet of said casing and having an outlet connected to the face piece, said meter being actuated by the flow of air through it for indicating the extent of use to which the air-purifying apparatus has been put.

7. In a gas mask, the combination of a face piece, an air-purifying apparatus comprising an outer casing provided with an air inlet and an air outlet and having an air-purifying canister therein, and a flow meter having an inlet connected to the outlet of said casing and an outlet connected to said face piece, said meter being actuated by the flow of air through it for indicating the extent of use to which the air-purifying apparatus has been put.

In testimony whereof, I sign my name.

ROSCOE P. MASE.