No. 864,445. PATENTED AUG. 27, 1907.

E. N. CASEY & H. E. RATHBUN.

RESPIRATOR.

APPLICATION FILED JUNE 15, 1905.

2 SHEETS—SHEET 1.


FIG. 1.

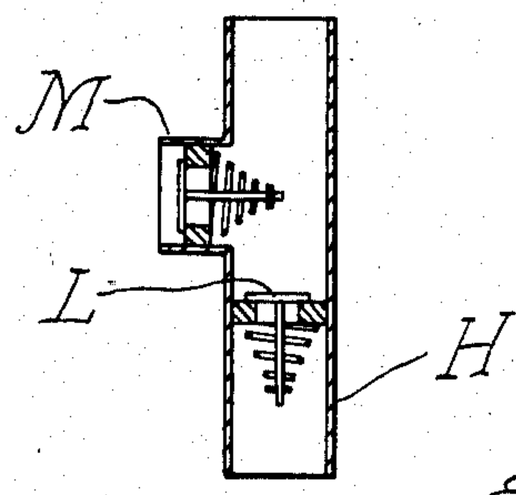


FIG. 2

WITNESSES.

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2 SHEETS—SHEET 2.

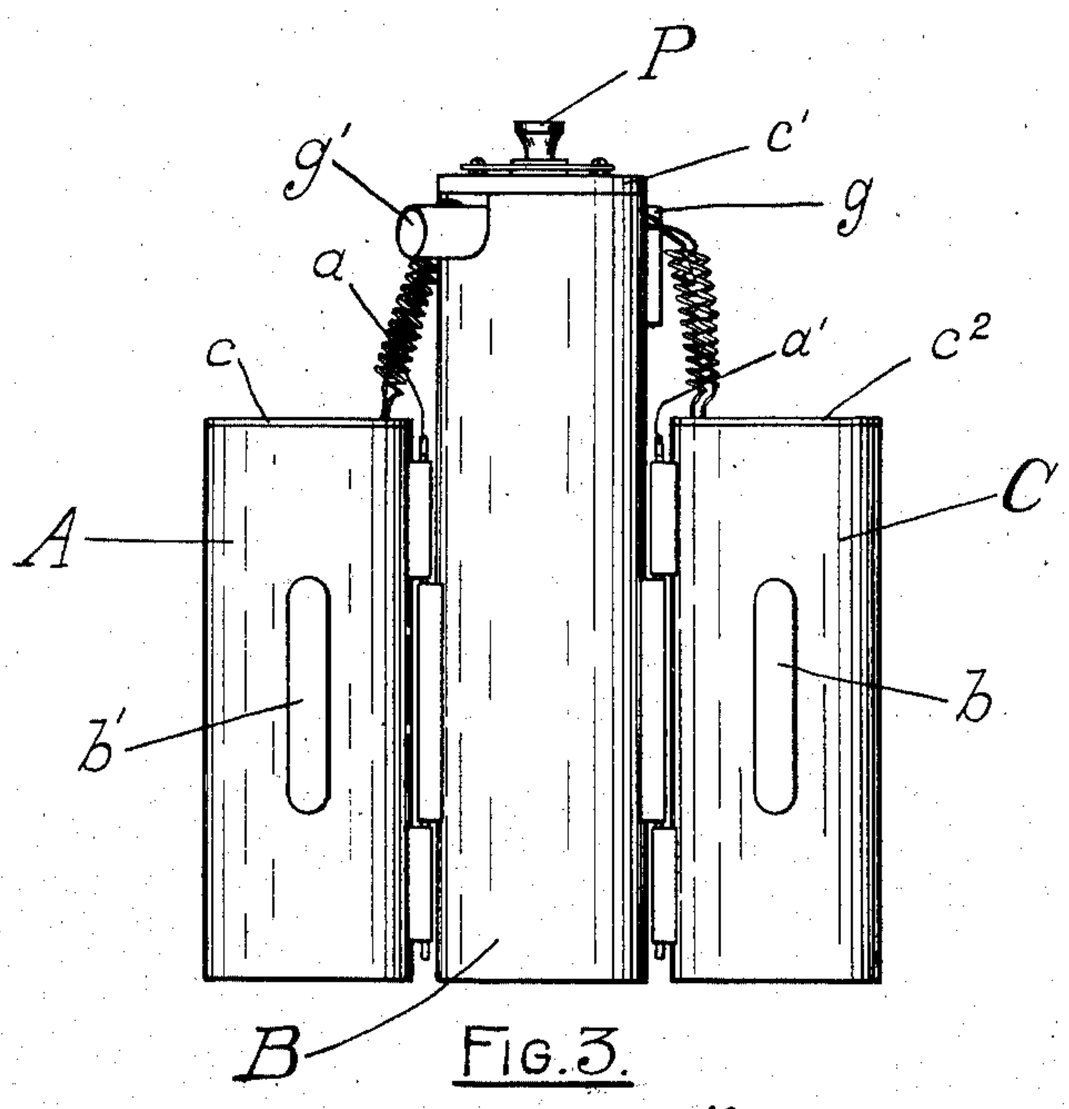


FIG. 3.

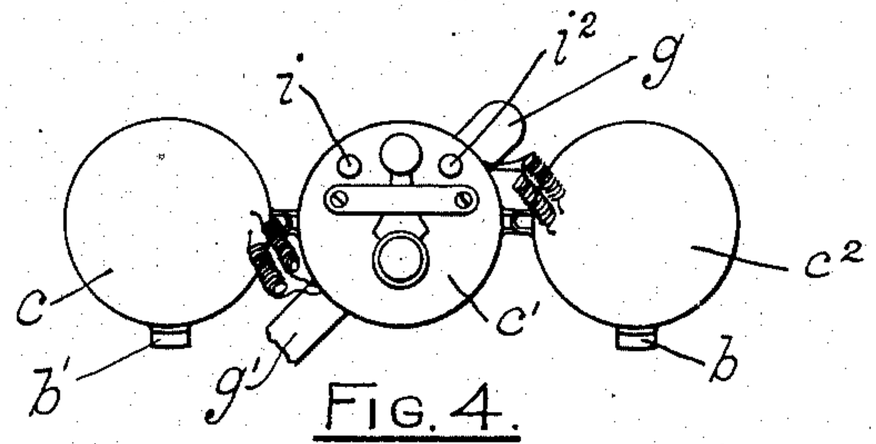


FIG. 4.

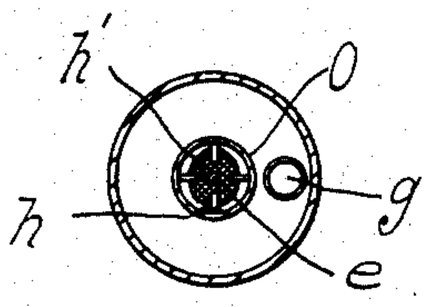


FIG. 6.

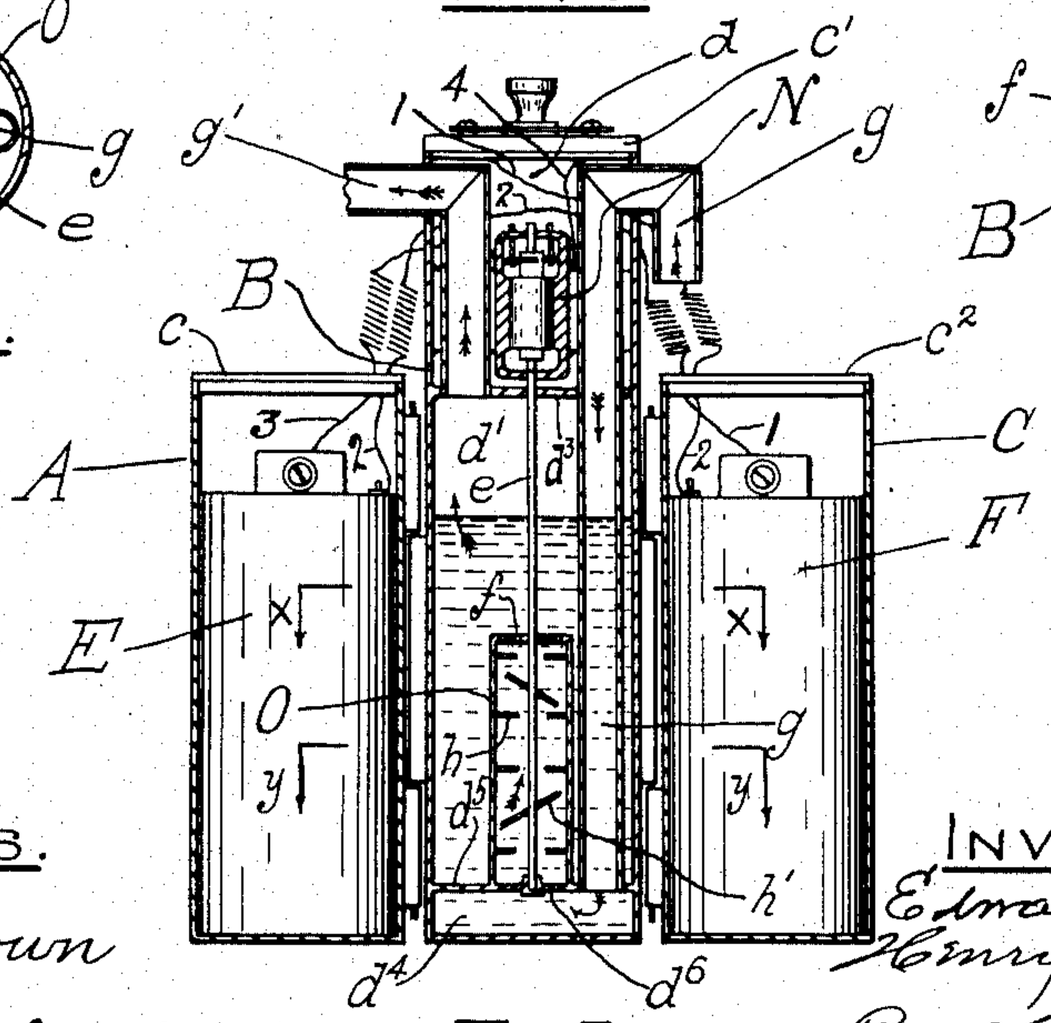


FIG. 5.

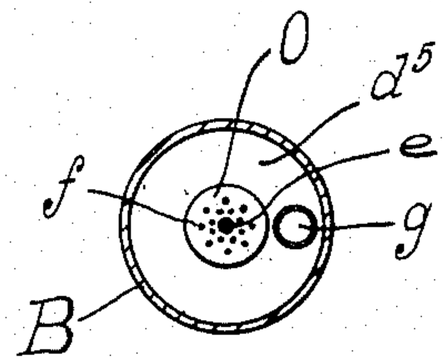


FIG. 7.

WITNESSES.

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# UNITED STATES PATENT OFFICE.

EDWARD N. CASEY AND HENRY E. RATHBUN, OF PROVIDENCE, RHODE ISLAND, ASSIGNORS, BY MESNE ASSIGNMENTS, TO AMERICAN RESPIRATOR COMPANY, OF BOSTON, MASSACHUSETTS, A CORPORATION.

## RESPIRATOR.

No. 864,445. Specification of Letters Patent. Patented Aug. 27, 1907.

Application filed June 15, 1905. Serial No. 265,403.

*To all whom it may concern:*

Be it known that we, EDWARD N. CASEY and HENRY E. RATHBUN, both citizens of the United States, residing at Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Respirators, of which the following is a specification, reference being had therein to the accompanying drawing.

Our invention relates to portable devices and apparatus adapted to protect the lungs of miners, firemen, and others who are compelled to inhale noxious vapors, gases and smoke; and relates further to an improved process for converting smoke laden atmosphere into pure or comparatively pure air.

The purposes of our invention are, besides those sought in analogous devices, the facile adjustment or removal, simplicity, durability, of the apparatus; and the increased effectiveness of the purification process.

To the above ends, our invention consists in the novel construction and arrangement of parts hereinafter described, and illustrated in the accompanying drawings, wherein,

Figure 1 is a perspective view of our apparatus adjusted to the body of a fireman. Fig. 2, a transverse section of the air valves adjacent the mask. Fig. 3, a rear elevation of the purifying and battery chambers. Fig. 4, a plan of the same. Fig. 5, a vertical central section of the purifying cylinder, showing the batteries in side elevation, and Figs. 6 and 7, transverse sections of the purifying chamber on lines *y y* and *x x* of Fig. 5 respectively.

Like reference characters indicate like parts throughout the views.

Our novel structure has three cylindrical receptacles or cases, A, B, C. The central and longer of the three cases, B, has hinged to its side by pins, *a a'*, the cases, A and C, while the latter are respectively provided with metallic guides *b b'*, to receive a belt, D, by which the described parts are secured to the back of the wearer.

In detail, the cases or cylinders, A, B and C, are preferably of brass provided respectively with frictionally engaging tops or covers, *c c'*, $c^2$, of rubber or other insulating material.

In the cylinders A and C respectively are the dry battery cells, E and F.

The case, B, comprises the upper and lower compartments or chambers, *d* and *d'*, formed by the horizontal partition, $d^3$. An additional chamber, $d^4$ is formed by a second horizontal plate, $d^5$ near the base of the cylinder B, forming a false bottom. This bottom has perforations, $d^6$ through its central portion. Traversing the partitions, $d^3$ and $d^5$ is a vertically disposed pipe, *g*, whose upper end is outwardly and downwardly directed where it passes through the side of the case, B, near its top. Depending from the free extremity of the pipe, *g*, is a flexible rubber air supply tube, G, whose open end is designed to receive the air near the floor where it is least laden with gases. The tube hangs free in order that its end may be easily elevated when the operator stands in water. A second vertical pipe, *g'*, traverses the partition, $d^3$ and leads through the side of the case, B, opposite the pipe, *g*. To the outer end of this pipe is fixed a flexible tube, H, leading to a rubber mask, I, which is fixed to the wearers' head by a strap, J, and is provided with mica filled eye openings, K. The pipe, H, is provided with a valve, L, which opens with each inhalation of the wearer; and above this is a valve, M, leading to the atmosphere, which opens and allows the escape of each exhalation.

Referring again to the casing, B, wherein the purifying process is accomplished, a motor, N, is mounted in the chamber, *d*, above the partition, $d^3$. Fixed in and rotated by the motor, N, is a vertical rod, *e*, whose lower end rests upon the center of the partition or plate, $d^5$. A cylinder, O, with a perforated top, *f*, rests upon the plate, $d^5$, and is also traversed by the rotating rod, *e*. This cylinder, O, forms an agitating chamber and to this end is provided upon its inner wall with projections or pins adapted to coact with inclined articulated arms or disks, *h'*, fixed at intervals upon the rod, *e*. The arms or disks, *h'*, may be of any desired shape, and the pins, *h*, may be of any desired arrangement, so long as the liquid be thoroughly mixed. The motor, N, is actuated by the batteries, E and F, through the following circuit wires:—Wire 1 connects the cell, F, to the binding post, or contact, *i*, in the cover or cap, *c'*; the wire, 2, connects the cell, F, with the cell E; the wire, 3, connects the cell, E, with the motor, N, and the wire, 4, leads from the motor to the second binding post or contact, $i^2$. A switch, P, mounted upon the cap, *c'*, intermediate the points, *s* and $i^2$, are adapted to complete the above described circuit. The chamber, $d^4$, cylinder O, chamber *d'* and pipe *g*, contains a suitable liquid for washing or otherwise freeing the air of its smoky properties. We prefer the use of lime water, but do not limit ourselves to any specific liquid composition for this purpose.

The operation of our invention is as follows: The smoke laden air enters the open end of the tube, G, enters the pipe, *g*, and passing through the chamber, $d^4$ enters through the perforations, $d^6$ of the plate, $d^5$ into the cylinder, O, where the air bubbles containing the smoke are broken by the interaction of the rotating arms, *h'* and the adjacent pins *h*. The

breaking of these smoke globules exposes the smoke to the cleansing action of the liquid, and the purified air arises from the chamber *d'* through the pipe, *g'*, and tube H to the mouth of the wearer behind the mask, I. An inspiration is sufficient to form a vacuum in the air space above the liquid, which displaces all the liquid in the intake tube; consequently, allowing the air to reach the perforations in the bottom of the agitator chamber, thence in the form of bubbles up through the liquids in the agitator chamber and above the same, thereby filling the air space that was exhausted by inhalation.

When it is desired to operate the device, the switch, P, is moved to complete the circuit by connecting the terminals of wires 1 and 4, which immediately actuates the motor and revolves the agitator rod, *e*. While our invention is shown operated by dry battery cells, it is obvious that a liquid or any kind of battery or source of mechanical energy may be employed for rotating the agitator, which mechanism, though herein shown as a motor, may be a clock-work arrangement or other convenient device.

What we claim is,

1. In a respirator, the combination with a mask, of a case for containing a purifying liquid, a tube connecting the mask and case, a tube leading to the case, a mechanism in the case for agitating the liquid, and electrical means for actuating the mechanism.

2. In a respirator, the combination with the mask, of a case for containing a purifying liquid, a tube connecting the mask and case, a tube leading to the case, a mechanism in the case for agitating the liquid, auxiliary cases connected with the first case, and means in the auxiliary case for actuating said mechanism.

3. In a respirator, the combination with the mask, of a case for containing a purifying liquid, a tube connecting the mask and case, a tube leading to the case, a mechanism in the case for agitating the liquid, auxiliary cases connected with the first case, battery cells in the auxiliary cases, and electrical connections between the cells and said mechanism.

4. In a respirator, the combination with the mask, of a case, a tube connecting the mask and case, means for connecting the air supply to the case, a motor in the case, a source of electrical energy adjacent the case, and electrical connections between the source of electrical energy and the motor.

5. In a respirator, the combination with the mask of a case for containing a purifying medium, a tube connecting the mask and case, an opening in the case to receive the air supply, a motor in the case, batteries adjacent the case, an electrical circuit intermediate the battery and motor, and a switch in the circuit.

6. In a respirator, the combination with the mask and a case, of a tube connecting the mask and case, a motor in one part of the case, a chamber in another part of the case for containing a purifying liquid, an agitator rod connected with said motor, and partially submerged in the liquid, an air supply tube leading to the chamber, and means for actuating the motor.

7. In a respirator, the combination with the mask and a case, of a tube connecting the mask and case, a motor in one part of the case, a chamber in another part of the case for containing a purifying medium, a cylinder provided with perforations fixedly mounted in the chamber beneatn the purifying medium, projections upon the interior of the cylinder, means for introducing the air supply beneath the cylinder, a rotary rod mounted in the motor and traversing the cylinder, means upon the rod within the cylinder coacting with the projections to agitate the purifying medium when the rod rotates, and means for actuating the motor.

8. In a respirator, the combination with the mask and case, of a tube connecting the mask and case, a mechanism within the case, a chamber in the case for containing a purifying medium, a cylinder provided with perforations fixed within the purifying medium, projections upon the interior of the cylinder, means in the case for introducing a supply of air beneath the cylinder, a rod rotated by the mechanism and entering the cylinder and inclined articulated arms upon the rod.

9. In a device of the class described, a chamber for a purifying medium having an air outlet at its top and an air inlet at its bottom, a shaft in said chamber, agitators on said shaft, and means for rotating said shaft.

10. In a device of the class described, a chamber for a purifying liquid having an air outlet above said liquid and an air inlet below said liquid for passing air in the form of bubbles through the liquid, and means for breaking up said bubbles within said liquid.

11. In a device of the class described, a chamber for a purifying liquid having air passages for drawing air through said liquid, and means for agitating the liquid in the path of the air.

12. In a device of the class described, a chamber for a purifying medium having an air outlet at the top and an air inlet at the bottom, and means for agitating said medium.

13. In a device of the class described, a chamber for a purifying liquid having an air outlet passage above said liquid and an air inlet passage below said liquid for passing air in the form of bubbles through said liquid, means for breaking up the bubbles within said liquid, a connection from said outlet passage for communication with the respiratory organs of the user, a valve opening towards the user on an inhalation, and a valve between said first named valve and the user and opening to the atmosphere upon an exhalation of the user.

In testimony whereof we have affixed our signature in presence of two witnesses.

EDWARD N. CASEY.
HENRY E. RATHBUN.

Witnesses:
HORATIO E. BELLOWS,
WILLIAM E. BROWN.