

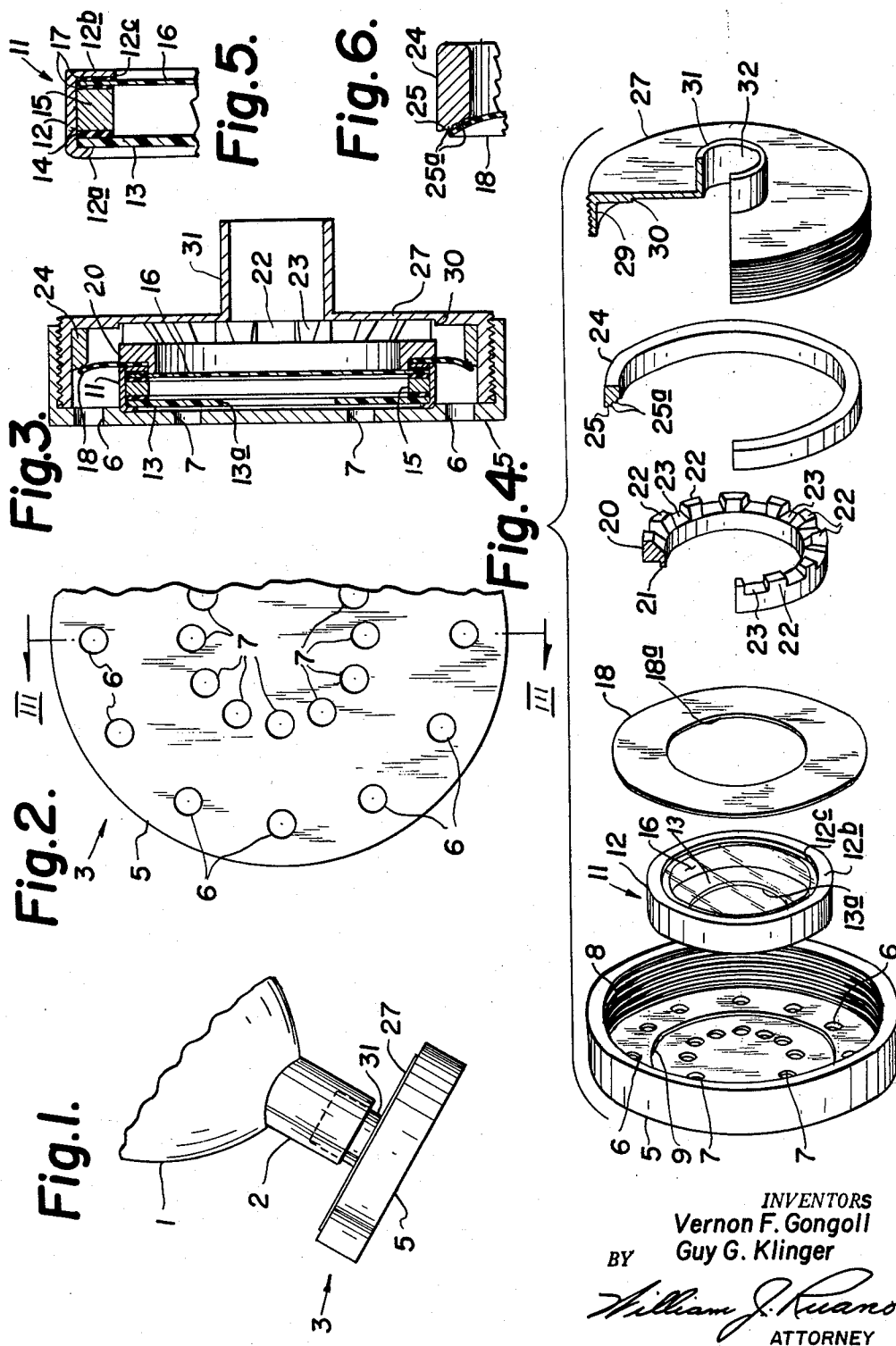
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RESPIRATOR SPEAKING DIAPHRAGM AND EXHALATION VALVE UNIT

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1

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RESPIRATOR SPEAKING DIAPHRAGM AND EXHALATION VALVE UNIT

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1 Claim. (Cl. 128—141)

This invention relates, generally, to a respirator and, more particularly, to a combined speaking diaphragm and exhalation valve unit for such respirator.

In the past, speaking diaphragms have been mounted in respirators and the like for enabling the wearer of a respirator or gas mask to be heard by others while wearing his mask. An outstanding disadvantage of prior constructions is that the speaking diaphragm is generally made as a separate unit from the exhalation valve, therefore both cannot be placed opposite the mouth of the wearer where both would be most effective. Attempts have been made to place the speaking diaphragm and exhalation valve substantially in the same general locality, but these have not met with success. Since the exhalation valve is usually mounted so that its diaphragm is exposed to the exterior of the mask it is subject to damage as the result of mishandling, as well as unseating, such as by particles of dust and the like. The speaking diaphragm mounting is usually such as to cause voice distortion.

An object of the present invention is to provide a novel combined speaking diaphragm and exhalation valve unit which is devoid of the above named disadvantages and which is of unitary construction being self contained and involving a minimum number of easily manufactured parts, therefore being relatively inexpensive.

A further object of the present invention is to provide a unitary speaking diaphragm and exhalation valve unit which enables placement of both the exhalation valve and speaking diaphragm directly opposite the mouth of the wearer to provide maximum efficiency for both units and yet which provides ample protection against mechanical injury of both units and prevents voice distortion of the speaking diaphragm.

Other objects and advantages will become apparent from a study of the following description taken with the accompanying drawing wherein:

FIG. 1 is a side elevational view of a combined speaking diaphragm and exhalation valve unit applied to a respirator or gas mask shown broken away;

FIG. 2 is an enlarged, fragmentary plan view of the unit 3 shown in FIG. 1;

FIG. 3 is an enlarged, transverse cross-sectional view taken along line III—III of FIG. 2;

FIG. 4 is an enlarged, perspective, exploded view of the assembly forming the combined speaking diaphragm and exhalation valve unit shown in FIGS. 1, 2 and 3;

FIG. 5 is an enlarged, fragmentary, cross-sectional view showing the details in construction of the speaking diaphragm assembly and;

FIG. 6 shows an enlarged, fragmentary cross-sectional view of the exhalation valve and seat.

Referring more particularly to FIG. 1 of the drawing, numeral 1 denotes a respirator or gas mask of rubber or other suitable material and of any conventional type, only a fragmentary portion of which is shown, namely, that portion opposite the mouth of the wearer located in the lower front part of the respirator or gas mask. Integrally formed on the gas mask or respirator 1, is a short tubular piece 2, preferably of the same material, for providing an air exhalation outlet. It will be understood, of course, that there is also provided an air inlet or air inhalation valve elsewhere on the respirator or gas mask, which is not shown since it is conventional.

2

The unit 3 embodying the principles of the present invention is a combined speaking diaphragm and exhalation valve unit of cylindrical form having an integral tubular extension 31 that may be slip-fitted within the tubular portion 2 of the respirator. Turning to FIGURES 2, 3 and 4 of the drawing which more clearly illustrate unit 3, it will be noted that such unit comprises a cover 5 which may be made of plastic material, metal or other suitable material, and which cover is provided with a series of outer holes 6, for air exhalation, and a series of inner holes 7 for transmission of voice signals, both holes being disposed about circular paths. Cover 5 has an annular peripheral flange having screw threads 8 internally thereof which are adapted to be screw threaded to a correspondingly threaded portion 29 of a housing or container 27 as shown in FIG. 4. A slightly dished out or well portion is formed in the inner surface of the cover 5 and is defined by the marginal wall 9 to form a seat for centering and receiving the speaking diaphragm unit 11.

This speaking diaphragm unit comprises a plastic ring 12 as shown more clearly in FIG. 5 having at one side thereof a protective ring 13, preferably of transparent plastic material and of rigid construction, which has a central hole 13a to allow voice signals to travel outwardly of the unit. The protective ring 13 is mounted on and separated from ring 15 by a resilient annular seal 14 of rubber or other suitable elastic material. The speaking diaphragm 16 is preferably of very thin plastic material, such as, for example, that described in Matheson et al. Patent No. 2,838,788, dated March 20, 1956, assigned to the present assignee. The speaking diaphragm 16 is adapted to vibrate freely, without touching hard mounting parts by virtue of the rubber sealing rings 17 disposed on both sides of the peripheral portion thereof, which also, together with ring 14, form an air-tight seal. That is, ring 15 is held in tightly compressed relationship between the radially inwardly extending peripheral flanges 12a and 12b. By virtue of the seating of flange 12b on the flexible exhalation valve diaphragm ring 18 and its close fit about annular flange 21 on ring 20, an air-tight seal is provided, part of which is formed by speaking diaphragm 16. Thus as the wearer of the respirator speaks into the opening 32, which is immediately opposite his mouth, the voice tones will strike the speaking diaphragm 16, causing it to vibrate and to project voice or speech signals through the opening 13a of protective ring 13 and through holes 7 so as to be distinctly heard. Additional central openings in cap 5 may be provided if desired for better transmission of voice signals. The ring or barrier 13 protects the very thin and easily ruptured diaphragm 16 from breakage, such as by possible piercing of objects projecting through holes 7, and yet allows sound to travel through. It will be noted, therefore, that a perfect gas tight seal is provided so as to make it impossible for outside air to travel inwardly through the diaphragm or its seal with ring 20 and into the outlet tube 31 whenever the exhalation valve 18 is closed.

The exhalation valve or diaphragm 18 is in the form of a thin ring of rubber or other suitable flexible material and which is adapted to be seated on a plastic ring 24 tightly fitted in or integral with container 27 of plastic or metal. Ring 24 is preferably dished at 25 and provided with annular ridges 25a to produce more effective and reliable alternate sealing surfaces. The exhalation valve diaphragm is tightly sandwiched between the speaking diaphragm assembly and a crown-like ring 20, preferably of plastic material, having peripherally spaced notches or openings 23 to allow passage therethrough of air exhaled through tube 31. Ring 20 is seated and centered by the well portion defined by wall 30 in container 27.

Thus, in operation, as air is exhaled by the wearer

of the mask, it will pass through tube 31, through the openings 23 and will outwardly deflect and unseat the exhalation valve diaphragm 18 allowing the exhaled air to pass through holes 6 of cap 5 and into the surrounding atmosphere. When air is inhaled, diaphragm 18 will be sucked or drawn into seating engagement with ring 24 thereby preventing entry into tube 31 of outside air.

Voice signals will move outwardly not only through openings 13a and 7, but through the exhalation outlet path described above, therefore will be very clear and intelligible and devoid of distortion.

In some situations, to improve sound transmission, the cover 5 may be omitted—other well known means keeping the assembled relationship shown, may be used instead.

It will be understood that the above described construction may be used also for inhalation valves, in which event it would be necessary merely to place the sealing ring 24 on the cover side instead of the bottom side of the container.

Thus it will be seen that we have provided an efficient, unitary, respirator or gas mask unit which forms a combined spaker diaphragm and exhalation valve, which unit may be slip-fitted onto a projecting tubular portion of the gas mask or respirator, and which unit is adapted to be located just opposite the mouth of the wearer so that he may be heard distinctly by others and so that the exhalation valve breathing resistance is maintained at a minimum; furthermore, we have provided a combined speaking diaphragm and exhalation valve unit for respirators and the like which is made of relatively simple and inexpensive parts and which offers maximum protection against rupturing of the speaking diaphragm or damage to or interference with the operation to the exhalation valve diaphragm as often occurs in prior art devices.

While we have illustrated and described a single embodiment of our invention, it will be understood that this is by way of illustration only, and that various changes and modifications may be made within the contemplation

of our invention and within the scope of the following claim.

We claim:

In combination with a respirator mask having an integral projecting tubular portion for exhalation of air, a combined speaking diaphragm and exhalation valve unit comprising two nested, interfitting and opposed, cup shaped cylindrical parts, screw threaded together to form a substantially closed, hollow cylindrical container, one of said parts having at one end thereof a tubular portion which is slip-fitted to said mask tubular portion, ring means coaxially disposed within said container, a speaking diaphragm of thin flexible material supported coaxially on said ring means in air-tight relationship, an annular exhalation valve diaphragm of flexible material also coaxially mounted on said ring means within said container, an annular exhalation valve seat coaxially mounted in said container, surrounding said ring means and engaging the peripheral portion of said exhalation valve diaphragm, radially extending openings in said ring means for providing air-intercommunication between said tubular portion and said seat, the other of said cup shaped parts having an outside disc shaped wall thereof containing a plurality of holes, some in communication with said peripheral portion to enable exhaled air to be discharged therethrough and others in communication with said speaking diaphragm to enable sounds emanating from said speaking diaphragm to travel therethrough to the outside of said unit.

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