

United States Patent

[11] 3,548,823

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 [21] Appl. No. **728,116**
 [22] Filed **May 10, 1968**
 [45] Patented **Dec. 22, 1970**

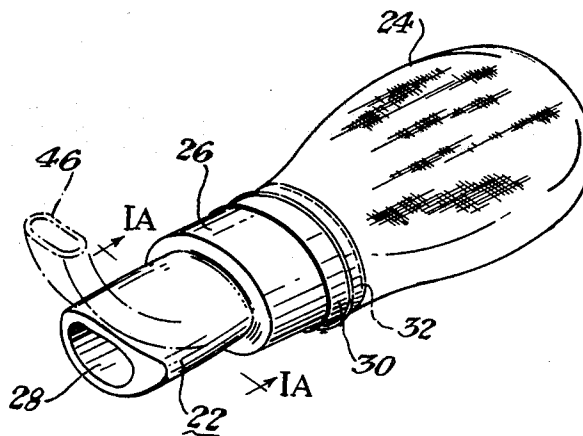
[54] **RESPIRATORS**
20 Claims, 13 Drawing Figs.

[52] U.S. Cl. **128/147,**
128/29, 128/140
 [51] Int. Cl. **A61b 7/00**
 [50] Field of Search **128/140,**
29, 146, 146.6, 147, 145

[56] **References Cited**
UNITED STATES PATENTS
 2,610,624 9/1952 Haller et al. 128/147
 2,655,150 10/1953 Cupp 128/146.6
 2,708,932 5/1955 Pipher 128/146.6
 3,046,978 7/1962 Lea 128/29

Primary Examiner—Adele M. Eager
Attorney—Buell, Blenko and Ziesenheim

ABSTRACT: A respirator comprising a mouthpiece, a detachable filtering bag for said mouthpiece, and means on said mouthpiece for detachably receiving said bag.



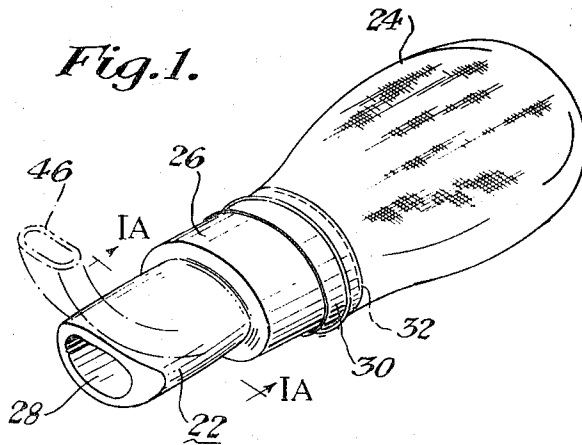


Fig. 1.

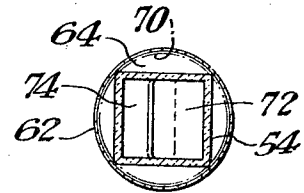


Fig. 6A.

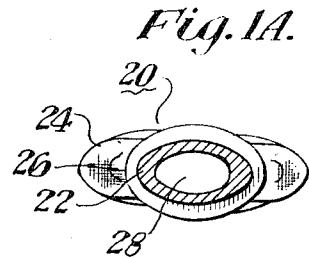


Fig. 1A.

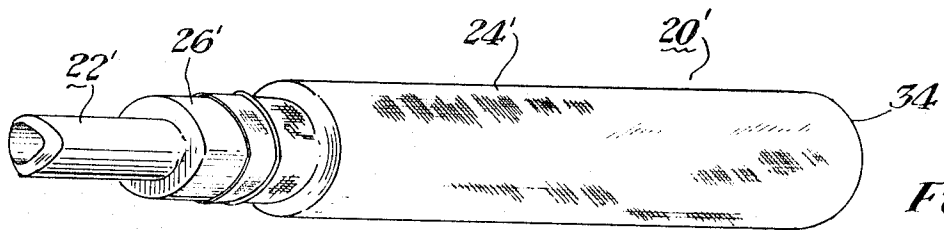


Fig. 2.

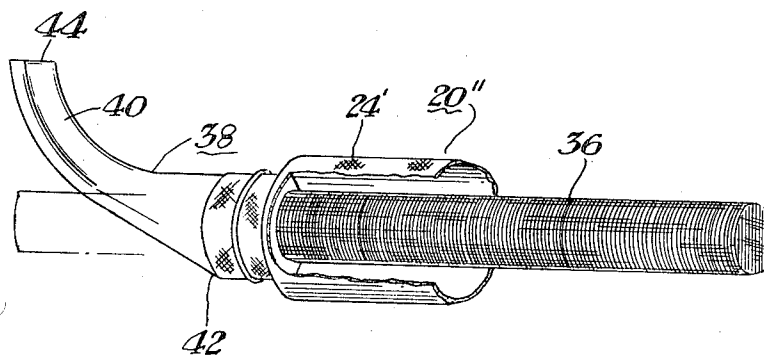


Fig. 3.

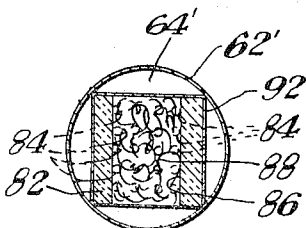


Fig. 11.

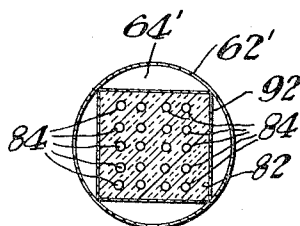
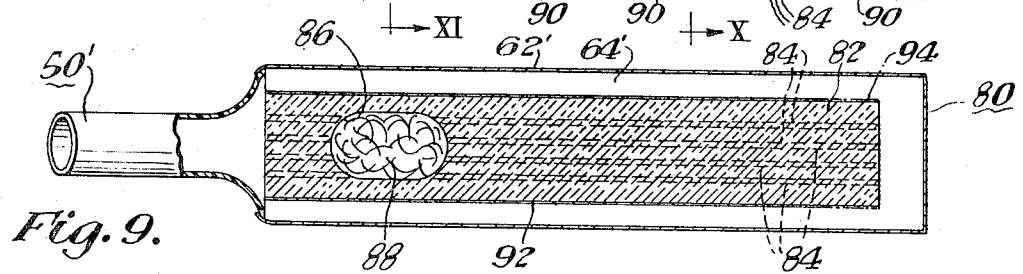
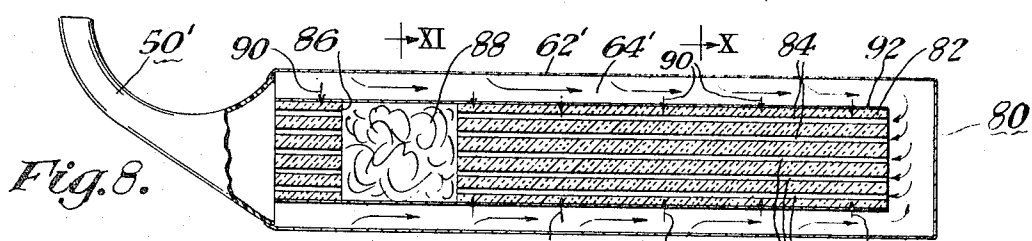
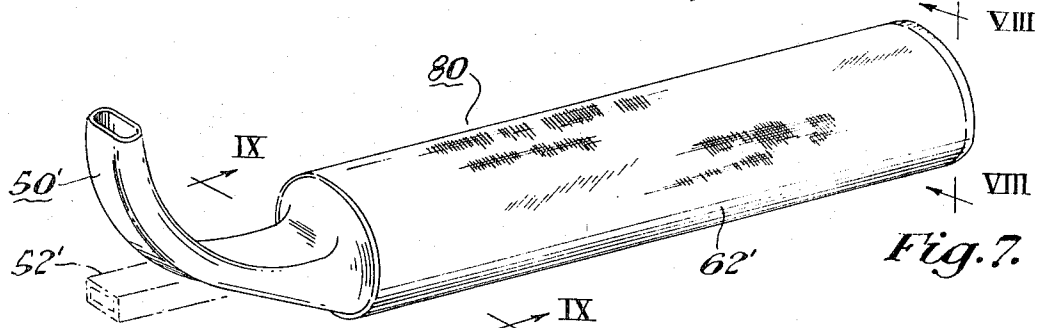
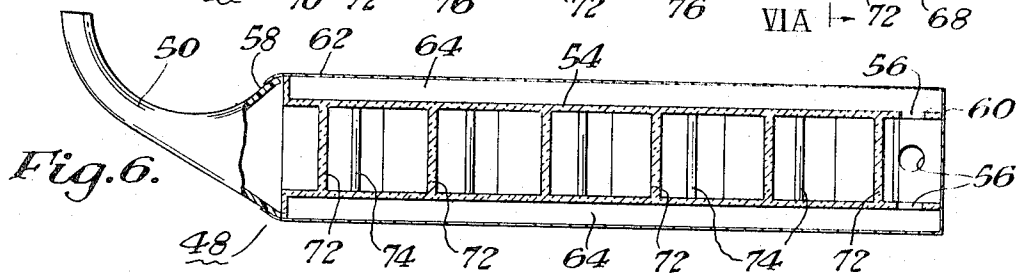
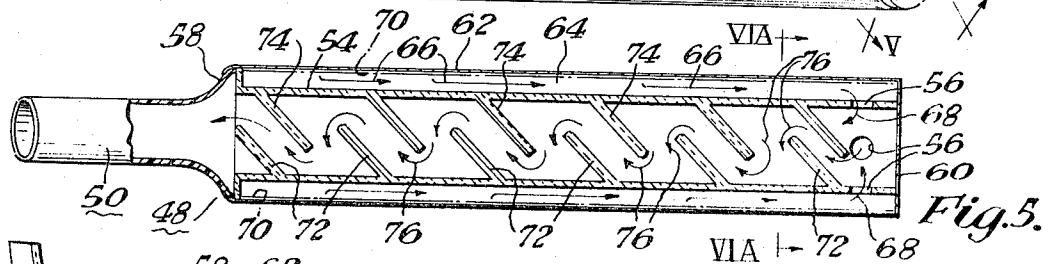
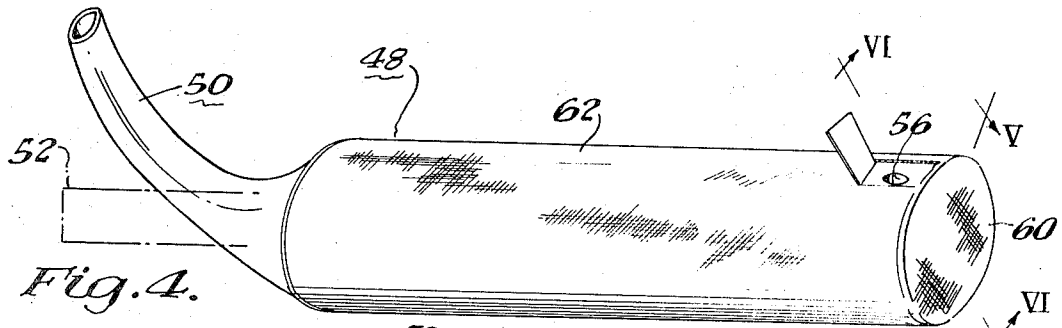


Fig. 10.

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RESPIRATORS

The present invention relates to respirators and more particularly to pocket-sized, mouth-held respirators. The invention is directed primarily to eliminating the problems associated with fitting and adjusting complicated facial type masks and similar respirators. While mask type respirators are suitable for many applications, many workmen neglect their use for short exposure periods in dusty or similar environments. Unfortunately, in such cases, it is preferred not to use conventional, mask type respirators rather than to undergo the difficulties of transporting and storing the bulky respirators and to expand the necessary time consumed in donning and adjusting the respirators. Hence, the use of conventional respirators is frequently and undesirably omitted, except under extremely hazardous conditions.

The pocket-sized respirators heretofore available have provided insufficient absorptive and/or filtering surfaces. In consequence, conventional respirators must frequently be cleaned or replaced, which limits their serviceability and the likelihood of their faithful use for either long or short term exposures to dust-laden and other potentially hazardous atmospheres. As a corollary to the aforementioned disadvantages, conventional respirators are difficult to clean because of their failure to incorporate adequate self-cleaning and replacement features.

Finally, previously proposed mouth held respirators have no means of preventing the entry of saliva into the respirator including its mouthpiece.

Previous attempts to solve these problems have met with limited success. For example, the U.S. Pat. No. 1,175,799 to Niessner discloses a mouth-held respirator of interest to the present discussion. The Niessner respirator affords a very small absorptive or filtering area which quickly becomes clogged in an atmosphere containing dust or other particulate matter, such as that encountered in the vicinity of paint spraying operations. Despite its small filtering area, the Niessner respirator is bulky and difficult to use and manipulate.

A mouth-held, pocket-sized respirator is shown in Haller et al. U.S. Pat. No. 2,610,624. Despite a considerably larger absorptive or filtering surface in the Haller et al. respirator, in contrast to Niessner, the Haller respirator is inadequate for many applications such as paint spraying and, moreover, is not capable of proper cleaning. Instead, the absorptive material must be removed and discarded.

Another pocket-sized, mouth-held filter is disclosed in Pierce U.S. Pat. No. 2,385,938. The Pierce filter suffers from the same disadvantages of limited flow areas although the filter may be suitable in certain applications. The Pierce filter moreover involves a relatively complex foldable structure which would militate against its widespread use, except under extremely hazardous conditions. Of interest in this connection is the disposable respirator of Jaroslaw U.S. Pat. No. 2,928,388. The Jaroslaw respirator rather than being a mouth-held device is a partial mask which is taped to the wearer's face about his mouth. The latter respirator suffers from the common disadvantage of prior respirators in that the time and difficulty involved in its use would result in its neglect except under extremely hazardous conditions, requiring perhaps, more sophisticated equipment.

There are, of course, many other types of respirators constructed in the form of partial masks, such as Piper 2,708,932; Olsen 306,946; Hoffman 58,255; Schwartz 2,199,230, which are of lesser interest in this discussion.

In addition to the disadvantages pointed out above none of the prior respirators incorporates a self-cleaning feature nor do they provide means for preventing the entry of saliva in the case of mouth-held respirators. Although Pierce utilizes various types of check valves in the mouthpieces of his respirators, this does not prevent the undesirable entry of saliva into the mouthpiece itself. For dust filters and the like, the prevention of the user's exhalations from passing through the respirator eliminates any potential self-cleaning action. In the case of the mouth-held respirators the presence of a check valve causes

the user to continuously manipulate his mouth to exhale around the mouthpiece or to continuously open and close his nasal passages with the tongue and velum. Complicated valved nose plugs would be necessary with the Pierce filter, where the use of nose plugs is desired or required.

Finally, mouth-held respirators of known design usually have failed to provide adequate air flows for the more strenuous physical exertions of the user. A further limitation is imposed by the tendency of their filtering systems to clog after short periods of use.

I overcome these disadvantages of the prior art by providing a mouth-held, pocket-sized respirator capable of use over extended periods but sized for convenient transport in the pocket of the user when he is not exposed to hazardous environments. The novel respirator, which is particularly useful in dusty or paint spraying atmospheres, is easily constructed from readily available filtering materials. Parts of the respirator, therefore, can be easily replaced, but more importantly the respirator of my invention can be readily cleaned when replacement is not desired. The long-lived characteristic of my respirator is further enhanced by its self-cleaning feature. My novel respirator is particularly useful for short term exposures encountered, for example, in furnace cleaning or paint spraying operations, where workmen are reluctant to bother with more sophisticated and troublesome mask-type respirators.

As noted previously, a primary consideration in the design for respirators is the provision of adequate air flow therethrough so that the respirator can be utilized under conditions of strenuous employment. I provide novel means for affording such air flow, while affording adequate filtering conditions. Certain features of my respirator therefore are of general and advantageous applicability to various types of respirators other than the mouth-held respirators shown in the drawings. I also provide novel means for preventing the entry of saliva into the respirator when constructed in mouth-held configuration. Such means do not involve the use of check valves or other relatively complicated structures.

I accomplish these desirable results by providing a respirator comprising a mouthpiece, a detachable filtering bag for said mouthpiece, and means on said mouthpiece for detachably receiving said bag.

I also desirably provide a respirator wherein said filtering bag is of elongated tubular construction, and a tubular mesh is secured to said mouthpiece and substantially coextends with said bag for stiffening said bag and for preventing collapse thereof.

I also desirably provide a respirator wherein said mouthpiece is curved for disposition toward the roof of the mouth to prevent the entry of saliva into the mouthpiece and the respirator.

I also desirably provide a respirator wherein a canister is spacedly mounted within said bag, said canister supporting additional filtration means thereon.

I also desirably provide a respirator wherein said canister is formed from a block of open-celled foamed plastic material, the interconnected cell structure thereof forming said additional filtration means.

I also desirably provide a respirator wherein said filter bag is supported by a wire mesh or the like substantially surrounding said canister.

I also desirably provide a filtration system for a respirator and the like, said system comprising a bag of filtering material, means for supporting said bag on said respirator, a canister spacedly mounted within said bag and substantially coextending therewith, additional filtering means mounted on said canister and communicating with the space between said bag and said canister, and means for coupling an outlet of said canister to an outlet of said respirator.

During the foregoing discussion, various objects, features and advantages of the invention have been set forth. These and other objects, features and advantages of the invention together with structural details thereof will be elaborated upon during the forthcoming description of certain presently

preferred embodiments of the invention and presently preferred methods of practicing the same.

In the accompanying drawings I have shown certain presently preferred embodiments of the invention and have illustrated certain presently preferred methods of practicing the same, wherein:

FIG. 1 is an isometric view of one form of mouth-held respirator arranged in accordance with my invention and illustrating usage of alternative mouthpieces;

FIG. 1A is a cross-sectional view of the respirator as shown in FIG. 1 and taken along reference line IA-IA thereof;

FIG. 2 is an isometric view of a similar respirator but having a different form of filter bag;

FIG. 3 is an isometric view partially broken away of a similar respirator having means for distending and stiffening the filter bag and having modified mouthpiece means;

FIG. 4 is an isometric view of still another form of respirator shown here as a mouth-held respirator but incorporating a filtering system of general utility;

FIG. 5 is a horizontal, longitudinally sectioned view of the respirator as shown in FIG. 4 and taken along reference line V-V thereof;

FIG. 6 is a vertical, longitudinally sectioned view of the respirator as shown in FIG. 4 and taken along reference line VI-VI thereof;

FIG. 6A is a cross-sectional view of the respirator as shown in FIG. 4 and taken along reference line VIA-VIA thereof;

FIG. 7 is an isometric view of still another form of my novel respirator likewise incorporating a filtering system of general utility;

FIG. 8 is a vertical, longitudinally sectioned view of the respirator as shown in FIG. 7 and taken along reference line VIII-VIII thereof;

FIG. 9 is a horizontal, longitudinally sectioned view of the respirator as shown in FIG. 7 and taken along reference line IX-IX thereof;

FIG. 10 is a cross-sectional view of the respirator as shown in FIG. 8 and taken along reference line X-X thereof; and

FIG. 11 is another cross-sectional view of the respirator as shown in FIG. 8 and taken along reference line XI-XI thereof.

Referring now more particularly to FIGS. 1-3 of the drawings and initially to FIG. 1 thereof my novel respirator 20 includes, in this example, mouthpiece 22 and a filtering bag 24 or the like constructed for example from filter material such as flannel or filter paper. The bag 24 is secured to a shoulder 26 formed in this instance integrally with the mouthpiece 22, so that the mouthpiece opening 28 communicates with the interior of the filtering bag 24. The mouthpiece 22 can be also provided with a circumferential flange 32 about its outward or bag end to facilitate retention of the bag 24 on the mouthpiece shoulder 26.

When using the mouth-held respirator cracklings FIG. 1 the user flightings as well as inhales through the filter bag 24. The use of the bag 24 affords ample flow area for the air inhaled into the user's lungs such that cracklings rate of flow through cracklings respirator 20 is limited primarily by the shape of the mouthpiece 22 and its through opening 28. Thus, the rate of air flow through the respirator 20 can be adjusted to the demands of physical exertions indulged in by individual users. For the user's comfort the mouthpiece 22 is ovoid in cross section as better shown in FIG. 1A.

The respirator 20, in common with other forms of my respirator disclosed herein, exhibits an important self-cleaning feature, which results from the user's exhalation as well as inhalation through the filter bag 24. Such exhalation tends to blow dust and other accumulated foreign material off the outer surfaces of the filter bag 24 and to minimize clogging thereof. Moreover, removal of accumulated particles from the filter bag 24 can be accelerated by gently shaking or dusting the filtering bag against a relatively firm surface. The respirator 20, therefore, is capable of use over extended periods without clogging.

Finally, the filter bag 24 particularly, when provided with the elastic neck 30, can be readily removed from the mouthpiece 24 for complete washing or cleaning or for replacement. In the latter connection it should be pointed out that the filter bag 24 can be simply formed on the job so to speak, from a rectangle of filter material such as flannel or filter paper by wrapping the ends of the rectangle about the mouthpiece shoulder 26 and securing in place with a rubberband or the like. The exposed but overlapped edges of the filter bag thus formed can be sealed with suitable pressure sensitive tape (not shown).

In FIG. 2 of the drawings a similar respirator 20' is shown, wherein the filter bag 24' is provided in the form of a tube closed at its outward end as denoted by reference character 34. The open end of the tubular bag 24' is secured to the shoulder 26' is secured to the shoulder 26' of the mouthpiece 22', for example in one of the operative modes described above. The bag 24' likewise can be formed from filter cloth or paper or from other suitable filter material.

As better shown in FIG. 3 of the drawings respirator 20'' can be provided with a generally tubular stiffener 36 inserted within the filter bag 24' and coextending therewith. In this example the stiffener 36 is fabricated from a tubular wire mesh to preclude interference with the air flow characteristics of the respirator 20''.

The respirator 20'' is provided in this example with a mouthpiece 38 having a curved stem 40 and a secureance shoulder 42 similar to the mouthpiece shoulder 26 or 26' of FIGS. 1 and 2. In this arrangement, the mouthpiece 38 is placed in the mouth of the user with the upper end 44 of the mouthpiece adjacent the roof or hard palate. This disposition of the mouthpiece 38 prevents saliva from entering the mouthpiece 38 and from wetting the filter cloth or other filtering material comprising the bag 24'.

It is contemplated of course that either of the respirators 20 or 20' of FIGS. 1 and 2 can be provided with a similar curved mouthpiece, as denoted for example by chain outline 46 thereof in FIG. 1.

Referring now to FIGS. 4-6 of the drawings a modified filtering system is disclosed therein in accordance with my invention. In this example the respirator 48 includes a mouthpiece 50 which can be curved as denoted by the solid outlines thereof, or straight as denoted by chain outline 52 if the saliva-excluding feature is not desired. In this example the mouthpiece 50 is joined to the adjacent open end of canister 54, which, in this modification, can be fabricated from a suitable structural material such as plastic or aluminum. Adjacent the opposite end of the canister 54 a number of flow openings 56 extend through the adjacent wall surfaces of the canister 54.

The mouthpiece 50 desirably includes a flange 58, in this example of arcuate configuration, which projects outwardly of the canister 54. The canister is provided with a similarly flanged end closure 60.

Suitable filtering material 62 such as the aforementioned flannel or filter paper is wrapped about the canister 54 and lightly stretched between the mouthpiece flange 58 and the end closure flange 60, as shown in FIG. 6A. Alternatively, the filtering medium can be provided in the form of a tube or bag, open at both ends, through which the canister 54 is inserted and the ends of the bag secured respectively to the mouthpiece and canister flanges 58, 60.

The entire surface of the filtering medium 62 is available for filtering flow therethrough and into the area 64 between the filtering medium 62 and the outer surfaces of the canister 54, as denoted by flow arrows 66. The incoming air then flows through the apertures 56 adjacent the outward or distal end of the canister 54 and into the interior of the canister 54 as denoted by arrows 68. If desired, a wire mesh or screen, as denoted by chain outline 70 thereof, can likewise be extended between the mouthpiece flange 58 and the canister end closure 60 to ensure separation between the filtering media 62 and the outer surfaces of the canister 54. However, in most ap-

plications, lightly stretching the filtering material between the mouthpiece flange 58 and the canister end closure 60 will in itself assure adequate separation between the filtering material 62 and the canister 54.

Within the canister 54 a plurality of flow baffles 72, 74 are mounted in spaced, interleaved relationship as better shown in FIGS. 4 and 5 of the drawings. The flow baffles 72, 74 force the incoming air to assume a serpentine path through the canister 54 as denoted by flow arrows 76. However, the relatively wide spacings among the baffles 72, 74 do not materially reduce the rate of flow of incoming air through the canister 54. The baffles 72, 74 in this example are formed from folded pieces of flannel or similar fuzzy material stiffened by suitable means so that the baffles 72, 74 retain their shape. The baffles 72, 74 remove any very fine mist or particles which are small enough to have passed through the filter paper 62. Removal in this fashion is effected by the successive impingement of the air upon the adjacent surfaces of the baffles, as the air passes through the canister 54, as better shown in FIG. 5. In order to ensure a substantially normal impingement of air flow against at least some of the baffles, such baffles, for example the baffles 72, can be inclined generally toward the inlet air openings 56 of the canister.

The respirator 48, as evident from the drawings and the foregoing description, can be subjected to extended usage without clogging owing to the large flow area afforded by the outer filtering means, i.e., the filter paper or cloth 62, and the rather larger serpentine passages within the canister 54. The sizes of these passages is not affected materially by build up of residue upon the baffles 72, 74.

In assembling the respirator 48, the filtering medium 62 can be provided in the form of an open ended tubular member, the ends of which are secured to the flanges 58, 60 for example in the manner described above in connection with FIG. 1. The filtering media 62 is likewise self-cleaning as the user of the respirator 48 exhales as well as inhales therethrough. On the other hand, the filtering media can be readily removed for cleaning and/or replacement.

Another novel arrangement of my respirator is denoted by the reference character 80 in FIGS. 7-11 of the drawings, where similar reference characters with primed accents refer to similar components of FIGS. 4-6. In this example, however, the canister 54 of FIGS. 4-6 is provided in the form of a mass or a block 82 of a foamed plastic such as foamed polystyrene (Styrofoam) open-celled foamed plastic such as polyurethane. A polystyrene foam is particularly useful in paint spraying activities, as the foamed polystyrene quickly absorbs paint fumes.

Therefore, as used herein, the term canister includes either the substantially hollow structure 54 of FIGS. 4-6 or the mass 82 of foamed plastic material of FIGS. 7-11. That is to say, the term canister is inclusive of any suitable device which can be spacedly mounted within the outer filtering material or bag 52' and is capable of supporting additional filtration means therein or thereon. Such additional filtrational means are inclusive of an interconnected cell structure of an open-celled foamed plastic mass or the longitudinal flow passages 84 of the foamed plastic mass, or both.

In this example the canister block or mass 82 has a plurality of longitudinal flow passages 84 extending therethrough. The passages 84 can be interrupted by a pocket 86 formed in the Styrofoam block 82 to contain a mass of wool 88 or other suitable filtering material. Thus, incoming air passing through the passages 84 are subjected to a third filtration by the mass of wool, subsequent to the filtering action of the foamed material of the block or mass 82, and particularly the many minute projections on the walls of the flow passages 84.

The longitudinal passages 84, even without the use of the pocket 86 and filtrational material 88, therefore, offer the advantages of considerable absorption of foreign material from the air flowing therethrough without appreciably obstructing the flow areas of the passages 84, as noted previously in connection with the serpentine flow passages through the canister 54 of FIGS. 4-6.

It is contemplated that open-celled foamed plastic materials can be substituted for the styrofoam mass 82, for example one of the foamed polyurethane, of known formulation. In the latter instance, a relatively soft or a relatively hard polyurethane foam, of many known formulations, can be selected depending upon the application of the invention. The selection of a soft polyurethane sponge will, of course, facilitate periodic cleaning of the foamed mass 82.

Owing to the air flow characteristic of the foamed plastic mass 82 some of the incoming air will bypass the longitudinal passages 84 as denoted by flow arrows 90. The bypassing air however is likewise subjected to an additional filtration by covering the sides of the styrofoam mass 82 with flannel or other filtering media 92 as better shown in FIGS. 10 and 11 of the drawings. Thus, in the illustrated example, the spaces 64' are defined by the outer filtering media or bag 62' and the foamed material coverings 92. Subsequent filtration is afforded, of course, by passage of incoming air through the open-cell configuration of the foamed plastic mass or canister 82.

It follows, then, that the longitudinal passages 84 and the block pocket 86 can be eliminated altogether, in many applications, such that a second or additional filtration stage is provided by the inherent air permeability of the canister 82. In the latter case, it is desirable in certain applications to terminate the block covering 92 short of the outward end of the block, as denoted by chain outline 94, to increase the effective flow area through the foamed block 82.

The respirator 80 of FIGS. 7-11 is likewise capable of easy assembly, disassembly and maintenance and moreover exhibits the self-cleaning characteristic, from the user's exhalations, as mentioned previously.

From the foregoing it will be apparent that novel and efficient forms of respirator constructions have been described herein. While I have shown and described presently preferred embodiments of the invention and have illustrated presently preferred methods of practicing the same, it is to be distinctly understood that the invention is not limited thereto but may be variously embodied and practiced within the scope of the following claims.

I claim:

1. A respirator comprising a supporting mouthpiece, a detachable flexible filtering bag for said mouthpiece, and means on said mouthpiece for detachably and closely receiving an open end of said bag, said mouthpiece being shaped for holding only between the lips or teeth of a user of the respirator, said bag being mounted solely on said mouthpiece.

2. The combination according to claim 1 wherein said mouthpiece is provided with a shoulder for receiving an open end of said filter bag.

3. The combination according to claim 1 wherein said bag is provided with elastic securance means for quick attachment to said mouthpiece.

4. The combination according to claim 1 wherein said filtering bag is of elongated tubular construction, and a tubular mesh is secured to said mouthpiece and substantially coextends with said bag for stiffening said bag and for preventing collapse thereof.

5. The combination according to claim 1 wherein said mouthpiece is curved relative to said filtering bag for disposition toward the roof of the mouth to prevent entry of saliva into the mouthpiece and the respirator.

6. The combination according to claim 1 wherein a canister is spacedly mounted within said bag, said canister supporting additional filtration means thereon.

7. The combination according to claim 6 wherein said canister is provided with opening means at the distal end thereof and in communication with the space between said bag and said canister, said additional filtration means are mounted within said canister, and said canister is provided with opening means adjacent the other end thereof in communication with said mouthpiece.

8. The combination according to claim 7 wherein said additional filtration means includes an array of flow baffles extending substantially along the length of said canister.

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9. The combination according to claim 6 wherein said bag is lightly stretched between flange means formed respectively on said mouthpiece and on the distal end of said canister, said canister being secured to said mouth piece in communication therewith.

10. The combination according to claim 6 wherein said filter bag is supported by a wire mesh or the like substantially surrounding said canister.

11. The combination according to claim 6 wherein said canister is formed from a block of foamed plastic material, and passage means are formed therethrough to form said additional filtration means.

12. The combination according to claim 11 wherein at least that end portion of said block adjacent said mouthpiece is covered with a filtering medium.

13. The combination according to claim 11 wherein a plurality of longitudinal discreet flow passages are extended through said block.

14. The combination according to claim 13 wherein a pocket is formed in said block and intersects each of said longitudinal flow passages, and a mass of filtering material is inserted into said pocket.

15. A filtration system for a respirator and the like, said system comprising a bag of filtering material, means for supporting said bag on said respirator, a canister spacedly

mounted within said bag and substantially coextending therewith, additional filtering means mounted on said canister and communicating with the space between said bag and said canister, and means for coupling an outlet of said canister to an outlet of said respirator.

16. The combination according to claim 15 wherein said canister includes a block of open-celled foamed plastic material, and said additional filtering means include the interconnected cells of said block.

17. The combination according to claim 15 wherein said canister includes a block of foamed plastic having a plurality of longitudinal flow passages extending therethrough, each of said passages communicating at one end thereof with the space between said bag and said block and at the other end thereof with said respirator outlet.

18. The combination according to claim 8 wherein at least some of said flow baffles include a fuzzy material disposed for impingement by incoming air for entrapment of fine mist or particles entrained therein.

19. The combination according to claim 15 wherein said canister comprises a mass of foamed plastic material having fluid passage means extending therethrough.

20. The combination according to claim 19 wherein said foamed plastic material is foamed polystyrene.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,548,823 Dated December 22, 1970
Inventor(s) John A. Bogacik

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 2, after "respirators" insert a period.
Column 3, line 55, "cracklings" should read -- of --; line 56, "flightings" should read -- exhales --; line 58, "cracklings" should read -- the --; line 59, "cracklings" should read -- the --. Column 4, line 16, after "26'" cancel "is secured to the shoulder 26'". Column 5, line 29, "is" should read -- are --.

Signed and sealed this 4th day of ~~May~~ 1971.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

WILLIAM E. SCHUYLER,
Commissioner of Patent