THE JOINT EXAMINATION BOARD

PAPER P4

AMENDMENT OF SPECIFICATIONS FOR UNITED KINGDOM PATENT APPLICATIONS IN PROSECUTION, REVOCATION PROCEEDINGS OR OTHERWISE

Thursday, 14th November, 2002

10.00 a.m. – 1.00 p.m.

Please read the following instructions carefully. ***Time Allowed – THREE HOURS***

1. Where a question permits, reasons should be given for the conclusions reached.

2. Please note the following:

   - Start each question (but not necessarily each part of each question) on a fresh sheet of paper.
   - Enter the Paper Number, the question number and your Examination number in the appropriate boxes at the top of each sheet of paper
   - Write on one side of the paper only, within the printed margins using a **BLACK** pen.
   - **DO NOT** use coloured pens or highlighters within the answers – they will not photocopy.
   - **DO NOT** staple or join pages together in any way
   - **DO NOT** state your name anywhere in the answers

3. **Unless specifically requested answers are NOT required in letter form.**

4. **NO** printed matter or other written material may be taken into the examination room. **ALL** mobile phones and electronic aids **must be** switched off and stored away.

5. Answers **MUST** be legible. If the examiners cannot read a candidate's answer no marks will be awarded.

6. **NO WRITING OF ANY KIND WILL BE PERMITTED AFTER THE TIME ALLOTTED TO THIS PAPER HAS EXPIRED. At the end of the examination assemble your answer sheets in question number order and place in the WHITE envelope provided.**

This paper consists of **twenty one** pages including this page

THE JOINT EXAMINATION BOARD

PAPER P4 AMENDMENT

Please read the instructions carefully. This is a **THREE HOUR** paper.

1. Write on one side of the paper only using **BLACK OR DARK BLUE INK.** You must write your examination number and designation of the paper in the top right hand corner of each sheet. You must not state your name anywhere in the answer.

2. **NO** printed matter or other written material may be taken into the examination room.

3. Answers **MUST** be legible. If the examiners cannot read a candidate's answer no marks will be rewarded.

4. **NO writing whatsoever, including numbering of papers, is allowed prior to commencement of the examination or after it has finished.**

In this paper, you should assume that a United Kingdom patent application comprising the attached specification (identified as GB 0123456.7) was filed at the UK Patent Office on April 1st, 2001 with a claim to priority from an earlier UK application filed April 1st, 2000; and that the UK Patent Office has issued the attached Official Letter. The text of the earlier application was identical to that of the application now undergoing examination except that no claims were present in the application.

You have reported the Official Letter to your client and have received instructions for response in the form of the attached letter.

Your task is to prepare the following:

1. A letter to the UK Patent Office in response to the Official Letter, accompanied by a set of amended claims if appropriate. (Please note that for the purposes of this examination you are **not** required to propose any amendments to the description of the patent application.)

2. A memorandum consisting of notes to provide the basis of advice and comment in reply to your client explaining the actions you have taken and the reasons for those actions. These notes should be restricted to patent matters; you are **not** required to consider any other matters such as copyright or design protection.

You should accept the facts given in the paper and base your answer on those facts. In particular, you should **not** make use of any special knowledge that you may have of the subject matter concerned, and you must assume that the prior art referred to is in fact exhaustive. Where only extracts of documents are presented, you should assume that those extracts contain all relevant material.

If your advice to your client includes a suggestion that one or more divisional applications should be filed, you should draft independent claim(s) for the or each divisional and your memorandum should indicate your grounds for believing the filing of such a divisional application to be advisable. You should **not**, repeat **not**, draft a description or any dependent claims for a divisional application.

If you submit amended claims and/or independent claim(s) for a divisional application, please place these at the top of your papers when handing in your answer.

Document check list :-

OFFICIAL ACTION 1 PAGE

CLIENT'S LETTER 1 PAGE

CLIENT'S APPLICATION NO. GB 0123456.7 11 PAGES,with 2 sheets drawings

GB SPECIFICATION GB 2040608A 2 PAGES with 1 sheet of drawings

MINE SAFETY GAZETTE, Issue 322 1 PAGE

MINE SAFETY GAZETTE, Issue 325 1 PAGE

Your Reference: DT/PAT/08

Examiner: I. Shaftoe

Application No: GB 0123456.7
Applicant: Everfirm Limited

Latest date for reply: 1 December 2002

Patents Act 1977
Examination Report under Section 18(3)

1. The invention as defined in claim 1 at least is not new and/or is obvious in view of the disclosure of:

GB 2040608 A, published September 22nd, 1990
"Mine Safety Gazette", Issue 322, published March 1st 2000
"Mine Safety Gazette", Issue 325, published June 3rd 2000

2. Care should be taken when amending the specification to avoid adding subject matter.

Letter from Client

1 November 2002

Dear Patent Attorney

Thank you for your report enclosing the Examiner's comments on our patent application for the Everfirm Filter Device Mark 8.

I can't make out what the problem is. The Examiner has referred to GB 2040608 A, which seems to have no relevance to my invention. The "Mine Safety Gazette" articles are very sketchy and, in any event, are concerned with cartridge filters - not our province, as you know. I know Bill Digger of Nebulon well - he's prone to hyperbole, and I should take his comments with a pinch of salt. Nonetheless, it would be useful to know what our position would be if Nebulon were to start selling filters having a spacer arrangement resembling ours.

Given that time is fairly short, I suggest you prepare a response as best you can. We're still keen to get the best cover possible, since preliminary tests have given outstanding results. We therefore expect to have a winner on our hands. I know I can rely on you to get the best out of the situation.

I'll be away for a few weeks from tomorrow, so I look forward to seeing what you have done when I get back from caving down under.

Yours sincerely

Dick Tumulus
CEO, Everfirm Limited

GB0123456.7

RESPIRATOR FILTER

This invention relates to filters. In particular it is concerned with a detachable filtration device for use with a respirator.

Respirators are employed to filter the air inhaled by a user under hazardous breathing conditions such as environments having noxious vapours or particulates suspended in the air. A respirator includes a face mask which covers the nose and mouth of the user and one or more inlet valves through which air is drawn as the user inhales, and an outlet valve through which air exits the face mask as the user exhales. A filter is attached over the inlet valve so as to form a closed air channel between the filter and the interior of the face mask so that air is first drawn through the filter before it is inhaled .

A key consideration in designing respiration filters is filtering efficiency. The filter must be capable of removing a sufficient amount of contaminants from the air so as to supply "safe" breathing air to the user. . Enhanced filtering efficiency is often obtained by utilizing multiple layers of tightly webbed or woven filter material.. However this means the effort required by the user to draw a sufficient volume of air through the device - also termed breathing resistance - is correspondingly increased. There is thus a competing interest between the need to filter effectively and the need to avoid undue breathing resistance.

In order to reduce breathing resistance, recent designs have attempted to increase the overall surface area of the filtration device. However there is still a need to develop better designs having improved performance and user characteristics. Thus the filtration device is generally secured to and disconnected from the respirator face mask by connecting the breather tube to the respirator using a threaded or bayonet type fitting. To do this, the user must grasp and touch the filter pads and twist or otherwise manipulate the device to make the connection. Thus any soil on the user's hands can contaminate the filter pad. In disconnecting a spent filter device from the respirator, the user's hands may come into contact with potentially harmful material deposited on the filter pads. Handling the filters

may also cause particles on the pads to flake off and/or become airborne so as to present a hazard to a bystander or to the user.

In manipulating the filtration device for connection or disconnection with the respirator face mask, the pliable filter material tends to be rotated further than the relatively stiff breather tube, thereby placing stress on the filter material which can potentially lead to damage to the filter material and may even result in separation of the filter material from the breather tube.

It is thus highly desirable to prevent user contact with the filter material and to avoid relative rotation between the breathing tube and the filter material. Optimally, these objectives should be achieved while minimising breathing resistance and maximising filtration efficiency.

According to the present invention, there is provided a filtration device suitable for use in a respirator, characterised in that the filtration device comprises a flexible pad-type filter element disposed within a rigid frame, and an inner breather tube supported by said rigid frame.

This invention is of particular application to so-called "stand-alone" filtration devices, but may also be of use with cartridge-type filters.

By providing a rigid frame holding the filter pad , insertion and extraction of the filtration device into a respirator face mask is facilitated and does not require the user's hands to come into contact with the filter material . Also, by having an inner breather tube connected to the rigid frame, relative rotation between the filter material and the breather tube is avoided.

Advantageously, the rigid frame comprises a ring-like band disposed around the periphery of the device. In a preferred embodiment, the device comprises two pad-type filter elements disposed so that they define an interior volume generally in the form of a cylindrical segment defined by the inner face of the ring-like band and by opposing faces of the two filter elements. With such a structure, it is advantageous for the rigid frame to include at least one spacer element which extends across the interior volume between the filter elements to maintain separation between the filter elements. Conveniently, a plurality of such spacer

elements are provided; these can be generally in the form of spokes extending inwardly from the ring-like band at the periphery of the filter pads.

Such rigid spacers prevent the filter pads from collapsing into the interior space, and thus maintain a good air flow through the device. This assures that the pressure drop across the filtration device is minimised, thereby tending to keep the breathing resistance low.

Preferably, the inner breather tube is rigidly connected to the outer peripheral band by means of the spacer elements.

The outer peripheral band may be formed with a contoured surface texture to assist the user in gripping the device during insertion and extraction procedures.

In one embodiment, the filtration device is disk-shaped and the inner breather tube is positioned in an offset position away from the central axis of the frame so that when the filtration device is connected to the respirator face mask, a large portion of the filtration device is positioned downward away from the user's line of vision. The spacers in this embodiment extend radially outwardly from the breather tube to the outer peripheral band so as to provide a rigid and stable frame, while maintaining as much open space within the central air pocket as possible.

In a further development, we have found that a filtration device having a spacer positioned between a pair of filter pads is best constructed so that at least a portion of the rigid spacers has a diamond-shaped cross section so that only the sharp edge of the spacer actually makes contact with the filter material. The spacers therefore maintain the separation between the filter pads without significantly reducing the overall filtration area.

In order to illustrate the invention, reference will now be made by way of example to the accompanying drawings, in which:

FIG. 1 is a partially exploded perspective view of a respirator utilising two filtration devices in accordance with this invention;

FIG. 2 is a front side elevational view of one of the filtration devices of Fig. 1 having a portion of the front filter pad removed;

FIG. 3 is a cross-sectional view of the filtration device of Fig. 2 taken along the line 3-3;

FIG. 4 is a fragmentary cross-sectional view of the filtration device of Fig. 2 taken along the line 4-4; and

FIG. 5 is a fragmentary perspective view of a spacer of the filtration device of Fig. 2.

Fig. 1 shows two filtration devices 10 in accordance with a preferred embodiment of this invention. The devices 10 are adapted for detachable use with a conventional respirator 12. Respirator 12 comprises a face mask 14 configured to cover a user's nose and mouth and to create an airtight seal against the surrounding facial area. Face mask 14 may be secured by resilient straps 16 which attach to a flexible bracket 18 provided along the outer edge of the face mask. Straps 16 can be adjusted in length using a buckle or cinch means 20.

Face mask 14 includes an exhalation port 22 centrally located adjacent the user's mouth when in use and having a one-way valve through which exhaled air can exit but not enter the respirator. The face mask also includes two inlet ports 24 positioned so as to be adjacent the user's cheeks when in use. Each inlet port 24 comprises an opening formed by a rigid tubular port wall 26 extending outwardly from the front of the face mask. A one-way inhalation valve 28, preferably in the form of a flexible diaphragm valve, is secured at the central axis of a three-leg attachment member 30 to cover the opening in a manner to allow air to be drawn into the interior of the face mask, but to prevent air from exiting through the opening.

Each filtration device 10 is adapted to be secured to port wall 26 so as to provide a closed channel for air flow from the filtration device through inlet port 24 into the interior of the face mask.

With reference to Figs. 2 and 3, filtration device 10 comprises a round disk having a front face 32 which faces forward when secured to the respirator face mask and a rear face 34 which faces the user when the mask is secured in position. Device 10 has a substantially rigid frame 36 comprising an outer ring-like band 38 connected by a plurality of spacers 40 to an inner breather tube 42 which projects toward the user from the rear face 34 of device 10 for attachment to the respirator. Filter pads 44 and 46 are secured over the front and rear faces 32 and 34 of the frame 36 and are maintained in a spaced-apart relationship by means of spacers 40 so as to form an interior volume or central air pocket 48 in communication with breather tube 42. The breather tube 42 is adapted to be detachably connected to port wall 26 in a manner to provide a closed passageway for airflow from the central air pocket to the interior of the face mask through inlet port 24.

Frame 36 may be constructed of any relatively rigid inert material for example from wood, metal, plastic or a combination thereof. The frame is preferably formed as a unitary component from a plastic material that can be easily fabricated, e.g. by injection moulding. It is particularly advantageous to fabricate the frame from a material such as polystyrene, polyethylene or polypropylene so that conventional ultrasonic welding techniques can be used to secure filter pads 44 and 46 to the frame.

Outer peripheral band 38 has an exterior surface 50 which may be grasped by the user to hold the filtration device; an internal surface 52 to which spacers 40 are connected; and front and rear sidewalls 54 and 56 corresponding in direction to the front and rear faces 32 and 34 of the device, respectively. As seen from Fig. 3, band 38 is T-shaped in cross-section so as to provide a peripheral groove 58 along the sidewalls 54 & 56 adjacent internal surface 52 of the band. A peripheral flange 60 is therefore formed by each of the sidewalls 54 and 56 adjacent to the outer surface 50 of band 38.

As shown in Fig. 1, the outer surface 50 of band 38 includes a plurality of equally-spaced ridges 62 which assist the user in grasping the filtration device. Other forms of surface texture may be used for this purpose.

Breather tube 42 forms a tubular opening 43 projecting from the rear face 34 of the device and includes a circular mounting base 64 forming a peripheral flange along

the inner end of the tube. Spacers 40 extend radially outwardly from mounting base 64 and are connected at their other ends to the internal surface 52 of band 38.

A series of air channels 66 are defined within central air pocket 48 by the spacers 40 and each channel 66 opens into that region of air pocket 48 immediately adjacent breather tube opening 43. In order to enable filtered air to flow from channels 66 to breather tube opening 43, a divided spacer 68 is secured over port opening 43 along the inner surface of mounting base 64 to prevent front filter pad 44 from collapsing over the breather tube opening 43.

As shown in Fig. 2, in the currently most preferred embodiment of the invention, spacers 40 are divided along their length into a first inner section 70 and a second outer section 72. Inner section 70 has a diamond-shaped cross section as shown in Fig. 4 such that opposing pointed edges 74 and 76 are positioned in contact with filter pads 44 and 46 respectively. Thus, the spacer and filter pads are in contact only along a fine line and, in consequence, filtration efficiency is not significantly affected.

As seen in Fig. 5, pointed edges 74 & 76 in contact with the filter pads are gradually levelled or shaved within outer section 72 of the spacer as it approaches connection with outer peripheral band 38, thereby generating a hexagonal cross-section. The distance between the edges of the spacer in contact with the filter pads is therefore reduced so as to equal the transverse width of the interior surface 52 of band 38 at the point of connection. In this manner, filter pads 44 and 46 are brought closer together along the outer edges of the pads to assist in securing the pads to the band 38.

Filter pads 44 and 46 may be constructed of one or more layers of any known filter material; the filter material not being critical to the present invention.

Front filter pad 44 is configured to cover the entire front face 32 of frame 36; rear filter pad 46 is configured to cover that portion of rear face 34 of the frame extending from band 38 to breather tube 42. The filter pads are preferably seated in peripheral groove 58 such that the outer edges of the pads and flanges 60 are of sufficient dimension to assure that the outer edges of the filter pads are not exposed.

Sharp protrusions 78 may be provided within peripheral groove 58 and on the outer surface of mounting base 64 to serve as energy directors during ultrasonic welding to attach the pads to the frame.

As shown in Fig. 1, breather tube 42 is detachably secured to the forward end of port wall 26 using a bayonet-type fitting to provide a closed air channel between the face mask and central air pocket 48 . Tabs 80 provided along the outer periphery of port wall 26 are configured to mate with slots 82 formed within the outer edge of the interior wall of breather tube 42. The breather tube is secured over the port wall by fitting each tab 80 into a corresponding slot 82 and turning the device such that tab 80 is conveyed along a track 84 extending from the inner end of slot 82 along the inner edge of breather tube 42. In this manner, the filtration device is pulled inwardly toward the respirator for a more secure attachment. Tab 80 is pushed over a step 86 provided along track 84 to snap the tab into a locking position against the end of track 84. Step 80 serves to prevent the filtration device from becoming inadvertently loosened, the step blocking accidental movement of the tab from the locking position. A peripheral ridge 85 extends outwardly along the outer end of breather tube 42 so as to form an air-tight seal with the outer end of port wall 26.

In the preferred embodiment shown in the drawings, inner breather tube 42 is positioned offset from the central axis of the frame 36. Spacers 40 are of various lengths to accommodate this offset position. By positioning the breather tube in this offset position, the breather tube may be secured to the face mask such that a significant portion of the device is positioned upwardly, downwardly or to the side of the mask. In the illustrated embodiment, tabs 80 and slots 82 are spaced symmetrically such that the individual user may choose the most desired orientation of the filter device. For example, the user may desire to position a majority of the filtration device toward the lower extent of the mask when being used with a welding helmet; or to the side of the mask when being used with a face shield. Alternatively, the tabs and slots may be asymmetrically positioned so that the filtration device 10 will attach to the respirator in only one, predetermined orientation.

To attach filtration device 10 to the respirator, the user grasps the device by outer peripheral band 38, aligns tabs 80 of breather tube 42 with slots 82 of port wall 26, and then rotates the filtration device until tabs 80 lock into position. Because frame 36 is substantially rigid, there is no relative rotation between outer band 38 and breather tube 42. This prevents any twisting or stress which might tear or otherwise damage the filter material.

To remove the filtration device, the user again grasps band 38, rotates the device 10 to snap tabs 80 over step 86 to allow removal of the device 10 from the respirator. Again, the rigidity of frame 36 protects the filter pads from damage. Therefore, any contaminants deposited on the pads are not disturbed and the integrity of the filter material is maintained.

CLAIMS:

1. A filtration device suitable for use in a respirator, characterised in that the filtration device comprises a flexible pad-type filter element disposed within a rigid frame, and an inner breather tube supported by said rigid frame.

2. A filtration device as claimed in claim 1, characterised in that said rigid frame comprises a ring-like band around the periphery of the filtration device.

3. A filtration device as claimed in claim 2, characterised in that the device comprises two pad-type filter elements disposed so that they define an interior volume generally in the form of a cylindrical segment and defined by the inner face of said ring-like band and by opposing faces of the two filter elements.

4. A filtration device as claimed in claim 3, characterised in that said rigid frame further includes a plurality of spacer elements which extend across said interior volume to maintain separation between the filter elements.

5. A filtration device as claimed in claim 4, characterised in that said inner breather tube is connected to said ring-like band by said spacer elements.

6. A filtration device as claimed in claim 4 or 5, characterised in that said inner breather tube extends through one of said filter elements.

7. A filtration device substantially as hereinbefore described with reference to, and as illustrated in, the accompanying drawings.

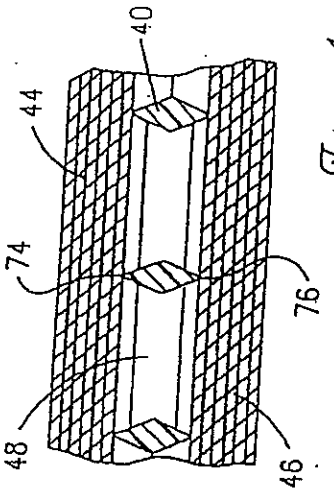
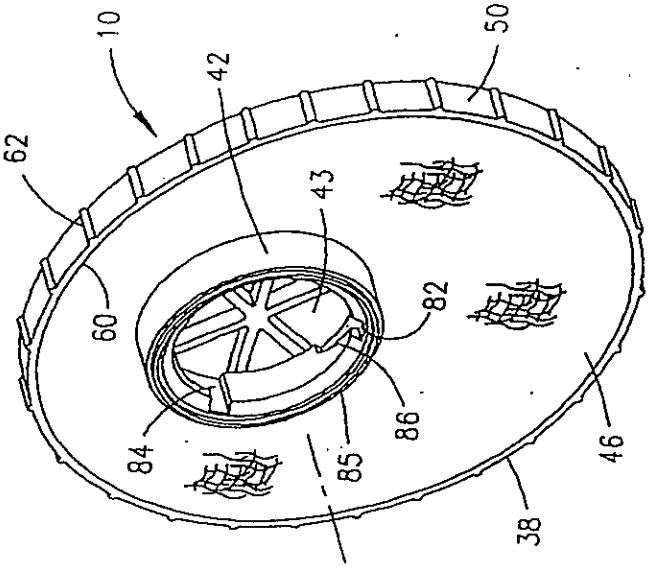


Fig. 4.



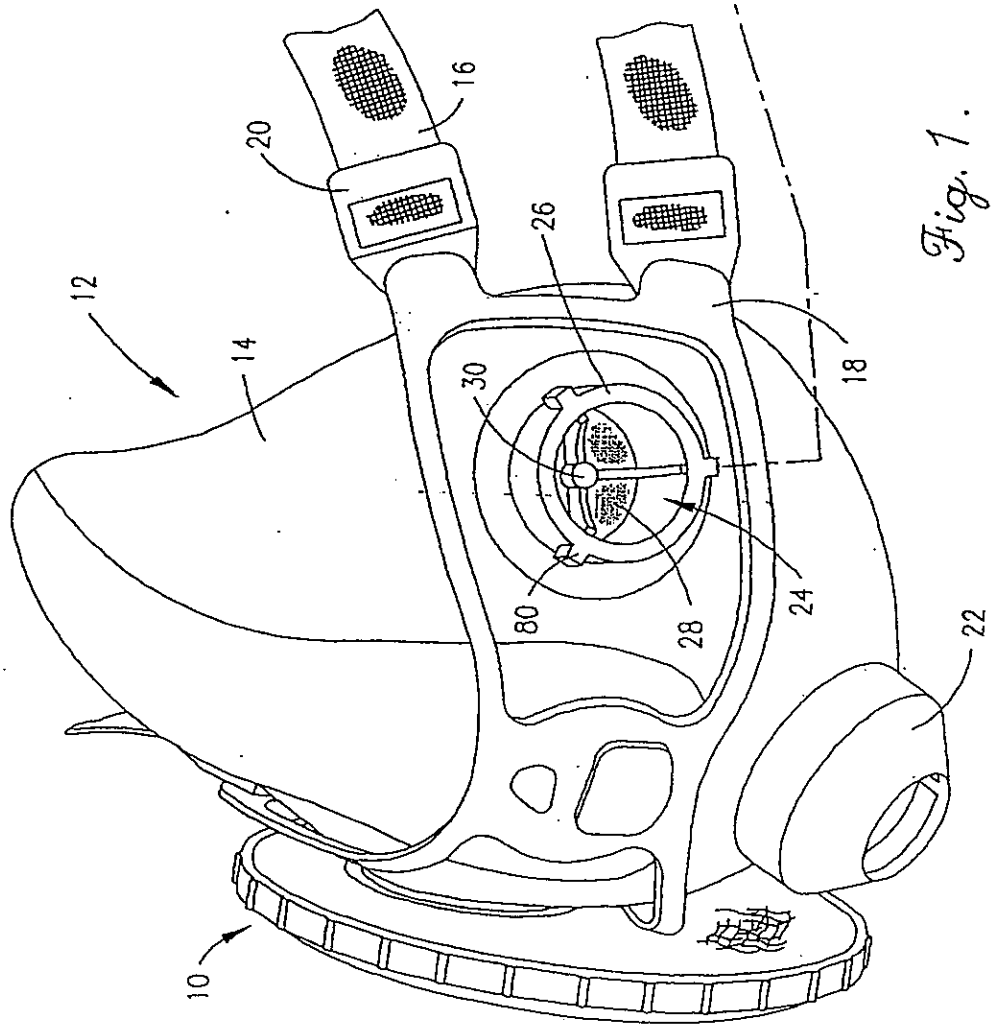


Fig. 1.

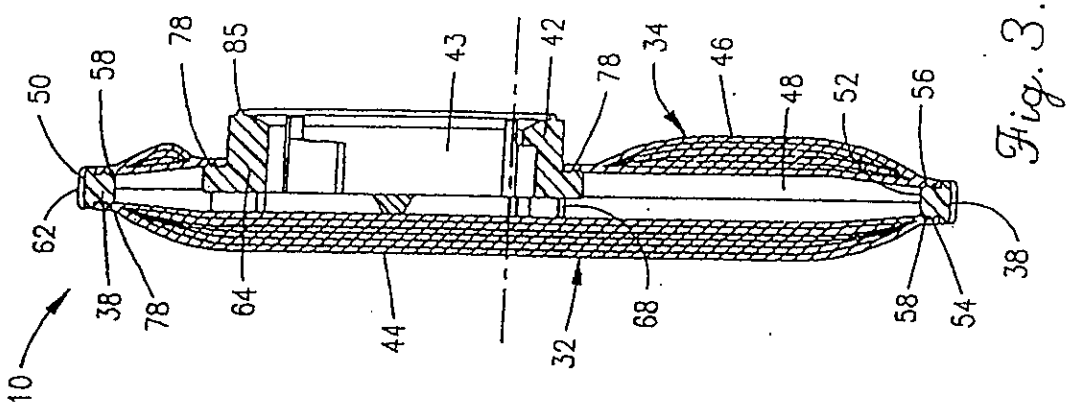


Fig. 3.

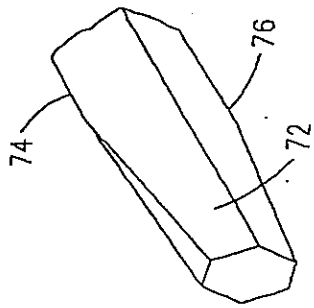


Fig. 5.

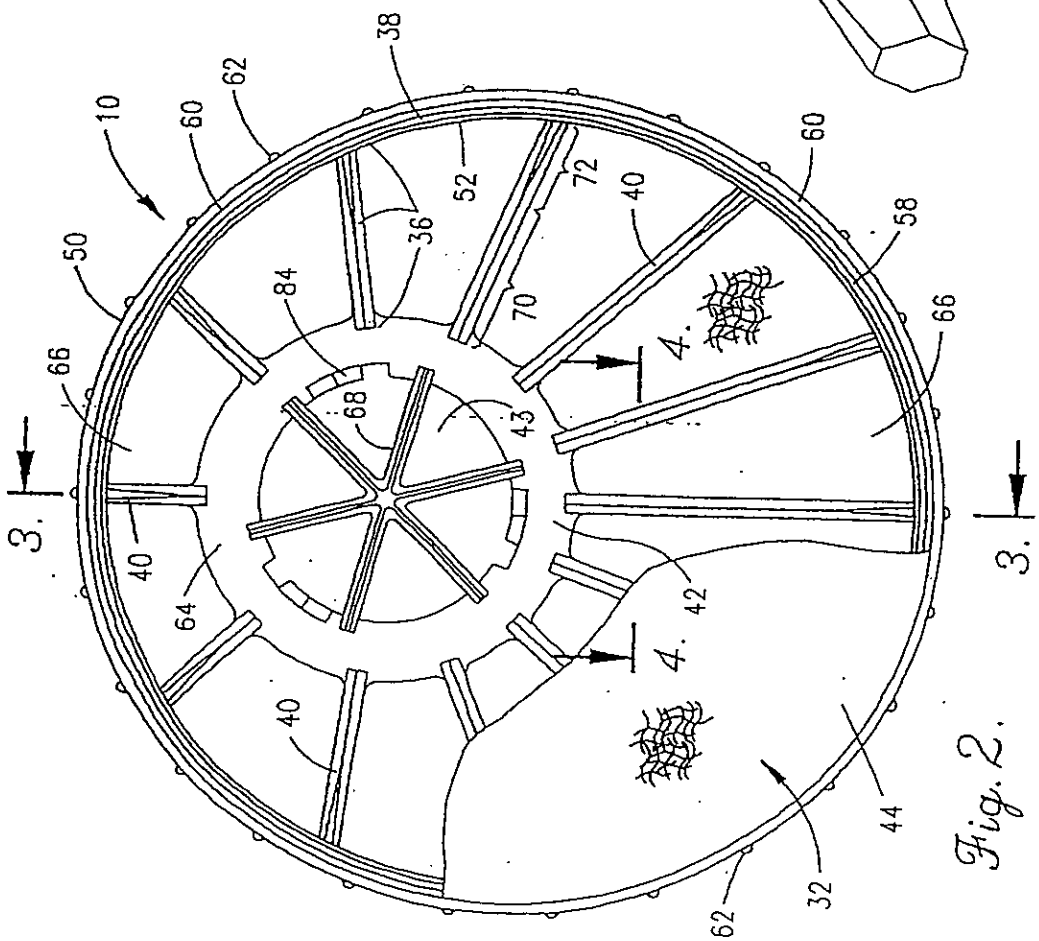


Fig. 2.

GB 2040608 A

(EXTRACTS)

RESPIRATOR FILTER

This invention relates to respirator filters. In particular it is concerned with respirator filters which are in the form of a pad.

Air-purifying respirators are worn on a user's face to protect against noxious gases, vapours and particulates while permitting oxygen to reach the user. Typically, an air-purifying respirator comprises a facepiece which fits over and seals around the nose and mouth; a filter which fits into the facepiece; and a harness which holds the facepiece with its filter in place on the head of the user.

Respirator filters come in various shapes, sizes and materials. There are two basic types of filter, namely those in the form of a rigid cartridge, and those in the form of flexible pads; this invention is principally concerned with the latter.

According to the present invention, there is provided a deformable filter comprising: a first filter element having a non-planar configuration; a second filter element attached to the first filter element along an outer edge of each to create an inner chamber therebetween; such that air can pass through the first or second filter element into the chamber; and a connector located in and attached to one of the filter elements, the connector having an opening therethrough to permit air to pass from the inner chamber to a respirator facepiece.

In preferred embodiments of the invention, the inner chamber is filled with a particulate filtration material.

Generally, it is preferred for the filter to be free-standing; however, the efficacy of filtration does not demand such an arrangement. Thus a support element in the form of an annular member may be provided at the periphery of the filter.

The invention will now be illustrated by referring to the drawing, which shows a preferred embodiment of the invention, and in which:
FIG. 1 is a cross-section of one form of filter in accordance with the invention;

FIG. 1A illustrates an alternative mode of construction for the filter of Fig. 1; and

FIGS. 2-4 illustrate alternative embodiments of filter in accordance with the invention.

In the accompanying Figure, a deformable filter 100 includes a first filter element 101 disposed substantially opposite to a similarly shaped second filter element 102. First filter element has an inner surface 103, an outer surface 104, and a perimeter 107. Second filter element has an inner surface 105, an outer surface 106, and a perimeter 108. At least one of the first and second filter elements 101 and 102 is, in its stress free configuration, of non-planar configuration. This may be accomplished by thermoforming, moulding, or other processing techniques known in the art. Because of the stress-free, non-planar shape of either element 101 or element 102, or of both, an inner chamber 109 is created between and defined by inner surfaces 103 and 105 and perimeters 107 and 108. Perimeters 107 and 108 define an edge 110 impermeable to air, gas or vapour. Perimeters 107 and 108 may be joined together directly or by sandwiching a flexible or rigid perimeter support element 121 as shown in Fig. 1A.

Air being filtered by the device enters inner chamber 109 through outer surfaces 104 and 106 of first and second filter elements 101 and 102, and exits through at least one opening 111. Alternatively, the direction of flow of fluid being filtered may be reversed, that is, opening 111 provides an inlet for fluid being filtered and filtration is accomplished by passing the fluid through inner walls 103 and 105 of elements 101 and 102 respectively.

Figs. 2-4 show cross-sectional views of alternative stress-free shapes of filter 100.

GB2040608 A

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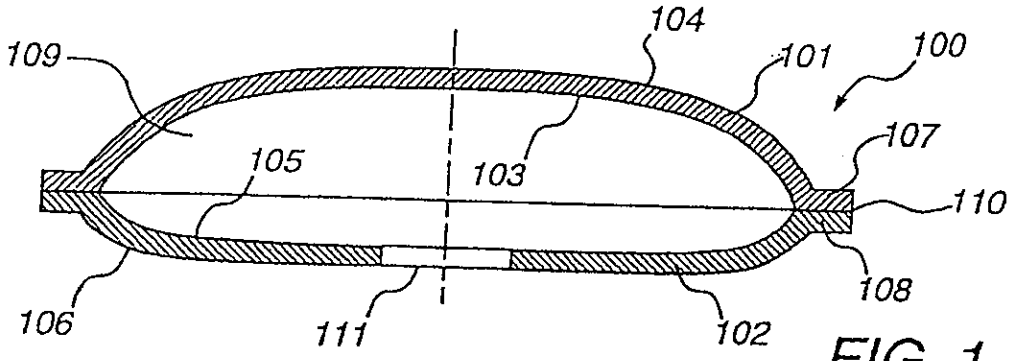

FIG. 1

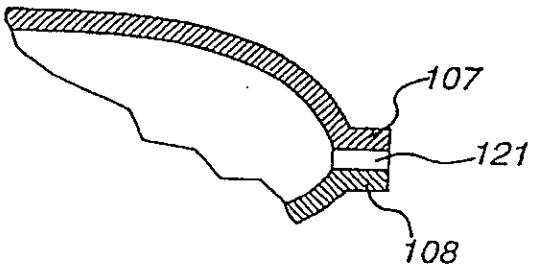

FIG. 1A

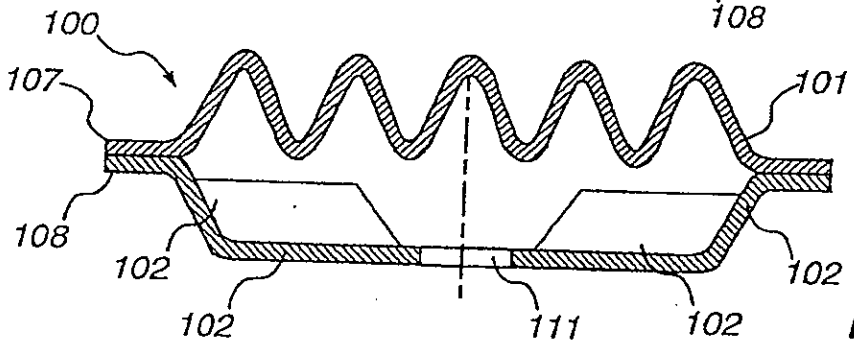

FIG. 2

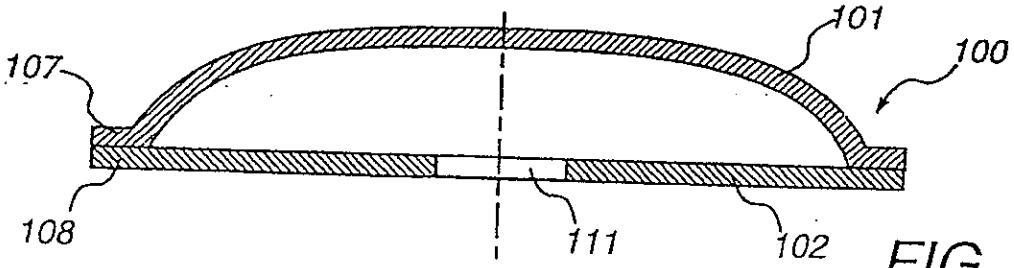

FIG. 3

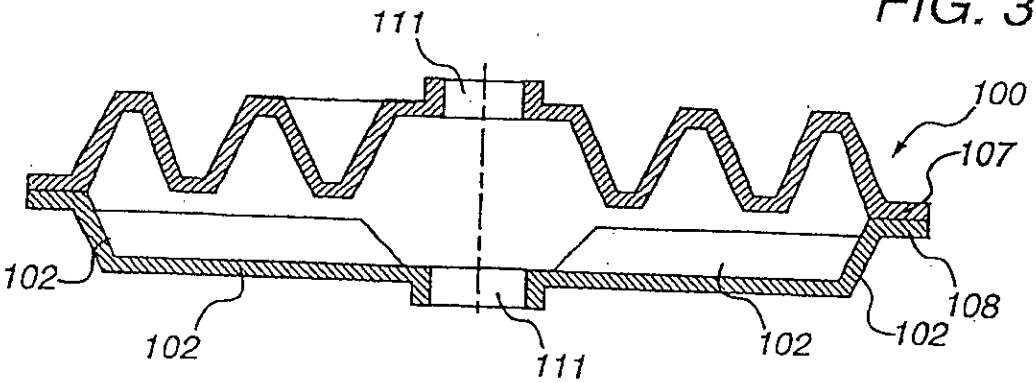

FIG. 4

Mine Safety Gazette
Issue 322 - March 1st 2000

Our reporter at the recent World Mining Conference in Johannesburg has found a novel way of dealing with a particularly troublesome form of airway obstruction in cartridge-type filters. As our readers will be aware, these filters comprise an outer body formed of a rigid material which houses a pair of filter pads. An inlet port is formed in one face of the cartridge body to admit air to the filter pads, and an outlet - generally termed a breather tube - passes though the other face of, and is held in place by, the cartridge body so that filtered air can reach the interior of a face mask and thence be inhaled by the user. A pressure drop is created across the filter due to the resistance of the filtration material to the passage of air, and in some circumstances it is possible for the two filter pads to come together, thereby creating a temporary obstruction of the airway between the inlet and outlet ports. Conventionally, this problem has been solved by providing a particulate filter material within the central cavity of the cartridge; while this is effective in keeping the filter pads apart, it increases the breathing resistance and so makes the device less suitable for asthmatics and others with weakened breathing.

The simple solution proposed by the American corporation Nebulon, Inc. is to fit a spacer in the central cavity between the two filter pads. At present the design of the spacer is a closely guarded secret, but we are informed that extensive trials have proved the worth of this development.

Bill Digger, CEO of Nebulon, Inc., said he was proud to have developed this novel improvement designed exclusively for use with cartridge filters.

Mine Safety Gazette
Issue 325 - June 3rd 2000

Following up on the report in our March issue, we have now learnt that the new spacer for the interior cavity of cartridge-type filters comprises a series of radial spokes attached at their outer limit to a ring-like member which extends around the periphery of the filter pads within the body of the cartridge. The spokes are profiled to minimise any obstruction of the total filtration surface. Furthermore, a re-evaluation of the development has suggested that the spacer may well find application in stand-alone filters as well as cartridge-type filters.