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Walkenhorst

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[54] **ELECTRICALLY OPERATED DUST MASK**

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[52] **U.S. Cl.** **55/123,** 55/131, 55/136, 55/146, 55/155, 55/485, 55/DIG. 35

[51] **Int. Cl.**.....**B03c 3/04**

[58] **Field of Search**....55/2, 155, 123, 131, 132, 143, 55/145, 101, 146, 151, 136, 137, 485, DIG. 35

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[57] **ABSTRACT**

A breathing filter for dust filtering masks in which electrodes in the form of insulated metal wires are employed. The polarity of the electrodes changes in periods which are of greater duration than the duration of dust particles in the filter, but is less than the time required for equalizing the difference in potential of the electrodes. Hardly any electrical energy is used so that a source of voltage of low yield can be used.

2 Claims, 8 Drawing Figures

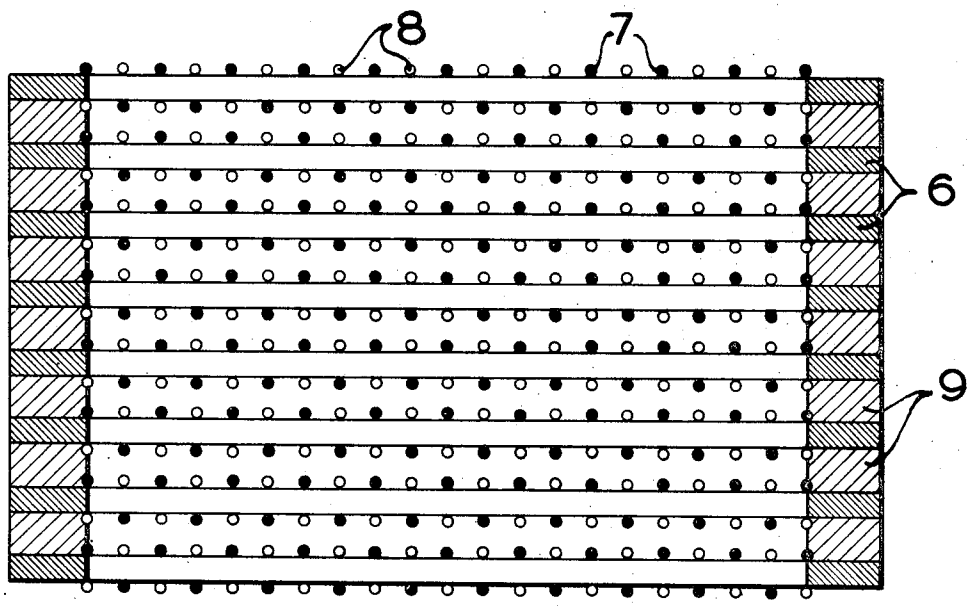

FIG.1a

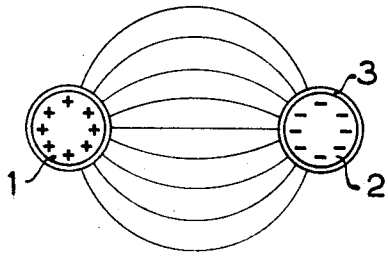

FIG.1b

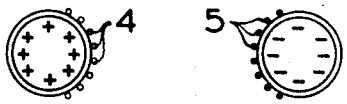

FIG.1c

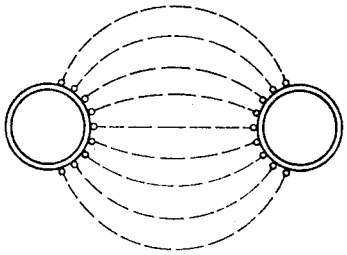

FIG.1d

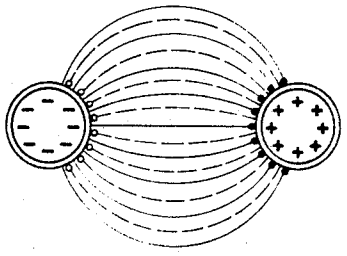

FIG.1e

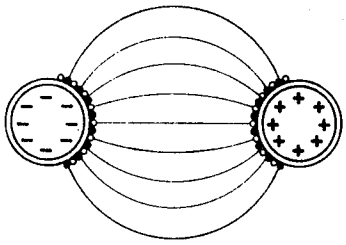

FIG.1f

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FIG. 2

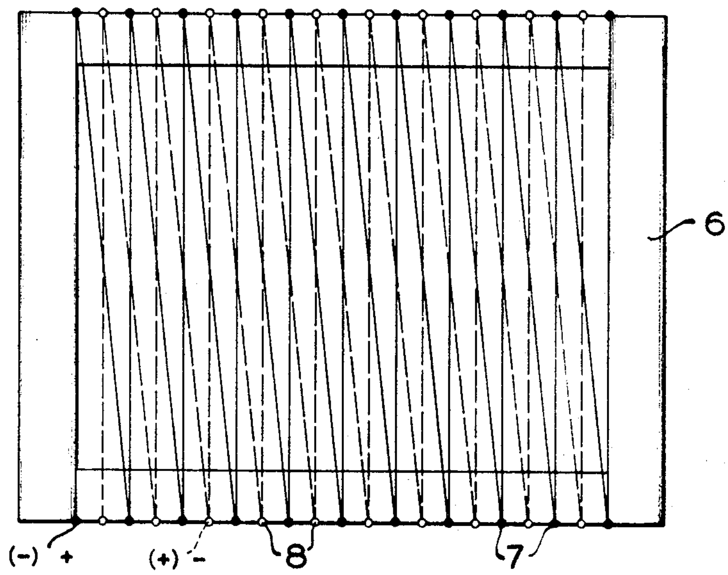
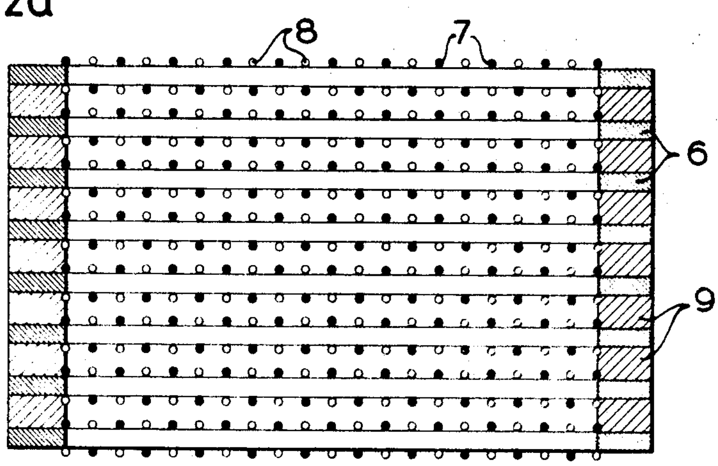


FIG. 2a



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ELECTRICALLY OPERATED DUST MASK

BACKGROUND OF THE INVENTION

The invention relates to a breathing filter for dust filtering masks for the separation of particles out of gases through a non-homogeneous electric field, which is produced with the aid of positively and negatively charged electrodes.

Filters according to the invention are for removing dust, above all finely divided dust, particularly out of the breathing air for the prevention of silicosis, whereby the temperature of the gases and their moisture should in principal remain without influence on the filtering effect. These filters are particularly adapted for dust filtering masks in mining, in whose construction, the danger of explosion and other considerations are additionally to be considered.

It is known that the dust carried away by gases, particularly by air, have electrical charges, which may derive from the comminution of the dust forming material, and frequently constitute several thousand electric element charges. The polarity of the charges is different. In many cases, the charges are not distributed symmetrically, but outweigh charges of the one or the other indication. The electric separation of dust rests on the forces which an electric field exerts on the charged, and under certain circumstances also on the uncharged particles. It is superior to mechanical dust separation. In any case, when a relatively large mass of gas possesses correspondingly small dust content, the forces to be produced for the dust separation with mechanical means must be produced through effect on the mass of gas, somewhat through acceleration.

Electrofilters with non-homogeneous electric field are likewise known per se. In breathing masks for this purpose frequently plate electrodes are provided, between which a mass of fibers for the different materials coming into question, is packed in. These fibers bring about the non-homogeneousness of the field and additionally a mechanical separation of the dust. On the other hand, the non-homogeneousness of the electric field thus attainable and therewith the degree of effectiveness of the electric separation of the dust are low. Unfavorable are the side effects of such filters deriving from the fiber packing, among them above all the relatively great breathing resistance and the low sound permeability of the filter. This has a particularly disadvantageous effect in hot and non-supervisable operations.

Additionally, in the separation of the dust, the difficulty may arise that masses of dust are of different polarity, causing a sudden electric discharge. Under certain circumstances, mixtures capable of ignition, such as a pocket of natural gas, may be ignited.

SUMMARY OF THE INVENTION

The invention proposes to eliminate such disadvantages, and to provide a filter, particularly a breathing filter for dust filtering masks, in which for the non-homogenization of the electric field, no fibers or fibrous materials are employed.

In accordance with the invention, this problem is solved by constructing each electrode of metal wires with insulated surface, the metal wires having a diameter of approximately 0.1 mm. and the spacing of the metal wires of different polarity amounting to approximately 0.5 mm. The polarity of the electrodes changes in periods which are greater than the duration of the particles of dust in the filter, but is less than the time required for the equalization of the difference in potential of the electrodes.

In the filters according to the invention, the filter fibers previously used are replaced by good electrically conducting, metallic, thin wires with insulated surface. The electric voltage may amount to from 300 to 500 volts. By a good surface insulation of the wires, hardly any electrical energy is used, so that a source of voltage of very low yield and therewith of small dimensions is utilizable.

Such filter makes use of the electric charges of the dust particles for the filtration operation. It prevents, however simultaneously, an accumulation of electric charges of an indication, because the polarity of the electrodes changes periodically. In view thereof, ignition of the dust or surrounding gas mixtures is prevented. The filter has a relatively large free surface and accordingly a very low breathing resistance, but also has a good sound permeability.

The surface of the metal wires may be provided with hills and valleys for the reinforced non-homogenization of the electric field. Such hills and valleys may be produced by roughening the wire surface. The metal wires are provided with an insulating coating which may consist of varnish or lacquer customarily used therefor. The insulation of the metal wires is prepared moisture-repellent, where the filter is to be utilized in moist gases or gases charged with moisture.

The details of the invention will be explained more fully in the following on the basis of the figures of the drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIGS. 1*a* to 1*f* are views showing diagrammatically the modus operandi of the filter according to the invention;

FIG. 2 is an elevation of an embodiment of the invention; and

FIG. 2*a* is a plan view of the embodiment shown in FIG. 2.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIGS. 1 to 1*f* show, for example two individual wires and the effect attained in the filter according to FIG. 2*a*, where the wires are shown in cross-section. Between the wires is located an electric field.

FIG. 1a presumes that the left wire is charged positively and the right is charged negatively. The electric field resulting between the wires is indicated with field lines, which extend from left to right. The field is non-homogeneous. The non-homogeneousness results by means of the curved surface of the electrodes. The insulating coating 3 which the surfaces of the electrodes 1 and 2 carry, prevents a flow of current after application of an electric voltage even then when electrically conducting particles of dust are separated in the filter so that eventually conducting bridges result between the wires.

The dust particles 4 are accumulated with negative charging 4 and with positive charging on the insulated wire surfaces. The accumulated particles of dust

change simultaneously the field between the wires, because the negative particles of dust accumulated on the wire 1 with positive polarity and the dust particles 5 with positive charging on the wire 2 diminish the field with increasing dust separation. This complete removal of the electric field between the electrodes 1 and 2 is to be prevented in the practice, and is illustrated in FIG. 1*b*.

In FIG. 1*c* is illustrated a condition which sets in when the voltage on hand before the dust separation is disconnected and this part of the charging of the wires 1 and 2 is removed. Then there are still active solely the charges of the dust particles, which build up a field which is illustrated in dotted lines. When this field has the same strength as the starting field according to FIG. 1*a*, then its direction is solely reversed.

If now the polarity of the electrodes is reversed, that is the electric voltage is reversed as to polarity, then there results the condition according to FIG. 1*d*. The wire 1 is then negative, the wire 2 is charged positively. The charging of the dust particles and the source of voltage applied accumulate. Subsequently, there results a field which is stronger than the starting field. In any case, the field weakens again with the application of further particles of dust, this being illustrated in FIG. 1*e*. FIG. 1*f* shows the condition which fundamentally corresponds to that according to FIG. 1*b*, in which the particles of dust divided off on the surface of the wire exactly compensate with their charges the field applied.

The filter illustrated in FIGS. 2 and 2*a* utilize several individual elements. Each element consists of a frame 6, on which are wound two layers of wire 7 and 8. The wires of one layer are positive, those of the other layer are charged negatively. Negatively charged wires are illustrated solely in their circular contour, positively charged wires are illustrated by means of filled out circles. The wires which form the electrodes do not need to lie parallel to one another, that is, to be arranged like a harp, but rather, net-like arrangements are also utilizable.

The frames 6 are layered superimposed in the filter and are held spaced from one another by elements 9. In the embodiment by way of example, eight individual frames are present.

In the illustrated filter, the period of time between two polarity changes is greater than the duration of the dust particles in the filter. It is, however, smaller than the time required for the neutralization of the electrodes through dust charges. In practice, period changes result between several seconds to several minutes.

Although the invention has been explained mainly for breathing filters for dust-filtering masks, among them chiefly for such as used in mining, the outstanding characteristics of such filters may be utilized also in other branches of industry, and filters with other dimensions may be carried out, whereby the resistance to temperature of such filters, which reaches beyond several 100° C., still substantially increases their possibilities of use.

What I claim is:

1. Breathing filter especially for dust masks, for the separation of dust particles from gases comprising a plurality of frames arranged in superposed relation, positively and negatively charged electrodes on each frame, said electrodes comprising two similar layers of metal wires extending back and forth between the sides of each frame, the wires of one layer being charged positively and those wires of the other layer being negatively charged, a moisture-repellent insulating coating for each of said wires, each wire being of a diameter of approximately 0.1 mm. and wires of different polarity being spaced approximately 0.5 mm., hills and valleys on the surface of said wires for the reinforced nonhomogenization of the electric field, and spacers separating one frame from another, whereby the polarity of the electrodes may be changed in periods which are greater than the duration of the dust particles in the filter but less than the time required for the equalization of the potential difference of the electrodes.

2. Breathing filter according to claim 1, in which the wire layers are harp-like in arrangement.

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