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(71) Applicant: **THE WESTERN TRADING COMPANY (LONDON) LIMITED**
The Green
Southhall Middlesex UB2 4DE(GB)

(72) Inventor: **Selden, Otto Carl**
72 Emlyn Road
London W12(GB)

(72) Inventor: **Stern, Malcolm**
Firs House Home Farm Road
Rickmansworth Hertfordshire(GB)

(74) Representative: **Smith, Philip Antony et al,**
REDDIE & GROSE 16 Theobalds Road
London WC1X 8PL(GB)

(54) **Filter element for electrostatic air cleaner.**

(57) An insulating ribbon 10 coated on both faces within an electrically conductive paint is wound into a spiral coil on a core 11 and enclosed by a sheath 12. Spacers 13 are formed by insulating strips perpendicular to the turns of the coil whose ends are twisted through 90° and welded to the margins of the ribbon. Electrical contacts to the two faces of the ribbon are formed by contact strip 22 on the core and contact strip 24 on the sheath (through its ends 23).

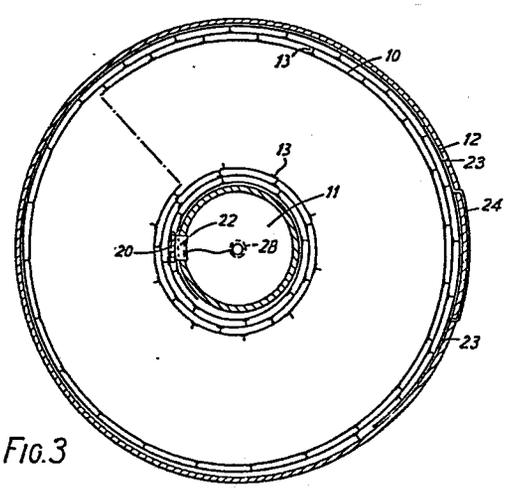

Fig.3

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FILTER ELEMENT FOR ELECTROSTATIC AIR CLEANER

This invention relates to a filter element for use in an electrostatic air cleaner. In such a cleaner air to be purified passes through an ionizer and thence through a filter element which electrostatically removes charged impurities.

In conventional electrostatic air cleaners the filter element must be removed periodically for cleaning, which entails the use of washing equipment which may not be on hand. Cleaning also requires the time of an operative and thus increases the expense.

According to the present invention there is provided a filter element for use in an electrostatic air cleaner, the element comprising an insulating support layer having on each of its sides a layer of conductive material, the support layer being wound to form a coil with gaps between the turns, to allow air to pass through the gaps, axially of the coil.

Preferably the support layer is an elongate band which is wound to form a coil of required shape. The band may have insulating spacers on one side, which determine the gap between successive turns of the coil. In a preferred construction each spacer is formed by a narrow strip which extends between the edges of the band and lies in a plane perpendicular to the surface of the band, i.e. radial to the coil. The ends of the strip are twisted through 90° and offset so that they can be welded to marginal zones of the insulating band which are not covered by the layer of conductive material.

In use, the filter element is fitted in an electrostatic air cleaner, downstream of an ionizer. Electrical contacts are made to each of the layers of conductive material. When the air cleaner is operated one acts as a cathode and the other as an anode. Air to be purified is fed through the ionizer, in which impurity particles are charged, and then passes axially through the coil. The charged particles are attracted to and collected by the conductive layers acting as electrodes.

The gap between successive turns of the coil must be sufficiently large to prevent electrical discharge between the layers of conductive material due to their difference in potential.

Filter elements according to the invention can be made and sold cheaply, as disposable items.

The invention will now be described in more detail with the aid of an example illustrated in the accompanying drawings, in which

Fig. 1 is a perspective view of a filter element in accordance with the invention,

Fig. 2 is a detail of the turns of the coil of the filter element of Fig. 1 showing the construction of the spacers,

Fig. 3 is a view from one end of the filter element in the direction of air flow, and

Fig. 4 is a partial diametrical section of filter element.

The filter shown in the drawings is formed from a ribbon 10 of electrically insulating material wound into a coil on a central cover 11 and surrounded by an outer sheath 12, the turns of the coil being separated by spacers 13. As seen particularly in Fig.2 each face of the ribbon 10 is coated with a conductive layer 14 which stops short of the edges of the ribbon to leave clear margins 15 and 16. Each spacer 13 consists of a strip whose main length 17 lies in a plane perpendicular to the surface of the ribbon 10 and whose ends 18 and 19 are turned through 90° and offset to lie in the plane containing one edge of the length 17 so that they can be welded to the marginal zones 15 and 16 respectively.

The inner face of the innermost turn of the coil is clamped against the core 11 by an insulating bar 20 and clamps 21 so that the conductive layer on that face engages an electrical contact strip 22 on the core. The outer face of the outer turn of the coil is free of spacers and its conductive layer is engaged by the ends 23 of an electrically-conductive resilient metal strip 24.

The outer sheath 12 is formed of a tube of cardboard. The mid-region of the contact strip 24 is on the outside of the sheath with the ends passing through slots to the inside of the sheath. The central core 11 consists of a cardboard cylinder 25 with end caps 26 and 27. The core 11 and the sheath 12 are held together by six rods 29 on one end of the filter element and six similar rods 30 on the other end. An electrical terminal 28 on the end cap 26 is connected to the contact strip 22.

In the preferred construction the coil is formed from a ribbon of polyvinylchloride (PVC) 15 meters long and 90 mm wide coated on each side with a conductive graphite paint over 80 mm of its width, leaving marginal zones of 5 mm width at each edge. The spacers are also formed of PVC strip which is 4 mm wide and each spacer has its ends formed by cold crimping to lie in a plane perpendicular to the main length of the strip and aligned with one edge thereof. These ends are welded to the marginal zones of the ribbon. The distance along the ribbon between spacers is conveniently about 35 mm.

The two metal contacts 24 and 28 of the filter element engage respective supply contacts when the filter element is fitted into an air cleaner. Each supply contact is depressed against a spring bias when the filter element is fitted. Leaf springs may conveniently be used.

When the air cleaner is switched on, air is passed through a conventional ionizer operating at a voltage of about 7kV, and thence axially through a filter element. The potential difference between the anode and the cathode of the filter element is about 3.5kV. Charged impurity particles collect on the electrodes and the filtered air passes on.

If the air cleaner has a filter duct of elongate cross-section transverse to the throughflow direction several spiral filter elements may be fitted in a row, across the duct, or else a filter element having a generally elliptical coil may be used.

It would be possible to use a filter element comprising a coil of generally rectangular cross-section, although some care in design would be needed to prevent discharge at the corners of the coil, due to their field intensifying effect.

A coil according to the invention, coated with conductive material on both sides, can form a capacitor of sufficient magnitude to act as the storage capacitor in the rectifier circuit providing the high voltage supply for the filter element. Furthermore, if the filter includes two electrically independent coils they can be used as the storage capacitors in a voltage doubler circuit of the type commonly used to obtain the high voltage required for the ionizer section of an electrostatic filter.

CLAIMS:

1. A filter element for use in an electrostatic air cleaner, the element comprising an insulating support layer having on each of its faces a layer of conductive material, the support layer being wound to form a coil with gaps between the turns, to allow air to pass through the gaps, axially of the coil.

2. A filter element as claimed in claim 1 in which the support layer has insulating spacers attached to one face to determine the gap between successive turns.

3. A filter element as claimed in claim 2 in which each spacer is a strip extending across the support layer between the edges thereof and lying in a plane perpendicular to the support layer.

4. A filter element as claimed in claim 3 in which the support layer is a ribbon with the layer of conductive material stopping short of the edges of the ribbon to allow a margin for the attachment of the spacer strips, each strip having its ends turned through 90° and attached to the margins of the ribbon.

5. A filter element as claimed in claim 4 in which the support layer and the spacer strips are composed of a similar insulating synthetic resin material and are attached by welding.

6. A filter element as claimed in claim 1 or 3 in which the layer of conductive material is formed by the application of a conductive paint to the support layer.

7. A filter element as claimed in claim 1 or 3 in which the coil has a central core and an outer sheath which are coupled by rods extending across the faces of the coil to centre the core within the sheath.

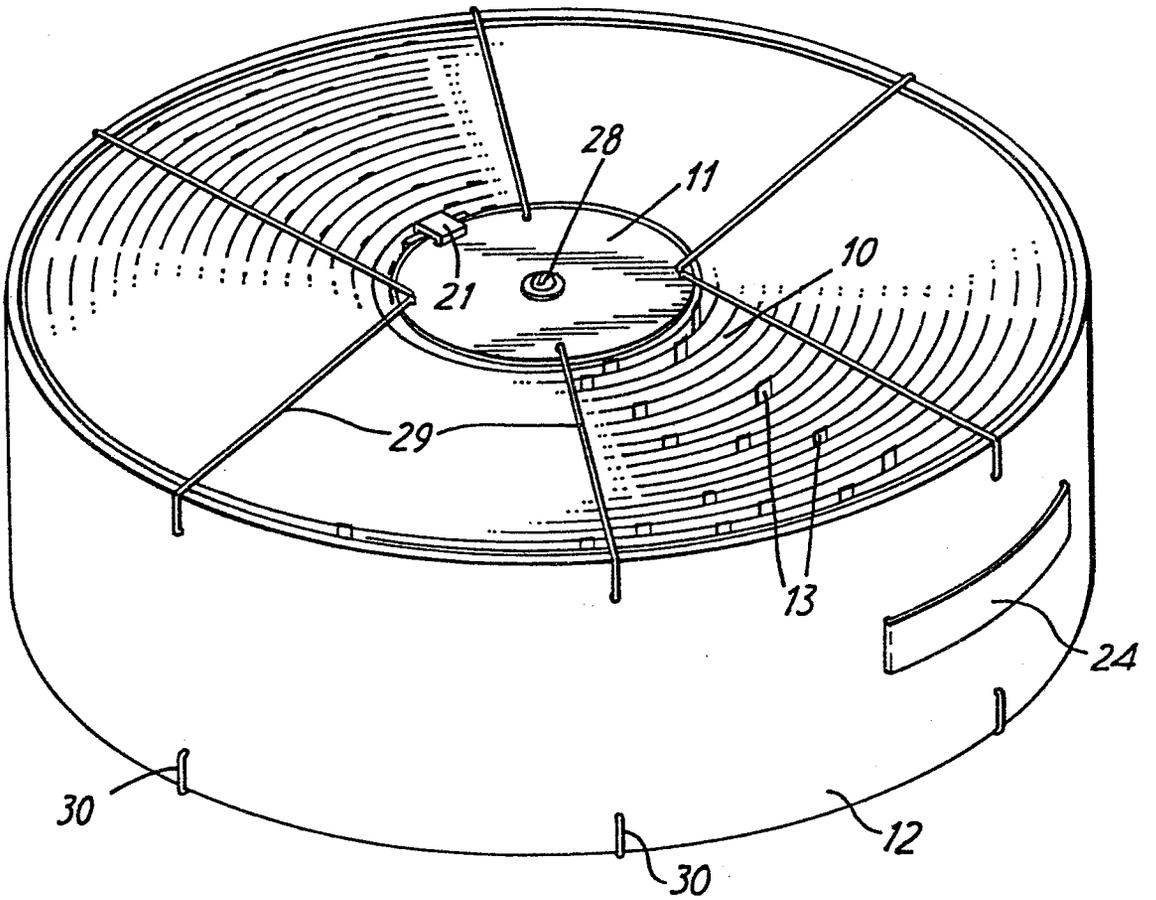

FIG.1

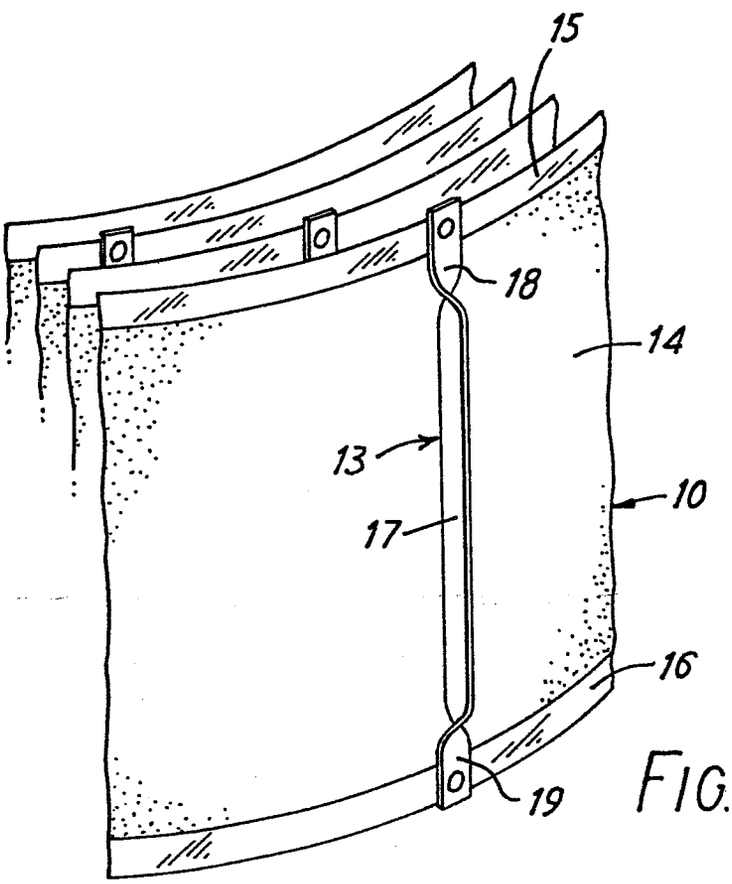

FIG.2

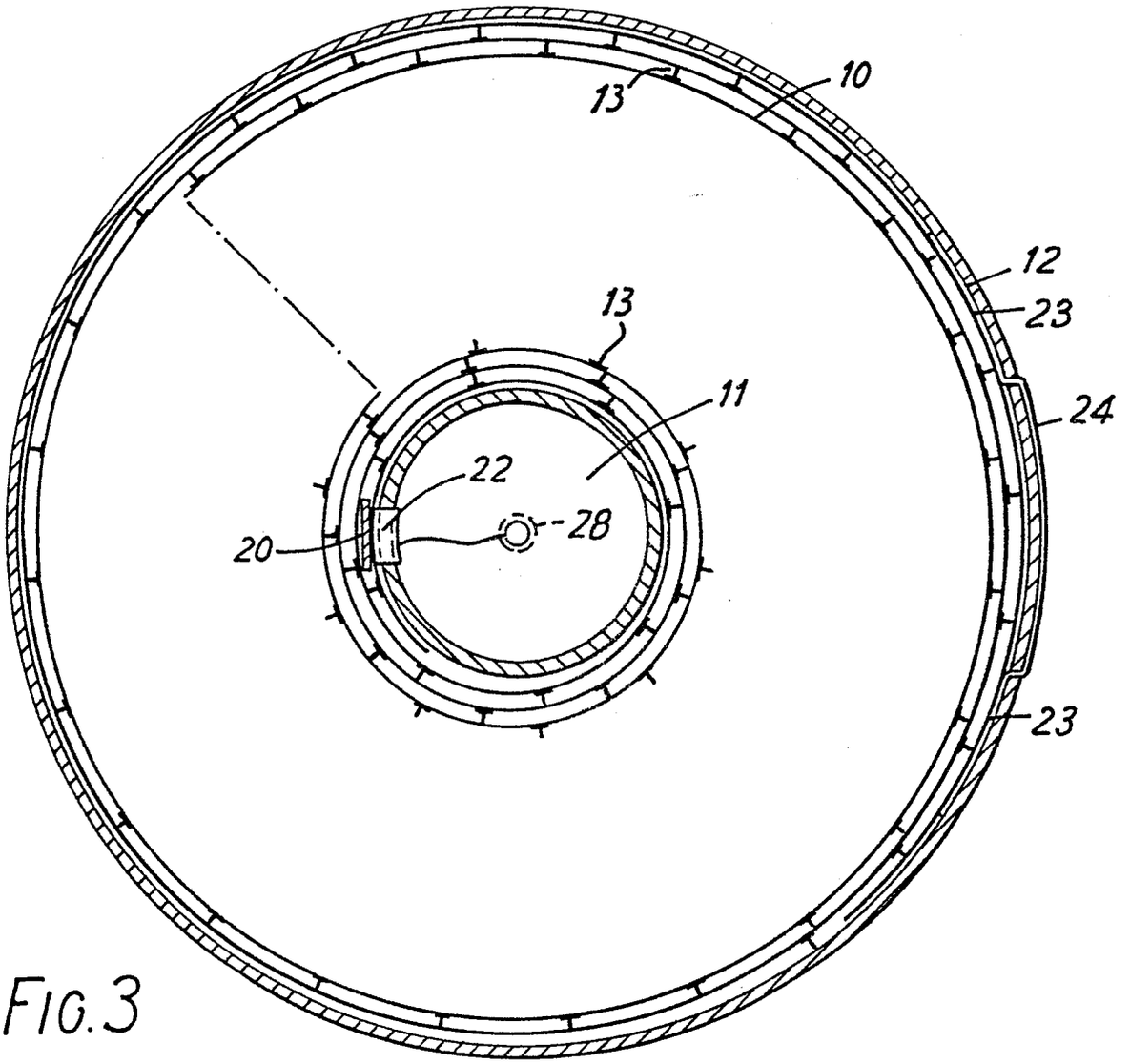
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FIG.3

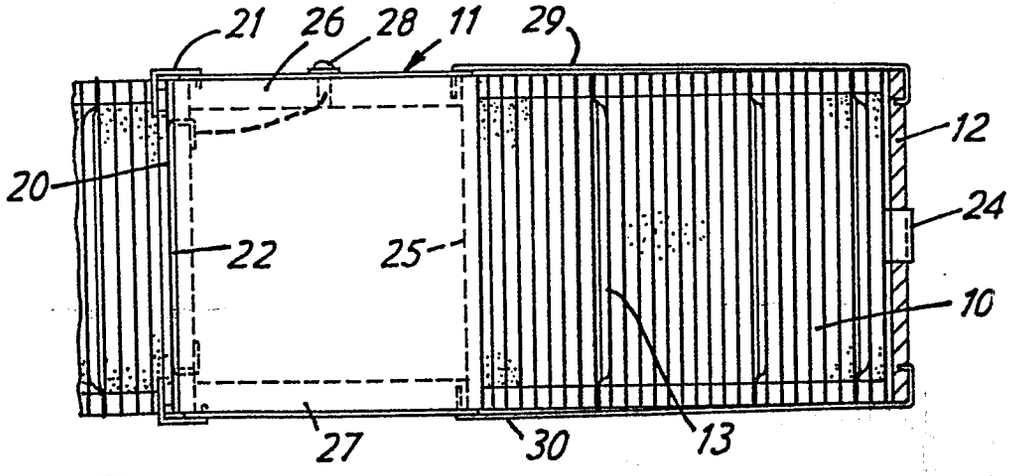
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FIG.4

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EUROPEAN SEARCH REPORT

0129401

Application number

EP 84 30 3991

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int Cl ³)
X	US-A-4 313 741 (S. MASUDA et al.) * claims 1,2; column 5, line 59 - column 6, line 33; figures 8,9 *	1,2,4, 6,7	B 03 C 3/49 B 03 C 3/60
X	US-A-4 234 324 (C.E. DODGE) * claim 1; column 3, line 50 - column 4, line 2; column 6, lines 12-15; figures 1-3,11 *	1,3	
X	FR-A-1 400 684 (NIPPON KUKI KOGYO K.K.) * abstract, points 1,5,6; page 3, right-hand column, paragraph 2; figures 7A,7B,7C *	1,2,7	

TECHNICAL FIELDS SEARCHED (Int. Cl ³)

B 03 C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	13-09-1984	DECANNIERE L.J.

CATEGORY OF CITED DOCUMENTS

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