

(12) UK Patent Application (19) GB (11) 2 160 447 A

(43) Application published 24 Dec 1985

(21) Application No 8515023

(22) Date of filing 13 Jun 1985

(30) Priority data

(31) 59/128494 (32) 22 Jun 1984 (33) JP

(71) Applicant  
Midori Anzen Industry Co. Ltd. (Japan),  
4-3 Hiroo 5-chome, Shibuya-ku, Tokyo 150, Japan

(72) Inventors  
Naoki Sugita,  
Yutaka Hatta

(74) Agent and/or Address for Service  
Mathys & Squire,  
10 Fleet Street, London EC4Y 1AY

(51) INT CL<sup>4</sup>  
B03C 3/14

(52) Domestic classification  
B2J 101 203 206 D1  
U1S 1272 B2J

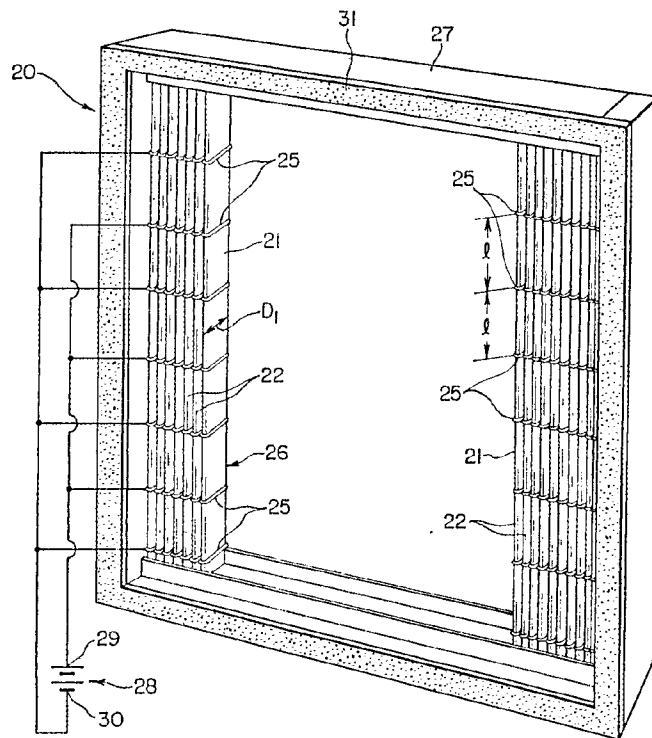
(56) Documents cited  
GB A 2110119 GB 1357303  
GB A 2083380 GB 0892908

(58) Field of search  
B2J

(54) Electrostatic filter dust collector

(57) The collector has a dust collecting section comprising mini-pleat type filter member 26 having a small width of the fold thereof and a short distance between the adjacent ridge portions thereof and a plurality of spacers 25 (24 Figs 4 & 5) inserted into the filter member from the upstream and downstream sides thereof, the percentage of the contacting area of the spacers with respect to the filter member is low, and the percentage of the dust collecting area thereof is high. Either or both of the upstream and downstream spacers are electrically conductive, and a high voltage is applied between the corresponding conductive spacers, so that a uniform and stable electric field is generated on the filter member as a whole. A charging section (to Figs 2 & 5) having flat electrodes (8) and discharge wires (16) is mounted upstream of the filter member.

FIG. 3



GB 2 160 447 A

FIG. 1

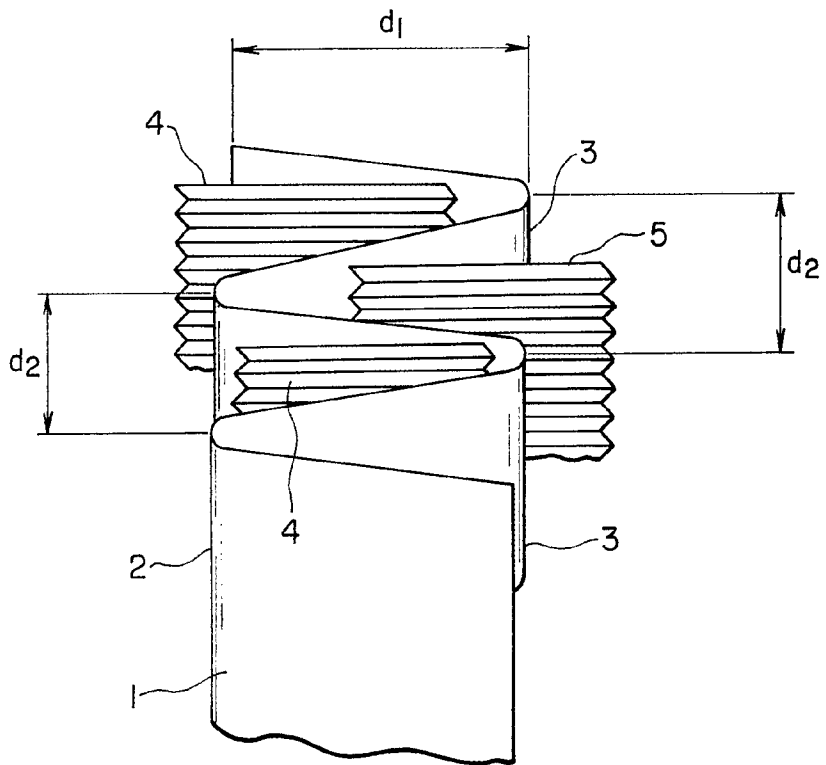


FIG. 2

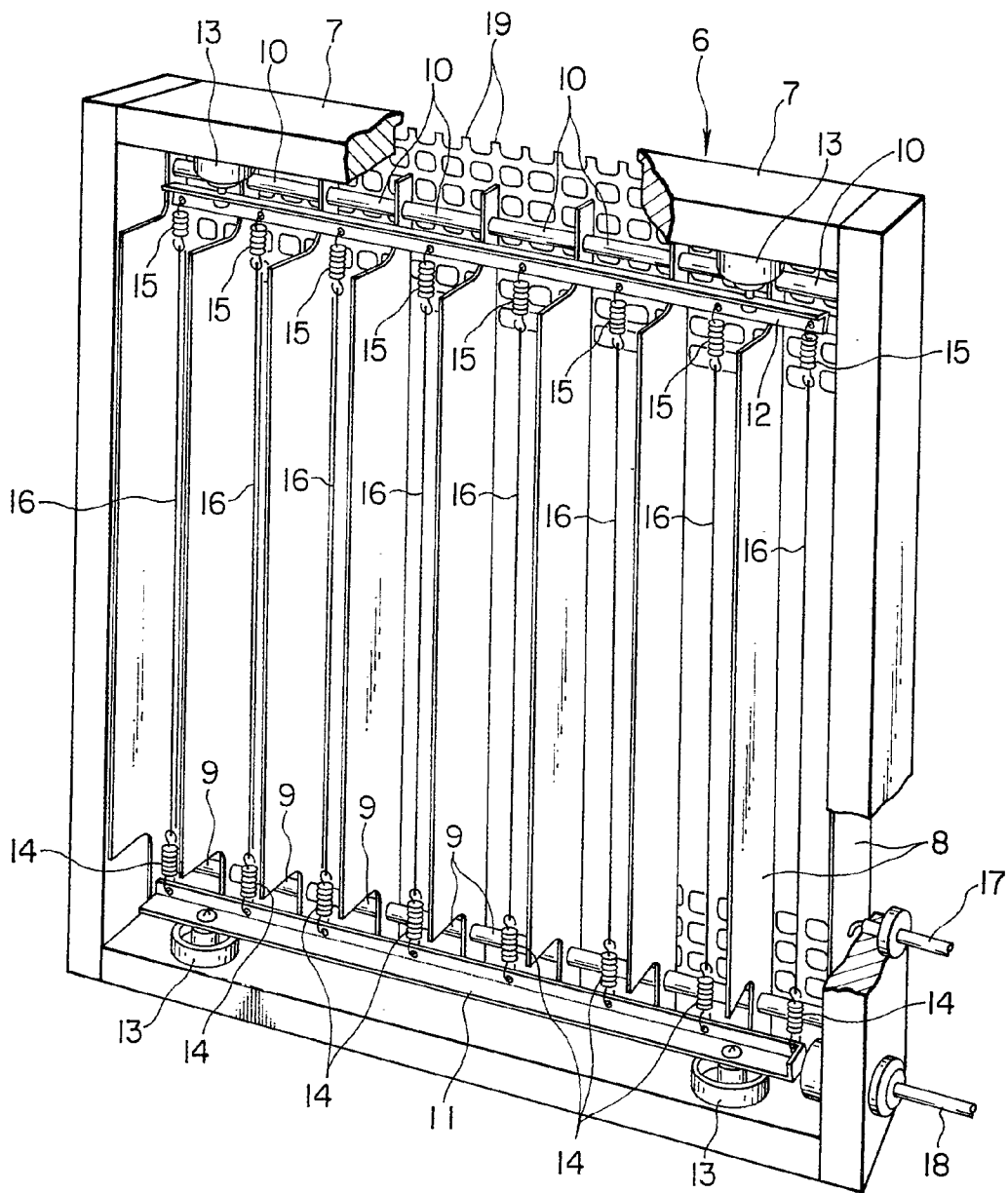


FIG. 3

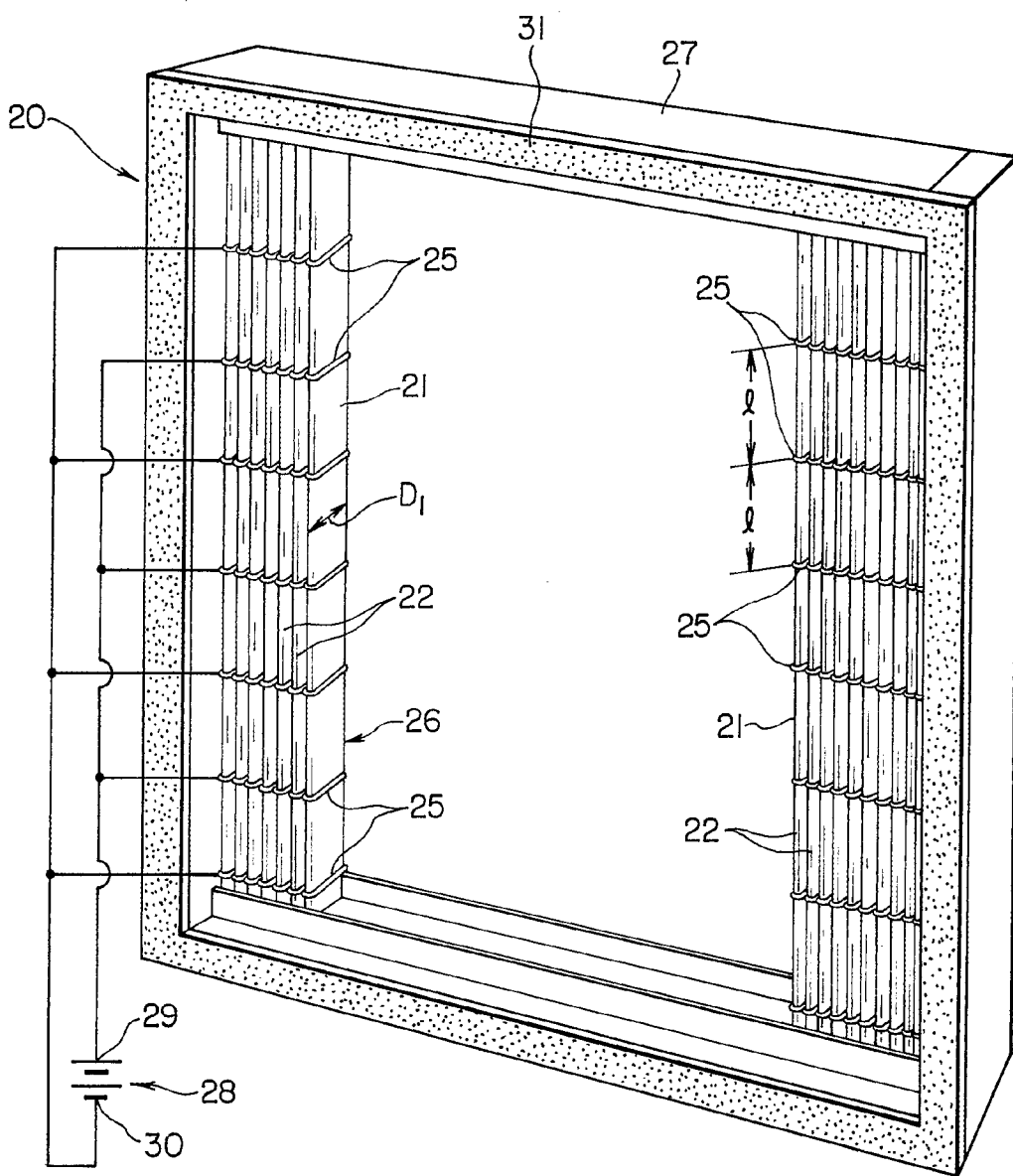


FIG. 4

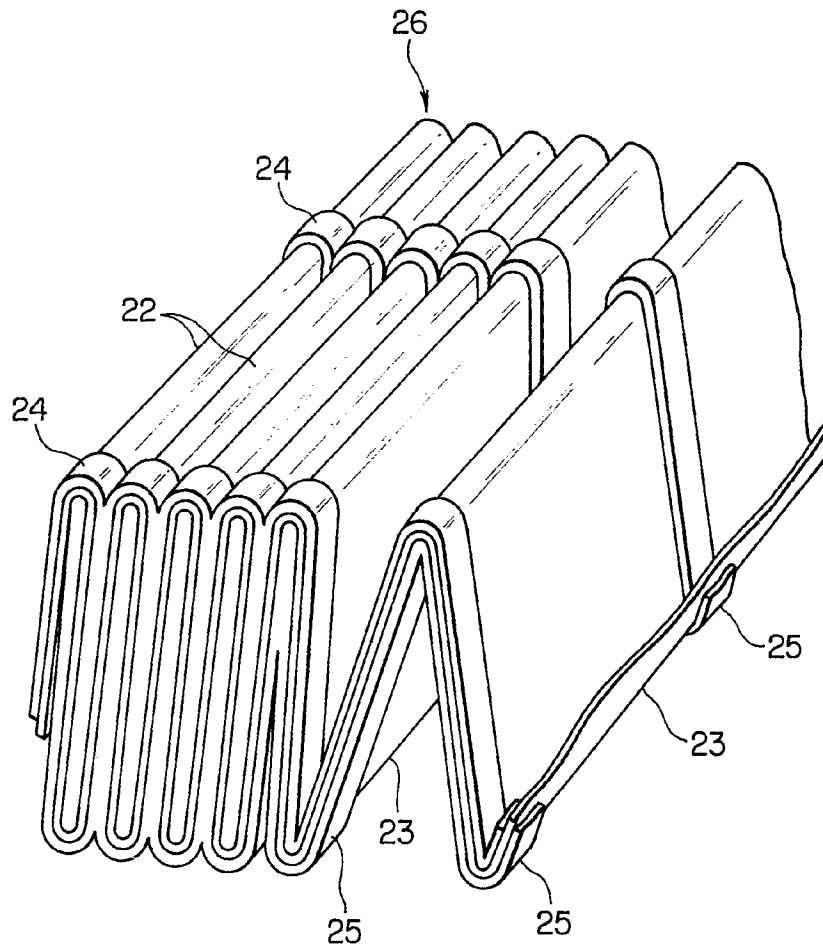


FIG. 5

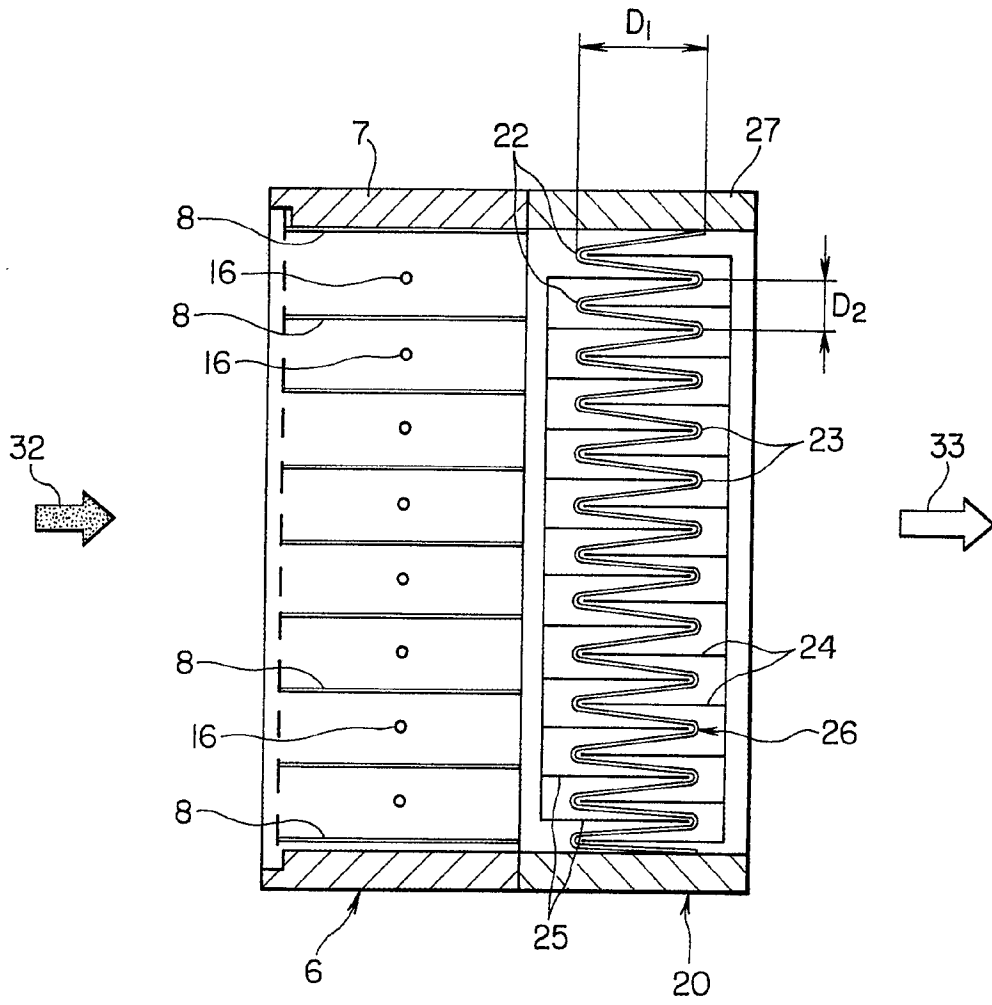


FIG. 6

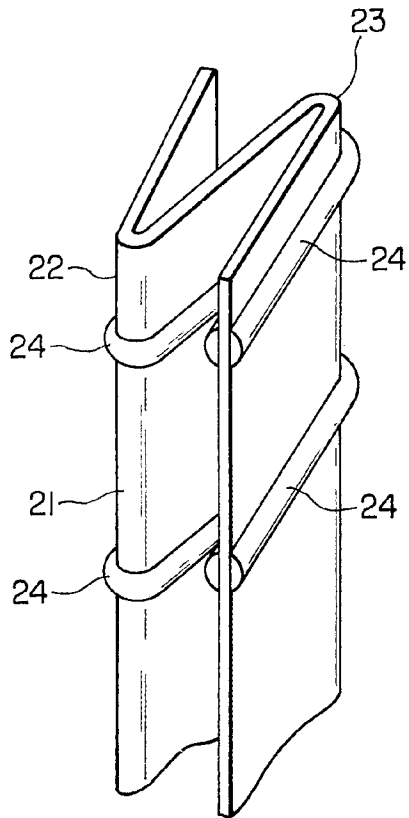
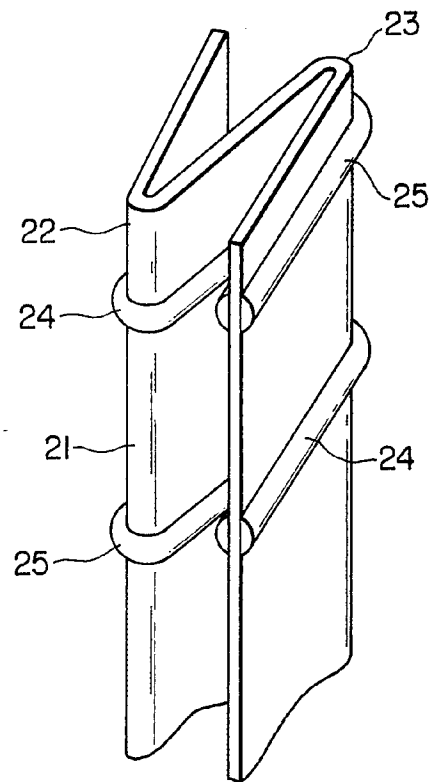


FIG. 7



## SPECIFICATION

**Electrostatic filter dust collector**5 *Summary of the invention:*1. *Field of the invention:*

This invention relates to an electrostatic filter dust collector for use in cleaning the dust-containing air and a dust containing gas.

10

2. *Prior art:*

There is a conventional electrostatic filter dust collector using in its dust collecting section a filter medium which consists as shown in Figure 1 of a filter member 1 of glass fiber folded so as to form ridge portions 2, 3 at the upstream and downstream portions thereof with respect to a direction in which a dust-containing gas flows, and spacers 4, 5 inserted between the opposed surfaces of adjacent ridge portions 2, 3 from the upstream side and downstream side thereof. If the width  $d_1$  of the fold of this filter member 1 is reduced, it becomes difficult to keep the filter member 1 and the spacers 4, 5 in the accurate folded position and the accurate inserted positions, respectively, during the assembling of the dust collecting section. In consequence, it becomes difficult to assemble the dust collecting section. This fact imposes restrictions on the miniaturization and thickness-reduction of the dust collecting section of the filter dust collector. If the distance  $d_2$  between the adjacent ridge portions 2, 3 is reduced, the percentage of the containing area of the spacers 4, 5 with respect to the filter member 1 increases, so that the dust collecting area of the filter member 1 decreases accordingly.

3. *Objects of the invention:*

An object of the present invention is to provide an electrostatic filter dust collector which has smaller dimensions including the thickness and a higher dust collecting efficiency than the above-described conventional electrostatic filter dust collector.

Another object of the present invention is to provide an electrostatic filter dust collector which is used as a high-performance filter for clean benches, clean tunnels and clean zone units, and an air cleaner.

50 *Brief description of the drawings:*

The above and other objects as well as advantageous features of the invention will become apparent from the following detailed description of the preferred embodiment taken in conjunction with the accompanying drawings.

Figure 1 illustrates how to assemble a dust collecting section of a conventional electrostatic filter dust collector;

Figures 2-7 show an embodiment of the present invention, wherein:

Figure 2 is a partially cutaway perspective of a charging section;

Figure 3 is a partially cutaway perspective of a dust collecting section;

65 Figure 4 is an enlarged perspective showing the

construction of a filter member;

Figure 5 is a schematic diagram of the electrostatic filter dust collector in which the dust collecting section is connected to the charging section;

70 Figure 6 shows a modification of spacers provided on the filter member; and

Figure 7 shows another modification of the spacers provided on the filter member.

75 *Detailed description of the invention:*

An embodiment of the present invention will now be described with reference to Figures 2-5. Reference numeral 6 denotes a charging section, which consists of a frame 7 through which the dust-containing air is passed, a plurality of flat electrodes 8 provided on the inner side of the frame 7 so as to extend at regular intervals and in parallel with the direction in which the dust-containing air flows, conductive spacers 9, 10 provided among narrowed portions formed at both end sections of the flat electrodes 8, conductive support members 11, 12 provided in the spaces defined within the frame 7 by the narrowed portions at both end sections of the flat electrodes 8, insulating seats 13 via which both end portions of the support members 11, 12 are fixed to the frame 7, springs 14, 15 joined to the portions of the support members 11, 12 which are halfway between the adjacent flat electrodes 8, discharge wires 16 provided in a tensed state between the springs 14, 15, a lead wire 17 to be grounded which is connected to the flat electrode 8 positioned near the inner surface of one side member of the frame 7, a high-voltage-applying lead wire 18 connected to the support member 11, and a net member 19 having openings of a suitable size and attached to an inlet for the dust containing air of the frame 7. Reference numeral 20 denotes a dust collecting section to be joined to an outlet for the dust containing air of the charging section 6 having the above-mentioned construction. The dust collecting section 20 employs a filter 26 which consists of a filter member called a mini-pleat type filter member, i.e., a filter member 21 of glass fiber which is folded to a small width  $D_1$ , for example, not more than 100 mm so as to form alternate ridge portions 22, 23 at the upstream and downstream portions thereof with respect to the direction in which the dust-containing air flows. A plurality of conductive spacers 24 and a plurality of insulating spacers 25 consisting of plastics straps or tapes are inserted into the portions, which are spaced from each other by a suitable distance  $\ell$ , of the spaces defined by the surfaces of adjacent folds of the filter member 21, from the upstream side and downstream side of the same member 21, so as to maintain the distance  $D_2$ ,  $D_2$  between the adjacent ridge portions 22, 23 in a low level, for example, at not more than 5 mm, and the spacers 24, 25 are then bonded to the filter member 21. The filter 26 thus constructed is fitted in a frame 27 which has the same shape as the frame 7 for the charging section 6, and the circumferential portion of the filter 26 is bonded airtightly to the inner surface of the frame 27. The plurality of conductive spacers 24 are alternately



connected with a high-voltage side terminal 29 and a ground-side terminal 30 of a high-voltage device 28 in the manner shown in Figure 3. Reference numeral 31 denotes a packing attached to such a portion of the frame 27 that is to be joined to the frame 7.

The dust-collecting section 20 constructed as mentioned above is joined to the charging section 6 as shown in Figure 5. A high voltage is applied to the discharge wires 16 in the charging section 6 to generate corona discharge, and a high voltage between the conductive spacers 24 in the dust collecting section 20 to generate a high electric field. The dust-containing air 32 is then introduced into the inlet of the charging section 6 by means of a blower. Consequently, while the dust-containing air 32 passes through the charging section 6, the dust in the air 32 is electrically charged to turn into charged particles. While the dust-containing air 32 thereafter passes through the dust collecting section 20, these charged particles receive the actions of the high electric field between the conductive spacers 24, and are absorbed around the fibers of the filter member 21. As a result, the dust-containing air 32 is cleaned, and the resultant clean air 33 is sent out from the outlet of the dust collecting section 20.

Although in the above-described embodiment the conductive spacers 24 are provided on the downstream side of the filter member 21, the present invention is not necessarily limitative thereto. For example, the arrangement may be such that, as shown in Figure 6, a plurality of conductive spacers 24 are provided on both the downstream and upstream sides of the filter member 21, and a high voltage is applied between the adjacent spacers 24 on the upstream side, and a high voltage is also applied between the adjacent spacers 24 on the downstream side. Further, it is also possible to employ an arrangement, such as that shown in Figure 7, wherein a plurality of conductive spacers 24 and a plurality of conductive spacers 25 are alternately provided on both the downstream and upstream sides of the filter member 21 in such a manner that each of the spacers 24 on the downstream side opposes each of the spacers 25 on the upstream side across the filter member 21, while each of the spacers 25 on the downstream side opposes each of the spacers 24 on the upstream side across the filter member 21, and a high voltage is applied between each of the conductive spacers 24 on the upstream side and the corresponding one of the conductive spacers 24 on the downstream side. Furthermore, in the present invention, either a high AC or DC voltage may be applied to the conductive spacers.

Since the present invention employs a mini-pleat type filter member as mentioned above, the width of the fold thereof can be reduced, and the proper folded condition thereof can be retained accurately by the plurality of spacers bonded thereto. This enables the thickness-reduced, miniaturized dust collecting section to be assembled simply. Moreover, the distance between the adjacent ridge portions of the filter member is short, and the contacting area

of each spacer with respect to the filter member is small. Therefore, the dust collecting area can be increased. Since it is possible to obtain a sufficiently large insulating distance  $\ell$  between the adjacent conductive spacers, insulating of the spacers can be done easily. Even when a high voltage is applied between the adjacent conductive spacers, an accident does not occur. Even when the humidity is high, a leakage current rarely occurs. Therefore, the stable characteristics of the dust collector can be maintained constantly. Although the width  $D_i$  of the fold of the filter member may vary depending upon the flow rate of air or the wind velocity, it is possible for the distance  $\ell$  between the adjacent conductive spacers to be maintained at a constant value. It is therefore possible to apply a constant high voltage to various filter members which are different from each other in terms of the width  $D_i$ . In other words, it is possible for the same high-voltage power source to be employed for filter members of different widths  $D_i$ , and it is therefore unnecessary to adjust the voltage to be applied every time the width  $D_i$  changes. Since the insulating distance between the adjacent conductive spacers is constant, a uniform, high electric field can be generated in the filter member as a whole. Owing to these advantages as well as the large dust collecting area of the filter member, a dust collecting section having an extremely high dust collecting efficiency can be obtained. Accordingly, this invention can provide a thin, miniaturized electrostatic filter dust collector having a high dust collecting efficiency and capable of being used as a superhigh performance filter for clean benches, clean tunnels and clean zone units, an air cleaner and various other filtering devices.

#### CLAIMS

1. An electrostatic filter dust collector having a charging section through which a dust-containing gas is passed to subject the floating dust particles therein to the preliminary electric charging, and a dust collecting section provided with an insulating filter member which is used to collect under the actions of an electric field the charged particles in the dust containing air passed through said charging section, characterized in that said insulating filter member is folded so as to form ridge portions at the upstream and downstream sections thereof alternately, a plurality of spacers for use in retaining in a predetermined level the distance between the surfaces of the adjacent folded parts of said filter member being inserted between said adjacent folded parts from the upstream side and the downstream side of said filter member and fixed thereto, either or both of said upstream and downstream spacers being electrically conductive, and a high voltage being applied between said conductive spacers.

2. An electrostatic filter dust collector according to Claim 1, wherein said high voltage applied to said conductive spacers is a high AC voltage.

3. An electrostatic filter dust collector according to Claim 1, wherein said high voltage applied to

said conductive spacers is a high DC voltage.

4. An electrostatic filter dust collector according to any one of Claims 1 to 3, wherein a distance between said upstream ridge portions and said  
5 downstream ridge portions is not more than 100 mm, a distance between adjacent upstream ridge portions being not more than 5 mm.

---

Printed in the UK for HMSO, D8818935, 11 85, 7102.  
Published by The Patent Office, 25 Southampton Buildings, London,  
WC2A 1AY, from which copies may be obtained.