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E. L. RICHARDSON
ELECTROSTATIC PRECIPITATOR

2,665,770

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2 Sheets-Sheet 2

Fig. 4.

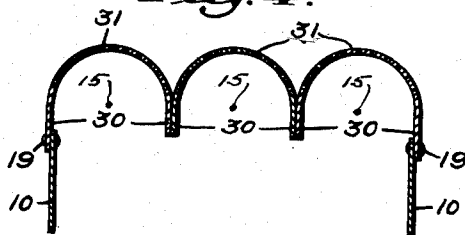


Fig. 5.

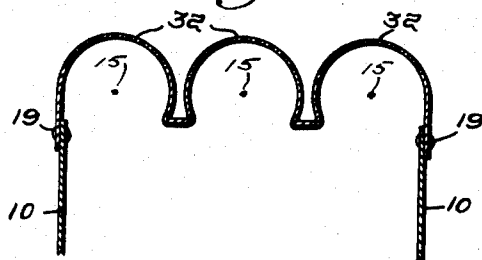
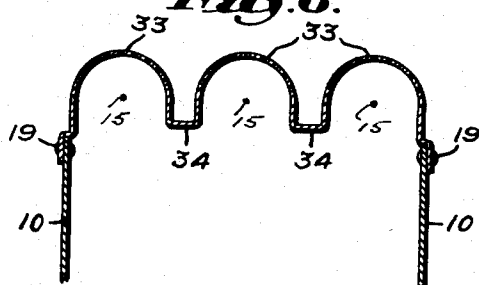


Fig. 6.



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ELECTROSTATIC PRECIPITATOR

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12 Claims. (Cl. 183—7)

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This invention relates to electrostatic precipitators for removing small foreign particles such as dust from gases such as air.

The electrostatic precipitators most commonly used for cleaning air are of the two-stage type having an upstream ionizer chamber and a downstream collector chamber. Such an ionizer chamber usually includes ionizer wires used as discharging ionizer electrodes, and which are located midway between relatively large tubular, non-discharging ionizer electrodes. For insuring that air distribution is uniform across the air inlet of the ionizer chamber it is usual to place a baffle plate having a large number of very small holes, across the inlet. Such a perforated baffle offers resistance to the air moved by a fan through the precipitator causing a static pressure to be built up at the inlet side of the baffle with the result that the same volume of air flows through each hole in the baffle so that the air distribution across the inlet to the ionizer chamber is uniform. Such precipitators usually have separate non-perforated baffles between the ionizer wire supports and the perforated baffles for preventing air from flowing in the areas of the ionizer wire supports where the ionization field is relatively weak.

This invention combines such a perforated baffle, such a non-perforated baffle or baffles, and the non-discharging ionizer electrodes of an electrostatic precipitator in a single structure which may be a single metal sheet which may form an inlet structure which is easily removable for cleaning and for providing access to the ionizer wires.

An object of this invention is to combine the non-discharging ionizer electrodes of an electrostatic precipitator, and its perforated inlet baffle sheet in a single structure.

Another object of this invention is to combine the non-discharging ionizer electrodes of an electrostatic precipitator, its perforated inlet baffle sheet, and its non-perforated baffles in a single structure.

The invention will now be described with reference to the drawing, of which:

Fig. 1 is a side elevation, in section, of an electrostatic precipitator embodying this invention;

Fig. 2 is an end elevation, in section, of the precipitator, the section being along the lines 2—2 of Fig. 1;

Fig. 3 is a plan view looking downwardly upon the precipitator of Figs. 1 and 2, and

Figs. 4, 5 and 6 are different forms of combined perforated inlet baffle sheets, non-perforated baffles and non-discharging ionizer electrodes

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which may be substituted for the one shown by Figs. 1 and 2.

The metal casing 10 has an upper air inlet and a lower air outlet, the blower 11 serving to draw air through the precipitator. Ducts may be connected to the inlet and outlet as is usual in many installations.

The insulators 12 attached to the end walls of the casing support the framework 13 to which are attached the ionizer wire supporting arms 14 between which the ionizer wires 15 are suspended.

The perforated inlet sheet 16 has the vertical end portions 18 which are attached by the screws 10 to the upper open end of casing, and has the semi-cylindrical portions 20 above the end portions 18 and which have their centers of curvature aligned with the ionizer wires 15. The sheet 16 also has the two intermediate portions 21 which are cylindrical except at their extreme upper portions which are connected by the counter-curved cylindrical portions 22 of relatively large diameter with each other and with the semi-cylindrical portions 20. The portions 21 of the sheet also have their centers of curvature aligned with the ionizer wires.

The cylindrical sheet portions 22 have the relatively small circular holes therethrough except in their end areas adjacent the upper ends of the ionizer wire supporting arms 14. The sheet portions 20 and 21 are non-perforated.

The insulators 25 located downstream of the ionizer structure are attached to the side walls of the casing 10, and support the plate supporting members 26 which contain notches in which are held the upper and lower ends of the insulated supported collector plates 27.

The grounded collector plates 28 are located between the plates 27, and are supported at their corners in the notched bars 28 which are secured to the side walls of the casing 10.

The outer ionizer wires 15 are located midway between the curved sheet portions 20 and 21. The central wire 15 is located midway between curved sheet portions 21. The sheet portions 20 and 21 serve as non-discharging ionizer electrodes.

The casing 10, the sheet 16 and the collector plates 28 would be connected to a grounded negative terminal of a conventional direct current, high voltage power pack. The plates 27 would be connected to a positive terminal, which may be a +6 kv. terminal of the power pack, and the ionizer wires 15 would be connected to a positive terminal, which may be a +13 kv. terminal of the power pack.

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In operation, the electrostatic fields between the wires 15 and the grounded ionizer electrodes 20 and 21 would ionize the air passing through the ionizer causing positive electrostatic charges to be imparted to the dust entrained in the air. The electrostatically charged dust would then precipitate upon the grounded collector plates 28 as is usual in precipitators of this general type.

The perforated sheet portions 22 in addition to performing the function of the usual perforated inlet sheet for providing uniform air flow across the inlet to the ionizer, but also provide non-discharging ionizer electrode surface in addition to that provided by the sheet portions 20 and 21, resulting in increased ionization current.

The non-perforated end portions of the sheet portions 22 serve as baffles for preventing air from passing over the end portions of the ionizer wires where the ionization field is relatively weak due to the shielding effect of the wire supports 14.

The combined non-discharging ionizer electrode and baffle structure illustrated by Fig. 4 of the drawings, instead of having the parti-cylindrical portions 20 and 21 opposite the ionizer wires 15, has flat portions 30 opposite the wires, which are continuations of the semi-cylindrical, perforated portions 31 which correspond to the perforated portions 22 of Fig. 2. The structure illustrated by Fig. 4 may be bent from a single sheet of metal or formed from three separate sheets spot welded together.

Tests have shown that approximately the same ionization current and dust charging effect is obtained with the ionizer structure of Fig. 4 as with the usual tubular non-discharging ionizer electrodes. While it is pointed out in the G. W. Penney Patent No. 2,129,783 that less effective ionization is obtained using flat plates opposite ionizer wires than where tubular non-discharging electrodes are used, apparently the additional ionizer surface provided by the curved sheet portions provide sufficient additional ionizer surface for providing adequate ionization current.

The ionizer structure illustrated by Fig. 5 of the drawing differs from that of Fig. 4 in that instead of having flat electrode surfaces opposite the wires, the parti-cylindrical electrode portions 32 upstream of the wires, are curved further to more closely approach cylindrical forms, there being no flat portions except where the ends of the sheet are attached to the casing 10. Only those portions of the curved sheet portions 32 which are upstream of the ionizer wires are perforated. An advantage of this design is that more non-discharging electrode surface is nearer the ionizer wires resulting in greater field intensity and greater ionization current.

The ionizer structure illustrated by Fig. 6 of the drawing has three semi-cylindrical portions 33 with centers of curvature at the ionizer wires, the central portion 33 being separated from the end portions 33 by the non-perforated horizontally extending portions 34. The portions 33 are perforated except upstream of the end portions of the ionizer wires. Using this design the ionizer wires can be spaced further apart than in the designs of Figs. 4 and 5, the non-perforated portions 34 preventing air from entering the precipitator except through the perforations in the electrode portions 33.

When designs such as are illustrated by the drawings were first suggested, the points were raised that they might not be effective since the perforations removed electrode surface, and that

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the edges of the perforations might cause undesired corona. Tests of working models have shown, however, that the surfaces between the perforations provided sufficient electrode surface with fields overlapping the perforations, and that the edges of the perforations had no observable adverse effects.

Another advantage of this invention is that the removal of a single sheet removes the non-discharging ionizer electrodes as well as the air inlet structure, permitting free access to the ionizer wires, and easy cleaning of the non-discharging ionizer electrodes. The inlet sheet is easily removed by the removal of the screws 15 which secure it to the casing.

What I claim as my invention, is:

1. An ionizer for an electrostatic precipitator comprising spaced-apart walls forming a gas passage having a gas inlet, a pair of spaced-apart ionizer wires insulatedly supported from said walls, and a combined perforated baffle and non-discharging ionizer electrode sheet-like member extending across said inlet and secured to said walls, said member having a metallic surface facing said wires and having portions extending across the space between said wires and having other portions extending alongside said wires.
2. An ionizer as claimed in claim 1 in which the first mentioned portions are perforated, and the said other portions are non-perforated.
3. An ionizer for an electrostatic precipitator comprising spaced-apart walls forming a gas passage having a gas inlet, a plurality of ionizer wires insulatedly supported at their ends from said walls, and a combined baffle and non-discharging ionizer electrode member extending across said inlet and secured to said walls, said member having a curved perforated portion upstream with respect to gas flow through said inlet, of each of said wires.
4. An ionizer as claimed in claim 3 in which the member has reversely curved portions on opposite sides of said wires connected to said first mentioned curved portions.
5. An ionizer as claimed in claim 3 in which the member has other portions extending downstream of the first mentioned portions on opposite sides of said wires.
6. An ionizer as claimed in claim 5 in which the said other portions are flat.
7. An ionizer as claimed in claim 3 in which the member has other portions forming curved continuations of said curved portions on opposite sides of the wires.
8. An ionizer as claimed in claim 1 in which the first mentioned portions are curved and perforated, and the said other portions are flat and non-perforated.
9. An ionizer for an electrostatic precipitator comprising spaced-apart walls forming a gas passage having a gas inlet, a plurality of spaced-apart ionizer wires insulatedly supported from said walls, and a combined perforated baffle and non-discharging electrode member extending across said inlet and removably secured to said walls, said member having a plurality of perforated parti-cylindrical portions centered about said wires.
10. An ionizer as claimed in claim 9 in which the said portions are spaced apart and interconnected by non-perforated portions of said member.
11. An ionizer as claimed in claim 3 in which the curved portion is non-perforated adjacent the ends of the wires.

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12. An ionizer for an electrostatic precipitator comprising a pair of spaced-apart walls forming a gas passage having a gas inlet, a plurality of ionizer wires adjacent said inlet, means including a plurality of arms contacting said wires for supporting said wires from said walls, and a metal baffle sheet extending across said inlet and forming the non-discharging ionizer electrode of said ionizer, said sheet having perforations for passing gas except adjacent said arms where it

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has non-perforated portions for preventing gas from contacting said wires where said arms contact said wires.

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