

May 17, 1955

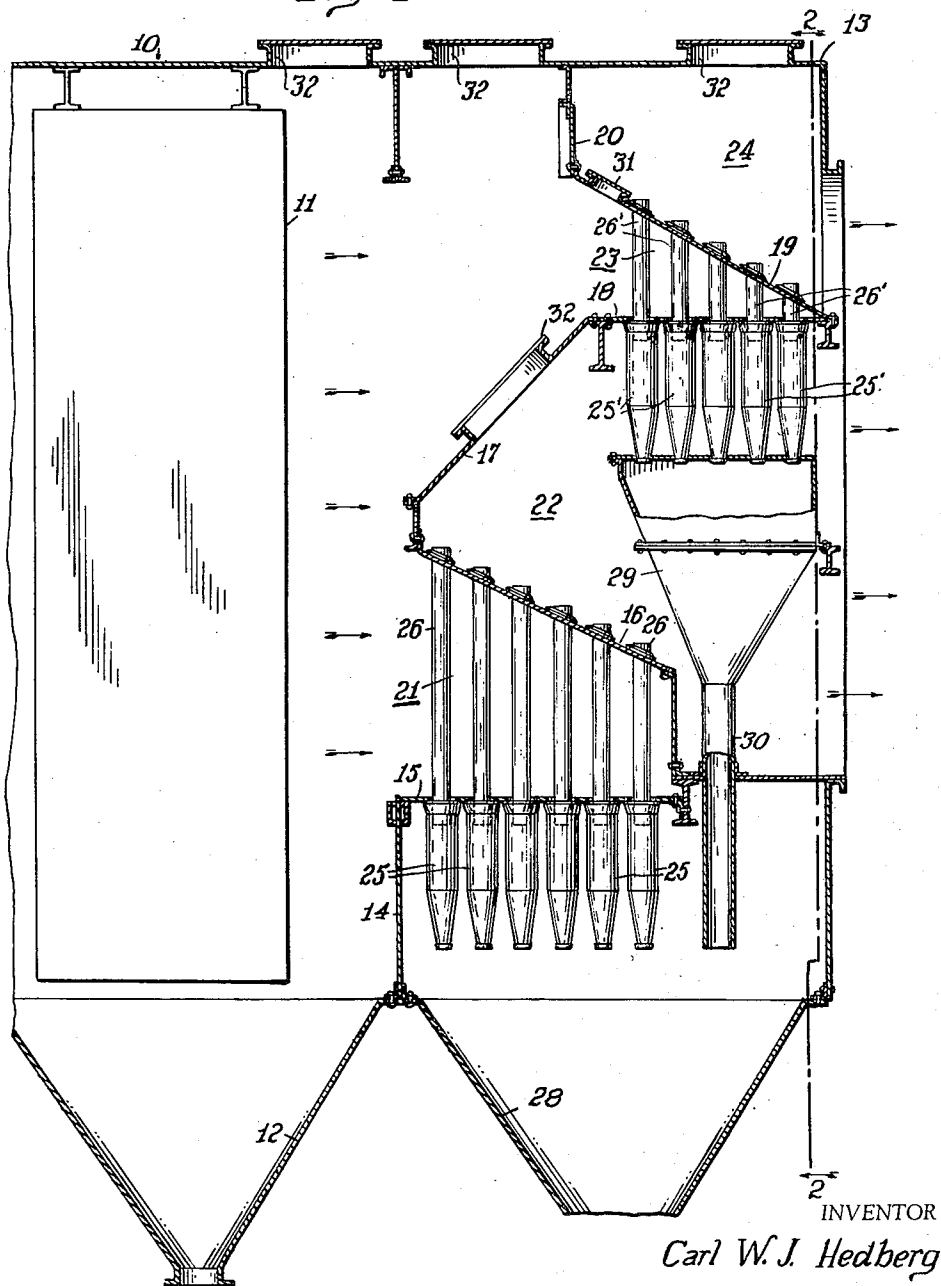
C. W. J. HEDBERG
GAS CLEANING APPARATUS

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Fig. 1.



BY *Harold T. Stowell*

ATTORNEY

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Fig. 2.

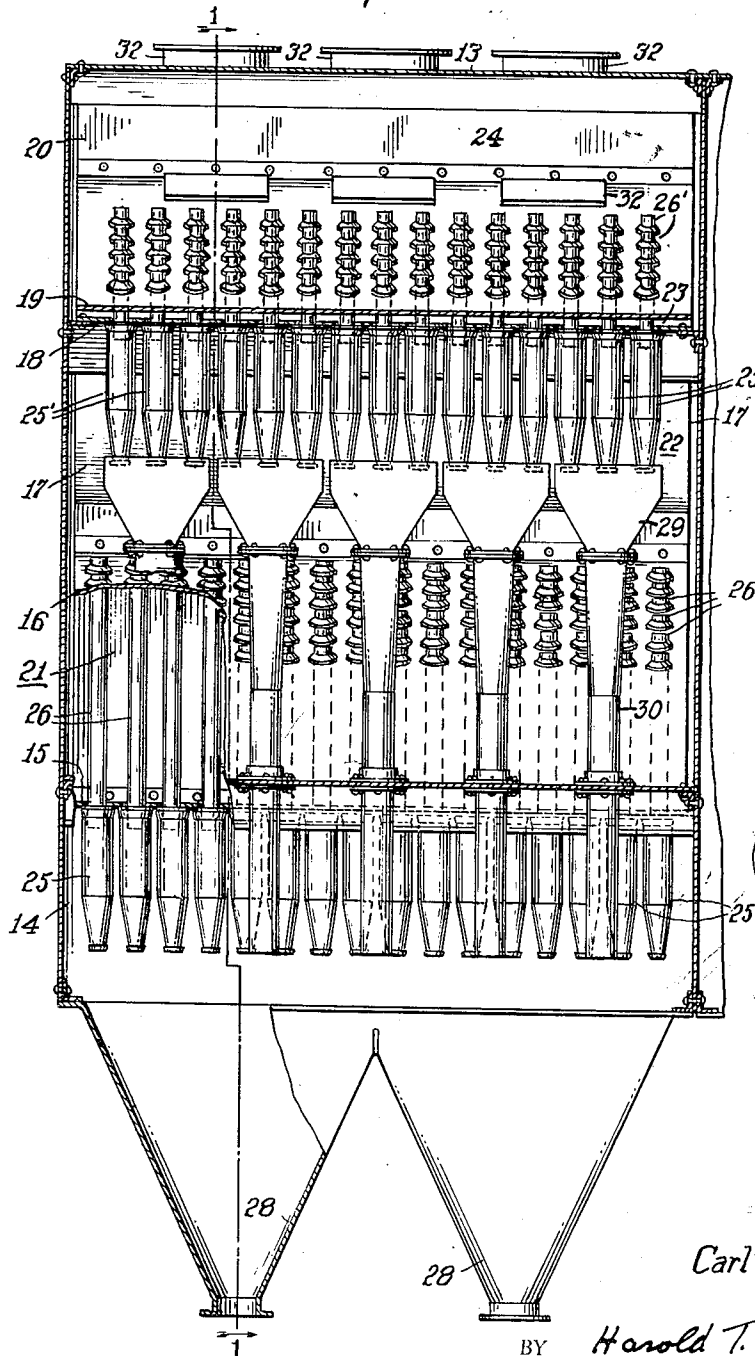


Fig. 3.

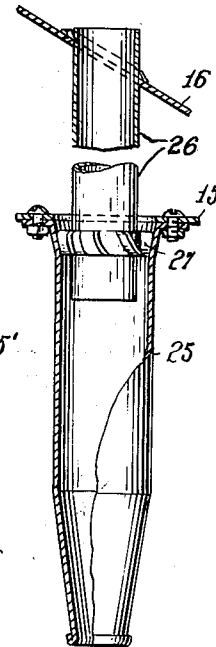
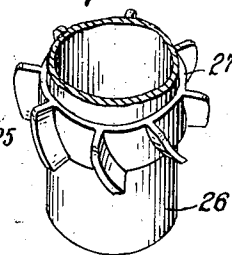


Fig. 4.



INVENTOR
Carl W. J. Hedberg

BY *Harold T. Stowell*

ATTORNEY

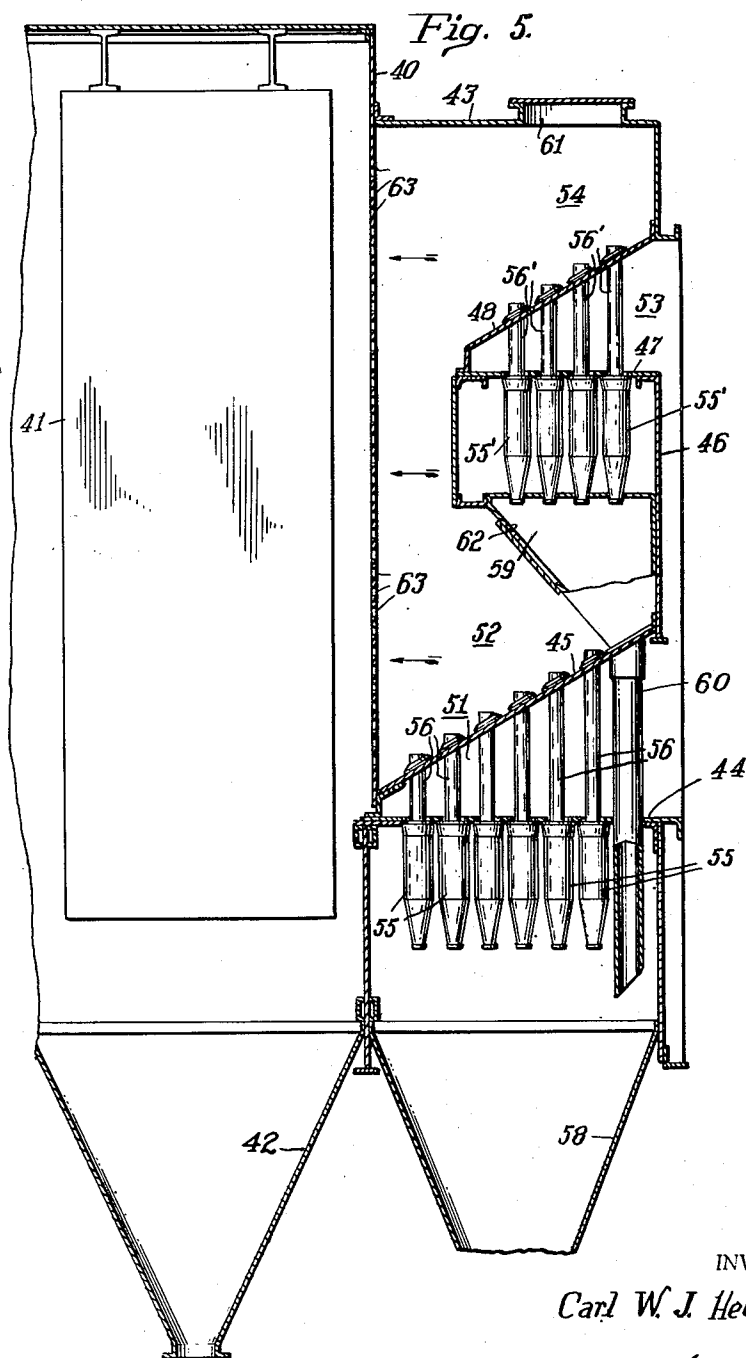
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INVENTOR

Carl W. J. Hedberg

BY

Harold T. S. Towell

ATTORNEY

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GAS CLEANING APPARATUS

Carl W. J. Hedberg, Bound Brook, N. J., assignor to Research Corporation, New York, N. Y., a corporation of New York

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4 Claims. (Cl. 183—7)

This invention relates to gas cleaning apparatus and particularly to the combination with electrical precipitators of vortical separators for removing suspended particles from the gases entering or leaving the precipitator.

The apparatus of the invention is particularly suitable for removing from the exit gases of electrical precipitators particles which have become agglomerated by electrical action in the precipitator and have become resuspended in the gas stream. It has been found that vortical separators of the multiple type are very well adapted to the removal of agglomerated and resuspended particles from the exit gases of electrical precipitators but in connection with precipitators of large capacity the provision of an adequate number of tubular vortical separators has required an inordinate amount of space and a large expense in constructing the shells and associated supporting structure for housing the separator tubes.

When applied to the inlet flue of a precipitator the invention is particularly advantageous in removing from the entering gases a large portion of the larger size particles thereby substantially reducing the load on the precipitator and increasing the efficiency and operating capacity of the precipitator.

The present invention greatly reduces the requirements in floor space and in housing structure by positioning a plurality of superimposed sets of separator tubes in the precipitator inlet or outlet flue in association with partition members which cause the gases to flow in parallel through the superimposed sets of tubes.

The objects and advantages of the invention are attained by providing in combination with an electrical precipitator having a gas inlet or outlet flue extending horizontally from the precipitator, a material-receiving hopper opening into the lower portion of the flue, partition members extending laterally across the flue and co-operating to define a first gas inlet chamber open to the flue in the upstream direction and closed therefrom in the downstream direction, a first gas outlet chamber above the first gas inlet chamber open to the flue in the downstream direction and closed therefrom in the upstream direction, a second gas inlet chamber above the first gas outlet chamber open to the flue in the upstream direction and closed therefrom in the downstream direction, and a second gas outlet chamber above the second gas inlet chamber open to the flue in the downstream direction and closed therefrom in the upstream direction, a first set of vortical separator tubes extending between the first gas inlet chamber and the material-receiving hopper, a gas outlet tube concentrically positioned in each of the first set of separator tubes and extending into the first gas outlet chamber, a second set of vortical separator tubes extending between the second gas inlet chamber and the first gas outlet chamber, conduit means extending from the lower ends of the second set of separator tubes into the material-receiving hopper, and a gas outlet tube concentrically positioned in each of the second set of separator tubes and extending into the second gas outlet chamber.

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The invention will be more particularly described with reference to the accompanying drawings in which:

Fig. 1 is a fragmentary vertical section, on line 1—1 of Fig. 2, of a portion of the gas outlet flue of an electrical precipitator embodying an illustrative embodiment of the invention;

Fig. 2 is a fragmentary vertical section on line 2—2 of Fig. 1;

Fig. 3 is an enlarged view in partial section of a typical vortical separator element;

Fig. 4 is a fragmentary perspective view of the gas inlet portion of the separator element of Fig. 3; and

Fig. 5 is a fragmentary vertical section of an embodiment of the invention wherein the vortical separating devices are positioned in the gas inlet flue of an electrical precipitator.

In Figs. 1 and 2 of the drawings, 10 is the shell of an electrical precipitator including the usual extended surface collecting electrodes indicated at 11 and complementary discharge electrodes not shown. 12 is one of the material receiving hoppers for precipitated particles.

In the outlet end 13 of the precipitator a plurality of transverse partition members 14—20 are provided which cooperate to form a vertical barrier, except for the vortical separators hereinafter described, across the gas outlet flue of the precipitator, and also provide a gas inlet chamber 21 and outlet chamber 22 for a lower bank of separators and a gas inlet chamber 23 and outlet chamber 24 for an upper bank of separators.

Mounted in partition 15 are a plurality of vortical separator tubes 25 having concentrically positioned within each a gas outlet tube 26 projecting through partition 16 into gas outlet chamber 22. At the inlet end of the separator tubes 25 are positioned vane members 27 (see Figs. 3 and 4) adapted to impart a vortical motion to gases entering the tubes as is well-known in the art. The separator tubes 25 project downward and discharge separated particles into material-receiving hoppers 28.

A second bank of vortical separator tubes 25' are mounted in partition 18 with associated vanes 27' and gas outlet tubes 26' projecting through partition 19 into gas outlet chamber 24. The lower ends of separator tubes 25' open into a plurality of intermediate hoppers 29 which discharge separated material into material-receiving hoppers 28, through conduits 30 which preferably terminate at approximately the level of the bottom openings of tubes 25 of the lower bank of separators to maintain a balanced draft between the upper and lower banks of separators thereby preventing gas flow out of the lower ends of the separator tubes.

Dampers 31 are provided in partition 19 to relieve excess gas pressure arising from occasional surges.

Manholes 32 in the roof of the precipitator and outlet flue and in partition 17 provide access to the interior of the precipitator and to the vortical separator elements for inspection and repair. Gas outlet chamber 22 also provides a space for the storage of intermediate hoppers 29 when they are removed for the purpose of inspecting or repairing the elements of the upper bank of separators.

In operation, gases from the electrical precipitator distribute uniformly to the vortical separators of the upper and lower banks and in passing through the separator a major portion of the suspended particles are removed and drop from the bottom ends of the precipitators into material-receiving hoppers 28.

Because of the expansion of gas outlet chamber 22 at its downstream end, gas emitted from the lower bank of separators readily flows out of the chamber between the intermediate hoppers 29 of the upper bank of separators.

In Fig. 5 which shows the arrangement of the vortical

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separator tubes in superimposed banks in the inlet flue of an electrical precipitator, 40 is the shell of an electrical precipitator including the usual extended surface collecting electrodes indicated at 41 and complementary discharge electrodes not shown, 42 is a material-receiving hopper and 43 is the inlet flue of the precipitator.

In the flue 43 a plurality of transverse partition members 44-48 are provided which define a vertical barrier across the inlet flue and also provide a gas inlet chamber 51 and gas outlet chamber 52 for a lower bank of vortical separators and a gas inlet chamber 53 and outlet chamber 54 for an upper bank of vortical separators as described in connection with Figs. 1 and 2.

The vortical separator tubes 55-55' and associated outlet tubes 56-56' are positioned as described for the corresponding tubes of Figs. 1 and 2 and are likewise provided with vane members (not shown) as described with reference to Figs. 3 and 4.

Separator tubes 55 project downward and discharge separated particles into material-receiving hoppers 58, while the lower ends of separator tubes 55' open into a plurality of intermediate hoppers 59 which discharge separated material into hoppers 58 through conduits 60 as described in connection with Figs. 1 and 2.

Manholes 61, 62 in the roof of the flue and in hoppers 59, respectively, provide access to the vortical separator elements for inspection and repair.

Perforated partition 63 aids in providing a uniform distribution of gas flow into the precipitator chamber.

I claim:

1. In combination with an electrical precipitator having a gas flue extending horizontally from the precipitator shell, a material-receiving hopper opening into the lower portion of the flue, partition members extending laterally across the flue and cooperating to define a first gas inlet chamber open to the flue in the upstream direction and closed therefrom in the downstream direction, a first gas outlet chamber above the first gas inlet chamber open to the flue in the downstream direction and closed therefrom in the upstream direction, a second gas inlet chamber above the first gas outlet chamber open to the flue in the upstream direction and closed therefrom in the downstream direction, and a second gas outlet chamber above the second gas inlet chamber open to the flue in the downstream direction and closed therefrom in the upstream direction, a first set of vortical separator tubes extending between the first gas inlet chamber and the material-receiving hopper, a gas outlet tube concentrically positioned in each of the first set of separator tubes and extending into the first gas outlet chamber, a second set of vortical separator tubes extending between the second gas inlet chamber and the first gas outlet chamber, conduit means extending from the lower ends of the second set of separator tubes into the material-receiving hopper, and a gas outlet tube concentrically positioned in each of the second set of separator tubes and extending into the second gas outlet chamber.

2. In combination with an electrical precipitator having a gas flue extending horizontally from the precipitator shell, a material-receiving hopper opening into the lower portion of the flue, a first partition separating the material-receiving hopper from the flue, a second partition extending laterally across the flue and cooperating with the first partition to define a first gas inlet chamber open to the flue in the upstream direction and closed therefrom in the downstream direction, a third partition extending laterally across the flue and cooperating with the second partition to define a first gas outlet chamber open to the flue in the downstream direction and closed therefrom

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in the upstream direction, a fourth partition extending laterally across the flue, cooperating with the third partition to define a second gas inlet chamber open to the flue in the upstream direction and closed therefrom in the downstream direction and co-operating with the top of the flue to define a second gas outlet chamber open to the flue in the downstream direction and closed therefrom in the upstream direction, a first set of vortical separator tubes extending from the first gas inlet chamber through the first partition into the material-receiving hopper, a gas outlet tube concentrically positioned in each of the first set of separator tubes and extending through the second partition into the first gas outlet chamber, a second set of vortical separator tubes extending from the second gas inlet chamber through the third partition into the first gas outlet chamber, a gas outlet tube concentrically positioned in each of the second set of separator tubes and extending through the fourth partition into the second gas outlet chamber, and conduit means extending from the lower ends of the second set of separator tubes into the material-receiving hopper.

3. In combination with an electrical precipitator having a gas flue extending horizontally from the precipitator shell, a material-receiving hopper opening into the lower portion of the flue, a first partition separating the material-receiving hopper from the flue, a second partition extending laterally across the flue and cooperating with the first partition to define a first gas inlet chamber open to the flue in the upstream direction and closed therefrom in the downstream direction, a third partition extending laterally across the flue and cooperating with the second partition to define a first gas outlet chamber open to the flue in the downstream direction and closed therefrom in the upstream direction, a fourth partition extending laterally across the flue, cooperating with the third partition to define a second gas inlet chamber open to the flue in the upstream direction and closed therefrom in the downstream direction and cooperating with the top of the flue to define a second gas outlet chamber open to the flue in the downstream direction and closed therefrom in the upstream direction, a first set of vortical separator tubes extending from the first gas inlet chamber through the first partition into the material-receiving hopper, a gas outlet tube concentrically positioned in each of the first set of separator tubes and extending through the second partition into the first gas outlet chamber, a second set of vortical separator tubes extending from the second gas inlet chamber through the third partition into the first gas outlet chamber, a gas outlet tube concentrically positioned in each of the second set of separator tubes and extending through the fourth partition into the second gas outlet chamber, and conduit means extending from the lower ends of the second set of separator tubes into the material-receiving hopper and terminating at substantially the level of the lower ends of the first set of separator tubes.

4. In the construction defined in claim 1, a plurality of hoppers positioned in said first gas outlet chamber, into each of which extend the lower ends of a plurality of said second set of vortical separator tubes and conduit means extending from each of said hoppers into said material receiving hopper.

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