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King

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[54] **PARTICLE COLLECTOR**

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[51] **Int. Cl.** **B03c 3/06,** B03c 3/78

[58] **Field of Search** ..... 55/117, 118, 120, 146, 55/155, 136, DIG. 38; 317/242

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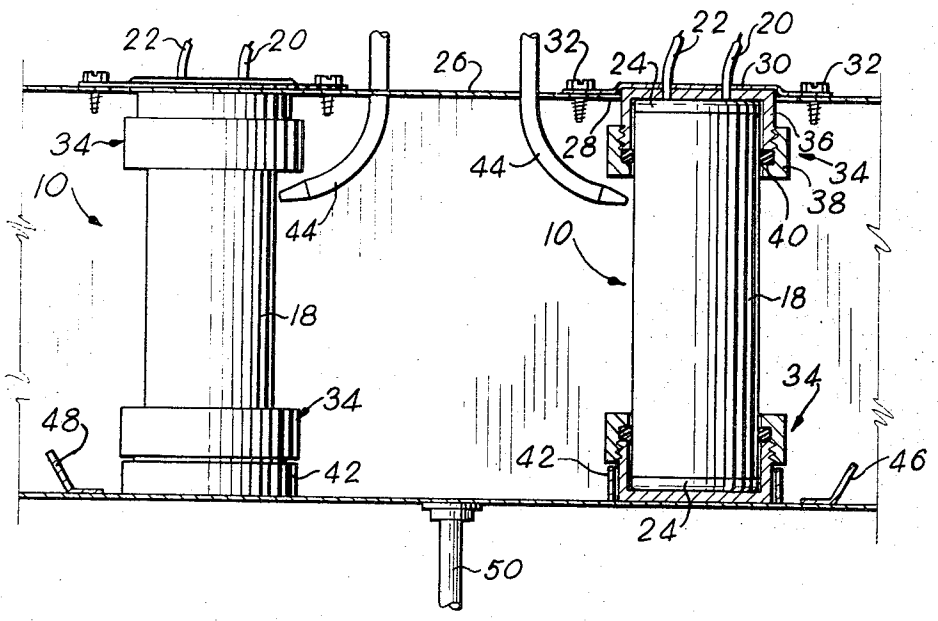
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[57] **ABSTRACT**

A particle collector, such as for installation within a heating duct for removing dust from the air flowing therethrough, is capable of corona-free operation to preclude the generation of ozone within the heating duct. The composite collector has inner and outer tubular electrodes separated by a dielectric casing with a dielectric sheathing around the outer electrode so that a charge is imparted to the sheathing for retention thereby to attract charged particulate matter. A series of the composite collectors charged alternately positive and negative may be utilized to remove both negatively and positively charged particulate matter from a fluid stream, and a spray wash system may be employed to periodically remove collected matter from the units.

4 Claims, 3 Drawing Figures



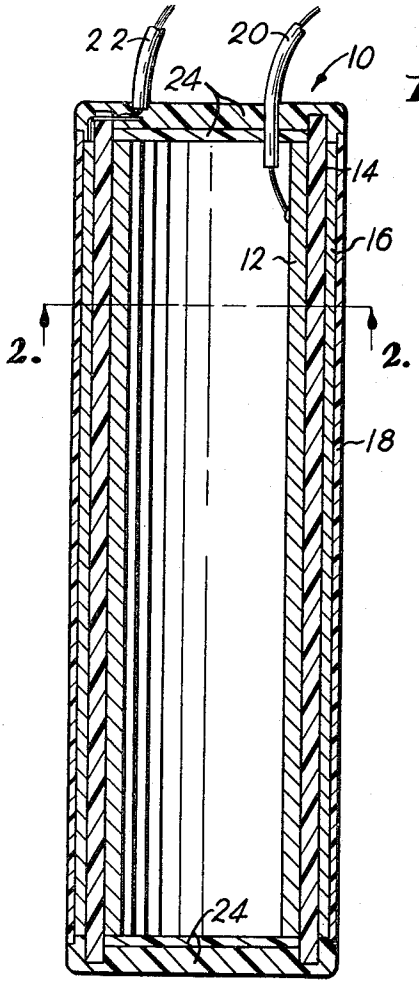


Fig. 1.

Fig. 2.

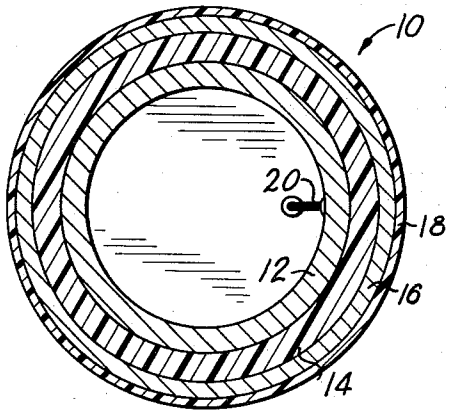
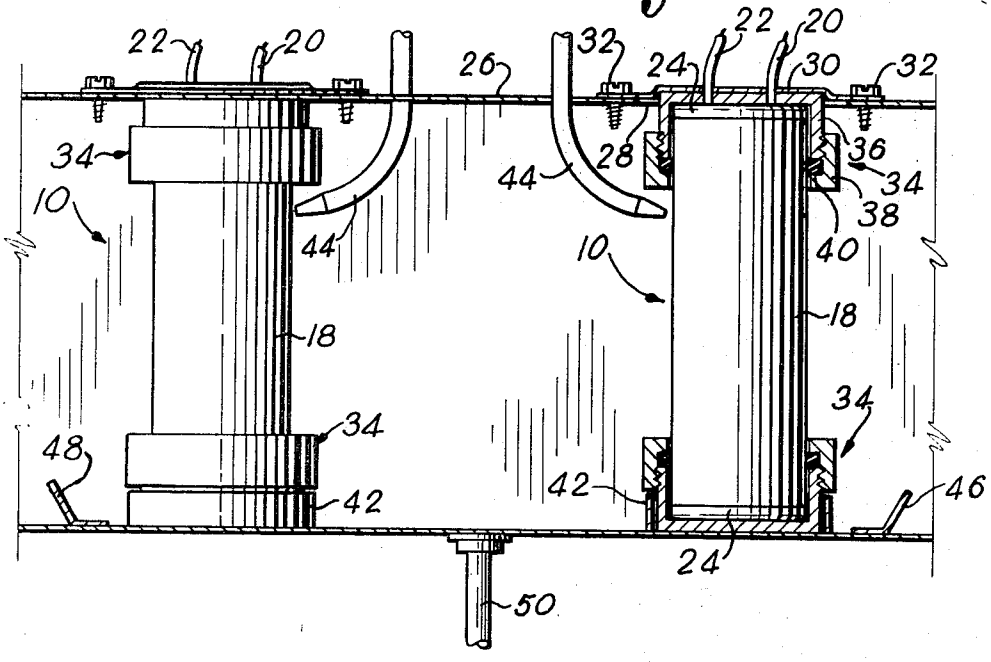


Fig. 3.



PARTICLE COLLECTOR

This invention relates to electrically charged equipment for removing particulate matter from a fluid and, more particularly, to corona-free collector apparatus which is especially well-suited for removing dust and other dry particulate matter from a stream of gas, such as hot air flowing from furnaces.

Many types of electrified particle collectors heretofore available, especially dust collectors for home or business installations, have relied upon a corona discharge from one of the electrodes of the collector toward the other to attract particulate matter to the discharging electrode and to, in effect, burn up the particles coming within the influence of the corona. Collectors of this type have a very serious drawback where the gas being treated consists merely of ambient air in that the corona produces ozone, which is extremely toxic. Thus, systems which rely upon a corona discharge must be carefully regulated to avoid the generation of ozone beyond a predetermined level of safety, and persons living and working within the ozone-laden atmosphere must be careful to limit their exposure to the noxious atmosphere.

Accordingly, an important object of the present invention is to provide a safe, effective, corona-free particle collector which is ideally suited for removing dust from the airstreams of heating, cooling and ventilating systems in view of the complete absence of ozone generated by the collector.

Another important object of this invention is the provision of a particle collector as aforesaid which comprises a single composite unit capable of producing an electrostatic field within itself to present a charged, exposed outer surface to attract particulate matter without corona discharged.

As a corollary to the foregoing object, it is an important aim of this invention to provide a composite collector unit having inner and outer, oppositely charged electrodes separated by a dielectric material to prevent current flow, yet establish an electrostatic field, the outer electrode of the unit having a second dielectric sheathing thereabout for holding a charge imparted thereto by the outer electrode, yet precluding current flow from the latter to any conductive environmental surfaces.

A further important object of this invention is the provision of spray means associated with the particle collector for periodically washing collected matter therefrom.

In the drawing:

FIG. 1 is a vertical cross-sectional view of a particle collector constructed in accordance with the teachings of my present invention;

FIG. 2 is a horizontal cross-sectional view of the collector taken along line 2—2 of FIG. 1; and

FIG. 3 is a fragmentary, cross-sectional view on a reduced scale of a dust-collecting installation employing two or more of the collectors illustrated in FIGS. 1 and 2.

The collector unit **10** has an inner electrode **12** which may be tubular in configuration as illustrated in FIGS. 1 and 2, or may be a solid rod without impairing the principles of the present invention. A first dielectric casing **14** surrounds inner electrode **12** and is thus positioned between the latter and an outer electrode **16** which may take the form of a metal foil layered upon

dielectric **14.** Surrounding outer electrode **16** is a second dielectric sheathing **18** which is constructed from a material such as Teflon. The important property with regard to sheathing **18** is that while it must electrically insulate outer electrode **16** to prevent current flow from the latter to conductive environmental surfaces, sheathing **18** must still be capable of holding an electric charge imparted thereto by outer electrode **16.**

A pair of conductors **20** and **22** are electrically secured to the inner and outer electrodes **12** and **16** respectively for connecting the same across a source of electrical potential to charge unit **10.** Insulating closure elements **24** at opposite ends of unit **10** seal the latter against moisture and prevent short-circuiting of unit **10** should the latter come into contact with an environmental surface at ground potential.

Because dielectric casing **14** is interposed between electrodes **12** and **16,** electrical current flow between electrodes **12** and **16** is effectively precluded. However, an electrostatic field is established with electrodes **12** and **16** retaining their opposite polarities so that sheathing **18** takes on and retains a charge imparted thereto by outer electrode **16.** Therefore, when unit **10** is placed within a stream of fluid containing particulate matter, such as dust-laden air within heating ducts or conduits, the particles which carry a charge opposite in polarity to that of sheathing **18** are attracted to the latter and collect thereon as the stream flows past the unit **10.**

Such removal of charged particulate matter from a flowing stream of gas or liquid is thus accomplished entirely without corona discharge and its attendant ozone generation (in gas streams where oxygen is present). By virtue of the fact that no current flow is produced between electrodes **12** and **16,** nor between electrode **16** and any conductive environmental surface, only an electrostatic field is created, completely precluding the possibility of ozone generation.

FIG. 3 illustrates an installation utilizing more than one unit **10** so that charged particles of different polarities may be removed from a fluid medium. In this regard, a duct or conduit **26,** such as for carrying heated air from a furnace to a remote point, has a pair of the units **10** housed therewithin, each unit **10** being inserted into and removed from conduit **26** through an opening **28** which is normally closed by a cover **30** secured in place by a pair of sheet metal screws **32.** A pair of sealing assemblies **34** are provided at opposite ends of each unit **10** to prevent the entry of moisture into the interior of the respective units **10** from the outer surface of sheathing **18,** and each assembly **34** comprises a pair of threadably interlocking components **36** and **38** which are slipped onto sheathing **18** and clamp an O-ring **40** between themselves to force the ring **40** into tight sealing engagement with sheathing **18.** The endmost component **36** of each assembly **34** projects slightly through the proximal opening **28,** and each cover **30** is formed to complementally receive its corresponding end component **36** to locate and hold the unit **10** in place. An upstanding locating ring **42** on the floor of conduit **26** for each unit **10** receives the corresponding component **36** at the normally lower end of each unit **10** to cooperate with its formed cover **30** in retaining the unit **10.**

Preferably, units **10** are offset from one another within conduit **26** so that gas flowing therethrough may pass in close proximity to both units, it being under-

stood that a multitude of units **10** could be utilized within conduit **26,** depending upon its size, in order to completely remove the particulate matter flowing therethrough.

By reversing the connections of the conductors **20** and **22** of certain of the units **10** with the source of electrical potential, alternate units **10** in the group may be positively and negatively charged so that negatively charged particles are attracted to the positively charged units **10,** while positively charged particles are attracted to the negatively charged units **10.** In this manner, virtually all of the charged particulate matter within the stream flowing through conduit **26** may be effectively and safely removed.

In order to provide periodic cleaning of the units **10,** conduit **26** is provided with a spray nozzle **44** for each unit **10,** operable to direct a stream of cleaning liquid onto the sheathing **18** of the respective units **10,** thus washing the collected matter therefrom for reception within a basin defined by opposed members **46** and **48.** A drain **50** is provided within the basin thus defined to allow periodic emptying of the slurry from conduit **26.**

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. In combination with conduit means normally carrying a gas containing particulate matter, corona-free collecting apparatus for removing the matter from the gas including:

a plurality of spaced-apart, individually operable, composite electrode units located within said conduit means, each being capable of producing its own electrostatic field independently of other units,

said units each having a pair of oppositely charged electrodes separated by a first dielectric to establish an electrostatic field between said electrodes and prevent current flow, and a second dielectric on one of the electrodes exposed to the gas for holding a charge imparted to the second dielectric by said one electrode to attract particles opposite in polarity to the second dielectric,

alternate units having their second dielectrics oppositely charged whereby particles of one polarity are attracted to one of the units while those of the opposite polarity are attracted to the next unit; and

cleaning means within said conduit means for periodically removing collected particles from the second dielectrics of said units.

2. Collecting apparatus as claimed in claim **1,** wherein said cleaning means includes sprayer means for directing liquid to said second dielectrics of the units to wash the same.

3. Collecting apparatus as claimed in claim **1,** wherein said one electrode of each unit is tubular in configuration, surrounding the other electrode and the first dielectric.

4. Collecting apparatus as claimed in claim **3,** wherein said second dielectric of each unit surrounds said one electrode.

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