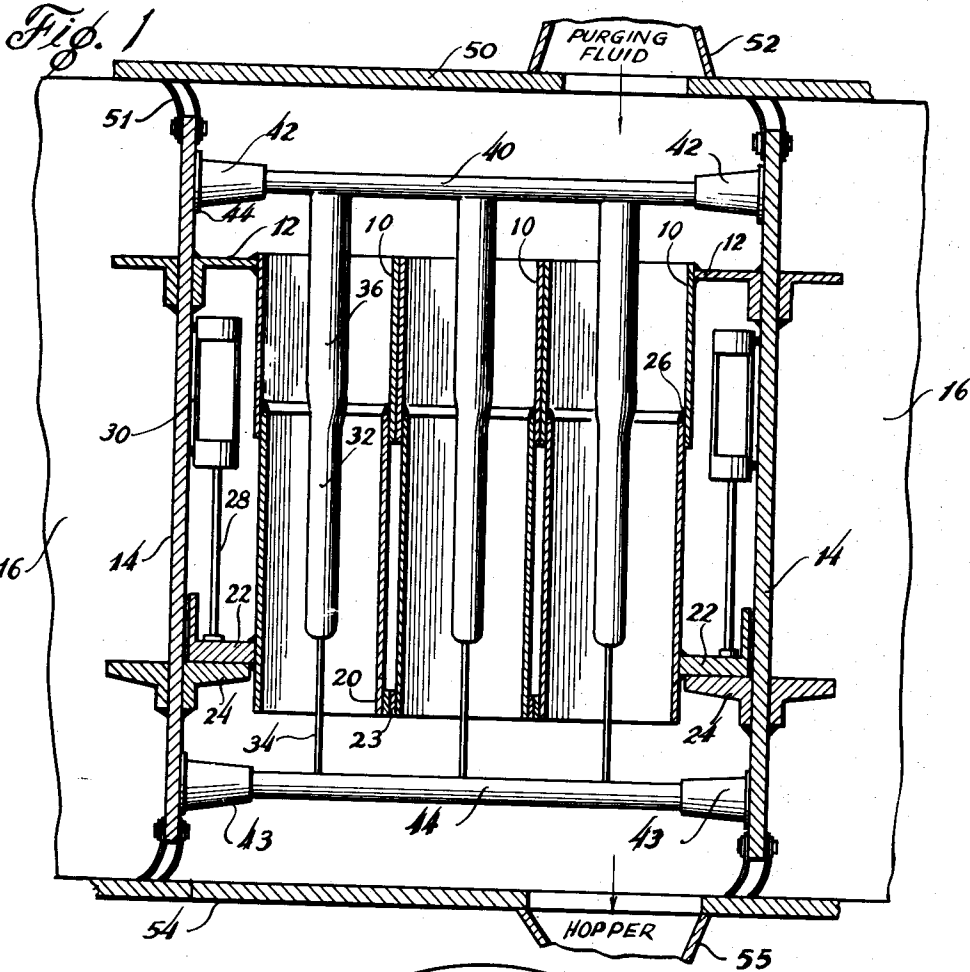
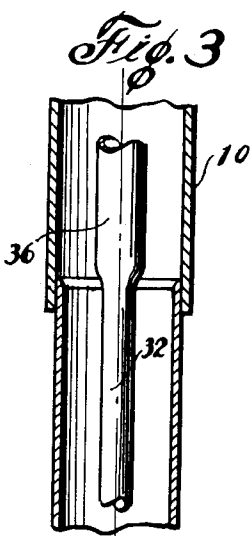
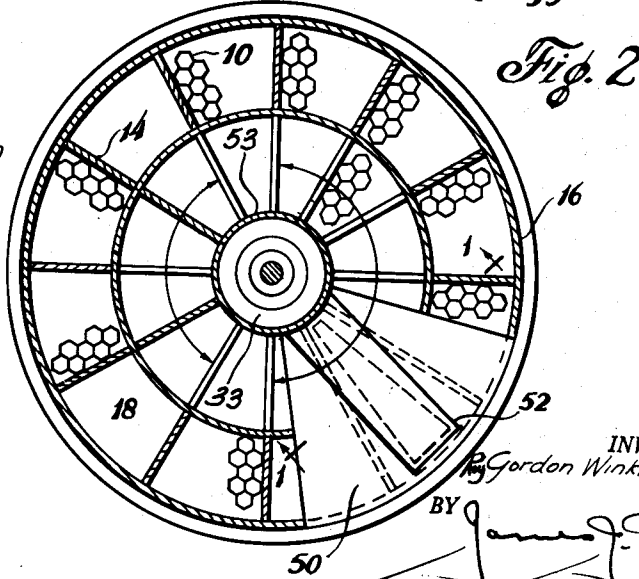


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R. G. WINKLEPLECK
COMBINED SCRAPER AND RAPPER FOR
ELECTROSTATIC PRECIPITATOR
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COMBINED SCRAPER AND RAPPER FOR ELECTROSTATIC PRECIPITATOR

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3 Claims. (Cl. 183—7)

The present invention relates to gas cleaning apparatus and particularly to improved means for removing collected particles of dust, etc., from the collecting surfaces of electrostatic precipitators.

In the art of electrostatic precipitation, entrained dust particles are removed from a gas stream by electrically charging said particles and attracting them to a grounded collector surface on which they are deposited. This invention is especially directed to improvements in means for removing the deposited dust particles from the collector surface on which they are precipitated by electrostatic action, thereby maintaining the precipitator in a clean condition for optimum collecting efficiency.

An object of this invention therefore is to provide a means for removing the dust particles which have been precipitated on the collecting surfaces of an electrostatic precipitator.

A more particular object of this invention is to provide inner and outer telescoping collector surfaces which can be moved relative to one another so as to scrape any dust deposit from one of the telescoping members, the dust deposit on the other telescoping members being removed by jarring or rapping said member.

Other features of the invention will become apparent upon consideration of the following detailed description of an illustrative embodiment of the invention when read in conjunction with the accompanying drawings which show the essential features of the invention.

Figure 1 is a sectional elevational view of a fragmentary part of an electrostatic precipitator embodying the invention as viewed on line 1—1 of Figure 2.

Figure 2 is a plan view of the precipitator partly in section showing the particular relationship of a dust purging hood to the precipitator as a whole.

Figure 3 is an enlarged fragmentary view of telescopic collector surfaces and associated electrode.

The apparatus illustrated in Figure 1 comprises stationary hexagonal tubes 10 which are suspended from brackets 12 on radially extending partitions 14 that divide a stationary cylindrical housing 16 into a plurality of wedge shaped compartments 18 that contain the banks of collector tubes 10. Telescoping within the lower part of each tube 10 is a second and somewhat longer hexagonal tube 20, these tubes being joined together at their outer ends 22 opposite the portion which telescopes within the stationary tubes 10 to form an integral bank of tubes.

Attached to the lower portion of tubes 20 which lie adjacent to the partitions 14 are brackets and tube guides 22 movable with the tubes 20 and abutting the stationary bumper or stop 24 on the partition 14 when the telescoping tubes 10 and 20 are in relatively extended position.

The ends of tubes 20 which telescope within tubes 10 are preferably rounded in the manner indicated at 26 in Figure 3, so as to prevent arcing or an electrostatic discharge therefrom. The fixed hexagonal tubes 10 are shown as being approximately one-half the length of the tubes 20; however they may be of other lengths if so desired.

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Connected to the movable brackets and tube guides 22 at spaced locations around the periphery of said tube guide are a plurality of operating rods 28 which are actuated by means such as the pneumatic cylinders 30. Any other suitable means for actuating the lower bank of collecting tubes 20 may be used without departing from the spirit of the invention.

Extending through each of the hexagonal tubes 10, 20 in concentric relation thereto is a collector electrode 32 of such a large diameter so as not to promote a corona discharge therefrom. Attached to the lower end of said collection electrode in concentric relation thereto is a discharge electrode 34 having a sharp edge which freely supports a corona discharge.

To compensate for the variation in distance radially between the collector electrode 32 and the walls of the telescoping sections of the collector tubes, the diameter of the collector electrodes are increased slightly within the stationary tubes in the manner shown at 36 of Figure 3 of the drawing. With the collector electrode shaped in this manner, the distance from any point on the electrode radially to the collecting surface remains constant when the tubes are in their extended or normal collecting position. This arrangement tends to create an electric field of constant strength between the electrode and all sections of the collector tubes 10, 20.

Each collector electrode 32 is suspended from a conductor 40 which lies in a plane normal to the axis of the electrodes and extends between insulators 42 which are attached to flexible shock absorbers 44 which are in turn mounted on opposite walls 14 of a compartment 18 of the housing 16. Mounted at the lower end of the partitions 14 are oppositely disposed insulators 43 between which is mounted a conductor 44 lying in a plane parallel to that of conductor 40. Attached to said conductor 44 so that they may be held concentric with tubes 10, 20 are the ionizing electrodes 34 which depend from the collector electrodes 32. The conductors 40 are connected in a manner not shown to any suitable source of high voltage direct current.

Sector shaped sealing plates 50, 54 for directing purging gas to a limited portion of the collecting tubes is mounted to rotate with respect to each end of the housing 16. Suitable members 51 provide for adequate sealing with the housing 16.

The upper plate member 50 (Figure 2) comprises a hood 52 which receives purge gas from the rotary duct 53 and conducts it into the housing 16, while the lower sector plate 54 (Figure 1) includes a hopper portion 55 which conducts the purge gas and collected dust particles out of the housing to any suitable depository.

The hood for admitting purge gas may actuate a hydraulic cylinder or any other mechanism suitable for raising the hexagonal tubes to the height required by the cleaning operation.

In operation, gases that contain suspended dust particles move upward through a duct (not shown) and into the housing 16 and through banks of collecting tubes 10, 20 in compartments 18 which are not covered by the sector shaped plates 50, 54. The suspended dust particles become ionized by the corona discharge from the discharge electrode when they pass through the high intensity electric field around the electrode 32. Easily separated large particles move readily to the walls of the tube 20 opposite electrode 32 while the small particles, being more difficult to separate from the moving gas stream, are carried on to be subjected to the high field stress of the collector electrode 32. The charged particles are therefore forced to the grounded collecting surfaces 20 and 10 and are held on said surfaces by electrostatic force and mass attraction.

In removing the collected particles from the surfaces 10

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and 20 it has been found that the large particles can be readily removed by a jarring of the surface on which they are collected, while the smaller particles being tightly packed are more difficult to remove and may best be removed by scraping or shaving them from the collecting surface. When the collecting tubes are in need of cleaning, the centrally mounted sector plate members 50 and 54 are rotated so as to seal off tubes 10, 20 in a compartment 18 aligned with hood 52 and hopper 55 from all incoming gas carrying the suspended dust particles. At the same time, electrical energy to the electrodes within these isolated tubes is discontinued and a flow of purge gas in countercurrent relation to the flow of dust carrying gas is supplied from duct 53 via hood 52.

Rotation of the hood 52 and hopper 55 actuates the adjacent pneumatic cylinders 30 which in turn raise the related bank of inner hexagonal tubes 20 so as to scrape the fine collected dust particles off the inside surface of the tubes 10. The inner tubes 20 are then dropped from a predetermined raised position and are jarred by impact when the bracket 22 to which they are attached, strikes the stationary bumper 24. The shock from bracket 22 striking bumper 24 is sufficient to jar the larger collected particles off the surface of the tubes 10, 20. It is therefore seen that the small particles which are most difficult to remove from the collecting surfaces are scraped off by the telescoping action of tubes 10 and 20, while the larger particles which are collected predominantly within the hexagonal tubes 20 are relatively easily removed by jarring said tubes.

This type of mechanical tube cleaner is especially effective in all tube cleaning since the efficiency of its operation is not dependent upon a specific size tube being used for the collecting surface. Where a gas stream of high velocity is involved, relatively long telescoping tubes can be used, while much shorter tubes can be used in an application involving lower gas velocity. Within practical limits of tube length and tube size, the above described cleaning mechanism remains equally effective.

This type of mechanical scraper and rapper permits

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a given section of the precipitator to be cleaned without disturbing the other sections which remain in collecting operation. Furthermore, this type of cleaning means is rapid in its action and will positively scrape the packed dust particles from the outer collector tube while rapping the more loosely packed particles from the inner collecting tube.

What I claim is:

1. In an electrostatic precipitator for removing suspended dust particles from a gas stream; a housing located between two end plates; a passageway in each end plate for permitting the flow of gas therethrough; a bank of collecting tubes suspended from the interior wall of said housing in a parallel relation to its longitudinal axis; collecting electrode means insulated from said housing and passing concentrically through each collecting tube, each of said collecting tubes comprising a plurality of telescopic portions having one portion fixed to the housing and another movable with respect thereto; means lifting the movable tubes into the fixed tubes so they scrape dust deposits therefrom; bracket means on said movable tube bank positioned to engage a bumper member fixed to the housing walls when the movable tubes are in an extended position, whereby dust particles clinging to the inner surface of said movable tubes are separated therefrom by the impact of the bracket means striking the bumper member when the movable tube bank is dropped from an elevated position.

2. Apparatus as defined in claim 1 wherein the lifting means for the movable collecting tubes is connected to the bracket means.

3. Apparatus according to claim 1 wherein the movable collecting tubes have substantially greater length than said fixed tubes.

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