

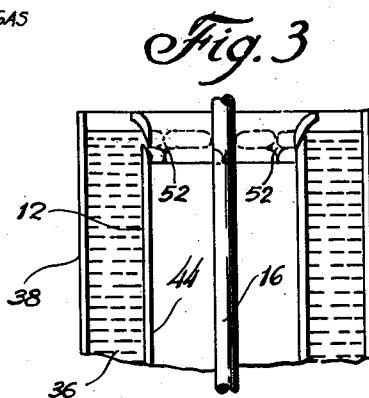
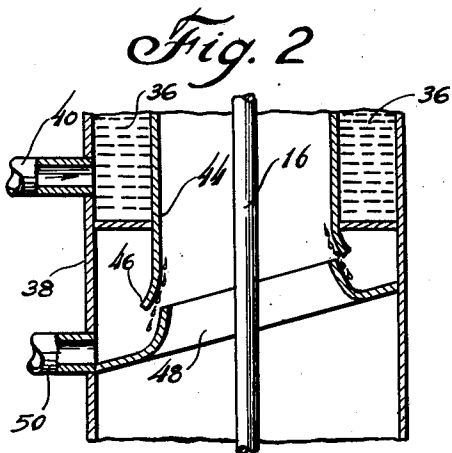
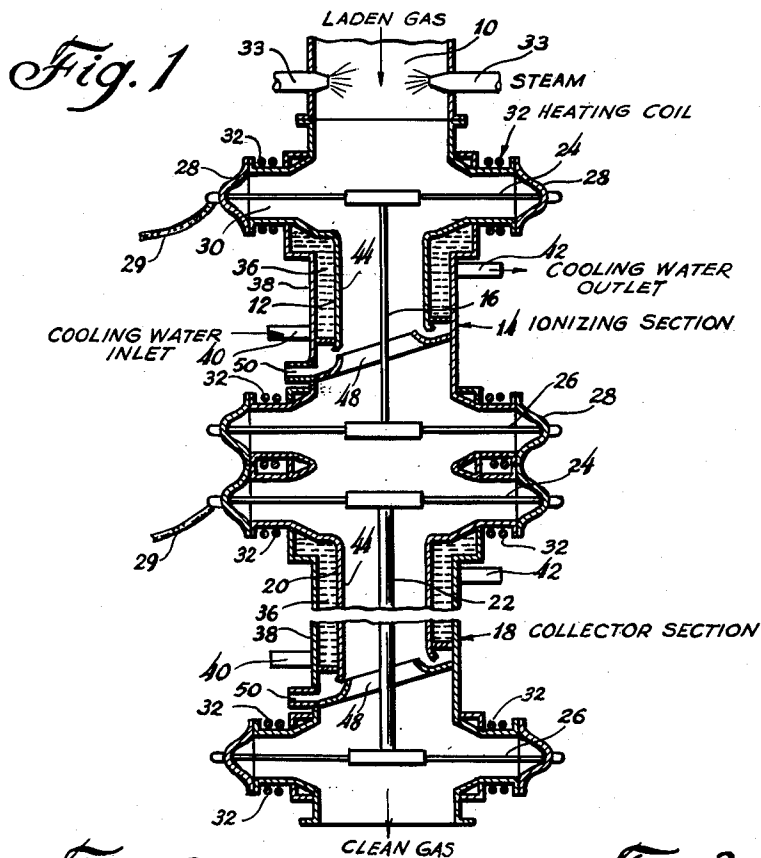
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LIQUID CLEANED PRECIPITATOR

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LIQUID CLEANED PRECIPITATOR

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1 Claim. (Cl. 183—7)

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The present invention relates to gas cleaning and particularly to improvements in electrical precipitators for removing ash, dust and other fine particles from gases, especially from gases of combustion.

The present invention involves ionization of dust-laden gases to electrostatically charge the particles of dust and the like carried therein with subsequent deposit of the dust in these gases on collecting surfaces. In particular, the invention contemplates cooling parts of the precipitator apparatus so that advantage may also be taken of the "thermal head" existing between the hot gases and cooler collecting surface to cause the particles to be attracted thereto.

The invention will best be understood upon consideration of the following detailed description of an illustrative embodiment thereof when read in conjunction with the accompanying drawings in which:

Figure 1 is a sectional elevational view of one of a number of ionizing and collecting tubes employed in an electrical precipitator embodying the present invention.

Figure 2 is an enlarged view of a portion of Fig. 1 illustrating in detail a collecting trough for carrying off moisture precipitated from the gases together with particles washed from the collecting tubes, and

Figure 3 is a fragmentary view also on an enlarged scale of an alternative device for wetting the collecting surfaces.

In the drawings, there is shown one of a plurality of ionizing and collecting tube units that make up a complete electrical precipitator. The inlet conduit 10 through which the dust-laden gases flow downwardly in the direction of the arrow as indicated in the drawing is axially aligned with the tube 12 that forms the gas passage of the ionizing section 14 of the precipitator and containing an ionizing wire 16. The collecting section 18 includes a similar tube 20 and the collecting electrode 22. The ionizing and collecting electrodes 16, 22 extending axially of the tubes 12, 20 are supported in suspended relation therein between the support rods 24 and 26 which are supported at their ends in the insulators 28 and connected to the high voltage leads 29. The insulators 28 are located at the outer ends of the neck-like extensions 30 of the tube 10 with which are associated heating coils 32 which serve to maintain the insulators and adjacent part of the ionizing tube and its electrode in a dry state.

The charging of particles in the ionizing section is accomplished very rapidly, in the matter of a

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fraction of a second, and consequently this section of the apparatus may be relatively short. In the collecting section, the transverse movement of the charged particles toward the collecting surfaces is relatively slower, and for this reason the gas channels in this section are very much longer than is required for the ionizing section.

The exact proportions of the apparatus will, of course, differ with circumstances of gas quantity and velocity and the nature and density of the particles to be removed.

Above the location of the ionizing wire 16 several steam nozzles 33 introduce moisture into the stream of gas immediately adjacent the entrance to the ionizing section 14. Surrounding the relatively narrowed tube portions 12 and 20 of the ionizing and collecting sections are water jackets 36 formed between these tubes and casings 38 to be supplied through the inlet pipes 40 with the cooling water being drawn off through the outlet pipe 42. The cooling of the walls of the ionizing tubes 12 causes some of the steam and condensable constituents of vapor in the gas to condense on the inner wall 44 of the narrow tube section. This condensed moisture together with any dust particles which may be driven to the wall because of the thermal head existing between the relatively hot stream of gas and the relatively cooler wall 44 runs down the latter in a thin film and drips off the flared portion 46 at its bottom into collecting trough 48 of annular form that is mounted beneath the tubes 12 and inclined transversely with respect to the axis of the tube so that the water collected in the trough may flow downwardly to the drainage tube 50. The same action takes place in the collector section 18 with a greater quantity of water being condensed and more dust carried off. The quantity of steam admitted through the jets 33 and the rate of flow of cooling water through the jackets 36 may be regulated to give any desired thickness of water film. The particles of water in the gas condensed on the dust particles act on nuclei and these particles of water tend to go to a cool surface such as the walls 44 of the tubes 16 and 20 thus materially aiding collection. The dust particles stick to the cool wet surface until washed off and do not become re-entrained in the gas because the constantly moving film of water carries them away into the drainage troughs 48 making the apparatus self-cleaning. Moisture condensing around the particles of dust tends to increase their size allowing a large charge to be placed thereon in the ionizing section. The thermal head between the gas and the cool wall of the

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tubes also drives the particles towards the wall 44 thereof and water being a dipole lends itself readily to electrostatic precipitation. Even uncharged particles of water tend to move to the center electrode 22 in the collector section 18 because of the fact that they are dipoles and this assists in keeping the center electrode clean. The employment of water also causes a solid or liquid compound to be formed with gases such as gases SO₂ and NO₂ which otherwise would not be collected. The electron attachment for water vapor slows down the ion mobility reducing the current required and increasing the breakdown field strength.

Figure 3 shows the ionizing tube 12 formed with several orifices 52 near its upper end so that water from the water jacket 36 may pass through the tube wall to flow along its surface 44 to cool it and cleanse it of collected particles separated from the gas stream.

While a single tube two-stage collector has been illustrated, it will be appreciated that the same method may readily be applied to a single stage or multiple stage collector and obviously may be embodied in apparatus employing a large number of multiple tube collectors.

What we claim is:

Apparatus for the precipitation of electrically charged dust particles or the like from suspension in a gaseous carrier fluid comprising; vertically disposed tubular members mounted in spaced relation and in axial alignment; means including wall elements forming a chamber between said members in communication therewith and together with said members forming a continuous

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gas passage; individual precipitator electrodes extending axially of said members; electrical means for charging said electrodes extending into said chamber for connection with said electrodes; insulators for said electrical connecting means in the walls of said chamber; means for introducing moisture into the stream of laden gases; means forming cooling jackets surrounding the wall of each tubular member; means for continuously circulating a cooling medium through said jackets to condense fluid from the stream of gases upon the walls of said tubular members; annular fluid collecting troughs extending transversely across the lower end of each tubular member and disposed opposite its lower perimetral edge for receiving the stream of fluid and entrained particles flowing from the inner wall of said tubular member; drain means connected to said troughs for carrying away the liquid collected therein; and heating means associated with said insulators for protecting them from moisture in gases flowing through said chamber and maintaining them in a dry state.

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