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APPARATUS FOR ELECTRICAL PRECIPITATION

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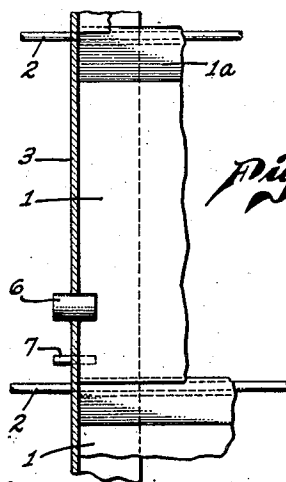
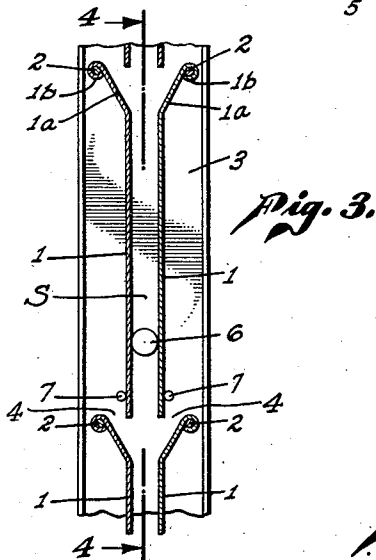
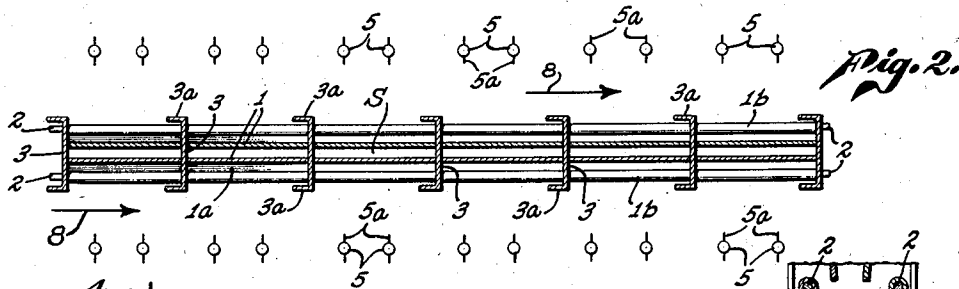
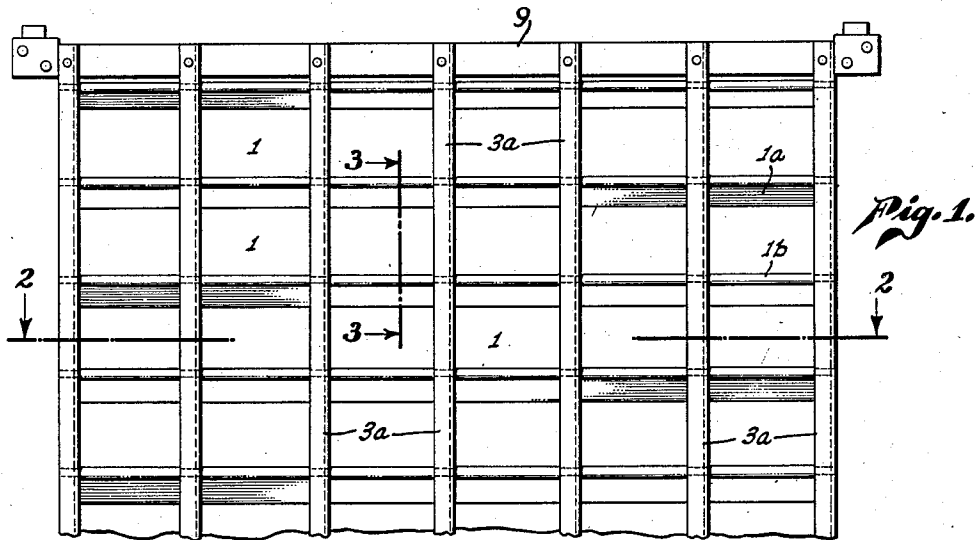


Fig. 5.

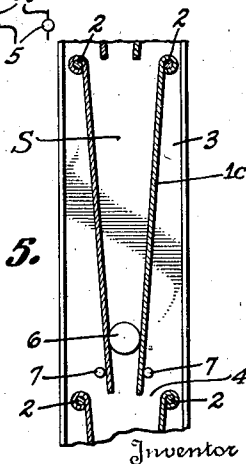


Fig. 4. By Alfred W. Knight

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APPARATUS FOR ELECTRICAL
PRECIPITATION

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The present invention is generally concerned with the art of electrically precipitating suspended particles from a stream of gas; and it is more particularly concerned with improvements in collecting electrodes of the kind generally known as "pocket-type" electrodes, for use in the electrical precipitation of suspended particles from a horizontally flowing stream of gas.

In the following description and appended claims, the term "discharge electrode" will be understood to designate an electrode that facilitates corona discharge therefrom, because it has a configuration that establishes a sufficiently high potential gradient at or near its surface to create corona discharge before there is a disruptive discharge or sparkover. In contrast with this type of electrode, the term "non-discharging electrode" will be understood to designate an electrode that minimizes or prevents corona discharge therefrom because it has a configuration that establishes a sufficiently low field concentration at or near the surface to suppress corona discharge at elevated potentials lower than the voltage required for disruptive discharge or sparkover. The function of an electric precipitator is to precipitate particles of suspended matter upon a non-discharging electrode, and an electrode which is so used is generally termed a "collecting electrode."

It has been found in the precipitation of certain kinds of suspended solid particles, that there is an appreciable amount of material lost from the surface of the collecting electrode, and that the amount of loss rises rapidly with an increase in the velocity of the gas stream passing over the surface of the collecting electrode. This loss represents a loss of particles which have once been precipitated on the collecting electrode but are so lightly held that the gas stream is able to blow them off the surface of the collecting electrode. The failure of the particles when precipitated to adhere more securely to the collecting surface is largely a characteristic of the material being collected, although the amount of loss is effected by the design of the precipitator as well as by the velocity of the gas stream from which the particles have been precipitated. Since this loss is caused primarily by the erosive effect of the gas stream, the loss is termed erosion loss.

From this discussion it will be seen that the mechanics of the loss are apparently that the solid particles are precipitated upon the collecting surface, but adhere rather loosely thereto; so that the gas stream loosens their hold on the collecting surface and causes the particles to

travel or creep along the surface of the collecting electrode. In this way, particles are again entrained in the gas stream and carried out of the precipitator.

5 It thus becomes a general object of my invention to provide means for preventing erosion loss of precipitated particles from the collecting electrode of an electrical precipitator removing suspended particles from a horizontally flowing stream of gas, and to prevent re-entrainment of the particles in the gas stream.

10 It is also an object of my invention to provide a simple, inexpensive, and effective collecting electrode adapted for use with a horizontally flowing gas stream, which retains particles within the precipitator when once removed from the gas stream and prevents loss from the surface of the electrode by gas erosion and subsequent re-entrainment.

20 The above objects of my invention are attained by providing a collecting electrode structure of the pocket type comprising means forming two vertically extending parallel walls that provide external surfaces on which particles are precipitated, the two walls being spaced apart horizontally to form a particle-receiving space between them and each wall being formed with a series of vertically spaced, horizontally elongated openings to admit particles to said space. The wall

25 forming means comprises one or more vertical series of plates. A plurality of horizontally spaced baffles that extend vertically and transversely of said walls are spaced at intervals along the horizontal length of the walls to prevent

30 travel of precipitated particles horizontally along the collecting surface. When the collecting electrode is cleaned, as by jarring to remove the adhering particles, the particles fall downwardly through the elongated openings into the particle-receiving-space between the two walls. Particles which are loosened from the surface by gas erosion, by gravity, or by jarring of the electrode to remove adhering particles, are prevented from traveling horizontally along the exterior of

35 the walls by the baffles which extend outwardly beyond the walls to trap the particles and cause them to be deflected downwardly into the particle-receiving space inside the electrode.

40 The electrodes and baffles preferably project at their lower ends into a dust-collecting hopper to insure that all dust removed from the electrodes by jarring is collected in a space outside and removed from the main gas stream. The dust may be removed from the hopper by any

45 conventional type of means.

How the above, as well as other objects and advantages of my invention not specifically stated, are attained will be more readily understood by reference to the following description and to the annexed drawing, in which:

Fig. 1 is a fragmentary side elevation of a collecting electrode constructed according to my invention;

Fig. 2 is a horizontal section through the electrode taken on line 2—2 of Fig. 1;

Fig. 3 is a fragmentary vertical section through the electrode on line 3—3 of Fig. 1;

Fig. 4 is a fragmentary vertical section on line 4—4 of Fig. 3; and

Fig. 5 is a sectional view similar to Fig. 3 showing a variational form of plates constituting the wall-forming means of the electrode.

Fig. 1 is a side elevation of the upper portion of a non-discharging, collecting electrode constructed according to my invention. From the drawing and the following description, it will be seen that the electrode may be considered as comprising two vertically extending parallel walls which are horizontally spaced apart to form between the two walls a particle-receiving space S. Each of these walls comprises one or more vertical series of plates 1, the plates being individually supported from rods 2 by bending the upper ends of the plates around the rods, as at 1b in Fig. 3. The major portion of each plate 1 is flat and lies in a substantially vertical plane, and consequently each plate may itself be considered as being vertically extending. The outer or external surfaces of the plates form the collecting surfaces of the electrodes on which the particles are precipitated. The upper portion 1a of each plate is inclined outwardly and upwardly in order to form between two vertically adjacent plates a horizontally elongated opening 4. It will be noticed from Fig. 3, that the top edge of each plate is spaced outward of, and preferably slightly above, the bottom edge of the plate next above in order that the dust particles falling from the outside surface of a plate 1 be caught and directed by the inclined portion 1a of the plate next below through a horizontally elongated opening 4 and into the particle-receiving space S between two horizontally spaced plates. Openings 4 are upwardly and outwardly facing to catch the falling particles.

In order to prevent the gas stream from carrying particles horizontally along the collecting surfaces of the electrode, baffles 3 are placed at intervals along the horizontal length of the electrode walls. These baffles form traps that catch the particles, halting horizontal movement.

In the particular construction of the electrode hereafter disclosed, each wall or face of the electrode is made up of several vertical series of plates, the series being horizontally spaced apart by baffles 3 which are in turn horizontally spaced by the intervening vertical series of plates. The baffles 3 extend vertically and transversely of the plates, and preferably extend across the particle receiving space between the two walls of the electrode as well as extend outwardly beyond the plates, as shown in Fig. 3. Baffles 3 may be flat plates, but it is preferred that the outer edges of baffles 3 be provided with flanges 3a which lie in vertical planes substantially parallel to the plates and spaced outwardly from the main portions of the plates. From the standpoint of manufacture, the transverse baffles 3 with their attached flanges 3a may be made

from plates with the flanges welded on, or they may be made from H or channel sections of structural shapes, the use of channel members for the baffles being shown in the accompanying drawing. When channel or similar shapes are used, it is preferred that flanges 3a point toward the precipitator inlet, that is, they point into the oncoming gas stream in order that the baffles and flanges may be most effective in preventing horizontal travel of particles along the exterior collecting surface of the electrode. The direction of gas flow is generally horizontal, as indicated by arrow 8.

From a structural standpoint, advantage may be taken of the strength of baffles 3 to use them as a framework for the electrode. Baffles 3 are attached at their upper ends to a crossbar 9 from which the electrode is suspended. Rods 2 pass through aligned openings in baffles 3 and are supported thereby, so that plates 1 are supported by and between baffles 3.

Horizontal spacing between adjacent plates in order to establish within the interior of the electrode a particle receiving space, is maintained by cylindrical spacers 6 which are mounted on baffles 3 and engage the inner surfaces of two plates 1. A plurality of pins 7 supported in baffles 3 are provided, each pin engaging the outer surface of a plate 1 to hold that plate in engagement with the associated spacer 6. Pins 7 are preferably located somewhat below the spacer 6.

Although the collecting electrode described may be used in a separated field type of precipitator, the electrode is herein shown as being placed in a single field precipitator, for simplicity of description. The collecting electrode acts as the opposing non-discharging electrode for a plurality of discharge electrodes, as shown in Fig. 2. Each discharge electrode consists of a vertically extending tube or rod 5 provided with a plurality of projecting discharge points 5a at which corona discharge is established and an electric field is maintained between the discharge electrodes and the non-discharging electrode. Any other suitable type of discharge electrodes may be used. The gas stream carrying particles in suspension passes between the collecting electrode and the row of discharge electrodes, the direction of gas flow being generally parallel to the exterior surfaces of the walls of the electrode. When my improved collecting electrode is used in the precipitating section of a separated field precipitator, the discharge electrodes 5 are replaced by non-discharging electrodes.

A complete precipitator is formed by the addition of other units or means which are conventional and consequently not described herewith. These include a housing having a gas inlet and outlet and enclosing the electrodes, suitable gas conduits for conveying the gas to and away from the precipitator housing, and suitable electrical means for supplying high tension uni-directional current to the discharge electrodes. In order to secure the advantages of my invention, the gas inlet and outlet of the housing are at opposite ends, thus directing the gas in a generally horizontal direction through the housing, in a conventional manner. A complete precipitator also usually includes, among other conventional elements not shown herewith, some suitable means to strike or rap the collecting electrode in order to loosen dust particles adhering to the collecting surfaces. A hopper is preferably formed by the precipitator housing and located underneath the

collecting electrode to store dust particles falling from the electrode. All these means are well-known to persons skilled in the art. The collecting electrode may also be considered as comprising a plurality of pairs of vertically arranged plates which are supported in the intervals between baffles which are spaced in the direction of stream flow, the members of each pair of plates being spaced horizontally in a direction transversely to the stream flow in order to form between the members of each pair of plates a particle-receiving space. Although Fig. 3 shows one such pair of horizontally spaced plates 1, and the top portion of a lower pair with the members of each pair arranged at substantially the same level, it will be understood that the members of each pair of plates may occupy different levels so that the horizontally elongated openings 4 between the plates at one face of the electrode would be higher than the similar openings 4 at the opposite face of the electrode.

Fig. 5 shows a modified form of plate 1c in which the entire plate is flat and slightly inclined from the vertical, the inclination of the plates being sufficient to form between vertically adjacent plates a horizontally elongated opening 4 through which particles of precipitated material reach the particle receiving space established between horizontally spaced plates. Except for the slight change in the shape of the plate, the construction and arrangement of parts is the same as heretofore described.

It will be seen that with the collecting electrode construction of the present invention, the exterior collecting surfaces of the electrode upon which particles are precipitated lie between successive horizontally spaced baffles which shelter these collecting surfaces to some extent from the gas flow. The baffles form traps or quiescent zones at intervals along the surfaces of the electrode in which particles eroded from the electrode surfaces are collected out of the influence of the horizontally moving gas stream and are thus prevented from traveling horizontally along the plates. The particles thus collected, are dropped through openings 4 in the electrodes into the particle receiving space S in the interior of the electrode.

From the foregoing description of my invention, it will be seen that various modifications in the shape and arrangement of parts constituting the collecting electrode may be made without departing from the spirit and scope of my invention; and consequently it is to be understood that the foregoing description is to be considered as illustrative of rather than limitative upon the invention as defined in the appended claims.

I claim:

1. A collecting electrode structure for an electrical precipitator for removing suspended particles from a horizontally flowing stream of gas,

comprising: a vertical series of plates; a second vertical series of plates spaced horizontally from the first series to provide a particle receiving space between the two series, the plates in each series extending vertically and being spaced apart to provide horizontally elongated openings to admit particles to said space; and a plurality of horizontally spaced baffles disposed at intervals along the horizontal length of said two series of plates, said baffles extending vertically and transversely across the particle receiving space and projecting outwardly beyond the outer faces of the two series of plates to prevent travel of precipitated particles horizontally along the plates.

2. A collecting electrode structure as in claim 1 in which each plate comprises a substantially vertical lower portion and an outwardly inclined upper portion, the top edge of the plate being outward of and slightly above the bottom edge of the plate next above to form the particle admitting opening between each two vertically adjacent plates.

3. A collecting electrode structure for an electrical precipitator for removing suspended particles from a horizontally flowing stream of gas comprising: a plurality of spaced, vertically extending baffles; a vertical series of plates; and a second vertical series of plates, the plates of both series being supported by and between the baffles and the plates being spaced apart to form a particle receiving space between the two series and openings to said space between successive plates; the baffles extending transversely of the plates to prevent travel of precipitated particles horizontally along the plates; a plurality of spacers attached to the baffles, each spacer projecting into the particle receiving space to space apart a pair of plates; and a plurality of pins attached to the baffles, one pin being located to engage the outside face of each plate to hold the plate in engagement with the spacer.

4. A collecting electrode structure for an electrical precipitator for removing suspended particles from a horizontally flowing stream of gas, comprising: means forming two vertically extending parallel walls providing external surfaces on which particles are precipitated the two walls being spaced apart horizontally to form a particle receiving space between them and each wall being formed with a series of vertically spaced horizontally elongated openings to admit particles to said space; and a plurality of horizontally spaced baffles disposed vertically and transversely of said walls at intervals along the horizontal length of the walls, said baffles extending across the particle receiving space and projecting outwardly beyond the outer faces of the walls to prevent travel of precipitated particles horizontally along the external surfaces of the walls.

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