Dec. 10, 1957 J. A. ARMSTRONG ET AL 2,815,824

ELECTROSTATIC PRECIPITATOR

Filed May 12, 1955

Fig 1.

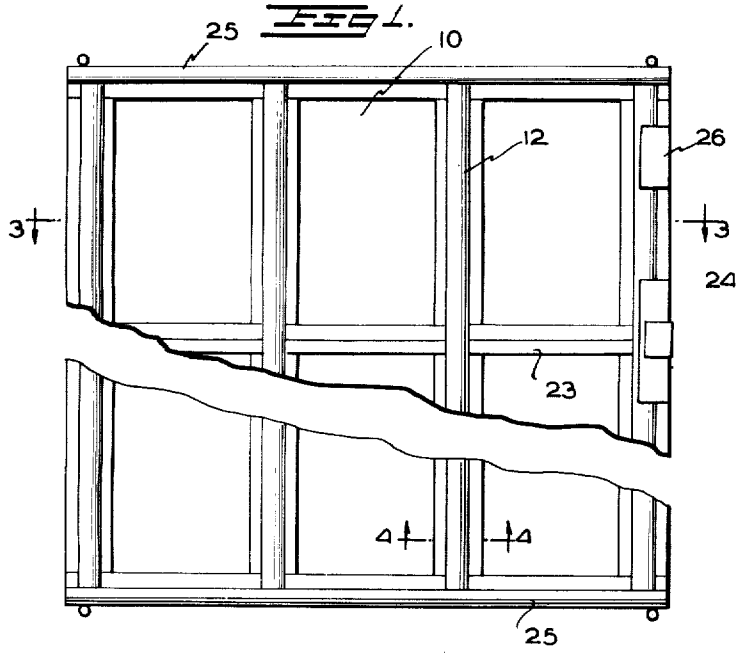


Fig 2.

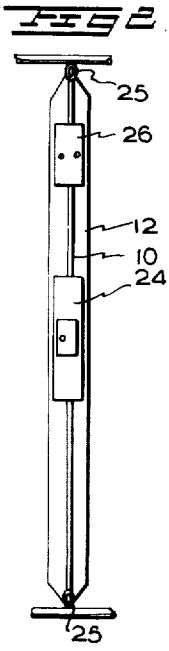


Fig 3.

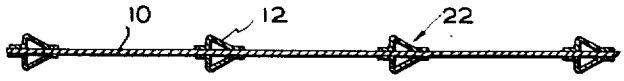


Fig 4.

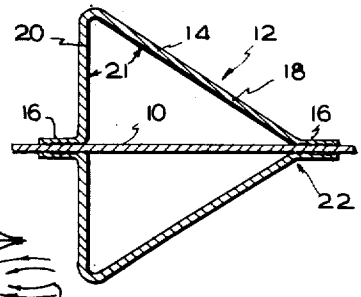


Fig 5.

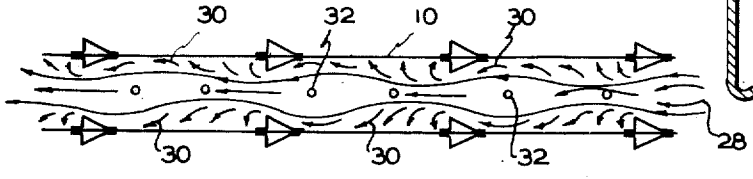
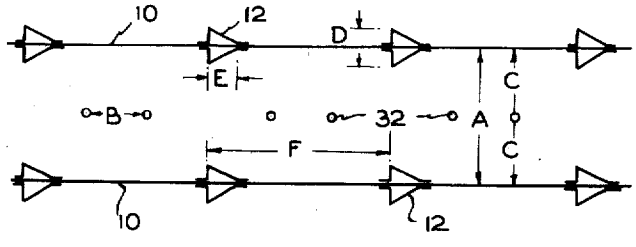


Fig 6.



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ELECTROSTATIC PRECIPITATOR

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3 Claims. (Cl. 183—7)

The present invention relates to collecting plates for electrical precipitators and more particularly and specifically to a new and improved collecting plate having a unique gas flow baffle structure and arrangement which serves to produce new and useful results in the precipitation art.

It has long been recognized that the performance efficiency of electrostatic precipitators is directly dependent to a substantial degree on the construction and characteristics of the collecting plates utilized in the precipitators. Electrical and gas flow properties are essentially the most important factors in providing the effective and satisfactory collecting plate constructions necessary to the maximum efficiency of the precipitators.

For example, collecting plate characteristics of sparking voltage and reaction to high-resistivity dusts are of primary importance in providing the most satisfactory plate performance, while gas flow characteristics lending themselves to prevention of particle erosion and high collection efficiency are also of utmost importance.

It is, therefore, a general object of the present invention to provide a collecting plate construction for electrical precipitators which inherently satisfies all of the basic and fundamental factors necessary to maximum collecting plate performance.

Another object of this invention is to provide a collecting plate construction for electrical precipitators which presents smooth, unbroken plate surfaces enabling the maintenance of maximum operating voltage and fields through which the gas flows within a precipitator.

A further object of this invention lies in the provision of a collecting plate construction for electrical precipitators which insures stagnant gas flow zones adjacent plate surfaces substantially reducing tendencies toward particle erosion, yet a structure which provides substantially uniform corona current densities and high electrical fields near the plate surfaces which are necessary for effective particle precipitation.

It is another object of this invention to provide a collecting plate construction including a new and unique baffle design and structure which results in the substantially new gas flow characteristics above referred to whereby scrubbing and erosion action of the gas along the plate surfaces is greatly reduced.

Still a further object of this invention is the provision of an electrical precipitator collecting plate in which the new and improved baffle structures enable the use of lighter plate assemblies with a maximum characteristic of plate stiffness and rigidity inherent in the combined assembly of the plate with the gas flow baffles which form plate stiffening structures.

Another object of this invention is the provision of new and improved collecting plates for electrical precipitators which may be arranged and supported in combination with the discharge electrodes within the precipitator in such a manner as to provide improved alignment and more accurate electrical clearance between the charging and collection electrodes thereby producing new and improved results in the nature of higher operating voltages and precipitator efficiency.

Yet another object of this invention is the provision of collecting plates for electrical precipitators which are, by reason of their unique and improved construction, inherently less expensive in manufacture and installation, but which are extremely durable and long-lasting in use.

Still further objects and advantages of this invention will become more readily evident to those skilled in the art when the following general statement and description are read in the light of the accompanying drawings.

The nature of the present invention may be stated in general terms as consisting of a new and improved collecting plate for electrical precipitators including a flat rigid plate of substantially rectangular configuration, a plurality of baffles secured longitudinally of the plate in one direction in spaced parallel relationship therealong, said baffles including a pair of complementary members secured in direct opposition on opposite sides of the plate and presenting angular projections with the plate in one direction therealong, said angular projections turning at their projected ends to extend perpendicularly to the plate forming right angular projections in the opposite direction along the length of the plate.

Referring now to the accompanying drawings in which like numerals indicate similar parts throughout the several views:

Fig. 1 is a side elevation of a collecting plate constructed in accordance with the present invention.

Fig. 2 is an end view of the plate illustrated in Fig. 1.

Fig. 3 is a horizontal section taken on line 3—3, Fig. 1.

Fig. 4 is an enlarged fragmentary horizontal section taken on line 4—4, Fig. 1.

Fig. 5 is a diagrammatic plan view illustrating gas flow along two spaced collecting plates made in accordance with the present invention.

Fig. 6 is a schematic view in plan illustrating the arrangement of two plates made in accordance with the present invention in combination with discharge electrodes within a precipitator construction.

The new and improved collecting plate for electrical precipitators constituting the present invention will be hereinafter described in an embodiment including flat, solid sheet plate construction incorporating the improved baffle structure forming in combination with the plate a part of the present invention, however, it is fully contemplated and anticipated that ribbed, corrugated, dimpled, or perforated sheets may be used in the present collecting plate structure without departing from the intent and scope of the present invention, since the disclosure of a solid sheet construction is for purposes of illustration only.

Referring to Fig. 1 of the drawings, there is illustrated a flat, substantially rectangular solid sheet or plate **10** which forms the basic collecting electrode or collecting plate within an electrical precipitator construction. The plate **10** is provided at equally spaced intervals along the lateral length of the plate with baffles **12** which extend vertically of the plate in parallel relationship.

As is best seen in Fig. 4 of the drawings, each of the baffles **12** includes a pair of elongated channel members **14** having a pair of oppositely projecting spaced, aligned flange members **16** which are interconnected by two straight sections **18** and **20** forming a rounded, acute angle **21** to the plane of said aligned flanges with the section **20** extending perpendicularly to the plane of said flanges and the section **18** lying at an angle relative thereto. The two identical trough members **14** forming the baffle **12** are positioned in opposition to one another on opposite sides of the baffle to form in cross sectional configuration a substantially equilateral triangle with the corresponding flanges **16** of each of the members being secured to the opposite faces of plate **10**.

All of the baffles on each of the plates **10** within the

precipitator are secured to the plates with their apex portions **22** extending in the same direction along the length of the plate **10** thereby forming in a direction opposite thereto a series of V-shaped projections extending on either side of the plate with the projections being closed by the perpendicular portions **20** of the baffle members on the sides thereof away from the apexes of the baffles.

As may be best seen in Figs. 1 and 2 the baffle members **12** form a lightweight stiffening frame for the plate and by interconnecting the upper and lower ends of the baffles along the length of the plate with stiffening members **25** the plate is completely framed forming a rigid lightweight component element. An additional stiffening member **23** may interconnect the spaced baffles intermediate the top and bottom of the plate.

It is possible with a plate constructed as described to secure at a point on one end of the plate over the baffle member thereadjacent an attachment plate **24** for cooperation with a rapping apparatus (not shown) to provide for the rapping of the collecting plate to dislodge precipitated dust particles thereon. Additional means taking the form of end attached plates **26** may be provided for non-rigid suspension of the collecting plate within the precipitator in accordance with known plate supporting practices.

Referring now to Fig. 5 of the drawings, wherein there is shown a gas flow diagram for a precipitator in which are incorporated collecting plates **10** made in accordance with the present invention, it may be seen that gas entering two spaced parallel collecting plates, as indicated by arrows **28**, will flow along the opposed surfaces of the plates in the general flow pattern indicated by the arrows **30** creating stagnant gas flow zones immediately adjacent the plate surfaces which results in the prevention of particle erosion on the plate surfaces without impairing corona current densities and high electrical fields adjacent the plate surfaces which are necessary for effective particle precipitation.

Fig. 6 of the drawings illustrates diagrammatically the preferred arrangement and spacing of baffles of the type herein described both with regard to one another along the length of each of the collecting plates and with regard to their spacing relative to the discharge electrodes **32** arranged in parallel rows intermediate each adjacent pair of spaced collecting plates. There is also illustrated in Fig. 6 the preferred ratio of baffle depth relative to the spacing of adjacent collecting plates.

It is preferable that when collecting plates **10** of the present invention are employed in precipitators the lateral spacing (A) of adjacent plates be about eight inches, center to center, with the discharge electrodes **32** spaced six inches apart (B), center to center, and spaced equidistant (C) from each adjacent collecting plate. It is also preferable that the discharge electrodes **32** be spaced from the nearest plate baffle edge a minimum of 150 percent of the sparking distance of the assembly, which requires omission of electrodes **32** immediately between aligned baffles.

Accordingly in a collecting plate construction including baffles **12** of the type herein described, it is advantageous to construct each baffle with a lateral measurement (D) of 3¼ inches and a longitudinal measurement (E) of 2½ inches whereby a ratio of baffle depth from the collecting plate to collecting plate spacing of approximately 2/10 is achieved, and it is essential that this ratio be maintained within the range of 1.5/10 to 2.5/10.

In the construction shown in the drawings, the baffles longitudinally of each plate are spaced (F) 16¾ inches apart, center to center. This spacing provides for a ratio of baffle spacing to collecting plate spacing of 2/1 and it is desirable to proper functioning of the precipitator that this ratio be maintained within the range of 1.75/1 to 2.25/1.

Thus from the foregoing it is seen that new and improved collecting plate construction incorporating a unique baffle structure has been provided which when assembled within an electrical precipitator within the specification ranges set forth will produce substantial new and improved results in precipitator operation rendering the precipitator more efficient and effective than prior constructions.

Having thus described and explained the present invention including all combinations and sub-combinations embodied therein, what is desired to be claimed is:

1. In an electrostatic precipitator having a plurality of spaced parallel discharge electrodes arranged in a row, and collecting plate electrodes extending in parallel spaced relationship to the row of discharge electrodes, the combination with said collecting electrode plate of a plurality of baffles extending in parallel spaced relationship from the plate electrode transversely of the direction of gas flow, each of said baffles comprising a base portion extending normally to the extended surface of the collecting plate and to the direction of gas flow, and a leg portion sloping inwardly and upstream from the extended edge of the base portion to the collecting plate, thereby providing right triangular baffle structures projecting into the gas stream and presenting a sloping face upstream and a substantially perpendicular face downstream, the baffles on opposed plates being positioned in opposed parallel relationship.

2. The invention defined in claim 1 wherein the ratio of the spacing of adjacent baffles longitudinally of each plate to the lateral spacing of adjacing plates is within the range of 1.75/1 to 2.25/1.

3. The invention defined in claim 2 wherein the ratio of the depth of baffle projection on one side of a collecting plate to the lateral spacing of adjacing collecting plates is within the range of 1.5/10 to 2.5/10.

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