

[54] **DEVICE FOR ELECTRIC PRECIPITATOR**

2,812,035 11/1957 Sohlman et al. 55/130 X

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[57] **ABSTRACT**

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A device for electric precipitators designed for horizontal gas flow and having plane precipitation electrodes in a number of rows parallel to the direction of gas flow and with emission electrodes situated between said rows, and equipped with an impact device for cleaning at specific intervals the precipitation electrodes, the rows of precipitation electrodes being situated between a number of transverse bars at different heights of the precipitator, said bars having guides opposite each row of precipitation electrodes, said electrodes in each row being linked together and the impact device being designed in known manner to strike against the rows of linked precipitation electrodes to displace them one after the other in the plane of each row.

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55/148, 55/150, 55/156

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[58] Field of Search **55/112, 130, 154,**
55/156, 140, 141, 148, 150

[56] **References Cited**

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9 Claims, 5 Drawing Figures

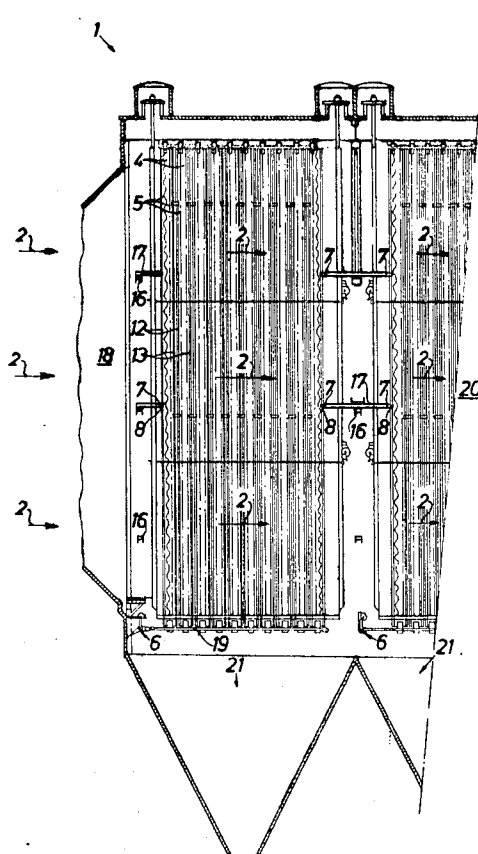
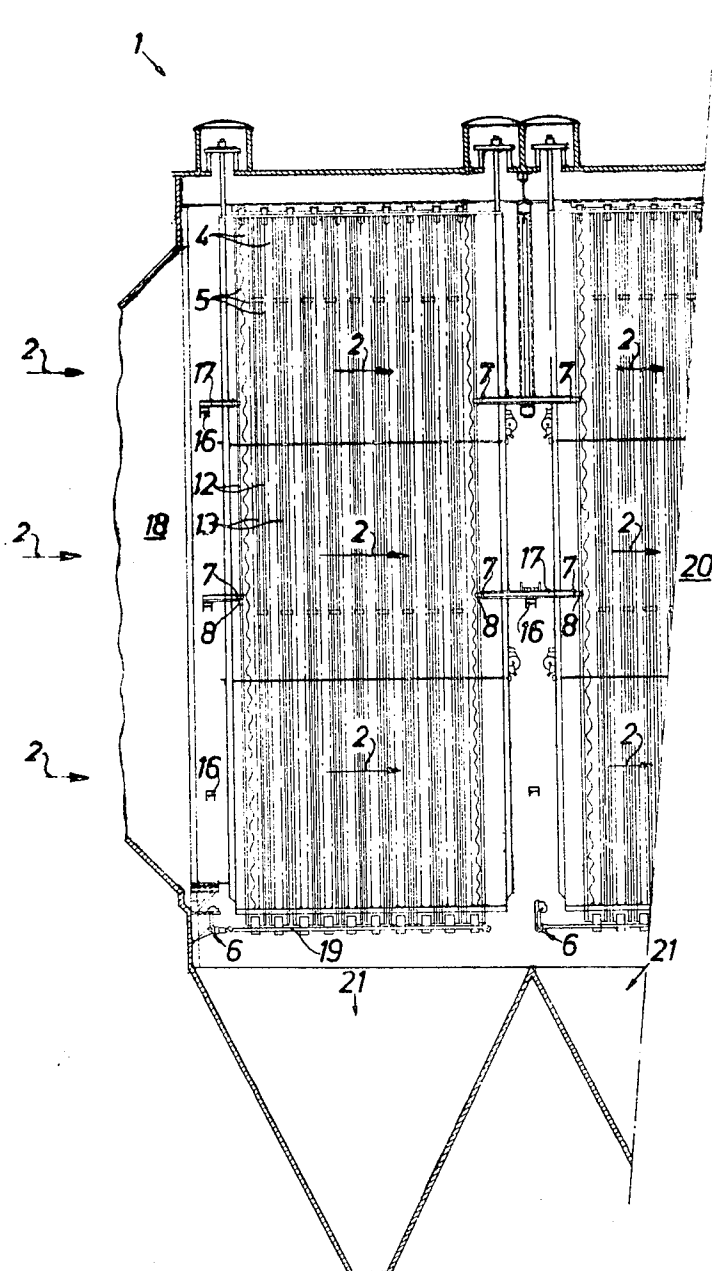


Fig. 1



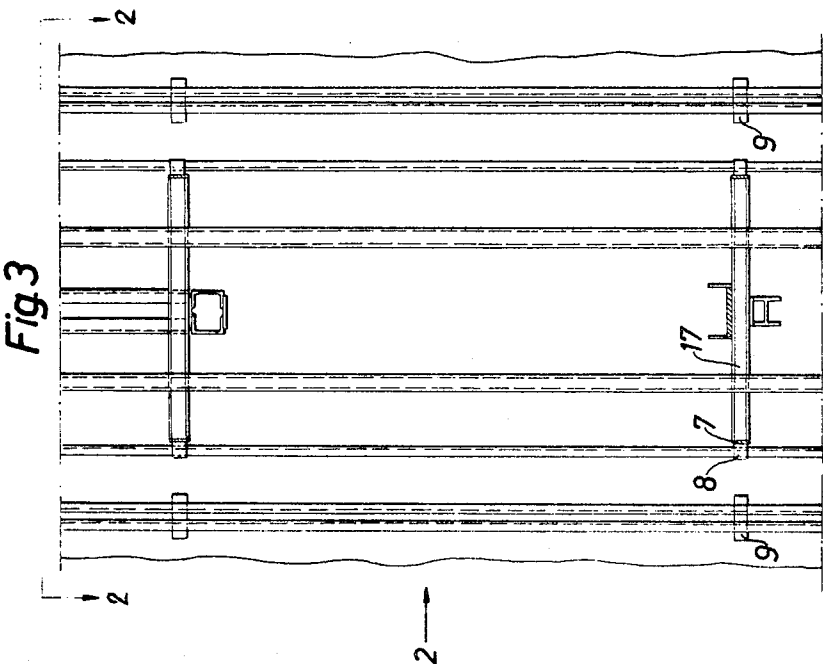
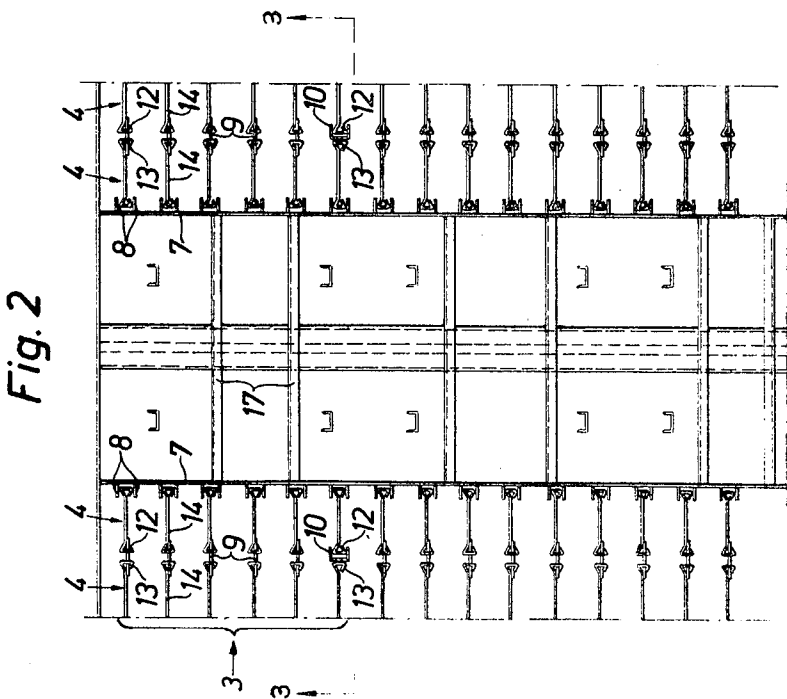


Fig. 4

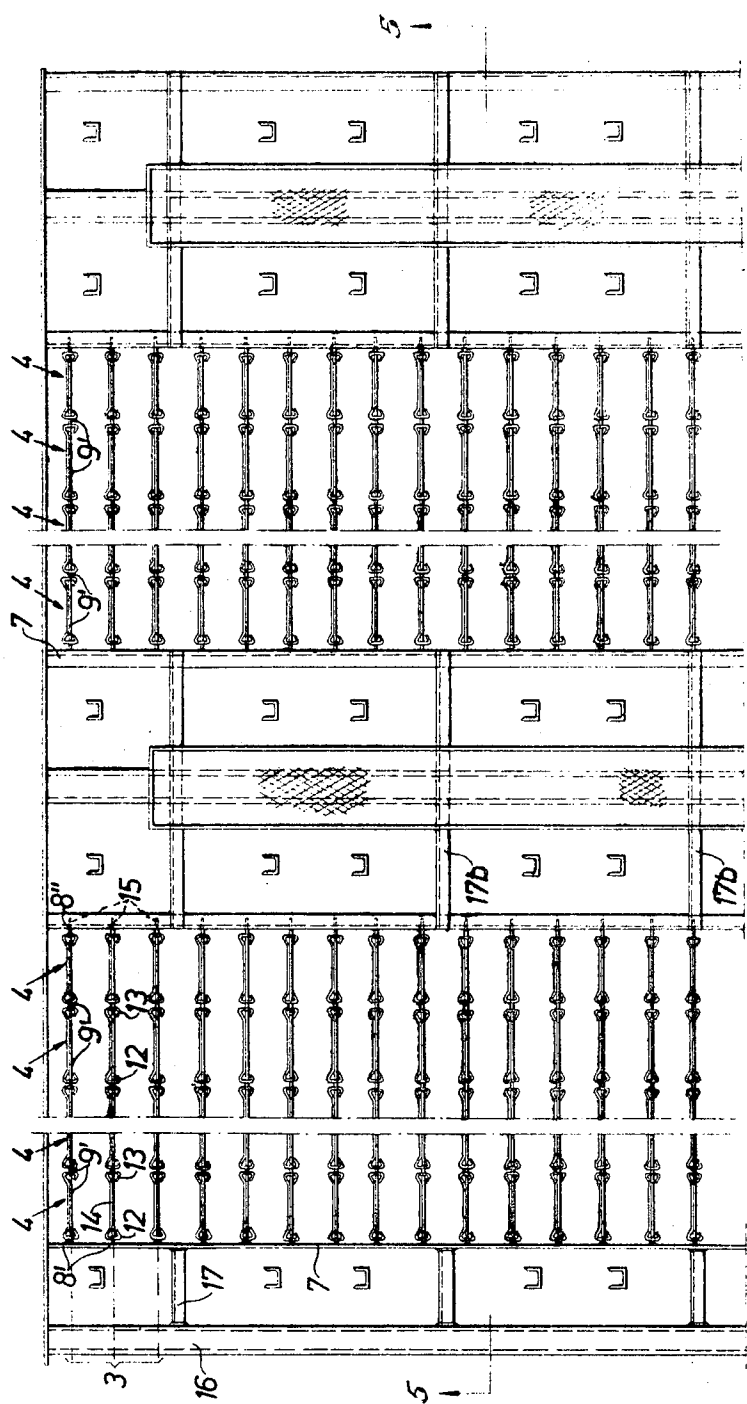
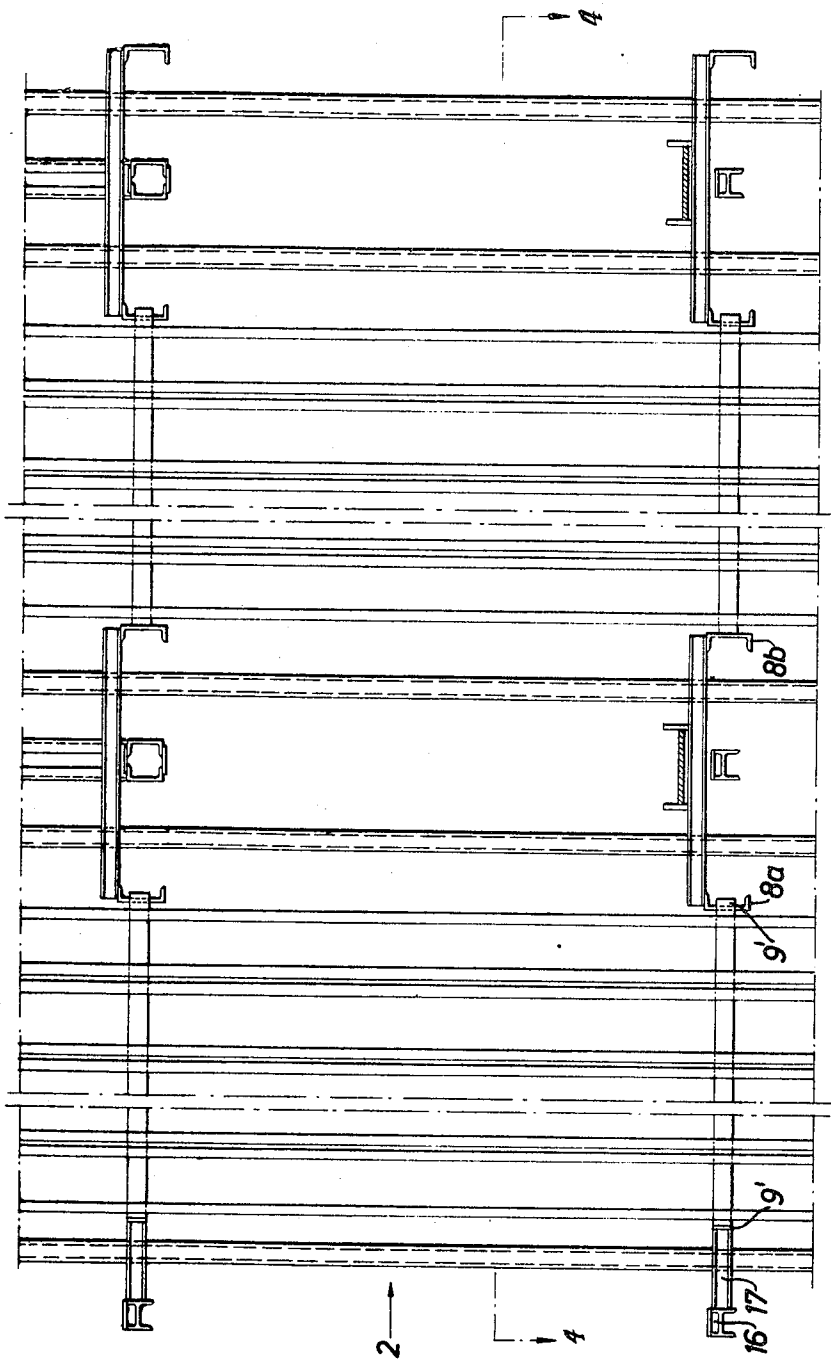


Fig. 5



DEVICE FOR ELECTRIC PRECIPITATOR

This invention relates to a device for use with electric precipitators designed for horizontal flow of the gas to be cleaned and having plane precipitation electrodes placed in a number of parallel rows, with emission electrodes situated between the rows, and equipped with hammers or similar impact devices for cleaning of the precipitation electrodes at specific intervals.

In view of its ability to separate difficultly separated dust particles from flue-gases an electric precipitator is generally used when environmental hygiene requires degree of separation of an order of 98 percent and above. In electric precipitators of dry type the dust particles are separated from the gas flow by electrical charging of the particles with electrons emitted by emission electrodes and by attraction of the particles to grounded precipitation electrodes under the influence of the strength of the electro-static field. One of the most significant problems in the design and operation of an electric precipitator of this type is the removal of the precipitated material from the precipitation electrodes without the material being carried along once again by the gas flow. The commonest method for this purpose is to shake the precipitation electrodes, and in some cases also the emission electrodes, by blows upon them at specific intervals, by means of which the material is removed and collected in dust traps and carried off, for example, by means of screw conveyors or similar mechanical element. From the economic aspect it is often necessary to design electric precipitators of considerable height, and consequently with large height of electrodes, e.g., 10 m or more.

A common design of electric precipitator comprises plane, stiffened precipitation electrodes arranged in a number of parallel rows of several electrode surfaces placed one after the other. Electric precipitators of this size are designed for high nominal gas speeds having regard to the available space. Severe problems often arise in such cases as a result of violent turbulence of the incoming gas which, after passage through the gas distributor screens on the inlet side, readily sets up oscillations of a standing sine wave character in the precipitation electrode plates. The oscillations result in a reduction of the so called electrical voltage distance in the electric precipitator causing recurrent flashover and other interruptions of operation, for which reason it is extremely urgent to remedy this disadvantage, which is disastrous for the reliability of operation. These oscillations arise despite the fact that the precipitation electrode plates are usually stiffened by bending back of their fore and rear side-edges. The attempt has been made to limit the oscillations of the precipitation electrodes by placing two plate bands on the two sides of the cross-sectional profile of the precipitation electrodes at roughly half the height of the electric precipitator. This has the serious disadvantage, however, of reducing also the aforesaid voltage distance, so that the operating voltage of the electric precipitator must be somewhat reduced. This reduction of the operating voltage, however, results in a heavy reduction of the efficiency of the electric precipitator, for which reason the separation per volume of precipitator is smaller and the precipitator is consequently uneconomical in operation. This design also has the disadvantage that the impact energy from the impact device cannot be fully utilized for shaking down of the particles collected on the precipitation electrodes.

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The object of the invention is to provide a device for controlling the movement of the precipitation electrodes during hammer-cleaning, so that this can be done at the normal operating voltage of the electric precipitator and at the same time the oscillations of the precipitation electrodes and their movement relative to one another can be kept under control, so that the electrical voltage distance in the electric precipitator can be kept at an optimal value, with the best possible efficiency in consequence. The device is characterized in that the parallel rows of precipitation electrodes are situated between a number of transverse bars disposed at different heights in the electric precipitator and across it perpendicular to the plane through the said rows of precipitation electrodes, which bars have guides opposite each row of precipitation electrodes. Furthermore the precipitation electrodes in each row are linked together in the direction of impact along the plane for the impact device and In addition, the impact device is designed in the known manner to strike against the rows of precipitation electrodes so as to displace the electrodes one after the other. An effective embodiment in which each precipitation electrode has a fore and rear side-edge partially bent back in the flow direction of the gas for stiffening of the electrode and a plane intermediate portion, is characterized in that the precipitation electrodes in each row are linked together by means of tongues secured preferentially in a rear, bent-back side-edge and entering preferentially into a fore, bent-back side-edge of the next precipitation electrode, and in that the foremost bent-back side-edge and the last bent-back side-edge in each row are held rigidly laterally to the said aforementioned transverse bars by means of a guide attached to each bar. Each tongue can be of -shape, i.e., with a bent-up lip to permit a limited reciprocal movement, at the same time preventing exceeding of said movement and involuntary separation of two adjacent precipitation electrodes from one another. According to another embodiment all precipitation electrodes in one row can be anchored to one another by means of a continuous long and narrow, flat (placed edgewise) metal band passing both through the fore and rear bent-back side-edge of each precipitation electrode. This band may suitably be fixed to one of said bars and passed through the other bar in a clearance hole, so assuring a limited reciprocal movement longitudinally but at the same time to prevent exceeding of this movement and involuntary separation of two adjacent precipitation electrodes from one another. In an improvement of this embodiment the band has a number of cut-outs or notches () along one edge resting in the lower edge of the non-threaded opening, the which cut-outs or notches permit a limited reciprocal movement longitudinally but at the same time prevent exceeding of said involuntary movement and separation of two adjacent precipitation electrodes from one another, which during operation of the precipitator must be considered as virtually a catastrophe. A further embodiment of the device according to the invention is characterized in that, in each row, the precipitation electrodes are anchored to one another by means of a -shaped strap attached to the rear bent-back side-edge, and embracing the fore bent-back side-edge of the next precipitation electrode, and in that the front bent-back side-edge and the last bent-back side-

edge in each row — viewed in the direction of flow of the gas — are held fixed laterally to said bars by means of said guides, preferentially designed as a □-shaped or □-shaped strap attached to each bar. An advantageous embodiment of the new and improved device is characterized in that the two opposing sides of the horizontal beams holding together the side-walls of the electric precipitator carry tie-rods which rigidly join each of said bars to said horizontal beams or, in cases when the electric precipitator consists of a number of groups or packages of emission electrodes and precipitation electrodes situated at intervals one after the other in the direction of flow of the gas, and associated impact devices, also join a bar in a forward group to a bar in a rearward group in the direction of flow of the gas.

The invention will now be described with reference to the attached drawings, where

FIG. 1 shows a cross-section through an electric precipitator which horizontal gas flow and with dust traps for collection and removal of precipitated dust,

FIG. 2 shows in enlargement a horizontal cross-section through a part of the electric precipitator with one embodiment of the linking device according to the invention,

FIG. 3 shows a longitudinal section through the same portion of the electric precipitator as taken on the line 3—3 of FIG. 2,

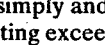
FIG. 4 shows in enlargement a horizontal cross-section through a part of the electric precipitator with a different embodiment of the linking device according to the invention.

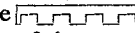
FIG. 5 shows a longitudinal section through the same part of the electric precipitator as FIG. 4.

In the drawing 1 denotes an electric precipitator for horizontal flow in the direction of the arrow 2 of the gas to be cleaned, which enters at 18 and is visualized as leaving the electric precipitator at 20. A number of parallel rows of precipitation electrodes 4 are denoted 3. In all cases of guidance and linkage shown, the precipitation electrodes have a plane mid-portion 14 and partially bent-back fore and rear side-edges 12 and 13 respectively, viewed in the direction of flow of the gas, the which side-edges serve to stiffen the precipitation electrodes, which are often of considerable length, 10–12 m, and extend throughout the entire height of the electric precipitator. The emission electrodes 5 of the electric precipitator consist in the case shown of so called spiral electrodes of the same length as the precipitation electrodes and suspended in the conventional manner, electrically insulated from the precipitation electrodes. The emission electrodes are supplied with a high voltage in the known manner. The impact device 6 consists of a hammer of conventional type and is driven in the known manner at specific intervals against an impact rod 19 fitted to the bottom of the precipitation electrode. The parallel rows 3 of the precipitation electrodes are situated between a number of transvers bars 7 extending across the precipitator at different heights and perpendicular to the planes through the rows of precipitation electrodes 4. The bars 7 have guides 8 opposite the ends of each row of electrodes 4.

The precipitation electrodes are assumed to be linked together by means of tongues 9 inserted in a rear bent-back side-edge 13 of a precipitation electrode, and preferentially fixed to it, and a fore bent-back side-edge 12 of the next precipitation electrode, with which the tongues preferentially have a clearance fit. Another

type of linkage element may consist of a □-shaped strap 10 (FIG. 2). All precipitation electrodes in one row may also — as shown in FIG. 4 — be anchored or linked to one another by means of a continuous long and narrow, flat metal band 9' (placed on edge). The band is assumed to pass both through the fore bent-back side-edge 12 and through the rear bent-back side-edge 13. The band 9' allows in itself a small lateral movement of each of the linked together precipitation electrodes and is preferentially fixed at 8' to one of aforesaid bars 7 at the beginning of each group of electrodes — viewed in the direction of flow of the gas — and at the end of the group as indicated at 8'' passes through a nonthreaded opening 15 in the other bar, between which bars the band 9' extends in one piece.

By giving each of the tongues 9 linking together the precipitation electrodes 4 a bent-up lip  at one end, a limited reciprocal movement is simply and effectively arranged, at the same time preventing exceeding of said movement and an involuntary separation of two adjacent precipitation electrodes. Were this to occur by mishap, the consequence would be tripping and stoppage of operation.

To limit correspondingly the reciprocal movement of the precipitation electrodes 4 when using the band 9', according to an effective embodiment, the latter can be provided with a number of inverted castellated cut-outs, e.g., of type , along one edge resting in the lower edge of the nonthreaded opening.

Electric precipitators of the size in question should, on mechanical grounds, be provided with a number of horizontal beams 16 holding together the sidewalls. As shown in the drawings, these are used to carry tie-rods 17 which rigidly join together each of said bars 7 with said horizontal beams. If the electric precipitator consists of a number of groups or packages of emission electrodes 5 and precipitation electrodes 4 situated at intervals in the direction of flow of the gas, such tie-rods 17 also join a bar in a forward group to a bar in a rearward group (package) in the direction of the flow of the gas. In some cases, in electric precipitators of very large dimensions, the aforesaid bars 7 are replaced by heavy beams 8a and 8b, as appears from FIG. 5. 21 is a dust trap into which the matter precipitated by means of the electrostatic field on the precipitation electrodes 4 runs down and is carried off in an environmentally hygienic manner by means of a screw conveyor or the like not shown in the drawing. In other respects as well, individual details and the form of the elements in the device may be varied within the scope of the following claims.

What is claimed is:

1. In an electric precipitator designed for horizontal flow of the gas to be cleaned, and having plane precipitation electrodes placed edge-to-edge in a number of rows parallel to the direction of flow of the gas through the electric precipitator, emission electrodes situated between the rows, and an impact device displacing said electrodes parallel to the flow direction for cleaning of the precipitation electrodes at specific intervals, the improvement wherein the precipitator has a number of transverse bars fixedly mounted at different heights extending perpendicular to the planes through the said rows of precipitation electrodes adjacent the entrance and exit ends of said rows, guides on each bar engaging the end electrodes in each row of precipitation electrodes to limit perpendicular movement thereof, and

linking elements for the precipitation electrodes in each row linking the electrodes together in the direction of impact along the plane of each row.

2. An improvement according to claim 1 wherein each precipitation electrode has a fore and rear side-edge partially bent back in the direction of flow of the gas for stiffening the electrode and a plane intermediate portion, and said linking elements comprise tongues secured in a rear, bent-back side-edge and entering into a fore, bent-back side-edge of the next precipitation electrode.

3. An improvement according to claim 2, characterized in that each tongue has a bent-up lip to permit a limited reciprocal movement longitudinally but at the same time to limit said movement and thus prevent involuntary separation of two adjacent precipitation electrodes from one another.

4. An improvement according to claim 1, characterized in that said precipitation electrodes have fore and rear bent-back side-edges, and said guides and linking elements each comprise a continuous long and narrow, flat metal band passing both through the fore and rear bent-back side-edges of each precipitation electrodes, the band being at one end fixed to one of said bars and at the other end passing through the other of said bars in a clearance hole.

5. An improvement according to claim 4, characterized in that the band has a number of cut-outs or notches along one edge resting in the lower edge of the clearance hole, the which cut-outs or notches permit a limited reciprocal movement but at the same time limit said movement and prevent separation of two adjacent

precipitation electrodes from one another.

6. An improvement according to claim 1, characterized in that said precipitation electrodes have fore and rear bent-back side-edges, and at least one of said linking elements comprises a □-shaped strap attached to the rear bent-back side-edge and embracing the fore bent-back side-edge of the next precipitation electrode, and in that the bent-back side-edge at the entrance end and the bent-back side-edge at the exit end in each row — viewed in the direction of flow of the gas — are fixed laterally to said bars by means of said guides, and wherein each of said guides comprises a □-shaped or □-shaped strap attached to its associated transverse bar.

7. An improvement according to claim 1 wherein the precipitator includes horizontal beams holding together the side walls of the electric precipitator and tie-rods which rigidly join each of said transverse bars to said horizontal beams.

8. An improvement according to claim 7 wherein the precipitator consists of a plurality of groups of electrode rows spaced-apart in the direction of flow, said beams being disposed in the space between said groups, each beam supporting both the exit-end transverse bar of the fore group and the entrance-end transverse bar of the rear group to join the same.

9. An improvement according to claim 1 wherein said linking elements are disposed at the same heights as the transverse bars to limit movement of each electrode in the row against movement perpendicular to the plane of said row.

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