

March 12, 1968

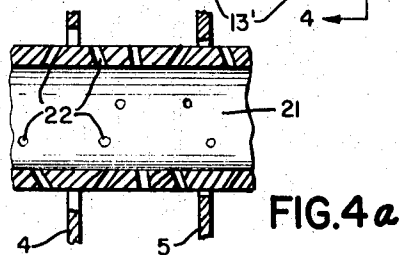
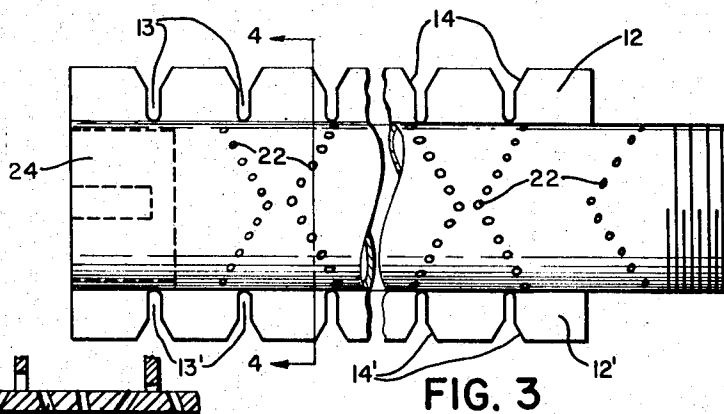
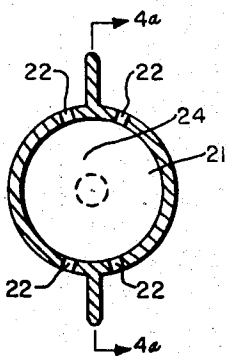
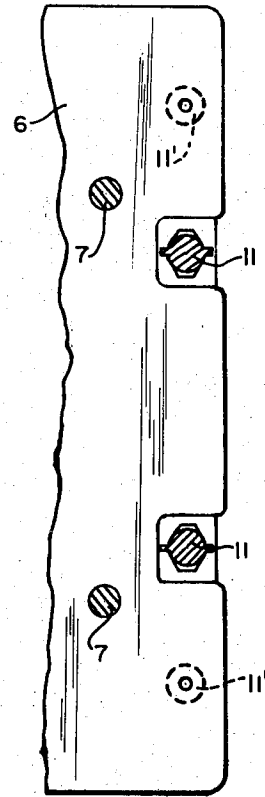
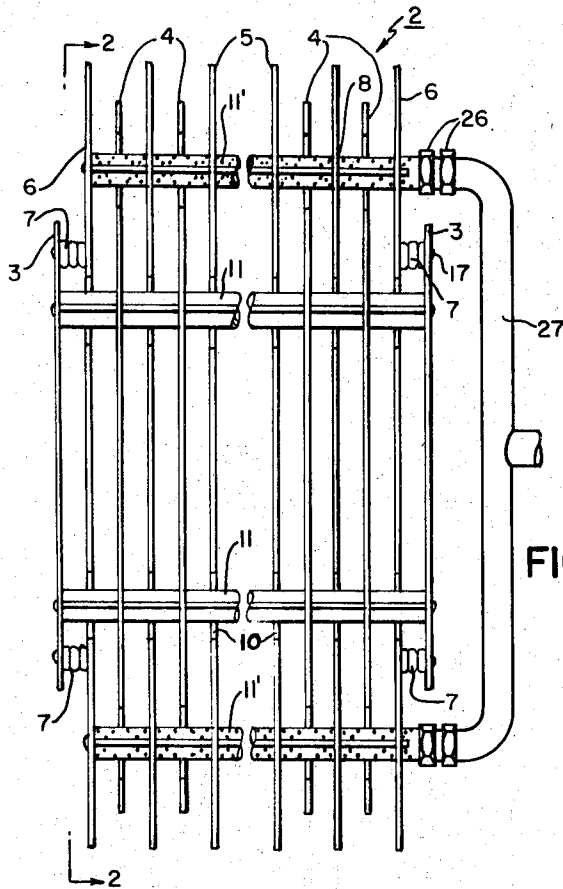
J. D. HARMS

3,372,529

PLATE ELECTRODE ASSEMBLY FOR ELECTROSTATIC PRECIPITATOR

Filed Sept. 8, 1966

2 Sheets-Sheet 1



INVENTOR.
JOHN D. HARMS

BY

Ralph B. Brink
ATTORNEY

March 12, 1968

J. D. HARMS

3,372,529

PLATE ELECTRODE ASSEMBLY FOR ELECTROSTATIC PRECIPITATOR

Filed Sept. 8, 1966

2 Sheets-Sheet 2

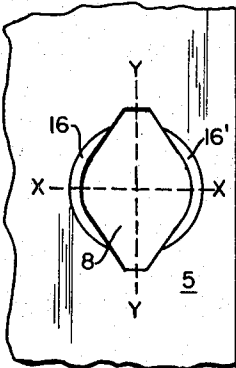


FIG. 5

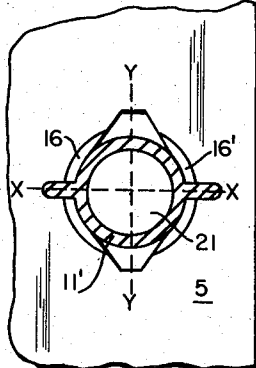


FIG. 6

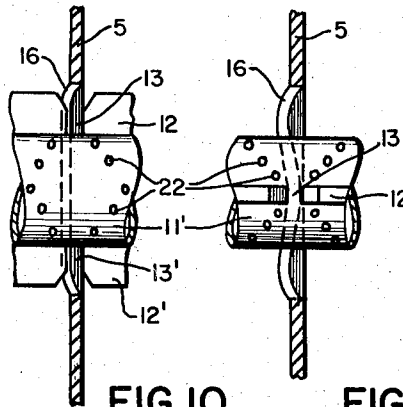


FIG. 10

FIG. 11

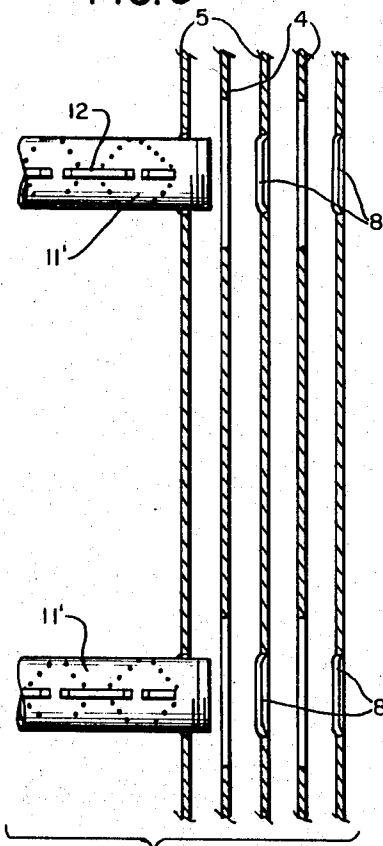


FIG. 7

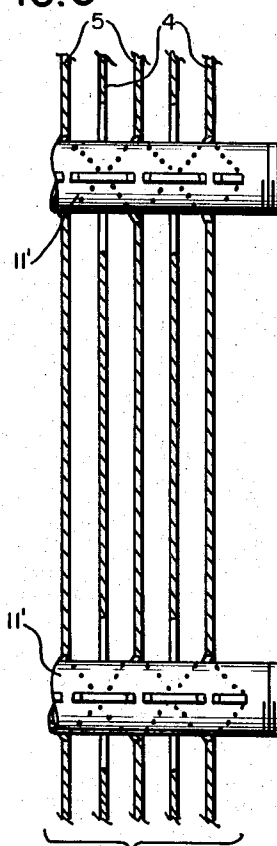


FIG. 8

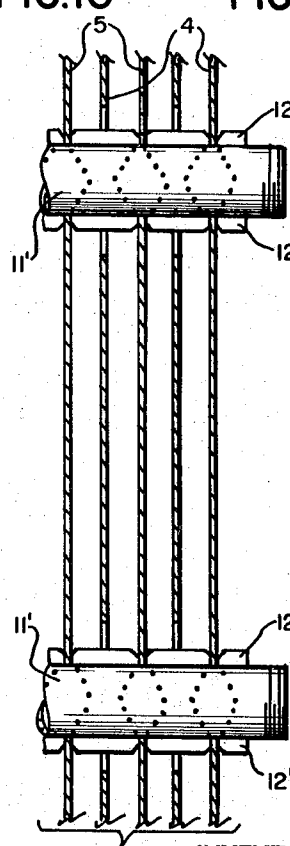


FIG. 9

INVENTOR.

JOHN D. HARMS

BY

Ralph B. Brink
ATTORNEY.

1

3,372,529

PLATE ELECTRODE ASSEMBLY FOR ELECTROSTATIC PRECIPITATOR

John D. Harms, Milwaukee, Wis., assignor to American
Air Filter Company, Inc., Louisville, Ky., a corpora-
tion of Kentucky

Filed Sept. 8, 1966, Ser. No. 578,052

3 Claims. (Cl. 55—118)

ABSTRACT OF THE DISCLOSURE

A plate electrode assembly for electrostatic precipitators wherein the precipitator plates are spaced from each other by inwardly positioned spacer bars having hollow passage means extending along the longitudinal axis thereof in communication with fluid supply means to permit fluid treatment of the plates.

The present invention relates to electrostatic precipitators and more particularly to an improved plate electrode assembly for electrostatic precipitators.

In accordance with the present invention, an improved plate electrode assembly is provided which insures effective electrical contact between select parts of the assembly to reduce problems of arc-over and which at the same time permits a thorough and complete fluid treatment of the plates during pre-selected periods of operation. The present invention obtains these features without sacrificing any of the desirable features of past electrode assemblies and yet eliminates many of the structural parts of past assemblies including previously required complex fluid treatment equipment. Furthermore, the present invention provides an assembly which can be economically and readily constructed and assembled in an efficient manner with a minimum of operating steps. In addition, the present invention provides a novel fluid treatment arrangement which can be readily adapted to a given environment and to a pre-selected type of fluid.

Various other features of the present invention will become obvious to one skilled in the art upon reading the disclosure set forth hereinafter.

More particularly, the present invention provides a plate electrode assembly for an electrostatic precipitator comprising: a plurality of plates spaced from each other a predetermined distance, the plates having openings therein of preselected contour; spacer bar means of cross-sectional contour which in at least one position of the bar conforms substantially to the contour of the openings to permit passage of the spacer bar means through the openings, the spacer bar means having sets of correspondingly spaced slots extending transverse the longitudinal axis of the spacer bar means with the slots of each set being spaced from each other substantially the same distance as the plates, the slots being of sufficient depth and breadth to permit engagement with the plates to maintain the plates in spaced relationship; holding means to hold the slots in the spacer bar means in firm contacting relationship with the plates when the spacer bar means has been passed through the plate openings and the slots are aligned with the plates; and, fluid spray means cooperable with the spacer bar means to permit selective fluid treatment of the spaced plates.

It is to be understood that various changes can be made in the arrangement, form, and construction of the several parts of the structure disclosed herein without departing from the scope or spirit of the present invention.

Referring to the drawings which disclose one advantageous embodiment of the present invention;

FIGURE 1 is a partial face elevation of a plate elec-

2

trode assembly arrangement which embodies the present invention;

FIGURE 2 is a partial side elevation in a plane passing through line 2—2 of FIGURE 1;

FIGURE 3 is a side view of a portion of the hollow spacer bar of the present invention including fin members attached thereto, the fin members having sets of transverse slots running along opposite sides of the longitudinal axis of the bar with the slots of one set corresponding with the slots of the other and the bar walls having a plurality of spaced spray orifices disposed in a pre-selected geometric pattern around the circumference of the bar;

FIGURE 4 is a cross-sectional view of the spacer bar of FIGURE 3 taken in a plane passing through line 4—4 of FIGURE 3;

FIGURE 4a is a cross-sectional view of the spacer bar of FIGURES 3 and 4 taken in a plane passing through line 4a—4a of FIGURE 4;

FIGURE 5 is an enlarged side elevation of a portion of one plate disclosing an opening in the plate with which a spacer bar like that of FIGURES 3 and 4 cooperates, the opening having raised mating surfaces for camming action on opposite sides of the periphery thereof;

FIGURE 6 is an enlarged side elevation of a portion of a plate similar to that of FIGURE 5, further disclosing a cross-section of a spacer bar after it has been inserted into the open end of the plate and rotated into operational position;

FIGURES 7 through 9 is a series of enlarged, schematic partial plan views, disclosing in sequence the steps involved in assembling the plates and spacer bars of the electrode assemblies of FIGURES 1—6;

FIGURE 10 is an enlarged slightly exaggerated view of a portion of a spacer bar and plate, further disclosing in broken lines the camming means in the form of raised surfaces; and

FIGURE 11 is an enlarged view similar to that of FIGURE 10 but with the spacer bar turned 90° into plate engagement.

It is to be understood that the apparatus described hereinafter includes a plate electrode assembly having a camming means for holding the several plates of the electrode assembly in fast position substantially like that disclosed in assignee's Patent No. 3,114,616, issued Dec. 17, 1963 to R. A. Palmore. Although the novel aspects of this camming means as described in the aforementioned patent are set forth in detail hereinafter in order to disclose the most advantageous embodiment of the present invention, it is to be understood that the spray means of the present invention can be utilized with spacer bar means of a different type. For example, spacer bar means such as that disclosed in assignee's patents No. 3,017,953 and 3,018,844 can also utilize the novel spray means described hereinafter.

Referring to FIGURES 1 and 2 of the drawings, plate assembly 2 includes charged end plates 3 from which are supported, intermediate thereto, the charged plates 4. Charged plates 4 are arranged in spaced, parallel relationship to each other and have positioned in alternate arrangement therewith, spaced parallel grounded electrode plates 5. Plates 5 are supported from grounded end plates 6 which, in turn, are attached to the housing of the precipitator (not shown) and which support end plates 3 by means of insulators 7.

As can be seen particularly in FIGURES 1, 2, 5, and 6, each electrode plate 4 and 5 is provided with support openings 8 therein. It is to be understood that in the embodiment disclosed, four or more of such openings can be provided in each plate. The plates 3, 4 and 5, 6 are loaded in a jig for proper parallel spacing and for proper align-

ment of corresponding support openings. It is to be noted that each of the support openings 8 in the embodiment disclosed is of substantially elliptical contour (as indicated in FIGURES 5 and 6), the major axis Y—Y of the ellipse extending in a vertical direction along the plate and the minor axis X—X extending in a horizontal direction.

Once plates 3, 4 and 5, 6 are properly set in a jig innermost spacer bar members 11 and outermost spacer bar 11' are inserted through the aligned sets of openings 8. As can be seen in FIGURES 3, 4, and 6 of the drawings, spacer bars 11 and 11' are of a cross-sectional contour advantageously conforming substantially to the contour of the support openings 8, providing limited tolerances therebetween when passed through the openings after being properly orientated in alignment with such openings. In this connection, it is to be noted that spacer bars 11 and 11' can be of substantially circular cross-sectional contour of a diameter conforming to the minor axis X—X of the openings 8. Spacer bar members 11 and 11' are each provided with fin portions 12 and 12' which extend from diametrically opposite sides of that portion of the spacer bar of circular cross-sectional contour, the distance between extremities of fins 12 and 12' being slightly less than the distance along the major axis Y—Y of elliptical openings 8. Sets of slots 13 and 13' are provided in fin portions 12 and 12' respectively so as to extend transverse the longitudinal axis of spacer bar members 11 and 11' on opposite sides thereof, with corresponding slots of one set being substantially opposite corresponding slots of the adjacent set. The slots in each set 13 and 13' are spaced from each other a preselected distance which distance is substantially the same as the distance that the plates to be supported are spaced from each other in a jig during plate electrode assembly (as will be seen hereinafter). It is to be noted that slots 13, 13' are of sufficient depth and breadth to permit rotation of spacer bars 11 and 11' about their longitudinal axis from one position to another when the spacer bars have been passed through plate openings 8 of the plates and the slots are in proper alignment with their respective plates. In this connection, it also is to be noted that as the spacer bars are rotated the sides of slots 13, 13' engage with camming means in the form of raised rib-like members 16, 16' which are positioned on opposite sides and around the peripheries of openings 8. These rib-like members, each of which can be contoured to gradually rise out of the plane of the plate from its opposite ends so that the high point rests along line X—X of elliptical openings 8, serve to provide a camming action between the plates and the bars 11 and 11' adjacent the slots 13, 13' to hold the plates in firm contacting relationship with the spacer bars.

With the arrangement described, it is possible to hold the electrode plates of an assembly in properly spaced relationship, lock the assembly into desired position and, at the same time, establish a small controlled curvature of a balanced nature in the plates around the openings to impart additional strength to such plates. It is to be noted that the limited tolerance provided between spacer bars 11 and 11' and openings 8, as above mentioned, avoids accurate machine requirements and permits ready assembly of the several parts of the overall structure without requiring precise jig alignment. It is to be understood that the spacer bars can be cast, rolled, or press formed, and, in some instances, can be extruded advantageously from some suitable material such as aluminum.

Referring to FIGURES 7 through 9 of the drawings, the several steps of the assembly and plates are disclosed in detail. In assembly, plates 3, 4 and 5, 6 are supported in a jig (not shown) in spaced relationship to each other with the corresponding support openings 8 in alignment, the spacing between plates being the same as the spacing of the transverse slots in sets 13 and 13' of spacer bars 11 and 11'. Bars 11 and 11' are then inserted through the openings 8, the bars being orientated so that the fin portions 12 and 12' are in alignment with the major axis Y—Y of the openings 8. When each of the sets of slots

13, 13' of each bar is opposite its matching plate, the bar is turned about its longitudinal axis through a 90° angle so that the plates engage in the sets of corresponding slots 13 and 13'. In this connection, and as aforesaid, it will be noted that the sets of corresponding slots 13 and 13' are of sufficient depth and breadth to permit this action, the slots being flared as at 14, 14' to insure such turning and to facilitate the operation. Since the camming means or rib-like members 16, 16' are provided alongside each of plate openings 8, when the bar members 11 and 11' are turned through a 90° angle the sides of the slots engage against the camming means to provide a fast wedging contact between the spacer bars and plates. As a result of the wedging action between the raised surfaces 16 and 16' and the sides of slots 13, 13', a slight distortion is set up in the plates opposite sides of openings 8, with the distortion on one side of each opening being substantially like the distortion on the other side—the slight distortion serving to insure further strength to the plate structure. Hence, the rib-like members not only serve to strengthen the plates but also serve to effect a tight engagement between slots 13, 13' and plates 4 without undesirable plate distortion so that an effective electrical contact is provided during electrical precipitating operation.

To fasten the assembly to end plates 3, the two innermost spacer bars 11 which can be of solid material are tapped at their extremities to receive tap screws 17 which hold the spacer bars 11 to plate 3. With the spacer bars properly positioned in the assembly, the plates in the assembly are spaced correctly and cannot be changed until the spacer bars 11 and 11' are unfastened, turned 90°, and withdrawn from the plate openings.

It is to be noted that when inserting spacer bars 11 and 11' into openings 8 of the plates, provision is made in the form of cutaways 10 in those plates not supported by the bars (FIGURES 1 and 2) to permit such assembly and provide proper electrical clearance where necessary.

Referring to FIGURES 3 through 4a of the drawings, it can be seen that the outermost spacer bars 11' are hollow to include fluid feed passages 21 extending within and along the longitudinal axis of such spacer bars. A plurality of spaced spray orifices 22 are provided in the walls of the bars 11' in communication with the fluid passage 21. These spray orifices extend in staggered spaced bands around the circumference of the spaced bars. As will be noted in FIGURES 4 and 4a particularly, the orifices are provided with canted axis of varying angle to insure that thorough fluid contact of the planar surfaces of the electrode plates is obtained.

One end of each of spacer bars 11' can be sealed with a suitable screw threaded plug 24. The other end is provided with a coupling arrangement 26 which, in turn, is connected to a fluid supply manifold 27 connected to a suitable fluid source not shown. It is to be understood that any one of a number of types of fluids can be supplied at certain stages of the operation in order to insure proper wash-down of the plate. Then, the fluid in the system can be selectively alternated to provide a suitable viscose-type fluid to further enhance the electrostatic and dust-entrapping characteristics of the plates. It will be appreciated that since the fluid conducting spacer bars are inwardly positioned with respect to the plates, a thorough wash-down of the plates can be obtained as distinguished from previous arrangements wherein fluid treating mechanisms were either positioned upstream, downstream, or above the plates.

The invention claimed is:

1. An electrostatic precipitator plate electrode assembly comprising: a plurality of parallel substantially planar plate electrodes spaced from each other a predetermined distance, each of the plate electrodes having openings therein of substantially the same preselected contour; spacer bar means of cross-sectional contour which in at least one position of the bar conforms sufficiently to the contour of the openings to permit passage of the spacer bar means through the openings, the spacer bar means

5

having sets of corresponding slots extending transverse the longitudinal axis of the spacer bar means with the slots of each set being spaced from each other substantially the same distance as the plate electrodes are spaced from each other, the slots being of sufficient depth and breadth to permit engagement with the plate electrodes to maintain the plate electrodes in spaced relationship, holding means holding the slots of the spacer bar means in firm contacting relationship with the plate electrodes when the spacer bar means has been passed through the plate electrode openings and the slots are aligned with the plate electrodes; and fluid spray means inwardly positioned with respect to the peripheral edges of said plate electrodes and cooperable with said spacer bar means and permitting selective fluid treatment of said spaced plates; said fluid spray means including a fluid supply manifold; a fluid feed passage extending within and along the longitudinal axis of the spacer bar means and in fluid communication with said fluid supply manifold; and a plurality of spaced spray orifices in the walls of said spacer bar means in communication with said fluid feed passage and positioned to direct fluid streams against the walls of said plate electrodes of said assembly.

2. The apparatus of claim 1, said holding means to hold said slots of said spacer means in firm contacting relation with said plate electrodes comprising: pairs of rib-like members integral with said plate electrodes and adjacent the openings of said plate electrodes, said rib-like members of each pair being positioned in spaced relationship on substantially opposite sides of the periphery of an opening and displaced from the planar surface of the plate electrode with which they are integral with corresponding ends of each rib-like member sloping gradually out of the plane of the plate electrode in the same direction around the periphery of the opening, said rib-like members being positioned to extend transverse the depth of said slots when

6

said spacer bar means is rotated about its longitudinal axis to hold said plate electrodes in fast contacting relationship with said spacer bar means.

3. The apparatus of claim 1, said spray orifices extending in staggered spaced bands around the circumference of said spacer bar means and having canted axes of varying angle to insure thorough fluid contact of the planar surfaces of said plate electrodes.

References Cited

UNITED STATES PATENTS

1,522,143	1/1925	Rathbun	55—118 X
1,888,022	11/1932	Wintermute et al.	55—119
1,957,560	5/1934	Thompson	55—145 X
2,504,430	4/1950	Lincoln	55—146 X
2,998,098	8/1961	McNall, et al.	55—143 X
3,006,066	10/1961	Grossen et al.	55—145 X
3,017,952	1/1962	Westlin	55—143
3,018,844	1/1962	Gonzalez	55—143
3,055,158	9/1962	Smith	55—118
3,114,616	12/1963	Palmore	55—145 X
3,124,439	3/1964	Rittenhouse	55—143
3,238,702	3/1966	De Seversky.	
3,257,778	6/1966	Flagg	55—118
3,257,779	6/1966	Strubler.	

FOREIGN PATENTS

155,913	3/1954	Australia.
563,130	9/1958	Canada.
490,168	1/1930	Germany.
830,573	3/1960	Great Britain.

HARRY B. THORNTON, *Primary Examiner.*

D. TALBERT, *Assistant Examiner.*