May 17, 1949. K. W. MacKENZIE 2,470,356

ELECTRICAL PRECIPITATOR

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FIG. 1.

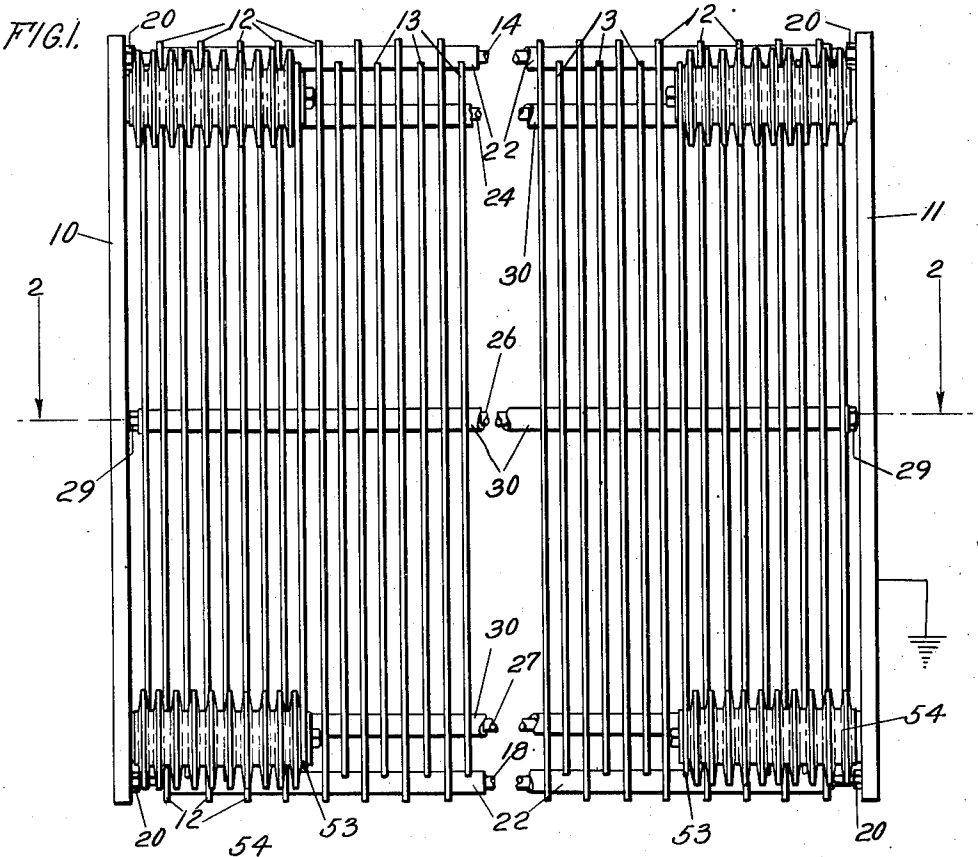
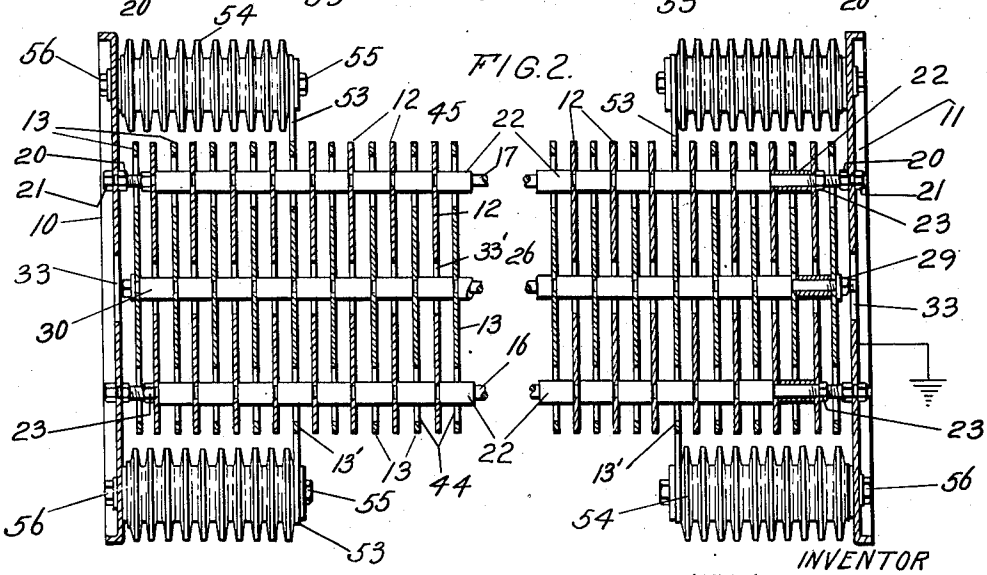


FIG. 2.



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FIG. 3.

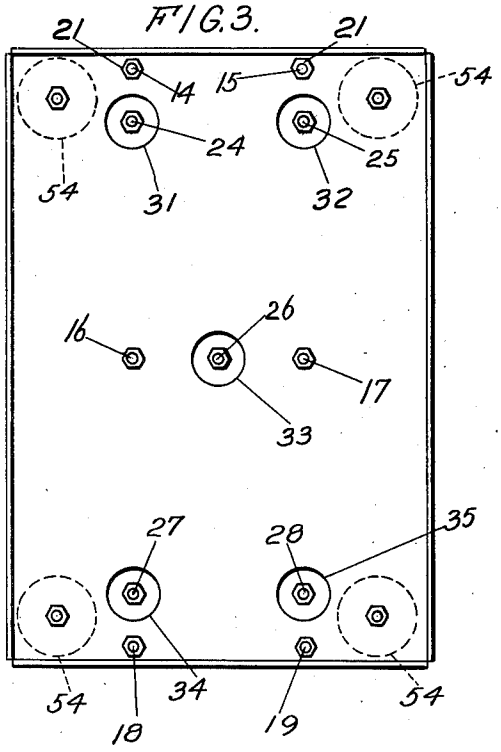


FIG. 6.

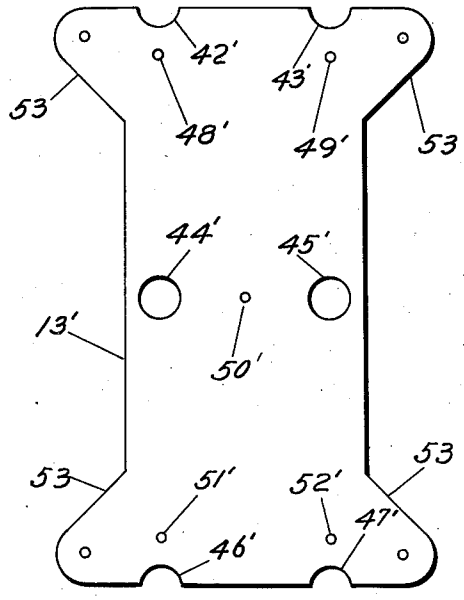


FIG. 4.

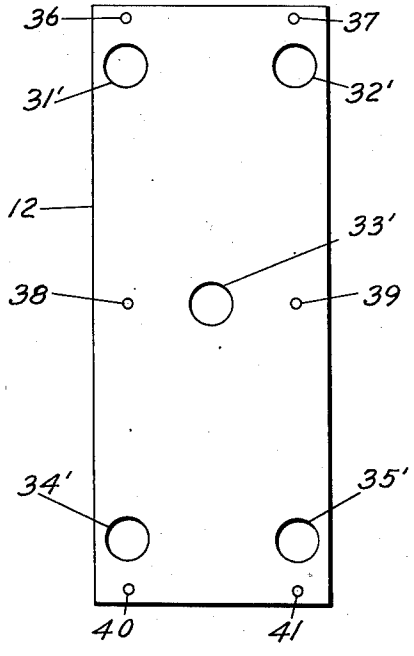
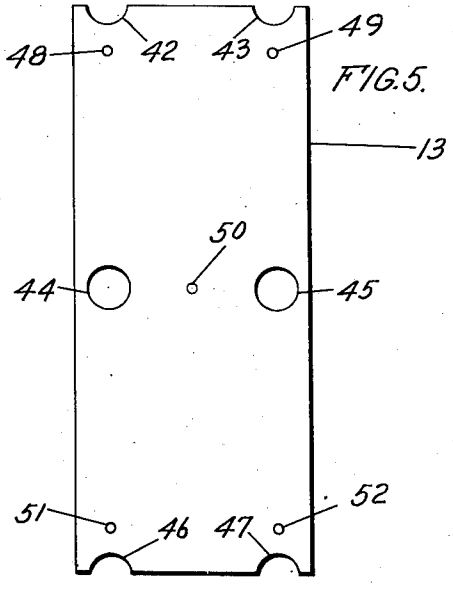


FIG. 5.



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UNITED STATES PATENT OFFICE

2,470,356

ELECTRICAL PRECIPITATOR

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Application June 20, 1946, Serial No. 678,146

6 Claims. (Cl. 183—7)

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This invention relates to electrical precipitators for electrically precipitating dust or smoke from atmospheric air flue gases or the like. More particularly, the invention relates to precipitators of the type in which the air or the other gas to be cleaned is first ionized by an ionizing device and thereafter passed through a precipitating device comprising a plurality of parallel plates, alternate plates being charged in one polarity and intervening plates charged in the opposite polarity. The invention is primarily concerned with the construction and arrangement of the precipitating device.

In precipitators of the type to which the invention relates the construction of the precipitator chamber involves a number of difficult manufacturing problems. A large number of plates must be assembled and supported in spaced parallel relation, with any two successive plates insulated from each other, so that alternate plates of the structure may be charged in one polarity and the intervening plates charged in the opposite polarity or grounded. Heretofore, the construction of such devices has involved elaborate welding or brazing operations in the assembly of the plates or has required the provision of numerous insulators between the plates for the purpose of spacing and supporting them.

It is among the objects of the invention to provide a precipitator of the type described which may be readily assembled by a simple stacking operation without necessitating a large number of welding operations and without requiring the insertion of spaced insulators between the plates.

A further object of the invention is to provide a rigid and firmly connected structure in which the ground plate assembly is directly supported by a pair of side plates forming the outer side walls of the assembly and in which the charge plates are supported in the proper spaced parallel relation to the ground plates from said side walls yet insulated therefrom.

A further object of the invention is to provide a construction in which the ground plates may be adjusted relative to the charge plates.

The above and other objects and features of the invention will be made fully apparent to those skilled in the art from a consideration of the following detailed decsription taken in conjunction with the accompanying drawings, in which:

Fig. 1 shows a front elevation of a precipitator chamber constructed in accordance with the invention;

Fig. 2 is a section, with parts in side elevation, taken on the line 2—2 of Fig. 1;

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Fig. 3 shows a side elevation of the precipitator;

Fig. 4 is a detail showing the construction of one of the ground plates of the precipitator;

Fig. 5 is a view similar to Fig. 4 showing the construction of one of the charge plates of the precipitator; and

Fig. 6 shows one of a pair of charge plates which are of slightly modified construction for supporting the charge plate assembly.

Referring to the drawings, the precipitator chamber comprises a pair of side walls 10 and 11, which side walls are grounded and provide the sole support for a plurality of precipitator plates. Alternate of said precipitator plates 12, hereinafter called the ground plates, are supported directly from the side walls 10 and 11 and electrically connected thereto in a manner to be more fully described. Intervening plates 13, hereinafter called charge plates, are also supported by the side walls 10 and 11, but insulated relative thereto and to the ground plates 12 in a manner to be described.

In order to support the ground plates 12 in spaced parallel relation to the side walls 10 and 11, and to each other, six tie rods 14—19, having screw-threaded end portions extending through the side walls 10 and 11, are rigidly secured thereto by nuts 20 and 21 positioned inside and outside of the side walls of the casing and rigidly securing said tie rods thereto. A plurality of spacing bushings 22, one on each tie rod between each of the successive plates 12, maintain said plates in the proper spaced relation, and nuts 23, one adjacent each end of each of the tie rods 14—19 between the outermost of the plates 12 and the side walls 10 and 11, prevent lateral motion of said plates 12.

In order to support the charge plates 13 in parallel spaced relation to the ground plates 12, and insulated therefrom and relative to the side walls 10 and 11, a second set of tie rods comprising five tie rods 24 to 28, inclusive, of slightly less length than the length of the rods 14—19, carry the plates 13 in spaced parallel relation with one of the plates 13 between any two successive plates 12. The plates 13 are spaced by bushings 30 in the same manner in which the plates 12 are separated by the spacing bushings 22. The ends of the tie rods 24—28 are screw threaded, and nuts 29, one on each end of each of said tie rods, secure the charge plate structure together.

Openings 31—35, in each of the side walls 10 and 11, provide an insulating clearance space between the ends of the tie rods 24—28 and said

side walls. Similarly spaced openings 31'—35' in each of the plates 12, which openings are of substantially larger diameter than the external diameter of the spacing bushings 30, provide an insulating space between the ground plates 12 and the spacing bushings 30 of the plates 13. Openings 36—41 in the plates 12 have a sufficient diameter to permit the rods 14—19 to pass therethrough, but are of substantially less diameter than the spacing bushings 22 on the tie rods 14—19, so that the spacing bushings secure the plates 12 therebetween at each of said openings 36—41. The charge plates 13 are of slightly less length than the plates 12 and are provided with cut-away portions 42 and 43 at the upper ends thereof, openings 44 and 45 in the central portion thereof, and cut-away portions 46 and 47 at their lower ends, which cut-away portions and openings provide a clearance for the rods 14—19 and the bushings 22 at the points where these rods and bushings pass adjacent to or through the plates 13. Openings 48—52 in each of the plates 13 are provided for the rods 24—28, respectively, these openings being of sufficient diameter to permit the rods to pass therethrough and of substantially less diameter than the diameter of the spacing bushings 30. Each of the plates 13 is thus secured on each side thereof between two of the spacing bushings 30 at each of the openings 48—52, except the outermost of said plates, which are secured adjacent the side walls 10 and 11 by the nuts 29.

Two of the charge plates, intermediate the length of the precipitator chamber and indicated at 13', have projecting corner portions 53 providing tabs for securing the plates 13' to insulators 54. The insulators 54 are secured by nuts 55 to the projecting tabs of the plates 13' and by nuts 56 to the side walls 10 and 11 of the precipitator. Otherwise the plates 13' conform in contour to plates 13 and are provided with cut-away portions of openings 42'—52' corresponding to the cut-away portions and openings of the plate 13.

By the construction described in the foregoing, the precipitator plates can be assembled by a simple stacking process in which the charge plates and the ground plates are alternately stacked on the tie rods with the spacing bushings 30 positioned between successive charge plates and spacing bushings 22 between successive ground plates. By this construction there is complete electrical spacing of the ground plate assembly from the charge plate assembly without the necessity of utilizing insulating spacers therebetween, the openings and cut-away portions in the precipitator plates permitting a substantial clearance between the supporting rods and spacing bushings of the oppositely charged plates to provide a substantial insulating space therebetween. The relatively few insulators required to support the charge plate assembly in spaced insulated relation to the ground plate assembly may be of substantial size to avoid electrical losses. Also the ground plates may be adjusted relative to the charge plate assembly by means of nuts 20 and 21 which may be shifted relative to the tie rods 14—19 to adjust the relative spacing of the charge plates and ground plates.

The insulators 54 support the entire charge plate structure through the plates 13'. These plates support the rods 24—28 which, in turn, support the charge plates 13 and the spacing bushings 30. When so assembled, the precipitator structure constitutes a rigid unitary assembly supported entirely by the outer side walls 10 and 11, and this assembly may be readily inserted as a unit in a complete electrical precipitator assembly.

It will be understood that the precipitator chamber shown is adapted to be used in conjunction with a suitable ionizing device for ionizing the air or gases to be cleaned prior to the flow thereof through the spaces between the precipitator plates. A suitable ionizing device is described and claimed in my copending application Serial No. 678,145, filed June 20, 1946.

While there has been herein described a preferred embodiment of the invention, other embodiments within the scope of the appended claims will be apparent to those skilled in the art from a consideration of the form shown and the teachings hereof.

What is claimed is:

1. A precipitating device for electrical precipitators, comprising a pair of side walls forming the end walls of said precipitating device, a plurality of dust precipitating plates positioned parallel to said side walls and to each other, a plurality of tie rods extending from one of said side walls to the other and rigidly secured and electrically connected thereto, alternate of said plates providing ground plates and being supported by said tie rods, spacing bushings on said tie rods, one on each of said tie rods between any pair of successive alternate plates, a second set of tie rods extending through cut-away portions and openings in said alternate plates and free from said side walls, the dust precipitating plates intervening said alternate plates and providing charge plates being mounted on said second set of tie rods, spacing bushings on said second set of tie rods one on each of said tie rods between any pair of successive charge plates, and insulators secured to said side walls and two of said charge plates for supporting all of said charge plates from said side walls in spaced relation to said alternate plates.

2. A precipitating device for electrical precipitators, comprising a pair of side walls forming the end walls of said precipitating device, a plurality of dust precipitating plates positioned parallel to said side walls and to each other, a plurality of tie rods extending from one of said side walls to the other and rigidly secured and electrically connected thereto, alternate of said plates providing ground plates and being supported by said tie rods, spacing bushings on said tie rods, one on each of said tie rods between any pair of successive alternate plates, a second set of tie rods extending through cut-away portions and openings in said alternate plates and free from said side walls, the dust precipitating plates intervening said alternate plates and providing charge plates being mounted on said second set of tie rods, spacing bushings on said second set of tie rods one on each of said tie rods between any pair of succesive charge plates, two of said charge plates having projecting portions, and insulators secured to said side walls and to said projecting portions of said two of said charge plates for supporting all of said charge plates from said side walls in spaced relation to said alternate plates.

3. A precipitating device for electrical precipitators, comprising a pair of side walls forming the end walls of said precipitating device, a plurality of dust precipitating plates positioned parallel to said side walls and to each other, a plurality of tie rods extending from one of said side walls to the other and rigidly secured and electrically connected thereto, alternate of said

plates providing ground plates and being supported by said tie rods, spacing bushings on said tie rods, one on each of said tie rods between any pair of successive alternate plates, a second set of tie rods extending through cut-away portions and openings in said alternate plates and free from said side walls, the dust precipitating plates intervening said alternate plates and providing charge plates being mounted on said second set of tie rods, spacing bushings on said second set of tie rods one on each of said tie rods between any pair of successive charge plates, two of said charge plates having projecting portions, insulators secured to said side walls and to said projecting portions of said two of said charge plates for supporting all of said charge plates from said side walls in spaced relation to said alternate plates, and means for adjusting said ground plates relative to said charge plates.

4. A precipitating device for electrical precipitators comprising a pair of side walls forming the end walls of said precipitating device, a plurality of dust precipitating plates positioned parallel to said side walls and to each other alternate of said plates constituting ground plates, and the intervening plates constituting charge plates, a first set of tie rods rigidly secured and electrically connected to said side walls, said tie rods passing through openings in each of said ground plates whereby said ground plates rest on and are supported by said first set of rods at said openings, means on said first set of tie rods for maintaining said ground plates in spaced relation and preventing displacement thereof relative to said rods, a second set of tie rods extending across the space between said side walls and free from electrical contact therewith, said second set of tie rods passing through openings in each of said charge plates and being in electrical contact with said charge plates at said openings, means on said second set of tie rods for maintaining said charge plates in spaced relation and preventing displacement thereof relative to said second set of rods, said ground plates each having relatively large openings through which said second set of tie rods pass with a substantial clearance therebetween, said charge plates having openings through which said first set of tie rods pass with a substantial clearance therebetween, a plurality of insulators secured to said side walls, and means supporting two of said charge plates by said insulators whereby said two plates support said second set of tie rods and thereby support the remainder of said charge plates.

5. A precipitating device for electrical precipitators comprising a pair of side walls forming the end walls of said precipitating device, a plurality of dust precipitating plates positioned parallel to said side walls and to each other alternate of said plates constituting ground plates, and the intervening plates constituting charge plates, a first set of tie rods rigidly secured and electrically connected to said side walls, said tie rods passing through openings in each of said ground plates whereby said ground plates rest on and are supported by said first set of rods at said openings, means on said first set of tie rods for maintaining said ground plates in spaced relation and preventing displacement thereof relative to said rods, a second set of tie rods extending across the space between said side walls

and free from electrical contact therewith, said second set of tie rods passing through openings in each of said charge plates and being in electrical contact with said charge plates at said openings, means on said second set of tie rods for maintaining said charge plates in spaced relation and preventing displacement thereof relative to said second set of rods, said ground plates each having relatively large openings through which said second set of tie rods pass with a substantial clearance therebetween, said charge plates having openings through which said first set of tie rods pass with a substantial clearance therebetween, a plurality of insulators secured to said side walls, means supporting two of said charge plates by said insulators whereby said two plates support said second set of tie rods and thereby support the remainder of said charge plates, and means for adjusting the spacing of said ground plates relative to said charge plates.

6. A precipitating device for electrical precipitators comprising a pair of side walls forming the end walls of said precipitating device, a plurality of dust precipitating plates positioned parallel to said side walls and to each other alternate of said plates constituting ground plates, and the intervening plates constituting charge plates, a first set of tie rods rigidly secured and electrically connected to said side walls, said tie rods passing through openings in each of said ground plates whereby said ground plates rest on and are supported by said first set of rods at said openings, metallic bushings on said first set of tie rods for maintaining said ground plates in spaced relation and preventing displacement thereof relative to said rods, a second set of tie rods extending across the space between said side walls and free from electrical contact therewith, said second set of tie rods passing through openings in each of said charge plates and being in electrical contact with said charge plates at said openings, metallic bushings on said second set of tie rods for maintaining said charge plates in spaced relation and preventing displacement thereof relative to said second set of rods, said ground plates each having relatively large openings through which said second set of tie rods pass providing a substantial clearance between the bushings on said rods and said ground plates, said charge plates having openings through which said first set of tie rods pass with a substantial clearance between the bushings on said second set of rods and said charge plates, a plurality of insulators secured to said side walls, and means supporting two of said charge plates by said insulators whereby said two plates support said second set of tie rods and thereby support the remainder of said charge plates.

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