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PLATE ELECTRODE ASSEMBLY

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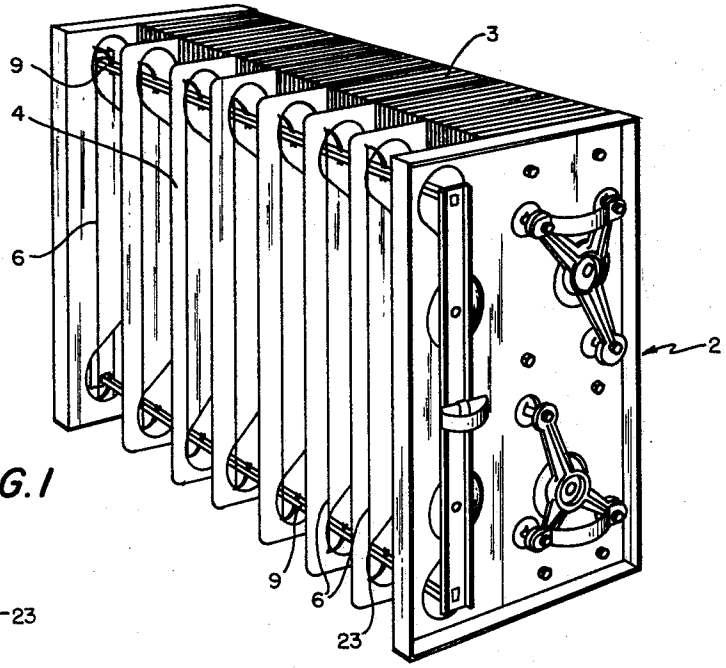

FIG. 1

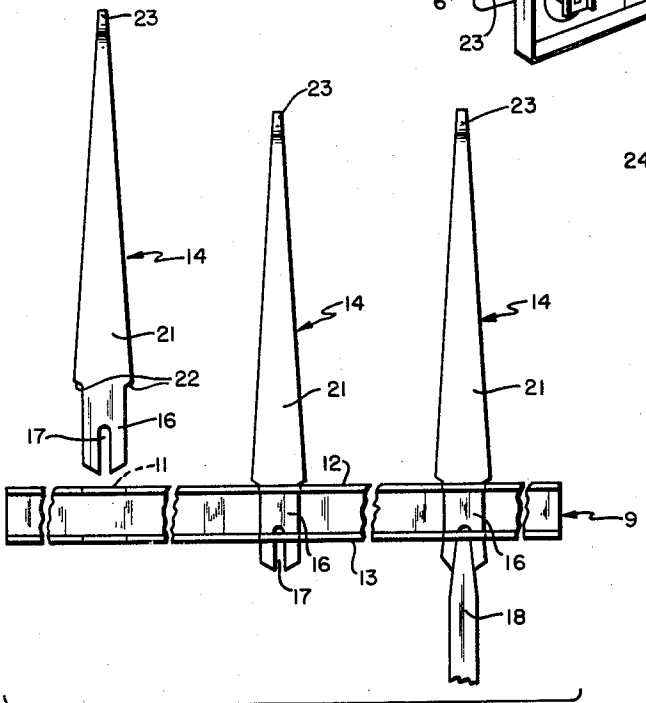

FIG. 2

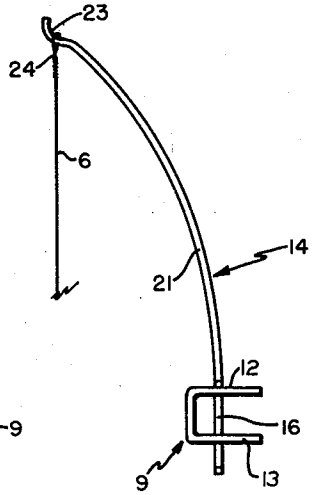

FIG. 3

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PLATE ELECTRODE ASSEMBLY

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This invention relates to electrostatic precipitators for removing contaminant particles from a gaseous stream and more particularly to an improved arrangement in electrostatic precipitators for supporting ionizing electrode members in the ionizing zones of precipitators.

One of the problems which has existed for a number of years in the art of electrostatic precipitation has been the frequent breaking of support pins used to maintain ionizing electrode wires in extended position across gas streams to be treated. When one of the support pins would break, the electrically charged wire supported thereby would fall free and, as a result, undesirable arcing or short circuiting would occur. Further, replacement of broken pins would occasion complex and time consuming operations, resulting in lengthy and costly shutdowns.

The present invention avoids the aforementioned disadvantages of the past by providing a support pin arrangement which can be rapidly assembled and which maintains ionizing electrode wires supported thereby in properly extended position for long periods of time without breakage. In accomplishing this result, the present invention recognizes that insufficient tension has been placed on the electrode wires in the past, such insufficient tension leading to excessive wire vibration and consequent breaking of the support pins along lines of concentrated stress. Not only does the support pin arrangement of the present invention provide a means for maintaining appropriate tension on the electrode wires supported thereby so as to reduce wire vibration to a minimum but, in addition, the present invention provides a support pin arrangement wherein stresses along the body of the support pin are maintained constant along the length of the pin to avoid lines of concentrated stress and wherein the body of the pin can be readily deflected for installation purposes.

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, in a plate electrode assembly for an electrostatic precipitator including an ionizer zone and a collector zone and having spaced discharge ionizing electrode members disposed in the ionizer zone alternately with electrode plates extending in the ionizer zone, a pair of spaced support members extending transverse the electrode plates in insulated relationship therewith, the support members including cantilever support pins for the discharge ionizing electrode members, each of the support pins having a narrow longitudinally extending body portion of substantially uniformly variable cross section with the base of the body portion of largest cross sectional area being fastened to a support member and the apex of the body portion of nominal cross sectional area being fastened to an end of ionizing member. In addition, the present invention provides a novel bifurcated shank portion integral with the body portion of the support pin to permit ready assembly of the pin in cantilever fashion to its support member.

It is to be understood that various changes can be made by one skilled in the art in the arrangement, form and construction of the apparatus 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 perspective view of a plate electrode assembly which embodies the present invention;

FIGURE 2 is an enlarged, exploded plane view of a portion of a pin support arrangement included in the plate electrode assembly of FIGURE 1; and,

FIGURE 3 is a side view of the pin support arrangement of FIGURE 2.

Referring to FIGURE 1 of the drawings, a plate electrode assembly **2** is disclosed, such assembly including a collector zone, indicated generally by reference numeral **3**, and an ionizer zone, indicated generally by reference numeral **4**. The broad, general arrangement of the plate electrode assembly disclosed is similar to that set forth in assignee's co-pending application, Serial No. 798,029, filed on March 9, 1959, under the name of Don J. Gonzalez, now U. S. Patent No. 3,016,980. It is to be understood that this broad, general arrangement, in itself, does not constitute a critical part of the present invention and therefore is not described in detail herein. It further is to be understood that the inventive concept which is included with this broad, general arrangement in a manner as described hereinafter, is not to be considered as limited to use only with the particular electrode assembly disclosed but that it can be used in any one of a number of plate electrode assemblies well known in the electrostatic precipitation art.

As can be seen in FIGURE 1 of the drawings, ionizer zone **4** includes a plurality of ionizer wires **6**. To support wires **6** in a proper manner so that there is a minimum of breakage with the consequent arcing and shorting out, the present invention provides the improved ionizer wire support arrangement described hereinafter. As can be seen in the drawings, this support arrangement includes a pair of spaced support members **9** which extend transverse the electrode plates of the ionizer zone in insulated relationship therewith. Support members **9** are channel-shaped and each has a plurality of spaced slots **11** disposed therein in opposed legs **12** and **13** (FIGURE 2). Slots **11** are so arranged that corresponding slots in each of the legs are in substantial alignment so as to form aligned slot pairs.

Arranged to engage in each of aligned slot pairs **11** is shank portion **16** of ionizer wire support pin **14**. Pins **14** can be made from any one of a number of well known flexible, electrically conductive metals and advantageously a spring tempered brass alloy can be used. The shank portion **16** of each pin **14** is bifurcated at its extremity, as at **17**, so that it is only necessary to slip the shank into an aligned slot pair and spread the bifurcated portion of the shank apart with a suitable wedging tool (as shown at **18** of FIGURE 2) in order to insure that pin **14** is firmly fastened in support member **9**.

Extending integrally in cantilever fashion from the fastly support shank **16** of pin **14** is a flat, narrow, longitudinally extending body portion **21** of pin **14**. It is to be noted that body portion **21** is of substantially uniformly varying cross section with the base of the body portion of largest cross sectional area being adjacent to shank portion **16**. Thus, shoulders **22** of shank **16** abut against leg **12** of support member **9** adjacent one of the slots **11** of an aligned slot pair. The free end of body portion **21** of each pin is provided with a small indentation **23** at that place where the cross sectional area of the pin is nominal, this indentation serving to receive looped end **24** of a discharge ionizing electrode wire **6** (FIGURE 3).

In accordance with the present invention it is to be noted that body portion **21** of each pin **14** has, in effect, its cross sectional dimensions reduced as the bending

moment of such body portion decreases. That is, the pin tapers outwardly from its free end of nominal cross section to its fastly anchored shank end. This configuration not only permits a savings in material and in weight of the pin without sacrificing pin strength but, in addition, the absence of material where not needed for strength permits an optimum of deflection of the body portion so as to allow such body portion to better serve as a spring-like tensioning member for the ionizing wire which it supports. In this connection and referring to FIGURE 3 of the drawings, it is to be noted that body portion 21 is curved along its longitudinal axis to take the configuration of an arc of constant radius. The preselected arcing of body portion 21 permits usage of more metal in a given space so as to increase further the spring-like properties of pin 14 and, at the same time, to avoid sharp breaks along the longitudinal axis of the body portion 21 so that the body portion is free of any lines of concentrated stress where vibration might induce a rupturing or breaking.

It is to be understood that the particular shape and dimension of the pin would vary in accordance with the length of the ionizing wire to be supported and the amount of tension that is desired to be placed thereon. For example, specific details of configuration can be determined by employing structural design principles that would be applicable where constant strength in a body member is a desideratum, such principles, for example, including the one that the section modulus of a body member (the moment of inertia of a cross section of the body member divided by the distance from the member's centroid to the fiber carrying the greatest stress) varies directly as the bending moment on such body member varies.

The invention claimed is:

1. In a plate electrode assembly for an electrostatic precipitator including an ionizer zone and a collector zone, said ionizer zone having spaced electrode plates extending therein and having spaced discharge ionizing electrode members disposed alternately with respect to said spaced electrode plates, an improved support arrangement for said ionizing electrode members comprising:

(*a*) a pair of spaced support members extending transverse said electrode plates in insulated relationship therewith;

(*b*) spaced slot means in each of said support members, said slot means extending parallel to said ionizing electrode members;

(*c*) a support pin for each of said slot means, said support pin including a narrow, longitudinally extending tapered body portion of substantially uniformly increasing cross-section along the overall length of said body portion from apex to base, the apex of said body portion having means receiving an end of one of said ionizing electrode members for fastening thereto and the base of said body portion having shank means integral therewith and inserted into said slot means, said shank means including a bifurcated end spread into wedging action with said slot means of said support members to fasten into anchored position therewith, said body portion being curved in a preselected arc of substantially

constant radius along the longitudinal axis thereof from apex to base in a plane common to the longitudinal axis of said ionizing electrode member fastened thereto to increase the resilient action thereof and to avoid lines of concentrated stress.

2. In a plate electrode assembly for an electrostatic precipitator including an ionizer zone and a collector zone, said ionizer zone having spaced electrode plates extending therein and having spaced discharge ionizing electrode members disposed alternately with respect to said spaced electrode plates, an improved support arrangement for said ionizing electrode members comprising:

(*a*) a pair of spaced channel-shaped support members extending transverse said electrode plates in insulated relationship therewith, each support member including a base portion and opposed leg portions, the leg portions of such channel shaped support members extending parallel to the direction of flow of a gas stream to be treated by said plate electrode assembly;

(*b*) a plurality of spaced, longtiudinally extending narrow slots in said opposed leg portions of each of said support members with corresponding slots in each of the legs of a support member being in substantial alignment to form aligned slot pairs;

(*c*) a support pin for each of said aligned slot pairs of a channel shaped support member, said support pin including a narrow, longitudinally extending tapered body portion of rectangular cross section along the overall length thereof with substantially uniformly increasing cross-sectional breadth along such length from apex to base, the apex of said body portion having an indentation receiving an end of one of said ionizing electrode members for fastening thereto and the base of said body portion having shank means integral therewith and extending therefrom into said slot means of said support members to fasten into anchored position therewith, said shank means including a bifurcated end spread into wedging action with said slot means, said body portion being curved in a preselected arc of constant radius along the longtiudinal axis thereof from apex to base in a plane common to the longitudinal axis of said ionizing electrode member fastened thereto to increase the resilient action thereof and to avoid lines of concentrated stress.

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