March 6, 1956 E. V. HARLOW 2,737,259

ELECTRICAL PRECIPITATOR

Filed Jan. 18, 1954 4 Sheets-Sheet 1

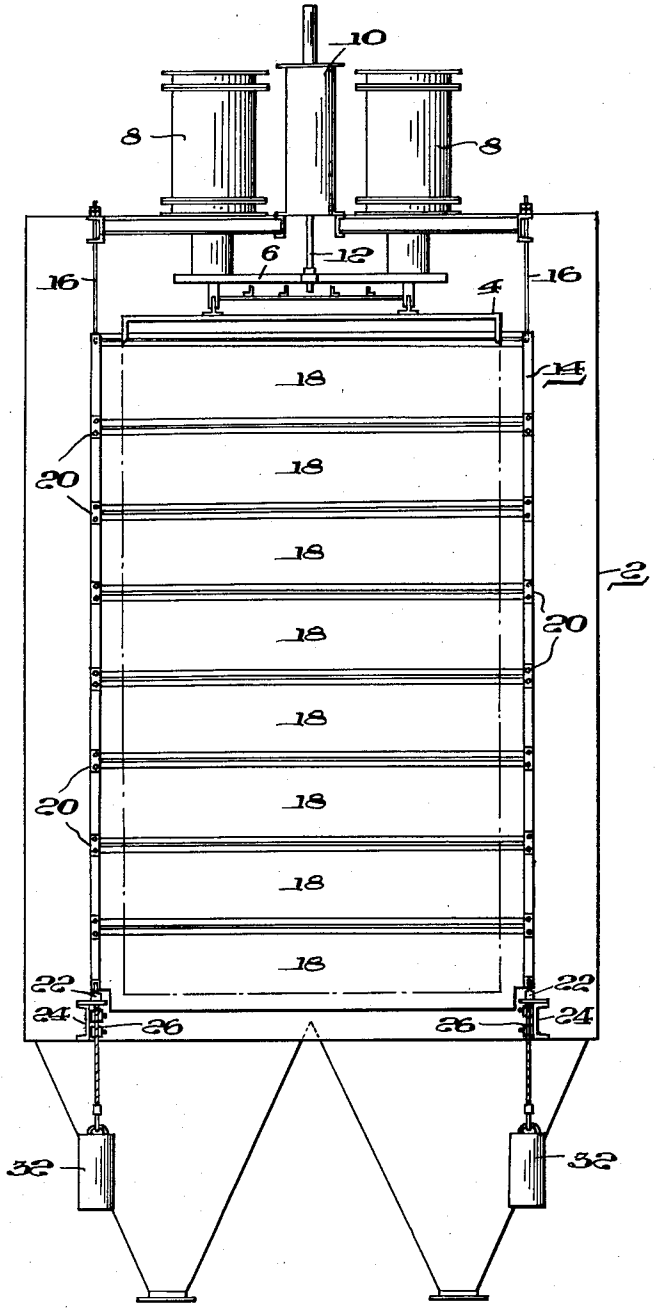

Fig. 1.

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ELECTRICAL PRECIPITATOR

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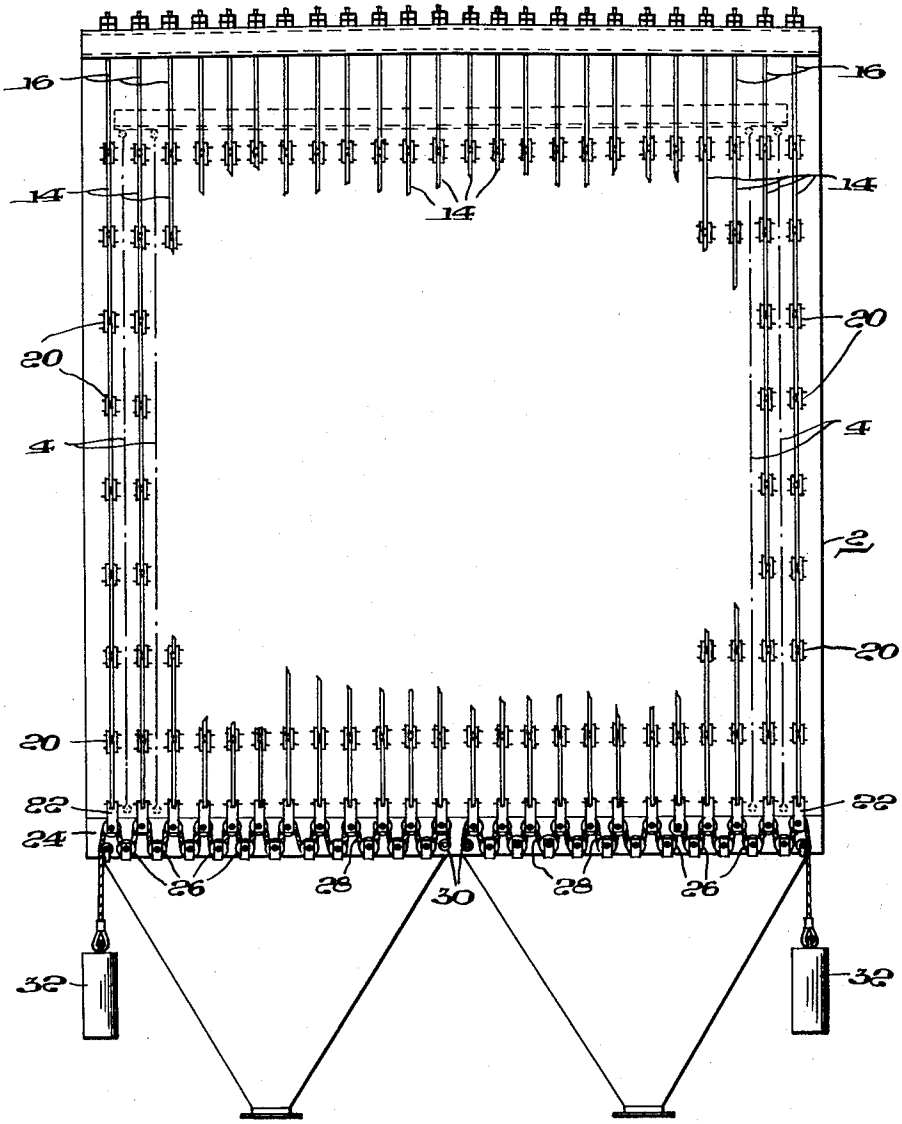

Fig. 2.

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ELECTRICAL PRECIPITATOR

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Fig. 4.

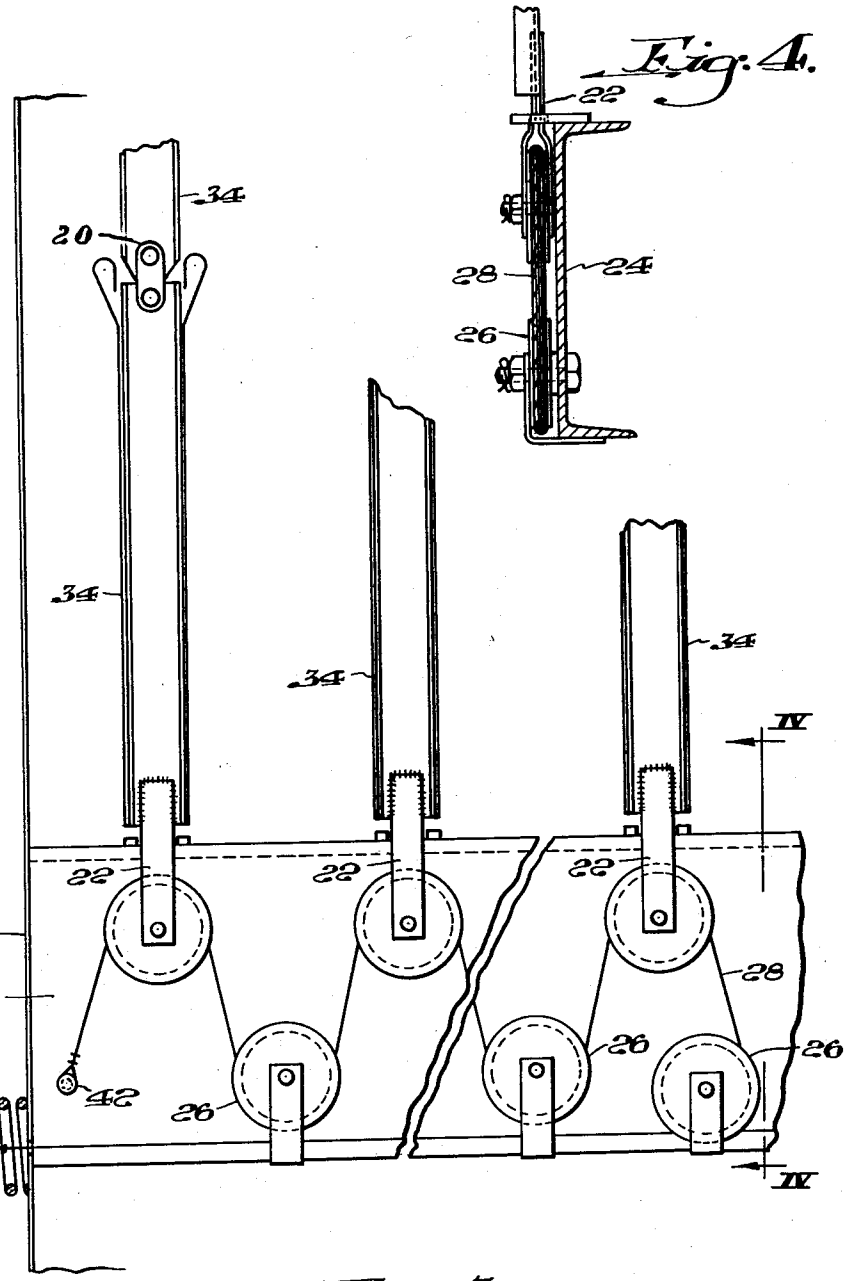

Fig. 3.

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ELECTRICAL PRECIPITATOR

Filed Jan. 18, 1954 4 Sheets-Sheet 4

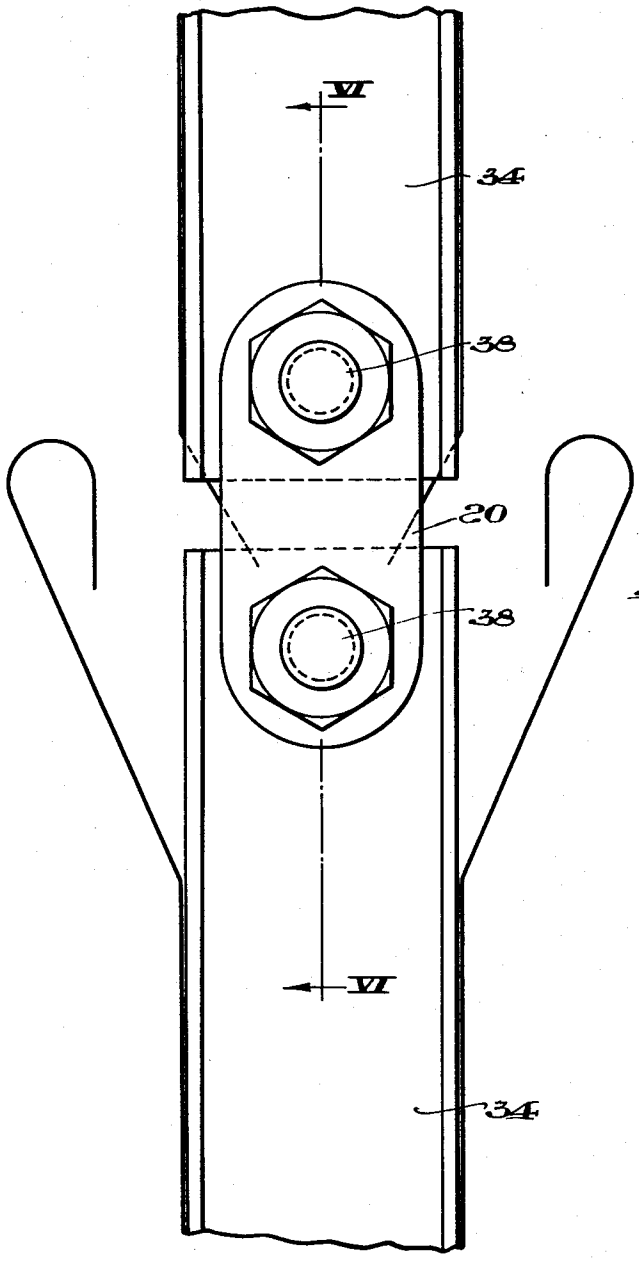

Fig. 5.

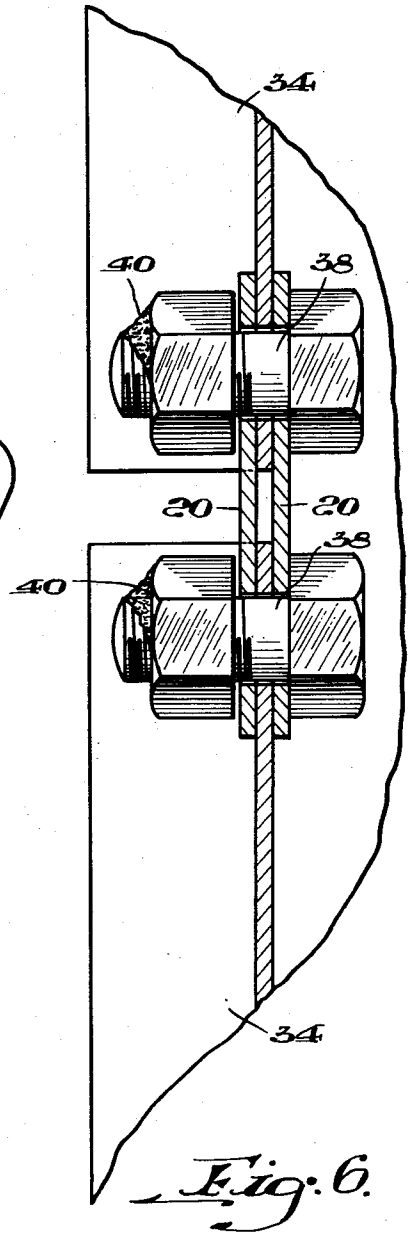

Fig. 6.

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2,737,259

ELECTRICAL PRECIPITATOR

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Application January 18, 1954, Serial No. 404,615

6 Claims. (Cl. 183—7)

The present invention relates to electrical precipitators and more particularly to electrode structure for use therein.

As steam generating plants, open-hearth furnaces and other industrial units have increased in size, it has become necessary to increase the size of the electrical precipitators which are utilized with these units to remove the fly ash or dust from effluent gases. Large precipitators require large sized electrode structures and this creates additional problems, since it is more difficult to support the weight of such electrode structures, maintain them in fixed spaced relationship and yet avoid having the supporting structure interfere with the gas flow in the precipitator chamber.

One of the features of the present invention is to provide a collecting electrode structure in which a substantially unlimited area can be maintained in one plane.

Another feature of the present invention is to provide a collecting electrode structure which is light in weight, making it readily susceptible to rapping operations.

Another feature of the present invention is to provide a collecting electrode structure which is efficient in construction, maintenance and operation.

Another feature of the present invention is to provide a collecting electrode structure that can be simply and quickly assembled.

Another feature of the present invention is to provide a collecting electrode structure wherein a substantially constant tension is maintained on the collecting electrode units.

Still another feature of the present invention is to provide a collecting electrode structure which reduces undesirable features of warping due to welding, machining and handling.

Still another feature of the present invention is to provide a collecting electrode structure wherein more effective electrical contact is obtained.

One inventive form of collecting electrode structure which satisfies all the above features has been disclosed in co-filed application, Serial No. 404,614 of even date herewith.

More particularly the present invention provides in an electrical precipitator having a precipitating chamber with a plurality of parallel spaced vertical discharge electrode units therein, a collecting electrode structure comprising a plurality of parallel spaced vertical collecting electrode units so arranged that each of said discharge electrode units is positioned substantially parallel to adjacent collecting electrode units; a plurality of suspension means, each connected to corresponding ends of said collecting electrode units whereby said units are vertically suspended within said precipitating chamber; and tensioning and aligning means adapted to hold said collecting electrode units under constant tension and to maintain said units in planes substantially parallel to each other.

It will be obvious to one skilled in the art to which this invention pertains that various changes can be made in the arrangement, form, construction and type of the various elements disclosed without departing from the scope or spirit of this invention.

Reference will now be made to the accompanying drawings which illustrate and exemplify an embodiment of the invention in a preferred type of construction.

Figure 1 represents a side view of an electrical precipitator, cut away to disclose the collecting electrode structure.

Figure 2 represents a front view of the electrical precipitator of Fig. 1, cut away to disclose the arrangement of the collecting and discharge units and one type of tensioning means for the collecting electrode units.

Figure 3 represents a partial front view of another type of tensioning means for collecting electrode units, the units comprising pocket style electrode panels.

Figure 4 represents a sectional view of Fig. 3 taken along the line IV—IV of Figure 3.

Figure 5 represents an enlarged partial view disclosing the linkage mechanism for the electrode panels of Figure 4.

Figure 6 represents a sectional view of Figure 5 taken along the line VI—VI of Figure 5.

Referring to Figures 1 and 2 of the drawings, precipitating chamber **2** is disclosed having a plurality of parallel spaced vertical discharge electrode units **4** suspended therein from the hanger bar assembly **6**. This assembly is, in turn, suspended from hanger rods (not shown) positioned in the insulator housings **8**. High tension wires (also not shown) lead to the insulator housings and a rapping mechanism **10** is connected to the hanger bar assembly **6** through rod **12**. All of the structure described so far is well known in the art and does not constitute a critical part of the present invention.

A collecting electrode structure comprising a plurality of parallel spaced vertical collecting electrode units **14** is so arranged that each of said discharge electrode units is positioned substantially parallel to adjacent collecting electrode units, the collecting electrode units being suspended from the chamber **2** by hanger rods **16**. Each of the collecting electrode units **14** is divided into a plurality of separate panels **18**, which panels are linked one to another by the linking members **20**. By providing separate panels, erection costs and erection time are greatly reduced and problems of warping which accompany the use of one continuous unit are greatly minimized. Further, the use of separate panels renders the collecting electrodes more sensitive to light rapping. The penels themselves can be constructed like those disclosed in the co-filed application, Serial No. 404,614, with reinforcing strips along vertical edges and bead-rolled horizontal edges, or, in another advantageous embodiment of the invention, the panels can be of the pocket type as disclosed in Figures 3 to 6, hereinafter described.

Attached to each of the lower corners of each of the lowermost panels is sheave **22** and positioned below the corresponding lower corners of each of the lowermost panels are members **24**, which can be channel members, which are fixed to the sides of precipitating chamber **2**. Fixed to each of the members **24** are sheaves **26**, each sheave being positioned below a lower corner of the discharge electrode units.

Ropes or cables **28**, which can be of steel, connect the upper and lower row of sheaves in snake-like fashion. One end of each cable is anchored to the channel **24** as indicated at **30**. At the opposite end of each cable is attached a counterweight **32**. The cables and sheaves operate on the well-known principle of fixed and movable pulleys and, neglecting friction, the tension in each collecting electrode unit will be equal to twice the weight of the counterweight **32**. It is to be understood that the number of collecting electrode units tensioned by one set of cable and sheaves can be varied to suit conditions,

The limiting factor is the friction in the sheaves which retard movement of the cables **28**, when the electrode units and sheave and cable arrangements contract due to cooling.

As shown in Figures 3 to 6 pocket style electrode panels **34**, which are well known in the art, can be used in order to limit re-entrainment of precipitated material in the gas during rapping. The pocket panels are linked together by linking members **20**, which are connected to the panels **34** by bolt and nut assemblies **38**. The nuts are not made tight enough to bind the linkage, but are left loose to allow free alignment when the linkage is placed under tension. The nuts are tack welded as at **40** to prevent rotation on the bolt due to vibration.

In Figures 3 and 4, a spring tensioning device is provided in place of the counterweight **32** disclosed in Figures 1 and 2. One end of the cable **28** is anchored to the member **24**, as indicated by the reference numeral **42**. The other end of the cable is fixed to a threaded bolt **44**, having a nut **46** threaded thereon. Abutting against the nut **46** is a washer **48** and positioned between the washer **48** and the outer wall of the precipitating chamber **2**, encircling the bolt **44**, is a coil spring **50**. By turning the nut **46**, tension on the cable **28** can be adjusted within limits. The cable and sheaves of this advantageous embodiment of the invention also operate on the well-known principle of fixed and movable pulleys, and, neglecting friction, the tension in the collecting electrode units **14** will be equal to twice the spring tension created by coil spring **50**.

Finally it is to be noted that the inventive features disclosed herein can be applied to discharge electrodes as well as to collecting electrodes of an electrical precipitator.

The invention claimed is:

1. In an electrical precipitator having a precipitating chamber with a plurality of parallel spaced vertical discharge electrode units therein, a collecting electrode structure comprising a plurality of parallel spaced vertical collecting electrode units so arranged that each of said discharge electrode units is positioned substantially parallel to adjacent collecting electrode units; a suspension means fixed to the upper portion of said precipitating chamber and connected to the upper ends of each collecting electrode unit whereby said units are vertically suspended within said precipitating chamber; and tensioning and aligning means adapted to hold each collecting electrode unit under constant tension and to maintain said units in planes substantially parallel to each other comprising, a first set of sheaves at least one sheave being fixed to the lower end of each collecting electrode unit, a second set of sheaves positioned below the first set, each sheave being adapted to receive a cable passing through a sheave of the first set, means rigidly holding each sheave of the second set in place and tensioned cable wound in snakelike fashion, connecting a sheave on each electrode unit with a corresponding sheave of the the second set.

2. In an electrical precipitator having a precipitating chamber with a plurality of parallel spaced vertical discharge electrode units therein, a collecting electrode structure comprising a plurality of parallel, spaced vertical collecting electrode units so arranged that each of said discharge electrode units is positioned substantially parallel to adjacent collecting electrode units; suspension means fixed to the upper portion of said precipitating chamber, and connected to the upper corners of each collecting electrode unit; sheaves fixed to the lower corners of each of said collecting electrode units, a pair of spaced structural members fixed to said precipitating chamber, the longitudinal axes of said members running perpendicular to the planes of said electrode units, each member being below corresponding lower corners of said collecting electrode units; sheaves fixed to each of said members, each of said sheaves positioned below corresponding corners of said discharge electrode units; and tensioned cables wound in snakelike fashion, connecting the sheaves on said electrode units with corresponding sheaves on said members.

3. The apparatus of claim 2, each of said collecting electrode units being divided into a plurality of panels, each panel being linked to the panel immediately thereabove.

4. In an electrical precipitator having a precipitating chamber with a plurality of parallel, spaced, vertical discharge electrode units therein, a collecting electrode structure comprising a plurality of parallel, spaced, vertical collecting electrode units so arranged that each of said discharge electrode units is positioned substantially parallel to and between adjacent collecting electrode units; each of said collecting electrode units being divided into a plurality of panels, each panel being linked to the panel immediately thereabove; a plurality of suspension means fixed to the upper portion of said precipitating chamber and connected to the upper corners of the uppermost panel of each collecting electrode unit; sheaves connected to the lower corners of the lowermost panel of each collecting electrode unit; a pair of spaced structural members fixed to said precipitating chamber, the longitudinal axes of said members running perpendicular to the planes of said electrode units, each member being below corresponding lower corners of said collecting electrode units; sheaves fixed to each of said members, each of said sheaves positioned below corresponding corners of said discharge electrode units; cables wound in snakelike fashion to connect the sheaves on said electrode units with corresponding sheaves on said cable, one end of said cable being anchored to the member with which it cooperates, the opposite end being attached to a cable tensioning means.

5. The apparatus of claim 4 in which said cable tensioning means comprises a counterweight.

6. The apparatus of claim 4 in which said cable tensioning means comprises a spring member.

References Cited in the file of this patent

FOREIGN PATENTS

96,319	Switzerland	Oct. 2, 1922
165,655	Great Britain	July 7, 1921