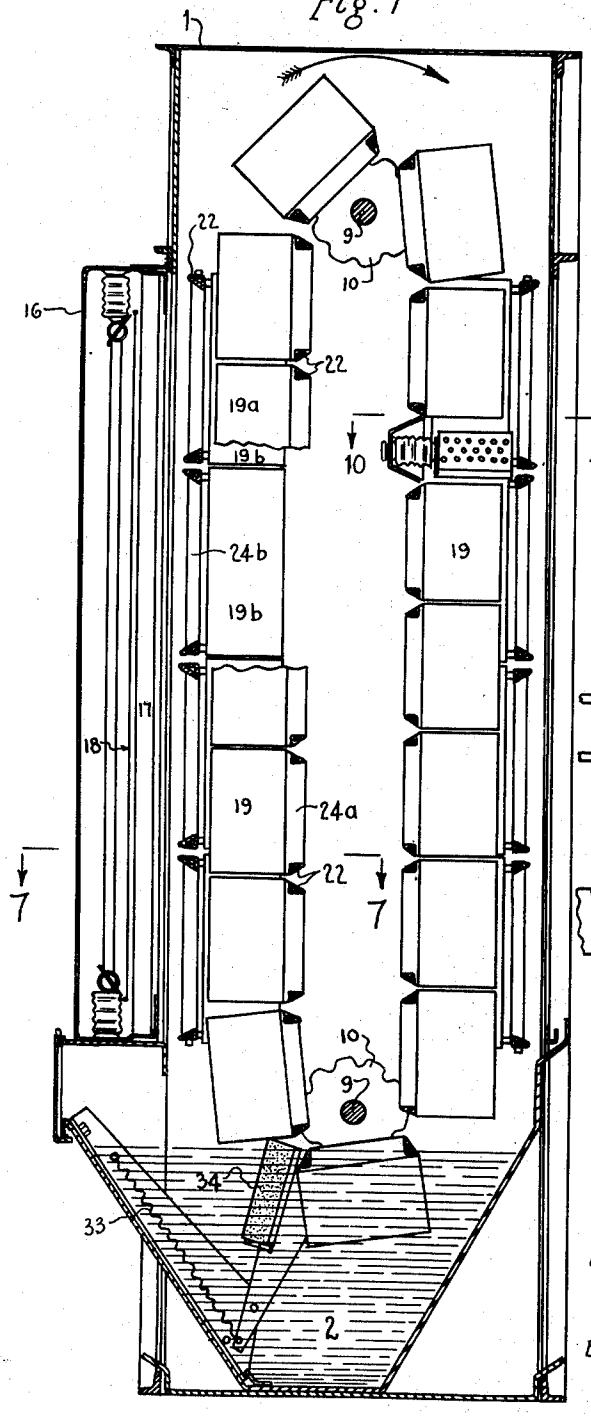
Aug. 21, 1945. V. DAHLMAN 2,383,112

AUTOMATIC ELECTRICAL AIR CLEANER

Filed June 5, 1943 4 Sheets-Sheet 1

Fig. 1



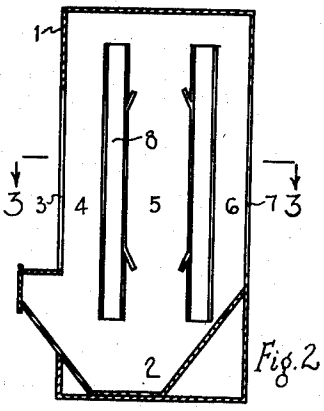


Fig. 2

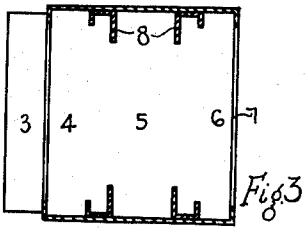


Fig. 3

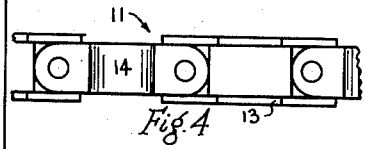


Fig. 4

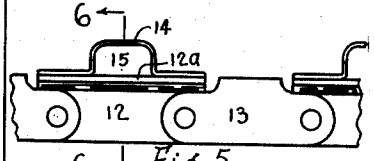


Fig. 5

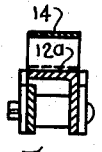


Fig. 6

VERNER DAHLMAN
INVENTOR

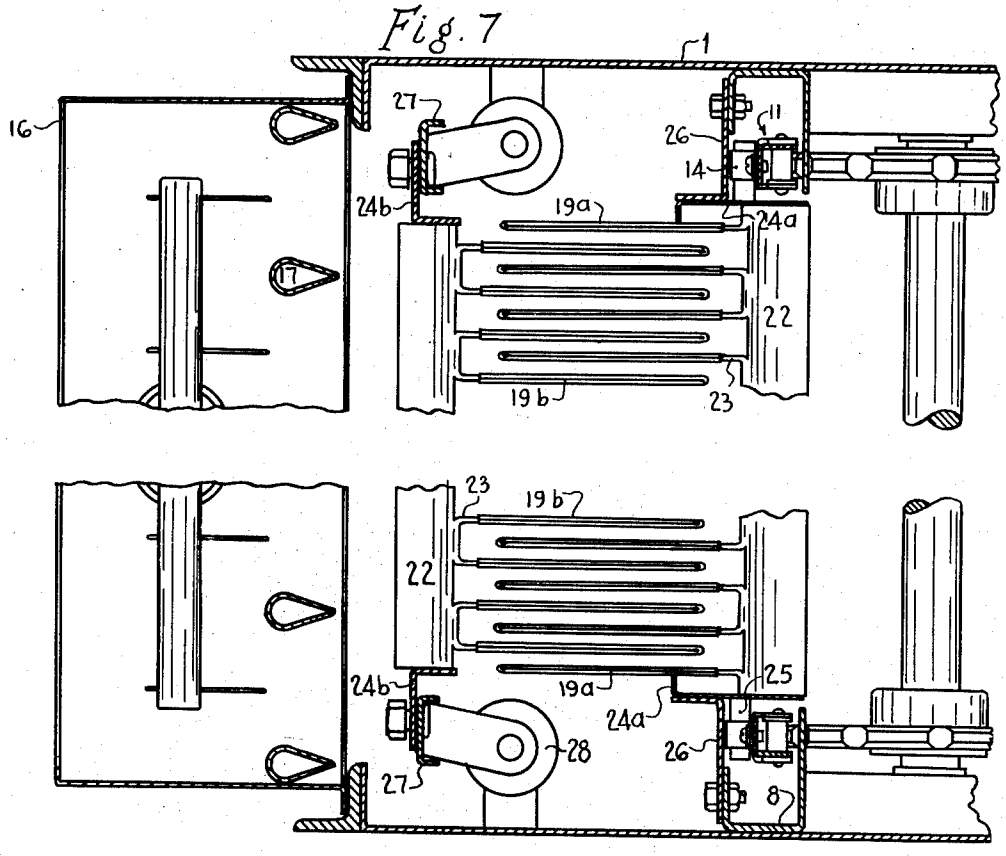
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ATTORNEY

Aug. 21, 1945. V. DAHLMAN 2,383,112

AUTOMATIC ELECTRICAL AIR CLEANER

Filed June 5, 1943 4 Sheets-Sheet 2

Fig. 7



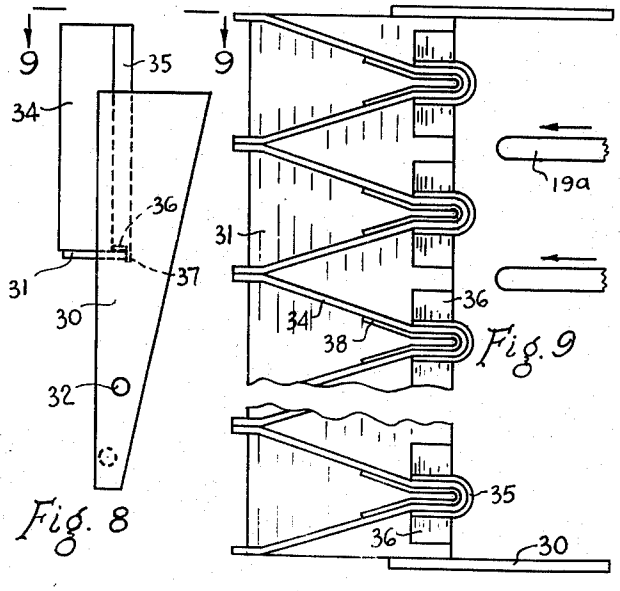


Fig. 8

Fig. 9

VERNER DAHLMAN
INVENTOR

BY Arthur Robert
ATTORNEY

Aug. 21, 1945. V. DAHLMAN 2,383,112

AUTOMATIC ELECTRICAL AIR CLEANER

Filed June 5, 1943 4 Sheets-Sheet 3

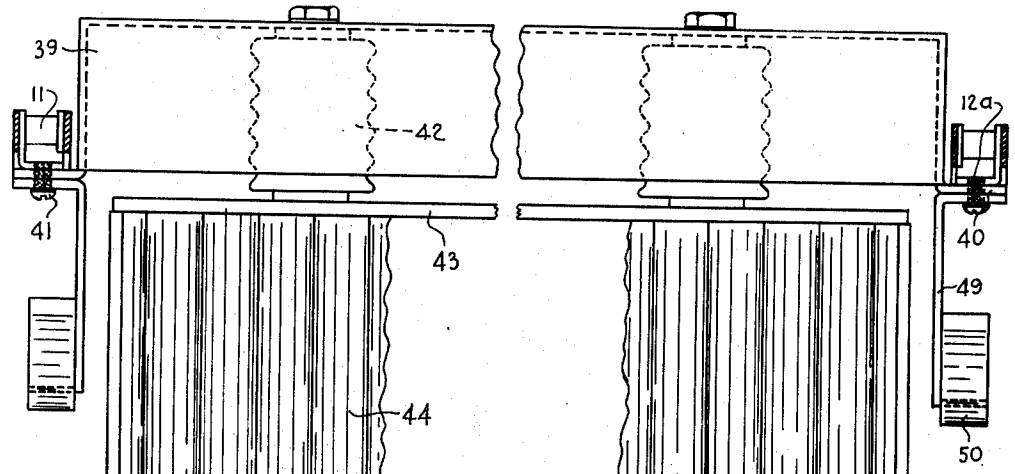


Fig. 10

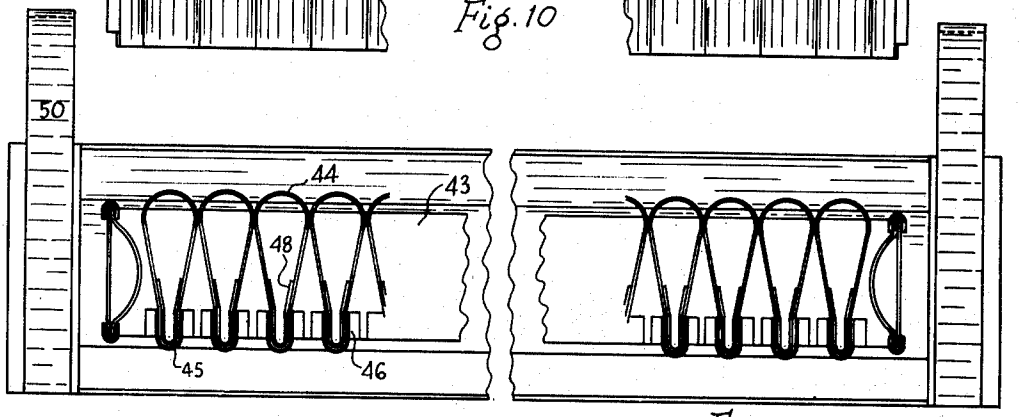


Fig. 11

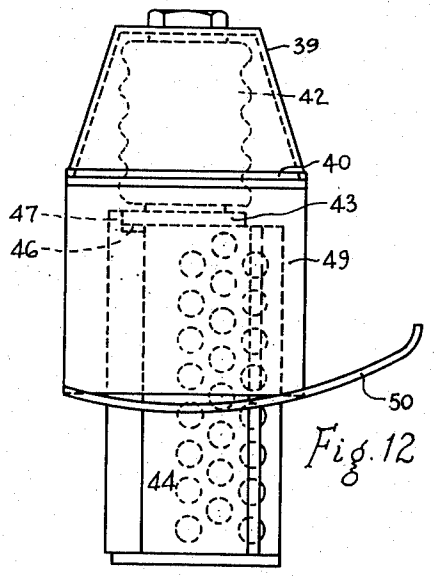


Fig. 12

VERNER DAHLMAN
INVENTOR

BY Arthur Robert

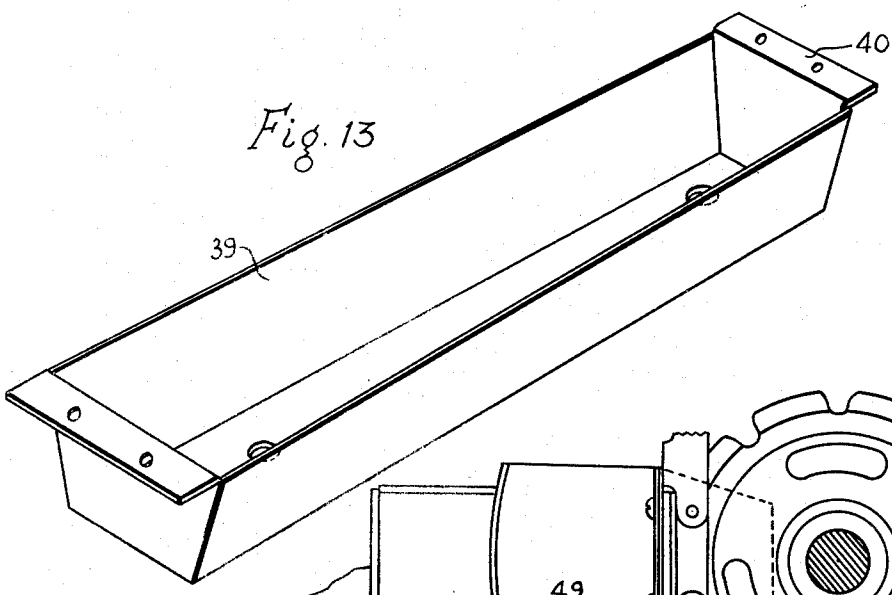
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Aug. 21, 1945. V. DAHLMAN 2,383,112

AUTOMATIC ELECTRICAL AIR CLEANER

Filed June 5, 1943 4 Sheets-Sheet 4

Fig. 13



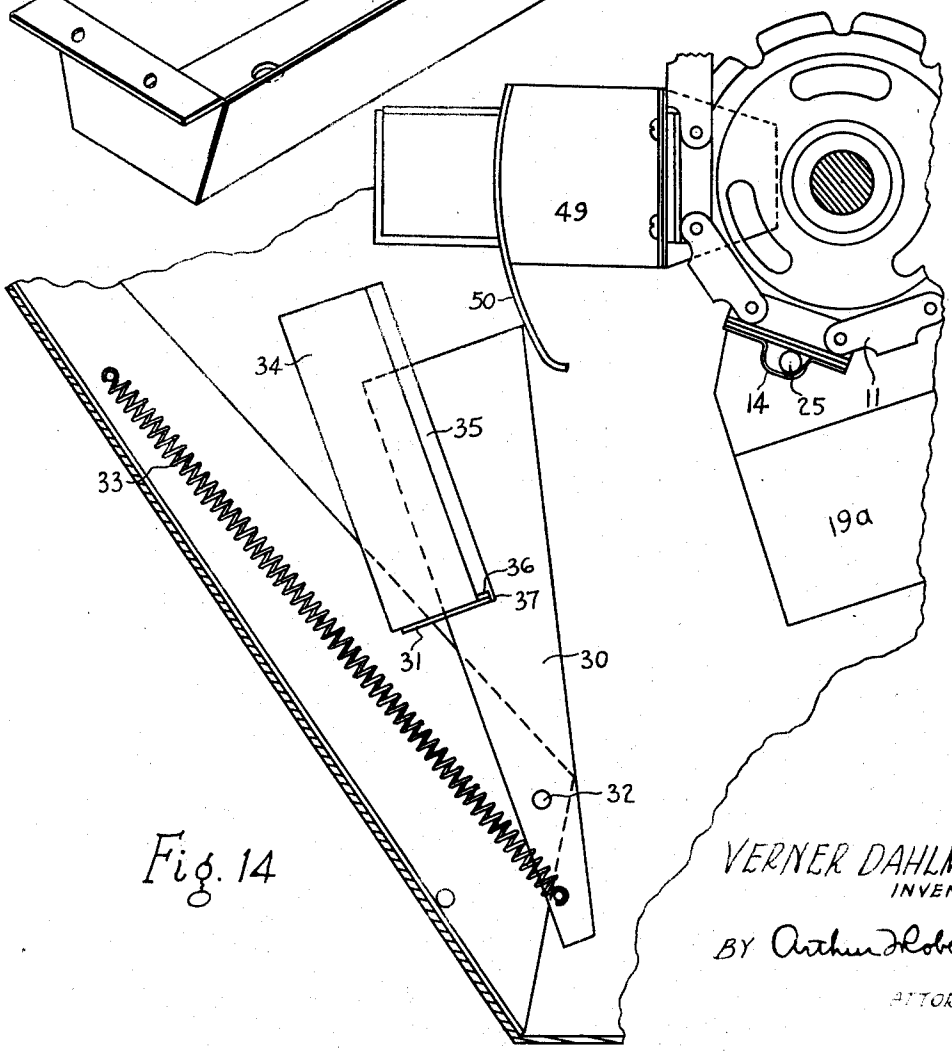


Fig. 14

VERNER DAHLMAN
INVENTOR

BY Arthur Robert

ATTORNEY

Patented Aug. 21, 1945

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UNITED STATES PATENT OFFICE

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AUTOMATIC ELECTRICAL AIR CLEANER

Verner Dahlman, Louisville, Ky., assignor to American Air Filter Company, Inc., Louisville, Ky., a corporation of Delaware

Application June 5, 1943, Serial No. 489,849

17 Claims. (Cl. 183—7)

This invention relates to automatic electrical air cleaners of the electrostatic precipitating type disclosed in my copending application, Serial Number 479,665, filed March 18, 1943, wherein: a series of spaced movable precipitating plates are mounted for movement along a path having gas-cleaning and filter-cleaning areas while another series of spaced stationary precipitating plates are stationarily mounted in the gas-cleaning area to interleave the movable plates as they pass through such area, the interleaved plates cooperating to form gas passages therebetween in which an electrostatic precipitating field is established. In this type of cleaner, some of the dust is deposited on the stationary plates where it slowly collects but most of the dust is deposited upon the moving plates and carried to the filter-cleaning or dipping area where it is dipped in, and thereby subjected to the washing action of, an oil bath. The precipitated dust clings tenaciously to the plates with the result that dipping them in the oil bath is not effective to prevent a gradual accumulation of dust thereon. The present invention relates to means for preventing the accumulation of dust on either or both sets of plates.

The principal object of the invention is to provide a simple form of means by which either or both sets of plates may automatically be intermittently cleaned to remove any accumulated dust.

Another object is to provide means by which both sets of plates may be automatically wiped at least once during each revolution of the movable plates.

An air cleaner embodying this invention is illustrated in the accompanying drawings wherein:

Figure 1 is vertical central section through the cleaner, the sprocket chains being omitted together with some of the movable plate cells for the sake of clearness;

Figure 2 is a schematic view of the casing as it appears in Fig. 1 but on a smaller scale with elements 8 relatively enlarged for sake of clearness.

Figure 3 is a section along line 3—3 of Fig. 2;

Figures 4 and 5 are top plan and side elevational views of corresponding link portions of the conveyor chain;

Figure 6 is a section along line 6—6 of Fig. 5;

Figure 7 is a horizontal sectional view corresponding to one taken on an enlarged scale along line 7—7 of Fig. 1 but showing the movable plates in plan instead of in section for the sake of clearness;

Figure 8 is a side elevational view of the stationary wiping assembly for the movable plates;

Figure 9 is a partly broken top plan view of the stationary wiping assembly shown in Fig. 8, this view being shown in relation to a pair of approaching movable plates;

Figure 10 is a plan view of the movable wiping assembly for the stationary plates, this view corresponding to one taken along line 10—10 of Fig. 1 except for the omission of the stationary plates, and being shown in relation to the sprocket chains;

Figure 11 is a side elevation of the movable wiping assembly for the stationary plates;

Figure 12 is an end elevation of the movable wiping assembly for the stationary plates and corresponds to the right end of the assembly shown in Fig. 10, except that it omits the sprocket chains shown in Fig. 10;

Fig. 13 is a perspective of the housing which carries and partially encloses the insulators of the movable wiping assembly; and

Figure 14 shows, on an enlarged scale, the manner in which the wiper assembly for the stationary plates pushes back the wiper assembly for the movable plates as it passes the latter.

As illustrated in Figures 1–7, the cleaner conventionally includes: a housing, an upright conveyor; an ionizer; and a plate-type electrical or electrostatic precipitator.

The housing 1 conventionally includes: a bottom filter-cleaning or plate dipping area in the form of an oil bath 2; an air or gas passageway extending horizontally through the casing above the bath from an upstream or front gas inlet 3 successively through a front gas-cleaning area 4, a central conveyor area 5, and a rear gas-cleaning area 6 to a downstream or rear gas outlet 7. The front and rear limits of the conveyor area are defined by front and rear conveyor guides 8 mounted on each vertical side wall of the casing 1.

The conveyor conventionally includes: upper and lower shafts 9; a pair of laterally spaced sprockets 10 on each shaft; a pair of laterally spaced sprocket chains 11, one encircling each upper and lower sprocket with front and rear flights lying within the channels of the adjacent front and rear conveyor guide 8, each chain being composed of alternate and intermediate links, the alternate links being formed by straps 12, one of which has a lug 12a and the intermediate links being formed by straps 13; and a bent rigid handle-like strap 14 secured to each lug 12a and cooperating therewith to form eye 15.

The ionizer 16 is conventionally mounted on the outside of the housing 1 over the gas inlet opening 3. It conventionally includes: a grounded assembly of electrodes 17, and an insulated assembly of fine wire electrodes 18.

The dust collecting portion of the precipitator conventionally includes two series or set of cells, one set being movable and preferably grounded and the other set being stationary, preferably insulated from the frame, and maintained at a relatively high electrical potential. Each cell, both movable and stationary, consists of a num-

ber of preferably plane, spaced parallel plates fixed to a crossbar. Each movable cell is secured to the conveyor and held in a position such that the spaced plates thereof bodily move, in vertical planes preferably parallel to their major surfaces, along endless paths which extend through each gas cleaning area and the bottom plate dipping area. Each stationary cell is fixedly secured to the frame, adjacent one gas cleaning area or the other, in a manner such that the spaced plates thereof extend vertically within the adjacent gas cleaning area and centrally between the fixed paths of the spaced movable plates so as to interleave said paths and thus interleave the movable plates as they pass through such gas cleaning areas, the interleaved plates cooperating to form gas passages therebetween.

Each movable cell comprises: an assembly of precipitating plates 19*a* presenting opposite side edges and opposite gas-flow edges respectively, the opposite side edges forming opposite side faces and the opposite gas-flow edges forming opposite gas-flow faces; and a framework secured to one of the gas-flow faces so as to leave the other gas-flow face and both side faces of the assembly open sufficiently to permit its being interleaved with and, moved sidewise relatively to, another similarly open assembly. The framework is composed of upper and lower horizontal cross bars 22 and vertical end plates 24*a*, plates 19*a* being secured to the framework through fingers 23 projecting from cross bars 22 and the cells as a whole being mounted on the conveyor chains by means of pins 25 projecting outwardly from end plates 24*a* into the eyes 15 of the conveyor chain. The space between each conveyor guide 8 and the adjacent movable cells is sealed by a stationary guide 26 adjustably secured to the guide 8 and frictionally engaging the cells.

The stationary cells similarly include: an interleavable assembly of plates 19*b*; and a framework composed of cross bars 22, fingers 23, and end plates 24*b*. These cells are stationarily mounted on, but insulated from, the housing 1 by bolting the end plates 24*b* to vertical bars 27, the upper and lower ends of which are secured to insulators 28 carried by the housing.

In operation: 11,000 to 13,000 volts are impressed across the ionizer; 5,000 to 7,000 volts are impressed across the precipitating plates; air or gas is drawn or forced through the gas passageway; and the conveyor is moved in the direction indicated, by a suitably controlled drive mechanism (not shown) in accordance with the usual practice of about ¾" every twelve minutes. As the movable plates pass upwardly out of the oil bath, they interleave the stationary plates in the front gas-cleaning area and as they pass downwardly on the other side of the cleaner toward the oil bath, they interleave the stationary plates in the rear gas-cleaning area. During the interleaving interval, dust is electrically precipitated on both sets of plates but principally upon the movable plates. Heretofore dust has accumulated on the movable plates because the action of the oil bath during the dipping interval was insufficient to effect a thorough cleaning of the movable plates.

In accordance with my invention, means are positioned relatively to one set of plates and arranged to present laterally-spaced, vertically-arranged, interleavable wipers which interleave such plates upon relative sidewise motion therebetween and which during such motion wipe the precipitating faces of the interleaved plates so as to remove the precipitated dust therefrom. Relative sidewise motion, between the wipers and the plate assembly which it is designed to clean, is obtained by stationarily mounting one set of stationary wipers on the housing along the path of the moving plates and arranging them to interleave the movable plates as the latter pass by and by mounting another set of movable wipers on the movable plate conveyor and arranging them to interleave the stationary plates as they pass through the gas-cleaning area occupied by such plates. With this arrangement means are also provided to move the stationary wipers aside as the movable wipers pass through the wiping area normally occupied by the stationary wipers.

The stationary wiping means for the movable plates may be mounted on the housing at any point along the path of the movable plates but preferably it is mounted in the oil bath 2 so that the wiping elements will be subjected to the washing action of the oil. This means comprises: a framework; and interleavable wipers carried by and projecting from the framework. The framework includes: a pair of vertically-arranged, laterally-spaced arms 30 and a cross bar 31 extending horizontally from the mid-section of one arm 30 to the mid-section of the other and rigidly secured to both. This framework is pivotally mounted on the housing, for movement from the operative position shown in Figure 1 to the inoperative position shown in Fig. 14, by rotationally securing the arms 30, adjacent their lower ends, to pins 32. The framework is resiliently urged toward and held in its operative position by suitable springs 33 extending between the housing and the lower ends of the arms and secured to both.

A series of laterally-spaced and vertically-arranged wipers, one for each end face of the movable cells and one for each space between the adjacent precipitating faces of adjacent plates in the cell, is mounted on the cross bar 31. Each wiper includes: a wiping element 34 composed of a sheet of any suitable material such as felt, leather, etc., and folded along a vertical axis to form a V in horizontal outline. The material should be sufficiently stiff and resilient that it tends to resume its original flat shape. The fold line of each wiping element 34 is nested in a U-shaped metal channel member 35, the lower end of which is secured to the cross bar 31 by horizontal side flanges 36 and a vertical back flange 37, all of which are welded or otherwise rigidly attached to bar 31. Each wiping element 34 is held within channel member 35 by a V-shaped spreader 38 which is nested within the element 34 to clamp it against channel member 35. The outer ends of the spreader 38 diverge in order to spread the outer ends of the wiping element 34 apart. The outer ends of adjacent elements 34 preferably engage each other so that when a movable plate 19*a* passes between adjacent elements, opposite faces of the plate will be firmly engaged and wiped by such elements.

The movable wipers for the stationary plates are positioned between two adjacent alternate cells on the conveyor and secured directly to, but preferably insulated from, the conveyor chains 11. It likewise comprises: a framework; and interleavable wipers carried by and projecting from the framework. The framework includes a base member or insulator housing in the form of a flared tray 39, the end marginal edges of which are provided with securing flanges 40. As indicated in Fig. 10, the flanges 40 may be secured

by bolts 41 to the lugs 12a of the chain 11. The base member or insulator housing 39 carries a pair of insulators 42 on which a cross bar 43 is mounted.

A series of laterally-spaced, vertically-arranged wipers, one for each end face of a stationary cell and one for each space between the adjacent precipitating faces of the plates in the cell is mounted on cross bar 43. Since the movable wipers for the stationary plates are constructed in a manner substantially identical to the stationary wipers for the movable plates, it should suffice to note that they include: a wiping element 44; a channel member 45 having side flanges 46 and a back flange 47; and a spacer 48. The wiping elements 44 at each end of the series are in the form of half loops while the intermediate elements in the series are in the form of complete loops. The elements 44 are preferably perforated, since it has been found that the perforations permit the sludge, wiped from the stationary plates, to pass into the interior of the elements from which it will readily wash upon traveling through the oil bath.

With the foregoing arrangement, it will be appreciated that when the movable plates pass through the area occupied by the stationary plates, they will be interleaved, and wiped, by the stationary wipers. Similarly, when the movable wipers pass through the gas-cleaning areas occupied by the stationary plates, they will interleave and wipe the stationary plates in such areas. In this manner both sets of plates will be cleaned once during each revolution of the conveyor and thereby prevented from accumulating an unchecked deposit of dust.

However, when the movable wipers pass the area normally occupied by the stationary wipers, it is necessary to move the stationary wipers aside. To this end, the securing flanges 40 of the movable wipers carry end plates 49, the outer ends of which are provided with cams 50. The cams 50 of the movable wipers are positioned to engage the arms 30 of the stationary wipers when the movable wipers closely approach the stationary wipers. As the movable wipers continue their movement toward and through the area of the stationary wipers, the cams 50, through their engagement with the arms 30, swing the stationary wipers to their inoperative position and hold them therein. When the movable wipers pass beyond the stationary wiping area, the cams 50 release the arms 30 permitting the springs 33 to return the stationary wiper assembly to its operative position.

As indicated previously, the cells have side faces and gas-flow faces with a framework securing one gas-flow face only so as to leave the other gas-flow face and both side faces open sufficiently to permit its being interleaved with, and moved sidewise relatively to, a similarly open oppositely disposed assembly. Both wiper assemblies are similar to the cells, in this respect, in that they have corresponding side faces and end faces (corresponding to the gas-flow faces of the cells) with a framework secured to one end face only so as to leave the other end face and both side faces open sufficiently to permit its being interleaved with, and moved sidewise relative to, a similarly open oppositely disposed assembly.

Having described my invention, I claim:

1. In an electrical gas cleaner having a frame and means on the frame prescribing a path of movement extending through a plate-wiping area: a plate assembly composed of a series of spaced parallel plate elements; a wiper assembly composed of a similar series of spaced parallel plate-wiping elements; means mounting one of said assemblies on the frame with its elements extending into said path at the plate-wiping area; means movably mounting the other assembly upon the frame for movement along said path with its elements extending into said path; the elements of both assemblies being so arranged in said path that the wiping elements interleave, and wipe the precipitating faces of, the plate elements during movement of the movable assembly through the plate-wiping area; and means for so moving the movable assembly.

2. In the cleaner of claim 1 wherein: the plate assembly is mounted in the wiping area; and the wiping assembly is mounted for movement along said path and through said area.

3. In the cleaner of claim 1 wherein: the wiping assembly is mounted in the wiping area; and the plate assembly is mounted for movement along said path and through said area.

4. In an electrical gas cleaner having a frame and means on the frame prescribing a path of movement extending through a plate-wiping area: a plate assembly composed of a framework and a series of spaced parallel plate elements secured to and projecting from the framework; a wiper assembly composed of a framework and a series of spaced parallel plate wiping elements secured to and projecting from the framework; means mounting the framework of one assembly on the frame at one side of said path with its elements extending into said path at the plate-wiping area; means movably mounting the framework of the other assembly upon the frame for movement along the opposite side of said path with its elements extending into said path; the elements of both assemblies being so arranged in said path that the wiping elements interleave, and wipe the precipitating faces of, the plate elements during movement of the movable assembly through the plate-wiping area; and means for so moving the movable assembly.

5. In the cleaner of claim 4 wherein: the plate assembly is mounted in the wiping area; and the wiping assembly is mounted for movement along said path and through said area.

6. In the cleaner of claim 4 wherein: the wiping assembly is mounted in the wiping area; and the plate assembly is mounted for movement along said path and through said area.

7. An electrical gas cleaner comprising: a movable assembly of spaced parallel plates of one electrical sign mounted for movement through a path having a gas cleaning area and a plate-wiping area; a stationary assembly of spaced parallel plates of the opposite electrical sign stationarily mounted in the gas cleaning area and so arranged therein as to interleave, and form gas passages with, the movable plates passing through the gas cleaning area; a relatively stationary assembly of spaced parallel plate-wiping elements mounted in the plate-wiping area and so arranged therein as to interleave, and wipe the precipitating faces of, the movable plates passing through the wiping area; and means for moving the movable plate assembly through said areas.

8. An electrical gas cleaner comprising: a movable assembly of spaced parallel plates of one electrical sign mounted for movement through a path having a gas cleaning area; a stationary assembly of spaced parallel plates of the opposite electrical sign stationarily mounted in the gas cleaning area and so arranged therein as to in-

terleave, and form gas passages with, the movable plates passing through the gas cleaning area; a movable assembly of spaced parallel plate-wiping elements mounted for movement through said path and so arranged therein as to interleave, and wipe the precipitating faces of, the stationary plates in the gas cleaning area as the movable wiping elements pass through said area; and means for moving the movable plate and wiping assemblies serially through said area.

9. An electrical gas cleaner comprising: a movable assembly of spaced parallel plates of one electrical sign mounted for movement through a path having a gas cleaning area and plate-wiping area; a stationary assembly of spaced parallel plates of the opposite electrical sign stationarily mounted in the gas cleaning area and so arranged therein as to interleave, and form gas passages with, the movable plates passing through the gas cleaning area; a movable assembly of spaced parallel plate-wiping elements mounted for movement through said path and so arranged therein as to interleave, and wipe the precipitating faces of, the stationary plates in the gas cleaning area as the movable wiping elements pass through said area; a relatively stationary assembly of spaced parallel plate-wiping elements mounted in the plate-wiping area and so arranged therein as to interleave, and wipe the precipitating faces of, the movable plates passing through the wiping area; and means for moving the movable plate and wiping assemblies serially through said areas.

10. The gas cleaner of claim 9 wherein: means are provided to move the relatively stationary wiping assembly out of the wiping area during the movement of the movable, wiping assembly through said area.

11. The gas cleaner of claim 9 wherein: the relatively stationary wiping assembly is arranged for movement into and out of said wiping area; means are provided normally urging said assembly into said area; and means, associated with the movable wiping assembly, for moving the stationary wiping assembly out of said area during the travel of the movable wiping assembly through said area.

12. An electrical gas cleaner comprising: a series of movable cells, each composed of an assembly of spaced parallel plate elements of one electrical sign, mounted for serial movement along a path having a gas cleaning area with their plate elements extending into said path; at least one stationary cell, composed of spaced parallel plate elements of the opposite electrical sign, stationarily mounted with its plates extending into the gas cleaning area and so arranged therein as to interleave and form gas passages with the plate elements of the movable cells passing through the gas cleaning area; a movable wiping unit, composed of spaced parallel plate-wiping elements, interposed in the series of cells and mounted for movement therewith along said path with its plate-wiping elements extending into said path and so arranged therein as to interleave, and wipe the precipitating faces of, the stationary plates in the gas cleaning area as the movable wiping elements pass through said area; and means for moving the movable wiping unit and movable cells serially through said area.

13. An electrical gas cleaner comprising: a series of movable cells, each composed of an assembly of spaced parallel plate elements of one electrical sign, mounted for serial movement along a path having a gas cleaning area and an oil bath area with their plate elements extending into said path; at least one stationary cell, composed of spaced parallel plate elements of the opposite electrical sign, stationarily mounted with its plate extending into the gas cleaning area and so arranged therein as to interleave and form gas passages with the plate elements of the movable cells passing through the gas cleaning area; a relatively stationary wiping unit, composed of spaced parallel plate-wiping elements, mounted with its elements extending in the oil bath area and so arranged therein as to interleave, and wipe the precipitating faces of, the movable plates passing through the oil bath area; and means for moving the movable cells serially through said areas.

14. An electrical gas cleaner comprising: a series of movable cells, each composed of an assembly of spaced parallel plate elements of one electrical sign, mounted for serial movement along a path having a gas cleaning area and an oil bath area with their plate elements extending into said path; at least one stationary cell, composed of spaced parallel plate elements of the opposite electrical sign, stationarily mounted with its plates extending into the gas cleaning area and so arranged therein as to interleave and form gas passages with the plate elements of the movable cells passing through the gas cleaning area; a movable wiping unit, composed of spaced parallel plate-wiping elements, interposed in the series of cells and mounted for movement therewith along said path with its plate-wiping elements extending into said path and so arranged therein as to interleave, and wipe the precipitating faces of, the stationary plates in the gas cleaning area as the movable wiping elements pass through said area; a relatively stationary wiping unit, composed of spaced parallel plate-wiping elements, mounted with its elements extending in the oil bath area and so arranged therein as to interleave, and wipe the precipitating faces of, the movable plates passing through the oil bath area; means for moving the movable wiping unit and movable cells serially through said areas; and means for moving the wiping elements of the relatively stationary wiping unit out of the oil bath area of said path during the movement of the movable wiping units through such area.

15. The cleaner of claim 14 wherein: each cell and wiping unit includes a framework to which its spaced parallel elements are secured and from which they project; each framework of a stationary cell and unit is mounted on one side of the path; and each framework of a movable cell and unit is mounted on the opposite side of the path.

16. A plate wiping unit of the class described comprising: a framework; a row-like series of plate wipers secured to said framework and projecting outwardly therefrom in parallel relationship to provide a series of spaced parallel passageways between wipers through which a series of spaced parallel precipitating plates may pass, said wipers being arranged to wipe the faces of the plates passing between them.

17. The unit of claim 16 wherein at least one wiper includes: a stiff spine secured at one end to the framework and projecting outwardly therefrom; and a wiping element secured to the spine along its length and arranged to present side faces which divergingly extend laterally from the spine.

VERNER DAHLMAN.