

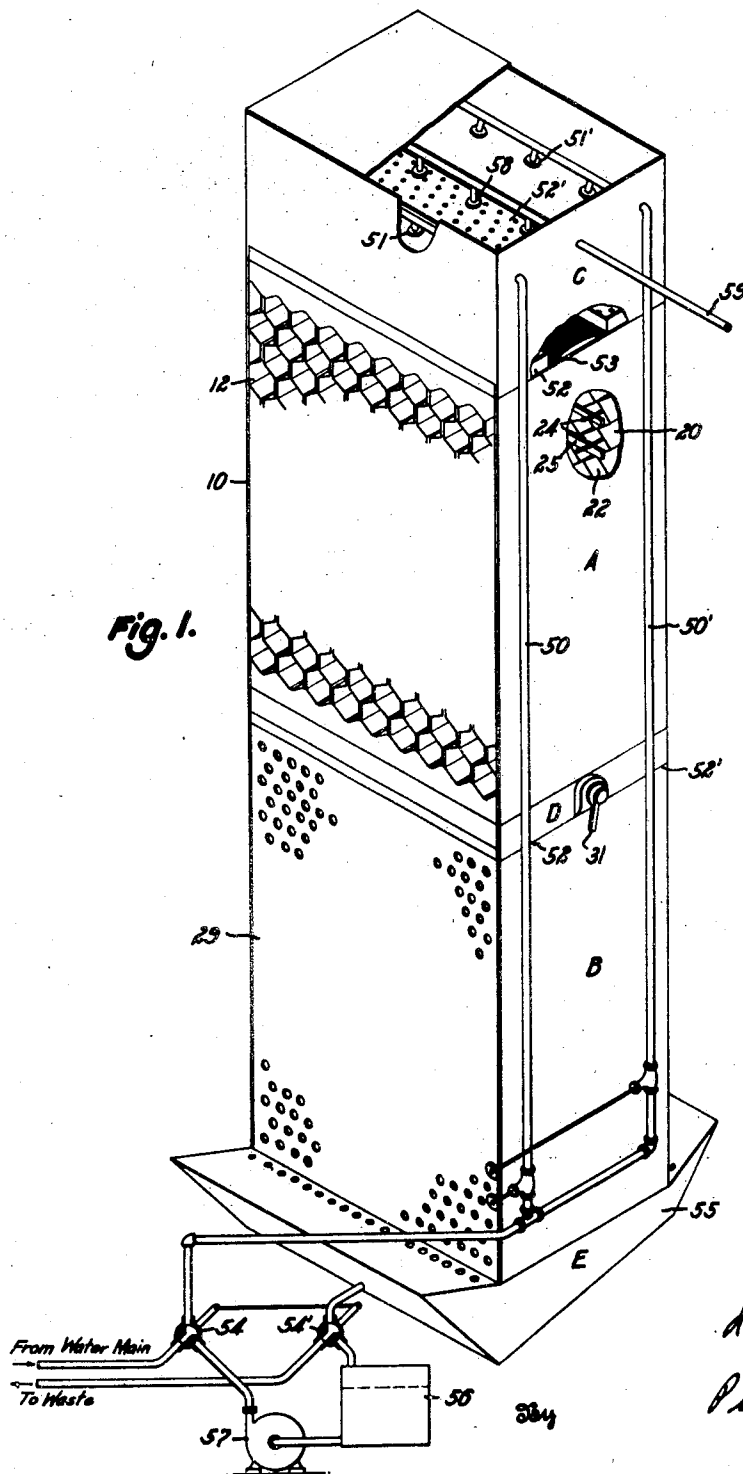
June 22, 1948.

H. A. WINTERMUTE
ELECTRICAL PRECIPITATOR

2,443,780

Filed Feb. 8, 1945

8 Sheets-Sheet 1



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8 Sheets-Sheet 2

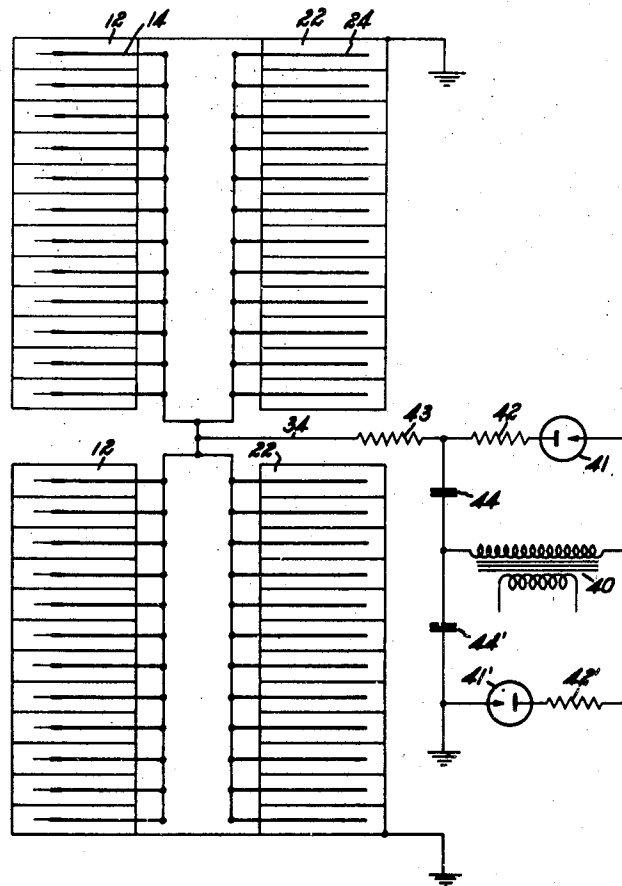


Fig. 2.

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8 Sheets-Sheet 4

Fig. 5.

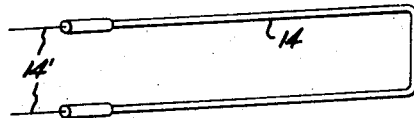
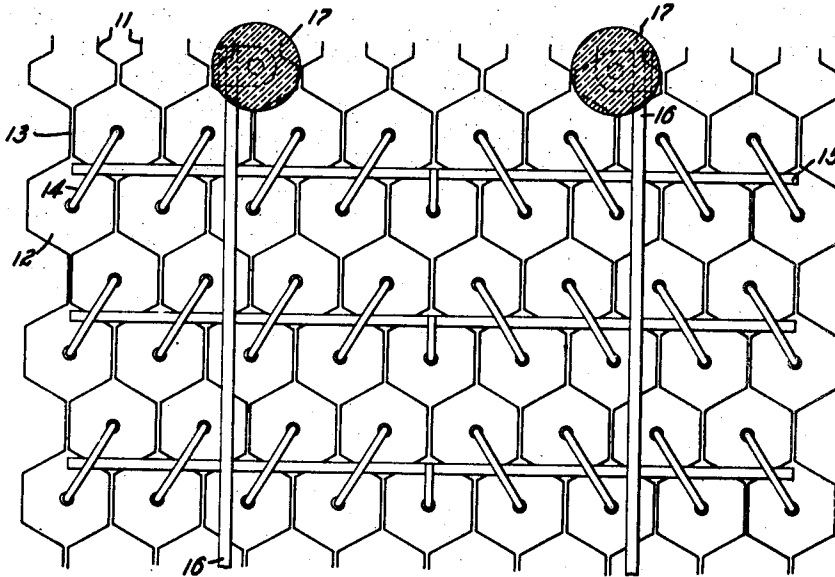


Fig. 6.

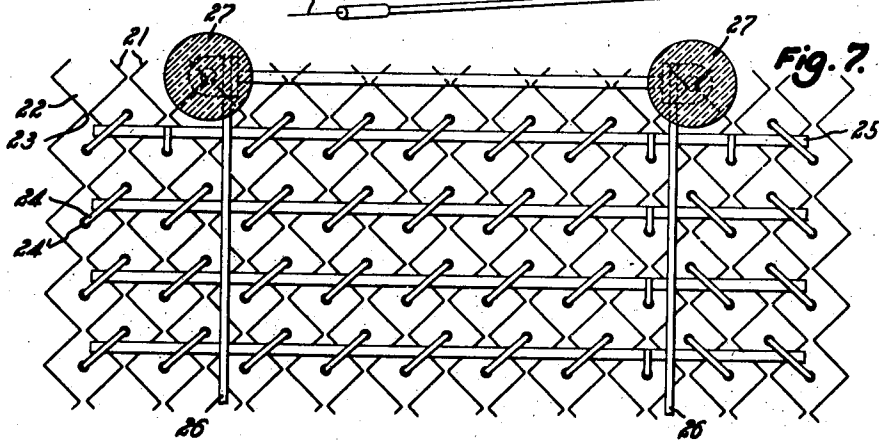


Fig. 7.

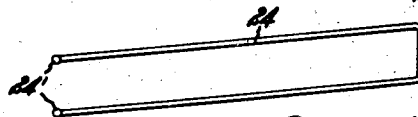


Fig. 8.

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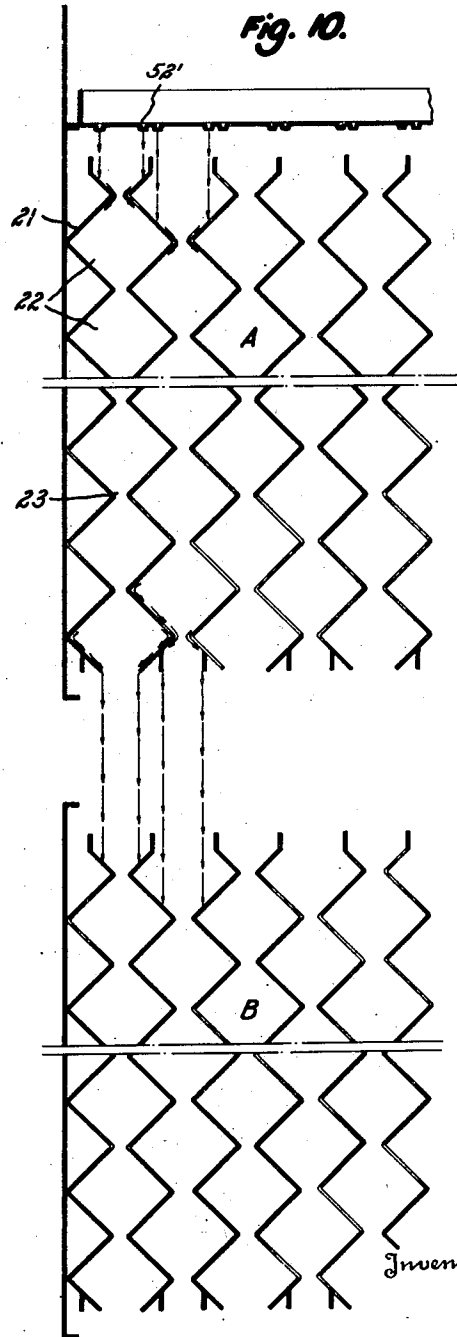
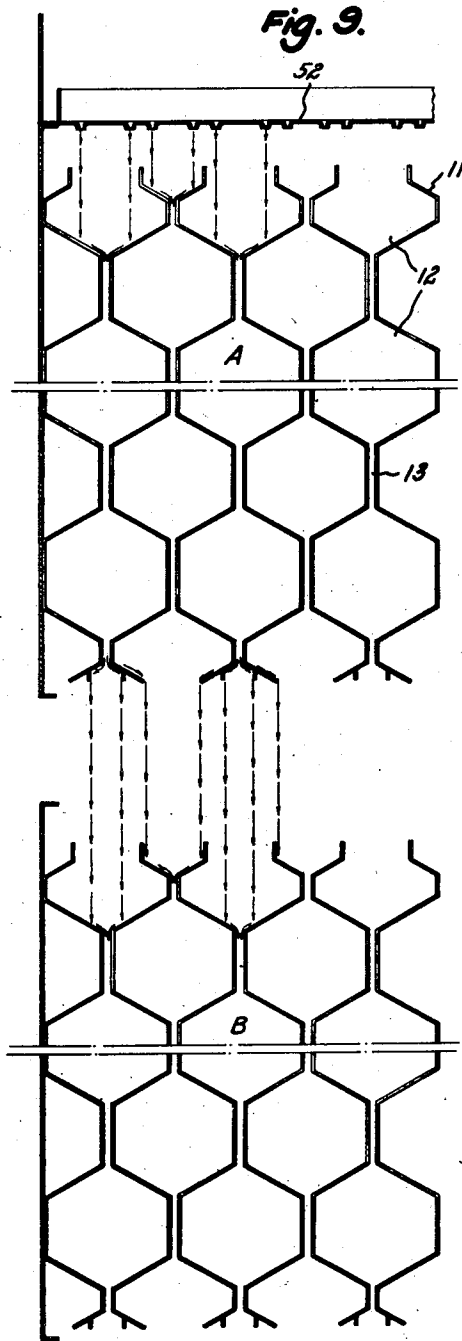
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8 Sheets-Sheet 5



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June 22, 1948.

H. A. WINTERMUTE
ELECTRICAL PRECIPITATOR

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8 Sheets-Sheet 6

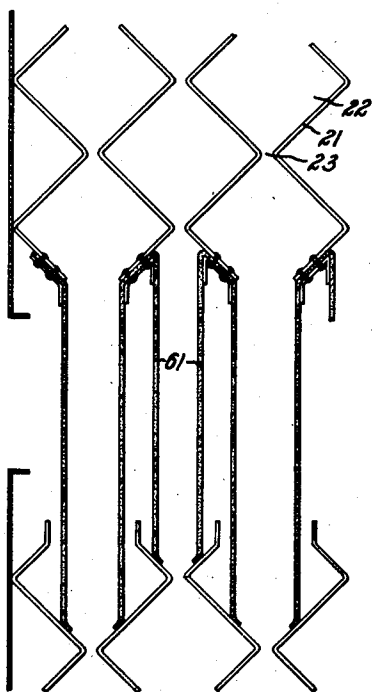


Fig. 11.

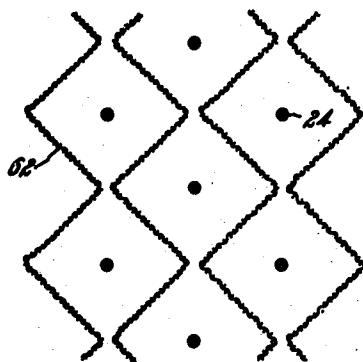


Fig. 12.

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By

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8 Sheets-Sheet 7

Fig. 13.

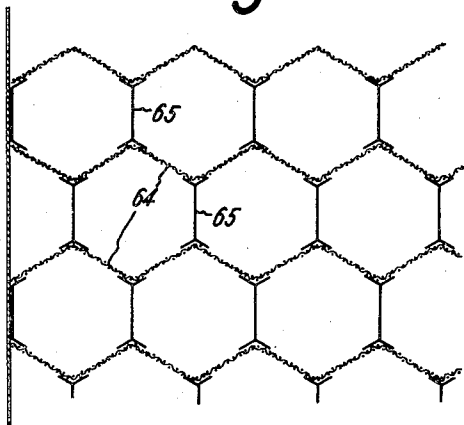


Fig. 14.

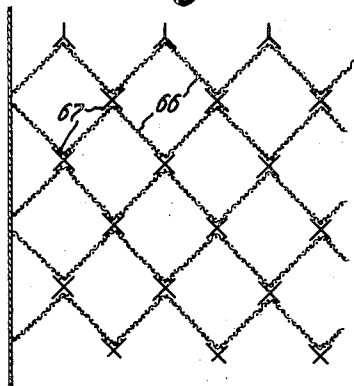


Fig. 15.

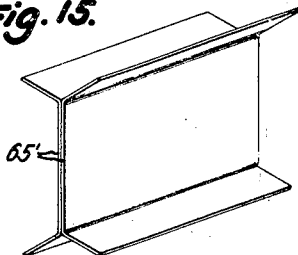


Fig. 16.

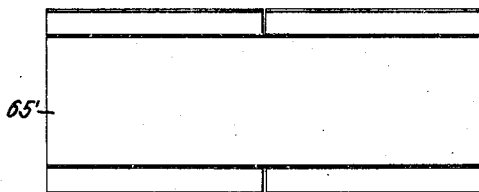


Fig. 16a.

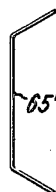


Fig. 17.

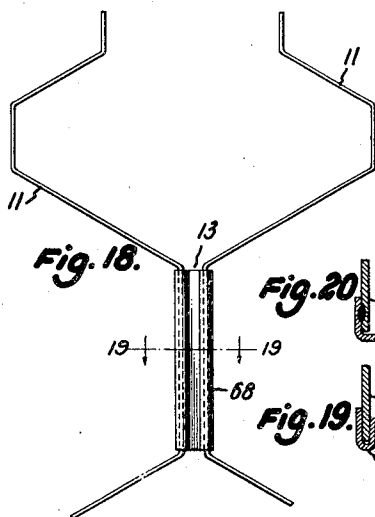
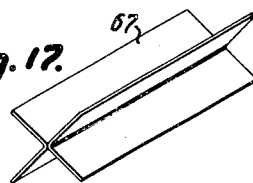


Fig. 20.

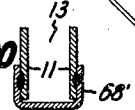


Fig. 19.

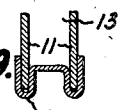
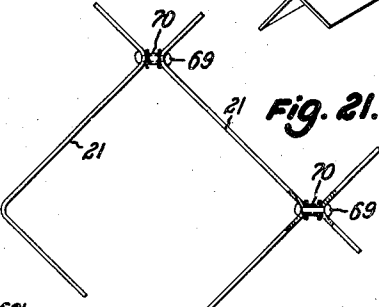


Fig. 21.



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8 Sheets-Sheet 8

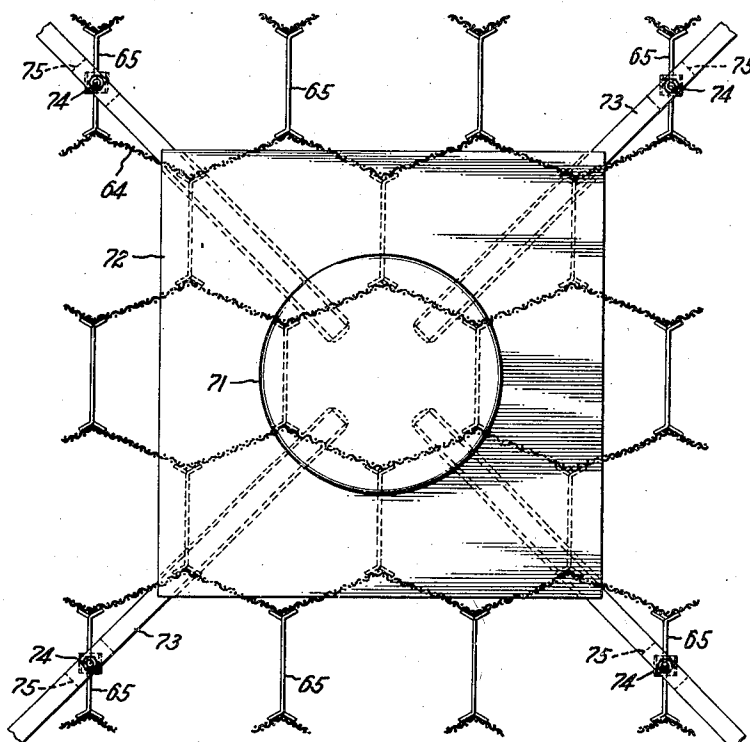
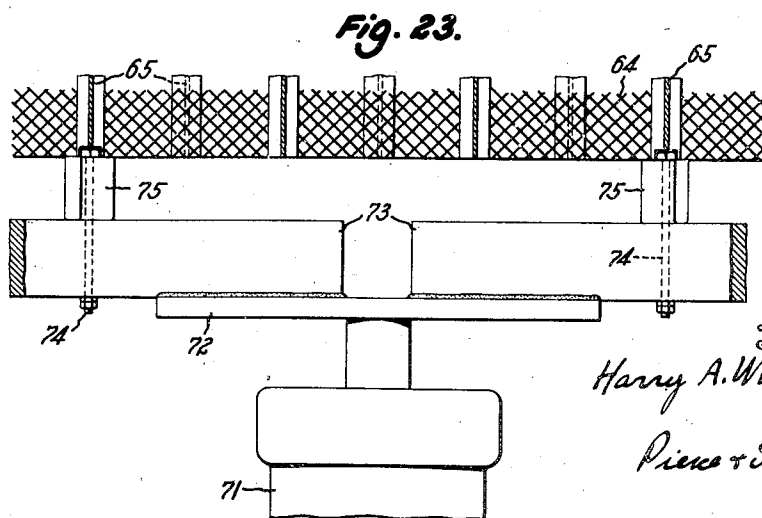


Fig. 22.



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UNITED STATES PATENT OFFICE

2,443,780

ELECTRICAL PRECIPITATOR

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Application February 8, 1945, Serial No. 576,734

16 Claims. (Cl. 183-7)

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This invention relates to electrical precipitation apparatus and particularly to electrical precipitators for use in the cleaning of air.

A purpose of the invention is the provision of electrical precipitation apparatus capable of eliminating substantially all (90% or more) of the suspended material from large volumes of air without the production of appreciable amounts of ozone.

A further purpose of the invention is the provision of air cleaning apparatus from which the collected suspended material can be removed with a minimum of interruption to the operation of the apparatus and in such manner that the separated material can be readily disposed of.

Another purpose of the invention is the provision of an electrostatic air cleaning apparatus having a relatively low weight and space requirement for a given air cleaning capacity.

A further purpose of the invention is to provide an electrostatic air cleaner capable of continuous operation over long periods of time with a minimum of electrical disturbances and with a greatly reduced fire hazard.

Other purposes and advantages of the invention will be apparent from the detailed description of the invention.

The electrical precipitators of the invention are characterized by a plurality of sheet members rectilinear in one direction and warped in another direction and positioned in parallel spaced relation to define a plurality of parallel conduits, preferably horizontal in extent, the sheet members providing extended collecting electrode surface walls to said conduits and providing means guiding the flow of liquids vertically downward from each of said conduits to the subjacent conduit. The sheet members may be conductive, for example, metal sheets or metal-surfaced sheet material or they may be non-conductive, when used with a conductive liquid film, and they may be perforate or imperforate. They may be shaped to provide conduits of any desired cross-section such as round, square or hexagonal.

In general, the air cleaning apparatus of the invention comprises one or more units each consisting of a charging section and a collecting section through which the air to be cleaned successively passes, and associated electrical energizing circuits, electrode flushing means, and disposal arrangements for the collected material. Each of the sections comprises a plurality of parallel conduits provided by suitably shaped sheet members forming extended collecting electrode surfaces and complementary precipitating electrodes positioned in each of the parallel conduits, the precipitating electrodes in the conduits of the charging section including a discharge element and the precipitating electrodes in the conduits of the collecting section being preferably non-

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discharging. The term "precipitating electrode" is used herein to designate electrode means opposed to and spaced from the collecting electrode structure and cooperating therewith to establish the electric field which causes charged particles to precipitate on the collecting electrode.

Means are provided for the periodic or continuous supply of flushing and/or coating liquids, and the collecting electrode construction of the invention in its preferred form includes means for uniformly distributing and guiding such liquids over the entire inner collecting surface of the conduits.

In a preferred embodiment of the invention, the collecting electrode construction is at ground potential and the precipitating electrodes are energized at a high potential, preferably negative. The precipitating electrodes in the charging and collecting sections of an air cleaning precipitator of the invention may be maintained at the same or at different potentials. In a preferred form of the invention, the high tension energizing connections, and the insulating supports therefor, for the precipitating electrode members if both the charging and collecting sections are positioned between the two sections, and means is provided for flushing the supporting members to remove any deposited material therefrom.

The invention also includes novel electric circuit arrangement for effecting the suitable energization of the complementary electrode systems in the charging and collecting sections of a precipitator.

The purposes and advantages of the invention will be more fully apparent from the following detailed description of illustrative embodiments of the invention with particular reference to the accompanying drawings.

In the drawings:

Fig. 1 is a semi-diagrammatic perspective view of an air cleaning precipitator embodying the principles of the invention, with portions broken away to show the relative arrangement of the parts;

Fig. 2 is a diagrammatic representation of an electrical circuit for energizing the precipitator of the invention;

Fig. 3 is a fragmentary front view and Fig. 4 is a fragmentary side view of the precipitator of Fig. 1 with cover members removed;

Fig. 5 is a fragmentary enlarged detail of the charging section of the precipitator showing the arrangement of the complementary electrodes;

Fig. 6 is a detail view of the charging electrode members of the charging section;

Fig. 7 is a fragmentary enlarged detail of the collecting section of the precipitator showing the arrangement of the complementary electrodes;

Fig. 8 is a detail view of the precipitating electrode members of the collecting section;

Fig. 9 is an enlarged fragmentary detail of the

charging section and Fig. 10 is an enlarged fragmentary detail of the collecting section, showing the arrangement of the extended surface electrodes;

Fig. 11 is a fragmentary detail view of a modified arrangement for the transfer of flushing liquid from an upper to a lower unit of the precipitator;

Figs. 12-14 are fragmentary detail views of extended surface electrodes constructed of wire mesh materials;

Figs. 15-21 are fragmentary views of constructional details of the precipitator of the invention;

Fig. 22 is an enlarged fragmentary view in elevation of an arrangement for rapping the electrodes of the invention; and

Fig. 23 is a fragmentary plan view of the arrangement of Fig. 22.

The air cleaning precipitator shown in semi-diagrammatic perspective in Fig. 1, in front elevation in Fig. 3 and in side elevation in Fig. 4, comprises two superposed cleaning units A and B, each comprising a charging section 10 and a collecting section 20. The cleaner may, of course, comprise only a single unit, or additional units may be added laterally or vertically, the number of units depending on capacity requirements, and the arrangement depending, in part, upon the available space.

The precipitator shown by way of example in Fig. 1 also includes a liquid supply and distributing section C, an intermediate redistributing section D, a liquid collecting base section E, and associated pipes, valves, pumps and containers, which will be more particularly described hereinafter.

The charging section 10 is divided by means of a plurality of suitably corrugated sheets 11 into closely nested horizontal conduits 12 of hexagonal section positioned with apices at the top and bottom edge. The sheets 11 are spaced apart to provide channel slots 13 about $\frac{1}{8}$ inch wide leading from the bottom apex of one conduit to the top apex of the next lower conduit. The precipitating electrodes advantageously consist of U-shaped rod members 14 (Figs. 5-6) having a fine wire discharge member 14' at the end of each limb. The discharge member 14' preferably comprises a fine wire, for example of tungsten, 2 to 15 mils in diameter, welded or brazed into the collar 14a at the end of the rod or held in place at the end of rod 14 by means of a tapered ferrule driven over the end of the rod. In this form of construction, the discharge wires are readily removable or replaceable.

The collecting section 20 is likewise divided by sheets 21 into square conduits 22, the sheets 21 being spaced apart to provide slots 23 between the contiguous top and bottom apices of vertically adjacent conduits. In the collecting section, the precipitating electrodes are advantageously provided by the U-shaped rod members 24. It is desirable to round off smoothly the ends of the rods 24 or to provide a ball termination 24' to eliminate surface portions of very small radius of curvature from which corona discharge might emanate. The rods may also be advantageously extended beyond the edges of the sheets 21 to eliminate corona discharge from the ends of the rods.

Perforate plates 29, or other means for equalizing the flow of gas into the conduits, such as louvers, are advantageously positioned over the

inlet ends of the conduits of the charging section.

The precipitating electrode members 14 and 24 are centrally positioned in conduits 12 and 22, respectively, by means of conductive frameworks comprising horizontal members 15, 25 and vertical members 16, 26, supported on insulators 17, 27 and connected to the high voltage energizing network as hereinafter described. The grill members 15, 16, 25, 26 are positioned so that none of the members intersect the centers of the adjacent conduits 12 and 22. The precipitating electrode supporting framework may also be provided by one or more sheets of wire mesh screen spaced from the ends of the conduits 12 and 22.

The precipitating electrodes may be L-shaped instead of U-shaped as shown in the drawings, the characteristic features of the preferred form of precipitating electrode comprising an extended rod portion, with attached discharge elements as required, and a root portion at right angle to the extended portion whereby the extended portion may be supported in projected position in the horizontal conduits of the precipitator.

The U- or L-form of the precipitating electrode members is particularly advantageous in combination with the supporting grid members 15, 25 as the individual electrode members may be readily shifted in position until their limbs are accurately centered in the corresponding conduits and then maintained in that position by spot-welding or tackwelding the root of the U- or L-member to the horizontal grid member, thus supporting the extended limbs of the electrode in cantilever fashion in the conduits.

The precipitating electrode supporting grids being positioned between the charging and collecting sections may advantageously be connected to, and disconnected from, the energizing circuit together with the supporting grids of adjacent units by means of a single switch device 30, actuated by insulated switch handle 31. Switch blades 32 are mounted on rod 33 which is connected to a source of high potential current by lead 34. By turning handle 31 the blades may be rotated into horizontal position, and the precipitating electrode system isolated from the high potential source. This construction permits the removal of a top or bottom section, when the switch blades are in a horizontal position, without disturbing other units.

A suitable arrangement for energizing the electrode systems of the cleaner is shown diagrammatically in Fig. 2. To supply a negative peak voltage of about 15 kv. to a precipitator of the type described above, the secondary of the transformer 40 (115/15,000 volts) is connected through rectifier tubes 41, 41' (20 kv. peak), resistances 42, 42' (50,000 ohms) 43 (25,000 ohms) and condensers 44, 44' (0.03 mfd.) to the electrode systems as shown. The voltage may be controlled by means of a voltage regulating device (not shown) in the primary voltage supply circuit. This high voltage supply gives effective precipitation when used with a cleaner in which the hexagonal collecting electrode conduits of the charging section are 6 inches long and 3 inches in diagonal section with a precipitating electrode comprising a 0.109 inch rod 14 and a 5 mil wire discharge point 14', and the square collecting electrode conduits of the collecting section are 10 inches long and 1.5 inch square in section with a precipitating electrode comprising a 0.125 inch rod 24.

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The invention also includes means for supplying and distributing liquids to the electrode surfaces for coating the surfaces or for flushing collected material away from the surfaces. As shown more particularly in Figs. 9 and 10, for example, the sheet members 11, 21 forming the collecting surfaces of the conduits 12, 22 are shaped and positioned to provide for the flow of liquid downward over the entire inner surfaces of each vertical tier of conduits, the lower ends of the sheet members being shaped to transmit liquid therefrom to the uppermost conduits in a precipitator section which may be positioned therebelow.

As shown by way of example in Fig. 1, electrode flushing and coating liquid is supplied to the distributing section E through pipes 50, 50' terminating in rows of spray nozzles 51, 51' positioned above the charging and the collecting section, respectively. Immediately over each of the precipitator sections is a perforated distributing pan 52, 52', while a wire mesh screen 53 is positioned over the space between the precipitator sections in which the high tension framework and supporting insulators are positioned. By means of interconnected three-way valves 54, 54' the pipes 50, 50' and spray heads 51, 51' may be connected to a water supply or other source of flushing liquid, the collected liquid in sump 55 being run to waste, or the pipes and spray heads may be connected to liquid reservoir 56 through pump 57, the liquid from sump 55 being returned to the reservoir.

The system may be advantageously operated as follows: A liquid composition, preferably one having a low vapor pressure, a relatively high viscosity, and high wetting power such as a mixture of triethylene glycol, sorbitol and a wetting agent, is placed in reservoir 56 and circulated through the precipitator until all of the collecting electrode surfaces of conduits 12 and 22 are thoroughly coated with a film of the liquid.

Thereafter the precipitator is put in operation and run either for a predetermined period of time or until inspection indicates the deposition of a substantial layer of precipitated dirt on the collecting surfaces. Then the precipitator is flushed out by connecting the liquid supply pipes and spray nozzles to the water supply system, the flushing liquid being usually run to waste. In the flushing operation, not only the collecting electrode surfaces but also the precipitating electrodes, the high tension supporting framework and the supporting insulators are thoroughly flushed and cleaned of deposited matter. The collecting electrode surfaces are then recoated with liquid from reservoir 56 as described above and operation is resumed. As a safeguard in case of fire, it is desirable to provide a set of high volume spray heads 58 connected directly to the water supply system by pipe 59 whereby the entire interior of the apparatus may be drenched with a large volume of water.

The precipitator may also be operated in the dry or uncoated condition, the collected material being flushed off the electrode surfaces and electrode supporting members periodically, or a continuous or intermittent flow of flushing liquid may be supplied to the electrode surfaces throughout the period of operation.

Fig. 11 of the drawings shows a modified arrangement for the guiding of liquid from the lower ends of the collecting electrode sheet mem-

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bers to corresponding members of a lower section, involving the provision of guide members 61 made, for example, of sheets of woven fabric material and attached to the lower ends of the electrode sheet members in suitable position to guide liquid from each tier of conduits to the corresponding tier in the lower unit.

The collecting surfaces of the conduits may be provided by perforated or wire mesh sheets. Wire mesh sheets are particularly suitable for operation with uncoated collecting electrode surfaces, the collected material being flushed from the collecting surfaces after each period of operation.

A typical construction, utilizing sheets of wire mesh material 62 to provide gas conduits of square section, is shown in Fig. 12.

The wire mesh material may extend horizontally, as shown in Figs. 13 and 14, rather than vertically. In forming conduits of hexagonal section with horizontally extending wire mesh sheets 64, as shown in Fig. 13, it is desirable to form the vertical sides of the conduits with dividing and liquid guiding members 65. These members may advantageously be formed of paired strips 65', as shown in Figs. 15-16.

In the construction with square sectioned conduits formed of horizontally extending wire screen material 66, as shown in Fig. 14, X-shaped members 67, shown more particularly in Fig. 17, are advantageously positioned at the vertices of the conduits.

When the collecting electrode surfaces are provided by perforated or wire mesh sheets as shown in Figs. 12-14, it is often advantageous to operate the precipitators with the collecting electrode surface dry or uncoated. Rapping means may be provided for the purpose of periodically jarring or vibrating the collecting electrode members to effect removal of deposited material.

Rapping of the electrodes is particularly effective when combined with a simultaneous flushing operation. The addition of a wetting agent to the flushing liquid is advantageous, particularly when the deposited material is oily or is otherwise difficultly wettable.

Figs. 18 and 19 show a construction for spacing and positioning the sheet members 11 by means of clips 63, positioned at the ends of the slot channels 13. Another form of construction in which the clips 68' are spot-welded to the sheets is shown in Fig. 20. The clips 68, 68' are also effective in preventing the flow of air through the channels 13.

Fig. 21 shows a construction for spacing the sheet members 21, by means of rivets 69 and spacing thimbles 70.

Figs. 22 and 23 show an advantageous arrangement for rapping the collecting electrode structures of the invention. The rapping device is shown for the purpose of illustration, in association with a collecting electrode of the form illustrated in Fig. 13. In these figures, 71 is a vibrator, which may be, for example, pneumatically or electrically operated. The vibrator 71 is mounted on a plate 72 to which are welded four bars 73, extending diagonally across the face of the electrode structure. The bars 73 are fastened at suitable intervals to members 65 of the electrode structure by means of bolts 74 and spacer blocks 75.

It will be seen from the foregoing description that the principles of the invention may be utilized in a wide variety of forms and arrangements characterized by the provision of a plu-

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rality of parallel horizontal conduits for the flow of gas therethrough between collecting electrode surfaces provided by the walls of the conduits and precipitating electrode members centrally positioned in the conduits and means for the vertical flow of liquid downwardly over the collecting electrode surfaces of superposed conduits.

I claim:

1. Apparatus for cleaning air by electrical precipitation comprising two horizontally spaced sections, each section comprising sheet members providing a plurality of vertical tiers of parallel horizontal conduits, a horizontally extending discharge-forming precipitating electrode positioned centrally of each conduit in the first of said sections, a horizontally extending non-discharge-forming precipitating electrode positioned centrally of each conduit in the second of said sections, means for maintaining a high potential between said precipitating electrode and said sheet members, and means for guiding a gas stream successively through the conduits of said first and said second section.

2. Apparatus for cleaning air by electrical precipitation comprising two horizontally spaced sections, each section comprising sheet members providing a plurality of vertical tiers of parallel horizontal conduits, a horizontally extending discharge-forming precipitating electrode positioned centrally of each conduit in the first of said sections, a horizontally extending non-discharge-forming precipitating electrode positioned centrally of each conduit in the second of said sections, means for maintaining a high potential between said precipitating electrode and said sheet members, means for supplying liquid to the uppermost conduit of each of said tiers, means for guiding the flow of liquid downward through each of said tiers, and means for guiding a gas stream successively through the conduits of said first and said second section.

3. Apparatus for cleaning air by electrical precipitation comprising two horizontally spaced sections, each section comprising sheet members providing a plurality of vertical tiers of parallel horizontal conduits, a horizontally extending discharge-forming precipitating electrode positioned centrally of each conduit in the first of said sections, a horizontally extending non-discharge-forming precipitating electrode positioned centrally of each conduit in the second of said sections, means for maintaining a high potential between said precipitating electrode and said sheet members, supporting means for said precipitating electrodes positioned in the space between said sections, and means for guiding a gas stream successively through the conduits of said first and said second section.

4. Apparatus for cleaning air by electrical precipitation comprising two horizontally spaced sections, each section comprising sheet members providing a plurality of vertical tiers of parallel horizontal conduits, a horizontally extending discharge-forming precipitating electrode positioned centrally of each conduit in the first of said sections, a horizontally extending non-discharge-forming precipitating electrode positioned centrally of each conduit in the second of said sections, means for maintaining a high potential between said precipitating electrode and said sheet members, a framework for mounting and positioning the precipitating electrodes of each of said sections positioned between said sections, and means for guiding a gas stream suc-

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cessively through the conduits of said first and said second section.

5. Apparatus for cleaning air by electrical precipitation comprising two horizontally spaced sections, each section comprising sheet members providing a plurality of vertical tiers of parallel horizontal conduits, a horizontally extending discharge-forming precipitating electrode positioned centrally of each conduit in the first of said sections, a horizontally extending non-discharge-forming precipitating electrode positioned centrally of each conduit in the second of said sections, means for maintaining a high potential between said precipitating electrode and said sheet members, a conductive framework for mounting and positioning the precipitating electrodes of each of said sections, insulators supporting said framework, said insulators and framework being positioned between said sections, means for supplying flushing liquid to the top portion of each of said sections and to the space therebetween, and means for guiding a gas stream successively through the conduits of said first and said second section.

6. In apparatus for cleaning air by electrical precipitation, sheet members providing collecting electrode surface walls of a plurality of vertical tiers of parallel horizontal conduits, a vertical conducting framework spaced from said tiers of conduits, and horizontal precipitating electrodes in each of said conduits centrally positioned and supported therein by said framework, said precipitating electrodes comprising a horizontal limb extending into one of said conduits and a portion extending at right angles to said limb and attached to said framework.

7. In apparatus for cleaning air by electrical precipitation, sheet members providing collecting electrode surface walls of a plurality of vertical tiers of parallel horizontal conduits, a vertical conducting framework spaced from said tiers of conduits, and horizontal precipitating electrodes in each of said conduits centrally positioned and supported therein by said framework, said precipitating electrodes comprising a metallic rod including a horizontal limb extending into one of said conduits and a portion extending at right angles to said limb and attached to said framework.

8. In apparatus for cleaning air by electrical precipitation, sheet members providing collecting electrode surface walls of a plurality of vertical tiers of parallel horizontal conduits, a vertical conducting framework spaced from said tiers of conduits, and horizontal precipitating electrodes in each of said conduits centrally positioned and supported therein by said framework, said precipitating electrodes comprising a metallic rod including a horizontal limb extending into one of said conduits, a fine wire discharge element attached to said limb within said conduit, and a portion extending at right angles to said limb and attached to said framework.

9. In apparatus for cleaning air by electrical precipitation, sheet members providing collecting electrode surface walls of a plurality of vertical tiers of parallel horizontal conduits, a vertical conducting framework spaced from said tiers of conduits, and horizontal precipitating electrodes in each of said conduits centrally positioned and supported therein by said framework, said precipitating electrodes comprising parallel horizontal limbs each extending into an adjacent conduit, and a root portion extending

at right angles to said limbs and attached to said framework.

10. Apparatus for cleaning air by electrical precipitation comprising two vertically superposed units each unit comprising two horizontally spaced sections each section comprising sheet members providing a plurality of vertical tiers of parallel horizontal conduits, a horizontally extending discharge-forming precipitating electrode positioned centrally of each conduit in the first of said sections, a horizontally extending non-discharge-forming precipitating electrode positioned centrally of each conduit in the second of said sections, means for maintaining a high potential between said precipitating electrodes and said sheet members, a conductive framework for mounting and positioning the precipitating electrodes of each of said sections positioned between said sections, means for supplying liquid to the uppermost conduit of each of the tiers of the upper unit, means for guiding liquid from the lowermost conduits of each of the tiers of the upper unit to the uppermost conduit of each of the tiers of the lower unit, and means for guiding a gas stream successively through the first and second sections of said units.

11. Apparatus for cleaning air by electrical precipitation comprising two vertically supported units each unit comprising two horizontally spaced sections each section comprising sheet members providing a plurality of vertical tiers of parallel horizontal conduits, a horizontally extending discharge-forming precipitating electrode positioned centrally of each conduit in the first of said sections, a horizontally extending non-discharge-forming precipitating electrode positioned centrally of each conduit in the second of said sections, means for maintaining a high potential between said precipitating electrodes and said sheet members, a conductive framework for mounting and positioning the precipitating electrodes of each of said sections positioned between said sections, switch means intermediate said conductive frameworks of the upper and lower units for disconnecting said frameworks from the source of high potential, means for supplying liquid to the uppermost conduit of each of the tiers of the upper unit, means for guiding liquid from the lowermost conduits of each of the tiers of the upper unit to the uppermost conduit of each of the tiers of the lower unit, and means for guiding a gas stream successively through the first and second sections of said units.

12. Apparatus for cleaning air by electrical precipitation comprising successive charging and collecting sections, and means for guiding a gas stream successively through said sections, at least one of said sections comprising a plurality of sheet members rectilinear and parallel in one direction, symmetrically warped in the other direction, and positioned in spaced relation to define a plurality of vertical tiers of parallel horizontal conduits, said sheet members providing extended collecting electrode surface walls to said conduits, means guiding the flow of liquids vertically downward along substantially the entire collecting surfaces of the conduits of each of said tiers of conduits, and horizontal insulated electrode means positioned in each of said conduits.

13. Apparatus for cleaning air by electrical precipitation comprising successive charging and collecting sections, and means for guiding a gas stream successively through said sections, said charging section comprising a plurality of sheet

members rectilinear and parallel in one direction, symmetrically warped in the other direction, and positioned in spaced relation to define a plurality of vertical tiers of parallel horizontal conduits, said sheet members providing extended collecting electrode surface walls to said conduits, means guiding the flow of liquids vertically downward along substantially the entire collecting surfaces of the conduits of each of said tiers of conduits, and horizontal insulated discharge electrode means positioned in each of said conduits.

14. Apparatus for cleaning air by electrical precipitation comprising successive charging and collecting sections, and means for guiding a gas stream successively through said sections, said collecting section comprising a plurality of sheet members rectilinear and parallel in one direction, symmetrically warped in the other direction, and positioned in spaced relation to define a plurality of vertical tiers of parallel horizontal conduits, said sheet members providing extended collecting electrode surface walls to said conduits, means guiding the flow of liquids vertically downward along substantially the entire collecting surfaces of the conduits of each of said tiers of conduits, and horizontal insulated precipitating electrode means positioned in each of said conduits.

15. Apparatus for cleaning air by electrical precipitation comprising a plurality of vertically superposed sections each section comprising sheet members providing a plurality of vertical tiers of parallel horizontal conduits, horizontal insulated electrode means in each of said conduits, means for supplying liquid to the uppermost conduit of each of the tiers of the uppermost unit, means for guiding liquid from the lowermost conduits of each of the tiers of the upper sections to the uppermost conduit of each of the tiers of successively lower sections, and means for guiding a gas stream through said sections.

16. Apparatus for cleaning air by electrical precipitation comprising at least two sections each comprising a plurality of electrically grounded sheet members defining gas conduits through said sections, means supporting said sections in spaced relationship, a vertically extending framework insulated from said sheet members, electrode means supported by said framework and extending into said gas conduits, and circuit elements connecting said framework to a source of high tension current including disconnect means positioned in the space between said sections.

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