July 25, 1944. J. H. HAMILTON 2,354,457

ELECTRICAL PRECIPITATION APPARATUS

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Fig. 1.

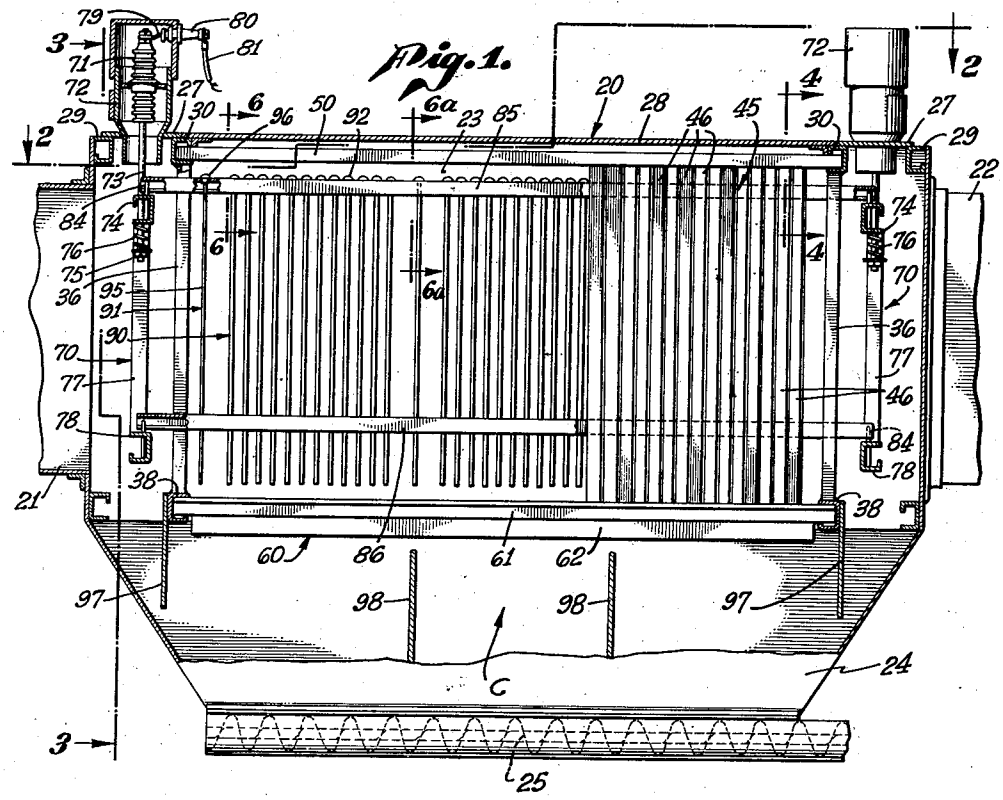
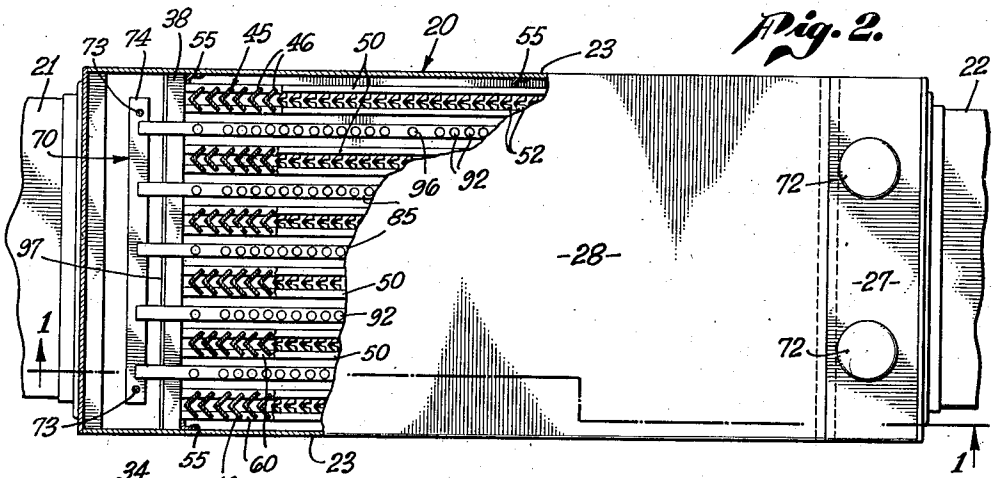


Fig. 2.



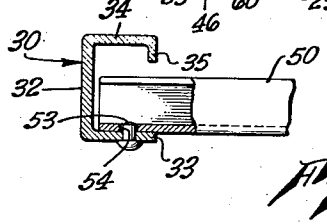


Fig. 1a.

INVENTOR.
JAMES HUGH HAMILTON,
BY
Alfred W. Knight
ATTORNEY.

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Fig. 3.

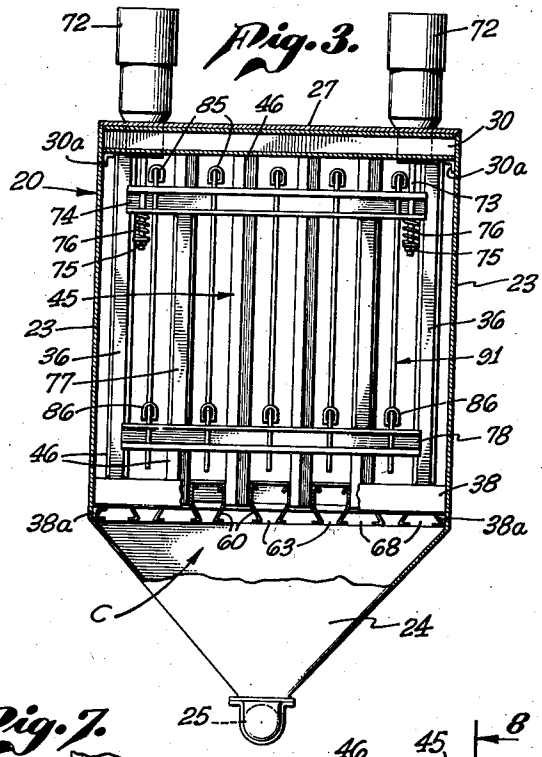


Fig. 4.

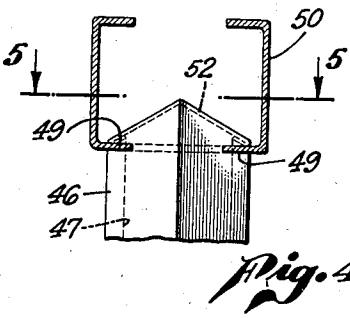


Fig. 5.

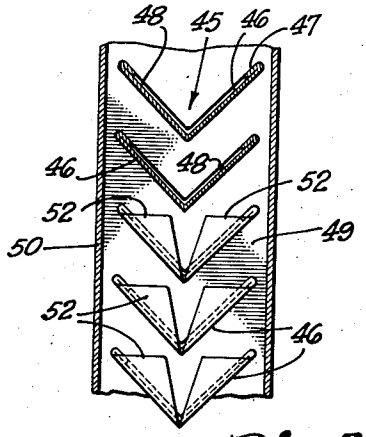


Fig. 7.

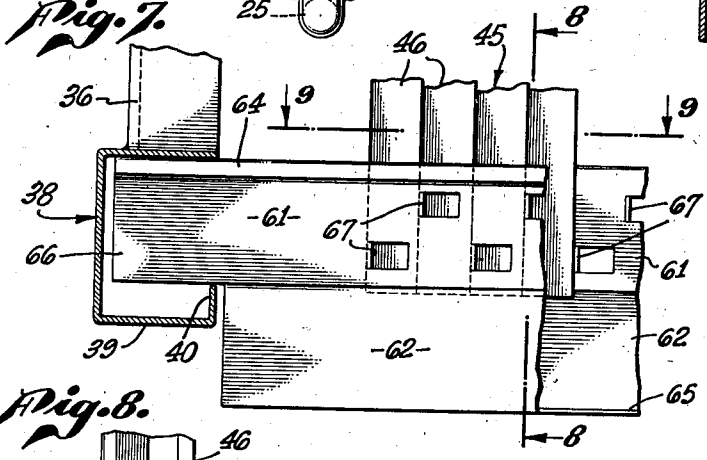


Fig. 6.

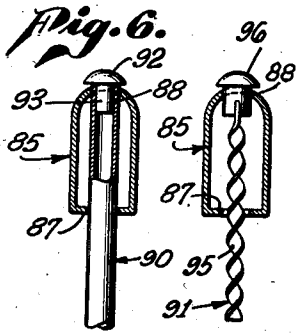
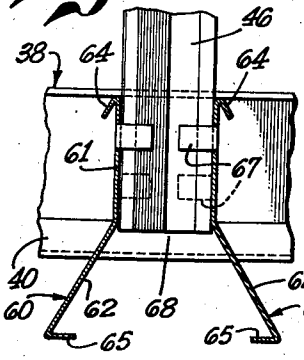


Fig. 6a.

Fig. 8.



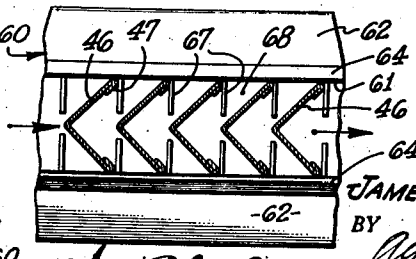


Fig. 9.

INVENTOR.
JAMES HUGH HAMILTON,
BY
Alfred W. Knight
ATTORNEY.

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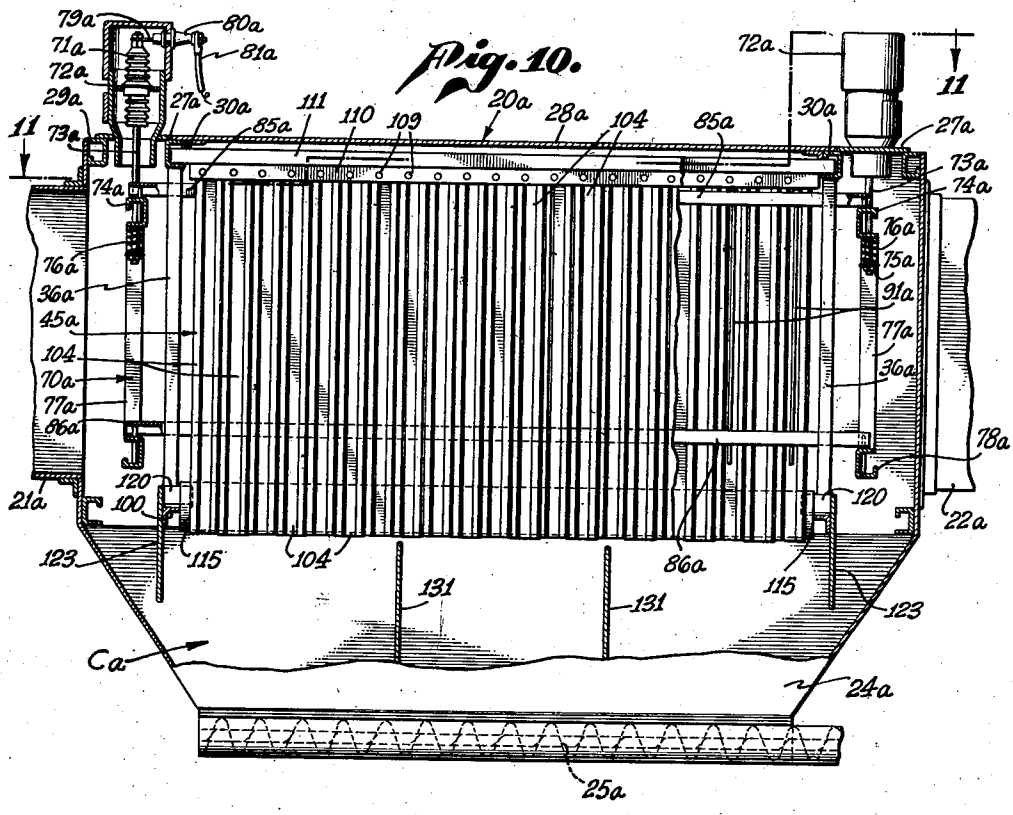


Fig. 10.

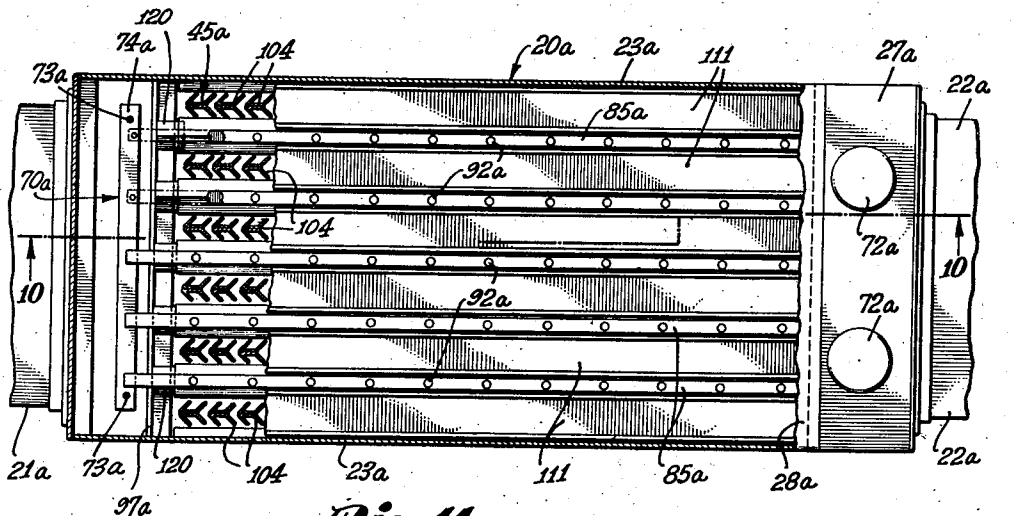


Fig. 11.

INVENTOR.
JAMES HUGH HAMILTON,
BY
ATTORNEY.

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Fig. 12.

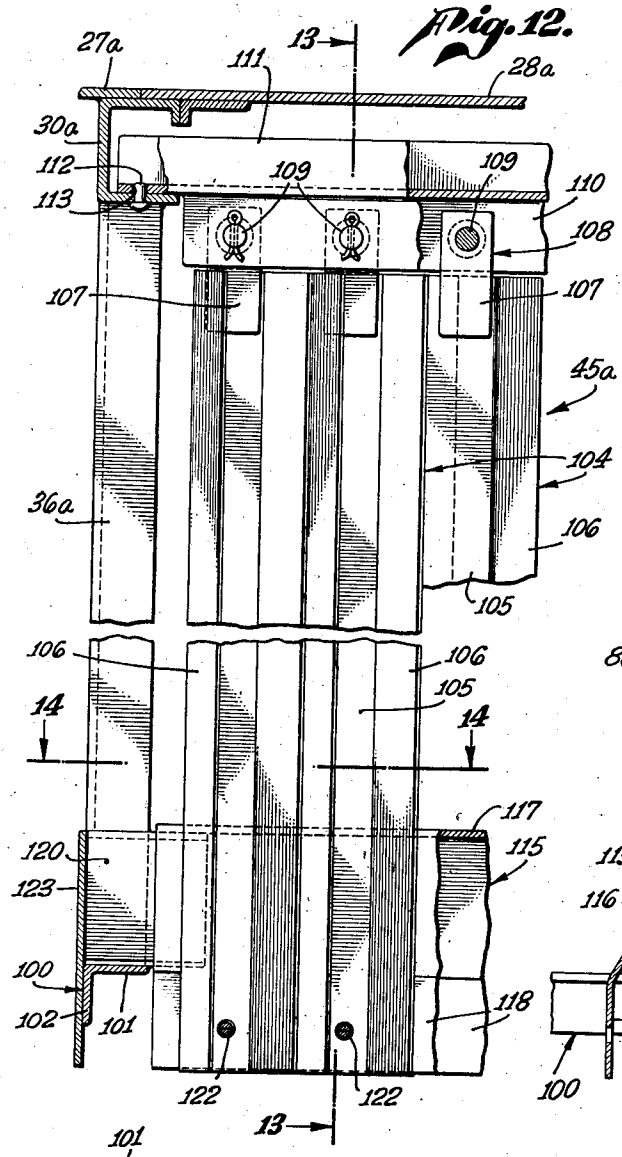


Fig. 13.

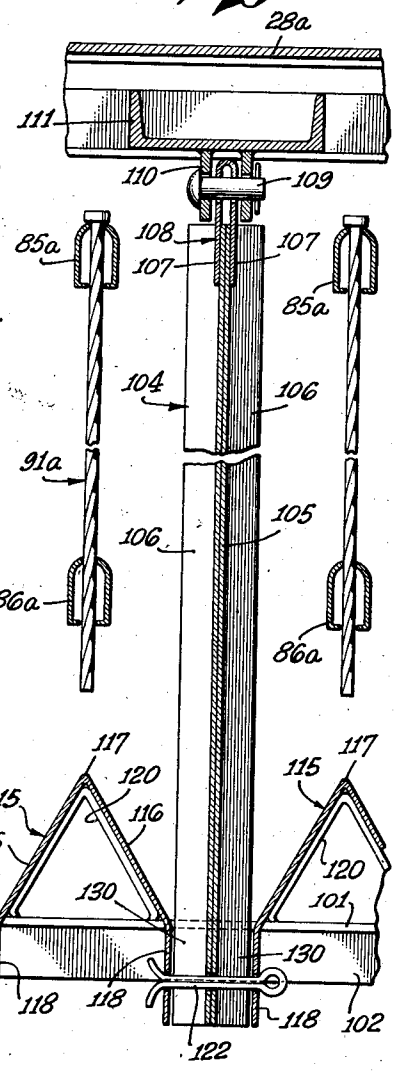
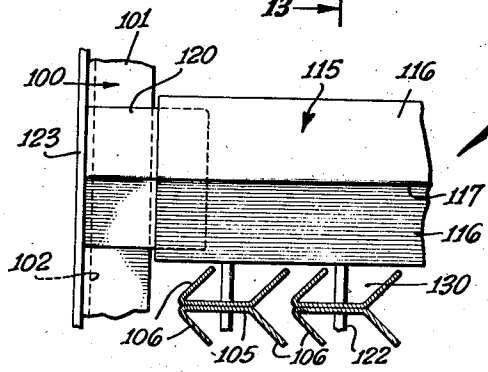


Fig. 14.



INVENTOR.
JAMES HUGH HAMILTON,
BY Alfred W. Knight
ATTORNEY.

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UNITED STATES PATENT OFFICE

2,354,457

ELECTRICAL PRECIPITATION APPARATUS

James Hugh Hamilton, Burbank, Calif., assignor to Western Precipitation Corporation, Los Angeles, Calif., a corporation of California

Application July 14, 1942, Serial No. 450,898

16 Claims. (Cl. 183—7)

The present invention relates generally to electrical precipitation of suspended particles from gases, and more particularly to single or multiple stage precipitators of the horizontal gas flow type in which the gas flows through horizontal ducts between or defined by parallel, longitudinally-extended and transversely-spaced electrode structures, of which at least one is a collecting electrode structure adapted to collect suspended electrically-charged particles and to deposit accumulations of such particles into a material-collecting chamber at the bottom of the apparatus.

In such precipitators, the particles are electrically charged by passing through a corona discharge created by an intense electrostatic charging field which is established between a discharging electrode and a non-discharging electrode, and thereafter migrate toward and precipitate or collect on a non-discharging collecting electrode charged to a polarity opposite to that of the discharging electrode. The discharging and non-discharging electrodes between which the charging field is maintained may define or be contained within portions of the horizontal gas ducts in which the precipitation occurs, and are here illustratively shown in such form, or they may be positioned in advance of such gas ducts, for instance as disclosed in Patent No. 2,275,001, issued March 3, 1942, to E. Anderson. The term "discharge electrode" will be understood to designate an electrode that facilitates corona discharge, because it has a configuration that establishes a sufficiently high potential gradient at or near its surface to create corona discharge before there is a disruptive discharge or sparkover. For this purpose, the discharge electrode usually takes the form of a member of small surface area, such as a small diameter wire or a rod provided with sharp edges or points, whereby there may be created in the immediate vicinity thereof a sufficiently high electric field intensity to cause ionization and corona discharge. The term "non-discharging electrode" will be understood to designate an electrode that minimizes or prevents corona discharge therefrom because it has a configuration that establishes a sufficiently low field concentration at or near the surface to suppress corona discharge at elevated potentials lower than the voltage required for disruptive discharge or sparkover. For this purpose, a non-discharging electrode is usually one of extended surface area, substantially free from sharp corners or other parts of sharp surface curvature at all portions which are located within the electric field, so as substantially to avoid ionization or corona discharge at that electrode.

The present invention is applicable to single stage precipitators, in which the electrostatic field is formed between a discharging electrode and a non-discharging collecting electrode, the particles charged by the corona discharge about the discharging electrode precipitating on the non-discharging collecting electrode, or to a "two-stage" or "separated-field" precipitator, in which a charging field is formed between a discharging electrode and a non-discharging electrode, beyond which is a spatially separate and functionally distinct precipitating field formed between two non-discharging electrodes, or to multiple stage precipitators which may be regarded as made up of two or more serially arranged sets of "two-stage" or "separated-field" electrodes.

The collecting electrodes may be of various types, such as vertical longitudinally-extended curtains, perforate or imperforate, or such as the pocket type disclosed in Patent No. 2,275,001, granted March 3, 1942, to E. Anderson. In all such precipitators, the suspended particles deposited on the collecting electrodes fall from time to time into a collecting chamber at the bottom of the precipitator, aided in many instances by the intermittent operation of a rapping mechanism which jars the collecting electrodes and so shakes the accumulated particles free. Under some conditions, there may be some substantial gas flow into and back up out of the collecting chamber, and such gas flow may act not only to carry previously collected particles back up out of said chamber, but also to erode particles previously deposited on and clinging to the lower portions of the collecting electrodes. This undesirable gas circulation into and back out of the collecting chamber accounts for considerable redispersion of collected particles, and considerable loss in overall recovery.

The primary object of the present invention is accordingly the provision of means for greatly restricting the flow of gas between the main gas passage and the collecting chamber of electrical precipitators of the classes mentioned.

This object is accomplished in accordance with the present invention by blocking off the top side of the hopper with a series of sloping baffles which permit the dust to fall through, but greatly restrict the circulation of gas into and back out of the hopper. These baffles, which are arranged between the main gas passage through the precipitator and the material collecting chamber, provide a plurality of baffle walls defining a series

of relatively narrow slots for passage into the hopper of collected particles falling from the collecting electrodes. The slots, of course, inevitably permit some flow of gas into and out of the collecting chamber, but such flow is so greatly restricted that a material and important reduction in re-dispersion of collected material is realized.

The invention will be understood more fully from the following detailed description of typical applications thereof to conventional modern types of electrical precipitators, reference for this purpose being had to the accompanying drawings, in which:

Fig. 1 is a longitudinal vertical section taken as indicated by broken line 1—1 of Fig. 2, the collecting electrodes in back of the illustrated rod electrodes being omitted; Fig. 1*a* is an enlarged detail taken from Fig. 1, showing the manner of supporting the ends of the longitudinal members from which the pocket electrodes are suspended; Fig. 2 is a plan section taken on broken line 2—2 of Fig. 1; Fig. 3 is a transverse section taken on line 3—3 of Fig. 1; Fig. 4 is a detail section taken on line 4—4 of Fig. 1; Fig. 5 is a detail section taken on line 5—5 of Fig. 4; Figs. 6 and 6*a* are detail sections taken respectively on lines 6—6 and 6*a*—6*a* of Fig. 1; Fig. 7 is an enlarged detail taken from Fig. 1, showing a portion of a collecting electrode and associated baffle means; Fig. 8 is a detail taken on line 8—8 of Fig. 7; Fig. 9 is a detail taken on line 9—9 of Fig. 7; Fig. 10 is a longitudinal vertical section showing a modified form of the invention, being a view taken on line 10—10 of Fig. 11; Fig. 11 is a plan section taken on broken line 11—11 of Fig. 10; Fig. 12 is an enlarged detail taken from Fig. 10, showing part of a collecting electrode and associated baffle means; Fig. 13 is a section taken on line 13—13 of Fig. 12; and Fig. 14 is a section taken on line 14—14 of Fig. 12.

Referring first to the form of the invention shown in Figs. 1 through 9, which show illustratively a multiple stage, separated-field type of precipitator, there is shown at 20 a generally rectangular shell or housing defining a horizontal gas passage between an inlet 21 at one end and an outlet 22 at the other. The housing 20 in the particular embodiment of the invention here shown for illustration includes vertical sides 23, a preferably hopper-shaped bottom 24 forming a material-collecting chamber C, which is preferably equipped with a screw conveyer discharge means 25 for the collected dust, and a top comprising end sections 27 and a central section 28 which may be removable, if desired, to permit access to be gained to the interior of the precipitator. A pair of longitudinally-spaced transverse members 29 and 30 at each end of the housing supports the corresponding top end section 27, and the removable central panel 28 rests on the members 30 and abuts top end sections 17, as illustrated in Fig. 1. The ends of the transverse members 30 are shown in Fig. 3 to be supported from side walls 23 as by means of brackets 30*a*, and the transverse members 29 may be similarly supported.

The transverse members 30 may be described generally as of channel cross-section, arranged with their channels facing one another, as shown in Fig. 1, and having web 32, side flanges 33 and 34, and a flange portion 35 turned inwardly from flange 34 (Fig. 1*a*). The members 29 may be of similar cross-section and arranged as also indicated in Fig. 1.

Engaging and welded to the undersides of the channel members 30, near the two ends of the latter, are the upper ends of vertical members 36, typically of U-shaped cross-section. The lower ends of these U-shaped members 36 engage and are welded to transverse channel-shaped members 38, typically of a cross-section similar to members 30, extending across the housing at the dividing plane between the rectangular portion of the housing and the hopper-shaped bottom 24. These members 38 are oriented with their channels facing one another, the flanges 39 having the inturned flange portions 40 being at the bottom, and they are preferably connected to side walls 13 through brackets 38*a* (Fig. 3) to restrain sway longitudinally of the housing. The described channel members 30 and 38 carry the supporting structure for the preferred pocket-type collecting electrodes presently to be described.

In the preferred construction here illustrated, there is a plurality of collecting electrodes 45 extending longitudinally and spaced transversely of the housing, each comprising a series or row of vertical V-shaped elements 46, which are aligned and spaced from one another in the direction of gas flow, as will be seen best in Fig. 2. These V-shaped elements will be seen to define "pockets" open to the gas ducts but removed from the gas streams flowing therethrough. These pockets may be regarded generally as forming channels or passageways, open laterally to the gas ducts, and leading downwardly to the hopper-shaped bottom. Sharp edges are preferably removed from the open ends of each V-shaped element 46 by turning the vertical edge portions 47 back, as illustrated in Fig. 9. The upper end portions of the series of V-shaped elements 46 are received within V-shaped slots 48 formed in the web 49 of a longitudinal channel-shaped member 50 (Fig. 4) whose ends extend into the channels of the members 30 and rest on and are supported by the lower flange portions 33 thereof. The V-shaped members 36 are hung from members 50 in any suitable manner; for instance, as indicated in Figs. 4 and 5, their upper corner portions 52 may be turned over so as to engage the web of the member 50. Members 50 are transversely spaced at desired intervals on the members 30; for instance, rivets 53 set into and projecting upwardly from the lower flanges 33 of the members 30 may be engaged with holes 54 in the webs of the members 50 (see Fig. 1*a*).

The two outside rows or series of V-shaped electrode elements 46 are preferably positioned at relatively close spacing to the side walls 23 of the shell. To close off gas circulation through any space which may be left, vertical baffle strips 55 may be mounted at suitable intervals therein, as indicated in Fig. 2.

The material-collecting chamber C of the precipitator is blocked off from the horizontal gas passageway above by means of a plurality of baffle members 60 which, in the present illustrative embodiment of the invention, are positioned at the bottom of the longitudinal spaces or gas ducts between the transversely-spaced rows of collecting electrodes 46. In the present illustrative form, these baffle members 60 extend between and are supported by the two lower transverse members 38. As viewed in cross-section, baffles 60 have vertical wall portions 61 which engage the vertical edges of pocket electrode elements 46, and sloping wall portions 62 extending downwardly and outwardly from the lower edges of wall portions 61, the apex of the angle made by the wall portions

61 and 62 preferably coming approximately at the lower end of the electrode elements 46. Thus the two baffle walls 62 between each two adjacent rows of collecting electrode elements 46 converge toward one another, defining at the bottom a relatively narrow longitudinally-extending slot 63, which is sufficiently wide to permit downward travel of dust particles falling from the collecting electrodes, but sufficiently narrow to offer a material restriction to circulation of gas between the horizontal gas passage above and the collecting chamber C below. The slope of the wall portions 62 is made sufficient to prevent dust particles from piling up thereon. Preferably, principally for the purpose of stiffening the baffles, the upper edge of the vertical wall portion 61 is formed with a relatively short downwardly-bent flange portion 64, also arranged at such an angle as not to catch dust, and the lower edge of the wall portion 62 is formed with a relatively short horizontal flange portion 65, which is bent inwardly or away from the slot 63 between adjacent baffles. The lower wall portions 62 of baffles 60 are cut away at the two ends of the baffles, leaving projecting end portions 66 of vertical dimensions such as will just be received within the channels of the members 38 (Fig. 7), the flange portions 40 of members 38 supporting the baffles by engagement with projecting end portions 65, in the manner clearly illustrated in Fig. 7.

Lugs 67, bent inwardly from the wall portions 61 of baffles 60, engage the open ends of the V-shaped collecting electrode elements 46 to space the lower ends of the latter, the pressure of the flow of gas longitudinally of the precipitator being relied upon to hold the electrode elements 46 against said lugs.

In order to block off the gas passageway from the material-collection chamber at each end of the latter, and also to prevent inflow of gas into the material-collecting chamber between the baffles below transverse member 38 at the inlet end of the apparatus, as well as outflow of gas from said chamber between the baffles at the discharge end of the apparatus, suitable closure means are provided; as here typically shown, vertically-extending transverse baffle plates or walls 97 are mounted on members 38 at both ends of the precipitator, extending transversely the full distance between the side walls of the hopper-shaped bottom that forms the material-collecting chamber, and depending substantially below the level of the baffles. Additional transverse baffles 98 may also be provided at intervals along the length of the hopper and below the baffle members 60.

In the particular precipitator here chosen to illustrate the invention, rows of high-tension alternate discharging and non-discharging electrodes are positioned in the longitudinally-extending spaces or gas ducts defined by the several series or rows of collecting electrode elements 46, the latter being spaced properly to accommodate these rows of discharging and non-discharging electrodes, with proper transverse spacing for the necessary electrical action. The preferred, and here illustrated, form of high-tension electrode system forms the subject matter of a co-pending application of Harry J. White, entitled "Electrical precipitation apparatus," filed July 13, 1942, Ser. No. 450,711. It includes a supporting structure comprising a high-tension frame 70 near each end of the housing, spaced somewhat beyond the ends of the rows of collecting electrode elements 46, and hung from suitable suspension insulators 71, mounted in tubular housings 72, extending through and supported by the top sections 27 of the enclosing housing of the precipitator. There are four of these suspension insulators 71, two for each frame 70. Each has a central vertical rod 73 extending therethrough and on downwardly to the upper horizontal transverse frame member 74 of the frame 70. Nuts 75 threaded on the lower ends of rods 73 support the lower ends of compression springs 76, the upper ends of which support the members 74. The frames 70 are thus spring-supported from high-tension conducting rods 73. Frames 70 each include two vertical end members 77, preferably aligned with rows of pocket collecting electrode elements 46 (see Fig. 3) so as not to interfere with the gas passages between the rows of electrode elements 46, the upper ends of member 67 being welded to upper transverse members 74, and the lower ends engaging and being welded to a lower transverse member 78.

Connected to electrode rod 73 at the upper end of one of the insulators 71 is a conductor 79, which passes through insulator 80 in the side of bushing housing 72 and connects on the outside to electrical conductor 81, which will be understood to be energized from one terminal, usually the negative terminal, of a suitable high-tension source of unidirectional current. The precipitator housing, and therefore the pocket collecting electrode structure, are electrically grounded, as is the positive terminal of the source of current. The upper and lower transverse members 74 and 78 of high-tension frames 70 carry upwardly-projecting supporting pins 84, the upper ends of which engage and support the end portions of upper and lower longitudinally-extending rails 85 and 86, respectively, spaced uniformly between the rows of collecting electrode elements 46, and adapted for support of the presently-described high-tension discharging and non-discharging electrodes. These rails 85 and 86 are generally of inverted U-shape in cross-section, with inwardly-turned flange portions 87 at the edges of the two sides, as illustrated in Fig. 6. The tops of members 85 and 86 are provided with uniformly-spaced pairs of vertically-aligned holes 88, adapted to receive with free sliding fit vertically-disposed non-discharging electrode rods 90 and discharging electrode elements 91. The former may be solid rods or tubes, and will be understood to be of sufficient diameter that high electrostatic field stresses at their surfaces, such as might cause ionization of the surrounding gases, will be avoided. The upper ends of the electrode rods 90 are furnished with heads 92, adapted to engage the tops of upper rails 85, for the purpose of support of the rods. In the case of tubular rods, these heads 92 are conveniently provided by welding rivets 93 in the upper ends of the tubes (Fig. 6).

The discharging electrode members 91 include portions having formations of relatively small radius of curvature, such as will establish high electrostatic stress sufficient to cause ionization of the surrounding gases. Suitable known forms include fine wires, twisted square bars, twisted ribbons and the like. The form here chosen for illustrative purposes embodies a twisted ribbon 95. The upper end of this twisted ribbon is here shown as welded to the lower end of a rivet 96, which is mounted in a hole 88 of upper rail 85, the head of the rivet engaging the top of the rail for support (Fig. 6a).

The first electrode-receiving holes in the rails 85 and 86 are located in transverse alignment with the first transverse row of V-shaped pocket collecting electrode elements 46, and are continued at uniform, relatively close spacing to the last transverse row of V-shaped electrode elements. In the first transverse row of electrode-receiving holes 88 are placed a transverse row of discharging electrodes 91, and beyond the discharging electrodes 91 is a series of non-discharging rod electrodes 90, a suitable spacing being provided between the discharging electrodes and the non-discharging electrodes, in order to prevent shielding of the former by the latter. At suitable points along the length of the electrode structures, additional transverse rows of discharging electrodes may be inserted. As here shown, two such additional rows are illustrated.

The discharging and non-discharging electrodes 90 and 91 are maintained at a high, direct-current potential, by reason of their connection through rails 85 and 86 with the high-tension frames 70. The housing structure 20 and, therefore, the pocket-type V-shaped electrodes 46, are electrically grounded, as previously stated. It will be understood that an electrostatic field will be established between the electrode members mounted on the rails 85 and 86 and the adjacent V-shaped collecting electrodes 46, and that this field will be of ionizing intensity adjacent the discharging electrodes 91, and below ionizing intensity adjacent the non-discharging electrodes 90.

The dust-laden gas passing between the discharging electrodes 91 and the V-shaped electrodes 46 is ionized, causing the dust particles to become electrically charged, so as to migrate toward the collecting electrode structure. Passing beyond the charging field created by the discharging electrodes, the charged dust particles come within the influence of the precipitating field between the non-discharging electrode rods 90 and the V-shaped pocket electrodes 46, and continue their migration toward the latter and into the spaces between them, finally to deposit on their surfaces.

The dust particles thus received within the "pockets" between adjacent V-shaped electrode elements 46 are removed from the gas current into relatively quiescent zones, and the tendency for re-dispersion of particles deposited on the electrode elements 46 due to "erosion" by the gas stream is minimized. Of course, as many transverse rows of discharging electrodes 91 may be incorporated as desired, additional rows increasing the overall dust recovery, though more than two such rows in addition to the first will usually fail to increase the recovery materially.

The dust particles gathered on the surfaces of the V-shaped collecting electrodes 46 fall from time to time, aided preferably by intermittent operation of a suitable rapping mechanism, not here illustrated, the falling dust descending partially outside the pocket electrodes and going on down through the spaces 63 between the outside surfaces of the sloping portions 62 of baffles 60, and partially within the vertical channels or passageways defined by the pocket electrodes to pass downwardly through the spaces 68 between the vertical wall portions 61 of the baffles. As stated above, the sloping baffles 60 materially restrict the gas circulation spaces between the horizontal gas passage above and the collecting chamber C below, tending substantially to reduce the undesirable flow of gas into and back out of said chamber. Re-dispersion of dust collected in the chamber and passage of such dust back up into the gas passage above is therefore materially curtailed, as is erosion of dust particles collected on the lower portions of collecting electrode elements 46 by gas flow upwardly from the chamber.

It is, of course, impossible to eliminate completely all movement of gas within the material-collecting chamber and, for the purpose of further reducing circulation of gas within said chamber, vertical transverse baffle plates 98 are preferably placed therein.

Figs. 10 through 14 show a precipitator having a modified form of baffles between the gas passageway and the material-collecting chamber, which are designed to offer materially increased restriction to the gas flow. Figs. 10 through 14 also show illustratively a single-stage type of precipitator in which a longitudinally-extending row of discharging electrodes is positioned opposite a longitudinally-extending collecting electrode structure. The collecting electrode structure is again preferably of a pocket type, though here shown as of a modified design.

The housing, including the hopper-shaped bottom forming the material-collecting chamber, the complete supporting system for the high-tension electrode elements, and portions of the supporting arrangements for the pocket electrode structure, are illustratively the same as corresponding parts of the form of Figs. 1 through 9, and corresponding parts are accordingly designated by like reference numerals but with the sub-letter *a* annexed in the case of the form of Figs. 10 through 14.

Thus, a pair of upper, generally channel-shaped transverse members 30*a* is provided, and from each of said members is hung a pair of vertical members 36*a*, preferably U-shaped in cross section, the lower ends of the latter carrying a horizontal transverse member which, however, is in this instance of angle cross-section and is designated by numeral 100. The lower ends of the members 36*a* engage the horizontal flanges 101 of angle members 100, and the members 100 are so oriented that their vertical flanges 102 extend downwardly from flanges 101 in the arrangement clearly illustrated in Fig. 12.

There is again a plurality of transversely-spaced rows of collecting electrode elements, here designated by numeral 104, each of which, in the illustrative construction here detailed, comprises two vertically-extending members having vertical wall portions 105 positioned back to back in planes extending longitudinally of the precipitator and formed at their two vertical edges with flange portions 106 bent preferably somewhat in the direction of gas flow (see Fig. 14). The walls 105 and flanges 106 define the protected "pockets," and also form channels or passageways, open laterally to the gas ducts, and leading downwardly to the hopper-shaped bottom and the electrode members 104 are spaced apart longitudinally to provide vertical passages connecting adjacent gas ducts through the collecting electrode structure. Welded to the upper end portions of the two walls 105 of each electrode member 104 are the two legs 107 of a hanger 108, and the hangers 108 of each row of electrode members 104 are suspended by means of pins 109 from a pair of horizontal and longitudinally-extending electrode supports 110. These supports 110 are welded to the under side of a channel-beam 111, and are spaced apart to receive the hangers 108 between them. The two ends of the

channel-beam 111 are received within the channel of the transverse members 30a, as shown in Fig. 12. The several channel members 111 may be spaced properly along transverse members 30a by means of rivets 112 set into and projecting upwardly from the lower flanges of the members 30a and engaging with holes 113 in the webs of the beams 111. As in the previously described form of precipitator, the two outside rows of collecting electrode elements 104 are preferably positioned at relatively close spacing to the side walls 23a of the shell. To close off gas circulation through any space which may be left, vertical baffles 45a may be mounted at suitable intervals therein (see Fig. 11).

Positioned between the lower portions of the longitudinally-extending rows of pocket electrode members 104 are the longitudinally-extending baffle members 115, which serve to block off gas circulation between the main gas passage through the precipitator and the material-collecting chamber. These baffles 115, one of which is thus provided in the lower portion of the longitudinal space or gas duct between each pair of adjacent rows of collecting electrodes 104, comprise two sloping wall portions 116 diverging downwardly from a central apex 117 positioned midway between the two adjacent rows of collecting electrodes, and vertical wall portions or skirts 118 depending from the lower edges of sloping portions 116 and engaging or positioned adjacent the vertical edges of electrode members 104 at the lower portions thereof, as seen best in Fig. 13. The end portions of these baffles 115 are engaged from their under sides and supported by angle supports 120 mounted on and projecting from transverse angle members 100. The lower wall portions 118 of baffles 115 are preferably secured in assembly with the adjacent collecting electrode elements 104 by means of long cotter pins 122, in a manner clearly illustrated in Fig. 13.

The gas in the gas passageway is blocked off from entering and leaving the material-collecting chamber by way of the open ends of the baffles 115 by closure means of any suitable form; for instance, as here shown, vertically-extending baffle plates or walls 123 are mounted on the angle members 100, in juxtaposition to the open ends of supports 120, and extending transversely entirely across the chamber. These baffle plates are preferably and here shown as extended downwardly into the material-collecting chamber substantially below the level of the baffles, so as also to restrict flow of gas into and out of the ends of the material-collecting chamber below the baffles.

The high-tension electrodes may, of course, be the same as employed in the precipitator illustrated in Figs. 1 through 9 though I have elected to illustrate the precipitator of Figs. 10 through 14 in single-stage form. Accordingly, the upper and lower electrode supporting rails 85a and 86a are arranged for support of a plurality of suitably spaced discharging electrodes 91a, which in this instance are shown in the form of headed, twisted square bars (see Fig. 13). These are spaced at sufficient intervals longitudinally of the rails 85a and 86a to prevent electrical shielding.

It will be understood that an electrostatic field will be established between each such discharging electrode member 91a mounted on the rails 85a and 86a and the adjacent collecting electrode elements 104, and that this field will be of very high intensity at the sharp edge formations of the discharging electrode 91a, sufficient to cause ionization of the surrounding gases. The dust-laden gas, passing through these electrostatic fields, is ionized, causing the dust particles to become electrically charged, so as to migrate toward the collecting electrode elements 104. The charged dust particles thus travel toward and into the relatively protected spaces or pockets between the flanges 106 of the collecting electrodes, finally to deposit on the surfaces of the flanges 106 and walls 105. The dust particles thus received within the "pockets" are removed from the gas currents into relatively quiescent zones, and the tendency for re-dispersion by erosion is minimized.

The dust particles collected on the surfaces of the pocket electrode elements 104 fall from time to time, aided preferably by intermittent operation of a suitable rapping mechanism not shown, the dust reaching the material-collecting chamber by passing through the spaces 130 defined by the vertical walls of the pocket electrodes and the vertical walls 118 of the baffle members 115. Any dust falling outside the pockets of the electrode members 104 strikes the sloping walls 116 of the baffles and is guided thereby into the vertical spaces or passageways 130 aforementioned.

The passageways for the dust particles shaken from the collecting electrode members 104 are thus restricted to the spaces 130, the entirety of the space between the rows of collecting electrodes 104 being closed off by the baffles 115. Circulation of gas down into and back out of the material-collecting chamber is accordingly very materially restricted. In practice, there is insufficient such circulation to cause any great carry-back of dust from the chamber to the space above. Moreover, the gas circulation upwardly from the chamber is insufficient to cause serious erosion of dust from the collecting electrodes. To restrict flow longitudinally of the chamber of what little gas does enter from above, however, vertical transverse baffle plates 131 may be mounted therein, as illustrated in Fig. 10.

It will be understood that the drawings and description are merely illustrative of the invention, rather than restrictive thereon, and that various changes in design, structure and arrangement may be made without departing from the spirit and scope of the invention or of the appended claims.

I claim:

1. In an electrical precipitation apparatus for removing suspended particles from a gas, the combination comprising: a shell enclosing a horizontal passageway for a stream of the gas, and formed with a material-collecting chamber below said horizontal gas passageway, vertical collecting electrodes extending longitudinally and spaced transversely of said gas passageway and defining longitudinally-extending gas ducts, said collecting electrodes each comprising a longitudinal row of pocket electrode elements having particle collecting surfaces defining passageways open to the gas ducts and leading downwardly into said chamber, and longitudinally-extending baffles at the bottoms of said gas ducts, said baffles including baffle walls restricting the circulation of gas between said gas ducts and said chamber.

2. In an electrical precipitation apparatus for removing suspended particles from a gas, the combination comprising: a shell enclosing a horizontal passageway for a stream of the gas, and formed with a material-collecting chamber below said horizontal gas passageway, vertical col-

lecting electrodes extending longitudinally and spaced transversely of said gas passageway and defining longitudinally-extending gas ducts, said collecting electrodes each comprising a longitudinal row of pocket electrode elements having particle collecting surfaces defining passageways open to the gas ducts and leading downwardly into said chamber, and a pair of horizontally-spaced, longitudinally-extending baffles at the bottom of each of said gas ducts, the baffles of each such pair having wall portions sloping downwardly toward one another to define relatively narrow longitudinally-extending slots for downward passage of collected material.

3. In an electrical precipitation apparatus for removing suspended particles from a gas, the combination comprising: a shell enclosing a horizontal passageway for a stream of the gas, and formed with a material-collecting chamber below said horizontal gas passageway, vertical collecting electrodes extending longitudinally and spaced transversely of said gas passageway and defining longitudinally-extending gas ducts, said collecting electrodes each comprising a longitudinal row of pocket electrode elements having particle collecting surfaces defining passageways open to the gas ducts and leading downwardly into said chamber, and longitudinally-extending baffles in the lower portions of said gas ducts, said baffles each including two baffle walls sloping downwardly in opposite directions from an apex located within the gas duct, toward the two adjacent collecting electrodes.

4. In an electrical precipitation apparatus for removing suspended particles from a gas, the combination comprising: a shell enclosing a horizontal passageway for a stream of the gas, and formed with a material-collecting chamber below said horizontal gas passageway, vertical collecting electrodes extending longitudinally and spaced transversely of said gas passageway and defining longitudinally-extending gas ducts, said collecting electrodes each comprising a longitudinal row of pocket electrode elements having particle collecting surfaces defining passageways open to the gas ducts and leading downwardly into said chamber, and longitudinally-extending baffles in the lower portions of said gas ducts, said baffles each including two baffle walls sloping downwardly in opposite directions from an apex located within the gas duct, toward the two adjacent collecting electrodes, and substantially vertical wall portions depending from the lower edges of said sloping wall portions and positioned in juxtaposition to said collecting electrodes.

5. In an electrical precipitation apparatus for removing suspended particles from a gas, the combination comprising: a shell enclosing a horizontal passageway for a stream of the gas, and formed with a material collecting chamber below said horizontal gas passageway, collecting electrode means in said passageway, and a plurality of transversely-spaced baffle walls extending longitudinally of said gas passageway arranged between said gas passageway and said material-collecting chamber, said baffle walls sloping in transverse planes, and wall members located at opposite ends of said longitudinally-extending baffle walls substantially separating the material-collecting chamber and the spaces between the end portions of said baffle walls from said gas passageway.

6. In an electrical precipitation apparatus for removing suspended particles from a gas, the combination comprising: a shell enclosing a horizontal passageway for a stream of the gas, and formed with a material-collecting chamber below said horizontal gas passageway, vertical collecting electrodes extending longitudinally and spaced transversely of said gas passageway and defining longitudinally-extending gas ducts, a pair of horizontally-spaced longitudinally-extending baffles at the bottom of each of said gas ducts, the baffles of each such pair having wall portions sloping downwardly toward one another to define relatively narrow longitudinally-extending slots for downward passage of collected material, and closure means at each end of the longitudinally-extending baffles blocking off gas flow between the gas passageway and the material-collecting chamber by way of the spaces between the ends of the baffles.

7. In an electrical precipitation apparatus for removing suspended particles from a gas, the combination comprising: a shell enclosing a horizontal passageway for a stream of the gas, and formed with a material-collecting chamber below said horizontal gas passageway, vertical collecting electrodes extending longitudinally and spaced transversely of said gas passageway and defining longitudinally-extending gas ducts, longitudinally-extending baffles in the lower portions of said gas ducts, said baffles each including two baffle walls sloping downwardly in opposite directions from an apex, located within the gas duct, toward the two adjacent collecting electrodes, and closure means at each end of the longitudinally-extending baffles blocking off gas flow between the gas passageway and the material-collecting chamber by way of the spaces between and under the two sloping walls of each baffle.

8. In an electrical precipitation apparatus for removing suspended particles from a gas, the combination comprising: a shell enclosing a horizontal passageway for a stream of the gas, and formed with a material-collecting chamber below said horizontal gas passageway, vertical collecting electrodes extending longitudinally and spaced transversely of said gas passageway and defining longitudinally-extending gas ducts, said collecting electrodes each comprising a longitudinal row of pocket electrode elements having particle collecting surfaces defining passageways open to the gas ducts and leading downwardly into said chamber, a pair of horizontally-spaced, longitudinally-extending baffles at the bottom of each of said gas ducts, the baffles of each such pair having wall portions sloping downwardly toward one another to define relatively narrow longitudinally-extending slots for downward passage of collected material, and closure means at each end of the longitudinally-extending baffles blocking off gas flow between the gas passageway and the material-collecting chamber by way of the spaces between the ends of the baffles.

9. In an electrical precipitation apparatus for removing suspended particles from a gas, the combination comprising: a shell enclosing a horizontal passageway for a stream of the gas, and formed with a material-collecting chamber below said horizontal gas passageway, vertical collecting electrodes extending longitudinally and spaced transversely of said gas passageway and defining longitudinally-extending gas ducts, said collecting electrodes each comprising a longitudinal row of pocket electrode elements having particle collecting surfaces defining passageways open to the gas ducts and leading downwardly into said chamber, longitudinally-extending baf-

fles in the lower portions of said gas ducts, said baffles each including two baffle walls sloping downwardly in opposite directions from an apex located within the gas duct, toward the two adjacent collecting electrodes, and closure means at the ends of said longitudinally-extending baffles blocking off gas flow between the gas passageway and the material-collecting chamber by way of the ends of said baffle members.

10. In an electrical precipitation apparatus for removing suspended particles from a gas, the combination comprising: a shell enclosing a horizontal passageway for a stream of the gas, and formed with a material-collecting chamber below said horizontal gas passageway, vertical collecting electrodes extending longitudinally and spaced transversely of said gas passageway and defining longitudinally-extending gas ducts, said collecting electrodes each comprising a longitudinal row of pocket electrode elements having particle collecting surfaces defining passageways open to the gas ducts and leading downwardly into said chamber, longitudinally-extending baffles in the lower portions of said gas ducts, said baffles each including two baffle walls sloping downwardly in opposite directions from an apex located within the gas duct, toward the two adjacent collecting electrodes, and wall members located at the two ends of said longitudinally-extending baffles separating the material-collecting chamber and the space between the two sloping walls of each baffle from the gas passageway.

11. In an electrical precipitation apparatus for removing suspended particles from a gas, the combination comprising: a shell enclosing a horizontal passageway for a stream of gas and providing a material-collecting chamber below said passageway, and collecting electrode structures each comprising a plurality of vertically-extending elements positioned in a longitudinal row in said passageway and defining longitudinally-extending gas ducts, each of said elements comprising a vertically-extending member parallel to said gas ducts and a plurality of vertically-extending members projecting from said parallel member transversely of said gas ducts to define at least one vertically-extending passageway open to only one of said gas ducts, said elements being longitudinally spaced apart to provide vertical passages connecting adjacent gas ducts through said collecting electrode structure.

12. In an electrical precipitation apparatus for removing suspended particles from a gas, the combination comprising: a shell enclosing a horizontal passageway for a stream of gas and providing a material-collecting chamber below said passageway, and collecting electrode structures each comprising a plurality of vertically-extending elements positioned in a longitudinal row in said passageway and defining longitudinally-extending gas ducts, each of said elements comprising a vertical web member parallel to said gas ducts and a plurality of vertical web members projecting from said parallel web member into adjacent gas ducts to define vertically-extending passageways each open to only one of said gas ducts, said elements being longitudinally spaced apart to provide vertical passages connecting adjacent gas ducts through said collecting electrode structure.

13. In an electrical precipitation apparatus for removing suspended particles from a gas, the combination comprising: a shell enclosing a horizontal passageway for a stream of gas and providing a material-collecting chamber below said passageway, and collecting electrode structures each comprising a plurality of vertically-extending elements positioned in a longitudinal row in said passageway and defining longitudinally-extending gas ducts, each of said elements comprising a vertical web member parallel to said gas ducts and a plurality of vertical web members projecting from said parallel web member at an angle thereto into adjacent gas ducts to define vertically-extending passageways each open to only one of said gas ducts, each of said projecting web members being inclined outwardly and forwardly in the direction of gas flow through the gas duct into which the members project, said elements being longitudinally spaced apart to provide vertical passages connecting adjacent gas ducts through said collecting electrode structure.

14. In an electrical precipitation apparatus for removing suspended particles from a gas, the combination comprising: a shell enclosing a horizontal passageway for a stream of the gas, and formed with a material-collecting chamber below said horizontal gas passageway, vertical collecting electrodes extending longitudinally and spaced transversely of said gas passageway and defining longitudinally-extending gas ducts, and a pair of horizontally-spaced longitudinally-extending baffles at the bottom of each of said gas ducts, the baffles of each such pair having wall portions sloping downwardly from positions adjacent the collecting electrodes at the respective sides of the corresponding duct toward one another to define between their lower edges a relatively narrow longitudinally-extending slot located substantially centrally of such duct for downward passage of collected material.

15. In an electrical precipitation apparatus for removing suspended particles from a gas, the combination comprising: a shell enclosing a horizontal passageway for a stream of the gas, and formed with a material-collecting chamber below said horizontal gas passageway, vertical collecting electrodes extending longitudinally and spaced transversely of said gas passageway and defining longitudinally-extending gas ducts, and longitudinally-extending baffles in the lower portions of said gas ducts, said baffles each including two longitudinally-extending walls sloping downwardly in opposite directions from an apex extending longitudinally and substantially centrally of the corresponding duct to positions adjacent the collecting electrodes at the respective sides of such duct, and said baffles being spaced transversely to provide a longitudinally-extending slot at the bottom of each collecting electrode for downward passage of collected material.

16. In an electrical precipitation apparatus for removing suspended particles from a gas, the combination comprising: a shell enclosing a horizontal passageway for a stream of the gas, and formed with a material-collecting chamber below said horizontal gas passageway, vertical collecting electrodes extending longitudinally and spaced transversely of said gas passageway and defining longitudinally-extending gas ducts, and longitudinally-extending baffles in the lower portions of said gas ducts having wall portions sloping downwardly toward adjacent baffles to define between the lower edges thereof relatively narrow longitudinally-extending slots opening into said material-collecting chamber.

JAMES HUGH HAMILTON.