

Aug. 26, 1930.

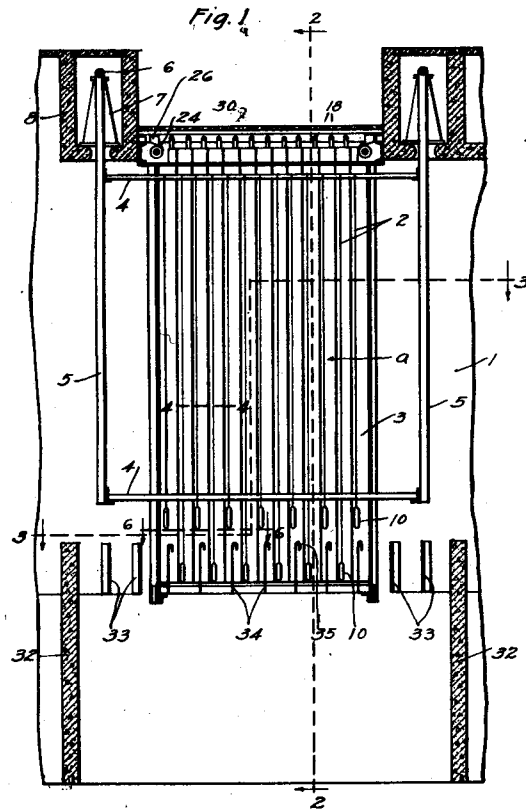
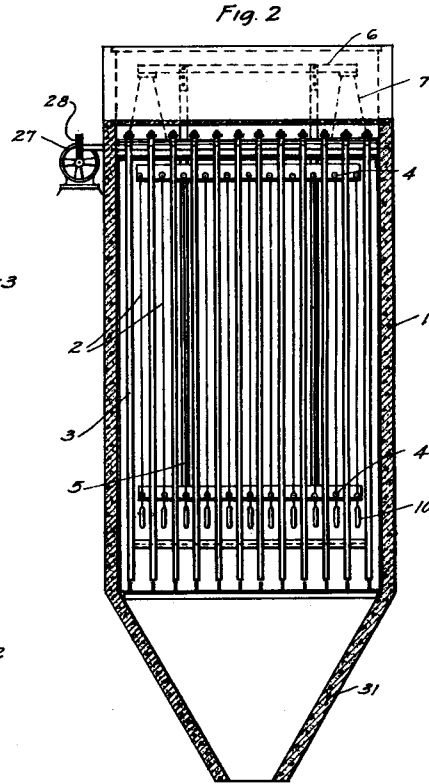
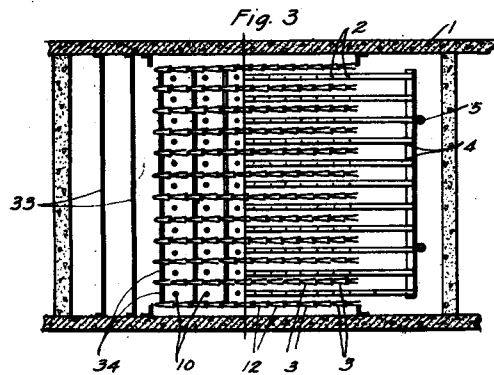
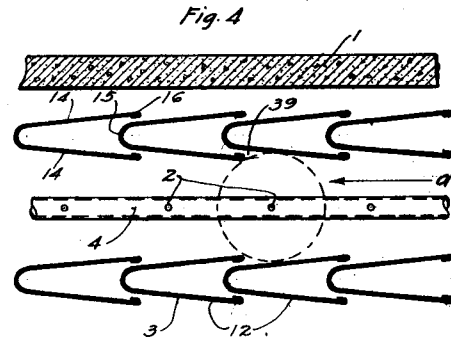
F. SEIPP

1,773,876

APPARATUS FOR ELECTRICAL PRECIPITATION OF SUSPENDED MATERIAL FROM GASES

Filed July 12, 1926

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 6

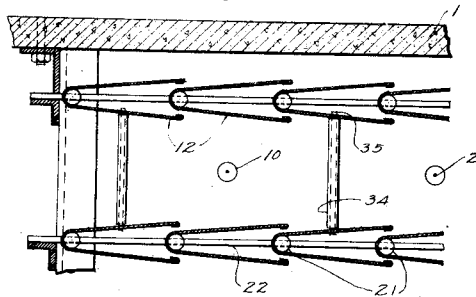


Fig. 5

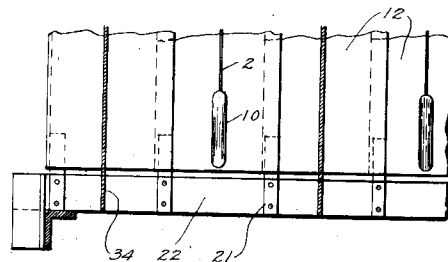


Fig. 7

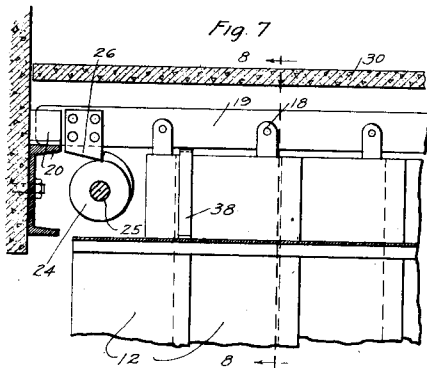


Fig. 8

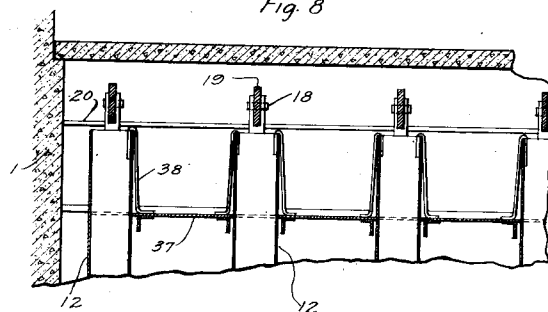


Fig. 9

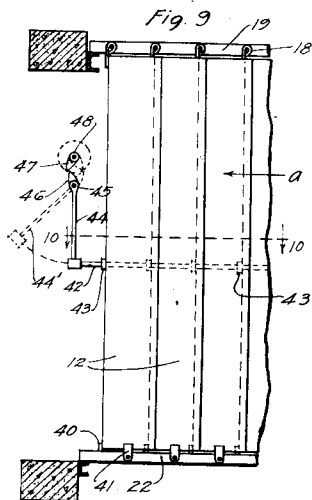


Fig. 12

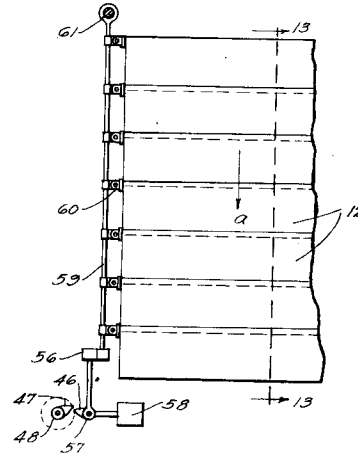


Fig. 13

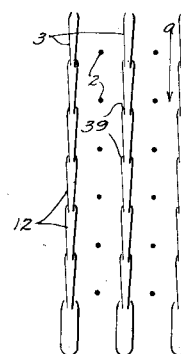


Fig. 10

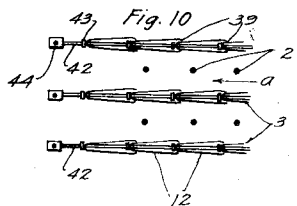
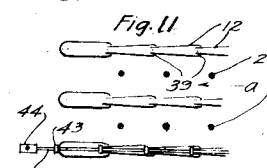


Fig. 11



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UNITED STATES PATENT OFFICE

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APPARATUS FOR ELECTRICAL PRECIPITATION OF SUSPENDED MATERIAL FROM GASES

Application filed July 12, 1926, Serial No. 121,979, and in Germany August 27, 1925.

This invention relates to apparatus for the electrical precipitation of suspended material, either solid or liquid, from gases containing the same.

5 The main object of the invention is to provide a more efficient apparatus for this purpose than those heretofore used. A further object of the invention is to provide a precipitator of such design as to permit high
10 velocity of gas flow therethrough, so that an apparatus of a given size is capable of handling a much larger volume of gas than has heretofore been possible. A further object
15 of the invention is to provide a collecting electrode of such construction that material once precipitated thereon is effectively prevented from being again picked up by the gas stream and carried away. A further object
20 of the invention is to provide efficient means for removing from the receiving electrode, and collecting the material which is precipitated from the collecting electrode.

The apparatus according to my invention comprises essentially a receiving electrode
25 consisting of a plurality of channel-shaped members, whose flat sides cooperate to form extended, substantially continuous surfaces at either side thereof, and whose open sides or edges are presented in the direction from
30 which the gas is flowing through the precipitator. By means of such a construction, the dust once precipitated upon the side wall of any one of the channels is carried along and into the open side of the next channel,
35 where such material may be dislodged from the surface of the channel and collected as hereinafter described. The invention in its preferred form also comprises a zone or chamber substantially free from gas flow there-
40 through and without the electrical field of the precipitator, and into which the channels above mentioned all open at their lower ends, in such manner that the precipitated material passing from said channels enters said
45 quiescent zone and is thus prevented from being picked up by the gas stream. The invention also comprises certain further features as hereinafter described.

50 The accompanying drawings illustrate em-

bodiments of my invention and referring thereto:

Fig. 1 is a longitudinal section of an electrical precipitator unit embodying my invention.

Fig. 2 is a vertical section on line 2—2 in Fig. 1.

Fig. 3 is a horizontal section on line 3—3 in Fig. 1.

Fig. 4 is an enlarged partial horizontal section of a portion of the above precipitator taken on line 4—4 in Fig. 1.

Fig. 5 is a side elevation of a lower corner of a receiving electrode.

Fig. 6 is a section on line 6—6 in Fig. 1.

Fig. 7 is a side elevation of an upper corner of one of the receiving electrodes shown in Fig. 1.

Fig. 8 is a section on line 8—8 in Fig. 7.

Fig. 9 is a side elevation of a somewhat modified construction of a receiving electrode.

Fig. 10 is a horizontal section on line 10—10 in Fig. 9.

Fig. 11 is a view similar to Fig. 10 showing another modification of the invention.

Fig. 12 is a side elevation of another modified form of receiving electrode construction.

Fig. 13 is a section on line 13—13 in Fig. 12. The apparatus shown in Figs. 1 to 3 inclusive comprises a housing or casing 1 through which the gas to be treated passes in the direction indicated by the arrow *a* and within which are suspended a plurality of discharge electrodes such as wires or fine rods indicated at 2 and a plurality of receiving electrodes 3, the discharge electrodes being arranged in sets as shown between the respective receiving electrodes.

The discharge electrodes may comprise vertical wires or rods supported by suitable frame means including horizontal bars 4 and vertical bars 5, said frames being in turn supported by suitable bars 6 mounted on insulating supports 7 in suitable boxes 8 above the housing 1. The discharge wires may pass through the lower horizontal bar 4 so that said bar serves only to guide or space said wires and suitable tensioning means such as weights

10 may be provided at the lower ends of said wires.

Each receiving electrode 3 may advantageously be composed of a plurality of channel members 12 which in this form of the invention extend vertically and which are somewhat U-shaped in cross-section with spreading or flaring sides 14 and are so arranged that the rounded edge 15 of each channel member projects somewhat within the open portion or side 16 of the next succeeding member, in such manner that the adjacent channel members overlap as shown in Fig. 4. Furthermore said channel members are so disposed that the open, wider, portions or sides 16 thereof are turned in the direction from which the gas is flowing so that the interiors of said channel members serve to form pockets for the collection and removal of precipitated material as hereinafter described.

As shown in Figs. 7 and 8, the channel members 12 of each receiving electrode may be loosely and independently mounted as at 18 upon an upper horizontal supporting bar 19 which rests at its ends upon fixed supporting means 20 secured to the wall of housing 1 in any suitable manner. The lower ends of said channel members may, as shown in Figs. 5 and 6, be guided and spaced non-rigidly by means of spacing members 21 secured to a lower horizontal bar 22 in such manner as to permit vertical movement of said channel members with respect to said bar. For the purpose of rapping or jarring the receiving electrodes, cam members 24 may be provided on shafts 25 in such position as to engage lifting lugs or plates 26 at the respective ends of the supporting bars 19 for said receiving electrodes. The shaft 25 may be driven in any suitable manner as by means of motor 27 and gearing 28.

Suitably removable cover means 30 may be provided for the housing 1 and the lower portion of said housing may be formed as a collecting hopper or bin 31, said hopper being separated by partitions 32 into sections corresponding to the respective treater sections or units. The channel members 12 open at their lower ends into such hopper and in order to prevent circulation of gas through said hopper I prefer to provide baffle means directly above the same, such means comprising for example vertical baffle plates 33 beyond the ends of the receiving electrodes and baffle strips 34 hung between the lower portions of the receiving electrodes as by means of pins or rods 35 mounted on the channel members comprising the receiving electrodes. Horizontal baffle plates 37 may also be provided adjacent the upper ends of the receiving electrodes so as to substantially prevent access of gas to the rapping or jarring means above described, said baffle plates being supported for example by means of hangers 38 engaging the upper ends of the receiving electrodes.

It will be understood that the discharge and receiving electrode means above described may be connected to any suitable means for creating high potential difference therebetween as is customary in electrical precipitation apparatus. For this purpose the discharge members or the supporting frame means therefor may be connected to a suitable source of high potential current either alternating or unidirectional, but preferably rectified alternating current of suitable voltage, say from 15,000 to 100,000 volts, the receiving electrode system and the other side of such source of current being grounded to complete the circuit.

Due to the high potential difference between the discharge and receiving electrodes, a silent electrical discharge occurs from the former. A discharge electrode member 2 is preferably provided opposite the mid-portion of the side wall 14 of each channel member, and such side wall preferably extends substantially perpendicular to the direction from the discharge member to the side wall. As shown by the dotted circle in Fig. 4, the discharge electrodes are also preferably positioned substantially equidistant from the side wall of the opposing channel member and the rounded tip of the next succeeding channel member. The slit or opening 39 between the closed side of each channel and the tip of the next one is therefore within the region of the field surrounding the discharge electrode.

In the operation of the above described apparatus the gas containing suspended matter is passed, in the direction indicated at *a*, through the electric field between the discharge electrodes and the receiving electrodes, and the suspended material is thereby precipitated in well known manner onto the receiving electrode surfaces, such surfaces in this case comprising the outer surfaces of the inclined or flared sides 14 of the channel members. The action of cam members 24 serves to alternately raise and drop the opposite ends of each supporting bar 19 so as to effectively jar the channel members and such jarring, together with the frictional effect of the gas stream, causes the material precipitated on the side wall of each channel member to move along such wall into the pocket provided by the interior of the next succeeding channel member. Any material which has once entered such pocket is substantially outside the influence of the gas stream so that it is effectively prevented from being again picked up thereby, and is also prevented from escaping by the action of the electrostatic field which blockades the openings of the channel members against outward passage of suspended material. The precipitated material therefore falls within the channel members into hopper 31, in which an absence

of gas flow is maintained by means of the baffle plates 33 and 34.

The effect of the precipitator is therefore, by virtue both of the arrangement of the channel members with their open edges toward the direction from which the gas is flowing and of the fact that such channels open at their ends into the quiescent zone provided by the baffle means aforesaid, such as to effectively remove from the gas stream and prevent re-picking up of the material which is once precipitated on the surfaces of the receiving electrodes. A relatively high gas velocity is therefore permissible without reducing the efficiency of dust collection, and consequently a larger volume of gas may be effectively cleaned in an apparatus of a given size than in other types of electrical precipitation apparatus.

A somewhat modified construction is shown in Figs. 9 and 10. In the form of the invention there shown the channel members 12 are arranged and supported in substantially the same manner as above described but rest at their lower ends against stops 40 on the lower bar 22 and are guided by means of guides 41. The rapping means in this case comprise a horizontal rod 42 extending through all of the channel members of each receiving electrode and provided with a projecting flange 43 engaging the back of each channel member. A hammer means 44 is pivotally mounted at 45 in such position as to strike the end of rod 42 when lowered. The other end of the hammer 44 is provided with a projecting finger 46 adapted to be engaged by finger 47 on rotating shaft 48 in such manner as to lift the hammer 44 to the position indicated in dotted lines at 44' and then allow the same to fall and strike against the rod 42 so as to deliver a horizontal blow against all of the channel members.

A further modification is shown in Fig. 11 in which all of the channels of each receiving electrode are open at both the forward and rearward edges with the exception of the last channel of each electrode in the direction of gas flow, this last channel being closed at its further end and being preferably somewhat larger than the other channels. In this form of the invention the precipitated material reaching the interior of any of the channel members may be carried along inside the remaining channels until it finally reaches the larger channel at the end of the electrode wherein it is finally collected and falls to the bottom of the precipitator.

As shown in Figs. 12 and 13 the channel members may extend horizontally instead of vertically. In this case the channel members are preferably open at both sides (that is, top and bottom) with the larger edge upward so as to envelope the smaller edge of the next higher channel. In this case the direction of the gas flow is down as indicated at *a*. The

lowermost channel of each receiving electrode is somewhat larger than the other channels and is closed at its lower edge so as to provide for collection of the material entering the channels, and such lower-most channel member may advantageously slope toward one end of the receiving electrode so as to facilitate discharge of such collected material therefrom. In order to further promote the removal of the collected material, rapping means may be provided which are adapted to impart a sudden blow to the receiving electrode in such direction as to cause the collected material to be moved in the direction in which the lower-most channel slopes. Such means may comprise as shown hammer 56 pivotally mounted at 57 and provided with counterweight 58 for causing hammer 56 to return to the position shown when it is displaced therefrom by the means 46, 47, and 48, so as to deliver a sudden horizontal blow on the lower end of the supporting bar 59, upon which the ends of the channel members may be pivotally mounted as at 60. The bar or rod 59 may be pivotally mounted at 61.

The channel members making up the collecting electrodes, in any form of the invention, may be formed of metal, such as steel or iron, or of any other suitable material possessing sufficient electrical conductivity for the purposes of electrical precipitation and sufficient mechanical strength.

I claim:

1. In apparatus for electrical precipitation of suspended material from gases, a receiving electrode comprising a plurality of flared channel members whose open sides are somewhat larger than the closed sides, said channel members being so arranged with relation to one another that the closed side of each channel member lies within the open side of the next channel member, and each of said channel members extending substantially perpendicular to the direction of gas flow through the apparatus and having its open side disposed in the direction from which the gas is to be passed through the apparatus.

2. In apparatus for electrical precipitation of suspended material from gases a collecting electrode comprising a plurality of vertically extending channel members arranged successively with the closed side of each channel member within the open side of the next channel member, the open side of each channel member being disposed in the direction from which the gas is to be passed, and means defining a quiescent zone below said electrode and substantially preventing gas flow therethrough, each of said channel members opening at its lower end into said quiescent zone.

3. An electrical precipitator comprising a casing provided with inlet and outlet means for gas, receiving electrodes mounted in said

casing and comprising a plurality of channel members extending in parallel relation and spaced apart so as to form openings between the same, each of said channel members having its open side disposed toward the direction from which the gas flows from the inlet to the outlet of the said casing, insulated discharge electrodes mounted between the receiving electrodes, and means defining a quiescent zone below said receiving electrodes and substantially preventing gas flow therethrough, each of said channel members opening at its lower end into said quiescent zone.

4. In an apparatus for electrical precipitation of suspended material from gases, a plurality of parallel receiving electrodes spaced from one another, each of said receiving electrodes consisting of a plurality of channel members extending substantially perpendicular to the direction of gas flow through the apparatus and arranged successively with the open side of each channel member disposed in the direction from which the gas is to be passed through the apparatus and overlapping the closed side of the next channel member, and discharge electrode means disposed between each pair of adjacent receiving electrodes, each of said discharge electrode means comprising a plurality of discharge members extending parallel to said channel members so as to set up an electrical field therebetween, there being one discharge electrode member opposite the mid-portion of the side wall of each channel member, said channel members defining spaces therewithin removed from the electrical field, and the overlapping portions of said channel members being spaced apart to provide openings communicating with said spaces.

5. In an apparatus for electrical precipitation of suspended material from gases, a plurality of parallel receiving electrodes spaced from one another, each of said receiving electrodes consisting of a plurality of slightly flaring channels extending substantially perpendicular to the direction of gas flow through the apparatus and arranged successively with the wider side of each channel disposed in the direction from which the gas is to be passed through the apparatus and overlapping the narrower side of the next channel, and spaced somewhat therefrom, and discharge electrode means disposed between each pair of adjacent receiving electrodes, each of said discharge electrode means comprising a plurality of discharge members extending parallel to said channel members so as to set up an electrical field therebetween, there being one of such discharge members substantially opposite the mid-portion of the side wall of each channel.

6. An apparatus for electrical precipitation, comprising a casing, a plurality of receiving electrodes mounted therein and each comprising a plurality of vertically extend-

ing and slightly flaring channel members closed at their narrower sides and open at their wider sides, and also open at their lower ends, said channel members being arranged so as to overlap and having the wider open side of each channel member spaced from the narrower closed side of the next channel member to form openings therebetween, said openings being directed toward the direction from which the gas is flowing, and discharge electrodes mounted between the respective receiving electrodes and opposite the outer faces of said channel members.

7. In an apparatus for electrical precipitation of suspended material from gases, a receiving electrode consisting of a plurality of channel members arranged successively so that the side walls thereof cooperate to define the receiving electrode surface, each of said channel members having its open side disposed toward the direction from which the gas is to be passed through the apparatus, a supporting member extending throughout the length of said receiving electrode and perpendicular to the length of the channel members, all of said channel members being movably and independently mounted at one end on said supporting member, and means for jarring said channel members so as to cause independent movement of the individual members relative to said supporting members and to dislodge deposited material therefrom.

8. In a receiving electrode for electrical precipitating apparatus, a plurality of electrode members extending in parallel directions and so formed as to define channel shaped spaces within the electrode, said members having their outer surfaces extending in planes approximately parallel to the plane of the entire electrode so as to provide receiving electrode surfaces at the opposite sides thereof and said members also having their adjacent edges overlapping and spaced apart sufficiently to provide openings therebetween communicating with said spaces within the electrode, a supporting member extending throughout the length of said receiving electrode and perpendicular to the length of the electrode members, all of said electrode members being movably and independently mounted at one end on said supporting member, and means for jarring said electrode members so as to cause independent movement of the individual members relative to said supporting member and to dislodge deposited material therefrom.

In testimony whereof I have hereunto subscribed my name this 1st day of July, 1926.

FRANZ SEIPP.