Sept. 21, 1926.

C. H. WEISKOPF

1,600,496

APPARATUS FOR ELECTRICAL PRECIPITATION OF SUSPENDED MATERIAL FROM GASES

Filed Nov. 28, 1923

2 Sheets-Sheet 1

Fig. 5

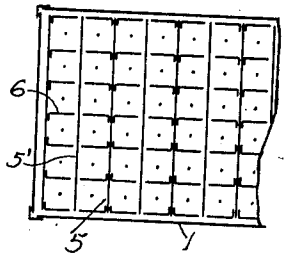


Fig. 1

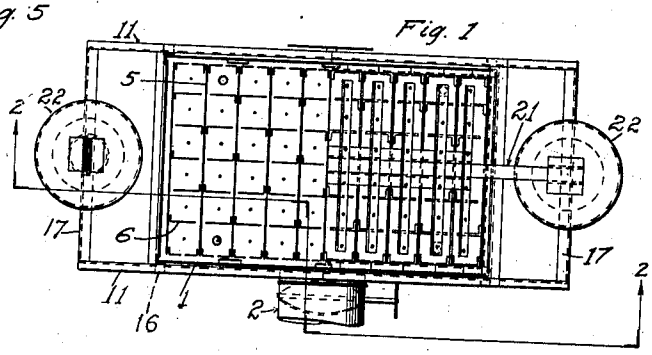


Fig. 3

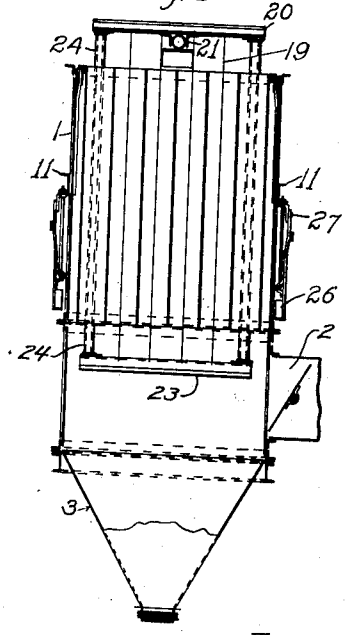


Fig. 2

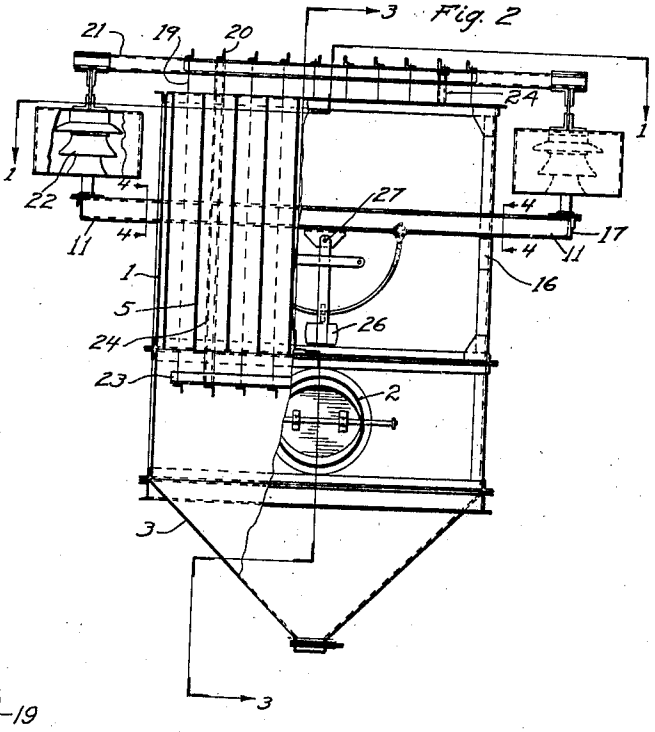


Fig. 6

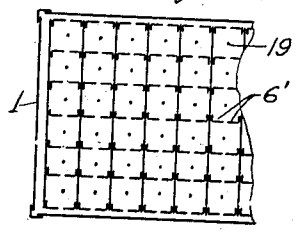
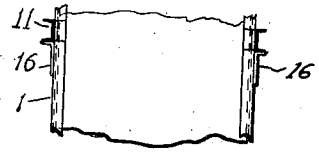


Fig. 4



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2 Sheets-Sheet 2

Fig. 7

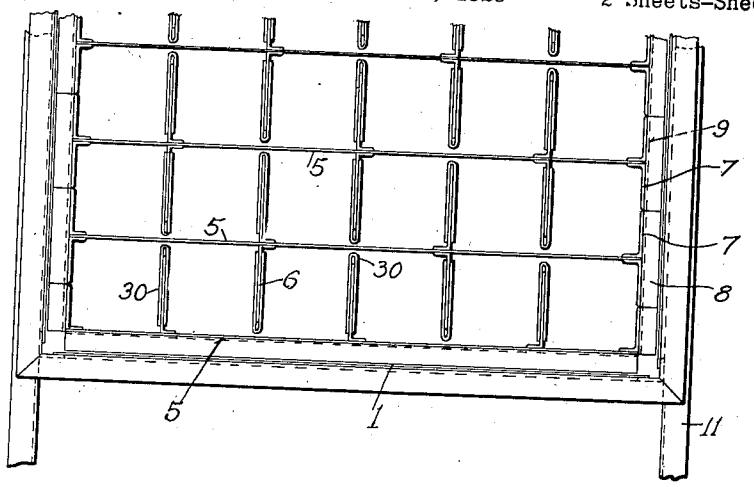


Fig. 8

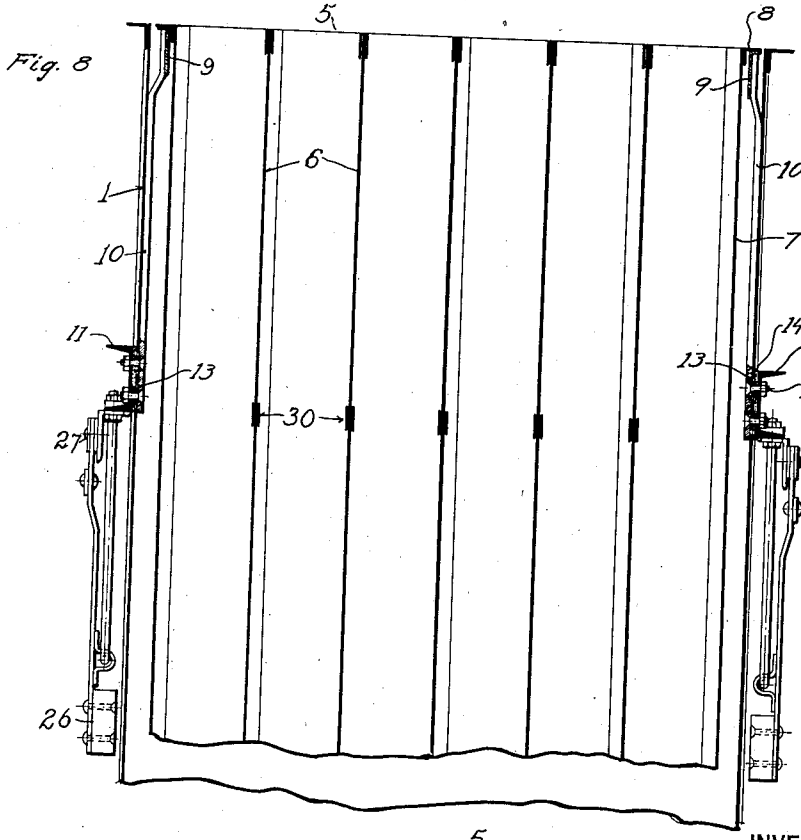


Fig. 9

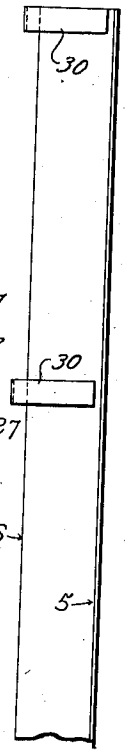
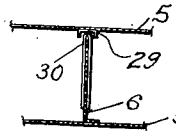


Fig. 10



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Patented Sept. 21, 1926. 1,600,496

UNITED STATES PATENT OFFICE.

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APPARATUS FOR ELECTRICAL PRECIPITATION OF SUSPENDED MATERIAL FROM GASES.

Application filed November 28, 1923. Serial No. 677,474.

This invention relates to an electrical precipitating apparatus of the so-called multiple pipe type in which a plurality of vertical pipes or flues are provided through which the gas to be treated is conducted and is subjected to electrical precipitating operation while passing through said pipe or flues. Such precipitating apparatus also comprises discharge electrodes extending in said pipes or flues, a suitable high potential difference being maintained between said discharge electrodes and the opposing walls of the pipes or flues, which serve as collecting electrodes, so as to effect the electrical precipitating operation.

The main object of the present invention is to provide for improved construction of such precipitating apparatus whereby the pipes or flues of the electrical precipitator are constructed at minimum expense.

A further object of the invention is to provide an electrical precipitator of the multiple pipe type wherein the walls or pipes or flues are formed as separate elements capable of independent vibration or movement, thereby facilitating the jarring or movement of the electrodes required for cleaning the same.

A further object of the invention is to provide improved cleaning means for an electrical precipitator.

The accompanying drawings illustrate embodiments of my invention and referring thereto—

Fig. 1 is a plan view partly in section of an electrical precipitator, taken on the line 1—1 in Fig. 2.

Fig. 2 is a side elevation partly in vertical section on the line 2—2 in Fig. 1.

Fig. 3 is a transverse vertical section on the line 3—3 in Fig. 2.

Fig. 4 is a detail section on line 4—4 in Fig. 2.

Figs. 5 and 6 are horizontal sections showing modified arrangements of the electrode members.

Figs. 7 and 8 are enlarged plan and vertical sectional views of the form of the invention shown in Figs. 1 to 3.

Fig. 9 is a side elevation of one of the collecting electrode elements shown in Fig. 8.

Fig. 10 is a horizontal section of a modification as hereinafter referred to.

In the form of my invention shown in the drawing a precipitating chamber is provided, indicated at 1, the walls of said chamber consisting of sheet metal, concrete or masonry or other construction as may be suitable in any particular case, said chamber being provided with an inlet flue 2 for the gases to be treated, and provided at its bottom with a bin or hopper 3 for receiving the precipitated material. The inlet 2 is shown as entering the lower portion of the precipitating chamber and the said chamber is shown as open to the atmospheric air at its upper end, but it will be understood that any suitable arrangement of the gas supply and delivery means may be provided for conducting the gases vertically through the precipitator chamber in either upward or downward direction. Within the precipitator chamber 1 are mounted a plurality of collecting electrodes in such a manner as to form a plurality of vertical pipes or flues of square cross section. Said electrodes preferably consist of vertical plates 5 of sheet metal having flanges 6 secured thereto and extending at right angles to the sheet metal plates 5. In the form of the invention shown in Figs. 1 to 3 and 7 and 8, the flanges 6 are of a width nearly equal to the distance between successive electrode plates 5, and are arranged alternately on adjacent plates so as to uniformly brace all of the plates. In the form of the invention shown in Fig. 5 the said flanges 6 are also of a width nearly equal to the distance between the plates, but are all on alternate plates, the intervening plates indicated at 5′ being not flanged. In the form of the invention shown in Fig. 6 the flanges indicated at 6′ are on all the plates but extend only halfway or somewhat less than halfway across the space between the plates, being arranged opposite one another on adjacent plates so as to form a more or less complete partition across the space between the plates. In any one of these embodiments of my invention the effect of the flanges 6 is to divide or partition the spaces between the plates into a series of vertical flues of square cross section, said flues being open at their lower ends into the gas receiving space at the bottom of the precipitator chamber 1 and open at their upper ends into the outer air or

into suitable gas delivering means. The main plates 5 of the electrodes are supported within the chamber 1 in any suitable manner, for example, as shown in Figs. 7 and 8, each plate 5 may be provided at each end with angle iron plates 7 which serve as substantial closure means for the ends of the respective spaces between the plates and said main plates 5 are further provided at each end with a top angle iron section 8 secured to the angle iron 7 aforesaid, and having its horizontal flange resting on the top of a horizontal beam 9, which is supported by a vertical bar 10, said bar 10 being secured at its lower end to a supporting beam 11 extending outside of the precipitator chamber.

The connection between the bars 10 and the supporting means 11 is preferably such as to provide for free movement of the said parts relative to the walls of the chamber 1 and at the same time prevent leakage of gas through said walls. For this purpose bar 10 may be connected to the beam 11 by means of bolts 12 extending through openings 13 in the wall of the precipitator, said openings being sufficiently large to permit free movement of the bolts 12 therein. Suitable packing such as an asbestos plate 14 may extend over these openings and around the bolts 12 to close the joint against leakage of gas. The supporting beams 11 rest freely on brackets 16, see Figs. 1, 2, and 4, extending from the wall or frame of the precipitator and may be connected together at their ends by cross beams 17.

The discharge electrode system may comprise vertical discharge electrode members such as wires, rods, or chains 19 extending vertically and axially within the respective vertical flues aforesaid, and supported at their upper ends on suitable cross bars 20 which are carried by beam 21 (or, in case of a large precipitator, a plurality of such beams) mounted on insulators 22 which are carried by the cross beams 17 aforesaid. Any other suitable construction of the discharge electrode and supporting means therefor, may however, be used. The discharge electrodes may be spaced or retained in position at their lower ends by a spacing frame 23 supported by vertical bars 24. The beams 11 and 17 constitute a supporting frame for the collecting electrodes and the beams 20 and 21 constitute a supporting frame for the discharge electrodes.

It will be seen that the above described construction provides collecting electrode elements which are assembled to form a plurality of vertical flues arranged in compact order with no waste spaces between the flues and at the same time a certain amount of freedom of movement is provided for the electrode elements whereby they may be readily jarred or agitated for the purpose of removing deposited material therefrom. In the construction of multiple flue precipitators having square flues arranged in compact order and formed by partitions and cross partitions rigidly secured together the objection has existed that by reason of the rigidity and mass of the assembled construction effective jarring or agitation of the structure for the purpose of removing deposited matter is a matter of some difficulty, but by mounting the collecting electrode elements loosely as above described, it is possible to jar such elements either simultaneously or successively so as to effect removal of deposited material therefrom.

Any suitable means may be provided for jarring the collecting electrodes but I prefer to provide means as shown in the drawing for simultaneously jarring both the discharge electrode and the collecting electrodes. For this purpose a hammer or impact member shown as 26 may be pivotally mounted at 27 on the supporting beam 11 at each side of precipitator chamber 1, said hammer being adapted to be operated in the manner of a pendulum and to strike the beam 11 at the side of the precipitator so as to jar said beam thereby jarring both the collecting electrode system resting on said beam through the medium of the bars 10 and the discharge electrode system supported by said beams through the medium of the insulators 22 and the cross beams 17. The hammers 26 aforesaid may be operated either manually or mechanically as may be desired.

In some cases it is desirable to provide for passage of gas to be treated between adjacent vertical flues and for this purpose the flanges 6 aforesaid forming the cross walls or partitions are preferably made somewhat shorter than the distance between the main electrode plates 5 as above stated so as to permit gas to pass between the edges of the flanges and adjacent plates and thereby equalize the pressure and the gas velocity through the flues of the precipitator. In order to provide for such passage of the gas and at the same time properly support and space the main electrode plates I may provide straps 30 attached to the respective flanges 6 and projecting beyond the outer edges thereof, so as to touch or approach closely to the opposing electrode plates 5, said flanges being, however, unattached at their outer edges to the opposing plates, so as to permit free vibration of the flanges and plates. In order to prevent warping said straps may be guided in U-shaped lugs 29 on the opposing plates (as shown in Fig 10) in such manner that lateral deformation of the flanges is prevented but the free vertical movement required in jarring or shaking the electrodes is provided for. Any excessive pulling or warping of the electrode plates will be resisted by engagement of the

plates 5 with these straps, said straps also serving as reinforcing or stiffening means for the said flanges.

Suitable electric connections are provided for maintaining the high potential difference between the discharge electrode system and the collecting electrode system, the collecting electrode system being for example grounded but the discharge electrode system being connected through a suitable rectifying means to the high tension side of a step-up transformer for example as set forth in U. S. patent to F. G. Cottrell, No. 895,729, August 11, 1908.

In the operation of the invention the gas to be treated is passed vertically through the precipitator flues aforesaid and is subjected to the action of an electrical field produced in said flues between the discharge electrodes and the collecting electrodes with the result that solid or liquid material suspended in the gases collects on the walls of the said flues and in case of material deposited in this manner is solid and adherent to the electrodes it may be dislodged from time to time by operation of the jarring means above described. In such jarring operation the loose mounting of the electrode plate members 5 on the supporting beams 9 and the loose mounting of the supporting beams 11 on the supports enables free jarring or free vibration of both the collecting electrode system and the discharge electrode system by the operation of the hammer means.

What I claim is:

1. In an electrical precipitator a plurality of collecting electrode members formed as parallel vertical plates having vertical flanges extending transversely thereto, and dividing the spaces between said plates into vertical flues, said flanges being free from attachment at their outer edges to said plates, so as to permit of free vibration of said plates and of the flanges thereon.

2. In an electrical precipitating apparatus a gas receiving chamber, parallel vertical plates mounted in said chamber and having vertical flanges, said plates and the said flanges thereon dividing the interior of said chamber into a plurality of vertical flues and said flanged plates forming collecting electrodes, and being mounted independently of one another to provide for free vibration thereof.

3. An electrical precipitator comprising a gas receiving chamber, a plurality of collecting electrode members independently mounted in said chamber and formed with vertical portions extending transversely to one another to form a plurality of collecting electrode flues, and insulated discharge electrodes mounted in such a manner as to extend within said collecting electrode flues, said members being sufficiently separated to provide for free vibration thereof.

4. An electrical precipitator comprising a gas receiving chamber, a plurality of collecting electrode members independently mounted in said chamber and formed with vertical portions extending transversely to one another to form a plurality of collecting electrode flues, and insulated discharge electrodes mounted in such a manner as to extend within said collecting electrode flues, said members being sufficiently separated to provide for free vibration thereof, and also to provide for circulation of gas between adjacent flues.

5. In an electrical precipitating apparatus, supporting means, an electrode supporting frame mounted to rest freely on said supporting means, collecting electrodes carried by said supporting frame, insulators carried by said supporting frame, a discharge electrode supporting frame mounted on said insulators whereby jarring of said supporting frame operates to jar both the collecting electrodes and the discharge electrodes.

6. A construction as set forth in claim 5 and comprising in addition jarring means independently mounted adjacent to said supporting frame and adapted to strike the same in the operation of said jarring means.

7. In an electrical precipitator, supporting means, an electrode supporting frame resting for free movement on said supporting means, collecting electrodes supported freely by said electrode supporting frame so as to enable free vibration of said collecting electrodes, and means for jarring said supporting frame.

8. A construction as set forth in claim 7 and comprising in addition insulators carried by said electrode supporting frame, a discharge electrode frame carried by said insulators and discharge electrodes mounted on said discharge electrode frame so that jarring of said electrode supporting frame operates to jar both the collecting electrodes and the discharge electrodes.

9. An electrical precipitating apparatus comprising a gas receiving chamber, supports located outside of said chamber, an electrode supporting frame extending outside of said chamber and resting freely on said supports, means connected to said electrode supporting frame and extending within said chamber and provided with collecting electrode supports, a plurality of collecting electrodes independently mounted on said collecting electrode supports and resting freely thereon to provide for free vibration of said collecting electrodes, and closure means for preventing leakage of gas where the said electrode supporting means passes through the wall of the gas receiving chamber.

10. A construction as set forth in claim 9 and comprising in addition insulators

mounted on said electrode supporting frame outside of the gas receiving chamber, a discharge electrode frame mounted on said insulators and discharge electrodes mounted on said insulators and extending over a plurality of collecting electrodes and discharge electrodes carried by said discharge electrode frame and extending in opposition to the collecting electrodes.

11. A construction as set forth in claim 9 and comprising in addition insulators mounted on said electrode supporting frame outside of the gas receiving chamber, a discharge electrode frame mounted on said insulators and extending over a plurality of collecting electrodes and discharge electrodes carried by said discharge electrode frame and extending in opposition to the collecting electrodes, hammer means movably mounted in position to strike said electrode supporting frame outside of the gas receiving chamber to jar said frame and the collecting and discharge electrodes carried thereby.

In testimony whereof I have hereunto subscribed my name this 21st day of November, 1923.

CHARLES H. WEISKOPF.