L. BRADLEY.

PRECIPITATOR FOR HOT GASES.

APPLICATION FILED OCT. 16, 1917.

1,379,897.

Patented May 31, 1921.

2 SHEETS—SHEET 1.

Fig. 1.

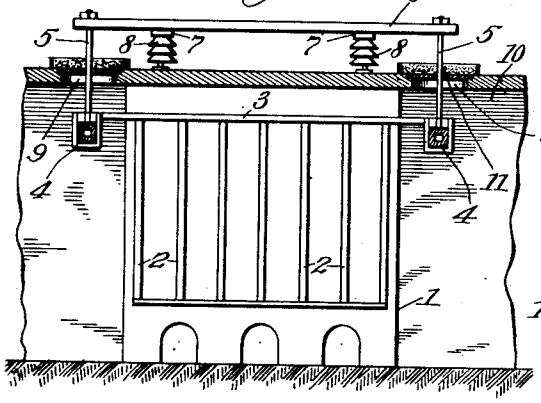


Fig. 2.

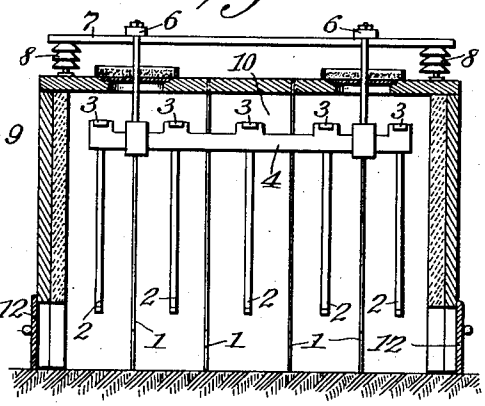


Fig. 3.

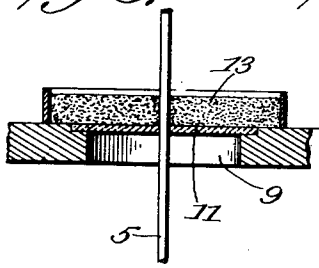


Fig. 4.

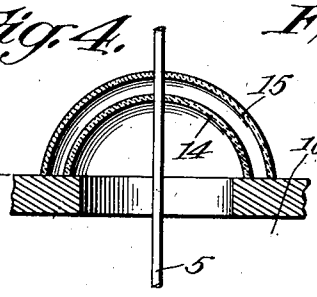


Fig. 5.

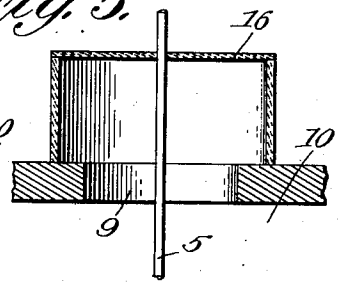


Fig. 6.

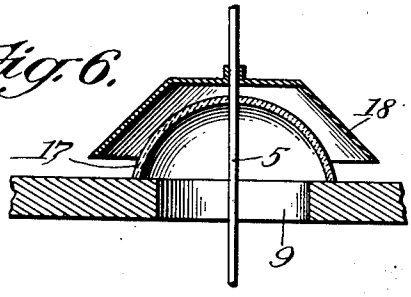


Fig. 7.

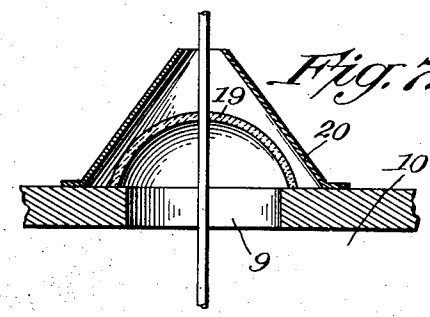
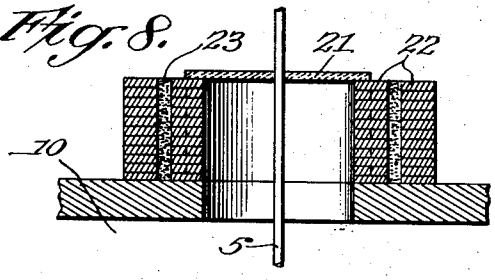


Fig. 8.



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2 SHEETS—SHEET 2.

Fig. 9.

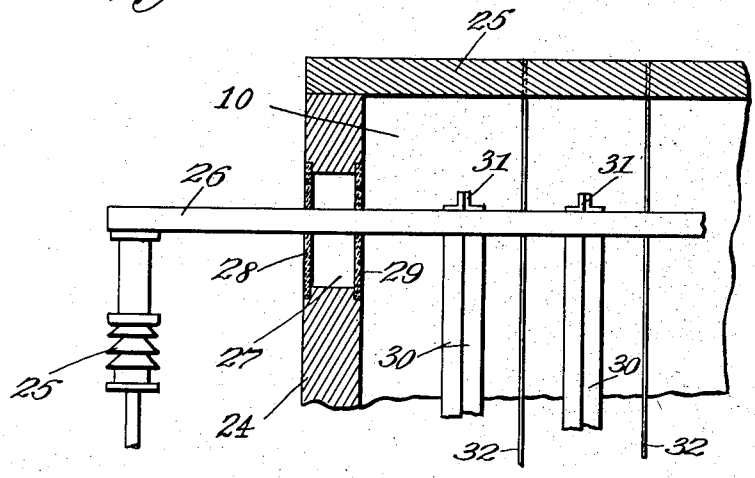


Fig. 12.

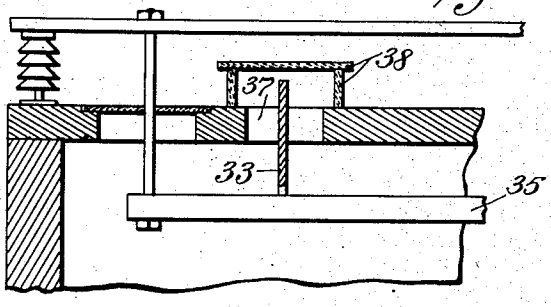


Fig. 11.

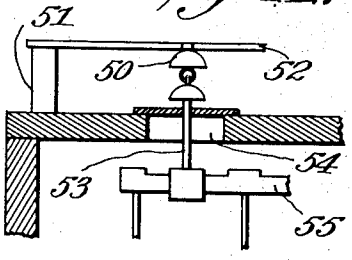


Fig. 10.

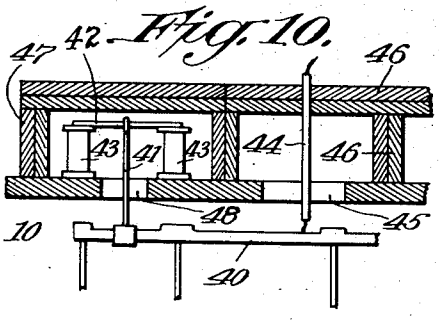
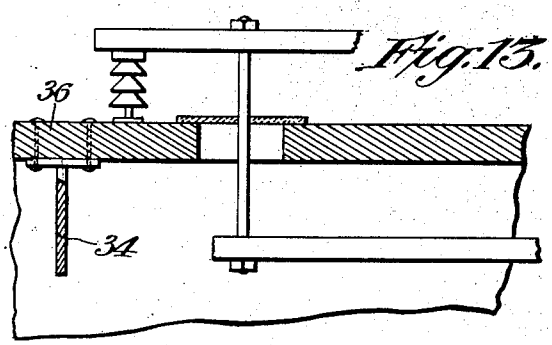


Fig. 13.



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UNITED STATES PATENT OFFICE.

LINN BRADLEY, OF EAST ORANGE, NEW JERSEY, ASSIGNOR TO RESEARCH CORPORATION, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

PRECIPITATOR FOR HOT GASES.

1,379,897. Specification of Letters Patent. Patented May 31, 1921.

Application filed October 16, 1917. Serial No. 196,910.

To all whom it may concern:

Be it known that I, LINN BRADLEY, a citizen of the United States, residing at East Orange, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Precipitators for Hot Gases, of which the following is a specification.

The present invention relates to electric precipitators for removing certain gaseous constituents from a mixture of gases or from a compound gas or for separating suspended particles from the gases.

It is often important to use gases for industrial purposes when they are at high temperatures, such as the gases arising from the burning of sulfur in the manufacture of sulfuric acid. Also in the process of selective removal of constituents from gases, by treating the gases at different temperatures, it is often necessary to subject the gases to the action of an electric precipitator at very high temperatures.

The insulation of high voltage conductors, when exposed to the action of hot gases, has been found difficult, because but few materials that are good electrical insulators at low temperatures are good insulators at high temperatures, such as 700° F. and above.

It is the object of this invention to provide, in electric precipitators of the class above referred to, means for effectively and safely insulating the high voltage elements from the remaining structure and more particularly to make use of ordinary insulators in supporting the high voltage elements in regions of high temperature.

I realize the object of the invention by placing the supporting insulators outside the treater chamber or out of contact with the gases in general and providing special means for electrically insulating the remaining structure from the high tension conductor elements.

For a fuller understanding of the invention, reference is had to the appended drawings in which—

Figure 1 is a vertical section through a device embodying one form of the invention;

Fig. 2 is a vertical section taken at right angle to the section shown in Fig. 1;

Fig. 3 is a detail on an enlarged scale of parts shown in Figs. 1 and 2;

Figs. 4–9 inclusive, show various modified forms thereof;

Fig. 10 is a fragmentary view showing a modified form of device for separately suspending and energizing the electrode system;

Fig. 11 is a fragmentary view showing a modified form of suspension; and

Figs. 12 and 13 show constructional details specially adapted for use in connection with the invention.

In Figs. 1 and 2, which represent the general arrangement characterizing my invention, 10 is the treater chamber. The collecting electrodes 1 have the form of plates and are preferably connected to ground. The gases in passing through the passage ways defined by the plates 1 are subjected to a strong electric field set up about the discharge electrodes 2 positioned in these passage ways which bring about a removal of the particles suspended in the gases. The collected material either falls of its own weight to the bottom of the chamber 10 or the collecting plates are periodically rapped and the material is thus jarred from the surface of the plates and falls to the bottom of the chamber, where it may be removed through the doors 12. It is understood that other provisions could be made for removing the collected material. The discharge electrodes 2 are connected to and suspended from horizontal bars 3 which are in turn supported at their ends on distributing bars 4. This electrode structure is held in firm suspension by rods 5 from an external supporting frame comprising bars 6 resting on bars 7 which in turn are carried by the insulators 8. Rods 5 are of conducting material to not only support the electrode system within the chamber, but also to conduct the high tension current thereto. Bars 6 and 7 are likewise conductors and the insulators 8 are, like ordinary high tension insulators, designed for the particular potential used.

By this arrangement the insulators which carry the weight of the electrode structure are protected against the action of the hot gases and free from disintegrating influ-

ences. While the problem of insulating the chamber structure from the high tension conductors still remains, the insulation may be carried out under different and more favorable conditions and with various suitable materials available for that purpose.

The rods 5 pass through openings 9 in the top of the apparatus and are surrounded by plates 11 of insulating material which may be crystalline, like glass, or more or less amorphous, like asbestos board and which can be built in many ways. The openings 9 and the plates 11 which are covers therefor are so dimensioned that they afford a sufficient insulation between the conductors 5 and the chamber 1 and ground.

While a large number of materials may be perfectly satisfactory, as to insulating qualities, to be used as covers, it is of primary importance that they should have a low coefficient of expansion, because sudden changes of temperature would lead to cracking and breaking of the cover, if the coefficient of expansion were high. This is especially true of materials of crystalline nature. The cover must be practically gas tight that air cannot enter and dilute the gases within the apparatus or allow the gases to escape into the air. The cover must be kept hot so that acid will not condense upon it and so form an electrical conducting surface between the high voltage conductor and the wall of the chamber.

Fig. 3 shows in detail an arrangement which satisfies all the conditions above stated. The plate 11 is preferably built of transite board, silica, glass or other heat resisting and electrical insulating material. To keep this plate hot and so prevent acid from condensing upon it, heat insulating material such as asbestos wool or clean, dry silica sand is placed upon the side exposed to the air as indicated at 13. While it has been found practical to heat this with a coil through which hot gas or steam is passing or by exposing it to the flames of blow torches or the like, such special heating has not been found necessary in most cases.

In Fig. 4 the cover 14 has the form of a bowl which is drilled to allow the rod 5 to enter. By making it in this form or in any other curved form a greater leakage distance is obtained from the high tension conductor 5 to the wall of chamber 1 along the insulator. A second bowl 15 may be placed over the first one and the interstice filled with electrical and heat insulating material, but preferably with gas or air only which acts as a heat insulator and keeps the lower bowl hot. One of the advantages of using a bowl similar to that shown in Fig. 4 is the opportunity to use a transparent material such as glass of special manufacture which permits the operator to determine when the under-surface of the cover is becoming dirty and he can in this way know when to clean it. It also permits him to look down into the gases and roughly determine their temperature, to note the creepage of current across the surface of the cover and obtain other visual effects.

The cover for the opening 9 can also be made as in Fig. 5 as indicated by 16, which is a construction easy to obtain and can be built of transite board, silica, glass, sil-o-cel brick, etc.

Fig. 6 shows a cover 17 protected from dust by another cover 18 which is directly connected to the rod 5 and is of the same voltage and polarity as the rod. If properly kept away from the grounded objects, it can be made of electrical conducting material. Its purpose is primarily to prevent radiation of heat from the bowl 17.

Another modification which has given good results is that shown in Fig. 7. The cover 19 is protected by a member 20 which in this case is a grounded frustum of a hollow cone. It prevents radiation from the cover 19 and furnishes a mechanical protection of the insulating member which may be made of fragile material.

Fig. 8 shows an inlet in which 21 is a transite board or cover of other insulating material supported by a structure built up of abestos brick 22 and a layer of sil-o-cel powder 23 interposed between layers of brick.

In the foregoing illustrations the openings or inlets for the high tension conductors are shown as made in the top surface of the chamber. It is understood that supporting members for the high voltage frame work can be passed through the sides or ends, or even through the bottom of the precipitator. In Fig. 9 is shown an arrangement comprising insulators 25 disposed laterally of the chamber 24 and supporting high voltage bars 26 passing through openings 27 in the side walls of the chamber (only one being shown for the purpose of illustration). The insulator plates 28 and 29 can be made sufficiently stiff to give firm support to the member 26 which carries the discharge electrode structure within the chamber, but ordinarily an insulator as 25 carries the weight of the discharge electrode structure and plates 28 and 29 are primarily for the purpose of preventing the gases from escaping from the chamber or air to enter the chamber. While the problem of affording mechanical rigidity, electrical insulation may be solved in various ways, the arrangement shown in Fig. 9 has been found to give good results. Plates 28 and 29 are fitted into the outer and inner surfaces of the wall respectively to make a gas tight fit and the intervening space may be filled with air, gas, or any other heat insulating substance. The discharge elec-

trodes 30 are suitably suspended from bars 31 resting on bars 26 and intercepting the gases flowing through the passage ways defined by the collecting electrode plates 32.

In the forms of the invention hereinbefore described the current is conducted to the electrode system through the supporting elements or suspension rods which are made of electrical conducting material. This arrangement, which is perhaps a preferred embodiment of the invention, is not absolutely essential. It may be found desirable to use separate means for conducting the current to the electrodes. In Fig. 10 the electrode system 40 is held in suspension by rods 41 (only one of which is shown) supported by cross bars 42 mounted on insulators 43. The current is separately conducted to the electrodes by a conductor 44 passing through an opening 45 into the chamber 10. The means for insulating the conductor 44 from the remaining structure may be the same as previously described. It is shown as comprising a housing 46 of heat insulating and electrical insulating material, such as transite board, silica, glass etc. In this arrangement the insulators are taken out of the precipitating chamber, as in the preceding structures, but they are inclosed by a heat insulating housing 47 which is in communication with the chamber through an opening 48 through which rod 41 passes. While the gases do not pass continuously around the insulators and do not cause a deposit of dust, sulfur or other matter tending to reduce the insulating property, they keep the insulators warm.

Fig. 11 shows the electrode system supported by suspension insulators 50. Support 51 which may be insulating, or not, supports a bar 52 from which the insulators 50 of ordinary construction are suspended. The lower of these insulators, of which there may be any number to suit the particular requirements, carries rod 53 extending through opening 54 into the chamber and supporting the electrode system 55. A suitable cover 56 of heat and electrical insulating material such as previously described is used to cover opening 54.

Figs. 12 and 13 show an arrangement found particularly useful in connection with the invention. It is very important that all gases be forced to pass through the strong electrical fields set up about the electrodes in order to have the particles suspended in them removed. To prevent the gases from passing through the space above the discharge electrodes and thereby escape the action of the electric field I provide baffles indicated by the numeral 33 in Fig. 12 and the numeral 34 in Fig. 13. The baffle 33 is shown as connected to the high voltage member 35, while the baffle 34 is connected to the grounded wall 36 of the chamber. The baffles may be of electrically conducting material or of insulating material. If they are of metal or other electrically conducting material, special provisions must be made to insulate baffle 33 connected to the electrode 35. For this purpose an opening 37 may be provided in the top of the chamber and closed by some suitable insulating cover 38. It is thereby made possible to afford sufficient electrical insulation and at the same time to extend the baffle substantially to the top and reduce the passage space for the gases to any desired degree or close it entirely. If they are made of insulating material, they may be connected to both the high voltage and collecting electrodes, as is obvious. These baffles also tend to bring about a mixing of the gases which may be needed to sweep away the space charges that exist near the collecting members under certain conditions.

In all forms illustrated two features stand out distinctly: The location of the supporting insulators outside the sphere of action of the hot gases and the provisions of heat insulation adjacent the high voltage conductors where they enter the precipitator chamber to safeguard the electrical insulation between these conductors and the remaining structure. The forms shown do not represent all the constructions possible within the scope of the invention, but are merely intended to explain the principles thereof.

In the claims the term "prevent heat exchange" or the like is to be understood as "reduce heat exchange to a practically negligible quantity.".

I claim:—

1. The combination with a closed electrical precipitator chamber for hot gases and a discharge electrode system within the chamber, of an electrical conductor passing through an opening in a wall of the chamber to the electrode system, a cover for said opening of electrical insulating material and means associated with the cover for preventing a heat exchange through said opening and cover.

2. The combination with a closed electrical precipitator chamber for hot gases and a discharge electrode system within the chamber, of an electrical conductor passing through an opening in a wall of the chamber to the electrode system and a cover for said opening of transparent electrical insulating and heat insulating material.

3. The combination with a closed electrical precipitator chamber for hot gases and a discharge electrode system within the chamber, of an electrical conductor passing through an opening in a wall of the chamber to the electrode system, a cover of electrical insulating material for said opening, a second cover adjacent the first cover and

spaced therefrom to prevent dissipation of heat from the chamber.

4. The combination with a closed electrical precipitator chamber for hot gases and a discharge electrode system within the chamber, of an electrical conductor passing through an opening in a wall of the chamber to the electrode system, a cover of electrical insulating material for said opening, a second cover adjacent the first cover and spaced therefrom and a heat insulating substance between the two covers.

5. The combination with a closed electrical precipitator chamber for hot gases and a discharge electrode system within the chamber, of an electrical conductor passing through an opening in a wall of the chamber to the electrode system, a cover of transparent electrical insulating material for said opening and a second cover surrounding the first cover and spaced therefrom to prevent dissipation of heat from the chamber.

6. The combination with a closed electrical precipitator chamber for hot gases and a discharge electrode system within the chamber, of an electrical conductor passing through an opening in a wall of the chamber to the electrode system, a cover of transparent electrical insulating material for said opening, a second cover of transparent electrical insulating material spaced from the first cover and transparent heat insulating material between the two covers.

7. The combination with a closed electrical precipitator chamber for hot gases and a discharge electrode system within the chamber, of an electrical conductor passing through an opening in a wall of the chamber to the electrode system, a cover of electrical insulating material for said opening, a second cover of electrical insulating material adjacent the first cover and a heat insulating fluid between the two covers.

8. The combination with a closed electrical precipitator chamber for hot gases and a discharge electrode system within the chamber, of an electrical conductor passing through an opening in a wall of the chamber to the electrode system, a cover of transparent electrical insulating material for said opening, a second cover of transparent electrical insulating material adjacent the first cover and a transparent heat insulating fluid between the two covers.

9. The combination with a closed electrical precipitator chamber for hot gases and a discharge electrode system within the chamber, of an electrical conductor passing through an opening in a wall of the chamber to the electrode system, and a bowl-shaped cover of electrical insulating material for said opening.

10. The combination with a closed electrical precipitator chamber for hot gases and a discharge electrode system within the chamber, of an electrical conductor passing through an opening in a wall of the chamber to the electrode system, and a transparent bowl-shaped cover of electrical insulating material for said opening.

11. The combination with a closed electrical precipitator chamber for hot gases and a discharge electrode system within the chamber, of an electrical conductor passing through an opening in a wall of the chamber to the electrode system, a transparent bowl-shaped cover of electrical insulating material for said opening and a second cover spaced from the first cover to prevent dissipation of heat from the chamber.

12. The combination with a closed electrical precipitator chamber for hot gases and a discharge electrode system within the chamber, of an electrical conductor passing through an opening in a wall of the chamber to the electrode system, a transparent bowl-shaped cover of electrical insulating material for said opening, a second transparent bowl-shaped cover surrounding the first cover and spaced therefrom and a transparent heat insulating fluid between said covers.

13. The combination with a closed electrical precipitator chamber for hot gases, of a discharge electrode system within the chamber, electrical insulators outside the chamber, means supported on the insulators and passing through a wall of the chamber for firmly suspending the electrode system within the chamber and conducting current thereto and means for electrically insulating said means from the chamber and means for preventing a heat exchange between the interior and exterior of the chamber where said first mentioned means passes through the wall thereof.

14. The combination with a closed electrical precipitator chamber for hot gases, of a discharge electrode system within the chamber, means extending through a wall of the chamber for firmly suspending the electrode system in the chamber and for conducting electric current thereto, electrical insulators for supporting said means on the external surface of the chamber, means for electrically insulating said suspending means from the chamber and means for preventing a heat exchange between the interior and exterior of the chamber where the said suspending means passes through the wall thereof.

15. The combination with a closed electrical precipitator chamber for hot gases and a discharge electrode system within the chamber, of means for insulating the said electrode system from the chamber comprising an insulator mounted outside the chamber, an opening in the wall of the chamber, means supported on the insulator and passing through said opening to firmly suspend

the electrode system in the chamber and conduct electric current thereto, means for insulating the said means from the chamber and means for preventing a heat exchange between the interior and exterior of the chamber through said opening.

16. In combination with an electric precipitator chamber and a plurality of electrodes having their ends spaced from a wall of the chamber, of a baffle plate connected with the electrodes and extending toward the said wall, the wall having a recessed portion and the baffle plate extending into said recessed portion in spaced relation thereto.

In testimony whereof, I affix my signature.

LINN BRADLEY.