Sept. 1, 1925. 1,551,724

E. ANDERSON

ART OF ELECTRICAL PRECIPITATION OF SUSPENDED MATERIAL FROM GASES

Filed May 31, 1922

Fig. 1

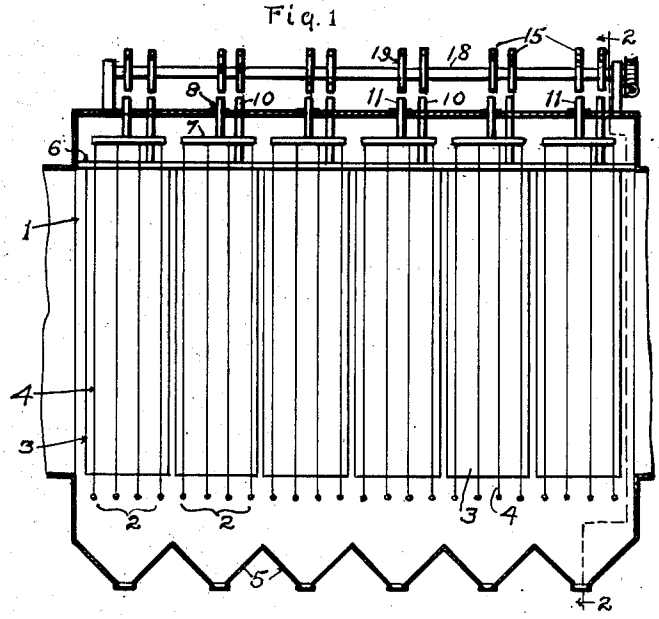


Fig. 2.

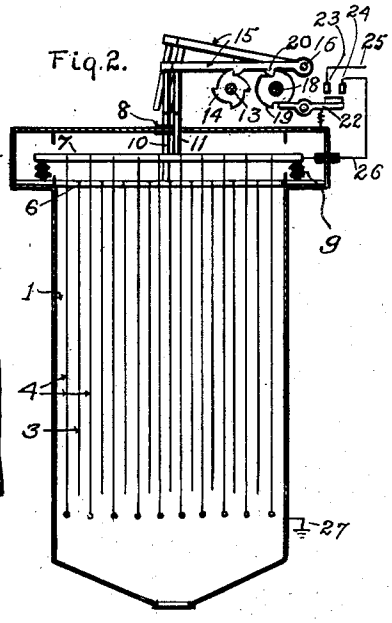


Fig. 3.

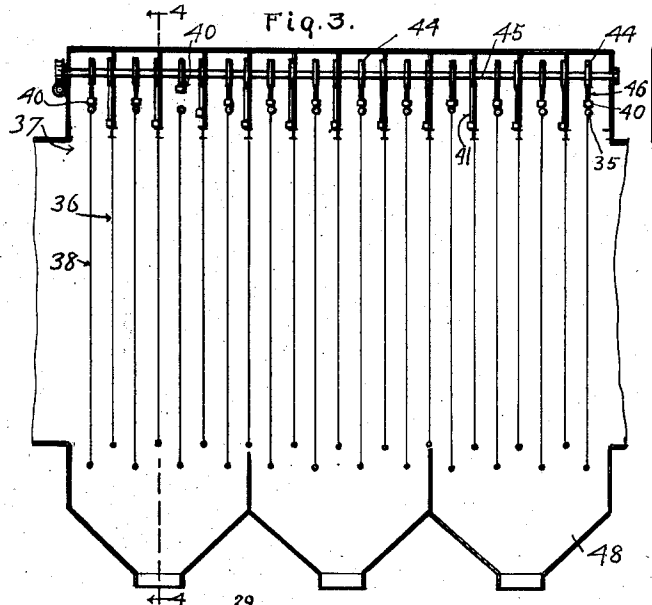


Fig. 4.

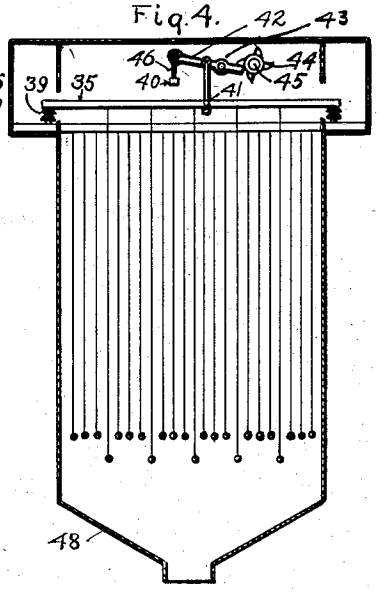
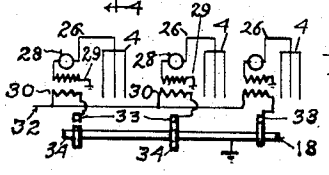


Fig. 5.



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UNITED STATES PATENT OFFICE.

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ART OF ELECTRICAL PRECIPITATION OF SUSPENDED MATERIAL FROM GASES.

Application filed May 31, 1922. Serial No. 564,974.

To all whom it may concern:

Be it known that I, EVALD ANDERSON, a citizen of United States, residing at Alhambra, county of Los Angeles, State of California, have invented a new and useful Improvement in the Art of Electrical Precipitation of Suspended Material from Gases, of which the following is a specification.

This invention relates to separation of suspended material from gases by electrical action, and the main object of the invention is to provide for such separation in a continuous manner so that the electrical precipitating operation proceeds continuously and does not have to be interrupted for cleaning operations.

In the operation of electrical precipitation apparatus the gases carrying suspended material are passed between discharge and collecting electrodes which are maintained at high electrical potential difference, in such manner that the suspended material carried by the gases is deposited or collected to a greater or less extent on such electrodes; and in the operation of such apparatus it has heretofore generally been necessary to shut down the apparatus from time to time so as to enable the material collected on the electrodes to be removed therefrom. Such shutting down of the apparatus has generally included the shutting off of the gas stream by means of dampers or otherwise, so as to prevent material dislodged from the electrodes in the cleaning operation from being carried forward with the gas stream and from being discharged at the outlet or stack of the apparatus, resulting in a nuisance or loss of valuable material. The cleaning operation as heretofore conducted, therefore, involves a cessation of the normal operation of the treater, resulting in decreased capacity of the treater and in considerable expense due to the oversight and control required in connection with such cleaning operations.

By means of my invention hereinafter described, the gases are cleaned by passing them through a series of electrical precipitation zones, each precipitating zone including a set of electrodes, and electrodes in the successive sets being subjected to cleaning operation for removing deposited material therefrom at different times so that at all times the major part of the precipitating means is in operation and the cleaning operation in any one section does not interfere with the general precipitation efficiency. With such a mode of operation, it is not necessary to shut off the gas stream at any time, the number of sections being sufficient to always provide for effective precipitation by the operation of those sections which are not being cleaned.

The accompanying drawings illustrate embodiments of my invention and referring thereto: Fig. 1 is a longitudinal section of one form of such apparatus. Fig. 2 is a vertical section on line 2—2 of Fig. 1. Fig. 3 is a longitudinal section of another form of such apparatus. Fig. 4 is a section on line 4—4 in Fig. 3. Fig. 5 is a diagram of a modified form of electrical circuit control.

In Figs. 1 and 2 my invention is shown as applied to an electrical precipitator of the so-called plate and wire type comprising collecting electrodes formed as plates and discharge electrodes formed as wires, chains or other flexible members, all arranged in a flue or chamber 1 through which the gases are passed, the said electrodes being arranged in a series of sections for units indicated at 2, it being understood, however, that any desired number of units or sections may be used provided the number is sufficiently great to give the desired uniformity of operation. In general, at least five sections are desirable. Each section 2 includes a set of collecting electrode plates or screens 3 and a set of high tension discharge electrodes 4 arranged in alternation with and opposite to the respective plates. The collecting electrodes 3 may be suspended from and supported by supporting frame means consisting of beams indicated at 6. The discharge electrodes 4 may be supported by frame means 7 which is mounted on insulators 9. Any other suitable construction of electrodes and of support may, however, be used; for example, the collecting electrodes 3 may be formed as plates or screens or as a series of chains, wires, or other flexible members spaced sufficiently close to produce approximately the effect of a continuous con-

ducting surface; and the discharge electrodes 4 may consist of wires, chains, rods, bars or other members of small area as compared with the collecting electrodes, so as to facilitate discharge from the discharge electrodes.

Any suitable means may be used for cleaning the electrodes, but in order to enable the electrodes to be cleaned without shutting off the draft or gas flow on the precipitator, it is desirable to provide for shaking, agitating or rapping the electrodes by means operating outside of the precipitating flue. For this purpose, the collecting electrode frames above described may be provided with anvils 10 projecting through the wall of the flue, for example, through the roof thereof and similarly the discharge electrode frames may be provided with anvils 11 projecting through the roof of the flue, suitable insulation indicated at 8 being provided where these anvils from the discharge electrodes pass through the roof. If it is desired to clean the precipitator by manual operation, the operator will pass over the flue, striking the anvils 10 and 11 for each section so as to jar the collecting and discharge electrodes in such section and will pass from section to section so as to operate upon the electrodes of the several sections successively. In this operation most of the material dislodged from the electrodes of any one section will fall into the receiving means or hoppers indicated at 5, at the bottom of the flue. In this connection, it may be stated that the material which has been precipitated and which is dislodged on shaking is generally conglomerated into larger masses than the original dust and fume content in the gases thus minimizing the tendency for the material to pass along with the gas stream. In general, however, more or less of such dislodged material particularly the finer particles thereof will be carried forward with the gas stream and will be collected in succeeding sections of the precipitator. It may also be stated that in electrical precipitating apparatus of this nature, including a series of sections operating successively on the gas stream, the major portion of the suspended material is caught in the first few sections and the last sections of the precipitator only serve to perform a final clean-up and receive but little material so that in cleaning such last sections, the material which may pass therefrom and fail to be caught in a succeeding section is a relatively small amount.

I prefer to provide for automatic operation of the cleaning means so that the expense of manual control or operation of the apparatus is reduced to a minimum. For this purpose an operating shaft 13 may be provided extending above the flue 1 and above the respective sections of the precipitator above described, said shaft carrying cams 14 adapted to operate upon trip hammers 15 which are mounted on a suitable pivotal support 16 and are adapted to strike anvil means 10 on the collecting electrode and anvil means 11 on the discharge electrode.

A control shaft 18 is also provided carrying a series of cams 19 which normally engage projections 20 on the respective trip hammers 15 to hold the same out of engagement with the operating cams 14. When the notch or depressed portion of any cam 19 comes opposite the projection 20 for the corresponding trip hammer, such trip hammer is lowered into position for operation thereof by the cam means 14; the several cams 19 being so positioned as to bring the series of trip hammers 15 successively into operation and show that the cleaning operation progresses along the treater from section to section and is repeated indefinitely in a cyclic manner. In case it is desired to cut off the current during the cleaning operation, this may be effected by switch means controlled, for example, by the control shaft 18. Thus, the cams 19 on said shaft may operate switch levers 22 for making connections between contacts 23 and 24 connected respectively to an electrical supply circuit 25 and (by wire 26) to the high tension discharge electrodes of the section corresponding to said cam, there being a switch 22 for each section or unit of the treater so that each section is shut off in the circuit during the operation of the cleaning means therein.

Suitable circuit connections are made for supplying the electrical precipitator with the unidirectional current of high potential difference, such connections including, for example, a rectifier of suitable type connected to receive current from the high tension transformer and to deliver rectified current to the electrical precipitator, the discharge electodes of said precipitator being connected through switches 22 aforesaid to such energizing circuit and the collecting electrodes being grounded as indicated at 27.

If desired, the energizing connection for the sections of the precipitator may be interrupted on the low tension side of the supply transformer, Fig. 5 showing diagrammatically circuit connections suitable for this purpose, 26 indicating the supply lines leading to the discharge electrodes for the respective sections, 28 indicating a suitable rectifier such as a mechanical rectifier, or a valve rectifier such as a kenotron, said rectifier being connected to the secondary of a high tension transformer, which is provided with a ground connection indicated at 29. The primary winding 30 of each of said transformers may be connected at one side

to an alternating current supply line indicated at 32 and at the other side to one of a series of contacts 33 adapted to be engaged by contact means 34 on the control shaft 18 aforesaid, said contacts 34 being so positioned and arranged as to successively interrupt the primary or energizing circuits for the respective transformers and to shut off the supply of electrical energy to each precipitator section during the period occupied by the cleaning operation in such precipitator section.

As shown in Figs. 3 and 4, my invention may also be applied to precipitators of the form in which the gas stream is forced through the electrodes, the collecting electrodes 36 being in this case formed as screens of previous members of any suitable construction extending transversely of the flue 37 and formed, for example, of vertical wires or chains, spaced sufficiently close together to produce approximately the effect of a substantially continuous surface, and the high tension discharge electrodes 38 being formed as wires, chains, or rods of a small cross section spaced sufficiently far apart to facilitate electrical discharge therefrom and suspended from frames 35 supported on insulators 39. In this case the gas to be cleaned passes successively through the discharge electrodes and collecting electrodes and provision is made for successive cleaning of the sets of discharge and receiving electrodes; for example, by means of hammer devices 40 and 41 respectively for the discharge electrodes and the collecting electrodes, said hammer devices being carried by levers 42 mounted on pivot or shaft 43 and operated by cam means 44 on a shaft 45 rotated in any suitable manner. In the rotation of said shaft the levers 42 are successively operated so as to raise the corresponding hammer devices which are allowed to fall suddenly into contact with the respective electrodes. In the operation of this form of my invention the gas stream passes successively through the series of discharge and collecting electrodes and is subjected to the action of electrical field maintained between said electrodes in such manner as to cause electrical precipitation of suspended material on the electrodes, such suspended material being removed from the electrodes by successive operation of the cleaning means on the respective electrodes, only one or a limited number of electrodes being cleaned at any one time, and the material dislodged therefrom falling into the collecting means 48 at the bottom of the flue 37, or being collected on succeeding electrodes as the case may be.

My invention may be carried out in such manner as to provide for cleaning of the precipitator sections while the potential difference is maintained between the electrodes thereof, the cleaning means shown in Figs. 3 and 4 being suitable for the purpose, suitable insulation, indicated at 46, being provided for the hammer devices for the high tension electrodes.

What I claim is:

1. The method of removing suspended material from gases which consists in subjecting a gas stream to the action of a series of electrical fields, each of said fields being produced by a separate set of discharge and collecting electrodes, and cleaning electrodes of each set independently of the other sets without interruption of the gas stream.

2. The method of removing suspended material from gases which consists in subjecting a gas stream to the action of a series of electrical fields, each of said fields being produced by a separate set of discharge and collecting electrodes, and cleaning both the discharge and collecting electrodes of each set independently of the other sets without interruption of the gas stream.

3. The method of removing suspended material from gases which consists in subjecting the gas stream to the action of a series of electrical fields, each of said fields being maintained between discharge and collecting electrodes, and subjecting the said electrodes for the respective electrical fields to cleaning action successively without interruption of the gas stream, the electrical connection to the electrodes of each of the electrical fields being interrupted during the cleaning operation thereon.

4. An apparatus for electrical precipitation of suspended material from gases comprising a series of precipitating sections each comprising a separate set of opposing electrodes, and means for maintaining said opposing electrodes at high potential difference and cleaning means adapted to operate on electrodes of each set independently of the other sets of the electrical precipitator, while the gas flow is maintained through such sections, the number of sections being sufficient to enable effective precipitation of suspended material from the gases by the operation of the electrical precipitator as a whole during each of such cleaning operations.

5. An apparatus for electrical precipitation of suspended material from gases comprising a series of precipitating sections each comprising opposing electrodes, and means for maintaining said opposing electrodes at high potential difference, cleaning means adapted to operate successively on the successive sections of the electrical precipitator, while the gas flow is maintained through such sections, the number of sections being sufficient to enable effective precipitation of suspended material from the gases by the operation of the electrical precipitator as a whole during each of such

cleaning operations, and means for interrupting the supply of electric current to each of such sections during the cleaning thereof.

6. The method of removing suspended material from gases which consists in causing such gases to flow horizontally through a series of electric fields maintained between vertically extending electrodes and subjecting the said electrodes for the respective electrical fields to cleaning action successively without interruption of the gas stream.

7. The method as set forth in claim 6 and comprising in addition interrupting the electrical connection to the electrodes for successive electrical fields during the cleaning operation thereon.

In testimony whereof I have hereunto subscribed my name this 22nd day of May, 1922.

EVALD ANDERSON.