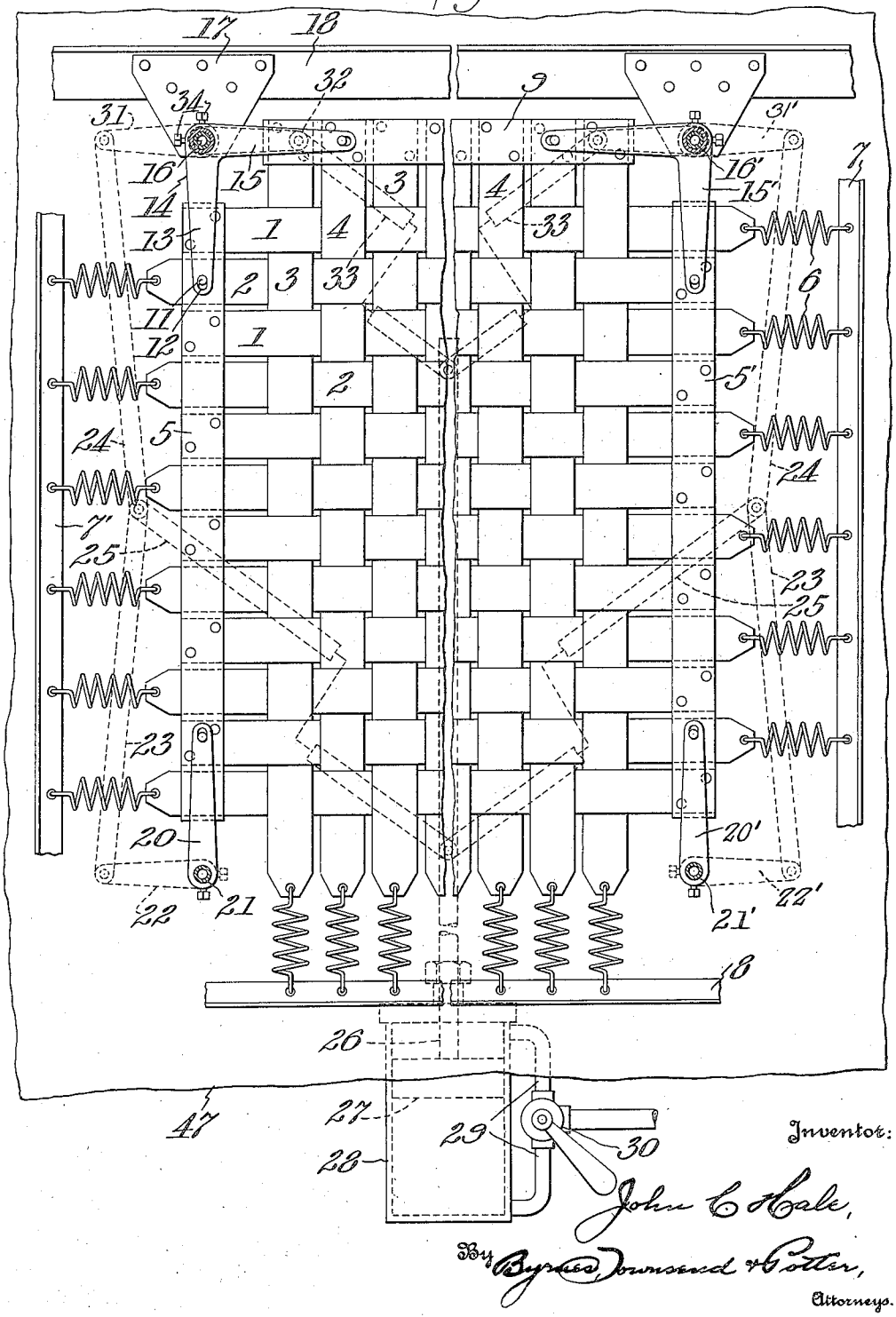
Feb. 2, 1932. J. C. HALE 1,843,510

ELECTRODE

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Fig. 1.



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Fig. 2.

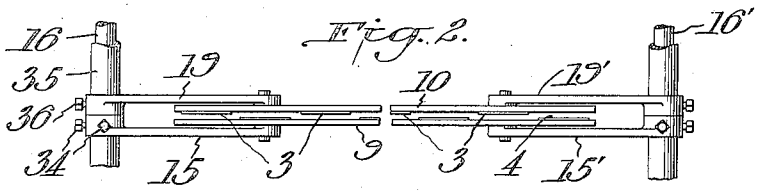


Fig. 3.

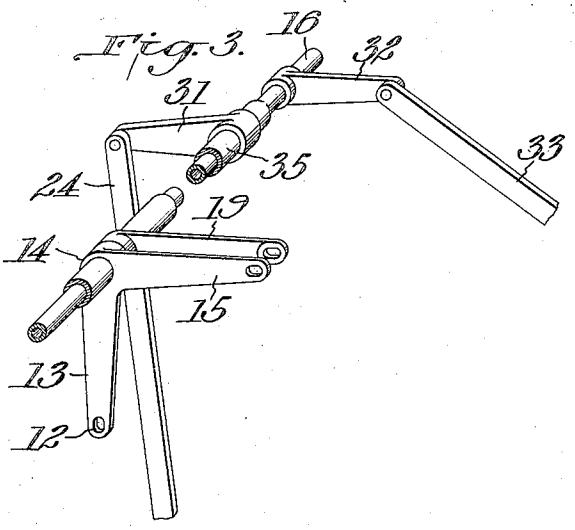


Fig. 4.

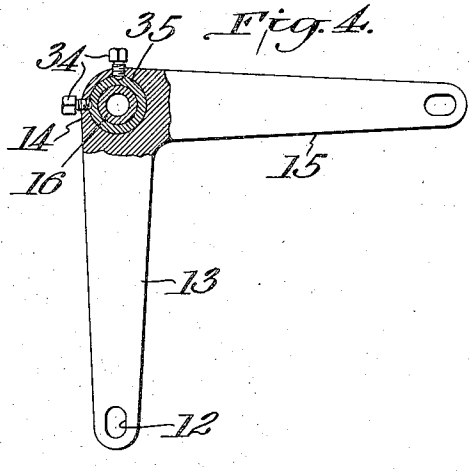
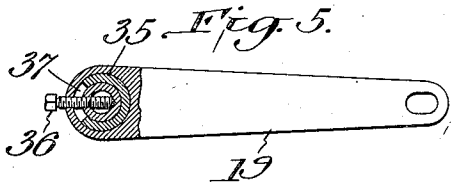


Fig. 5.



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Fig. 6.

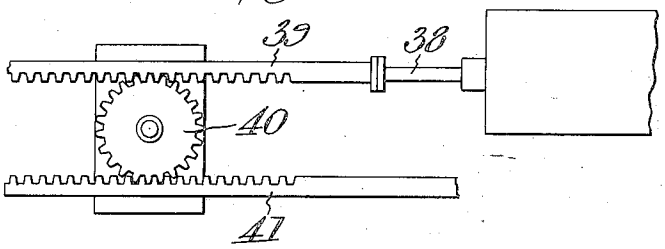
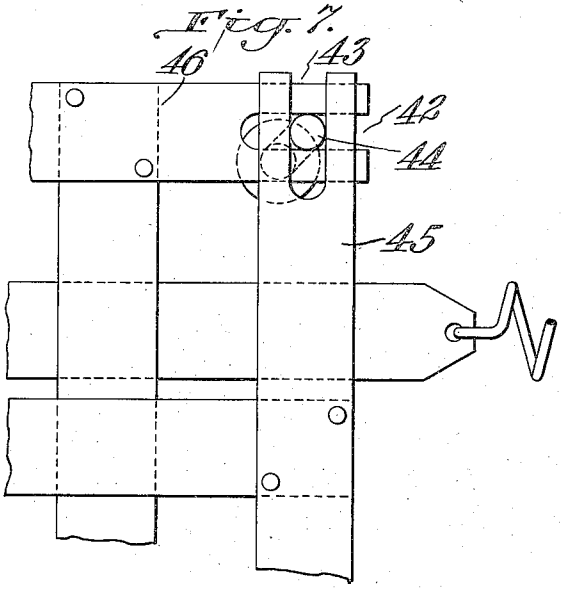


Fig. 7.



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UNITED STATES PATENT OFFICE

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ELECTRODE

Application filed May 6, 1930. Serial No. 450,270.

This invention relates to apparatus for the electrical precipitation of suspended particles from gases. More particularly, the invention relates to a collecting electrode forming a part of such apparatus and means for cleaning the same.

In apparatus for the electrical precipitation of suspended particles from gases, the collecting electrodes usually take the form of plates presenting relatively large surfaces to the action of the electric field which is set up between the discharge electrodes and collecting electrodes. When the collecting electrodes become covered with a coating composed of the particles which have been precipitated, other particles approaching the electrodes, due to the action of the field, are subjected to a back corona discharge which prevents the particles from reaching the electrodes before they pass out of the precipitation apparatus. It is therefore necessary to clean the electrodes periodically to remove the coating which has formed thereon.

Formerly, this cleaning was effected either by scraping the electrode surfaces, or by jarring the electrodes. In the method of cleaning the electrodes by scraping, the difficulty has been encountered either that the scraping means was left in the precipitator, in which case the shape of the electric field was affected by the presence of the scraper body between the electrodes, or, if the scraping means was inserted for each scraping operation, the precipitator had to be shut down while the scraping means was being inserted and while it was being removed.

It was also necessary to provide a flat, even surface having considerable rigidity so that the scraper would contact with a substantial portion of the surface. It was difficult to maintain the surface flat and smooth due to the severe duty to which precipitators are subjected. Also, in order to maintain the plates in proper shape and position, it was necessary to provide stiffeners which, together with their attaching members such as rivets or bolts, distorted the electric field.

In the method of cleaning by jarring the electrodes, it was necessary to employ such strong and heavy electrodes, to withstand the jarring, that the precipitator was too heavy and cumbersome to permit its installation in many desirable locations, as for instance on the roof of a building.

The present invention is directed to a precipitator in which the electrodes are self-cleaning, that is, the cleaning means forms a part of the electrode, and in which no scraper is used and no jarring of the electrode is necessary. The electrode is constructed in the form of a woven sheet, the members of which are relatively movable to effect a scraping action.

One of the objects of the invention is the provision of electrical precipitation apparatus having a plate-type electrode and means for readily cleaning the electrode without removing it from the apparatus.

Another object of the invention is to provide an apparatus for electrical precipitation having a plate-type collecting electrode wherein the electrode constitutes means for cleaning itself and no separate scraping means or other cleaning means are necessary.

Still another object of the invention is the provision of an electrical precipitator in which the cleaning means for the collecting electrode is simple and compact and is of such a nature that the collecting electrode may be light in weight.

Still another object of the invention is the provision of a collecting electrode which maintains its shape and position under all conditions of operation.

Further objects will appear from the following specification taken in connection with the accompanying drawings in which:

Fig. 1 is a fragmentary elevational view of one form of the invention,

Fig. 2 is a top view of the same,

Figs. 3 to 5 are fragmentary views showing details of the operating mechanism,

Fig. 6 is a view of an alternative form of actuating device, and

Fig. 7 is a fragmentary view of a modified form of operating means.

In Fig. 1 is shown an electrode formed of a set of thin ribbon-like strips 1, 2 of metal disposed horizontally and a second set of similar strips 3, 4 disposed vertically and

interwoven with the strips of the first-mentioned set to form a sheet.

The ends of alternate horizontal strips 1 are rigidly secured to a vertical end member 5 disposed at one side of the sheet and the other ends are resiliently secured by means of coil springs 6 to a vertical frame member 7 disposed at the opposite side of the sheet.

The remaining horizontal strips 2 are likewise secured to similar members only in a reverse manner, that is, the ends adjacent the rigidly secured ends of the first-mentioned horizontal strips are resiliently secured to a frame member 7′ and the ends adjacent the resiliently secured ends of the first-mentioned strips are rigidly secured to an end member 5′.

The vertical strips are resiliently secured at their lower ends to a horizontal frame member 8. The upper ends of alternate vertical strips 4 are rigidly secured to a top horizontal end member 9 and the upper ends of the remaining strips 3 are secured to a similar end member 10 disposed parallel to and in the rear of the first-mentioned horizontal end member. The sets of springs serve to keep the strips taut whereby there will be no buckling of the latter when the movement takes place; the surfaces of the strips will also be held in intimate contact. Secured to the upper end of the end member 5 by a pin and slot connection 11, 12 is one arm 13 of a double-armed crank 14, the other arm 15 of which is secured to the adjacent end of the horizontal end member 9 by a similar connection. The crank is mounted on an operating shaft 16 which is carried by a hanger 17 secured to a horizontal support 18. A single-armed crank 19 is mounted on the operating shaft in the rear of the first-mentioned crank and has its end secured to the rear end member 10. A similar operating shaft 16′ carrying a similar set of cranks 15′, 19′ is provided adjacent the other side of the sheet.

Secured to the lower ends of the vertical end members 5, 5′ are a pair of cranks 20, 20′ which are mounted on a pair of lower operating shafts 21, 21′. Secured to each of the lower operating shafts is a second crank 22, 22′ respectively, to which is pivotally connected a toggle linkage composed of three pivotally connected bars 23, 24, 25 which in turn are pivoted to a push rod 26. The push rod carries at one end a piston 27 which reciprocates in a cylinder 28, provided with conduits 29 leading from a source of power (not shown) which supplies a motive fluid under pressure, and a valve 30 whereby movement of the piston may be effected.

Carried by each upper operating shaft is a second single-armed crank 31, 31′ which is pivotally attached to the connecting rod 24 at its side of the collector electrode. Each of the upper operating shafts 16 also carries a third single-armed crank 32, normally extending inwardly from the shaft, to which crank is pivoted a connecting rod 33 which in turn is pivoted to the upper end of the push rod 26.

As seen in Figs. 3 to 5, the double-armed, or front crank 14 is secured, by means of set screws 34, to a sleeve 35 which surrounds the operating shaft 16 and which is rotatable with respect thereto. The outer single-armed crank 31 is secured to the sleeve in a similar manner. It will be seen that the above-mentioned cranks, both being secured to the sleeve will rotate together independently of any rotation of the operating shaft.

The second mentioned, or rear crank 19 is secured to the operating shaft by means of a set screw 36 which passes through a slot 37 in the sleeve.

The inner single-armed crank is secured to the operating shaft 16 at a portion beyond the end of the sleeve 35. Thus, the rotation of the operating shaft will effect rotation of the two cranks secured thereto which rotation may take place independently of the rotation of the sleeve and the cranks secured thereto.

The operation of the mechanism is as follows, reference being made only to the left hand portion of the apparatus, the other half operating in a similar manner.

The actuation of the valve 30 to admit motive fluid to the cylinder 28 causes an upward movement of the piston 27 which forces with it the push rod 26. The movement of the push rod 26 causes the toggle linkage 23, 24, 25 to move outwardly thereby rotating upwardly the upper crank 31 secured thereto and rotating downwardly the lower crank 22.

The rotation of the outer crank 31 rotates the sleeve 35 in a clockwise direction which effects a similar rotation of the front crank 14. The movement of the latter causes the end member 5 to be drawn to the left carrying with it the horizontal strips 1. The rotation of the front crank 14 also causes a downward movement of the front horizontal end member 9 and its associated vertical strips 4.

The upward movement of the push rod 26 causes the connecting rod 33 to rotate the inner crank 32 upwardly, thereby effecting a counter-clockwise rotation of the operating shaft 16 to which the crank is connected. The rotation of the shaft imparts a rotative movement to the rear crank 19 to move upwardly the vertical strips 3 which are secured to the rear horizontal end member 10.

Thus it will be seen that the strips are moved relative to one another, alternate vertical strips being moved in opposite directions simultaneously with the movement in opposite directions of alternate horizontal strips. This relative movement of the strips causes opposite faces of adjacent portions of interwoven strips to rub past one another whereby the coating of precipitated materials which

has collected on the strips is scraped off. Due to the completeness of the relative movement, i. e., horizontally and vertically, all portions of the surfaces of the strips are subjected to the scraping action and no precipitated material remains thereupon.

In Fig. 6 is shown a modified form of actuating means. A horizontal piston 38 actuates a rack 39 which, through a pinion 40, actuates in the opposite direction a second rack 41 disposed parallel to the first rack. The upper rack 39 performs the function of connecting the piston to the left hand toggle joint and the lower rack 41 operates the right hand toggle joint. It will be seen that a movement of the horizontal piston corresponds to an upward movement of the vertical piston shown in Fig. 1 and the members connected to this modified form of actuating means are operated in the same manner as in the first form.

A modified means for causing relative movement between the strips is shown in Fig. 7. In this form no cranks or levers are employed in moving the end members. The overlapping end portions of the end members are provided with longitudinal slots 42, 43. A crank pin 44 extends through the slots and is mounted for eccentric movement to impart horizontal reciprocating movement to the vertical end member 45 and vertical reciprocating movement to the horizontal end member 46.

It will be apparent that a certain amount of bending of the strips will be necessary in order that the interwoven strips may pass by one another when relative movement of the same is effected. Hence the strips are formed of very thin sheets of resilient material, such as chrome steel, having a high resistance to heat and corrosion.

Resistance to bending can be decreased by leaving spaces between adjacent parallel strips. However, the spaces must be small for, if large spaces were provided between strips, the isolated edges of the strips would cause a field of high intensity to be set up, and this would result in the formation of an ionizing corona on the collecting electrode, which is undesirable in precipitating apparatus.

The operating mechanism may all be disposed within the wall of the precipitator chamber, but it is preferable to dispose as much of this mechanism as possible outside of the walls. The fewer projecting edges that are disposed in the electric field, the less distorted will be the field, and the less possibility of undesired discharges occurring between the discharge electrode and the projecting edges and points of the members forming the operating mechanism. Hence, the principal portions of the operating mechanism are shown disposed outside of the chamber wall 47. The operating shafts 16, 16′, 20 and 21′ extend through the wall 47; any usual packing means may be provided where the shafts pass through the wall.

I claim:

1. A collecting electrode for an electrical precipitator comprising a plurality of relatively movable collecting members disposed in intimate contact and means for relatively moving said members.

2. The invention as set forth in claim 1 wherein said members comprise thin strips disposed substantially in the same plane.

3. A collecting electrode for electrical precipitation apparatus comprising a plurality of sets of flexible strips of metal interwoven to form a sheet, and frame members individual to said sets of strips for supporting the same.

4. In the method of cleaning collecting electrodes of an electrical precipitation system of the type having a plurality of collecting surfaces, the method which comprises moving certain of the collecting surfaces past other of the collecting surfaces while maintaining said relatively moving surfaces in mutual intimate contact.

5. The method of cleaning collecting electrodes for electrical precipitation apparatus which comprises moving portions of the collecting surfaces relatively to other portions of the collecting surfaces while in intimate contact therewith.

6. In electrical precipitation apparatus the combination with a plurality of interwoven strips, of means for moving certain of said strips relative to other strips.

7. In electrical precipitation apparatus the combination with two interwoven sets of parallel strips, of means for longitudinally reciprocating alternate parallel strips in opposite directions.

8. In apparatus for electrically precipitating suspended matter from gases and of the type wherein there is a flow of gas through an electric field, a collecting electrode comprising a plurality of conducting members forming a sheet, said members having portions of their respective surfaces exposed to the electric field, means for moving said members relative to each other to expose other portions thereof to the electric field.

9. In an electrical precipitator, a collecting electrode comprising a plurality of interwoven strips of metal, frame members secured to the ends of sets of said strips, and means for reciprocating said frame members.

10. In electrical precipitation apparatus, a plurality of thin, flexible metal strips, arranged to define a substantially continuous surface and supporting means for said strips, said supporting means including resilient members for maintaining said strips under tension.

11. In electrical precipitation apparatus, the combination with a collecting electrode, comprising a plurality of relatively movable members, means for supporting and tensioning said members and means for relatively moving said members.

12. In electrical precipitation apparatus, the combination with an electrode, comprising a plurality of flexible strips, of means for moving certain of said strips with reference to other of said strips, said means including springs secured to each of said strips for supporting and tensioning said strips.

In testimony whereof, I affix my signature.

JOHN C. HALE.