July 1, 1958 P. F. EILENBERGER 2,841,241

COLLECTING ELECTRODE

Filed March 9, 1956 2 Sheets-Sheet 1

Fig 1.

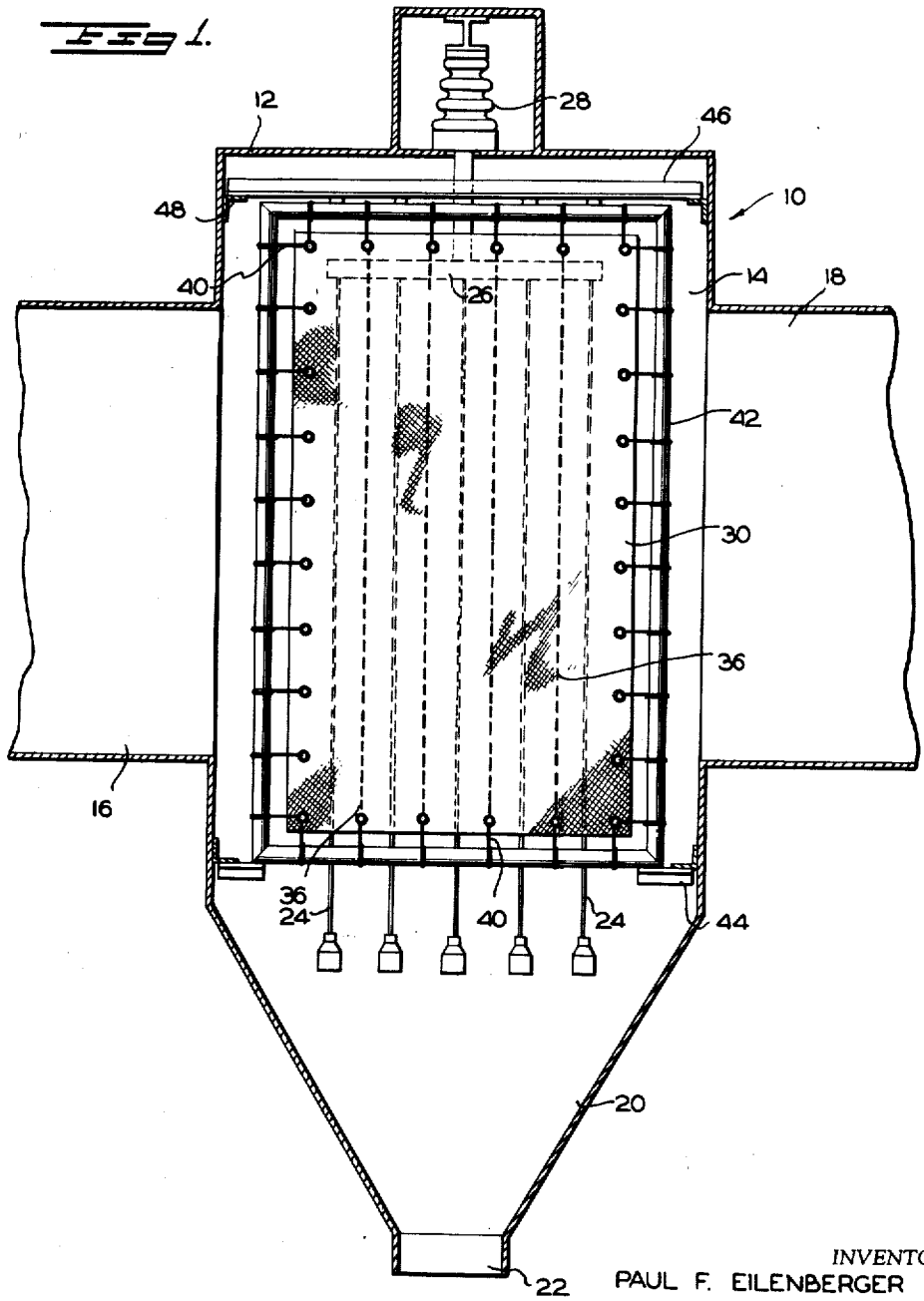

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Fig 2.

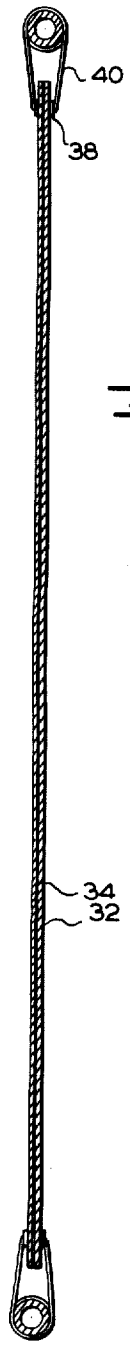

Fig 5.

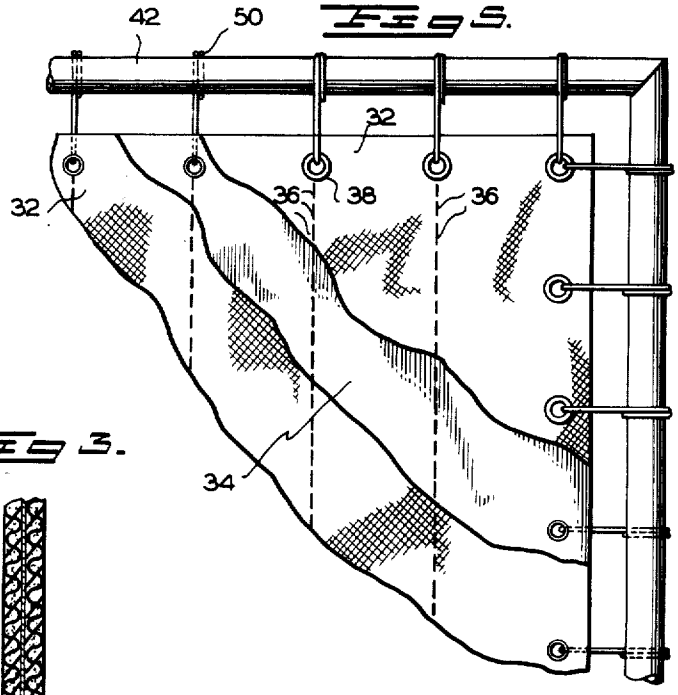

Fig 3.

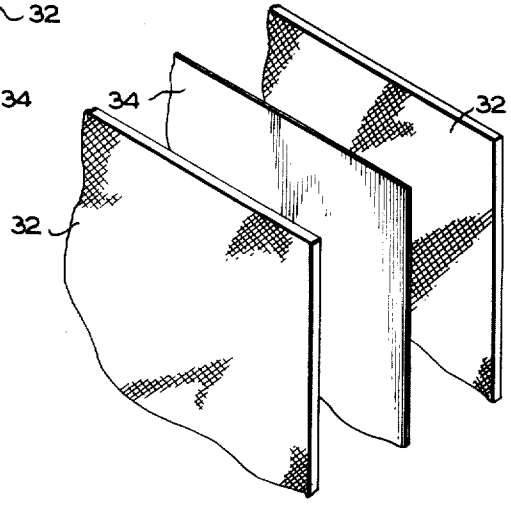

Fig 4.

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COLLECTING ELECTRODE

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3 Claims. (Cl. 183—7)

The present invention relates to apparatus for the electrical precipitation of suspended material, such as fly ash and the like, from flue gases and more particularly and specifically to a new and improved collecting electrode for such precipitation apparatus.

It is known to utilize collecting electrodes constructed of semi-conductive or electrical resistance materials, such as cement, plaster compositions, or the like. It has been discovered that the use of such electrodes presents problems relating to the supporting of the extreme weights and bulky structures constituting such electrodes, and, additionally, such electrodes have been found to be very rigid and difficult to rap or otherwise activate for the purpose of removing collected materials therefrom.

It is, therefore, a general object of the present invention to provide a unique and improved collecting electrode of a semi-conductive or electrical resistance material which overcomes most of the problems and disadvantages which have been found to be inherent in conventional electrode structures heretofore utilized.

Another object of this invention is to provide a new and improved collecting electrode of a semi-conductive or electrical resistance material which is relatively lightweight, thereby reducing the structural requirements necessary to support the electrode within the precipitator, and an electrode which is quickly and easily positioned and secured within the gas flow area of the precipitator.

It is another object of this invention to provide a new and improved collecting electrode of a semi-conductive or electrical resistance material which provides an extremely flexible electrode capable of high frequency vibration for the removal of collected materials precipitated thereupon.

A still further object of this invention is the provision of a new and improved collecting electrode for electrostatic precipitators which consists principally of two layers of a semi-conductive or electrical resistance web having a lightweight and flexible sheet of conductive material laminated therebetween.

It is still another object of this invention to provide a new and useful collecting electrode of the type heretofore described which is capable of quick and easy attachment to a supporting framework within the precipitator and which may be quickly and easily removed from said framework for repair or replacement.

A still further object of this invention is the provision of a collecting electrode consisting of laminated sheets of flexible, conductive material and semi-conductive or electrical resistance web which is tautly secured within a conductive frame by means establishing conductive contact between said frame and said laminated conductive sheet; wherein said laminated electrode is readily vibrated at high frequencies for removal of precipitated material therefrom by rapping apparatus associated with and acting directly upon said supporting frame.

Yet another object of this invention is the provision of an improved collecting electrode for electrical precipitators

which is of simple and inexpensive design and manufacture and which is highly efficient over long periods of operation.

Still other objects and advantages, both general and specific, will become readily evident to those skilled in this particular art when the following general statement and description are read in the light of the accompanying drawings.

The nature of the present invention may be stated in general terms as relating to a collecting electrode for electrical precipitators which includes in combination a rectangular conductive frame, a flat rectangular electrode plate composed of plural layers of a semi-conductive or electrical resistance cloth having laminated therebetween a sheet of flexible, conductive material, together with conductive means for supporting said electrode plate within said frame and establishing conductive contact between said frame and the laminated conductive layer of said electrode.

Referring now to the accompanying drawings in which like numerals designate similar parts throughout the several views:

Fig. 1 is a side elevation of an electrode constructed in accordance with the present invention mounted within a fragmentary portion of a precipitator shown in partial vertical section.

Fig. 2 is a vertical section through the electrode taken on line 2—2 of Fig. 1.

Fig. 3 is an enlarged fragmentary section through said electrode.

Fig. 4 is a fragmentary pictorial view showing the laminated structure of said electrode.

Fig. 5 is an enlarged fragmentary view illustrating the attachment of said electrode to its supporting frame.

With reference to Fig. 1 of the drawings, there is disclosed a fragmentary portion of an electrical precipitator, generally designated at 10, which includes a precipitator shell 12 consisting of a gas treating chamber 14 having a gas inlet 16 and a gas outlet 18 on remote sides of the treating chamber. The chamber is provided with a hopper type bottom 20 with a central discharge opening 22 through which precipitated materials removed from the collecting electrodes within the chamber are discharged.

Within the treating chamber 14 there is located in conventional arrangement plural rows of parallel spaced discharge electrodes 24 which are suspended from a high tension bus bar 26 supported in conventional manner by an insulator 28 in the upper regions of the housing chamber. Associated with said spaced rows of discharge electrodes, which depend vertically within the chamber, is a series of complementary collecting electrode plates 30 which are arranged in parallel spaced relationship one intermediate each adjacent pair of rows of discharge electrodes. This arrangement provides, in conventional manner, electrostatic fields between the discharge electrodes 24 and the grounded collecting electrodes in parallel spaced relationship on either side thereof through which gases entering the housing pass for the purpose of separating suspended dust particles.

In the present invention each collecting electrode plate 30 takes the form of two rectangular sheets 32 of semi-conductive or electrical resistance cloth, which are secured one to either side of a thin, flexible sheet 34 of a conductive material such as aluminum foil or the like. In the preferred form of the invention, the sheets 32 are flexible woven webs of asbestos. However, other filaments of fire and electrical resistant materials may be employed alone or in combination with asbestos to provide the flexible sheets 32. The asbestos webs 32, together with the conductive sheet 34 therebetween are all of substantially the same size and configuration and are secured

in lamination by a series of parallel spaced rows **36** of metallic stitching, staples or the like which extend longitudinally throughout the length of said laminated sheets.

Very satisfactory results have been obtained through the employment of asbestos cloth woven from 1/16 inch strands with 24 gauge aluminum foil as the conductive sheet between the two layers of the asbestos cloth.

This foregoing construction provides a unitary electrode plate of flexible structure having a semi-conductive or electrical resistance material on the outer faces thereof and a conductive material constituting the center layer of the three-layer lamination. Each of the electrode plates **30** is provided at spaced intervals entirely about the four edges thereof with metallic grommets **38** secured therethrough forming eyes for the reception therethrough of conductive hangers **40**. The hangers also engage about a rectangular frame **42**, of conductive material, to tautly suspend the collecting plate centrally within the frame. The frame, in turn, is supported at its lower ends on brackets **44** mounted on the inner walls of the housing chamber and at its upper end from a hanging bar **46** which is, in turn, supported from brackets **48** secured to the inner walls of the housing.

In the present disclosure, for the purposes of illustration only, the hanging members **40** are shown as elongated metallic loops. Each hanger has one end engaged through and in conductive contact with one of the conductive grommets penetrating said plate, and the second end being formed into a double coil **50** which provides for the resilient engagement thereof about the tubular frame **42**. The resilience of the hanging members **40** tends to tautly stretch the electrode plate **30** and support the same in dependent condition within the frame so that the surfaces thereof are flat and smooth providing highly efficient collection areas for precipitated dust particles and the like. The taut suspension of the cloth plate from the frame enables the setting up of high frequency vibrations throughout the flexible plate by conventional rapping of the supporting frame **42**.

Additionally, it is to be noted that the conductive center layer of the collecting plate is maintained in contact with the grounded frame **42** through the metallic grommets, which penetrate the plate and the conductive layer thereof, and the conductive hangers **40**. By the maintenance of these conductive contacts throughout the entire area of the collecting plate with the grounded housing, a highly efficient electrostatic separating field can be maintained between the discharge electrodes **24** and the collecting electrode **30**. It is to be additionally noted that in assembling the electrostatic elements of the precipitator the stitching lines **36**, particularly if metallic stitching or staples are used, should be aligned laterally of the treating chamber on a center line equidistant between the aligned rows of the discharge electrodes **24** laterally of the chamber so that maximum spacing is maintained between each discharge electrode and the closest rows of stitching on adjacent collecting plates to prevent arcing between said electrodes and said rows of stitching.

From the foregoing description it becomes evident that a new and improved collecting plate electrode for electrical precipitators has been provided which satisfies all of the objects and advantages heretofore set forth by presenting an electrode structure which is inexpensive, efficient, and easy to handle and mount within the separation field of a precipitator.

It is additionally evident from the foregoing disclosures that various modifications as to materials as well as to details of construction and arrangement could be utilized without departing from the scope and the spirit of the present invention, and no limitations are to be applied from the illustrative forms of the invention disclosed beyond those required by the prior art and the hereinafter appended claims.

I claim:

1. In an electrical precipitator, a collecting electrode including in combination a substantially rectangular frame of conductive material supported in said precipitator, sheets of a semi-conductive cloth centered within and spaced from said frame, a lightweight flexible foil of conductive material laminated between said sheets of cloth, conductive grommets secured in electrical contact with said laminated sheets at spaced intervals about and adjacent to the peripheral edge thereof, and conductive means providing an electrical coupling between said frame and said grommets.

2. The invention defined in claim 1 wherein the semi-conductive cloth comprises asbestos and said conductive foil comprises aluminum.

3. In an electrical precipitator in combination with spaced discharge electrodes, collecting electrodes in spaced relationship to the discharge electrodes, each collecting electrode comprising a grounded conductive frame, sheets of semi-conductive cloth located centrally within and spaced from said frame, a flexible lightweight foil sheet of conductive material laminated between said sheets of semi-conductive cloth, and electrically conductive members penetrating said laminated sheets and engaged about said frame suspending said sheets tautly within said frame to thereby provide a discharge path between said semi-conductive cloth and said frame through said foil sheet.

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