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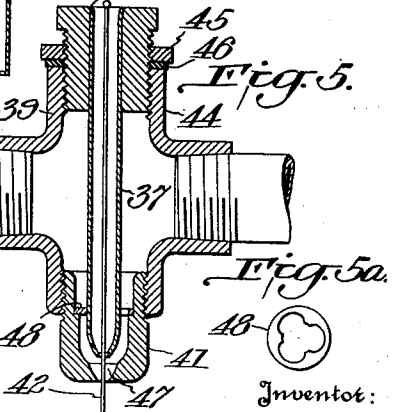
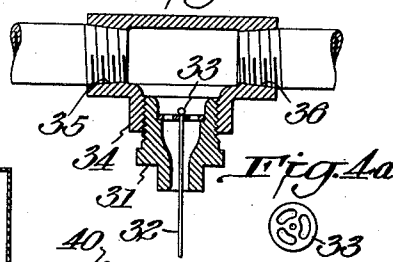
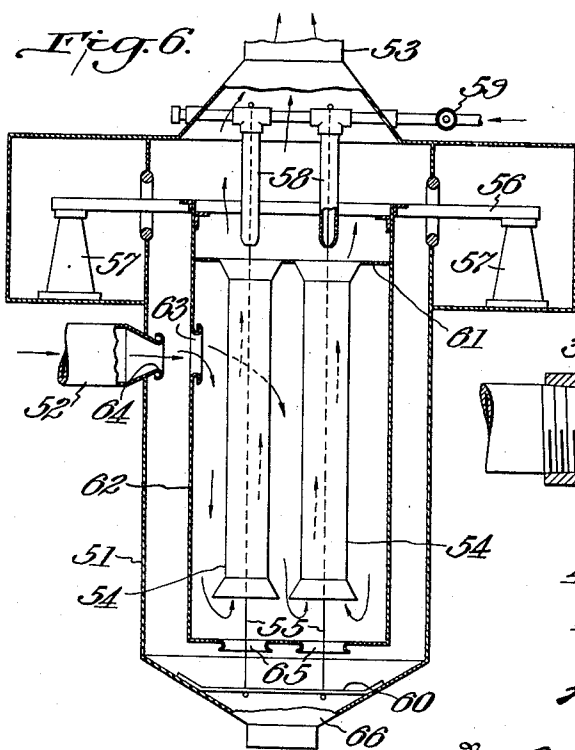
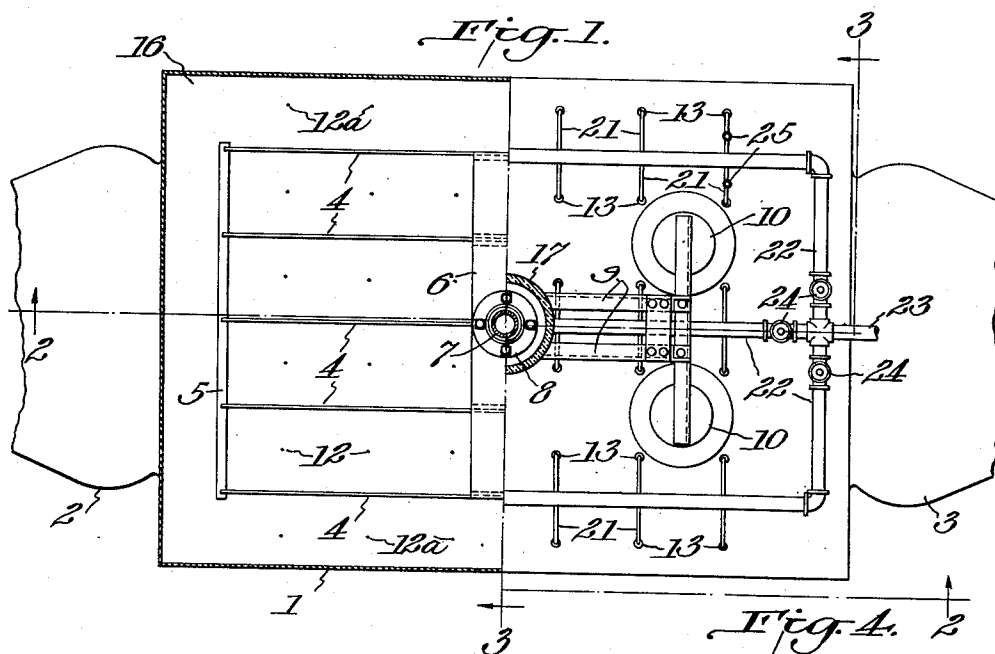
H. A. WINTERMUTE

1,959,752

LIQUID FLUSHING FOR DISCHARGE ELECTRODES

Filed March 9, 1932

3 Sheets-Sheet 1



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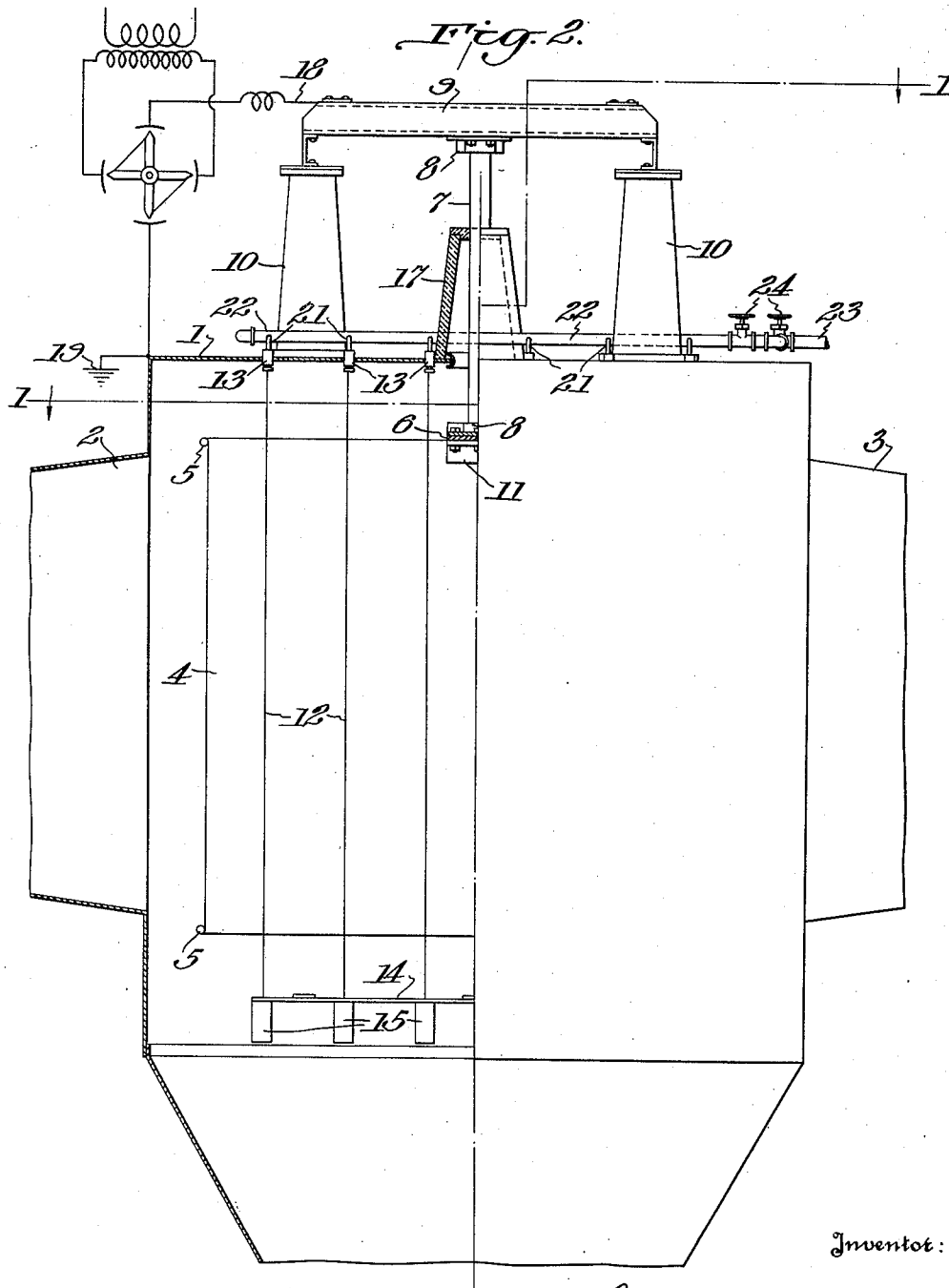
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3 Sheets-Sheet 2



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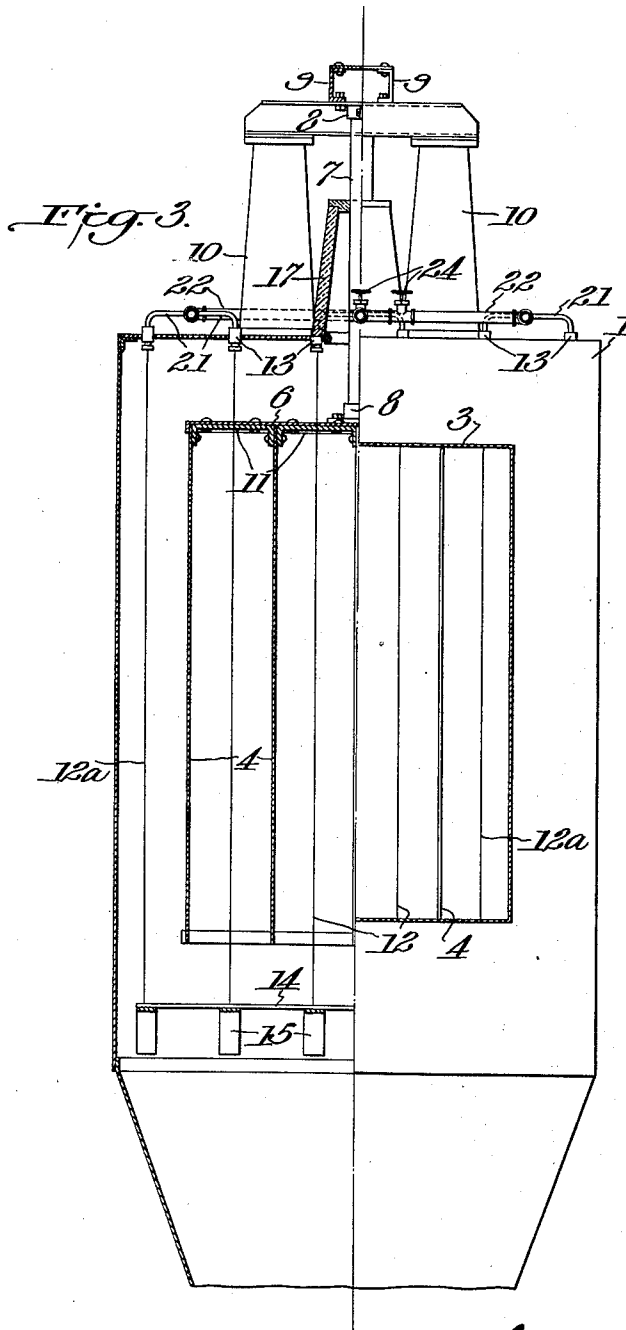
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LIQUID FLUSHING FOR DISCHARGE ELECTRODES

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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

1,959,752

LIQUID FLUSHING FOR DISCHARGE
ELECTRODES

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Application March 9, 1932, Serial No. 597,853

7 Claims. (Cl. 183-7)

This invention relates to apparatus and methods useful in the art of removing suspended particles from gases by electric discharges. The invention is especially applicable when it is found advantageous to supplement the use of electric discharges with liquid sprays and flushes. The main object of the invention is to provide means and methods whereby liquids can be supplied to the discharge electrodes of an electrical precipitator under controlled conditions. Another object is to supply the liquids from a source at ground potential and have the control means at ground potential also. Still another object is to supply the desired liquid at such pressure or velocity that it will pass rapidly down the discharge electrodes for a considerable distance before it is thrown off by the electrical forces existing between the discharge and collecting electrodes.

Liquids, for example water, have been used in electrical precipitators in various ways. Water has been sprayed into the gas to be treated previous to the entrance of the gas into the electrical fields to bring about cooling and humidification. Liquids have been flowed down the collecting electrode surfaces to carry away deposited material. Attempts have been made to flow water down the discharge electrodes.

Those attempting to have water flow down a discharge electrode have been confronted with the condition that the electrode was insulated from ground and maintained at high voltages, relative to ground potential, which made it difficult to apply water to the electrode. The common method has been to obtain the water from a source at ground potential, electrically, and have it fall through the air a suitable distance to be collected in a vessel connected to the high voltage discharge electrode. With clean water the distance it has to be dropped between the grounded part and the high voltage part is not excessive, but does add to the head room required when installing a precipitator. This method permits of a variation in head only to the extent that the collecting vessel for the water is raised above the discharge nozzles which direct the water down the discharge electrodes. A tall stand pipe above the precipitator receiving water dropped into it from a grounded supply pipe will, of course, furnish water at a pressure depending upon the height to which the water stands in the stand pipe. But this is not a convenient method. One of the most useful results secured by the present invention is that permitting the supply pipe to be directly connected to the distributing nozzles thus permitting easy control of

the pressure and the volumes of the water passed to the distributing nozzles and directed down the discharge electrodes.

When water is started down a discharge electrode at low velocity the electric forces pull or expel the water away from the discharge electrode and it is collected on the broad surfaces of the collecting electrode. Usually the water is thrown off the discharge electrode in its first foot of travel through the electric field. By the means of the present invention these difficulties can be largely overcome. The water can be projected down the discharge electrode at high velocity and can be made to move an appreciable distance before the electrical forces break it up into a spray and force it to the collecting surface. With this improved control which the present invention provides, discharge electrodes can be flushed with water sprays. Water in considerable quantity can be added to the gases as a mist and the collecting electrodes can be sufficiently sprayed with a water thus supplied to make them self-cleaning in the sense that the precipitated material will be collected as a sludge and will move by gravity to the hopper below the electrodes.

The manner in which the stated objects and other objects are accomplished can be easily understood after reference to the annexed drawings of illustrative embodiments of the invention.

In the drawings:

Figure 1 is a plan view partly in section, taken along 1-1 of Figure 2, showing the invention embodied into an electrical precipitator of the plate and wire type;

Figure 2 is a side view in partial section, taken along 2-2 of the apparatus shown in Figure 1;

Figure 3 is an end view in partial section taken along 3-3 of Figure 1;

Figures 4, 4a, 5 and 5a show details useful in carrying out the invention; and

Figure 6 shows a sectional elevation of a pipe type precipitator in which the invention is embodied.

In the precipitator shown in Figures 1, 2 and 3, the casing is designated by 1 with inlet 2 and outlet 3. The collecting electrodes 4 are flat plates spaced by cross members 5 and supported by a member 6 which in turn is suspended by pipe 7 with flanges 8 from framework 9 which is supported by high voltage insulators 10. Short channel members 11 space the plates along member 6 and furnish additional rigidity to that member. The discharge electrodes 12 are of small cross section, for example they may be small wires, and are positioned between the plates 4

in a relationship common to the plate type of precipitator. With the collecting electrodes insulated from ground and connected to a source of high voltage current, as indicated at 18, it is only necessary to connect the discharge electrodes to ground to secure a high potential drop between the two sets of electrodes. "Corona" discharges will emanate from the attenuated discharge electrodes and strong electric fields will extend across the gas passages causing the suspended particles to be charged and precipitated in the usual manner. The supports for electrodes 12 are shown as nozzles as indicated at 13. These nozzles, to be described in more detail later, are connected to a source of flushing liquid 23 which permits a stream of liquid, such as water, to flow down the electrode while the precipitator is energized electrically. A framework 14 is furnished to space the discharge electrodes at their lower ends and weights 15 maintain them taut. The discharge electrodes shown at 12a are for the purpose of furnishing a field on the outside of the collecting electrode assembly to collect any suspended matter which may be carried by gases which get around the outside of the assembly of the collecting electrodes. The inlet and outlet flues are so shaped and positioned that a minimum of gas flows through these outer passageways designated at 16. The support 7 for the collecting electrode passes through an insulating bushing 17 where it enters the casing 1. As the plates 4 are connected to a high voltage source through members 7 and 9, and conductor 18, it is necessary that proper insulation be provided between member 7 and casing 1, the latter being grounded as shown at 1f.

The amount of water to be supplied to each discharge electrode will depend upon the results desired. If it is desired to merely wash from the electrode the material which gradually collects upon it, an intermittent flush is all that is required in some installations, although a continuous flow is more effective. Where it is desirable that a considerable amount of water reach the collecting electrodes for the purpose of washing them free of the material precipitated upon them, the amount of water started down the discharge electrodes is advantageously from one-half a gallon to two gallons of water per hour per square foot of collecting electrode surface to be washed. The lesser value represents a very small amount of wash water—an amount that would be difficult to spread over the collecting electrodes by the jets or sprays commonly used for such purposes, but which are difficult to control when dispersing small amounts of liquids.

The flow of water can be controlled in a number of ways. A practical and useful manner of control is obtained through the use of valves in the supply lines. In Figures 1-3, valves 24 reduce the pressure in the main supply line to that desired in the branch lines 22 which supply the nozzles through individual supply lines 21. Valves can be placed in the lines 21, as shown at 25, if further control is desired. Another satisfactory control is secured by placing orifices of calibrated flow characteristics at the top of the discharge electrodes. A plug with such an orifice is shown at 31 in Figure 4. The orifice permits a constant supply at the desired rate to flow down electrode 32 when the water is supplied at a definite pressure. Different plugs with orifices of different diameter can be readily inserted into the T shaped fitting 34 which is attached to the supply line by means of pipe threads 35

and 36. A perforated centering disc 33, shown more fully in Figure 4a, supports the electrode 32 at its upper end without unduly restricting the flow of water to the orifice.

An orifice including an adjusting means is shown in Figure 5. The flow through the orifice 47 in plug 41 can be regulated by raising or lowering member 37 which is fastened at 40, say by brazing, to plug 38. This plug has a straight thread 39 which permits it to be turned to and left at any desired height, lock nut 45 and gasket 46 assisting in making the joint leak-proof. Member 37, which is raised or lowered when 38 is turned, is tapered at its lower end to match the inlet to orifice 47. This adjustment controls the flow of water through the orifice. Member 37 also functions to center electrode 42 and is itself centered by centering spider 48 shown more fully in Figure 5a.

The value of an adjustable nozzle such as the one just described will be apparent to those who have operated precipitators which make use of water sprays and flushes. When water flows from orifices and over exposed surfaces upon which the electric field terminates, it distributes differently when the electrical voltage is applied than when no difference of potential exists. A system having the water control means on the grounded side and having the control means easily adjustable permits the operator to note the results which may be obtained by varying the flow while the voltage is applied and gas is flowing through the precipitator.

The precipitator shown in Figure 6, which has pipes for collecting electrodes, includes casing 51, inlet 52, outlet 53, collecting electrodes 54, discharge electrodes 55, insulators 57 and insulated support for the collecting electrodes 56. The discharge electrodes, which may be wires, project from and are supported by nozzles 58. The nozzles may include an orifice such as that shown in Figure 4 in which case the pressure on the orifice is controlled by a valve in the water supply line as indicated at 59. The nozzles are grounded, electrically, and the bottom end of the discharge electrodes is connected to grounded member 60. Springs or weights can be used to keep the discharge electrodes taut. The collecting electrodes 54 are supported from a header plate 61 which depends from the insulated framework 56. This header plate is the top of inner casing 62 into which the gases to be treated are projected from inlet 52 which is provided with a nozzle 64 for that purpose. An opening 63 opposite the nozzle is of such size and is so positioned that it receives practically all the gases leaving nozzle 64, although nozzle and orifice must be spaced apart because they are at different potential. Openings 65 in the bottom of inner casing 62 permit the material which has been collected, often as sludge in this type of precipitator, to pass through into collecting hopper 66. The openings must be large enough to eliminate any chance of spark-over to the grounded discharge electrodes which pass through them, but they are not made any larger than necessary because they are not to present an easy outlet for the gases which, after entering opening 63, are to enter the bottom of pipe electrodes 54 and pass upwardly toward outlet 53 while being cleaned or treated. The space between casings 51 and 62, which are at different potential, cannot be closed except with insulating material and it is essential that the gases be not permitted to flow upwardly in this space 15

where, ordinarily, no effort is made to provide cleaning means.

It is understood that other embodiments of the invention will be apparent to those working in the art. Various types of nozzles can be used and the discharge electrodes can be fluted or given other shapes as well as the common round wire that finds extended use in the art. The nozzles themselves can be placed inside the gas chamber where there is less chance of freezing in cold weather and other departures from the invention as described will find useful applications and are within the scope of the invention which is not limited except as defined in the appended claims.

I claim:

1. Apparatus for electrically precipitating suspended particles from gases comprising in combination collecting electrodes connected to a source of high potential current, grounded discharge electrodes, and means for directing high velocity streams of liquid along said discharge electrodes.

2. Electrical precipitation apparatus for the removal of suspended particles from gases comprising a casing forming a gas passage, collecting electrodes connected to a source of high potential current and grounded discharge electrodes in said gas passage, conduits adapted to supply a high velocity stream of flushing liquid to said discharge electrodes.

3. Electrical precipitation apparatus for the removal of suspended particles from gases comprising a casing forming a gas passage, collecting electrodes connected to a source of high potential current and grounded discharge electrodes in said gas passage, conduits adapted to supply a high

velocity stream of flushing liquid to said discharge electrodes, and means for regulating the supply of liquid to said discharge electrodes.

4. In an electrical precipitation apparatus comprising high potential collecting electrodes and grounded discharge electrodes, an unbroken system of conduits connecting said discharge electrodes with a source of flushing liquids, said discharge electrodes being suspended in suitably located liquid discharge openings in said system of conduits.

5. In an electrical precipitation apparatus comprising high potential collecting electrodes and grounded discharge electrodes, a system of conduits connecting said discharge electrodes with a source of flushing liquids adapted to project high velocity streams of liquid along said electrodes.

6. Means for supplying a high velocity stream of flushing liquid to the discharge electrodes of an electrical precipitation apparatus comprising a system of conduits connected with a source of supply of flushing liquid, members suitably spaced in said conduits providing restricted discharge openings for said liquid, and means for suspending discharge electrodes in said openings.

7. Means for supplying a high velocity stream of flushing liquid to the discharge electrodes of an electrical precipitation apparatus comprising a system of conduits connected with a source of supply of flushing liquid, members suitably spaced in said conduits providing restricted discharge openings for said liquid, means for suspending discharge electrodes in said openings and means for adjusting the effective cross-section of said openings.

HARRY A. WINTERMUTE.

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