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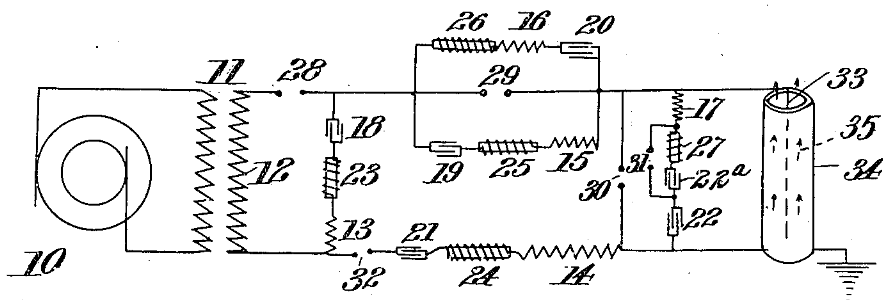
ART OF SEPARATING FINELY DIVIDED PARTICLES OF SOLIDS OR LIQUIDS FROM A GAS.

APPLICATION FILED FEB. 11, 1913.

1,120,561. Patented Dec. 8, 1914.

Fig. 1.



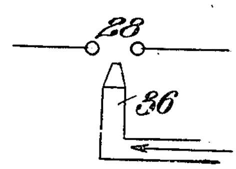


Fig. 2.

Fig. 3.

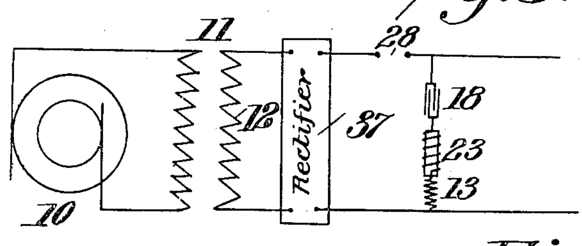
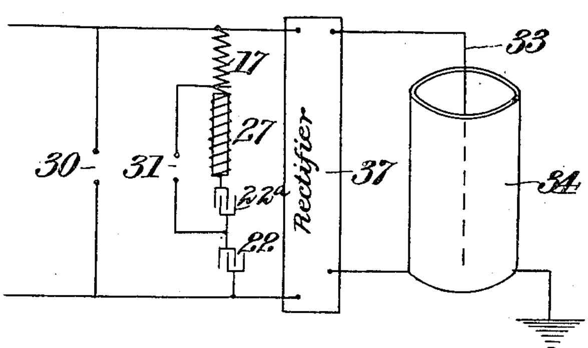


Fig. 4.



WITNESSES

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ART OF SEPARATING FINELY-DIVIDED PARTICLES OF SOLIDS OR LIQUIDS FROM A GAS.

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To all whom it may concern:

Be it known that we, WILLIAM WALKER STRONG and ARTHUR FLEMING NESBIT, citizens of the United States, residing at Pittsburgh and Wilkinsburg, respectively, in the county of Allegheny and State of Pennsylvania, have invented new and useful Improvements in the Art of Separating Finely-Divided Particles of Solids or Liquids from a Gas, of which the following is a specification.

This invention relates to the art of separating finely divided particles of solids or liquids, originally held in suspension in bodies of gas, vapor or liquid, by the application of electrical discharges to said gases, vapor or liquids.

It has long been known that when a wire is placed coaxially within a metallic cylinder and these two elements maintained at a high difference of potential, a luminous discharge will take place from the wire, the difference of potential being kept constant or at least not changed more rapidly than is customarily the case in the present use of commercial alternating currents. This discharge is known as the "corona" discharge and the luminosity only extends a comparatively short distance from the active wire. This corona discharge may be utilized in the precipitation of suspended matter and liquid particles from the bodies containing the same.

Experiments have been described where it is claimed that fogs, fumes, smoke, etc., have been dispelled by the use of active electrodes in the vicinity of the suspended particles. This may be attributed to the action of electromagnetic waves. Presumably these waves produce a polarization and an aggregation of the particles suspended in the gas, vapor, or liquid. After any considerable aggregation has taken place, the particles will settle by the action of gravity.

In the use of an ordinary high tension alternating current corona discharge, we have found that under certain conditions the luminous region about the active electrode may be greatly extended by the introduction of a spark gap in series with the active or grounded electrode. The effect of the introduction of such a spark gap is used in wireless telegraph practice for the purpose of introducing high frequency oscillations upon antennae circuits. It is well known that the frequency and damping factor of these oscillations depend upon various characteristics of the circuit including the momentary values of the resistance, the capacity and the self induction. It is therefore seen that the secondary ionization and the ionic currents of the corona may be increased by the use of a spark gap in the high tension circuit and the aggregating action of the discharge is also increased. The insertion of even a single spark gap in series with the high voltage circuit gives a very appreciable effect upon the precipitation produced. The length of the gaps and their positions relatively to circuits shunting them as shown in Fig. 1 are factors which enable a nicety of adjustment of the electrical circuits for the purpose of controlling the precipitation. These facts have been determined by actual experiment. We have also found that contrary to the usual view, iron cored inductances may be used to exert a very noticeable adjustment of the circuits.

The object of the present invention is to utilize the foregoing phenomena in connection with the separation of suspended particles from the bodies containing the same.

Reference has been made above to active and grounded electrodes and the same terms are also hereinafter employed. By an active electrode we desire to have it understood that we refer to any electrode at which the intensity of the electric field is very great. Any electrode at which the intensity of the electric field is comparatively weak, is the grounded electrode. In the case of a wire suspended within a cylinder, the wire would be the active electrode, and the cylinder would be the grounded electrode, there being a great difference of electrical potential between the wire and the cylinder.

The invention will be hereinafter fully set forth and particularly pointed out in the claims.

In the accompanying drawing: Figure 1 is a diagrammatic view illustrating means for carrying out our invention. Fig. 2 is a diagrammatic view illustrating one of the spark gaps. Figs. 3 and 4 are detailed views illustrating different locations of a rectifier.

Referring to the drawing, 10 designates a generator of any suitable or preferred type, the voltage of which is stepped up by a transformer 11. A suitable and convenient source of current is a single phase 110 volt, 60 cycle alternating current, and the voltage on the high tension side of the transformer is ordinarily in the neighborhood of 30,000 effective volts, the voltage depending upon the form and size of the active and grounded electrodes and the distance between these electrodes. Besides the resistance, capacity and self-induction of the secondary coil 12 of the transformer itself, certain combinations of resistances 13, 14, 15, 16, 17, capacities 18, 19, 20, 21, 22 22^a, self-inductances 23, 24, 25, 26, 27, and spark gaps 28, 29, 30, 31 and 32, are distributed in the secondary circuit so that under working conditions electromagnetic oscillations of the proper frequency and damping factor are produced. These resistances, capacities, and self inductances and spark gaps are placed in whatever parts of the circuit found most suitable or desirable for the results desired. We do not limit ourselves to a general distribution of resistances, inductances, capacities and spark gaps as shown in Fig. 1, and we also, under certain circumstances, employ the spark gap as a high non-inductive resistance. The active electrode 33 is illustrated in the form of a wire held coaxially within a cylinder 34 forming the grounded electrode, and the suspended matter to be removed is represented as flowing in the direction indicated by the arrows 35. If desired, the spark gaps may be subjected to the action of an air blast delivered by a pipe 36 (see Fig. 2), so, as to keep up the resistance of the spark gap. Any other means for preventing a flame discharge between the knobs of the spark gap may be used.

The grounded electrode 34 is shown to be the collecting electrode, in the drawing, the object of making it such being to minimize the amount of insulation necessary for the bulky parts of the electrodes and at the same time properly control the flow of gases etc., which may be admitted. The electrode 33 is called the active electrode because the electric field and consequent ionization is most intense at the surface of this electrode.

If desired, a rectifier 37 of any preferred type may be placed in the circuit between the coil 12 of the transformer and the resistances, spark gaps, etc., as illustrated in Fig. 3, or the same may be located between the resistances, spark gaps, etc., and the electrodes 33, 34, as illustrated in Fig. 4 or in any other convenient part of the circuit. The position of the rectifier, as in Figs. 3 and 4 respectively, will depend upon the use of open cored or iron cored inductances in the circuits. Even a small amount of laminated iron in the cores gives a noticeable change in the sparking at the gaps of the rectifier.

It is understood that the drawings are illustrative only and that we do not desire to limit ourselves to the particular system illustrated, as many other methods for producing high frequency currents of different periods and different damping factors can be utilized as will at once be obvious to those skilled in the art of producing current and electromotive force oscillations in electrical circuits. For instance the generator 10 could be so constructed as to give high frequency currents. Singing arcs, Poulsen and Duddell arcs, mechanical interruptors or vibrators, quenched arcs, etc. and various other well known methods may be used in any suitable part of the primary or secondary circuits and are included in the spirit of our invention. That is to say, the peculiar property possessed by an electric arc, that the potential difference across its terminals increases as the current through it decreases, may be utilized to produce electrical oscillation. Duddell, for instance, to produce his singing arc, employed an electrical circuit including a D. C. generator connected to the arc through inductances, the arc being shunted by a suitable oscillating circuit. The alternate expansions and contractions of the volume of the incandescent vapor of the arc is changed in unison with the variations of the current, thus causing the arc to emit a persistent musical note, the pitch of which depends upon the value of the capacity and inductance, the resistance in all cases being kept low. By varying the value of either of the inductance or capacity, or both, the current may be varied at will. The currents flow in and out of the condenser and pass through the arc and alternately strengthen and weaken the previously constant current. In the Poulsen system of providing persistent trains of waves, the electrical circuits are identical with those of Duddell, except that the arc is inclosed in an atmosphere of coal gas or hydrogen.

We claim as our invention:

1. An improvement in the art of separating suspended particles from gaseous or liquid bodies comprising subjecting said bodies to the action of an electric field between electrodes maintained at a high difference of electrical potential by a source of current and electromotive force which are oscillatory in nature and of high frequency and in which the amplitude and damping of the oscillations are controlled.

2. An improvement in the art of separating suspended particles from gaseous or liquid bodies comprising subjecting said bodies to the action of an electric field between electrodes maintained at a high difference of electric potential by a source of

current and electromotive force which is oscillatory in nature and of high frequency, and controlling the amplitude and damping of the oscillations by predetermined and adjustable values of resistance, self inductance and capacity.

3. An improvement in the art of separating suspended particles from gaseous or liquid bodies comprising subjecting said bodies to the action of an electric field between electrodes maintained at a high difference of potential oscillatory in nature and in a circuit which has one or more spark gaps.

4. An improvement in the art of separating suspended particles from gaseous or liquid bodies comprising subjecting said bodies to the action of an electric field between electrodes maintained at a high difference of electric potential by a source of current and electromotive force which is oscillatory in nature and of high frequency, and controlling the amplitude and damping of the oscillations by predetermined and adjustable values of resistance, self inductance and capacity, and one or more spark gaps.

5. An improvement in the art of separating suspended particles from gaseous or liquid bodies comprising subjecting said bodies to the action of an electric field between electrodes maintained at a high difference of potential oscillatory in nature and included in a circuit which has a spark gap and preventing a flame discharge in said spark gap.

In testimony whereof we have hereunto set our hands in presence of two subscribing witnesses.

WILLIAM WALKER STRONG.
ARTHUR FLEMING NESBIT.

Witnesses:
THOMAS S. CAIN,
W. J. MOORE.