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AUTOMATIC REGULATING APPARATUS FOR ELECTRICAL PRECIPITATION SYSTEMS.

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1,120,560. Patented Dec. 8, 1914.

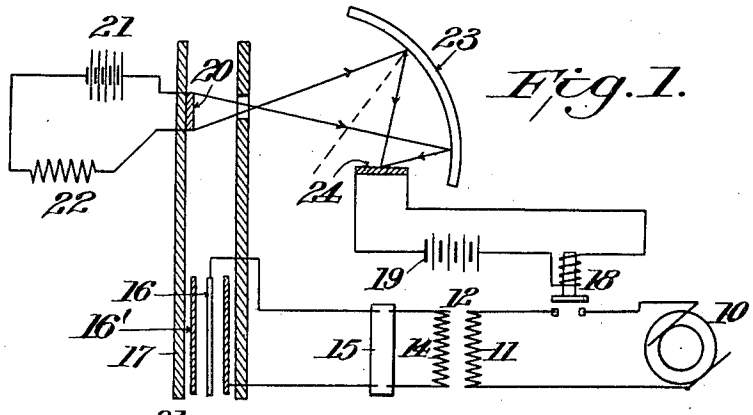


Fig. 1.

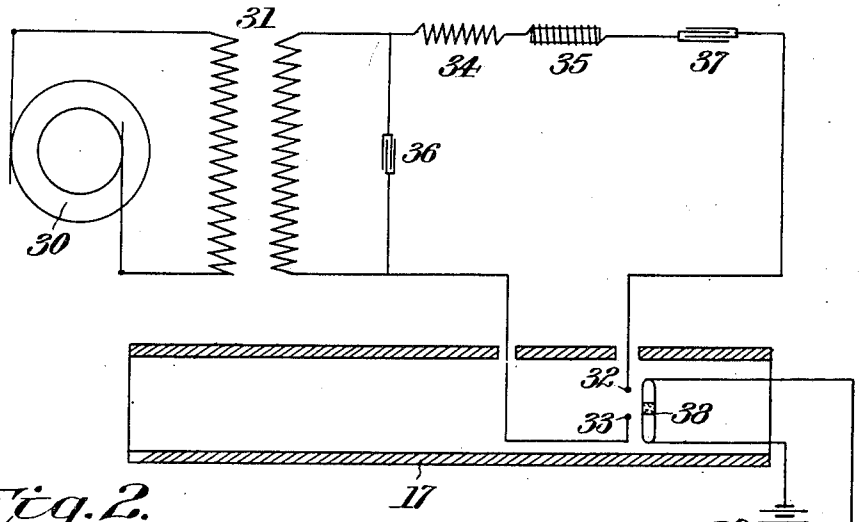
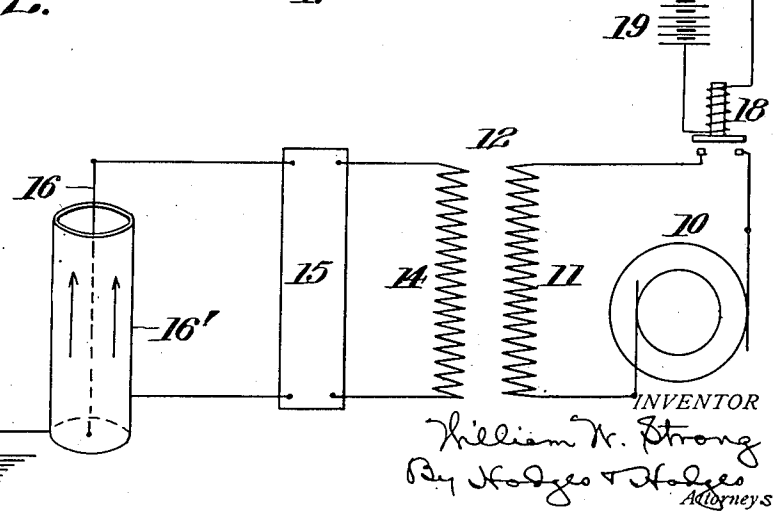


Fig. 2.



WITNESSES

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AUTOMATIC REGULATING APPARATUS FOR ELECTRICAL PRECIPITATION SYSTEMS.

1,120,560. Specification of Letters Patent. Patented Dec. 8, 1914.

Application filed February 11, 1913. Serial No. 747,785.

To all whom it may concern:

Be it known that I, WILLIAM WALKER STRONG, a citizen of the United States, residing at Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented new and useful Improvements in Automatic Regulating Apparatus for Electrical Precipitation Systems, of which the following is a specification.

This invention relates to an automatic regulating apparatus for electrical precipitation systems.

It is well known that various electrical methods have been used for the precipitation of suspended solid and liquid matter from gases and fluids. The method used for this precipitation may depend in part upon the action of the varying electromagnetic field upon the particles, be the suspended particles charged or not. If the particles are not charged, then their dielectric and magnetic properties may affect the action of the electromagnetic field. If the particles are charged and nonmagnetic, then the action of the electric field is the more important. If the particles are magnetic, the effect of the magnetic field may be of importance. In practice it is the custom to charge the suspended particles, the method of charging employed being dependent upon the formation of a brush, corona or similar discharges of high tension electricity. For this purpose two electrodes may be used, the one near the surface of which the electric field is very intense, being the active electrode, and the one near which the electric field is comparatively weak, being the grounded electrode. The production of a brush or corona discharge results in the loss of a considerable amount of electrical energy, the loss varying with the area of active electrode surface used. This loss of energy takes place whether suspended particles are present or absent in the gas or fluid and in some cases I have found this loss of energy to be greater when no suspended particles are present at all.

The primary object of the present invention is to provide an apparatus that will throw on the high tension electric current used for separating the suspended particles from the fluid or gaseous bodies only when suspended matter of a certain density exists in these bodies. An apparatus of this type is particularly useful in cases where the density of the suspended matter varies greatly at different times. This applies particularly to the electrical precipitation of smoke, since the density of smoke in tunnels, stacks, round houses, etc., varies greatly, being very small or even entirely absent at times, and at other times being very dense. Many city ordinances forbid the production of smoke of a certain density, say a density greater than No. 2 on the Ringleman scale. It might, therefore, only be necessary to apply the precipitating electrical current when the density of the smoke was greater than No. 2 according to this scale. Cases similar to this arise in the precipitation of various kinds of dust, fumes, smoke, etc.

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 my invention. Fig. 2 is a similar view illustrating a modification.

There are various means that may be employed to secure the regulation of precipitating apparatus as contemplated by my invention. For instance, if a source of constant light intensity is placed in or near the region of the suspended matter, and a beam of light is directed through the matter, some of this light will be absorbed or scattered by the suspended matter. The amount of light thus absorbed will depend upon the quantity and distribution of the suspended matter in the region of the beam of light. It is obvious that other sources of radiation such as those of electromagnetic waves, ultraviolet light, restrahlen or radiant heat, might be used in a like manner. Situated in a suitable position to receive this radiation of light, radiant heat or electromagnetic waves is a suitable receiving device such as a thermopile, selenium cell, coherer, or the like, the nature of the receiving device depending upon the kind, intensity and variation in the said radiation. In the use of optical devices a great deal of trouble is experienced in practice due to the formation of deposits of the suspended matter on the various surfaces through which the radiation may pass. I have succeeded in overcoming some of these difficulties by using a Nernst glower placed in the region of the suspended material. No deposition forms upon the glower so that the intensity of the

beam of radiation is independent of the deposition of matter upon surfaces near the source of said radiation.

In the present case I have illustrated two forms of apparatus embodying my invention. These illustrations are typical, however, and show the generality of the spirit of my invention. It will be understood therefore, that I do not desire to limit myself to the exact forms shown and described.

Referring to the drawing, 10 designates a generator of any suitable or preferred type, and 11 is the primary low potential circuit of a transformer 12. The high potential coil 14 of the transformer may be connected with a rectifying device 15 of any preferred construction, the same being employed to maintain the potential of the active electrode unipolar. It will be understood, however, that the rectifier may be omitted without departing from the spirit of my invention. The grounded electrode 16 is illustrated as cylindrical in form and located in the stack or conduit 17 through which the smoke passes. The current to the generator 10 is controlled by a suitable relay 18 controlled by the circuit from a battery 19.

Located within the stack or conduit 17 is a Nernst glower, diagrammatically illustrated at 20, connected with a source of potential 21 through the proper resistance 22. The radiation from the Nernst glower passes through the gases in conduit 17 and is then focused by a concave mirror 23 upon any suitable device that will respond to variations in the intensity of the glower 20 as resulting from the absorption of light and heat by the smoke, fumes or dust that may be present in conduit 17. A device of this kind is conventionally illustrated at 24 and may consist of a radiomicrometer, a selenium cell, etc., the same being connected up with the battery 19, as illustrated. In operation, the variations in the intensity of the radiation from the Nernst glower 20 causes a variation in the current in the absorbing device 24, battery 19 and relay 18, proportional to the amount of suspended matter passing through the conduit 17. When the density of the suspended matter has reached a certain value the relay 18 will be operated to throw on the current to the generator 10, whereupon precipitation of the suspended particles takes place at the electrodes 15 and 16, and the latter remain active until the density of the suspended particles passing through conduit 17 is sufficiently reduced to cause the relay to cut out the generator 10.

In Fig. 2, I have illustrated my invention in the form of an apparatus for producing electromagnetic radiations. In this form of the invention I provide a generator 30 and a transformer 31, and electrodes 32, 33 arranged within the conduit 17 to form a spark gap, said electrodes being connected with the high potential coil of the transformer through the proper amount of resistance 34, self-inductance 35, and condensers 36, 37. A wireless telegraph coherer 38 is located so as to receive electromagnetic radiations that may be emitted by the said gap and controls the circuit of the battery 19. If R represents the resistance of the whole circuit including the spark gap 32, 33, L the total self induction, and C the total capacity, then the theory of the discharge at present accepted indicates that the discharge will be oscillatory when $R^2/_4L^2$ is greater than $\frac{1}{LC}$, the values of C, L and R being instantaneous ones. In other words, it is a well known fact that the conditions necessary for the production of electric oscillation in a circuit are that (1) the discharge shall be very sudden, as in the case of a spark; and (2) the self induction shall bear a definite relation to the resistance and capacity of the circuit. That is, oscillations occur when

$$R<2\sqrt{\frac{L}{C}}.$$

When this is the case, the frequency N of the oscillation is

$$2\pi\sqrt{\frac{1}{LC}-\frac{R^2}{4L^2}}$$

or, if R^2 is negligible compared with $\frac{4L}{C}$ N becomes

$$\frac{1}{2\pi}\sqrt{\frac{1}{LC}}$$

and the period

$$T=2\pi\sqrt{LC}.$$

If the conditions

$$R>2\sqrt{\frac{L}{C}}$$

exist no electric oscillations can be obtained, and the discharge becomes a periodic one. It is quite evident that a change in the character capacity of the gases or fluid medium between the discharge knobs of the spark gap, automatically varies the ohmic resistance R of this gap, and changes the value of R in the expression

$$R<2\sqrt{\frac{L}{C}}.$$

Hence it is seen that the electric oscillation may be produced by a proper adjustment of the values L and C to accompany the variations produced in R. The electric circuit is one for which C, L and R have been predetermined so that the presence or absence of suspended matter between the electrodes 32, 33, determines whether the discharge between said electrodes is oscil-

latory or not. The circuit from the generator 30 to the electrodes 32, 33 is so constructed that a flammatory discharge may be produced between said electrodes when the bodies passing through the conduit 17 contain no suspended matter, or at least suspended matter of less than a predetermined density. Under these conditions little or no electromagnetic radiation of high frequency is emitted by the discharge. When the amount of the suspended matter exceeds the predetermined value, the discharge between the electrodes 32, 33 become oscillatory and electromagnetic radiations of high frequency are emitted. The apparatus for absorbing electromagnetic waves illustrated at 38 may be a coherer such as is used in wireless telegraphy for the detection of electromagnetic waves of high frequency. When there is no radiation, or at least a comparatively weak electromagnetic radiation from the oscillatory discharge between the electrodes 32, 33, no current flows in the circuit 19, 38, 18. When there is suspended matter present in the conduit 17 electromagnetic radiations of high frequency are emitted by the electrodes 32, 33, and the coherer 38 becomes a comparatively good conductor due to the absorption of the electromagnetic radiations from 32, 33 whereupon the relay 18 is operated in an obvious manner.

Having thus explained the nature of my invention and described an operative manner of constructing and using the same, although without attempting to set forth all of the forms in which it may be made, what I claim is:—

1. An improvement in apparatus for removing suspended matter from bodies containing the same, comprising a conduit, a source of radiation within said conduit past which and in contact with which said bodies are caused to travel, and means for detecting changes in the intensity of the radiation due to variations in the density of the suspended matter.

2. The combination with means for separating suspended matter from bodies containing the same, of a conduit, a source of radiation within said conduit past which and in contact with which said bodies are caused to travel, means for detecting changes in the intensity of the radiation due to variations in the density of the suspended matter, and means controlled by said detecting means for governing the operation of said separating means.

3. An improvement in apparatus for removing suspended matter from bodies containing the same, comprising a conduit, a source of radiation within said conduit past which and in contact with which said bodies are caused to travel, and a selenium cell for detecting changes in the intensity of the radiation due to variations in the density of the suspended matter.

4. As an improvement in apparatus for separating suspended matter from bodies containing the same, a regulating apparatus comprising a conduit through which said bodies are caused to travel, a source of light within said conduit and arranged to direct radiation through the bodies containing the suspended matter, means for detecting changes in the intensity of the radiation due to variations in the density of the suspended matter, and a curved mirror for directing the rays of light upon said detecting means.

5. The combination with means for separating suspended matter from bodies containing the same, and a controlling device therefor, of a conduit, a source of radiation within said conduit past which and in contact with which said bodies are caused to travel, means for detecting changes in the intensity of the radiation due to variations in the density of the suspended matter, and means controlled by said detecting means for operating said controlling device.

6. The combination with an electrical apparatus for removing suspended matter from bodies containing the same, of a conduit through which said bodies are caused to travel, a source of light radiation within said conduit, means for causing suspended matter to absorb radiation emitted by said source, a local circuit, means in said circuit for detecting changes in the intensity of the light radiation due to variations in the density of the suspended matter, and a relay in said local circuit and controlling said separating apparatus.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

WILLIAM WALKER STRONG.

Witnesses:
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ARTHUR FLEMING NESBIT.