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PROCESS AND APPARATUS FOR CAUSING PRECIPITATION BY COALESCENCE OF AQUEOUS PARTICLES CONTAINED IN THE ATMOSPHERE.

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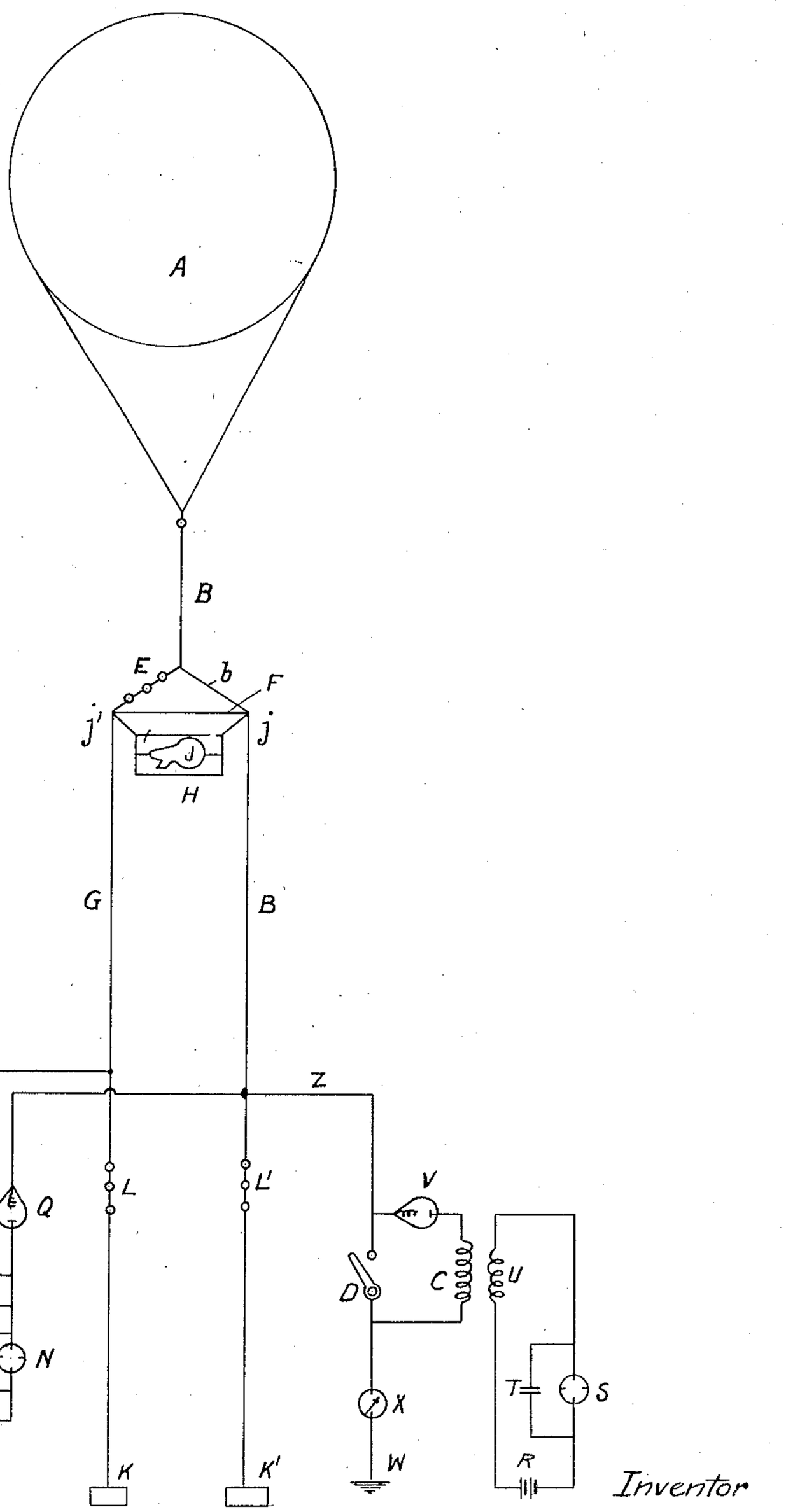
1,279,823. Patented Sept. 24, 1918.



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PROCESS AND APPARATUS FOR CAUSING PRECIPITATION BY COALESCENCE OF AQUEOUS PARTICLES CONTAINED IN THE ATMOSPHERE.

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Application filed June 22, 1916. Serial No. 105,204.

To all whom it may concern:

Be it known that I, JOHN GRAEME BALSILLIE, subject of the King of Great Britain and Ireland, residing at 51 Spring street, Melbourne, in the State of Victoria, Australia, have invented new and useful Improvements in Processes and Apparatus for Causing Precipitation by Coalescence of Aqueous Particles Contained in the Atmosphere, of which the following is a specification.

This invention consists in electrical means for assisting and promoting, under suitable meteorological conditions, formation of aqueous particles in the atmosphere and assisting and promoting the deposition of aqueous particles from the atmosphere; and it includes apparatus for producing the necessary electrical conditions for that purpose.

Ions may act as nuclei upon which in certain conditions aqueous vapor will condense. Aqueous particles comprising a cloud or fog or mist are invariably electrified by natural causes, and though their electrification is of one sign, the potential distribution throughout the mass is uneven. Aqueous particles of approximately equal dimensions and potential naturally repel each other.

Nuclei upon which vapor condensation may take place may be created by ionizing the atmosphere, and if the normal condition of mutual repulsivity of charged aqueous particles is altered to a condition of mutual attractivity, coalescence of such aqueous particles is assisted.

Practical operative means and apparatus hereinafter described have been devised by me for the purpose of assisting and promoting under suitable meteorological conditions the formation of aqueous particles in the atmosphere and assisting and promoting the coalescence of aqueous particles contained in the atmosphere into larger aggregates, thereby occasioning their deposition as rain.

The invention is susceptible of practical use only when the cooling of aqueous vapor resulting from its expansion in elevated regions of the atmosphere and other natural influences brings the vapor above saturation point so that condensation is possible.

With the object of providing nuclei upon which aqueous vapor may condense, I ionize an accessible zone of the atmosphere by means of suitable ray emanations, and simultaneously, with the object of procuring in effect a condition of mutual attractivity between the aqueous particles in said zone, I establish and maintain in said zone a condition of electrification of opposite sign to that naturally acquired and possessed by the aqueous particles contained therein. The aqueous particles thus become possessed of a charge of opposite sign to that which they originally had. This charge of opposite sign, however, is not and can not be communicated instantaneously to all the particles in said zone. The particles in close proximity to the source of electrification are rapidly charged by electrostatic induction with a charge of opposite sign to that which they originally possessed. This inversion of sign of charge is gradually communicated to all the particles in said zone in an ever-expanding circle, about the source of electrification as a center. At the perimeter of the circle of impressed electrification, at any instant, a condition exists whereby particles in close proximity to each other are possessed of electrical charges of opposite sign. Such particles consequently attract each other, coalesce, and then fall, under the influence of gravity.

In carrying out my invention, a captive balloon is most conveniently used to support certain electrical apparatus which must necessarily be operated in the region to be tapped. The apparatus for generating electrical energy necessary for operating such apparatus is located on earth and connected to the suspended electrical apparatus by conductors which serve as leashes or anchor lines for the balloon. Instead of a balloon, a kite or other air borne support may be used.

Röntgen rays are preferably used to effect ionization of the atmosphere, the Röntgen tube being supported from the balloon in such a manner that its rays are directed on to a metallic surface preferably carried as a coating on the ballon envelop. Ultra-violet rays are also operative for the same purpose, but are of little practical use, as they produce practical ionization effects only when reflected from a fluorescent surface. Ultra-violet rays may be projected by an electromagnetic projector, but this method of utilizing electrical energy to produce ionization is inefficient for my purpose, because of the fact that rays which

possess high ionizing values are low in penetrative power.

To effect electrification of the ionized zone of atmosphere, a condition of high electrical potential of one sign is maintained on a conductive surface of large area surrounding the balloon, or on such a surface suspended from the balloon. The potential used is of the order of 320,000 volts.

In the accompanying explanatory drawings A is a captive balloon constructed of rubberized silk and coated externally with a metallic surface, as by painting with a metallic paint. Its buoyant capacity is sufficient to support the pendent parts hereinafter referred to. The leash B is a flexible wire, the upper end of which is in good electrical contact with the metallized surface of the balloon A. The lower end of the leash B is grounded through the secondary C of an induction coil and may also be grounded through a shunt containing a short-circuiting switch D. E is a strain insulator, which, with the part *b* of the leash B, supports a gaff F of insulating material immediately below the balloon, the upper end of the lower length of the leash B being attached to one end of the gaff F. A flexible conductor G, which also forms a leash for the balloon A, depends from the end of the gaff F. H is a box constructed of oiled silk on a light frame and forming a protective case for a powerful Röntgen ray tube J, the terminals of which are connected at *j* and *j'* to the conductive leashes B and G. The tube J is so hung that its rays are directed toward and impinge upon the metallized surface of the balloon envelop. The lower end of the conductor G is secured to an earth anchor K through strain insulators L, and similarly the lower end of the conductor B is secured to an earth anchor K' through strain insulators L'.

The energizing apparatus comprises electrical devices for supplying appropriate current to the Röntgen tube J and for charging the conductive surfaces supported by the balloon A with electricity under high potential.

M is a suitable source of electric current, N a circuit breaker or interrupter, O a condenser, and P and P' the primary and secondary of an induction coil of a type suited for operating the Röntgen tube J. Q and Q' are current valves of known type operating to permit only unidirectional discharges or flow of current through the tube circuit. The outer terminals of these valves are electrically connected to the conductors B and G respectively. R is a source of electrical current, S a circuit breaker or interrupter, T condenser, U and C primary and secondary of a transformer, V current valve, W earth, X recording instrument, D by-pass earthing switch, Z line connection from the outer terminal of the valve V to the conductor B.

If the grounding switch D is closed, any static charge in the neighborhood of the balloon is conveyed to earth, an indication being obtained on the recording instrument X. When the switch D is opened and the power circuit M closed, the air surrounding the balloon for a radius of 200 to 300 feet, more or less, is endowed with conductive qualities as a result of the emanations from the tube J. When the power circuit R is closed a charge is imparted to the air through the conductor B and the metallized surface of the balloon.

Other known means distinct from those herein particularly described and illustrated may be used to produce high tension unidirectional electricity. For instance, there may be substituted for the generator and valve transformer a known type of static machine in which high pressure jets of condensing steam strike a metallic funnel and impart to it an electrical charge acquired by the minute water drops in making frictional contact with the walls of the non-conducting nozzles through which they are blown. In this case a control length of the conductor is supported parallel with earth on insulated poles. In this control length two choke coils are included, and between these coils a safety by-pass to earth through an adjustable spark gap is provided. The conductor may form the balloon tail rope if insulated at the foot, from earth.

The lower part of the conductor includes choke coils proportioned to check electrical oscillations and to prevent injury to the plant by lightning discharges, and safety spark gaps are provided to allow overflow charges to shunt to earth. The Röntgen ray tube is supported as previously described herein.

According to the observed meteorological conditions, two or more operating stations as above described may be used in coöperation, these stations being located at greater or less distances apart. In operating them the degree and sign of the charges used therein respectively may be varied.

The balloon functions only as a support for the parts mounted on and pendant from it. Under favorable conditions, a box kite or other air-borne support is usable instead of a balloon.

What I claim as my invention and desire to secure by Letters Patent is:

1. A process for assisting and promoting formation of aqueous particles in a zone of the atmosphere, and assisting and promoting the deposition of aqueous particles from said zone of the atmosphere, by electrical agency, consisting in providing nuclei in said zone upon which aqueous vapor may condense, and simultaneously establishing a condition

of mutual attractivity between aqueous particles in said zone, thereby effecting their coalescence and deposition.

2. An apparatus of the class described, comprising a conductor of relatively large area, means for supporting said conductor in elevated regions of the atmosphere, and a Röntgen ray tube so located with respect to said conductor so that its rays are directed on the surface of said conductor.

3. A process for the purposes set forth, consisting essentially in ionizing a zone of the atmosphere and simultaneously establishing a powerful electric field therein.

4. Apparatus for the purposes set forth, comprising a captive balloon, an extensive conductive surface supported by said balloon, a conductor pendent from said balloon and electrically connected to said surface and to a source of rectified high tension energy, a Röntgen ray tube, and conductors connecting said tube to another source of high tension electrical energy.

5. Apparatus for the purpose set forth, comprising a plurality of electrical stations capable of simultaneous operation, each of said stations comprising means for ionizing elevated regions of the terrestrial atmosphere and concurrently establishing and maintaining a powerful electric field in said ionized region.

6. An apparatus of the class described, comprising a conductor of relatively large area, means for supporting said conductor in elevated regions of the atmosphere, a Röntgen ray tube so located that its rays are directed on the surface of said conductor, a source of energy for said tube, and means for charging said conductor with unindirectional electrical energy at a high potential.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN GRAEME BALSILLIE.

Witnesses:
S. F. H. Laws,
J. M. S. Quin.