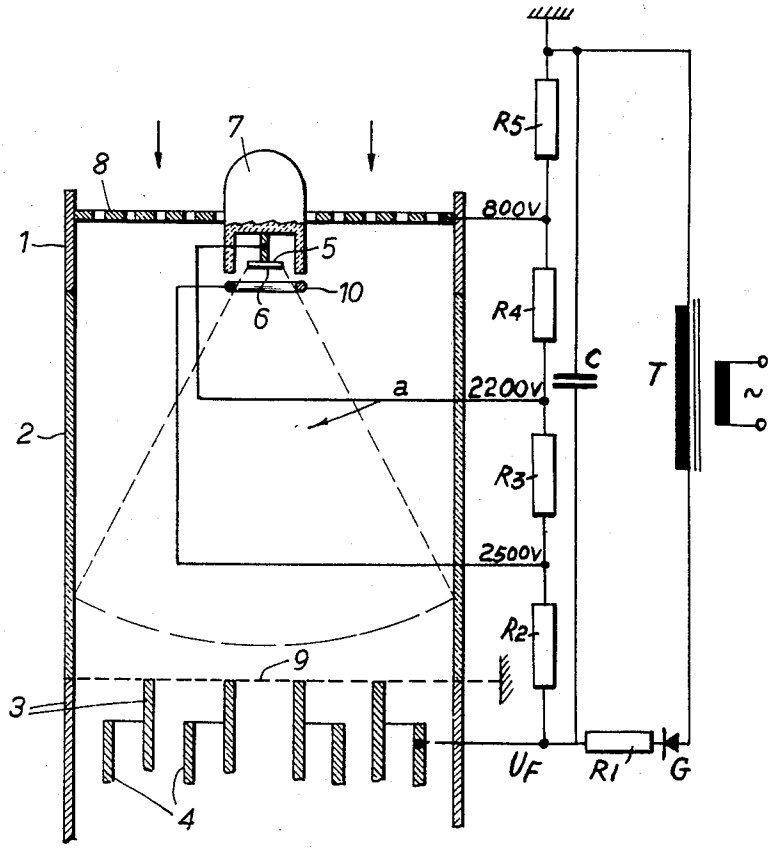
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APPARATUS FOR ELECTRICALLY CHARGING PARTICLES SUSPENDED IN AN AIR CURRENT BY MEANS OF RADIOACTIVE PREPARATIONS

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APPARATUS FOR ELECTRICALLY CHARGING PARTICLES SUSPENDED IN AN AIR CURRENT BY MEANS OF RADIOACTIVE PREPARATIONS

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The invention relates to an apparatus for electrically charging suspended matter, floating in an air current, with ions of the same polarity by using one or more radioactive preparations together with an electric field, in order to produce optimum loading conditions. Such an apparatus has at least one radioactive preparation, which is arranged on an electrically conductive support and the ray-emitting layer of which is remote from the air current, a potential difference being produced between the conductive support of the preparation, impressed with a voltage by means of a direct current source, and at least one counter-electrode, which is arranged outside of the range of the ionizing rays and the effective cone of rays.

It has been found that the electric field produced by means of the conductive support of the preparation and the counter-electrode exerts a certain separating effect upon already charged particles suspended in the air current, that means that particles, charged with a polarity opposite to the polarity of the conductive support of the preparation can be deposited on the preparation. Not only in case of liquid but also in case of solid particles, e.g. water or dust, such a deposit provided on the preparation, which suitably is an α- or β-ray source, can lead to a lowering of the preparation radiation owing to absorption and accordingly to a substantial decrease in the total amount of produced ions.

It is an object of the present invention to provide an apparatus of the described kind, in which the above mentioned drawback is avoided. For this purpose the charging apparatus according to the invention comprises a ring electrode, which is provided immediately downstream of the preparation and surrounds the ray cone of said preparation, an initial potential being applied to the ring electrode relatively to the conductive support of the preparation, in order to protect the preparation against soilure by deposited particles.

Actual practice has shown that the formation of deposits on the preparation can be perfectly avoided by the arrangement of such a ring electrode. The ionizing rays will by no means be weakened through the ring electrode surrounding the cone of rays, while the conditions of the electric field will change only to a slight extent, but in no way in a detrimental manner.

The present invention will now be described more fully with reference to the accompanying schematic drawing illustrating, by way of example, a preferred embodiment of the invention, and in which a longitudinal sectional view of the charging apparatus is shown.

The apparatus shown has a cylindrical housing, which is formed by a first metallic pipe member 1 and a second pipe member 2, which is made of insulating material and connected flush with the first member. When the apparatus is in operation, an air current passes through the housing 1, 2 in the direction of the arrows indicated. The pipe member 2 of insulating material is directly followed by the electrode system of an electrostatic separator, which system is formed by cylindrical metal tubes 3 and 4, coaxially nested into each other.

Within the metal pipe member 1 an ionizing cartridge is arranged coaxially to said member. This cartridge comprises a metallic supporting plate 5, upon the downstream-directed surface of which an α- or β-ray source 6 is arranged, for instance a radium foil. The radiation cone of the preparation 6, limited by the Bragg's zone in downstream direction, is designated by a. The conductive supporting plate 5 carrying the preparation 6 is surrounded by an enclosure 7, which is open in downstream direction and made of insulating material. A perforated electrode 8 arranged in upstream direction of the preparation 6 projects through the cross-sectional area of flow, remaining between the pipe member 1 and the ionizing cartridge 5—7. The downstream terminal of the insulating pipe member is formed by a perforated counter-electrode 9, which at the same time represents the conductive connection for the electrodes 3 of the separator. Moreover, immediately downstream of the preparation 6, a ring electrode 10 arranged coaxially to the tube axis is provided. The dimensions of this ring electrode 10 are chosen such that it completely surrounds the radiation cone a of the preparation 6.

In the example shown, the counter-electrode 9 is earthed while a potential differing from zero is applied to the other counter-electrode 8 by means of a direct current source. On the other hand, a potential is applied to both, the conductive preparation carrier 5 and the ring electrode 10, by means of the direct current source, so that, on the one hand, both members 5 and 10 have a higher voltage than the counter-electrode 8 and, on the other hand, the voltage of the ring electrode 10 is also higher than the voltage of the preparation carrier 5. In a practical example of embodiment, the voltage of the counter-electrode may amount to 800 v., the voltage of the preparation carrier 5 may be 2200 v., and the voltage of the ring electrode 10 may amount to 2500 v.

In practice, the described arrangement of the electrodes and the field, provided by said electrodes and superposed to the radioactively irradiated space, has shown to produce a great excess of ions having the sign or polarity of the conductive preparation carrier 5, and mainly in those space portions situated downstream, which are of greatest importance for the final charge of the suspended particles. The ring electrode 10, having a certain initial potential with respect to the preparation carrier 5, has the effect that particles, which are charged with a polarity opposite to the polarity of the electrodes and located in immediate proximity to the ionizing cartridge, are deposited not on the ray-emitting preparation but on the said ring electrode. Such a deposit is facilitated, as known, by the field which is largely heterogeneous adjacent the ionizing cartridge. The influence of a deposit on the ring electrode upon the remaining charging process can be neglected; at any rate it does not result into those disadvantages, which are produced by a deposit even of only filmy thickness on the emitting layer of the preparation. The provision of the deposit-electrode 10 as a ring electrode surrounding the radiation cone also presents a disturbance or weakening of the ray emission, which automatically would take place if this electrode were formed e.g. by a grid arranged immediately in front of the preparation. Voltage is supplied by a high frequency transformer T which is connected with a rectifier G, a condenser C, a resistance R_1 and potentiometers R_2—R_5, the filter voltage being indicated as U_F.

In cases where due to larger housing sizes the sectional area of flow must be irradiated by a plurality of preparations disposed side by side, a separate ring electrode will suitably be associated to each preparation. If the preparation is not of circular or square shape, but exists for instance in form of a strip, then the ring electrode 10,

instead of having an annular-shaped cross-section, may also be of oval or elongate annular cross-section.

I claim:

1. An apparatus for electrically charging particles suspended in an air current, said apparatus comprising a metal pipe, an at least partly insulating pipe constituting a continuation of said metal pipe and in alinement therewith, whereby an air current passes firstly through said metal pipe and then through said insulating pipe, a perforated electrode carried by and extending transversely to the axial direction of said metal pipe, at least one grounded perforated counter-electrode carried by and extending transversely to the axial direction of said insulating pipe, a conducting supporting plate located centrally within said metal pipe between said electrode and said counter-electrode and extending transversely to said metal pipe, a layer of at least one radioactive substance carried upon that surface of said supporting plate which faces said counter-electrode, said radioactive layer emitting a radiation cone extending into the interior of said insulating pipe, said counter-electrode being located outside of said radiation cone, a ring electrode located between said supporting plate and said counter-electrode adjacent to said supporting plate and extending in a plane perpendicular to the axial direction of said pipes, said

ring electrode surrounding said radiation cone, and a plurality of coaxial metal tubes constituting the electrode system of an electrostatic separator and extending coaxially to the axial direction of said pipes on that side of the counter-electrode which is away from the first-mentioned electrode.

2. An apparatus in accordance with claim 1, comprising a direct current source supplying voltage to said conducting supporting plate, means producing a potential difference between said conducting supporting plate and said counter-electrode and means applying to said ring electrode an initial voltage relatively to said supporting plate for protecting said radioactive layer from being soiled by the deposition of particles.

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