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GASEOUS-ION GENERATOR FOR ROOMS IN WHICH THERE IS A DANGER OF EXPLOSION

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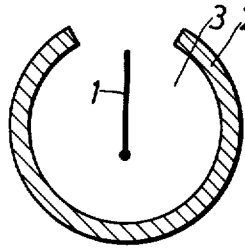

FIG. 1a

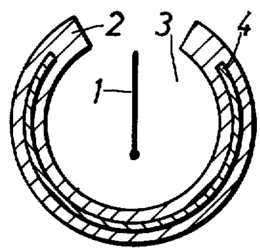

FIG. 1b

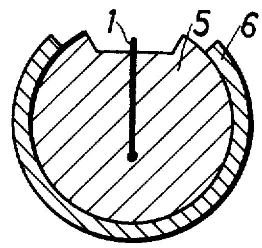

FIG. 1c

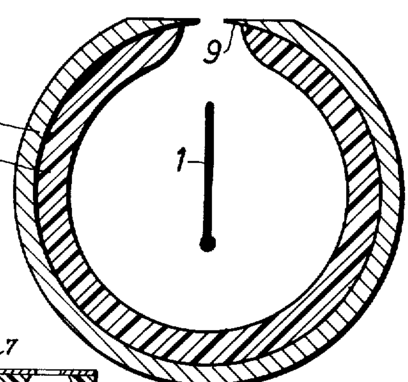

FIG. 2

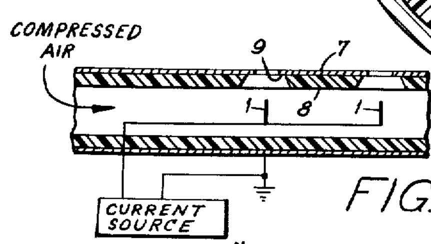

FIG. 2a

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GASEOUS-ION GENERATOR FOR ROOMS IN WHICH THERE IS A DANGER OF EXPLOSION

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In rooms in which there is danger of explosion, it is frequently necessary to produce ions, for example in order to remove electrostatic charges in the manufacture, processing or use of insulating materials or for purifying gases. In the following, the feature of the invention is described by reference to the example of eliminating electrostatic charges in traveling webs of insulating materials.

The known discharge methods either cannot be used in this case or are inadequate. The increase in the conductivity of the material by high air humidity, or by antistatic preparations, is now usually compatible with the working process. The method using air ionisation is limited in so far as it is based on the use of a low maximum ion stream for radio-active preparations considering the great activities which are necessary. For an ion current of about 2 μa., which is at least necessary to dissipate the maximum charge of a web with a width of 1 m. at speeds of only 2 to 4 m./min., normal α-radiators require an activity of about 3 millicuries and β-radiators an activity of 50 to 150 millicuries. Thus a considerable means for protection against radiation is needed.

The known high voltage spray-discharge rods operated by a mains frequency or high frequency cannot be used, because of the danger of an explosion. All experiments connected with the production of the ions outside the room in which danger exists, and transporting them in a current of air into the area to be discharged, are a failure because of the rapid recombination of the ions. The transport of air with a unipolar charge is certainly possible over a relatively large distance, but this only yields ion currents which are too small by some orders of magnitude. In addition, it is not possible with air having a unipolar charge to eliminate the charging, the sign of which is constantly changing in many cases.

Rods protected against explosion have not so far become known. In order to carry out the protective method using independent aeration, the ionisation must take place in a conductive grounded housing in which an adequate superatmospheric pressure can be maintained. With an insulated housing, the danger exists that sparks may penetrate out from the tips or wires and slide along the surface. In addition, the outside becomes charged by influence, and thus causes the possibility of ignitable discharges to grounded portions of the surroundings to occur.

As regards spray discharge rods, essentially the types shown in FIGS. 1*a*, 1*b* and 1*c* are already known. With the rods according to FIGS. 1*a* and 1*b*, the discharge tips or the discharge wires **1** are disposed in a slotted tube **2** made of metal (see FIG. 1*a*) or made of insulated material with a built-in metal foil **4** (see FIG. 1*b*). A superatmospheric pressure in the discharge chamber **3** cannot be maintained, even with considerable quantities of independent gas, since the area of the discharge opening is larger than the tube cross-section. As regards the rods according to FIG. 1*c*, the discharge tip is disposed in an insulating material **5** which is partially surrounded by a conductor **6** serving as counter-electrode.

With rods such as the one shown in FIG. 1*a*, providing the discharge openings in the metal tube are made

sufficiently small in order to reduce the gas consumption and to obtain a superatmospheric pressure, the ion current which can be obtained is much too small. By far the largest proportion of the ions is intercepted by the electrically conducting housing wall by electrostatic forces of attraction (formation forces).

If narrow holes instead of the wide slots are used in the discharge rods according to FIG. 1*b*, then the discharging ion current is also too small. The ions generated are deposited on the insulating ion surface and produce a counteracting field, more especially in the vicinity of the discharge openings. This field is repelled by the ions which follow. For the reasons mentioned above, such a construction is not permissible as regards technical safety.

If discharge rods according to FIG. 1*c* are surrounded with a conductive housing having small openings, the same objection as that against the separately aerated rod according to FIG. 1*a* applies, since the ion stream is much too small.

In the constructional form of the discharge rod according to the invention, the discharge openings are kept very small for reasons of safety and in favour of having a small consumption of independent gas.

By suitable construction of the discharge chamber and of the discharge openings in the manner indicated in FIG. 2, it is nevertheless possible to obtain a sufficiently large ion current. The housing **7**, which is necessarily conductive for technical safety reasons, is lined with an insulating layer **8** of sufficient thickness, so that only a narrow collar **9** directly at the outlet opening remains uncovered. With the start of each half wave of the applied high voltage, the interior, with the exception of the collar **9**, will consequently be charged in the same way as the tip, and the field and the ion stream will be compressed towards the discharge openings acting as counter-electrode. Therefore, a large proportion of the ions reaches the vicinity of the discharge openings, from which such ions emerge, supported by the stream of independent gas, after allowing for tenable losses by the absorption on the insulating inner wall and on the collar **9**. Without a stream of independent gas, the ion yield falls to about half. Discharge sparks terminate on the inside of the collar and cannot penetrate out through the discharge opening.

FIG. 2*a* is a schematic partial longitudinal view of FIG. 2 showing an air supply and a current supply for the ionizing chamber.

In one constructional example, the mains-frequency voltage of about 7 kv. usual for such rods was applied to tips which had a spacing of 20 mm. from the discharge openings. The said openings had a diameter of 5 mm. The air consumption with a superatmospheric pressure of 50 mm. water column was about 100 cubic metres per hour and per metre of rod length. Under these conditions, an ion curent of about 10 μa. was measured. It is thus considerably higher than with usual radio-active ionisers and in some cases is even greater than with spray discharge rods not protected against explosion, for which currents between 5 μa. and 100 μa. were measured under identical conditions.

On account of the high ion current which can be achieved, the ionisation process is also suitable for purifying explosive gases charged with dust. The independent gas stream reaches the gas stream to be purified directly from the rod, which in this instance is operated with direct voltage. The ions are in this case attached to the dust. The deposition thereafter takes place with low field intensities or with the aid of plastic filters, the deposition effect of which can be improved by previous ionisation.

We claim:

1. In an ion spray apparatus for ionizing gases in a

room to prevent the build-up of static electric charges, said apparatus having a chamber with an outlet opening, an ion discharge rod connectable to a source of current and said chamber being constructed and arranged for passing a gas into and through said chamber and out said opening, the improvement which comprises said chamber being defined by an imperforate outer wall of grounded conductive material wtih said outlet opening defined therethrough and an imperforate inner lining of insulating material in substantially coextensive abutment with the inner side of said outer wall and substantially covering the entire interior of said chamber, said inner lining terminating at the portion of said outer wall defining said outlet opening leaving only the internal marginal surface of said outlet opening uninsulated.

2. Improvement according to claim 1 wherein a narrow zone which is electrically conductive and grounded is provided as said marginal surface.

3. In the method of producing an ionized gas in a

room to prevent static electric charge build-up in which ions are generated from a discharge rod and passed in a gas stream into the room, the improvement which comprises generating the ions in an enclosed zone having a grounded conductive imperforate outer confirming layer, an inner insulating imperforate lining substantially covering the entire interior of said enclosed zone and a discharge opening defined by the outer conductive layer and maintained free, at its inner peripheral edge, of the insulating lining and passing the generated ions out through said discharge openings in a gas stream under superatmospheric pressure.

References Cited in the file of this patent

UNITED STATES PATENTS

2,333,213	Slayter	Nov. 2, 1943
2,484,202	Wintermute	Oct. 11, 1949
2,569,116	Roscoe et al.	Sept. 25, 1951
2,602,910	Stuart	July 8, 1952