

DESCRIPTION

The present invention concerns a process for the ionization of a fluid, such as air used for the conditioning of a space or a zone for air-conditioning by ionization or, further, for discharging static electricity and of the type in which the fluid is subjected in an air-conditioning enclosure to the action of at least one ionization agent, such as a set of electrodes, before being discharged into the space to be conditioned by ionization.

The ionization devices known per se generally comprise sets of electrodes brought to a relatively high alternating or direct electric current (for example, comprised between 2 and 5 kV for installations of considerable flow of air). These electrodes are disposed along geometric grids in conduits or pipe-lines through-crossed by the gas or air to be ionized and are present in the form of points or wires borne by the walls of these conduits or pipe-lines. These ionization installations for the treatment of gas by ionization such as dust-removing installations by electrostatic precipitation but prove to be much less efficient in air-conditioning installations by ionization.

These reduced-scale ionization installations are, for example, designed to remove static electricity that appears on textile fibers during trituration or in sensitive electric equipment such as computers or integrated circuits, particularly during their production and their assembly. This lack of efficiency of medium-size ionization installations seems to be due to the fact that, for reasons of cost and organisation of the air-conditioning installation, ionization electrodes are installed in an enclosure for the treatment of air and the treated air is distributed by relatively long conduits in utilization zones such as the proximity of covers of textile threads charged with static electricity or, furthermore, assembly tables of printed circuits.

After positive or negative ionization of the air to be treated, the relatively turbulent passage of this ionized air in the distribution conduits provokes a "recombination" of the positive and negative ions, previously disassociated and this "recombination" or depolarization of the air considerably reduces the ionization rate of the treated air when it is delivered into the utilisation zone constituting a space to be air-conditioned by ionization.

In order to reduce the recombination of the ions, in GB-A-1 059 417 and DE-A-2 449 227, it has already been proposed to dispose the ionization organ immediately adjacent to the discharge pipe-line of ionized air but experience shows that the ions recombine during passage through the discharge vanes or protection devices that it is necessary to dispose about the electrodes constituting the ionization organ.

According to GB-A-1 059 417, the ionization of the air can be carried out by using radiation emitter bodies that are fixed on to the blades of a free air-blowing screw.

The risks of recombination during the discharge of the air are thus radically reduced but such an apparatus cannot be applied for use in jet blowing or central blowing means.

One of the objects of the present invention is to almost completely remove the drawback of the recombination of the ions of the fluid such as air treated by an ionization operation, without considerably increasing the cost of the apparatus of treatment by ionization and by using a central blowing installation.

With this purpose when the discharge of the air-conditioning enclosure is carried out by a plurality of discharge sections adjacent to each of the outlets of which is disposed one ionization organ in order to reduce the possibilities recombination and/or depolarization of the ions generated by the ionization organ, the latter is placed in the space to be air-conditioned outside each of the discharge pipe-lines of the air-conditioning enclosure.

According to another embodiment of the invention, the ionization organ is separated from the space to be air-conditioned by walls, perforated by a plurality of passages, of a distribution chamber from which the fluid is discharged to the space to be air-conditioned by a plurality of outlets like those of a rose of a watering-can. The ionization organ is thus disposed, preferably, substantially in the center of the distribution chamber and as variant the perforated walls of the distribution chamber are provided so as to form protection with respect to the invention ionization organ if said organ presents dangers of exploitation, such as electrical dangers for the electrodes or irradiation dangers for a radioactive source.

According to a further embodiment of the invention, when the means for reducing the turbulence are disposed in the air-conditioning enclosure adjacent to the ionization organ, these turbulence-reducing means are positioned immediately downstream from the air-conditioning organ in direction of the flow of the fluid.

The turbulence-reducing means can be constituted by electrodes of the ionization organ; these electrodes being arranged in the form of blades or threads.

As a variant, turbulence-reducing means are provided by a flattened form of the discharge section of the air-conditioning enclosure in order to direct the air flow in the form of a relatively thin blade prior to its passage before the ionization organ. Furthermore, the discharge pipe-line(s) the air-conditioning enclosure can have a form converging in the direction of the ionization organ in such a way as to center exactly on the ionization organ, such as at least one electrode, the air jet to be ionized or deionized.

Other aims, advantages and characteristics of the invention will become evident by reading through the description of various embodiments of the invention, given by way of non-limitative illustration and with respect to the annexed drawings in which:

FIG. 1 is a schematic representation of an ionization installation according to the state of the art with a

synoptic diagram of the electrical equipment part;

FIG. 2 represents a modified version according to the invention of the installation of FIG. 1;

FIG. 3 represents in a diagrammatic section an embodiment of the invention applicable to a distribution of existing ionized air provided with a rain type distribution system;

FIG. 4 represents schematically an application of the invention to an ionization installation having a considerable air outflow blown on a reduced section.

The air ionization installation known per se, and represented in FIG. 1, aims at increasing the content of the discharged air into air-conditioning site 1 in negative or positive ions according to requirements of the electrostatic discharge of machines or apparatus 2,3 disposed in this site. In order to do this, positive 4 and negative 5 electrodes are arranged in an air pipe-line 6 in which the previously filtered external air is blown by ventilation 7 and delivered into site 1 by a plurality of outlet mouths or openings 8. In order to increase their electric efficiency electrodes 4 and 5 produced in the form of one or several sheets, are equipped with points 9 which constitute concentration zones of the gradient of the electric potential in the air to be treated and from which are formed ions that are scattered in the air to be ionized and distributed by openings 8.

Electrodes 4 and 5 are connected through the intermediary of cables 10 and 11 respectively, to transformers 12 and 13 generating alternating or direct high voltage (in the latter case, rectifiers, not shown, are intercalated). Transformers 12 and 13 are connected to phases 14 of an electric grid by the intermediary of phase indicators 15 and 16 controlled by an electronic adjuster 17 connected to the electric grid in 18 and subjected to an adjustment of the instructions value 19 via an amplifier 20. The electronic adjuster 17 is connected to an electric field indicator 21, itself connected, where necessary, to an electric field recorder by a wiring 22. An ionization indicator 23 placed in pipeline 6 can supply a negative feed-back indication to the electronic adjuster 17 that monitors, according to requirements, the voltage and the direction of the voltage of the adjustment electrodes 4 and 5.

If reference is made to the embodiment of the invention shown in FIG. 2, in which the elements identical to those of FIG. 1 have the same references, it can be seen that positive 4 and negative 5 electrodes that were disposed in a single zone of pipe-line 6 considerably downstream of the outlet openings 8 of air, are brought right to the outlet of each of slightly converging discharge outlets 24,25, 26,27 of pipe-line 6 outside this pipe-line and already in the site to be air-conditioned. In order to do this, high voltage cables 10 and 11 are extended to the inside or the outside of pipe-line 6 and are connected to plates of electrodes 4, 5 respectively, provided where necessary, with points 9 and generally having smaller dimensions than elec-

trode plates 4 and 5 of the example of FIG. 1.

Pipe-line 6 can be extended by conduit 28 having a smaller diameter, feeding outlet 27 in order to serve, for example, a static electricity discharge workplace of a sheet of textile threads 29. The number of electrodes is multiplied by the number of discharge outlets that it is obviously of interest to reduce in the example of the invention, but the actuation and generation equipment of ionization high voltage remains identical to that of FIG. 1 according to the state of the art. As can be easily imagined in considering FIG. 2, the possibilities of "recombination" of positive and negative ions in conduit 6 under the effect of turbulence and shocks against the walls of this conduit are radically eliminated and the yield of the ionization treatment is considerably increased in such a ratio that it largely compensates the increase of the number of electrodes and the necessity of setting the high voltage cables or insulated conductors 30 and 31 from outlet cables 10 and 11 of the high voltage generating equipment.

In solutions known per se, the electrodes are recessed inside a short connecting tube at a discharge outlet and this arrangement presents the advantage of protecting the electrodes from risks of accidental short circuiting. According to the invention, it is wished to reduce the risks of recombination of the ions and to facilitate their rapid diffusion in the ambience to be air-conditioned. For this, it is possible to place electrodes 4 and 5, for example in the form of sheets of threads, right at the discharge outlet connecting tubes of the feed pipe-lines to constituting an air-conditioning enclosure. FIG. 2 shows one solution in which electrodes 4 and 5 are placed in the space to be air-conditioned right at the outlet of exit pipe-lines 24-27 in converging form in such way that the intercalated space 38 between points 9 is blown through by the air jet that escapes from outlets, to be diluted in the atmosphere of the space to be air-conditioned. When electrodes 4,5 present dangers of short circuiting or electrocution, it is possible to surround them by a protection wall or cage or screen 39 perforated by a multitude of passages. The ionization indicator 23 supplying a feed-back to the electronic adjuster 17 is either removed, or placed adjacent to a discharge outlet beyond electrodes 4,5.

In the embodiment shown in FIG. 3, only the arrangement of the ionization electrodes 4 and 5 with respect to the pipe-lines and distribution conduit of air or flow in general is shown. It has been supposed that it concerns an air distribution of the rain type from distribution heads in the form of a rose of watering-can 32 connected to pipe-line 6 in order to distribute air in all directions by a multitude of small holes 33 bored in their wall.

In order to equip such an air distribution installation with an air ionization system according to the invention, it is not possible, of course, to equip each outlet hole of a set of external ionization electrodes. Ionization electrodes 4 and 4 connected to high voltage cables 10 and

respectively 11 of the generating and monitoring high voltage installation via a set of bars 30 and 31, are disposed substantially in the center of the distribution chamber 34 disposed at the inside of each rose of a watering can 32 downstream of the delivery conduit 35 to this rose 32, this conduit 35 constituting, in fact, a discharge pipe of the air-conditioning enclosure. The possibilities of recombination of the ions are reduced with respect to the state of the art represented in FIG. 1, since it is possible to produce the rose 32 in a material such as plastic material, which only provokes very few "recombinations".

The embodiment shown in FIG. 4 applies to a distribution of ionized air of a large section of which only the distribution box 36 is represented in perspective.

According to the invention, box 36 is divided by walls 37 into a plurality of outlets 38 having a flattened section and a set of ionization electrodes 4 and 5 is disposed opposite each of these flat outlets 38. Due to the flattened form of the outlet sections 38, the air turbulence is reduced and the possibilities of "recombination" and depolarization of the ions produced by electrodes 4 and 5 are reduced after the outlet of box 36 that ensures a large outflow of the air discharge.

In order to reduce the turbulence in the embodiments of FIG. 2 and 3, plates or filters in pipe-line 6 are placed immediately upstream from ionization electrodes 4 and 5. Another means of reducing the air turbulence passing the ionization electrodes 4 and 5 and after the discharge outlets into the space to be air-conditioned by ionization consists of shaping electrodes 4 and 5 in the form of blades disposed in the direction of air flow opposite the pipe-line 6 exists constituting an air-conditioning enclosure.

It is understood that the ionization organ constituted by electrodes 4 and 5 can be replaced by electric charges obtained by friction on an insulating body or by a radioactive body that can carry out at the same time a sterilization function of the fluid discharged by the outlets.

(Translation of the claims already present in the British document).