United States Patent

[11] 3,624,448

[72] Inventors **Donald G. Saurenman**
Whittier;
Harold W. Smith, San Marino, both of
Calif.

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[73] Assignee **Consan Pacific Incorporated**
Whittier, Calif.

[54] **ION GENERATION APPARATUS**
15 Claims, 13 Drawing Figs.

[52] **U.S. Cl.** **317/4,** 317/262
[51] **Int. Cl.** **H05b 3/00**
[50] **Field of Search** ..... 317/2, 3, 4, 262 A, 262 AE, 262 E, 262 S; 239/15, 433, 434

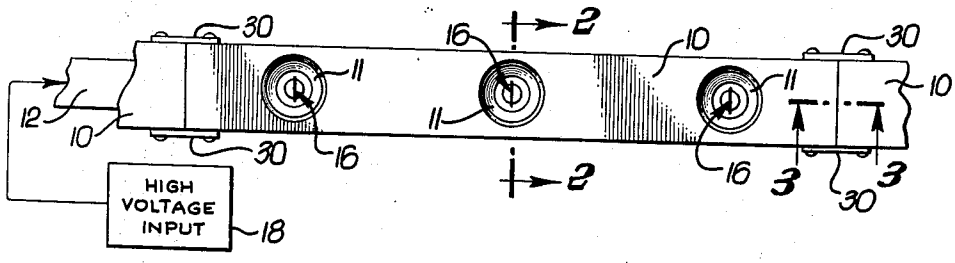
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Primary Examiner—D. F. Duggan
Assistant Examiner—Ulysses Weldon
Attorney—White & Haefliger

ABSTRACT: The invention concerns ion generation and dispensing apparatus having module form with an electrically conductive bus to which groups of ion generating radiants or clusters are connected, the modules being constructed for connection in series; the provision of means to dispense vapor in air flow created by the flow of such ions; means to use such ions to effect particle collection on surfaces; and means to control such ion polarity in relation to external conditions.



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SHEET 1 OF 2

FIG. 1.

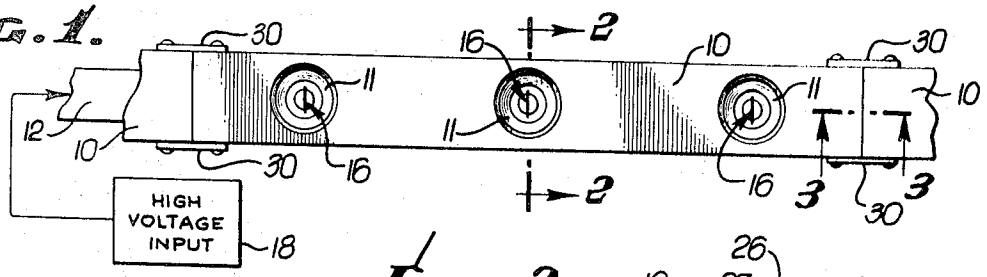


FIG. 3.

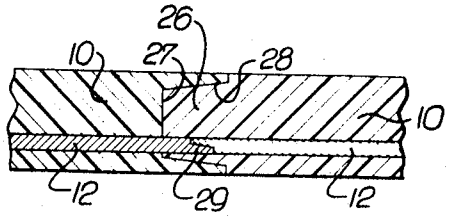


FIG. 2.

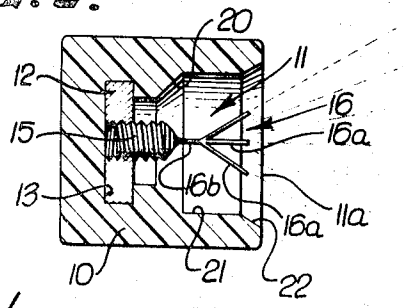


FIG. 6.

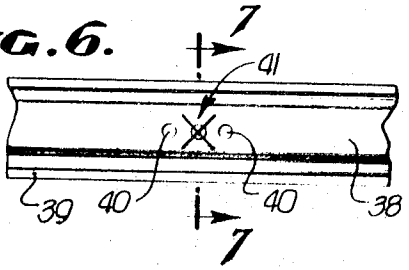


FIG. 4.

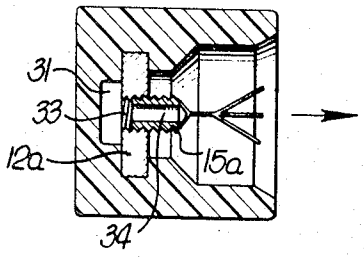


FIG. 7.

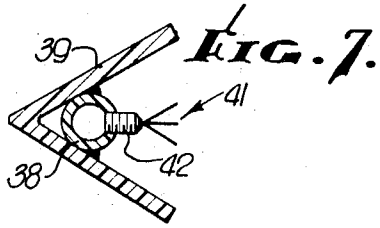


FIG. 5.

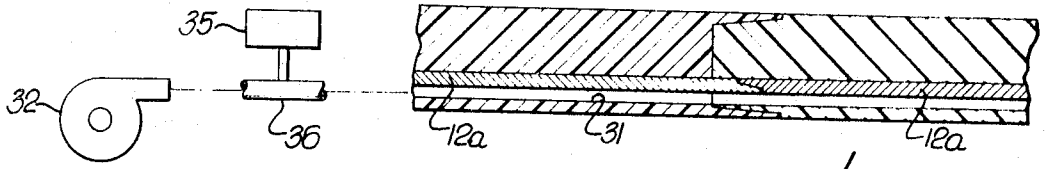


FIG. 8.

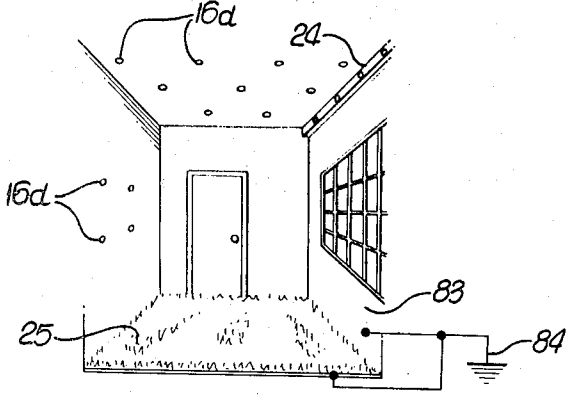
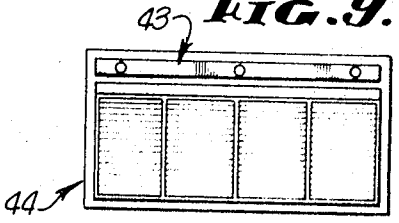


FIG. 9.



INVENTORS.
DONALD G. SAURENMAN
HAROLD W. SMITH
By White & Haefliger
ATTORNEYS.

FIG. 10.

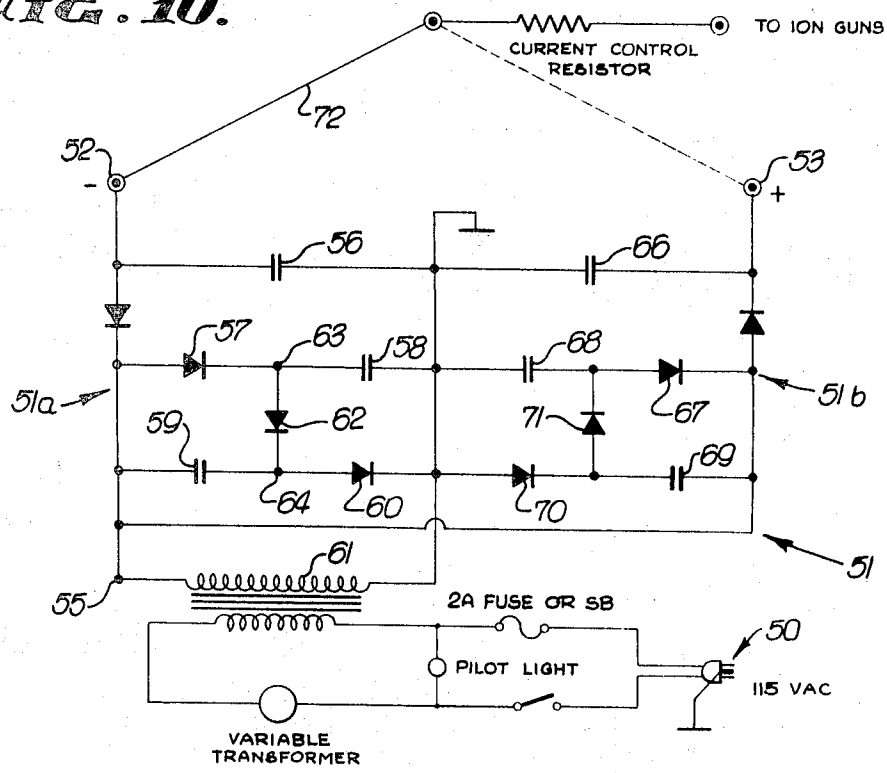


FIG. 11.

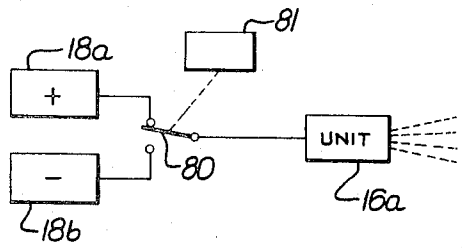


FIG. 12.

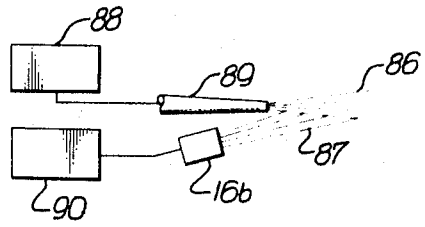
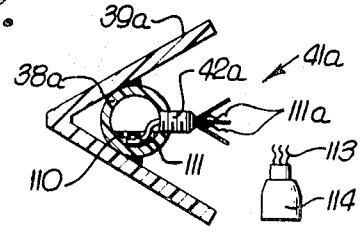


FIG. 13.



INVENTORS.
DONALD G. SAURENMAN
HAROLD W. SMITH

By White & Haefliger

ATTORNEYS.

ION GENERATION APPARATUS

BACKGROUND OF THE INVENTION

This invention relates generally to ion generation and dispensing apparatus, and more particularly concerns easily installable equipment for generating ions and dispensing them over large areas.

In certain processing industries the buildup of static charge has long been known as a critical problem. For example, in cotton gins static charge accumulates in lint cleaners, slides, feed distributors and rollers; in paper processing static charge builds up on printing presses and rollers; textile mill card webs, silver and tow and looms constitute problem areas; and charge collects in dry weather when people walk on certain types of carpeting, as is well known. Such static charge buildup reduces substantially the efficiency of processing materials in such industries, and static discharge or sparking encountered by people walking over carpets is very objectionable.

In the past, various devices have been constructed to alleviate these problems, one such device being described in U.S. Pat. No. 3,358,344 to Harold W. Smith et al. While that device is very effective, there remains a need for an easily installable system of such devices capable of distributing ions over large work or walking areas of many different shapes and sizes.

SUMMARY OF THE INVENTION

It is a major object of the invention to provide solutions to the above described problems through the provision of ion generation and dispensing apparatus having module form and facilitating ease of assembly of multiple modules to desired length for ready installation in static problem areas of various sizes. Basically, the apparatus module comprises an elongated insulative member forming a recess or recesses opening sidewardly; an electrically conductive bus extending lengthwise in the member; multiple electrically conductive inserts carried in the recess structure to have electrical connection to the bus, and multiple electrically conductive needles or metal radiants carried by the inserts in the recesses to project toward the recess openings so that electrical charge flowing to the needle tips will leave the tips and generate ions flowing away from the member. As will be seen, several such members may be connected in end-to-end relation so that the busses therein have electrical interconnection, whereby an ion generation system of desired length may readily be fabricated or assembled, or multiple systems connected.

Typically, the inserts may have threaded connection to the electrical bus; the needle tips may be located in enlarged portions of the recesses directly inwardly of the recess side openings; and the insulative member may be formed of molded or extruded plastic with a shaped recess extending lengthwise continuously to receive the bus.

Another important object of the invention has to do with the provision of an aperture contained by the insulative member or a hollow bus member to pass a stream of gas from within the member toward the recess to assist in carrying ions away from the member. The aperture may for example extend lengthwise within the member, either within or outside of the bus, and when the members are connected in end-to-end relation to form a system, the apertures or channels in the members are placed in end-to-end communication, as will be seen. Also, small side outlets may be formed along the channels to pass the gas in close proximity to the needles to assist in ion separation and flow to penetrate the work area.

Further objects include the provision of means to dispense vapor in air flow created by ion flow; means to use ions to clear contaminant particles from a confined zone; means to use ions to effect particle collection on surfaces, as for example foliage, as will be described in detail; and means to control ion polarity in response to external conditions.

These and other objects and advantages of the invention, as well as the details of illustrative embodiments, will be more fully understood from the following detailed description of the drawings, in which:

DRAWING DESCRIPTION

FIG. **1** is a side elevational view of a system of insulative members incorporating the invention;

FIG. **2** is an enlarged section taken on line **2—2** of FIG. **1**;

FIG. **3** is an enlarged section taken on line **3—3** of FIG. **1**;

FIG. **4** is a section like FIG. **2**, but showing a modified member;

FIG. **5** is a section like that of FIG. **3**, but showing insulative members of FIG. **4** modified type;

FIG. **6** is a fragmentary side elevation, similar to that of FIG. **1**, but showing still another modified member;

FIG. **7** is a section taken on line **7—7** of FIG. **6**;

FIGS. **8**, **9**, **11**, **12** and **13** show applications of the invention; and

FIG. **10** is a high voltage multiplying circuit.

DETAILED DESCRIPTION OF THE INVENTION

In FIGS. **1** and **2** an elongated insulative plastic member **10** contains a series of recesses **11** which open sidewardly. The member **10** also contains a lengthwise extending electrically conductive bus **12** which may be inserted into a channel **13** forward in member **10** upon extension. Prior to such insertion, the recesses **11** may be formed in the member at spaced locations.

Multiple electrically conductive inserts are carried in the recesses to have electrical connection to the bus. Also, multiple electrically conductive radiating clusters are carried by the inserts in the recess or recesses to project toward the recess mouths **11***a*, so that electrical charge flowing to the cluster tips will leave the latter and generate ions flowing sidewardly away from the member **10**. In the illustrated example, threaded inserts **15** carry the clusters **16**, and are threaded into tapped openings **17** in the bus to depths such that the clusters are received into the recesses **11**.

The cluster may, for example, include multiple needles directed in mutually diverging relation, with multiple needles **16***a* clustered about an axis defining central needle **16***b*. A source **18** of high voltage, when connected to the bus, produces a corona effect at the needle tips to generate ions with electrical repulsion effect in the space about the needles, thereby to establish an ion stream flowing rapidly with high ion concentrations penetrating for several yards toward work to be charged or neutralized. One useful circuit to provide the source **18** is described in U.S. Pat. No. 3,308,344 referred to above. Recess **11** is shaped to aid the flow of such ions, and includes a conical shoulder **20** merging with cylindrical bore **21**, the latter in turn merging with a conical bevel **22** at the recess mouth. Note that the needle tips are located in the enlarged portions of the recesses formed by the bores **21**. The inserts and needles of course are electrically conductive. Member **10** may for example consist of a suitable plastic material such as polyethylene or polyvinylchloride.

Referring to FIG. **3**, the members **10** may be connected in end-to-end relation so that the buses therein have electrical interconnection whereby a system of such modular members may be easily constructed to desired length corresponding to the size of work to be treated. Thus, unit installations may be made at intervals along ceilings or walls to treat large areas. For example, a hallway is shown in FIG. **8** with such a system installed at **24** along a corner between the wall and ceiling, with the needles directed downwardly to eject ions toward the walkway above carpet **25**. The ends of the members **10** in FIG. **3** have interfitting connection, i.e., a nose **26** on one member is received into the recessed end **27** of the other member, with tapered shoulder interfit at **28**. The buses **12** also interfit as shown at **29**, within the nose **26** for protection. Suitable brackets **30** interconnect the members as shown in FIG. **1**. Multiple members **10** of various types may thus be connected to a single power source, by insulated cable.

FIG. **8** also shows radiating clusters **16***d* installed in a ceiling and wall to completely control positive or negative ion conditioning of the room or hall atmosphere. Grounding the floor or walkway, or lower walls **83**, as at **84**, causes ion charged dust collection on the floor or walls, clearing the atmosphere.

Another aspect of the invention concerns the provision of an aperture in the member **10** to pass a stream of gas from within the member toward the recesses **11** to assist in carrying the ions away from the member, as by "wiping" them off the cluster tips. In the example shown in FIGS. **4** and **5**, the aperture **31** is formed to extend lengthwise within the member at the side of the bus opposite the recesses, air being delivered via a suitable blower **32**. The bus **12***a* and insert **15***a* are also apertured at **33** and **34** to pass the gas stream directly toward and through the cluster. If desired, a medicated vapor may be delivered to the air stream, as from a source **35** having an outlet passing to the air conduit **36** leading to the aperture **31**.

A variational form of air delivery is shown in FIGS. **6** and **7**, with the electrical bus **38** in the form of an air delivery tube received by the V-shaped insulative member **39** and attached thereto. Holes drilled in the tube at **40** pass air to flow over the needle cluster **41**. The latter is attached to the tube via insert **42**. The FIG. **13** variation is like FIG. **7**, and in addition includes means for dispersal of vapor, as for example medicated vapor in the ion stream. In one form, liquid **110** is contained in the tubular bus **38***a*, and a wick **111** has one end in that liquid and its opposite end **111***a* projecting from insert **42** for exposure to the air stream created and impelled forwardly by the forward movement of ions created by the cluster **41***a*. Liquid molecules evaporate from the wick end **111***a* as vapor and travel forwardly with the air stream. In another form, a wick **113** may protrude from a separate container **114** for the liquid, and into the air flow path as shown. A nozzle may be used in place of the wick.

FIG. **9** illustrates another application of the invention, the ion delivery device **43** of FIG. **2**, **4** or **7** type being carried by a room air conditioner unit **44**. Ions are caused to flow into the conditioned air stream delivered via the grille **45**, for treatment in the room area.

FIG. **10** illustrates an unusually advantageous voltage multiplying circuit employing rectifiers and capacitors, and capable of increasing the voltage delivered to the ion gun **16** to 18,000 volts, from a 115 volt AC source **50**. The network **51** includes two halves, **51***a* having a negative output terminal **52**, and **51***b* having a positive output terminal **53**.

Network half **51***a* includes a rectifier (diode) **54** between terminal **52** and the end terminal **55** of transformer winding **61**. A capacitor **56** is connected between one side of rectifier **54** and ground; series connected rectifier **57** and capacitor **58** are connected between the opposite side of rectifier **54** and ground; and series connected capacitor **59** and rectifier **60** are connected between said opposite side of rectifier **54** and ground. Finally, a rectifier **62** is connected between points **63** and **64**, as shown.

Similarly, network half **51***b* includes a rectifier **65** connected between positive terminal **53** and end terminal **55** of the winding **61**. Capacitor and rectifier elements **66–71** are connected as shown. Thus, the line **72** to the ion guns may be connected with either negative or positive high voltage terminals, **52** or **53**.

While AC systems of many varied needle configurations have been used in the past, they have tended to restrict the distance ions can be projected from the needles; further, using AC application to the needles, the latter tend to attract dirt and clog easily. We have found, however, that using either a positive or negative voltage application tends to keep the units clean and in workable condition. The same result can be achieved using positive voltage for some time, then negative voltage for some time, et seq. FIG. **11** shows sources **18***a* and **18***b* of high positive and negative DC voltage, and a switch **80** controllable at **81** (as for example in response to atmospheric charge or vapor conditions) alternately to connect these sources with the member **16***a* carrying needle clusters, which may be as described above at **16**. Solid state switches such as SCR's may be used in place of switch **80**. A timed sequence flow of positive and negative ions may thus be created to modulate atmospheric conditions.

FIG. **12** shows another application of the invention wherein particulate material such as dust or spray **86** (as for example pesticide) is treated with ions **87**, whereby the particles will take on electrical charge so as to attach or cling to objects. Thus sprays can be made to cling to walls and floors within buildings, and pesticide dust can be made to cling to foliage. Limbs and leaves of foliage tend to carry an electrical charge, so that ion treated dust of opposite charge will be attracted to such foliage. A source of spray or dust is indicated at **88** along with nozzle **89**, and a high voltage source **90** is connected with an ion dispensing unit **16***b* which may be similar to that described above at **16**.

We claim:

1. In ion generation and dispensing apparatus for altering the static charge of work, the combination comprising:

a. elongated insulative support members each forming recesses opening sidewardly, the exposed exterior of each said member being electrically nonconductive,

b. an electrically conductive bus extending lengthwise in each said member and exposed at the end thereof,

c. multiple electrically conductive inserts carried in said recesses to have threaded connection to said bus, and multiple electrically conductive ion generators carried by said inserts in said recesses to project toward the recess mouths and terminating at tips proximate the recess mouths so that electrical charge flowing to said tips will leave said tips and generate ions flowing away from said member and

d. said members connected in end-to-end interfitting relation so that said buses therein have end-to-end mechanical and electrical connection with one end of the interfitting bus defining a tongue and the other end of the interfitting bus defining a groove thereby to define an elongated system of generators and buses.

2. The combination of claim **1** wherein said recesses are separate and individual and said tips are located in enlarged portions of said recesses directly inwardly of the recess side openings.

3. The combination of claim **2** wherein each said recess is circular and defines a central axis extending sidewardly and said tips are spaced about said axis.

4. The combination of claim **1** wherein each said member contains an aperture to pass a stream of gas lengthwise within the member and toward said recesses to assist in carrying said ions away from said member, said aperture communicating with said recesses and apertures in successive members being in end-to-end communication.

5. The combination of claim **3** wherein said bus and insert are also apertured to pass said gas stream from the aperture within said member to said recess.

6. The combination of claim **1** wherein said bus contains an aperture to pass a stream of gas lengthwise within the bus and toward said recess to assist in carrying said ions away from said member, said aperture communicating with said recesses.

7. The combination of claim **1** including air channels extending lengthwise in said members in intercommunication and having air stream supplying communication with said recesses.

8. The combination of claim **6** wherein said recesses are V-shaped in cross section, and said bus comprises a tube received in said recess.

9. The combination of claim **1** including a chamber having a carpet defining a walkway, said system of buses and generators being installed proximate said walkway to direct ions thereto.

10. The combination of claim **1** including means to supply high voltage of selected polarity to said bus, and operatively connected therewith, whereby said apparatus is kept self cleaning.

11. The combination of claim **7** wherein said last named means includes sources of plus and negative high DC voltage, and a switch connected to alternately connect the sources with said bus.

12. In a room having particles in the atmosphere,

a. ion generator means having multiple tips located to inject ions of selected polarity into the room to be attracted to the particles in the atmosphere, for changing the particle charge,

b. and a charged particle attractor exposed to the room interior at a remote location lower than the generator and

c. a source of positive and negative high voltage and a device to electrically connect the generator means to the source to selectively and alternately supply the same generator means with said positive and negative high voltage.

13. Vapor dispensing apparatus comprising

a. ion dispenser means having multiple tips oriented to dispense ions directionally into the atmosphere to create a directional flow of air, and

b. means to direct a side stream of dispersed chemical treating agent into the air flow path for flow of said dispersed agent with the ions in said direction.

14. Apparatus as defined in claim 10 wherein said ion dispenser means includes a cluster of electrically energizable needles and said liquid supply means comprises a wick.

15. In ion generation and dispensing apparatus for altering the static charge of work, the combination comprising

a. an elongated electrically conductive bus,

b. multiple electrically conductive ion dispensers carried by said bus at spaced locations therealong, the dispensers having ends oriented in the atmosphere so that electrical charge flowing to such ends will leave the ends and generate ions in the atmosphere traveling away from said bus and creating flow of air in a predetermined direction.

c. and means to direct a side stream flow of a dispersed chemical treating agent to travel in the air with the ions away from said spaced locations along the bus.

* * * * *