Sept. 25, 1951 J. W. ROSCOE ET AL 2,569,116

STATIC CHARGE REMOVAL DEVICE

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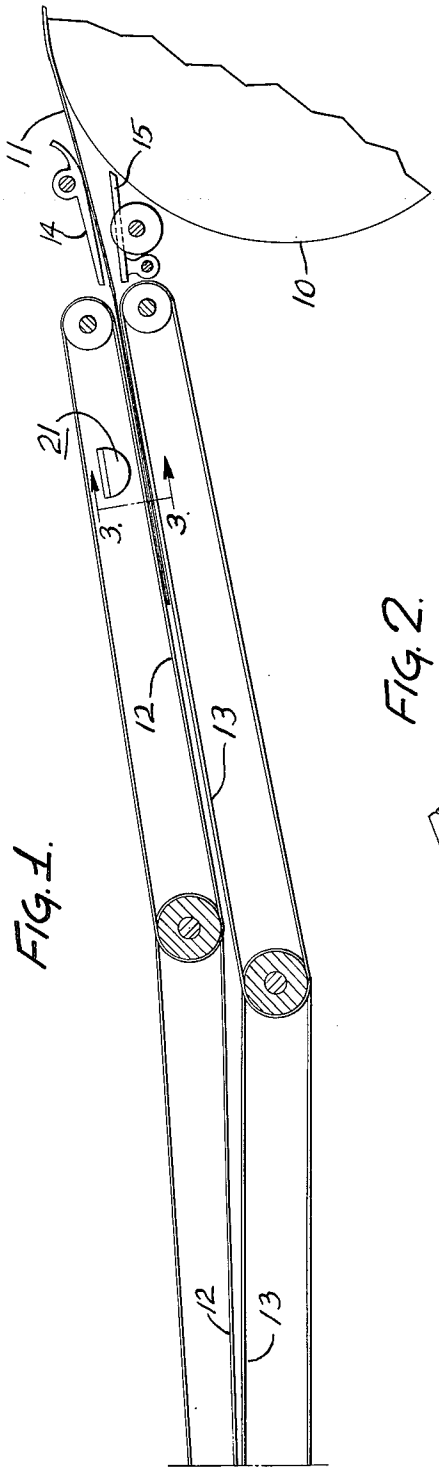



Fig. 1.

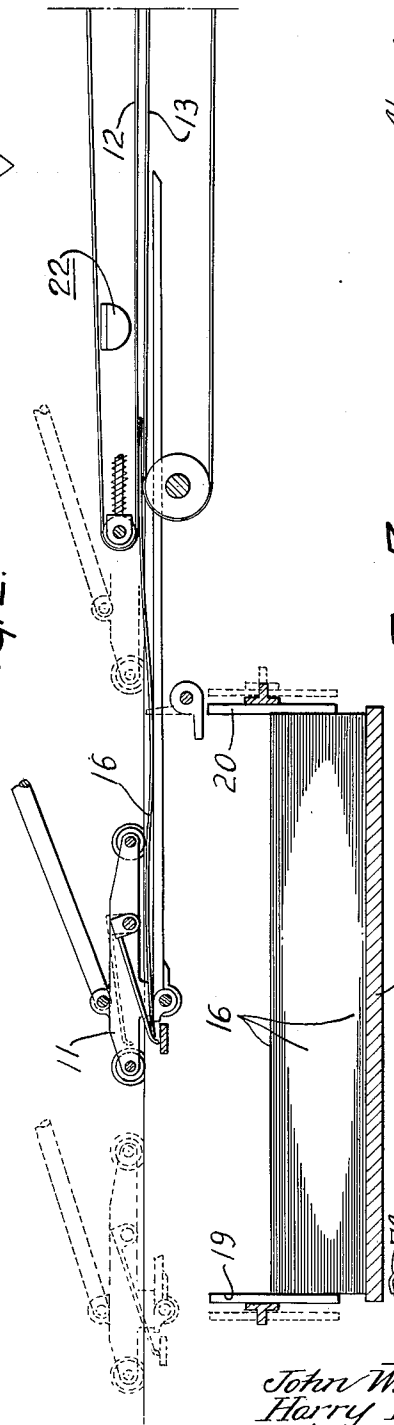



Fig. 2.

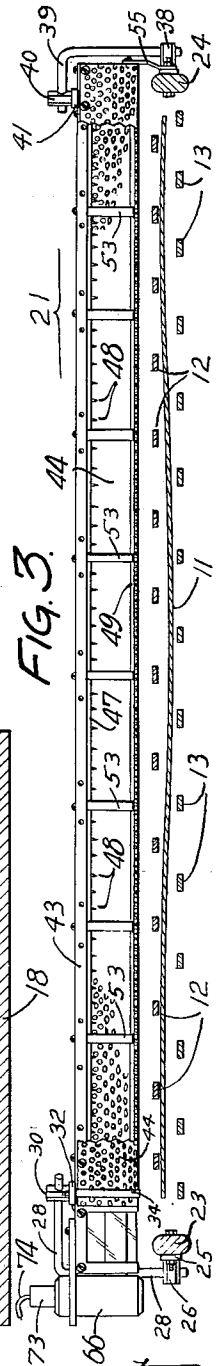



Fig. 3.

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FIG. 4.

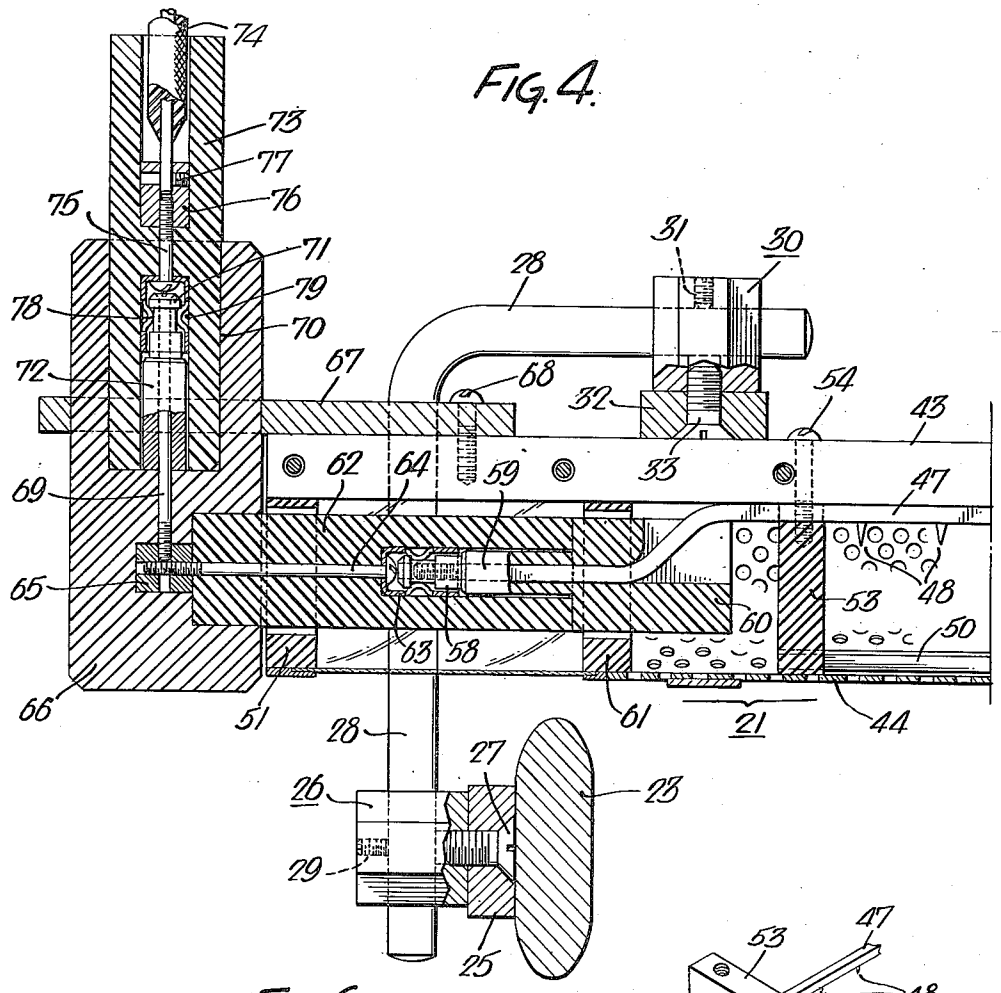
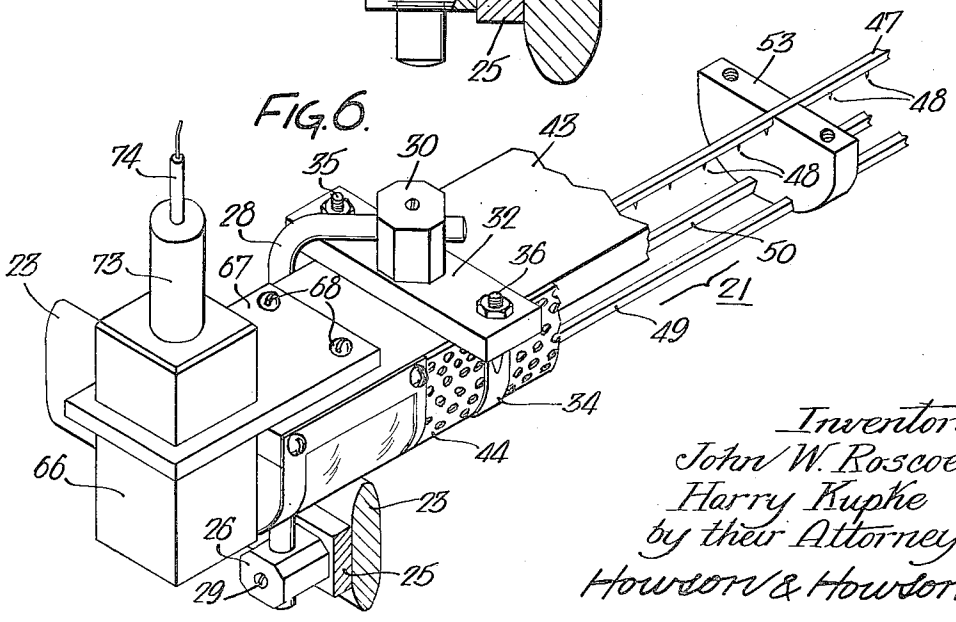



FIG. 6.




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FIG. 5.

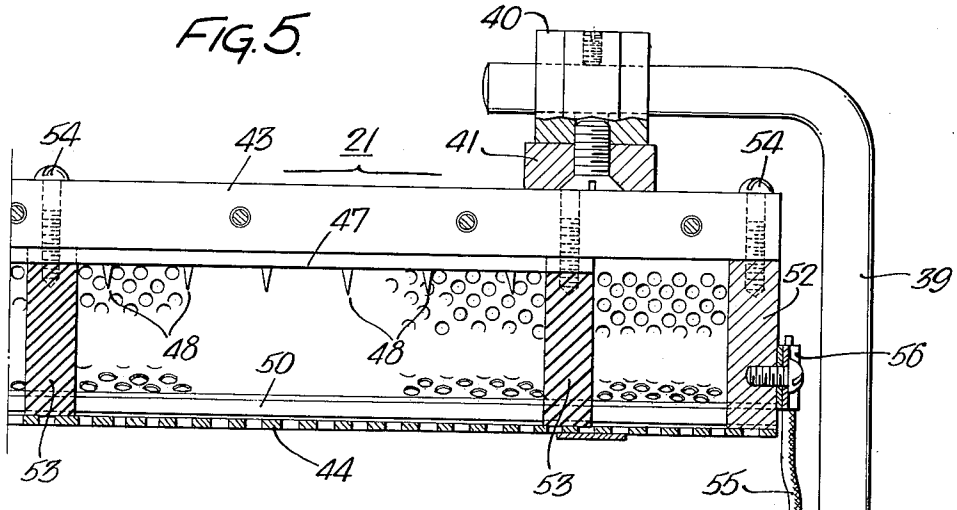



FIG. 7.

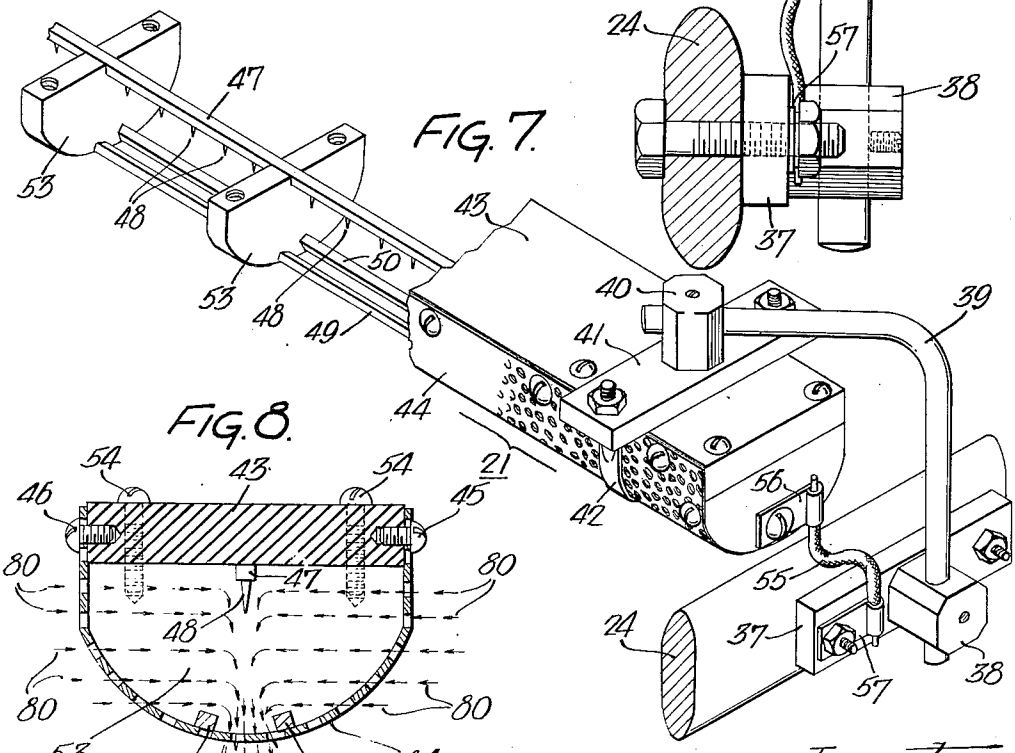



FIG. 8.




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# UNITED STATES PATENT OFFICE

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## STATIC CHARGE REMOVAL DEVICE

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4 Claims. (Cl. 175—264)

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This invention relates to the removal of static electrical charges from objects or materials which acquire such charges in the course of manufacture, treatment or handling.

One object of the invention is to provide a novel and highly efficient device for this purpose.

Another object of the invention is to provide a device which presents no hazard to personnel.

While the invention is generally applicable to the removal of static charges from any object or material, it is especially useful in connection with paper sheets which have heretofore presented a serious problem. Therefore, the invention will be described with particular reference to such use.

The handling of sheet paper, as in printing presses, has been very difficult in the past due to static charges which have previously been accumulated by the sheets or which are accumulated while the sheets are running through the press. This has presented a problem which has long plagued the industry. Various devices and techniques have been tried in the past to remove the static charges, but such efforts have not been very successful and the problem has persisted for a long period of time.

The most common form of static removal device is that which subjects the static-containing sheets to the effect of a high voltage established between two conductors or electrodes. Prior devices of this general type have been tried to a considerable extent but have failed to achieve a complete success. In some instances, forced air has been utilized in an effort to enhance the operation of this type of device but this has been of little or no avail. The purpose of an air flow is to effect delivery of a corrective condition to the static-containing sheets, but prior devices have failed to utilize this principle successfully. In some cases, the delivery of the corrective condition has been blocked; while in others improper design has limited the amount of air available to perform the desired function. A further objection which has been inherent in some of these prior devices is that they have been unsafe for operating personnel.

The present invention makes use of the principle of air flow as above mentioned, but it does so by utilizing unpropelled air in such a manner that effective delivery of a corrective condition to the static-containing sheets is obtained. The manner in which this is accomplished will be made clear in the following description.

For a complete understanding of the invention,

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reference may be had to the accompanying drawings, wherein:

Figs. 1 and 2 illustrate generally the intake and output portions of a conventional printing press, and also show preferred locations of static removal devices provided by the present invention;

Fig. 3 is a transverse sectional view taken along line 3—3 of Fig. 1;

Figs. 4 and 5 are sectional views, on relatively large scale, of the end portions of the static removal device, these views being taken longitudinally of the device;

Figs. 6 and 7 are perspective views of the end portions of the device; and

Fig. 8 is a transverse sectional view taken at any point along the device between the insulating spacers thereof.

Referring first to Figs. 1 and 2, the conventional printing press illustrated comprises a feed roll 10 which supplies the paper sheet material 11 to a conveyor apparatus constituted by upper and lower continuous driven belts 12 and 13. The guides 14 and 15 serve to feed the sheet material between the conveyor belts. At the output end of the press, as shown in Fig. 2, the printed sheets 16 are carried by a reciprocating device from the conveyor and are dropped in a stack on the support 18. Reciprocating devices 19 and 20 serve to align the edges of the sheets as the stack builds up.

As shown in Figs. 1 and 2, static removal devices 21 and 22, both constructed according to the present invention, are located at the intake and output ends of the printing press. These devices are disposed above the traveling web or sheet in spaced relation thereto. The device 21 serves to remove static charges from the sheet material as it enters the press, while the device 22 removes any static charges that have been accumulated by the sheets during passage thereof through the press.

Fig. 3 is a transverse view looking toward the device 21 as indicated in Fig. 1. As may be seen in Fig. 3, the static removal device is of elongate form and it extends transversely of the moving sheet 11. The device is mounted on metal side bars 23 and 24 which are parts of the framework of the press.

As shown in Figs. 4 and 6, the bar 23 has mounted thereon a block 25 to which a nut-like holder 26 is secured by means of a screw 27. The holder 26 has a passage therethrough to receive the lower end of a mounting rod 28 which is held by set screw 29. The rod 28 is L-shaped and at its other end it carries a nut-like holder 30 which is fixed

by set screw 31. The holder 30 carries a rigid bar 32 through the medium of screw 33. As may be seen in Fig. 6, the bar 32 supports a flexible strap or band 34 which is secured to said bar by means of bolts 35 and 36. The band 34 embraces one end of the static removal device to support the same.

As may be seen in Figs. 5 and 7, the opposite end of the static removal device is similarly supported by bar 24. Thus, the block 37 is secured to bar 24 and supports a holder 38 which carries the L-shaped rod 39. The latter, in turn, supports the holder 40 which supports the bar 41, and its associated band 42.

Referring now to the structure of the static removal device, as shown in Figs. 3 to 8, the device comprises an elongate insulating member 43 which extends substantially the length of the device and which is of substantial width; a foraminous conductive member 44 which is generally of channel shape and is secured to the sides of member 43 by means of screws 45 and 46, and which also extends the length of the device, a high voltage conductor or electrode 47 extending longitudinally of the device and having spaced pointed projections 48, and a pair of ground conductors or electrodes 49 and 50 also extending longitudinally of the device. As may be seen in Fig. 8, the members 43 and 44 form an elongate enclosure extending substantially the length of the device within which the conductors 47, 49 and 50 are disposed. The conductor 47 is disposed adjacent the inner face of member 43 substantially midway of the width thereof, while conductors 49 and 50 are disposed in contact with the inside of the foraminous member 44. While a single ground conductor could be employed, it is preferred to employ two such conductors arranged symmetrically with respect to the high voltage conductor 47 in spaced relation thereto, as clearly shown in Fig. 8. At the ends of the device, there are provided end closures 51 and 52 (see Figs. 4 and 5), the latter being formed of conductive material. Within the device, there are provided spaced insulating members 53, each of which is secured to the insulating member 43 by means of screws 54. These spaced insulating members are recessed to receive the three conductors, as may be clearly seen in Figs. 6 and 7, and they serve to hold the conductors in properly spaced relation throughout the length of the device. The conductors may be of square cross section, and the recesses in members 53 may be shaped accordingly.

At one end of the device, the foraminous conductive member 44 is grounded by means of a ground connection 55 (see Figs. 5 and 7) which is connected to the conductive end plate 52 by means of a screw-fastened terminal clip 56. The conductor 55 is also connected to the metallic bar 24 by means of a terminal clip 57. It will be seen, therefore, that the conductors 49 and 50 are grounded to the metal frame of the press or machine with which the device is associated.

At the opposite end of the device (see Figs. 4 and 6) an arrangement is provided for supplying a high A. C. voltage, e. g. 15,000 volts, to the conductor 47 with respect to ground. As may be seen in Fig. 4, the end portion of conductor 47 extends inwardly to about the center of the device and is provided with a projecting terminal 58 inside the end of the device. The end portion of the conductor is provided with a sleeve 59 and also carries a spacer member 60 with which there is associated an apertured member 61. This arrangement approximately centers the conductor. A plug receptacle 62 is inserted through the opening of end closure 51 and carries a spring clip 63 which engages the terminal 58. The plug receptacle 62 is secured by screw 64 to an insert 65 within a receptacle block 66. The screw 64 also serves to hold the spring clip 63.

The receptacle block 66 is held in position by plate 67 secured by screws 68 to the top of the device. A screw 69 is supported centrally within the socket recess 70 and is threaded into the insert 65 and engages screw 64. The upper end of screw 69 carries a terminal 71, and a bushing 72 serves to support the extending portion of the screw. A plug connector 73 is attached to the end of an insulated high voltage conductor 74 by means of screw 75 and associated screw block 76 which is secured by set screw 77 to the end of the conductor. The screw 75 also serves to hold a spring clip 78 within the socket recess 79 of the plug 73.

By means of the arrangement above described, all danger of contact with the high voltage connections is avoided. It will be understood, however, that any other suitable connector arrangement may be employed.

The operation of the static removal device may be seen from Fig. 8. The high voltage at the pointed projections 48 produces ozone and creates a suction effect which causes flow of air inward from the sides and downward between the ground electrodes 49 and 50, as indicated by the arrows 80. Since the member 43 is impervious to air, it acts as a baffle, while the air-pervious member 44 permits the flow of air as above mentioned. The air flow carries the ozone down onto the moving sheet which is passing below the device, as shown in Fig. 3. It has been found that this action completely removes static charges from the sheet. The device acts as a strong generator of ozone and it also forcibly projects the ozone at high velocity onto the sheet by causing strong air flow as above described. In this connection, it is important that the openings in the pervious member 44 provide sufficient unrestricted passage for free flow of air.

The value of the high voltage utilized in any instance will depend upon the spacing between the pointed projections 48 and the ground conductors. With a given spacing, the voltage should be sufficiently high to produce a strong electrostatic field without causing arc over. In a specific embodiment the above-mentioned spacing is one inch and the applied voltage is 15,000 volts.

With such a high voltage it is important that personnel be protected. The device provides this protection, because there is no possibility of contact with the high voltage conductor. The grounded member 44 serves as a guard in addition to its other functions.

The static removal device provided by this invention has been used under all conditions encountered in the handling of paper sheets and it has fully demonstrated its high efficiency. Not only does it remove all static charges but it also prevents offsetting in printing, i. e. transfer of ink from one sheet to an adjacent sheet. This is believed to be due to the strong ozone treatment of the sheets by the device.

As previously stated, the device is not limited in use to the removal of static charges from paper sheets but applicable to removal of such charges

from any object or material. In any instance it is only necessary to bring about reasonably close proximity of the device to the object or material, as the device is effective for a substantial distance. However best results are obtained with a spacing of several inches.

It will be understood, of course, that the invention is not limited to the illustrated embodiment, it being obvious that the variations and modifications thereof are possible without departing from the scope of the invention.

We claim:

1. A static charge removal device, comprising an elongate air-impervious member substantially rectangular in cross-section and composed of insulating material and having a substantially planar surface serving as an air baffle, a conductor extending along said surface lengthwise of said member substantially midway of the width of said member, connection means extending from said conductor for application of a high alternating voltage thereto, a plurality of pointed electrodes spaced along and extending from said conductor substantially perpendicular to said surface, at least one ground conductor extending substantially parallel to said surface and to said first conductor in opposed spaced relation to said electrodes, whereby application of said voltage produces ozone and creates a suction effect causing flow of air inwardly adjacent said surface and thence in the direction of said ground conductor, thus propelling the ozone past said ground conductor, and a semi-cylindrical perforated shield secured at its edges to said air-impervious member and with said member forming an enclosure for said conductors, the distance between said ground conductor and said pointed electrodes being less than the distance between said pointed electrodes and said shield.

2. A static charge removal device according to claim 1, wherein said ground conductor is mounted on said shield.

3. A static charge removal device, comprising an elongate air-impervious member composed of insulating material and having a substantially planar surface serving as an air baffle, a conductor extending along said surface lengthwise of said member substantially midway of the width of said member, connection means extending from said conductor for application of a high alternating voltage thereto, a plurality of pointed electrodes spaced along and extending from said conductor substantially perpendicular to said surface, a pair of ground conductors extending substantially parallel to each other and to said first conductor in opposed spaced relation to said electrodes and defining a relatively narrow slot, whereby application of said voltage produces ozone and creates a suction effect causing flow of air inwardly adjacent said surface and thence in



the direction of the slot defined by said ground conductors, thus propelling the ozone through said slot, and a semi-cylindrical perforated shield secured at its edges to said air-impervious member and with said member forming an enclosure for said conductors, the distance between said ground conductor and said pointed electrodes being less than the distance between said pointed electrodes and said shield.

4. A static charge removal device, comprising an elongate air-impervious member composed of insulating material and having a substantially planar surface serving as an air baffle, a conductor extending along said surface lengthwise of said member substantially midway of the width of said member, connection means extending from said conductor for application of a high alternating voltage thereto, a plurality of pointed electrodes spaced along and extending from said conductor substantially perpendicular to said surface, at least one ground conductor extending substantially parallel to said surface and to said first conductor in opposed spaced relation to said electrodes, whereby application of said voltage produces ozone and creates a suction effect causing flow of air inwardly adjacent said surface and thence in the direction of said ground conductor, thus propelling the ozone past said ground conductor, a semi-cylindrical perforated shield secured at its edges to said air-impervious member and with said member forming an enclosure for said conductors, the distance between said ground conductor and said pointed electrodes being less than the distance between said pointed electrodes and said shield, and a plurality of semi-cylindrical insulating members disposed within and spaced along the enclosure formed by said air-impervious member and said shield, said semi-cylindrical members being secured to said air-impervious member and having peripheral recesses seating said conductors to hold them in properly spaced relation throughout the length of the device.

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