# United States Patent

**Bower et al.**

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[45] **Nov. 7, 1972**


[54] **STATIC ELIMINATOR**


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[73] Assignee: **Varco Incorporated**



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[52] **U.S. Cl.** .....**317/2 F**, 317/4

[51] **Int. Cl.**.....**H05f 3/04**, H01t 19/04

[58] **Field of Search** .....317/2 F, 4



[56] **References Cited**

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| 3,283,209 | 11/1966 | Schutz | 317/4 |
| 3,551,743 | 12/1970 | Koepke et al. | 317/2 F |

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| 854,237 | 11/1960 | Great Britain | 317/2 F |



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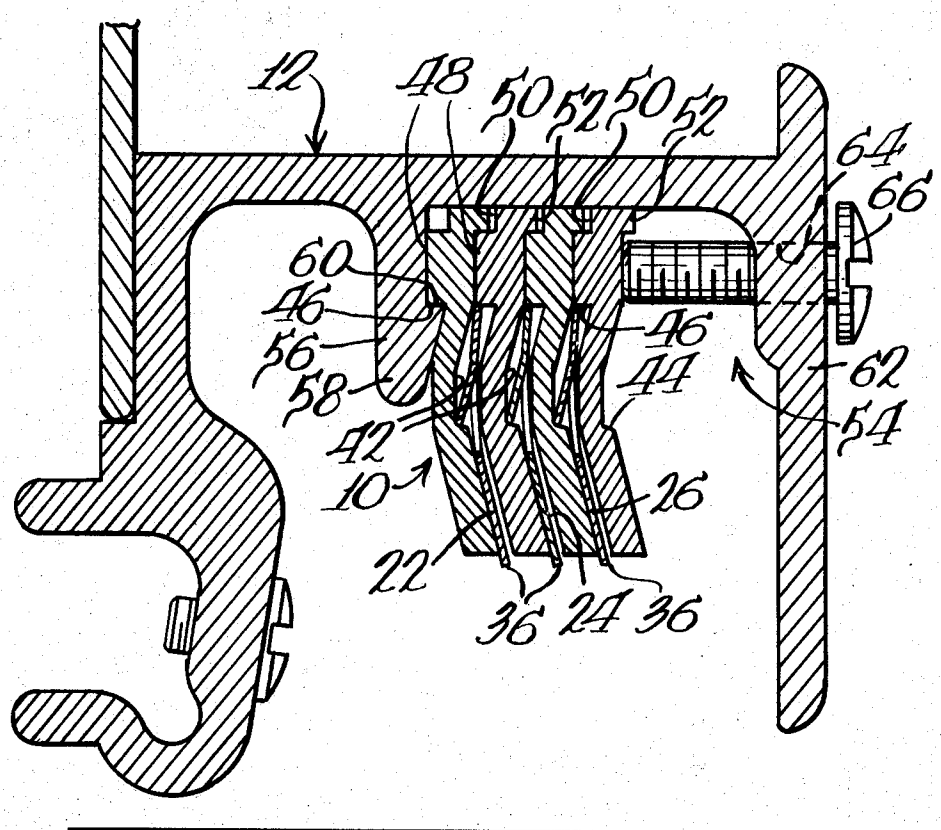
[57] **ABSTRACT**

A static electricity neutralizer preferably for use in business machines wherein webs of material, such as paper, are fed therethrough characterized by a construction that eliminates undesired secondary emitting points and wherein insulating members and electrically conducting elements are stacked in a sandwich type relation such that the number of layers in the sandwich can be varied as desired. Both high voltage and grounding elements are provided with discharge points.


**11 Claims, 4 Drawing Figures**



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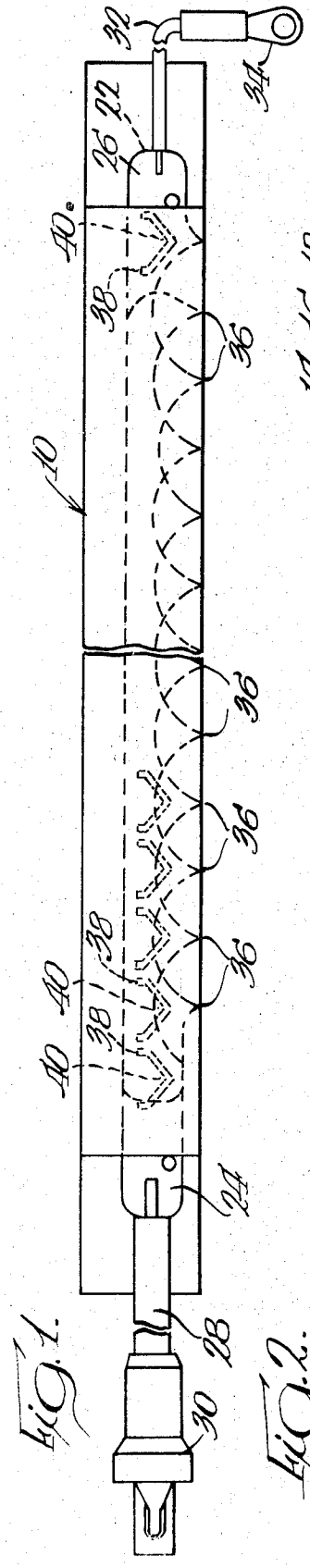

Fig. 1.

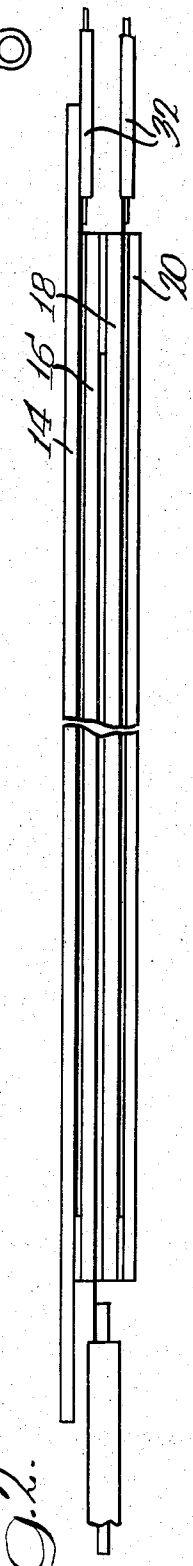

Fig. 2.

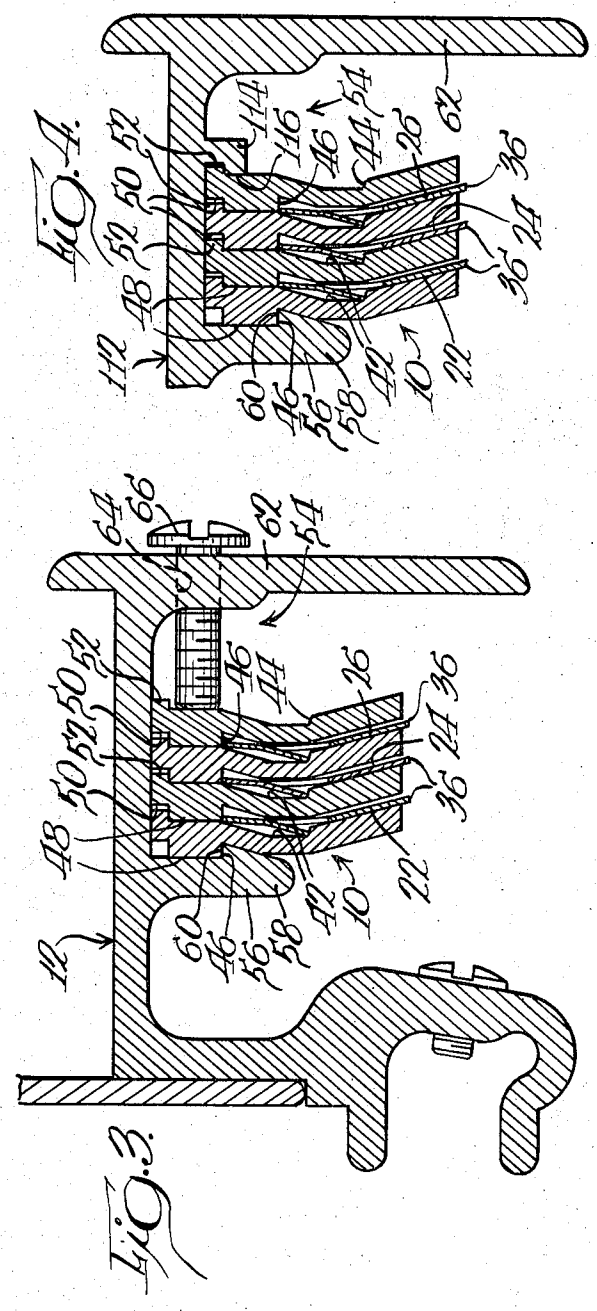

Fig. 4.



Fig. 3.


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# STATIC ELIMINATOR

## BACKGROUND OF THE INVENTION

This invention relates to a static electricity eliminator structure.

Over the years, there evolved a number of generator type static eliminator structures as, for example, disclosed in U.S. Pat. No. 3,283,209 and 3,551,743.

While such prior art structures have been satisfactory for performing their intended function of neutralizing static electricity, they have possessed the shortcomings of being relatively expensive to fabricate and by reason of their construction, for a given bulk, do not produce as large of an ion cloud around the bar as might be desired.

## SUMMARY OF THE INVENTION

It is the principal object of the invention to provide a new and improved static eliminator. More particularly, it is an object of the invention to provide a new and improved static eliminator which is inexpensive to produce and which, for a given size, has a greater effectiveness in terms of a larger ion cloud and/or increased ionization over that obtainable with structures heretofore known.

The exemplary embodiment of the invention achieves the foregoing objects by means of a construction wherein both high voltage elements and ground elements include spaced discharge points to increase the magnitude of ionization over that presently obtainable. By the same token, the use of discharge points on both high voltage and ground elements increases the size of the resulting ion cloud generated by a neutralizer of a given size.

In order to achieve simplicity and economics of construction, the above-described basic structure is implemented by means of the use of a plurality of substantially identical, insulating members that are in substantial abutment with each other and which sandwich at their respective interfaces, electrically conductive, elongated members each having a plurality of discharge points separated by relatively smooth surfaces to eliminate points of secondary emission. Alternate ones of the electrically conductive members may be connected to a high voltage source while the remaining ones may be connected to ground and the same are arranged so that adjacent ones of the electrically conductive members have their discharge points staggered in the direction of elongation from the adjacent electrically conductive member.

To assist in precise location of the point, each of the electrically conductive members is provided with struck out tabs which may be received in a groove formed on the associated insulating member and which is located at a predetermined point along the length thereof.

A base is employed to mount the sandwich assembly of the insulating members and the conductive members and includes a channel formation for receiving the sandwich. According to one embodiment, a clamp-like arrangement is employed to hold the assembly in the channel and is arranged so that the number of insulating members and the number of conductive members may be selectively varied to vary the size of the resultant ion cloud according to the requirements of a particular situation.



In addition, to further assist in precise basing, the elongated insulating members are made non-planar so that at least the points of the electrically conductive members are partially deformed to cause them to rest on one side of the opening between adjacent insulating members from which they protrude.

Other objects and advantages will become apparent from the following specification taken in conjunction with the accompanying drawings.

## DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side elevation of the sandwich assembly of conductive and non-conductive members employed in the invention;

FIG. **2** is a plan view of the sandwich assembly;

FIG. **3** is an enlarged cross section of the sandwich assembly when received in a mounting base; and

FIG. **4** is a fragmentary cross section of a modified mounting base.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

An exemplary embodiment of a static eliminator is shown in FIGS. **1–3** and is seen to comprise a sandwich assembly, generally designated **10**, including both high voltage and ground elements, and a mounting base, generally designated **12**, therefor. The sandwich assembly **10** is comprised of a plurality of at least three, substantially identical elongated insulating members, **14**, **16**, **18** and **20**. As can be seen in the drawings, the insulating members **16**, **18** and **20** are in fact identical while the insulating member **14**, on the end of the assembly **10**, differs only in terms of its length, that is, it is longer than any of the other insulating elements **16**, **18** and **20**; and the term "substantially" identical as used herein is intended to encompass this difference and others of a like nature.

As best viewed in FIG. **3**, the insulating members **14** through **20** are in substantial abutment with each other and sandwich at their interfaces, elongated, electrically conductive members **22**, **24** and **26**, formed of copper or the like. According to the preferred embodiment, the number of conductive members will be one less than the number of insulating members employed for obvious reasons and alternate ones of the conductive members will be connected to a high voltage source while the remainder will be connected to ground. In the embodiment illustrated, the central conductive member **24** has an electrical lead **28** connected to one end thereof at the left-hand end of the assembly **10** as viewed in FIG. **1** which in turn joins with a connector **30** for connection to a suitable source of high voltage. The outside conductive members **22** and **26** have leads **32** secured to their right-hand ends which may be connected to ground by a connector **34**.

In the preferred embodiment, the conductive members **22** and **26** are identical while the conductor **24** is generally similar but differs therefrom in the respects apparent from an examination of FIG. **1**. Any additional conductors included as if the width of the assembly **10** were increased, and connected to the same side of power as the conductor **24**, would be formed identically with the conductor **24**.

Each of the conductors, including the grounded conductors, is formed with a plurality of discharge points

36 in the manner described in the above-identified Koepke U.S. Pat. No. 3,551,743. That is, each of the discharge points 36 on a given one of the conductors is separated from adjacent points by smooth surfaces to eliminate points of secondary emission and the corners and ends of the conductors are rounded for the same purpose. Thus, the particular configuration of a given one of the conductors in terms of the points 36 forms no part of the instant invention. However, of substantial import is the fact that conductors having points 36 are not only employed as the high voltage conductors as taught by Koepke, but as the grounded conductors as well. Such a construction increases the size of the resulting ion cloud surrounding the static eliminator with the ultimate result of greater effectiveness for its intended purpose for an eliminator of a given size.

To maximize the efficiency of the unit while precluding arcing, the high voltage conductors are arranged with respect to the low voltage conductor such that their respective points 36 are staggered in the manner illustrated in FIG. 1 on approximately equal centers. In addition, while not clearly illustrated in FIG. 1, the points 36 are of such a length as to extend slightly beyond the lower end of the insulating member as illustrated in FIG. 3. According to one embodiment, the length of the extension beyond the ends of the insulating members is less than 0.125 inches and this feature increases the ionizing effect because of the increased volume of air in the immediate proximity of the points.

Along the length of each of the conductors, there is provided a plurality of generally V-shaped slots 38 which define tabs 40. The tabs 40 are slightly struck out from the plane of the associated conductor and are adapted to be received in grooves 42 formed in one side of each of the insulating members. The grooves 42 extend along the length of their associated insulating members as do the tabs 40.

Each of the grooves 42 includes a retaining formation 44 at its lower end for receiving the tip of each of the tabs 40. In addition, the side of each of the insulating members opposite the formation 44 is provided with a recess 46 for the purpose of receiving the upper edge of an associated one of the conductors. Thus, a positive retention of the vertical position of a respective conductor is established by the retaining formation 44 and the recess 46 as illustrated in FIG. 3 while the grooves 42 and the location of the tabs 40 along the respective length of the insulating members and the conductors provides for positioning of the conductive members relative to each other along the length thereof.

Just above each recess 46 on each of the insulating members is a platform formation 48 terminating in a step 50. On the opposite side of each of the members from the step 50, there is located a projection 52. As can be seen in FIG. 3, the arrangement of the steps, platforms and projections is such that the insulating members may next in substantial abutment with each other and may be bonded together in any suitable fashion.

Preferably, the insulating members are formed so that the conductor-receiving spaces at their interfaces are non-planar. As a result, when the conductors and insulating members are assembled into the sandwich, the conductors will be slightly distorted from their generally planar form so that the points 36 will forcibly rest against one of the insulating members defining the conductor-receiving spaces with the result that the spacing between points and adjacent rows is precisely controlled without regard to the possible variations in the width of the conductor receiving spaces. That is, by reason of the foregoing arrangement, the individual points 36 on a conductor are arranged in a perfectly straight line. This permits the fabrication of the eliminator with the points arranged very close to the critical spacing limit at which arcing might occur with the ultimate result that greater efficiency of operation is obtained.

With reference specifically to FIG. 3, the sandwich assembly 10 may be mounted in a machine by means of the base 12 in the following manner. Specifically, the base 12 includes a downwardly open channel formation, generally designated 54. One side 56 of the channel includes a hook-like outer end 58 having a tip 60 which may be received in the recess 46 of the endmost of the insulating members. The opposite side 62 of the channel-like formation 54 includes a plurality of tapped bores 64 for receiving screws 66 which define a clamping means for clamping the sandwich assembly 10 within the channel formation 54 as illustrated. It will be observed that the arrangement is such that additional ones of insulating members and conductors can be located in the channel formation 54 of the base 12 as may be required to generate an ion cloud of a particular size.

Alternatively, where size flexibility is not required, a mounting base such as that illustrated in FIG. 4 may be employed. The modified base is designated 112 and in all respects is identical to the base 12 except that the bore 64 and screw 66 are omitted and a fixed retainer 114 is added. The retainer 114 includes a hook end 116 facing the hook 58 adapted to slidably receive and overlie the projection 52 of the rightmost insulating member 20. The assembly may be secured in place in any suitable fashion.

In normal use, the base 12 with the assemblage 10 therein will overlie a web such that about a ⅝ inch spacing will exist between the ends of the point and the web, it being appreciated that the showing of FIG. 3 is greatly expanded in size.

From the foregoing it will be appreciated that a static eliminator made according to the invention provides significant advantages over those heretofore known in terms of the simplicity of construction, the capability to easily expand its size by reason of the unique sandwiching assembly with regard to the base 12 and the increased effectiveness in ionization by use of discharge points on both sides of the electrical circuit to which it may be connected as well as the unique arrangement wherein the points of the conductors are distorted to rest against one side of the associated insulator to promote well-controlled spacing.

I claim:

1. A static eliminator comprising: an elongated base; a plurality of at least three, substantially identical, elongated insulating members in substantial abutment with each other; and a plurality of at least two electrically conductive members, there being one of said conductive members disposed at each interface between said insulating members, alternate ones of said electrically

conductive members being adapted to be connected to a source of electrical energy and the remaining ones of said electrically conductive members being adapted to be connected to ground, each of said electrically conductive members including a plurality of discharge points spaced along one edge of the insulating members between which it is disposed, said electrically conducting members being disposed with respect to each other such that adjacent ones of the electrically conductive members have their points staggered in a direction parallel to the length thereof; and means for securing said electrically conducting members and said electrically insulating members to said base in sandwiched relation.

2. The static eliminator of claim 1 wherein said electrically insulating members include at least one notch in one side thereof; each of said electrically conductive members further including at least one tab received in the notch at the adjacent insulating member when said insulating members and said electrical members are assembled in said sandwiched relation.

3. A static eliminator comprising: a plurality of elongated insulating members in substantial abutment with each other; a plurality of elongated, electrically conductive members, one disposed between each of said insulating members, said conductive members including a plurality of discharge points, position interlocking means on said members whereby an electrically conductive member may be relatively precisely precisioned with respect to an insulating member; an elongated base receiving a sandwich assembly of said insulating members and said electrically conductive members; and adjustable means for securing said sandwich assembly to said base whereby the number of insulating members and conductive members in the sandwich assembly may be selectively varied.

4. The static eliminator of claim 3 wherein said interlocking means comprises a notch on one of said insulating members and said conductive members and a tab on the other of said insulating members and said conductive members.

5. The static eliminator of claim 4 wherein the notch is on said insulating member and the tab is on said electrically conductive member.

6. The static eliminator of claim 3 wherein said adjustable securing means comprises clamp means.

7. The static eliminator of claim 6 wherein said clamp means is defined by a channel-shaped formation on said base, said sandwich assembly being received in said channel, and at least one threaded member rotatably received in one side of said channel and adapted to clamp said sandwich assembly against the other side of said channel.

8. The static eliminator of claim 3 wherein said electrically conductive members and said insulating members are formed so that, upon assembly, said discharge points are forcibly urged against an adjacent one of said electrically insulating members to provide relatively precise alignment of said points.

9. A static eliminator according to claim 3 wherein said discharge points project slightly beyond the edges of the adjacent insulating members.

10. The static eliminator of claim 1 wherein said electrically conductive members and said insulating members are formed so that, upon assembly, said discharge points are forcibly urged against an adjacent one of said electrically insulating members to provide relatively precise alignment of said points.

11. A static eliminator according to claim 1 wherein said discharge points project slightly beyond the edges of the adjacent insulating members.

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