United States Patent

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[54] **ION GENERATOR**

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[51] **Int. Cl.** **H05f 3/06**

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

[56] **References Cited**

UNITED STATES PATENTS

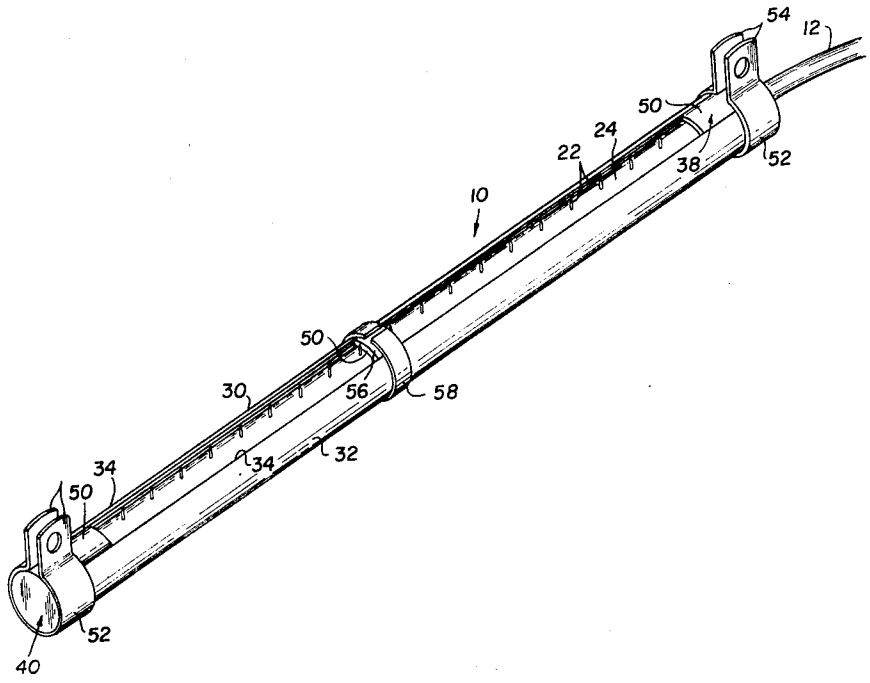
3,120,626	2/1964	Schweriner	317/2 F
2,392,808	1/1946	Chapman	317/2 F
3,037,149	5/1962	Herbert	317/2 F

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Assistant Examiner—Harry E. Moose, Jr.
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[57] **ABSTRACT**

An ion generator having an electrical cable for producing a corona field for capacitors having emitter electrodes discharging ions toward a grounded shield that protects the electrodes from accidental touching and discharge and causes the ions to assume an enlarging path of ion discharge.

7 Claims, 6 Drawing Figures



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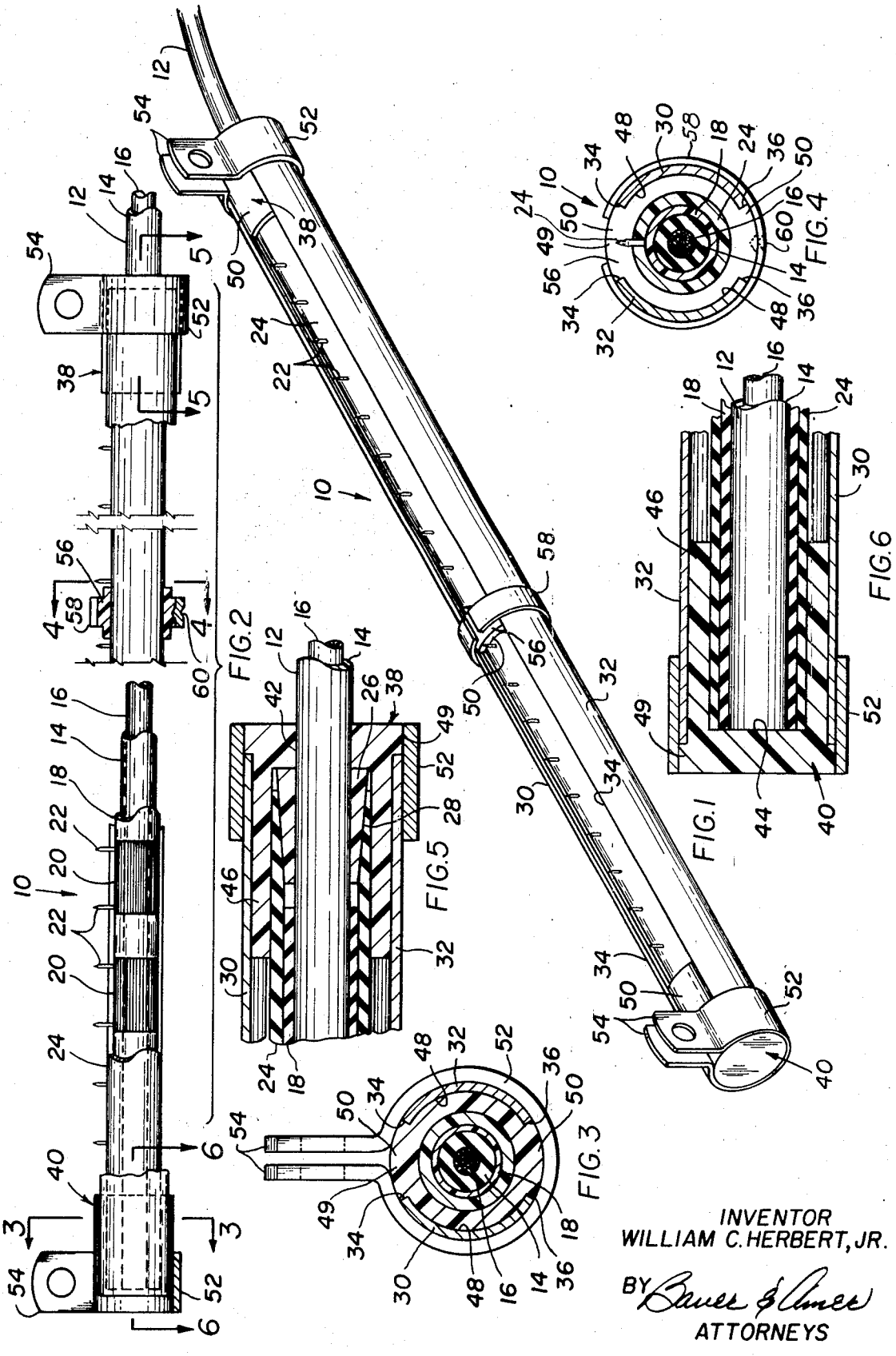


FIG. 1

FIG. 2

FIG. 3

FIG. 4

FIG. 5

FIG. 6

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ION GENERATOR

The present invention relates to an improved ion generator and more particularly of that type disclosed in my U.S. Letters Pat. Nos. 2,514,864, 2,866,923 and 3,037,149.

In the past, ion generators have been employed as static eliminators to remove static electricity from sheets moving in a machine under conditions which tend to generate static electricity on the surfaces of such sheets. This is especially the problem experienced with paper sheets used in printing presses and photocopy machines.

Although my own aforementioned patents constitute the bulk of relevant prior art, there has been a prevading problem of generating ions in such manner as to eliminate static from fast moving surfaces that are either continuous or discontinuous. In the past, the elimination of static has been accomplished by attempting to position the ion emitter electrodes as close as possible to the charged surfaces to assure that the full discharge of ions will impinge upon the surfaces and thereby neutralize the static charge. However, in such cases when it became necessary to conduct repairs to or adjustment in the machines, it often happened that mechanics performing such repairs or adjustments would accidentally touch the electrodes, the points of which projected from the static generator, and discharged the same to produce severe electrical shocks.

Furthermore, because the discharge points of the electrodes in the prior art were so close to and pinpointed at the surface of the moving sheet, the area of ion discharge and distribution was extremely limited. Therefore, even though the prior art devices may have operated satisfactorily for their intended purposes, the pinpointed nature and limited area of discharge of their ions often resulted in ineffectual elimination of static charges from the surfaces at which they were directed.

The present invention overcomes the aforesaid problems by providing a simple, yet novel, arrangement of structure wherein the ion emitter electrodes are recessed within and relative to an opening defined by relatively spaced walls of a grounded shield. This arrangement of structure protects the emitter electrodes by removing them from a shock hazard position at which they might be accidentally touched and discharged. Additionally, the present invention now produces an intense area of ionization in the shape of an ever enlarging mushroom field and area of ions by moving outward from the electrodes toward the spaced grounded shield walls and therebeyond toward the surface to be treated.

Hence, it is an object and feature of the present invention to produce an ion generator in which the emitter electrodes are recessed to eliminate the possibility of shock hazard or accidental electrical discharge and yet at the same time to produce an enlarging and increasing field of ions which, as they mushroom outwardly and away from the emitter electrodes toward the relatively spaced grounded shield walls, produce an ever increasing area of ion coverage which effectively covers a large surface to eliminate static electricity therefrom.

The above description, as well as further objects, features and advantages of the present invention, will be more fully appreciated by reference to the following detailed description of a presently preferred, but nonetheless illustrative, embodiment in accordance with the present invention, when taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is a perspective view of an ion generator constructed according to the teaching of the invention;

FIG. 2 is a side view of FIG. 1 with portions thereof removed;

FIG. 3 is a section taken along lines 3—3 of FIG. 2;

FIG. 4 is a section taken along lines 4—4 of FIG. 2;

FIG. 5 is a section taken along lines 5—5 of FIG. 2; and

FIG. 6 is a section taken along lines 6—6 of FIG. 2.

Referring now to the drawing, the ion generator illustrated in full detail in FIG. 1 is generally identified by the numeral **10**. The generator comprises an electrical cable **12** of usual construction containing an exterior insulator **14** and electric conducting wires **16**. The cable **12** extends into and is surrounded by an insulating tube or sleeve **18** that may be more conveniently referred to as a capacitor tube. The capacitor tube **18**, being of an insulating material, is non-conductive but is provided with a plurality of metallic or conductive bands **20** spaced relative to each other along the length thereof. The bands **20** may be made of any convenient metallic material. They may be painted on the capacitor tube or they may be metallic bands positioned about and relatively spaced along the capacitor tube. Such bands **20** function as individual electric capacitors for storing and releasing an electric charge produced by the corona of the electrical cable **12**.

Connected with each of the relatively longitudinally spaced capacitors **20** are ion emitter electrodes **22**. The emitter electrodes are relatively spaced from each other in longitudinal alignment along the length of the capacitor tube **18** with each capacitor **20** having in contact therewith two ion emitter electrodes **22** such as is more clearly illustrated in FIG. **2**. From the drawing, it will be noted that the emitter electrodes are relatively spaced along the length of the capacitor tube **18** in a straight line and are equally spaced from each other. Since two emitter electrodes **22** are in electrical contact with each capacitor **20**, the charge stored in each capacitor is discharged therefrom through the emitter electrodes connected therewith.

In the drawing, it is noted that the electrodes **22** are positioned radially with respect to the capacitor tube **18** and, thus, the discharge of ions is also normally directed radially outward away from the capacitor tube and the capacitors thereon. The emitter electrodes **22** are relatively pointed in the direction away from their electrical connection with their respective capacitors and, thus, the discharge of ions from each electrode is pinpointed to move away from each electrode at the very pointed tip thereof.

Normally, the discharge of ions from the pointed tips of the emitter electrodes would produce a pinpointing directional discharge of ions. However, as the description proceeds, it will become clear that although the ions discharged at the pointed ends of the emitter electrodes are restricted to their points of emission, the discharging ions are caused to assume an ever enlarging and more encompassing path as they flow away from the emitter electrode points.

Positioned in encompassing and insulating relation with the capacitor tube **18** is an insulating sleeve **24**. The insulating sleeve **24** extends for the full length of the capacitor tube and completely surrounds the same except to permit the ion emitter electrodes **22** to project radially therethrough. The insulating sleeve **24** thus aids to retain the ion emitter electrodes **22** in engagement with their respective capacitors **20** while fully insulating the capacitors **20** from external electrical fields and from possible accidental touching. In practice, the insulating sleeve **24** is also tubular conforming to the shape of the capacitor tube **18** and thus fits closely thereabout. The insulating sleeve **24** includes regularly and equally spaced holes arranged in longitudinal alignment to enable the snug passage of the ion emitter electrodes **22** therethrough and to retain the emitter electrodes in electrical contact with their respective capacitors **20**.

The assembly of the cable **12**, capacitor tube **18** and insulating sleeve **24** is retained in snug unmoving relationship by a split yieldable end cap **26** which fits snugly about the outer surface of the cable **12** at its entry into the ion generator. The cap has a tapered outer surface **28** which cooperates with a similarly tapered surface provided on the interior end of the outboard insulating sleeve **24**. This tapered relationship of the interior of the sleeve **24** and the end cap **26** produces a wedging action which, by the yielding nature of the end cap **26**, causes it to wedge between the cable and the insulating sleeve **24** to retain the combination of the cable, capacitor tube, insulating sleeve and end cap in a unitary assembly.

Positioned in radial outward spaced relation relative to the above described assembly is a grounded metallic shield means shown in the present disclosure in two parts **30** and **32**. The shield means **30, 32** is divided into the two elongated elements which are identical to each other and are arcuate in cross-section throughout their lengths as viewed in FIGS. **3** and **4**. The grounded shield means **30, 32** forms a composite structure extending for the full length of the ion generator **10**. Because of its two part construction, the shield has relatively spaced edge walls **34** bracketing along opposite sides and extending for the full length of the longitudinally aligned ion emitter electrodes **22**. The opposite relatively laterally spaced walls **36** of the shield elements **30** and **32** are positioned at the diametrically opposite side of the emitter electrodes.

Thus, the laterally spaced walls **34** define the limits of a recess through which ions discharged from the emitter electrodes **22** spread outwardly in an ever increasing mushroom shape. Because the arc of each of the shield elements **30** and **32** is greater than the radius from the center of the ion generator to the pointed ends of the emitter electrodes **22**, the edge walls **34** are spaced radially outward beyond the points of the emitter electrodes and, hence, shield and protect the electrodes from being accidentally touched by a screwdriver or other tool that may be manipulated near them.

The total assembly of details is completed by insulating end plugs generally identified by the numerals **38** and **40**. The construction of the end plugs **38** and **40** are substantially alike except that the end plug **38** as shown in FIG. **5** is provided with a central through opening **42** to permit the passage of the cable **12** therethrough, whereas the opposite end plug **40** is completely closed about all of its surfaces so as to insure that the cable **12** abuts against its inner surface **44**. Each end plug **38** and **40** has an axially extending wall **46** which encompasses a portion of the axial length of the outer surface of the insulator sleeve **24** in relatively close fitting relationship.

The outer surface of each end plug is provided with diametrically opposed arcuate seats **48** which extend for a lengthwise portion of each plug and terminate at a fully circular end wall **49**. Radial ears **50** of the same diameter as the wall **49** are provided at diametrically opposite portions of each plug between the recessed shoulders **48** to function as abutments against rotative displacement of the shield means **30** and **32**. The shield **30** and **32** fit and seat closely within the seats **48** with their edges **34** and **36** abutting the ears **50** and their extreme lengthwise ends resting against the end walls **49**. When so seated, the elements **30** and **32** conform to the circular configuration and shape of the end walls **49**. The end plugs **38** and **40** and the seated ends of the shield elements **30** and **32** are held together by clamps **52** shaped conformingly to the end wall **49** and having upstanding ears **54** with holes therein to enable the same to be secured to any convenient grounding surface of a machine within which the present ion generator **10** is to be utilized.

In the present disclosure, because of the elongated length of the ion generator **10**, there is provided an intermediate positioning plug **56** of insulating material which has similarly shaped recessed shoulders **48** matching those of the end plugs **38** and **40** and radially extended ear abutments **50** diametrically disposed therebetween. A further C-shaped spring clamp **58** having a radially inwardly directed detent **60** is adapted to engage in a similar detent provided in one of the abutment ears **50** of the plug **56** to thereby yieldingly retain the shield elements **30** and **32** within their shoulder recesses **48** of the intermediate plug **56**.

In the present construction when the cable **12** is connected with a source of electrical energy, a corona field is created to impart an electrical charge that is stored in the capacitors **20** spaced longitudinally along the length of the capacitor tube **18**. This charge is then released and discharged by way of the ion emitter electrodes **22** radially outward away from the capacitor tube. However, because the shield means **30, 32** is grounded and the walls **34** thereof are spaced laterally on opposite sides of the recess extending the length of the ion generator and slightly radially outward of the emitter electrode points, the discharging ions tend to flow in a path radially outward and away from the points of the emitter electrodes and then to spread laterally toward the bordering grounded walls **34** of the shield elements **30** and **32**.

This flow of ions follows an initially radial path that is then directed toward the ground of the laterally spaced walls **34** to cause a mushrooming effect of discharged ions that spreads from a pointed discharge to an ever and progressively increasing area of coverage of ions as the same flow away from the emitter electrode points. This results in an increased area of ion discharge coverage rather than a pinpointed ion discharge. Hence, the surface area covered by the discharging

ions is much larger and more encompassing then has been able to be accomplished heretofore.

By so positioning the emitter electrodes within the recess defined by the laterally spaced walls of the grounded shield means, the discharging ions seek to move toward ground and thus enlarge their flow path. Moreover, because the emitter electrodes do not extend beyond the walls **34**, they cannot be touched accidentally with tools that may be manipulated by a mechanic within the area of the ion generator and accidental discharge of the capacitors **20** is avoided with shock hazard reduced. In consequence, the area of ionization is larger than that accomplished heretofore and the surfaces having static charges to be neutralized can be treated more effectively and more rapidly. The intensity of ion discharge is enhanced by the discharging of each capacitor through two ion emitter electrodes. Thus, the discharge of ions is concentrated at only two emitter electrode points and the intensity of the discharge is greater than that which might be accomplished by a greater number of emitter electrodes discharging ions from a single capacitor.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to a preferred embodiment thereof, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention. It is the intention, therefore, to be limited only as indicated by the scope of the claims appended hereto.

What is claimed is:

1. In an ion generator,

a plurality of longitudinally arranged, relatively spaced ion emitter electrodes each having an emitter point,

a grounded metallic shield having an uninterrupted longitudinal opening defined by walls relatively spaced laterally on opposite sides of each of said plurality of longitudinally arranged electrodes and extending radially beyond the emitter points of said electrodes whereby ions emitted at said emitter points move radially outward through said opening and laterally toward the opposite walls of said grounded shield to assume a mushroom shape with said emitter points protected within the confines of said shield,

an electric cable,

a capacitor about said cable and in electrical contact with each of said emitter electrodes,

and insulator means between said shield and capacitor.

2. In a generator as in claim **1** wherein there are a plurality of capacitors each in electrical contact with every two of said plurality of relatively spaced emitter electrodes,

and said electrodes are longitudinally aligned with each other.

3. In an ion generator as in claim **2** wherein said plurality of capacitors are circular metallic bands on an insulated sleeve,

said emitter electrodes extending radially outward from their electrical contact with their respective bands,

and said shield is in radially spaced relation to and outward of said capacitors and the emitter points of each of said emitter electrodes.

4. In an ion generator as in claim **3**,

said cable, capacitor sleeve, insulator means and shield being concentrically arranged serially,

a plug at each end of said generator supporting said serial arrangement,

one of said plugs having an opening therethrough for the passage of an end of said cable into the generator through one end thereof,

and a closed plug at the other end of said generator receiving and closing the end of the cable in the generator.

5. In an ion generator as in claim **4**,

an end clamp at each end of said generator clamping said shield to said end plugs and grounding said shield.

6. An ion generator comprising

an electrical cable,

an insulator sleeve about said cable and having a plurality of relative axially spaced capacitors thereon,

at least two ion emitter electrodes in electrical contact with each of said capacitors,

each such electrode having an emitter end directed radially outward from its respective capacitor,

a grounded shield having relatively spaced walls spaced outward of said capacitors and said electrode emitter ends,

said walls being spaced on opposite sides of said electrodes,

and insulator means between said capacitors and shield with said electrodes extending therethrough toward but short of the space between said walls.

7. An ion generator as in claim **6**,

a plug at each end of said shield supporting said cable, sleeve, insulator means and shield serial in coaxial arrangement and closing the opposite ends of said ion generator,

and clamp means engaging each of said end plugs and said shield to retain said serial arrangement and to ground said shield.

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