Feb. 4, 1964 H. SCHWERINER 3,120,626

SHOCKLESS STATIC ELIMINATOR

Filed Nov. 7, 1960

Fig. 1.

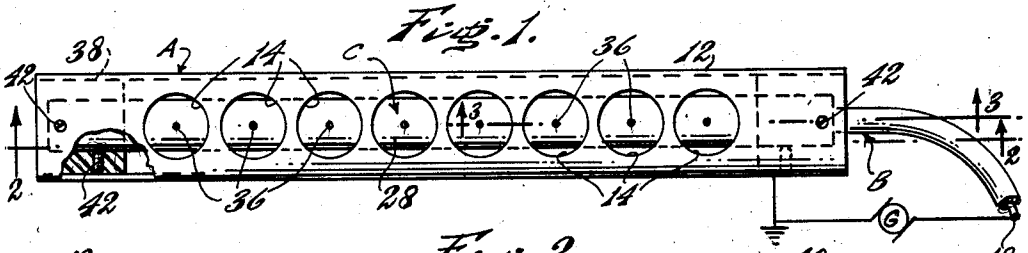


Fig. 2.

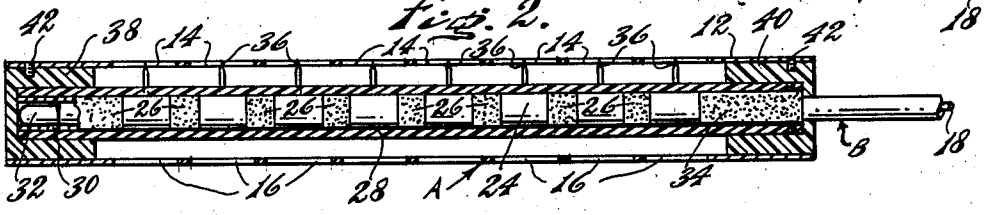


Fig. 3.

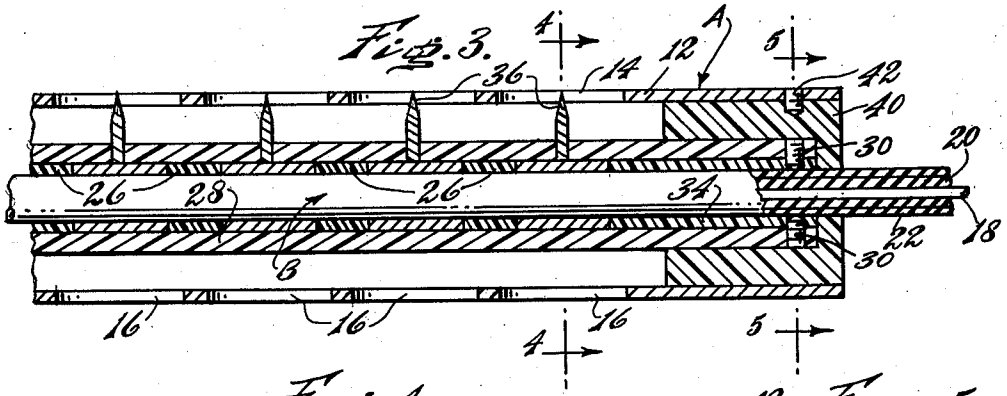


Fig. 4.

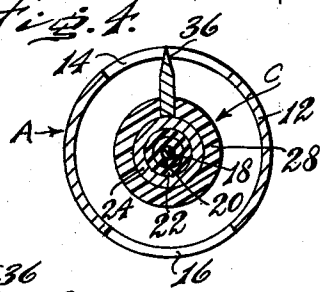


Fig. 5.

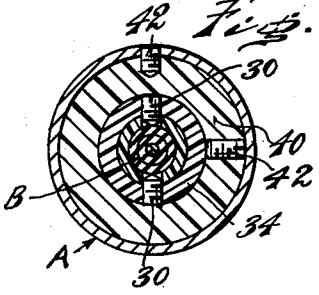


Fig. 6.

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SHOCKLESS STATIC ELIMINATOR

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This invention relates to static eliminators, and more particularly relates devices for neutralizing static charges which develop on machinery and on articles processed by or made on such machinery or equipment as a result of frictional, electrical, mechanical or other created forces.

As is well known in the art, static eliminators customarily employ a series of sharply pointed conductive needles which are air spaced from a condutive shield or casing so that a high voltage electromotive force applied directly across the needles and the casing will create an ionized field in the air gap and immediately thereabout. For any degree of efficiency, it is necessary that the needles be fully exposed and spaced in air from the casing shield in order to allow the ionized air particles within the gap to be juxtaposed with the statically charged device or article thereby enabling these air ions to combine with and neutralize oppositely polarized static charges. The electrical potential or voltage gradient across the gap may be from 2,500 to 15,000 volts to produce an effective field of air ions. While the electrostatic generator for creating this potential is usually of low amperage, the power is sufficient to sting or cause severe shock under certain conditions to personnel accidentally touching the points.

Similarly, if a conductive body were to accidentally shunt across the air gap, there would be great danger of arcing or sparking which is extremely hazardous in an explosive or inflammable environment.

It is therefore an object of this invention to provide a shockless static eliminator.

Another object of this invention is to provide a static eliminator which personnel may freely handle during operations without being exposed to electrical shock.

Another object of this invention is to provide a highly efficient static eliminator in which the points are guarded to an extent that avoids a great likelihood of personnel impaling themselves on sharp needles.

Another object of this invention is to provide a highly effective static eliminator which may be safely utilized in an explosive or an inflammable environment.

Another object of this invention is to provide a shockless static eliminator which is easily kept clean and collects a minimum of dust as a result of ordinary use.

Another object of this invention is to provide a shockless static eliminator which meets all of the requirements of Underwriters' Laboratory specifications.

Other objects of this invention are to provide an improved device of the character described that is easily and economically produced, which is sturdy in construction, and which is highly effective in operation.

With the above and related objects in view, this invention consists of the details of construction and combination of parts as will be more fully understood from the following detailed description when read in conjunction with the accompanying drawing in which:

FIG. 1 is a top plan view, and partly in section, of a shockless static eliminator embodying this invention.

FIG. 2 is a sectional view taken along lines 2—2 of FIG. 1.

FIG. 3 is a sectional view taken along lines 3—3 of FIG. 1.

FIG. 4 is a sectional view taken along lines 4—4 of FIG. 3.

FIG. 5 is a sectional view taken along lines 5—5 of FIG. 3.

FIG. 6 is a perspective view of a modified shockless static eliminator embodying this invention.

Referring now in greater detail to the drawing in which similar reference characters refer to similar parts, there is shown a shockless static eliminator comprising a first electrically conductive member, generally designated as A, a second conductive member B insulated thereform, and a discharging member C capacitatively coupled with the second member and projecting in air spaced relationship with said first member.

The first conductive member A in the preferred embodiment shown in FIGS. 1 to 5 inclusive comprises a tubular sheet metal casing or shield 12 made of a suitable electrically conductive material such as brass. A plurality of circular apertures 14 are cut or otherwise formed in the casing 12 and are longitudinally spaced along the upper portion thereof. These apertures 14 concentrically define an air gap about respective discharging needles and within which an ionized field is created when a high voltage generator source G is electrically connected across the first member A and the second member B as shown in FIG. 1. The lower portion of the casing 12 also has a plurality of openings 16 to serve for purposes of ventilation and to facilitate the removal of dirt and dust collecting within the casing tube without inverting the casing.

The second conductive member B may be of any conventional wire conductor 18 which is preferably stranded copper and having a polyethylene jacket 20 with an outer coating 22 of vinyl plastic. The polyethylene jacket provides good dielectric properties although it is soft and easily nicked. The vinyl sheath, while having a lesser coefficient or dielectric constant, lends support and protection for the polyethylene.

The discharging member C includes a plurality of tubular rings 24 which are axially spaced along the outer periphery of the member B by spacer sleeves 26. The rings 24 are of a good conductive material such as brass, and the sleeves of suitable insulative composition such as "Bakelite" formaldehyde resin. The conductor B with its concentrically or annularly supported and axially spaced conductive rings 24 and insulated sleeves 26 is longitudinally inserted within an insulating tubular collar 28 and fixed therein by set screws 30. The collar 28 is preferably a linen base phenoformaldehyde composition for good dielectric properties as well as strength and rigidity. The distal end 32 of the conductor B has the polyethylene jacket melted about the free stripped end so that insulation of the wire 18 from the casing 12 or an adjacent ring may be assured. The proximal end of the conductive member B has a sleeve element 34 of insulating formaldehyde material which maintains proper registration of the conductive rings 24 with longitudinally spaced holes in the collar 28. Conductive needles 36 are pressed through the respective collar holes into firm abutment against the corresponding rings 24 so that positive electrical contact is established between each needle and its corresponding ring. Thus, each needle 36 while insulated from the conductor 18 by the polyethylene jacket 20 and vinyl covering 22 is capacitatively coupled to the wire through the rings 24.

The discharging member C is axially disposed in the casing 12 and held in insulated spaced relationship therefrom by end plug 38 and annular spacer 40 both of which are retained in fixed position by set screws 42 extending through the ends of the casing. The needles 36 radially project through the collar 28 into the respective casing apertures 14 and register substantially with the respective axes thereof at the periphery of the casing.

The shockless static eliminator above described is operated in a conventional manner by connecting a high voltage generator source of approximately 7,000 to 8,000 volts output across the casing **12** and the terminal end of the wire conductor **18**. Each of the needles **36** is capacitively coupled to the conductor wire **18** through a corresponding ring **24**. The capacity between each ring **24** and the central conductor **18** is approximately 7 micromicrofarads, this capacity being so selected as to minimize shock or arcing at the points and at the same time to yield a high degree of air ionization within the circular gap about the needle points. The apertured tubular casing **12** provides a complete encirclment of ground about the needles for unusually high production of ionization. The needle points do not extend beyond the periphery of the casing **12** which not only augments efficiency but also affords protection to an operator by guarding against scratching or puncturing to some extent of his fingers. Again, in the aforementioned embodiment, the rings **24** and the discharging needls **36** are individually capacitively coupled to the conductor **18** thereby reducing the total capacity of the needle coupling if the needles were directly coupled together through a single conductive pipe or tube, i.e. the capacity of a condensor being proportional to the area of its plates.

In FIG. 6, there is shown another embodiment of this invention wherein an identical conductor B is longitudinally encased within and capacitatively coupled to the discharge element C. However, in the FIG. 6 embodiment, the discharge member C is mounted between insulated end blocks **50** and **52** across which metal rods **54** and **56**, i.e. first conductor member A1, extend in spaced parallel relationship on either side of the longitudinally extending line of needles **36**. A high voltage source is similarly connected across the rods **54**, **56** and the conductor **18** whereby an ionized air field is produced in the gap between the metal bars **54** and **56** about the needles **36**. The needles **36** are, again, capacitatively coupled to the conductor wire **18** through annular rings **24**. Although not specifically shown in the drawing, it is easily seen that a solid second conductor member such as a rigid metal rod having an insulated sheath thereabout may be employed by sliding commensurate conductive rings and insulated sleeves thereupon with either of the embodiments hereindescribed or in suitable manners not herein set forth.

Although this invention has been described in considerable detail, such description is intended as being illustrative rather than limiting since the invention may be variously embodied without departing from the spirit thereof, and the scope of the invention is to be determined as claimed.

What is claimed is:

1. A method for making a shockless static eliminator comprising the steps of sliding alternately a plurality of dielectric sleeves and conductive sleeves upon a flexible wire conductor having a dielectric sheath thereon so that the alternate sleeves are longitudinally contiguous with the next adjacent sleeves, co-axially sliding a rigid dielectric tube having longitudinally spaced transverse openings therein upon the sleeves so that the openings register with the conductive sleeves, and pressing conductive needles through the openings into abutment with the conductive sleeves so as to retain the sleeves within the tube with the needles radially projecting outwardly therefrom.

2. A method for making a shockless static eliminator comprising the steps of alternately sliding dielectric sleeves and conductive sleeve longitudinally about a flexible insulated cable and co-axially therewith, co-axially sliding a rigid dielectric tube over the sleeves co-extensive with the overall longitudinal dimension thereof, piercing the tube with conductive needles so that the needles are pressed into abutment with the conductive sleeves and radially project outwardly therefrom beyond the periphery of the tube, supporting the tube within a cylindrical conductive casing having longitudinally-spaced circular apertures therein so that the needles co-axially project within the respective apertures whereby the needles are capacitively coupled to the cable when a source of high voltage is applied across the cable and the casing.

3. A method for making a shockless static eliminator comprising the steps of co-axially sliding successively a plurality of tubular dielectric sleeves and tubular conductive sleeves in alternate longitudinal sequence about a flexible cable consisting of a central wire conductor having an insulated sheath thereon in an order whereby the first sleeve is a dielectric sleeve and encapsulates the medial portion of the cable and the last sleeve is also a dielectric sleeve and encapsulates the distal end of the cable, securing the first and last dielectric sleeves to the cable so that these and the interediate alternately-arranged sleeves are retained in longitudinally contiguous disposition on the cable, co-axially sliding about the contiguous sleeves so as to be in longitudinal co-extension therewith a rigid dielectric tube having a row of longitudinally-spaced openings therein which register with the respective conductive sleeves, pressing conductive needles through the respective openings into abutment with the underlying conductive sleeves so that the needles are secured firmly thereagainst and radially project outwardly from the tube, clamping the tube concentrically about the contiguous sleeves and the cable, annularly enclosing the ends of the tube, and mounting the tube co-axially within a conductive cylindrical casing having enlarged longitudinally-spaced circular apertures therein so that the needles are concentrically spaced within the respective apertures.

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