Dec. 30, 1958 W. C. HERBERT, JR 2,866,923

STATIC ELIMINATORS

Filed Jan. 28, 1954 2 Sheets-Sheet 1

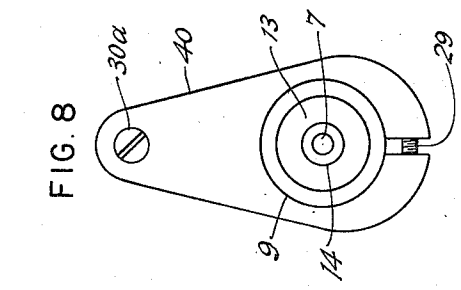


FIG. 8

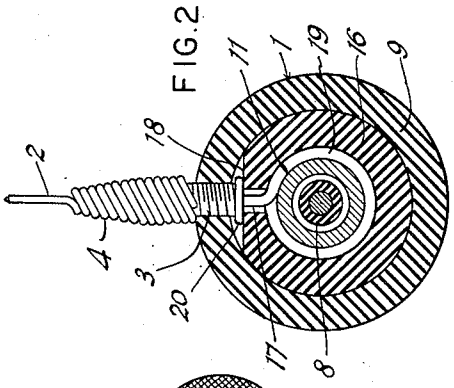


FIG. 2

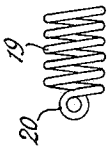


FIG. 7

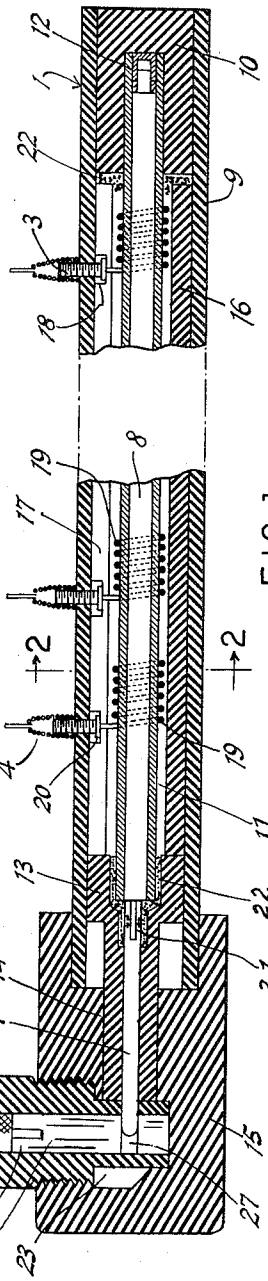
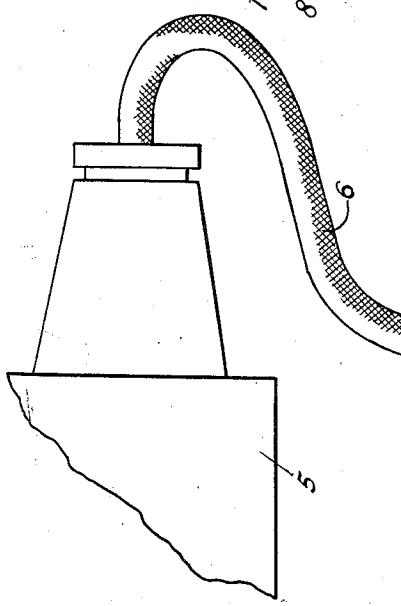


FIG. 1.



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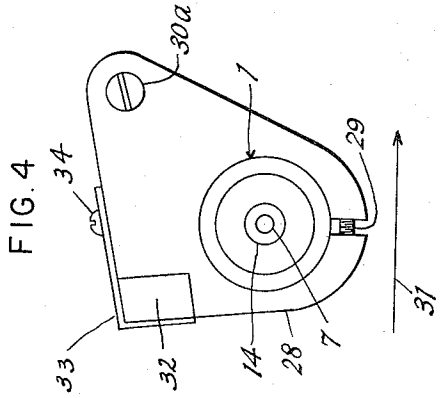


FIG. 4

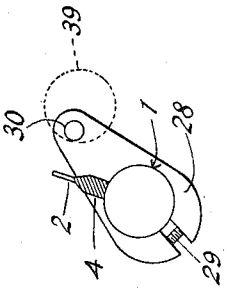


FIG. 6

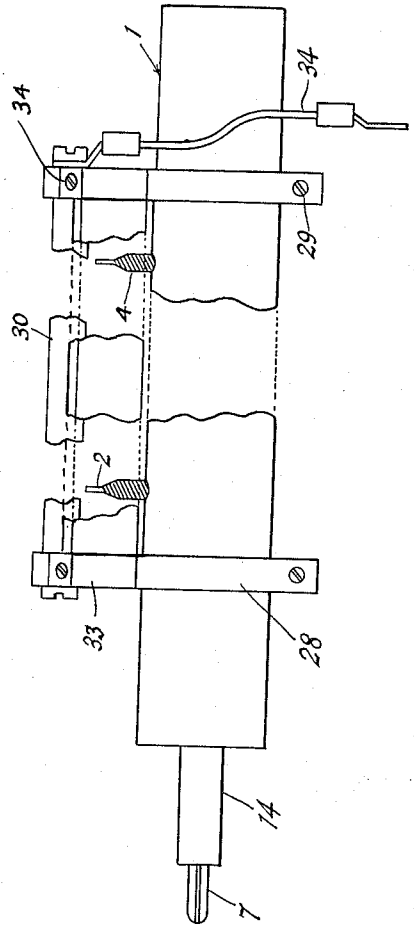


FIG. 3

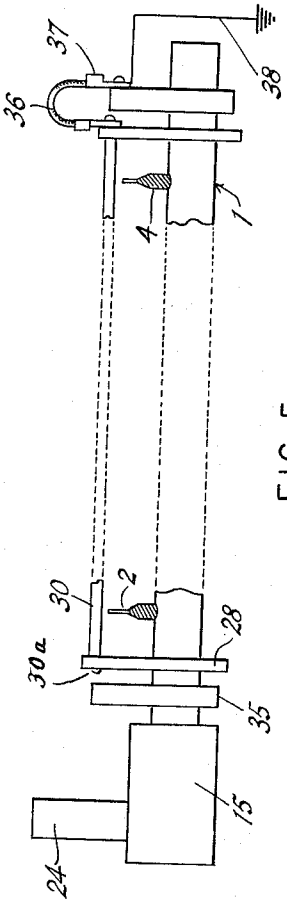


FIG. 5

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STATIC ELIMINATORS

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Application January 28, 1954, Serial No. 406,654

5 Claims. (Cl. 317—2)

My invention is an electrical accessory for machines having parts which make contact with material, such as paper or cloth, for example, in a manner to generate electrical stresses, and more particularly to a piece of equipment for the removal of static electricity.

The principal object of this invention is to provide a static eliminator which can be operated at high voltage without sparking or risk of shock to the attendants. Hence the device is perfectly safe in practice.

It is also an important object of this invention to provide a static eliminator to be mounted adjacent a machine for treating paper or other material in any form that collects static charges in the process, and which quickly and efficiently neutralizes such charges, so that the final product which the machine delivers can be advantageously handled.

Another object is to provide a static eliminator which is extremely durable, having component parts capable of bearing heavy electrical loads without risk of short circuit breakdown or puncture of parts, or any other damage; and which is simple in design, can be completed at relatively low cost, and is very easy to install in the required position.

The description sets forth the construction of the eliminator and the drawings show the best embodiment of my invention now known to me; the novel features of the improvement being defined in the appended claims. The disclosure, however, is explanatory only, and changes in structural details may of course be made without omitting or materially altering any of the essential features or characteristics by which the invention is distinguished.

In the drawings,

Figure 1 is a view showing in section a complete eliminator according to my invention, and the method of connecting the same to a source of electric energy.

Figure 2 is a transverse section on an enlarged scale through the eliminator, on line 2—2 of Figure 1.

Figure 3 is a side elevation of the eliminator with ground rod thereon.

Figure 4 is an end elevation thereof; as it appears from the supply end.

Figure 5 is a front elevation of the eliminator as it appears when mounted on an apparatus which works upon material that is apt to receive charges of static electricity in manufacturing or finishing the article for which it is used.

Figure 6 is an end view of what is shown on Figure 5.

Figure 7 illustrates a detail; and

Figure 8 is an end elevation similar to Figure 4, of a modified eliminator having a ground rod without a protective shield.

The static neutralizer bar is indicated as a whole at 1. It carries a plurality of short electrodes 2 projecting therefrom and arranged in a straight line at separated points along the length thereof. These electrodes are supported on studs 3, mounted on the bar 1, and the electrodes 2 are preferably of metal wire 4 coiled into form so that they can be screwed upon the studs and engage them

firmly. The wire coils 4 are each of the same diameter around the studs 3, but taper beyond the studs and have a straight portion at the outer end, terminating in a sharp point.

The bar is designed to be energized from a high tension step-up transformer 5, which is connected by a cable 6 to an insulated conductor 7, inside the bar at one extremity and protruding from said extremity thereof. The transformer is coupled to a supply circuit and suitable switches, not shown, are of course included. The conductor 7 is connected to a conductor cable 8, with a wire therein having a covering of insulation, and an outer sleeve or sheath of vinyl plastic. Cable of this type is well known.

The bar itself comprises a tubular outer casing 9 of insulator material with high dielectric strength, with openings at various points for the studs 3, which project into the wire coils 4 of the electrodes 2. The connection with the cable 6 is at one end, and the opposite end is closed by an insulator plug 10. Within the bar the cable is enveloped by an insulator sleeve or tube 11 which extends into the plug 10, but the adjacent end of the cable protrudes from the vinyl sleeve, and is covered by a cap of plastic insulation, preferably polyethylene 12. The end of the casing 9 at the cable connection contains a plug 13 with a reduced shank 14 which has a bore receiving the conductor 7, and this end is fitted into a rounded head of insulation 15. The shank 14 of the plug 13 projects from the casing 9, and the extremity of the rod 7 is electrically connected to the cable 6 in said head 15.

The insulator tube 11 extends from the plug 10 into the plug 13, and between the two plugs, the sleeve 11 is enveloped by a tubular insulator member or sleeve 16 which has a straight slot 17 at one side extending throughout its length. This member has recesses 18 in its outer surface extending across the slot 17, and in said recesses the studs 3 are seated. Between the insulator sleeve 11 and the sleeve 16 are coils of wire 19 encircling the sleeve 11, one end of each coil projecting through the slot 17 and having at one end a small flat turn 20 which is seated in one of the recesses 18. The coils 19 are thus in electrical contact with the metal studs 3 and electrodes 2. The member 16 is also of insulation.

The assembly can be accomplished by slipping the cable 8 into the tube 11, putting the coils 19 on the latter, and slipping the cable, tube 11 and coils into the sleeve 16 with one end of each coil in the slot 17. The ends of the coils in the slot are then straight and project through the side of the sleeve 16. At each recess the straight ends of the coils are then given the turns 20 and rest on the bottoms of the recesses 18. The studs 3 are threaded and are screwed into holes in the outer casing 1 and make firm contact with the turns 20.

The head 15 has a circular recess to receive the tube 9, and has a bore extending into it from the bottom of the recess, of a size to receive the shank 14 of the plug 13 snugly. The bore in the plug 13 for the conductor rod 7 is enlarged to receive the adjacent end of the cable 8 and sheath 11 and the conductor in the cable is soldered to the rod 7 as indicated at 21. The soldered connection and parts of the insulator covering of the cable in the plug 13 and sleeve 11 can be covered by an insulating compound 22. A quantity of the same compound can be inserted between the other sleeve 16 and the plug 10 and around the sleeve 11 at this point; and between the end of the cable 8 and the cap 12 in the plug 10, if desired. The compound 22 is not essential and may be omitted.

The insulator head 15 is shown as being rounded, or cylindrical, and it also has a threaded cavity or recess 23 in one side at a right angle to the bar 1, and into this recess is screwed a sleeve of hard rubber or

other insulation 24, in which is the end of the cable 6 joining the bar 1 to the transformer 5. Within the sleeve or plug 24, the conductor 25 in the cable 6 is connected to a metal terminal 26, which has a transverse bore 27 in line with the metal rod 7. The side of the plug has an aperture in line with the bore 27, so that when the bar 1 is inserted into the head 15, the bar 7 and cable 8 are put into electrical connection with the cable 6. The end of the bar is split to fit into the bore 27 tightly.

The coiled wire electrodes 2 are put into place by slipping or screwing them upon the studs 3, by which they are firmly held, in snug contact with the outer surface of the casing 9. They remain in place, but can be detached at will.

In some conditions brackets of insulation 28 are attached to the bar 1 near its ends. The brackets have openings for the bar and are split at one end through to the openings, and have screws 29 to enable the sides of the brackets to be drawn together and grip the bar 1 tightly. The brackets support a metal ground rod 30 at their outer ends, parallel to the bar 1 and spaced from the electrodes 2. When the eliminator is in operative position adjacent a web of material 31, as shown on Figure 6, the rod 30, preferably of aluminum, has the effect of swinging the field of electrical stress more towards the direction the material takes as it is moved in the machine and the eliminating or neutralizing action is rendered more thorough. The brackets 28 are held at an angle to the horizontal, and the bar 1 is set to hold the electrodes 2 at a greater angle so that the electrodes 2 point above the ground rod 30. The brackets 28 are spanned by a bar 32 of Lucite parallel to the rod 30, and secured to a shouldered seat at the top of the brackets 28 by clips 33 affixed to the tops of the brackets by screws 34. This bar 32 acts as a shield to prevent contact between electrodes 2 and the material if it sags during transmission, past the bar 32 on its way over the electrodes 2.

On long webs of paper and other material where static appears, the static is a surface charge of electricity. It is always due to excess or deficiency of electrons on the surface. This condition develops as surfaces in contact are separated. Where paper, cloth, plastic, etc. has had a surface in close contact with another surface, as for example, when it passes over or around a roller, electrons intermix at the contact area. As the surfaces separate, some of these electrons are caught "off base," due to the non-conductive nature of the material. The resultant excess or deficiency of electrons is static.

My eliminator overcomes static by causing ionization of air between the emitter points of the bar and the surface of stock on which static is present. The action causes release of free electrons from air molecules by application of high voltage at the emitter points. These free electrons strike other molecules, release more electrons from them—thus resulting in a flow of electrons, with a corresponding residue of particles from which electrons have been released.

When a surface having a static charge passes such ionized air, the charge is instantly overcome by flow of electrons in this ionized, or conductive, air. Excess electrons pass to ground through machine parts, or the aluminum rod on the eliminator and the surface is left in complete electron balance—free of static.

High voltage amounting to thousands of volts is applied at the emitter points, but elimination of static is accomplished with such control of the quantity of electrical current that no shock, sparking or arcing occurs. The attendants are in no danger of injury. The wire 19 must be such size and such number of turns as to obviate danger of sparking and still produce enough ionization.

Ordinarily the ends of electrodes 2 should be from ¾" to 2" away from the surface of the stock (above or below) depending upon material and nature of the installation, and separated by a space of ½ inch to ¾ inch from the ground rod 30. But if the eliminator is installed close to metal rods or rollers of the machine, as indicated at 39 in Figure 6, the aluminum ground rod 30 is unnecessary. If the aluminum ground rod 30 is used, it must be connected to the arms 35 (or some other grounded part) by means of the wire lead 36 joined to the rod 30 and mounting bracket 35 by clips 37, and the wire 36 is joined to a grounded lead 38.

In some instances the shield 32 can be discarded. The bracket carrying the ground rod 30 will then have the shape illustrated in Figure 8.

The bar 1 with brackets 28 and rod 30 are attached to the arms 35, which may have any length or shape to enable them to be fixed to the machine for which the eliminator is intended.

The invention is thus of the best and most efficient design and well suited to serve the purposes for which it is designed.

The polyethylene cap 12 keeps the end of the cable in the block 10 completely and permanently insulated. In the absence of a cap of this or equivalent material, the block 10 would soon permit leakage of electricity and danger of shock would arise. When finished as above described, the cable 6 can be disconnected from the transformer 5, or the whole head 15 can be detached from the bar 1, with the electric power circuit closed through the transformer in both instances, and no sparking will ensue or shock given to the attendant when he approaches or even touches the bar 1. The ground bar 30 can of course be fixed or mounted to be adjustable to suit any special conditions. It is held in place on the brackets 28 by screws 30*a* engaging its ends.

The coils or conductors 19 surrounding the tube 11 can be of other construction, but must be designed to posses the same electrical characteristic properties and effect.

The head 15 with the sleeve 24 constitutes a safety connection with the transformer 5. In some cases this connector can be omitted and the cable 8 made long enough to protrude from the bar at the end to which the head 15 would be attached and connected directly to the transformer 5.

The eliminator is most effective in practical operation and even when working at the highest voltage for which it is designed the attendant will receive no shock even if he touches the points of the electrodes 2.

Having thus described my invention, what I believe to be new is:

1. A static eliminator comprising a hollow insulator bar having a conductor member therein with insulation surrounding said member, a tubular insulator member in said bar surrounding said insulation, wire coils between said insulator member and said insulation surrounding said conductor member, outside electrodes carried by the bar at separated points along its length, said tubular member having a slit extending along its length and recesses in its outer surface extending across said slit, each coil having a turn at one end seated in one of said recesses, said electrodes being connected with said turns and thus electrically connected to said coils.

2. A static eliminator comprising a hollow bar of insulation, a conductor member in said bar, condenser elements spaced apart from one another and surrounding said member and insulated therefrom, and a plurality of electrodes mounted on the outside of said bar and each in electrical contact with one of said elements, said bar having means at one end to connect said member to a source of electric energy, said member having insulation thereon, the opposite end of the bar having a closure plug enveloping the adjacent extremity of said member and insulation therein, and an insulating cap in said plug upon the adjacent extremity of said member therein.

3. A static eliminator comprising a hollow insulator bar having a conductor member therein with insulation surrounding said member, a tubular insulator member in said bar surrounding said insulation, wire coils between said insulator member and said insulation surrounding said conductor member, outside electrodes carried by the bar at separated points along its length, said tubular member having a slit extending along its length and recesses in its outer surface extending across said slit, each coil having a turn at one end seated in one of said recesses, and threaded studs on said bar in contact with said turns, and projecting from said bar, said electrodes being coils of wire screwed upon the projecting studs and terminating in points.

4. A static eliminator comprising a hollow insulator bar having a conductor member therein with insulation surrounding said member, a tubular insulator member in the bar surrounding said conductor member and insulation, capacity elements adjacent within tubular member and separated from the conductor member, and outside electrodes carried by said bar at separated points along its length, said tubular member having a slit along its length, and a recess, its outer surface adjacent each electrode, said elements having terminals in said recesses, the electrodes being connected to said terminals.

5. A static eliminator comprising a hollow insulator bar having a conductor member therein with insulation surrounding said member, a tubular insulator member in the bar surrounding said conductor member and insulation, capacity elements within the tubular member and separated from the conductor member, and outside electrodes carried by said bar at separated points along its length, said tubular member having a slit along its length, and a recess, its outer surface adjacent each electrode, said elements having terminals in said recesses, and threaded studs on said bar in contact with said electrodes, and projecting from said bar, said electrodes being coils of wire screwed upon the projecting studs and terminating in points.

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