

June 20, 1939.

J. SIMONS

2,163,294

STATIC ELIMINATOR

Filed Nov. 21, 1936

3 Sheets-Sheet 1

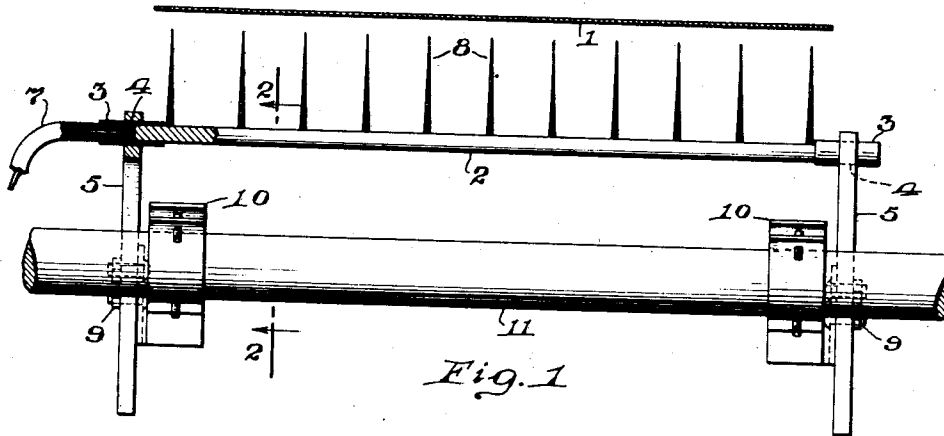


Fig. 1

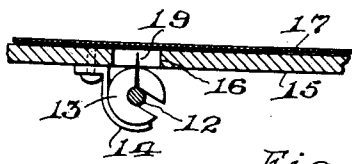


Fig. 4.

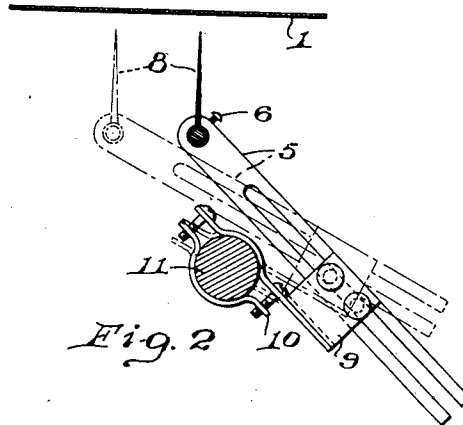


Fig. 2

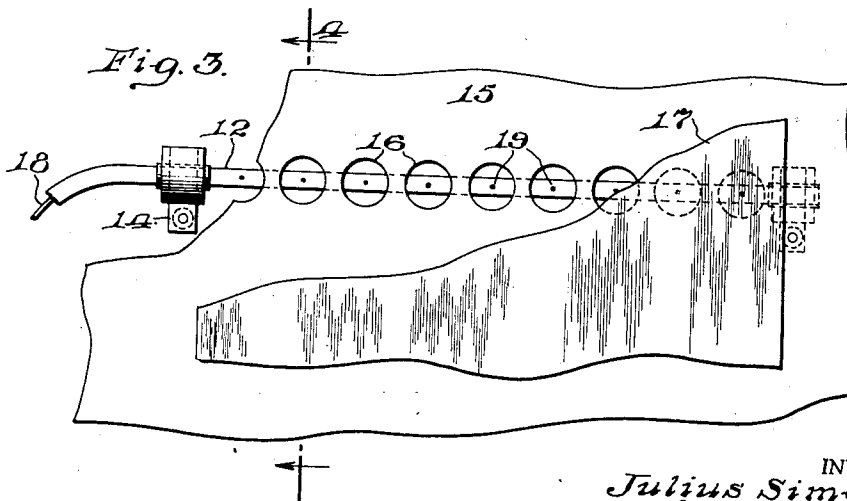


Fig. 3.

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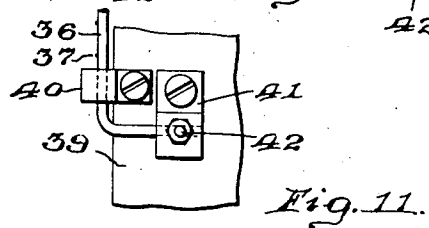
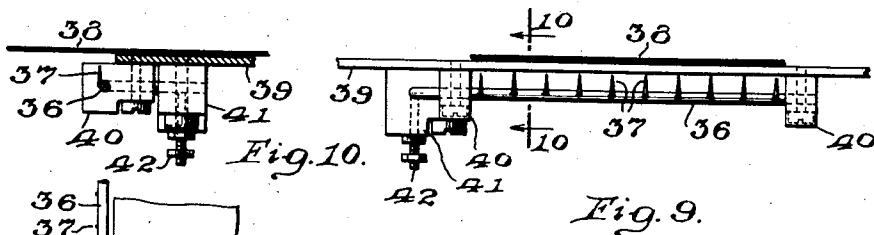
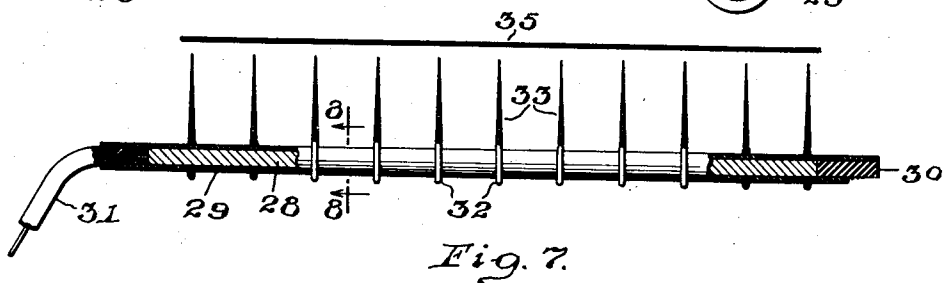
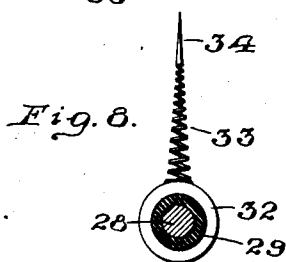
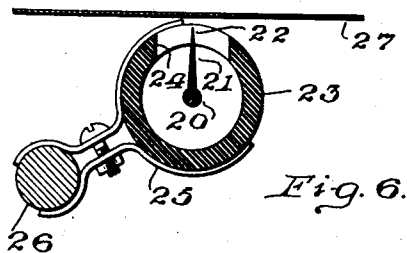
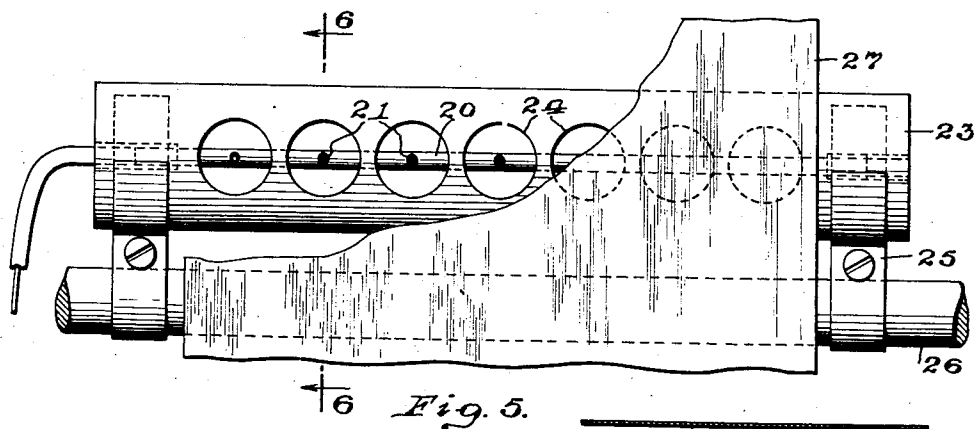
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STATIC ELIMINATOR

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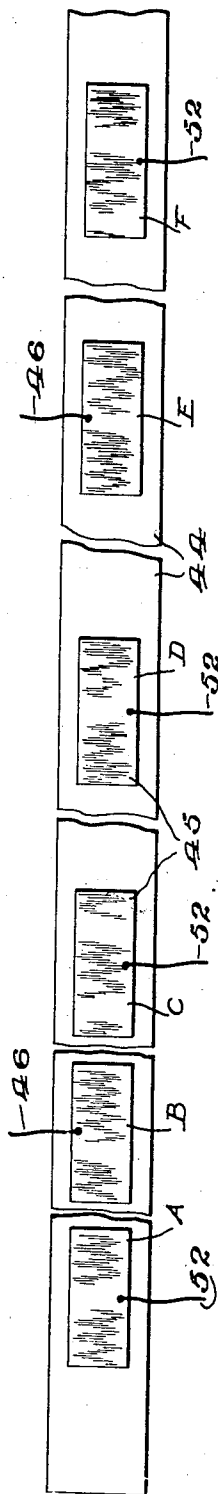


Fig. 13.

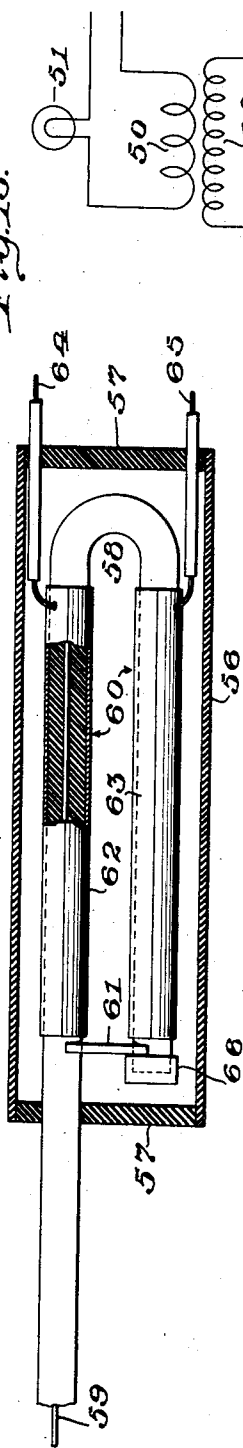


Fig. 14.

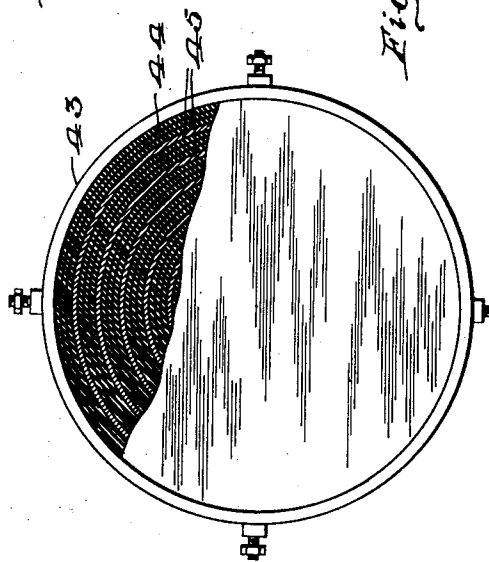


Fig. 12.

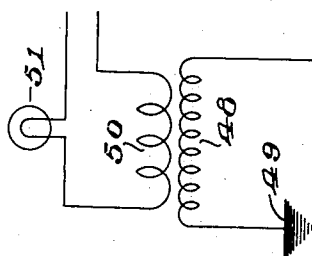
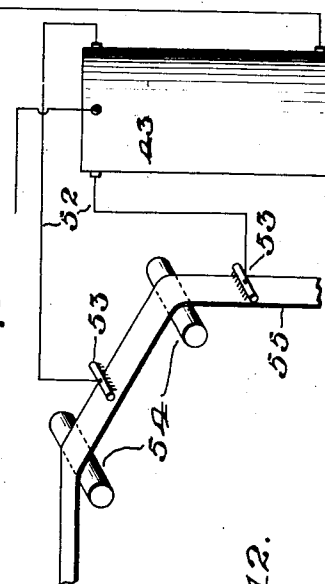


Fig. 15.



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STATIC ELIMINATOR

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3 Claims. (Cl. 175-264)

The object of the invention is to provide improved types of static eliminators with particular regard for making such devices of increased efficiency, but substantially decreased size or bulk, as compared with those heretofore available.

Many factors are met and have to be considered in the construction, application and use of static eliminators, as, for instance, when there are several machines of identical design handling the same material under the same conditions, one such machine will be found to experience considerable static trouble, while the others will be relatively free therefrom. Again, one lot of material which, as far as anyone can judge, is exactly uniform in construction, chemical content or structure and comes from the same source, will develop or produce a marked degree of static electricity, while other lots will run under the same conditions of handling with little or no trouble at all. Dry air notoriously lends itself to ionization much more readily than does moist air, wherefore static electricity is much more prevalent in dry than in moist atmosphere.

Frequently merely subjecting materials to sudden changes in temperature will cause the material to take on or emphasize a charge of static electricity without friction being involved. When material being processed is of highly absorbent nature, and the surrounding humidity can be artificially increased, the difficulty of static elimination is considerably reduced by increasing the relative humidity by well-known methods. However, when the material is relatively non-absorbent, or when it must be worked dry in order to obtain a particular finish or physical result, other means must be devised to eliminate static, and the most successful and logical method has been to neutralize the existing charge by means of a charge of the opposite sign or character.

This may be accomplished efficiently by means of the high voltage type of static eliminator, and the method employed in such case involves a transformer to step up the current to several thousand volts. This high voltage is then transmitted to applicators, mounted upon the machine within or through which the material is being processed, close to the point or points at which the static charges may be causing trouble. The applicators usually take the form of a cylindrical bar with points projecting radially from the bar, the said points not being connected directly to the transformer voltage, but receiving their current supply by induction through a dielectric, the efficiency and ultimate success of the device, as a

unit, depending in such case upon the design of the inductive elements.

By proper balance of the elements involved, one may obtain a maximum neutralizing power with a minimum of shock. The points of the static bar are directed towards the material to be discharged, not actually touching the material, but being spaced therefrom by as much as $\frac{3}{4}$ " or thereabouts. The points produce a constantly reversing field of high potential in the path of the material being processed, and a distinctly noticeable draft of air is produced away from and in axial alignment with the axes of such discharge points. No matter whether the undesired charge to be eliminated is positive or negative, the rapidly reversing field of the bar adjacent to said points always effects a neutralization of the same.

Another object of the invention, therefore, is to provide an efficient static eliminator, such as is adapted to fit the smallest and most intricate machines, as for instance packaging, wrapping, folding, bag, envelope, paper making and many other types of machines; to provide an eliminator which is so flexible in design that it can be employed to cover only a single point, a row of points in either a straight or curved line, points scattered throughout the machine and frequently in relatively inaccessible places, or an arrangement such as may be represented by an intricate geometrical figure; to provide an eliminator that is so relatively inexpensive in production and operation that it can be applied freely to many parts of the same machine or to a series of machines; to provide an eliminator capable of a wide range of adjustment, both as to the voltage and the quantity and quality of the discharge at the points of the bar; and to provide an eliminator which, while primarily designed for use in connection with small types of machines, is likewise adapted to fit the largest types of printing presses, paper making and converting machines, and the largest and most complicated textile machines, to mention only a few of the many types of apparatus to which the device is adapted.

With the foregoing objects in mind, the present invention comprises further details of construction and operation, which are hereinafter fully brought out in the following description, when read in conjunction with the accompanying drawings, in which Fig. 1 is a front elevational view, partially in section, showing a device comprising one embodiment of the invention; Fig. 2 is a vertical section on the line 2-2 of Fig. 1; Fig. 3 is a plan view showing a modified

form of the invention beneath an apertured guard or guide plate and a superimposed sheet or web, said plate and said sheet or web being cut away irregularly to show the static eliminator therebeneath; Fig. 4 is a section on the line 4-4 of Fig. 3; Fig. 5 is a plan view similar to Fig. 3, but showing a still further modification of the invention; Fig. 6 is a section on the line 6-6 of Fig. 5; Fig. 7 is an elevational view, partially in section, showing a still further modified form of static eliminator of extremely simple construction; Fig. 8 is a section on the line 8-8 of Fig. 7; Fig. 9 is a front elevational view of a relatively much smaller modified form of static eliminator; Fig. 10 is a section on the line 10-10 of Fig. 9; Fig. 11 is a fragmentary bottom plan view of one end portion of the structure shown in Figs. 9 and 10; Fig. 12 is an end elevation of an improved form of cylindrical or coiled condenser, termed a "neutrostat", with one end of the same partially broken away to show the interior thereof; Fig. 13 is an extended or developed view showing the elements contained within said cylindrical condenser in plan; Fig. 14 is a vertical longitudinal sectional view through a casing containing a still further modified form of static eliminator, said eliminator being principally shown in elevation, but a portion of the same being also broken away to show the interior construction thereof; and Fig. 15 is a diagrammatic view showing the condenser of Figs. 12 and 13, operatively arranged with respect to a moving web and also in operative association with an energizing electric circuit.

Referring to Figs. 1 and 2, the element 1 is intended to represent either a sheet or web, which may be traveling through any particular type of machine, during which travel it acquires either a positive or a negative charge of static electricity, and which charge it is desired to eliminate in order to facilitate the handling, stacking, or other operation of said sheet or web. The eliminator here shown comprises a metal rod 2, the opposite ends of which are surrounded by sleeves 3, which extend through apertures 4 in supporting arms 5, and with respect to which arms said sleeves and rod are angularly adjustable and are normally retained in fixed position, both angularly and longitudinally, by means of a set screw 6.

Into the opposite end of one of said sleeves extends the end of an otherwise insulated cable 7, which conducts high potential current to the rod 2, which, it will be noted, carries a series of spaced, laterally extending discharge elements 8, each of said elements preferably comprising an outwardly tapering laterally resilient spiral coil of piano wire, or the like, the inner end of which is in each case fixedly secured by solder or the like to said rod, while the outer ends of said discharge elements terminate substantially in a line, which is spaced with respect to the path of movement of the web or sheet 1. By this construction, each of said elements is free to vibrate or be deflected transversely of its axis, and, as a result of which fact, there is less likelihood of their becoming broken or bent and, therefore, out of substantial alignment.

Each of the supporting arms 5 is preferably bifurcated inwardly from its opposite end and throughout the greater portion of its length in order to provide for its longitudinal adjustment with respect to a bracket 9, carried by a suitable clamp 10, which, in turn, is angularly ad-

justable about a bar 11, which may be provided for the support of said eliminator, or may comprise a portion of the machine to which said eliminator is attached. By such construction, it will be obvious that the clamps 10, by oscillation upon said bar, and longitudinal adjustment of the arms 5 upon the brackets 9, as well as the angular adjustment of the rod 2 with respect to said supporting arms, cooperate to provide for a wide adjustment in the height and/or the lateral position of the discharge elements 8, as shown in Fig. 2.

Referring to Figs. 3 and 4, there is here shown a static eliminator comprising a metallic bar 12, the opposite ends of which are positioned within radially slotted annular members 13, which, in turn, are angularly adjustable within and are supported by brackets 14, carried by the under surface of a metallic guard or guide 15, having a row of spaced apertures 16, across which is intended to pass the web or independent sheets 17, and from which web or sheets it is intended to eliminate charges of static electricity which they may acquire, said guard or guide usually comprising a part of the machine to which the device is attached. One end of the rod 12 is connected to a source of high tension current by means of a wire or cable 18, while said rod is provided between the annular members 13 with a row of laterally extending outwardly tapered discharge elements 19, each of which elements is positioned centrally with respect to one of the apertures in said guard or guide 15.

In the operation of the device shown in Figs. 1 and 2, and in Figs. 3 and 4, the high tension discharge emitted from the elements 8 and 18, respectively, impinges upon the adjacent surface of the webs or sheets 1 and 17, thereby neutralizing or eliminating whatever charge of static electricity may be carried thereby, and irrespective of whether such charge may be positive or negative, and thus permitting such webs or sheets to be freely handled without difficulty arising from static electricity.

Referring to Figs. 5 and 6, the modified form of static eliminator here shown comprises a metallic rod 20, which is provided with longitudinally spaced, laterally extending discharge elements, each of which in turn preferably comprises a tapering, spiral coil 21 of piano wire, or the like, such as the elements 8 hereinbefore referred to, but in this instance, terminating outwardly in fixedly mounted pointed terminal members 22, each of said elements being secured by solder or the like directly to the rod 20, this construction being more clearly shown in Fig. 8. The rod 20 is axially positioned within and spaced from the inner surface of a surrounding tubular member 23, which is provided upon one side with a row of enlarged apertures 24, in the center of each of which apertures is positioned one of the discharge points 22. The opposite ends of the tubular member 23 are both angularly and longitudinally adjustable within brackets 25, which in turn are both angularly and longitudinally adjustable upon and with respect to a bar 26, which may comprise a part of the eliminator structure, or a unitary part of the machine upon which the eliminator is operatively carried. By using an eliminator of this type, it will be seen that it is unnecessary to employ a guard or shield of any kind, as the moving web or series of sheets 27 are protected from direct contact with the discharge points 22 by the outer surface of said tubular member 23, as indicated clearly in Fig. 6.

Referring to Figs. 7 and 8, a simple form of static eliminator is shown as comprising a metallic bar 28, surrounded by a sleeve of insulating material 29, one end of which sleeve is filled by an insulating plug 30, while into the opposite end of said sleeve extends one end of an insulated wire 31, whereby high potential current is conducted from a suitable source to said bar. Mounted upon and surrounding the sleeve 29 is a series of annular metallic rings or bands 32, to one side of each of which is secured the conically coiled wire 33 of a discharge element, the free end of which carries a terminal discharge point 34, as hereinbefore described. In this construction it will be noted that there is no direct metallic contact between the bar 28 and the several rings 32, but it will be realized that a charge of high potential current in said bar induces a charge in said rings, which latter charge is discharged from the respective points 34 towards the adjacent surface of a web or consecutive series of sheets 35, also as hereinbefore described.

Referring to Figs. 9, 10 and 11 there is here shown a relatively very small type of eliminator, adapted for use particularly in machines of small overall dimensions, or in highly restricted spaces within larger machines. Such eliminator comprises a metallic bar 36, having longitudinally spaced and laterally directed discharge elements 37, which terminate in spaced relation with a web or series of sheets 38, which pass across the opposite surface of a metallic guide or guard 39, in turn positioned preferably laterally with respect to the line of said discharge elements 37 and in this case also said guide or guard usually comprising a part of the machine to which the device is attached. The opposite ends of the bar 36 are supported by spaced brackets 40, which are preferably carried by the under surface of such guide or guard, while beyond one of said brackets said bar is bent angularly, so as to extend through a terminal block 41, also carried by the under surface of said guide or guard, and in turn provided with a binding post 42, which connects with the end of the said bar 36, that extends into said block.

Referring to Figs. 12 and 13, an unusually highly efficient condenser termed a "neutrostat" is here shown, as comprising an external cylindrical shell 43, in which is positioned an improved condenser, comprising a roll of insulative dielectric 44, to one surface of which is secured in properly spaced relation a series of condenser elements or of metal foil, or the like. These elements are so initially positioned upon the strip of dielectric, that when the latter is rolled into the form shown in Fig. 12, said elements become automatically positioned radially with respect to one another, as suggested by Fig. 12.

In order to illustrate the arrangement by which said condenser elements are connected to receive and discharge their respective charges externally, reference is had particularly to Fig. 13, which shows a set of six elements, A, B, C, D, E and F, the second and fifth of said elements, B and E, being connected by leads 46 to a common wire 47, as shown in Fig. 15, which connects in turn with the secondary 48 of a transformer, the opposite end of which secondary is grounded at 49, while the primary 50 of said transformer is connected through a resistance 51 with a suitable source of current (not shown). In such an arrangement, said resistance may comprise any one of a series of incandescent lamps having different resistances, and thereby passing different amounts

of electric current through the primary 50, and thereby indirectly varying the current obtainable from the discharge leads 52, connected to the first, third, fourth and sixth condenser elements, A, C, D and F, respectively, said leads 52 being adapted for extension to suitable static eliminator discharge units 53, such as for instance are hereinbefore described, and which may be positioned at any suitable locations within or with relation to a machine represented by the guides or rollers 54, across which passes the web (or series of sheets) 55.

In this phase of the invention, it will be noted briefly that there is provided a cylindrically wound condenser, consisting of a series of primary elements which are charged by or from a transformer, and a series of secondary elements which are charged by induction from said primary elements. The dielectric separating said elements preferably comprises layers of varnished cambric, the number of layers and the thickness of each layer being such as to give the greatest amount of condenser capacity, consistent with a satisfactory factor of safety against breakdown, in the event that the secondary side of the condenser becomes grounded for a considerable time. The area of the various elements is determined by the length of the eliminator discharge bar that it is intended to supply, and by the number of discharge elements or points per foot of length of such bar.

For example, a condenser of 6½" overall length, having a 2½" outside diameter, can be very easily designed with sufficient capacity to safely do the work of four 18" discharge bars with points spaced one inch apart, or four 36" bars with points spaced two inches apart, or two 72" bars with points spaced two inches apart. In fact, the condenser can be decreased in size sufficiently to fit a smaller space. Each secondary plate is brought out to its individual terminal, in such way that the several terminals are well separated and thereby reduce to a minimum the shock received, when accidentally touching a point upon the auxiliary discharge bar.

Such a condenser arrangement contributes a high degree of flexibility to the system, such as has never previously been equalled. And, furthermore, such a condenser may be mounted inside the transformer box, in which case it does not require a special support, but thereby simplifies the installation. In such a case it is protected from mechanical damage and is 100% safe. Usually four condenser terminals are provided, each being sufficient for a considerable number of discharge points, and these may be distributed in any desired arrangement, such, for instance, as in a circle, or in a straight line, covering any desired area in a given plane, or in fact, can be arranged to conform to any conceivable geometric figure.

Referring to the eliminator condenser of Fig. 14, a cylindrical casing 56 is shown as being closed at its opposite ends 57, and containing the U-shaped end portion 58 of a relatively large size insulated electric conductor 59, to form a pair of parallel sections 60 of said conductor, which are separated at one end by a spacer 61, and surrounded by metallic sleeves 62 and 63, to which in turn, are connected discharge leads 64 and 65, which pass through one of the casing end closures 57. Through the opposite end closure extends an intake lead comprising a conductor 66, forming the condenser primary, while the free end of the same within said casing is provided with an in-

sulated cap 66. In this form of the device, as in the form shown in Figs. 7 and 8, a high potential current in the conductor 59 induces a charge in both of the sleeves 62 and 63 simultaneously, hence these charges may be led to selected remote regions by means of the conductors 64 and 65, as in the case of the discharge leads 52, shown in Fig. 15.

Furthermore, in interpreting the appended claims, it is to be understood that the particular form of the device hereinbefore described, and illustrated in the accompanying drawings, is merely illustrative of one embodiment of the invention, and that said invention is capable of being modified in many ways, as to the exact details of its construction and operation, without departing from the scope of the appended claims.

Having thus described my invention what I claim as new and desire to protect by Letters Patent of the United States is:

1. The combination of a static eliminator, comprising a metallic bar and a series of discharge elements extending radially therefrom, with spaced supporting discs through which said bar extends, a guard-guide having spaced apertures, centrally disposed with respect to each of

which is one of said elements, said guard-guide extending in a plane substantially parallel with said bar, and arcuate brackets carried by said guard-guide and in which said supporting discs are rotatably mounted.

2. A static eliminator, comprising a relatively fixed support, a member detachably secured to said support, an arm longitudinally adjustable with respect to and normally fixedly carried by said member, a bar carried by a free end portion of said arm and adjustable both angularly and longitudinally with respect thereto, and discharge elements carried by said bar in adjustable relation to the plane of a web passing thereby.

3. In a static eliminator, the combination of a metallic bar and a series of discharge elements extending radially therefrom, a planular metallic guard-guide having spaced apertures and itself being spaced away from said bar, with spaced members to operatively support said bar with respect to said guard-guide, and each of said elements being substantially centrally disposed with respect to one of the apertures of said guard-guide.

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