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2,932,742

XEROGRAPHIC CHARGING DEVICE AND METHOD

Filed March 22, 1955

2 Sheets-Sheet 1

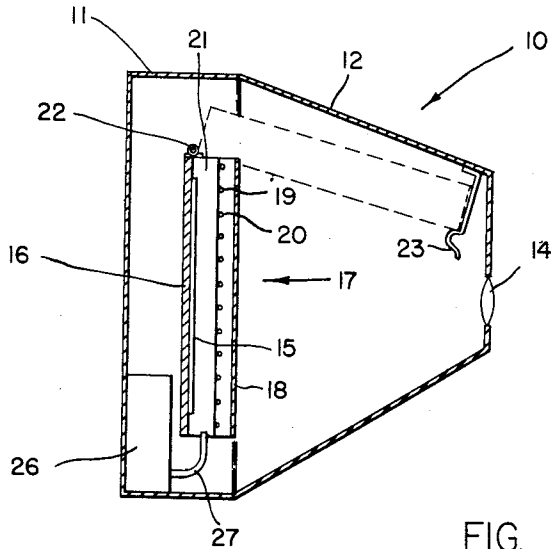


FIG. 1

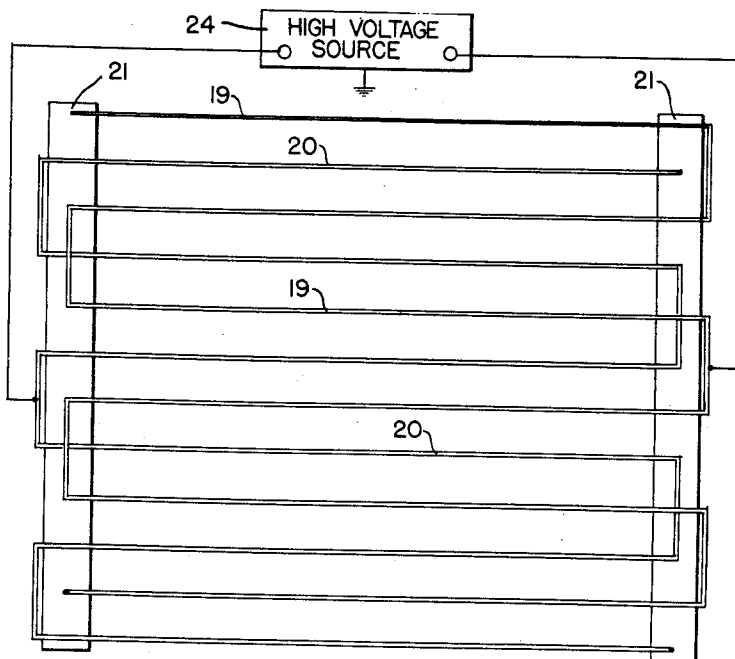


FIG. 2

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2 Sheets-Sheet 2

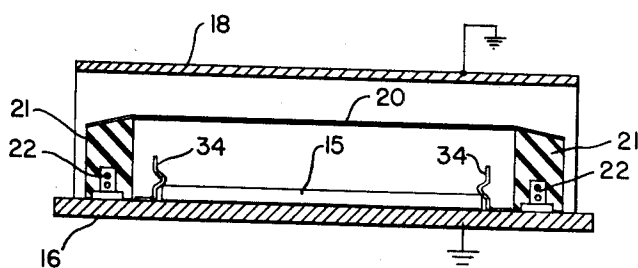


FIG. 3

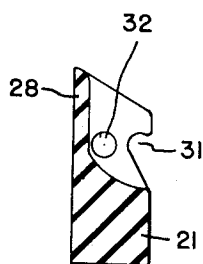


FIG. 5

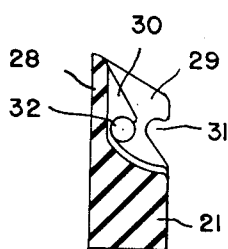


FIG. 6

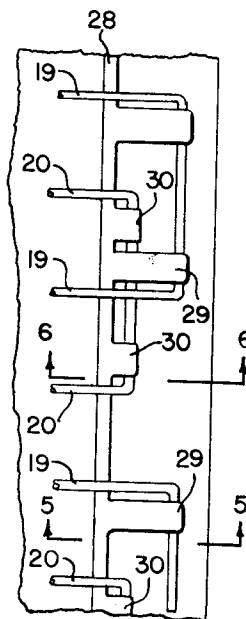


FIG. 4

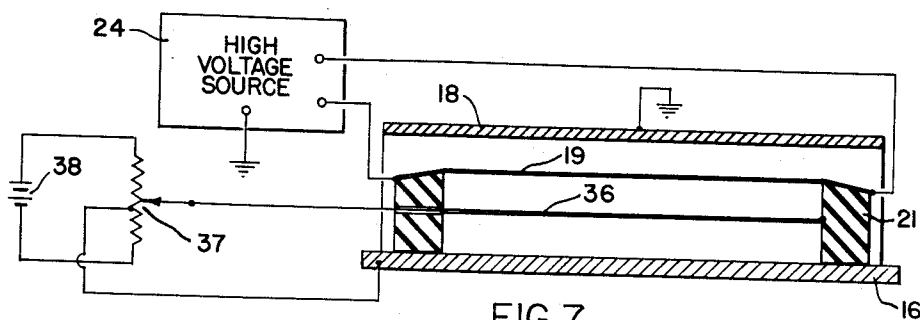


FIG. 7

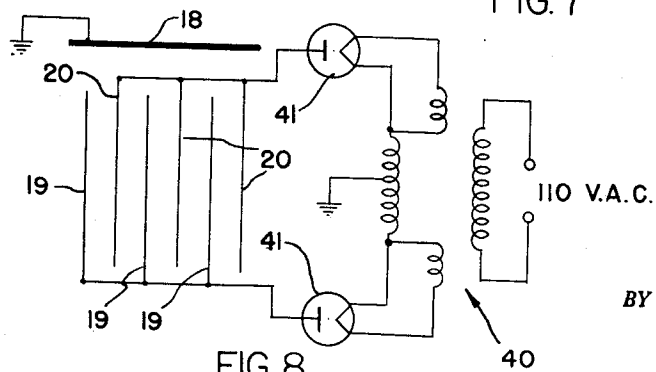


FIG. 8

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XEROGRAPHIC CHARGING DEVICE AND METHOD

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Application March 22, 1955, Serial No. 495,945

11 Claims. (Cl. 250—49.5)

This invention relates in general to xerography and in particular to the charging of xerographic photosensitive members.

In the art of xerography it is usual to place an electrostatic charge on a photoconductive insulating layer overlying a conductive backing member and to dissipate this charge selectively by exposure to a light image or other optical image to be recorded. On such exposure, as the charge is dissipated selectively and proportionately in the light areas, there is formed an electrostatic latent image which can subsequently be developed or otherwise utilized.

Each of the various process steps is in itself a link in the chain of forming a photographic likeness, and the quality of performance of the entire process is limited to the quality of the weakest link in the chain. The present invention, therefore, has to do with a new and improved apparatus, method, and means for charging a xerographic photosensitive member in xerography wherein it is critically essential to produce a substantially uniform charge across the entire xerographic plate surface.

In the prior art of xerography it has been usual to charge a xerographic plate by passing across the plate surface a corona discharge electrode adapted to ionize the air adjacent to the xerographic plate and to deposit on the plate surface a uniform charge of the resulting ions whereby the plate is charged to an operating potential. In this prior art it has been necessary to move the corona discharge electrode along the plate surface in order to get uniform charging of the surface at all areas. Attempts have been made to substitute, for the moving corona discharge electrode, a stationary electrode so that drive mechanisms and other mechanical devices could be eliminated from the structure. In such cases, however, it has been found that equal uniformity of charging was not produced. In particular, it was determined that the plate was charged in a pattern corresponding to the pattern of the corona discharge wires in the charging electrode. Attempts to change this pattern, by changing the design of the electrode, or by more close spacing of a multiplicity of corona discharge wires, were rendered ineffective by the fact that the charge pattern on the plate became correspondingly changed and retained the pattern configuration even with extremely close spacing of such wires.

Now in accordance with the present invention it has been found that a new stationary corona discharge electrode can be made to charge a xerographic plate uniformly by the application of successively pulsed corona-generating potential to interspaced corona discharge wires disposed over the plate surface, with at least some of the wires in a predetermined set of such wires receiving the electric pulse at times other than the pulsing of the potential to others of said wires. The invention will be described hereinafter with reference to its most simple embodiment wherein corona wires are provided in alternating series in alternating wires joined to different high potential electric sources. It is to be understood, however,

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that various other arrangements may be made, such as employing three or more sets of wires or needles suitably pulsed at different intervals or another pattern or system of individual controlled corona discharge wires or needles to which corona-generating potential is successively pulsed to different adjacent corona discharge elements.

It is, accordingly, an object of the invention to provide new xerographic plate charging apparatus adapted to be operated in a fixed position and being particularly suitable for small compact xerographic equipment.

It is another object of the invention to provide a new xerographic charging method particularly suited to charging a xerographic plate uniformly in a compact xerographic machine or camera.

It is a further object of the invention to provide new xerographic charging apparatus, methods and means wherein a xerographic plate receives a uniform charge across its entire area from substantially stationary corona discharge wires in which alternate wires are pulsed alternately with corona-generating electric potential.

Additional objects of the invention will in part be obvious and will in part become apparent by the following specification and drawings in which:

Fig. 1 is a diagrammatic side view of a xerographic camera according to one embodiment of the invention;

Fig. 2 is a front view of a charging unit according to this same embodiment of the invention;

Fig. 3 is an end view of the embodiment shown in Fig. 2;

Fig. 4 is an enlarged fragmentary front plan view of the corona wire support member;

Fig. 5 is an end cross-section of the same member along the line 5—5 in Fig. 4;

Fig. 6 is an end cross-section of a corona wire support member taken along the line 6—6 in Fig. 4; and,

Fig. 7 is a diagrammatic view of a corona charging assembly according to a further embodiment of the invention;

Fig. 8 is a schematic wiring diagram of a power supply suitable for operation in the invention.

In Fig. 1 is illustrated a simple xerographic apparatus generally designated 10 comprising a camera housing 11 having bellows 12 supporting a lens 14 or similar image forming member. Mounted within the camera housing at the focal plane is a xerographic plate 15 supported on a bed plate 16 or suitable plate mounting mechanism. Removably positioned in front of the plate is a corona electrode 17, as described hereinafter, consisting of a shield electrode 18 with plurality of corona discharge wires 19 and 20 mounted on insulating support mounts 21 which desirably are secured to the bed plate by means of a hinge 22. Desirably, a catch member is suitably mounted on the support mounts 21, adapted to meet with and be secured by a spring catch 23 on the bellows 12, whereby the entire electrode assembly may be secured in a position away from the plate surface.

Optionally positioned within the camera housing in a developer supply 26 having a developer feed conduit 27 adapted to feed finely divided developer material to the surface of the xerographic plate at its position within the camera housing. Other suitable xerographic process and apparatus elements may if desired be positioned or mounted in or on the xerographic camera housing and the present invention specifically contemplates the co-operation of the xerographic charging apparatus and method with such other process and apparatus elements.

In Fig. 2 is shown the charging electrode or corona discharge electrode generally illustrated in Fig. 1. This assembly consist of two separate sets of corona discharge wires 19 and 20 mounted on a pair of insulating support blocks 21 in front of a shield electrode 18, preferably grounded. The first set of these corona discharge wires

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is stretched between the support blocks 21 and extends thereacross as a series of fine corona discharge wires, each of which is operably connected to one pole of a high voltage source 24. The second set 20 of corona discharge wires is mounted between the insulating blocks 21 and inter-spaced between each of wires 19. This second set is in turn connected to a second output pole on the high voltage source 24. As specifically illustrated in the figure, wires 19 and 20 are alternated along the length of support blocks 21 and accordingly are alternated along the area of the xerographic plate to be charged. The shield electrode 18 behind the corona wires preferably is grounded or is biased at a suitable relatively low potential. It is composed of electrically conductive material such as metal, conductively coated glass, or the like.

In Figs. 4, 5, and 6 are shown structural details of the insulating support blocks 21 whereby two sets of wires are mounted on the blocks and electrically insulated one set from the other. Essentially, the block comprises a long strip-like support body of an insulating material having a shoulder member 28 on the inward side. At alternating locations along the length of the block are outer mounts 29 and inner mounts 30 which are adapted to carry separately the separate sets of wires. Thus, specifically in the right hand support block, wires 19 pass across the top of shoulder 28 and are carried by outer mounts 29 whereby they are borne around the outer section of the support block. Similarly, wires 20 on the right hand block, are passed over shoulders 28 and are carried near the inner portion of the support block around inner mounts 30. In this manner the separate sets of wires are kept separate from each other for insulation purposes.

Reference here is made to Fig. 4 showing the top view of the insulating blocks and illustrating the interweaving of the sets of wires 19 and 20. In the electrode structure of the right hand block, as illustrated, wire 19 passes around the high mount 29 and is held therein in support channel 31 positioned just below the outer shoulder of the outer mount. Similarly wire 20 passes around inner mount 30 to be carried in support channel 32, passing through the outer mount.

In its operating position the corona discharge electrode, as illustrated in Fig. 3, is mounted with wires 20 (and 19) stretched across the face of a xerographic plate 15 mounted on the bed plate 16 by means of clamps 34 or the like. The bed plate preferably is grounded, whereby the backing member of the xerographic plate is electrostatically connected to ground potential. Desirably, the entire electrode assembly is movable as for example by being mounted on hinges 22 whereby the xerographic plate may be both charged and exposed while remaining in the focal plane.

Preferably other xerographic mechanisms and operations are included in the device as disclosed, for example, in Carlson 2,297,691 and Carlson 2,357,809, these mechanisms being typified by the developer supply unit 26 as disclosed in Fig. 1.

In Fig. 7 is disclosed a further embodiment of this invention. As illustrated in this figure a plurality of corona wires 19 (and 20) are stretched between insulating mount supports 21 which in turn are supported on a bed plate 16 in much the same manner as illustrated in Figs. 2 and 3. In this embodiment, as in the previously described one, two sets of wires are illustrated across the surface of a xerographic plate to be charged. Positioned between the corona wires 19 and the bed plate 16 is a screen-like electrode 36 consisting of alternating conductive areas having open spaces therebetween. This electrode may, for example, comprise a plurality of parallel wires stretching between the insulating blocks or it may alternatively consist of a woven screen or mesh of conductive members, a grating, or a sheet-like conductive electrode having a plurality of holes or spaces therethrough.

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The corona wires 19 and 20 are operably connected to different poles of a high voltage source as illustrated in Fig. 2 whereby alternating successive pulses of corona-generating high voltage potential may be successively supplied to the differently adjacent corona wires. The screen-like electrode 36 is grounded or connected at a bias potential with respect to the bed plate 16, optionally, by means of a potentiometer 37 in a bias circuit with a D.C. power supply 38. In this manner the screen-like electrode may be maintained at a suitable potential preferably positive or negative with respect to the bed plate and thus at a suitable potential with respect to the backing member of a xerographic plate to be charged. By suitable control of the bias potential or screen electrode 36, the rate of charging and terminal charging potential on the xerographic plate surface may be controlled.

It is to be understood that the high voltage source 24 illustrated in Figs. 2 and 7 may be any suitable source designed and adapted to supply a corona-generating potential successively to different conductive members or a series of conductive members connected thereto. This may be done by various D.C. pulsing means including a half wave rectified A.C. voltage source. In order to be fully descriptive and completely illustrative a typical high voltage source is diagrammatically illustrated in Fig. 8. It is to be understood, however, that various conventional power supplies or the like may be substituted therefor.

In Fig. 8 is shown a high voltage transformer 40 whose primary is adapted to be connected to a suitable power source such as a 110 v. A.C. source or the like. The secondary is grounded at its center tap and its high voltage outputs lead to rectifying diodes 41. The output of each diode is, accordingly, half wave rectified A.C., which is fed directly to the corona discharge wires 19 and 20. The secondary output is capable of supplying up to about 7,000 to 10,000 volts, and preferably should be adjustable between about 6,500 volts and about 8,000 volts.

In use and operation the camera or other device embodying the present invention is employed for the purpose of applying a uniform surface charge to an insulating surface overlying a conductive backing, such as, for example, a xerographic plate, it being understood that this charging operation desirably is a part of a typical xerographic process carried out in the camera illustrated in Fig. 1 or other similar apparatus or devices. Referring to Fig. 1 a xerographic plate 15, comprising a conductive backing support bearing on its surface a photoconductive insulating layer, is suitably mounted on the bed plate 16 and the high voltage source 24 is energized. This high voltage source such as is illustrated in Fig. 8 is supplied with conventional 60 cycle current. It will be observed that 60 cycle pulses are alternately applied to the corona wires 19 and 20 whereby a continuous corona discharge occurs at the alternating corona wires. This corona discharge, as is familiar to those skilled in the art, causes the deposition of ion charges on the xerographic plate surface whereby the plate is charged to a uniform charge potential. A particular characteristic of this invention is that the charge potential applied to the xerographic plate does not bear the charge pattern corresponding to the structure of the charging electrode as has been usual in the prior art.

Next, according to the embodiment disclosed in Fig. 1 the corona discharge electrode is swung away from the focal plane, desirably being moved to engage spring catch 23 and the xerographic plate is exposed to a photographic image to be recorded, for example, by exposure through lens 14. This causes selective dissipation of the charge to form an electrostatic latent image on the plate surface, the image corresponding to the photographic image of exposure. This image may then be developed externally from the camera or, if desired, be presented to the plate surface in the camera housing by suitably charged developed particles by activating developer sup-

ply 26. The particles will deposit on the electrostatic latent image forming a visible xerographic image which may be transferred to a second surface or otherwise utilized as desired.

Reasonable variation is possible in the structure of the electrodes and in the voltages or potentials applied thereto. Thus, in general, the corona discharge wires should be spaced close enough together so that there is no pattern of charge on the plate surface corresponding to the wire pattern. It has been found generally that this can be accomplished by having the wires somewhat less than about one inch apart and preferably about $\frac{1}{2}$ inch apart. On the other hand the wires should not be so close together so as to encourage sparking between the wires, and this defect can be avoided by maintaining a spacing of at least about $\frac{1}{4}$ inch between the wires. In like manner, the distance between the corona discharge wires and the plate being charged may be varied in correlation with the potential applied to the wires, but excellent results have been achieved with these wires being about $\frac{1}{2}$ inch from the plate surface. If the special control electrode is employed as in Fig. 7 the wires or conductive elements in this electrode desirably are spaced somewhat more closely together in order to form an electrode closely resembling a screen. If individual parallel wires are used, they preferably should be in the order of about $\frac{3}{32}$ of an inch apart and spaced about $\frac{1}{4}$ inch from the plate being charged.

According to best engineering practice, all of the electrode wires or needles or the like are of corrosion resisting material such as stainless steel or the like. In particular, the corona emitting wires 19 and 20 have produced optimum results when made of stainless steel wire having a diameter of about 0.0035 inch and being extremely uniform along their entire length.

As an illustrative example, corona wires 19 and 20 were made of 0.0035 inch stainless steel spaced about $\frac{1}{2}$ inch apart over the entire area to be charged. Alternate wires in this structure were connected to separate poles of a high voltage source adapted to pulse into the wires, in alternating 60 cycle pulses, a peak D.C. voltage of about 6,500 volts positive polarity. In a plane $\frac{1}{16}$ inch from these wires was a screen of stainless steel wires of 0.01 inch diameter, the wires being spaced $\frac{5}{32}$ inch apart. These wires were all connected to a single D.C. bias terminal at 300 volts positive polarity. Positioned $\frac{1}{4}$ inch from the screen of wires and separated from the corona discharge wires by the screen was a xerographic plate to be charged, comprising a metallic backing surface having a selenium coating 0.001 inch thick and characterized by being selenium in its vitreous or photoconductive insulating form. The backing plate was maintained at ground potential.

This device, as illustratively presented, was capable of charging the xerographic plate to a potential of about 500 volts in about 1 second to form on the plate a charge that was substantially uniform from one position on its surface to another.

It is to be understood that variations in structure may be made without departing from the scope of the invention. For example, the corona discharge wires may be at any desired distance from the surface being charged with the potential being applied to the wires at a distance from the nearest counterelectrode being so selected as to give adequate corona discharge. Similarly, a multiplicity of points or needles may be substituted for the wires, provided care is taken to arrange the needles so as to avoid any electrical pattern resulting on the plate as a result of the needle pattern. Similarly the screen may be modified or removed depending on the results desired, although optimum uniformity of charge and optimum control of the rate of charging is best accomplished by the use of a screen or control electrode as illustrated in Fig. 7. Likewise, either positive or negative polarity may be chosen for charging the insulating surface and one of

the particular advantages of this invention is its adaptability to either polarity of charging.

According to one embodiment of the invention the shield electrode 18 is transparent, being made of conductively coated glass or like transparent conductive material. The corona wires 19 and 20 are very fine and are positioned away from the focal plane, whereby they cast substantially no distortion on the focal plane. Accordingly, the charging electrode may be permanently fixed in position and both charging and exposure through the electrode assembly may take place without moving the electrode. Alternatively, the backing member of the photosensitive plate may be of like transparent conductive material, whereby exposure may be carried out through the plate itself with similar result.

It is to be understood also that the invention is particularly adapted to the charging of a xerographic plate wherein a photoconductive insulating layer overlies a conductive backing member. By the same token, however, it is to be realized that non-photoconductive layers may also be charged by the device of the present invention, and that the device is not necessarily limited to the charging of a xerographic plate even though it is particularly advantageous for this use. It is to be observed here that one of the most critical applications for corona discharge devices is in the charging of a xerographic plate where quality and uniformity of charging are critically important.

Similarly, it is to be realized that the charging electrode and the plate being charged may be moved with respect to each other during the charging operation, but one of the principal advantages of the present invention is the elimination of the need for such relative motion.

What is claimed is:

1. Apparatus for charging a xerographic plate comprising a photoconductive insulating layer overlying a conductive backing member, said apparatus including means for supporting a xerographic plate in a position for charging, a corona discharge electrode arranged to overlie a plate supported by said supporting means and spaced therefrom, said corona discharge electrode comprising a plurality of interspaced corona members in planar relationship the adjacent members of which are connected to different voltage terminals one from the other, and means to pulse said different voltage terminals with high voltage corona-generating potential in phase shifted relationship whereby said adjacent corona members are alternately pulsed with such corona generating potential.

2. Apparatus for charging a xerographic plate comprising a photoconductive insulating layer overlying a conductive backing member, said apparatus including means for supporting a xerographic plate in a position for charging, a corona discharge electrode arranged to overlie a plate supported by said supporting means and spaced therefrom, said corona discharge electrode comprising a plurality of interspaced corona members in planar relationship the adjacent members of which are connected to different voltage terminals one from the other, means to pulse said different voltage terminals with high voltage corona-generating potential in phase shifted relationship whereby said adjacent corona members are alternately pulsed with such corona-generating potential, and a control electrode between said corona discharge electrode and a xerographic plate supported in position for charging, said control electrode having a plurality of conductive areas interspaced with open areas, said conductive areas being maintained at a relatively low potential with respect to the pulsed potential on the corona discharge electrode.

3. Apparatus for charging a xerographic plate comprising a photoconductive insulating layer overlying a conductive backing member, said apparatus including means for supporting a xerographic plate in a position for charging, a corona discharge electrode arranged to

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overlie a plate supported by said supporting means and spaced therefrom, said corona discharge electrode comprising a plurality of interspaced corona members in planar relationship the adjacent members of which are connected to different voltage terminals one from the other, a source of high voltage half-wave rectified A.C. potential to pulse said different voltage terminals with high voltage corona-generating potential in phase shifted relationship whereby said adjacent corona members are alternately pulsed with such corona-generating potential, and a control electrode between said corona discharge electrode and a xerographic plate supported in position for charging, said control electrode having a plurality of conductive areas interspaced with open areas, said conductive areas being maintained at a relatively low potential with respect to the pulsed potential on the corona discharge electrode.

4. A corona discharge apparatus for applying unipolar charge to xerographic plates when arranged in spaced relation thereto, said apparatus including a first plurality of corona discharge electrodes arranged in spaced parallel relation and connected to a first terminal, a second plurality of corona discharge electrodes arranged in spaced parallel relation and connected to a second terminal, the individual electrodes of the second plurality of electrodes being positioned intermediate adjacent electrodes of the first plurality of electrodes, said electrode array being arranged in planar relation and subtending an area substantially coterminous with that of a xerographic plate, and control means intermediate said terminals and an alternating current supply, said control means being effective to reduce potential of one polarity and to apply corona generating potential of opposite polarity and corresponding to the desired unipolar charge to said terminals in phase-shifted relation, whereby corona generating potential of the same polarity is applied alternately to adjacent corona discharge electrodes to apply the desired unipolar charge to a xerographic plate.

5. A corona discharge apparatus for applying unipolar charge to xerographic plates when arranged in spaced relation thereto, said apparatus including a first corona wire connected to a first terminal and arranged in a series of sinuous bends whereby to form a plurality of spaced parallel corona discharge electrodes, a second corona wire connected to a second terminal and arranged in a series of sinuous bends whereby to form a plurality of spaced parallel corona discharge electrodes, the individual corona discharge electrodes of the second wire being arranged intermediate adjacent corona discharge electrodes of the first wire, said electrode array being arranged in planar relation and subtending an area substantially coterminous with that of a xerographic plate, and control means intermediate said terminals and an alternating current supply, said control means being effective to reduce potential of one polarity and to apply corona generating potential of opposite polarity and corresponding to the desired unipolar charge to said terminals in phase-shifted relation, whereby corona generating potential of the same polarity is applied alternately to adjacent corona discharge electrodes to apply the desired unipolar charge to a xerographic plate.

6. A corona discharge apparatus for applying unipolar charge to xerographic plates including a first plurality of corona discharge electrodes arranged in spaced parallel relation and connected to a first terminal, a second plurality of corona discharge electrodes arranged in spaced parallel and connected to a second terminal, the individual electrodes of the second plurality of electrodes being positioned intermediate adjacent electrodes of the first plurality of electrodes, said electrode array being arranged in planar relation and subtending an area substantially coterminous with that of a xerographic plate, control means intermediate said terminals and an alternating current supply, said control means being effective to reduce potential of one polarity and to apply corona generating

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potential of opposite polarity and corresponding to the desired unipolar charge to said terminals in phase-shifted relation, whereby corona generating potential of the same polarity is applied alternately to adjacent corona discharge electrodes to apply the desired unipolar charge to a xerographic plate, and means for supporting a xerographic plate in spaced relation to the plane of the electrode array.

7. A corona discharge apparatus for applying unipolar charge to xerographic plates including a first corona wire connected to a first terminal and arranged in a series of sinuous bends whereby to form a plurality of spaced parallel corona discharge electrodes, a second corona wire connected to a second terminal and arranged in a series of sinuous bends whereby to form a plurality of spaced parallel corona discharge electrodes, the individual corona discharge electrodes of the second wire being arranged intermediate adjacent corona discharge electrodes of the first wire, said electrode array being arranged in planar relation and subtending an area substantially coterminous with that of a xerographic plate, control means intermediate said terminals and an alternating current supply, said control means being effective to reduce potential of one polarity and to apply corona generating potential of opposite polarity and corresponding to the desired unipolar charge to said terminals in phase-shifted relation, whereby corona generating potential of the same polarity is applied alternately to adjacent corona discharge electrodes to apply the desired unipolar charge to a xerographic plate, and means for supporting a xerographic plate in spaced relation to the plane of the electrode array.

8. Apparatus for applying unipolar charge on a chargeable xerographic member, said apparatus including means for supporting a chargeable xerographic member in position for charging, at least two corona discharge electrodes for applying charge to a chargeable xerographic member supported by said support means, said electrodes being arranged substantially parallel to each other and being substantially uniformly spaced from the surface of a chargeable xerographic member supported in position for charging, terminals on said electrodes for connecting said electrodes to an electrode energizing potential supply, and control means intermediate said electrode terminals and an alternating current source, said control means being effective to modify the potential of an alternating current source in a manner to reduce potential of one polarity and to apply corona generating potential of opposite polarity and corresponding to the desired unipolar charge to said terminals in phase-shifted relation, whereby corona generating potential of the same polarity is alternately applied to adjacent corona electrodes to apply the desired unipolar charge on the chargeable xerographic member.

9. Apparatus for applying unipolar charge on a chargeable xerographic member, said apparatus including at least two corona discharge electrodes for applying charge to a chargeable xerographic member supported in charging position relative to the electrodes, said electrodes being arranged substantially parallel to each other and being substantially uniformly spaced from the surface of a chargeable xerographic member supported in charging position, terminals on said electrodes for connecting said electrodes to an electrode energizing potential supply, and control means intermediate said electrode terminals and an alternating current source, said control means being effective to modify the potential of an alternating current source in a manner to reduce potential of one polarity and to apply corona generating potential of opposite polarity and corresponding to the desired unipolar charge to said terminals in phase-shifted relation, whereby corona generating potential of the same polarity is alternately applied to adjacent corona electrodes to apply the desired unipolar charge on the chargeable xerographic member.

10. Apparatus for applying unipolar charge on a chargeable xerographic member, said apparatus including at least two corona discharge electrodes for applying charge to a chargeable xerographic member supported in charging position relative to the electrodes, said electrodes being arranged substantially parallel to each other and being substantially uniformly spaced from the surface of a chargeable xerographic member supported in charging position, terminals on said electrodes for connecting said electrodes to an electrode energizing potential supply, and control means intermediate said electrode terminals and an alternating current source, said control means including a voltage limiting circuit to modify the potential of an alternating current source in a manner to reduce potential of one polarity and to apply corona generating potential of opposite polarity and corresponding to the desired unipolar charge to said terminals in phase-shifted relation, whereby corona generating potential of the same polarity is alternately applied to adjacent corona electrodes to apply the desired unipolar charge on the chargeable xerographic member.

11. Apparatus for applying unipolar charge on a chargeable xerographic member, said apparatus including at least two corona discharge electrodes for applying charge to a chargeable xerographic member supported in charging position relative to the electrodes, said electrodes being arranged substantially parallel to each other and being substantially uniformly spaced from the surface of a chargeable xerographic member supported in charging position, terminals on said electrodes for connecting said electrodes to an electrode energizing potential supply,

and control means intermediate said electrode terminals and an alternating current source, said control means being effective to modify the potential of an alternating current source in a manner to reduce potential of one polarity and to apply corona generating potential of opposite polarity and corresponding to the desired unipolar charge to said terminals in phase-shifted relation, whereby corona generating potential of the same polarity is alternately applied to adjacent corona electrodes to apply the desired unipolar charge on the chargeable xerographic member, said control means including a high voltage transformer having its primary coil adapted to be connected to an alternating current source and having the high voltage output leads of its secondary coil connected respectively through half-wave rectifier means to adjacent electrodes of said corona discharge electrodes.

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