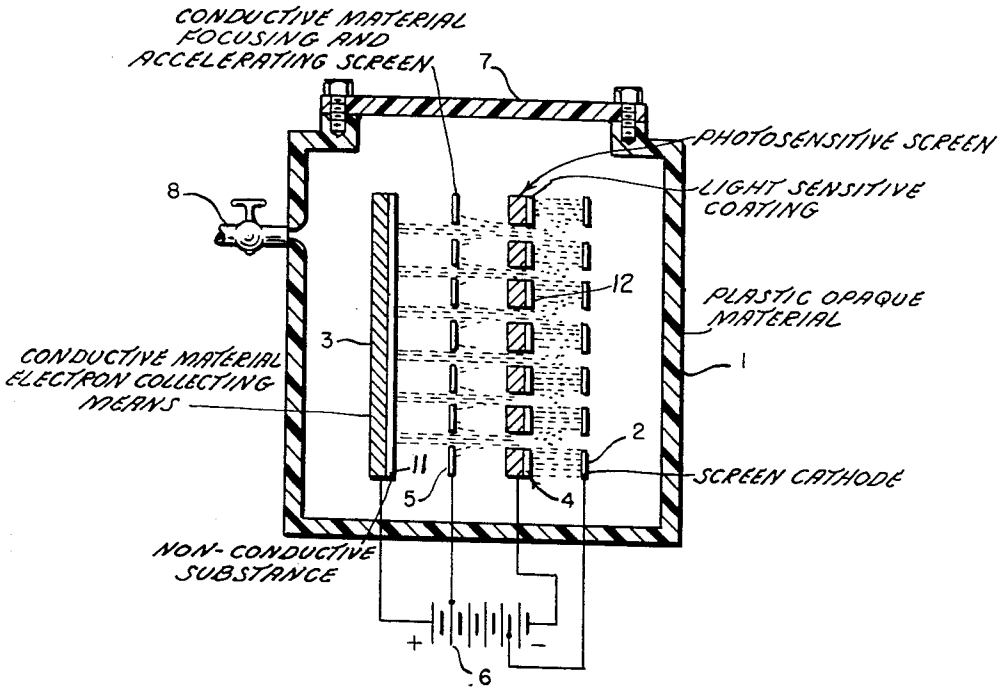
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DEVICE FOR INTENSIFYING PHOTOELECTROSTATIC IMAGE

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DEVICE FOR INTENSIFYING PHOTOELECTROSTATIC IMAGE

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The invention described herein may be manufactured and used by and for the Government for governmental purposes without payment of any royalty thereon.

This invention relates to electrophotography and more particularly to a device and method for intensifying a photoelectrostatic image.

It is an object of the present invention to provide a device for transferring a photoelectrostatic image from one surface to a second surface resulting in an overall increase in the latent intensity of said image on the second surface.

It is a further object to provide a method for increasing the latent intensity of a photoelectrostatic image.

In accordance with the present invention, there is provided a device for intensifying a photoelectrostatic image comprising an evacuable chamber, an electron emissive source at one end of the chamber and an electron collecting plate on the other end thereof. Means are provided for accelerating and focusing the emitted electrons from the electron source to the electron collecting plate. Means for controlling the flow of electrons between the electron source and the electron collecting plate comprising a negatively charged screen having a photoelectrostatic image thereon is interposed between the electron source and the accelerating and focusing means. Removable means is provided for permitting egress to and ingress from the chamber and means is also provided for evacuating the chamber.

Also, in accordance with the present invention, there is provided a method for intensifying a photoelectrostatic image comprising negatively charging a screen of small mesh coated on one side with a photosensitive material and exposing the negatively charged photosensitive coating on said screen to a light image to form a photoelectrostatic image thereon. The exposed screen is then inserted into an evacuable chamber which contains an emissive source of electrons on one end thereof, means for collecting electrons at the other end thereof, and means intermediate the electron source and the electron collecting means for accelerating and focusing the electrons from the electron source. The exposed screen is inserted into the chamber intermediate the accelerating and focusing means and the electron emissive source. The chamber is evacuated and the electron source and the electron collecting means are electrically connected whereby electrons are emitted from the electron source and are accelerated and impinge on the electron collecting means. The electron flow is controlled by the negatively charged screen and the electrons are focused onto the electron collecting means by the electron accelerating and focusing means. The electron collecting means is thereafter removed from the chamber and the latent photoelectrostatic image which has been transferred from the negatively charged screen to the electron collecting means in an intensified form, is developed.

For a better understanding of the present invention, together with other and further objects thereof, reference is had to the following description taken in connection with the accompanying drawing and its scope will be pointed out in the appended claims.

Referring to the drawing, there is shown a device for intensifying a photoelectrostatic image in accordance with the invention comprising an evacuable chamber of suitable opaque material 1 having an electron emissive source 2 at one end thereof, said source being a screen cathode of small mesh equal to or greater than 500 mesh per inch and comprising a substance which readily emits electrons under vacuum conditions and at moderately warm temperatures. The emitting qualities do not necessarily have to be equal to those found in an electronic vacuum tube since the system described does not depend on time elements of the magnitude necessary for vacuum tube applications. The electron source is arranged to project a beam of electrons to an electron collecting means 3 located at the other end of chamber 1 and comprises a plate consisting of a conductive material coated on one side with a non-conductive substance 11 capable of accepting and retaining an electrostatic charge. This plate is used to obtain the final photograph of the transferred- photoelectrostatic image. Interposed between screen cathode 2 and electron collecting means 3 is a photosensitive screen 4 of small mesh comprising a screen of conductive material coated on one side with a light sensitive substance 12 such as selenium or other suitable material. The screening of photosensitive screen 4 is of the order of an amount equal to or greater than 500 mesh per inch. This high number of mesh is required since the resolution of the final photograph is in direct relation to the number of openings present in the screen. Intermediate photosensitive screen 4 and electron collecting plate 3, there is provided a focusing and accelerating screen electrode 5 comprising a conductive material having a mesh substantially equal to that of photosensitive screen 4. Said focusing electrode 5 is maintained at a positive potential with respect to cathode 2 by means of battery 6 or any other suitable source. Removable means illustrated at 7 for egress and ingress are provided in evacuable chamber 1 and means for evacuating the chamber to the required degree is provided as indicated at 8.

Considering the operation of this device in obtaining a final photograph, light sensitive coating 12 on photosensitive screen 4 is charged negatively and is exposed to a light image. Coating 12 is exposed to the light image in a camera or other suitable photographic device. It is then placed in chamber 1 intermediate electron source 2 and focusing screen 5 and chamber 1 is then evacuated. Removal of the photosensitive screen 4 with the light image impressed on light sensitive coating 12 from the photographic device does not disturb the charge on coating 12 since this charge is electrostatic and is thus retained on coating 12 for an appreciable period. This period is quite sufficient to permit the transferral of screen 4 from a photographic device to chamber 1. Light sensitive coating 12 need not be in the form of a photographic emulsion but is preferably in the form of a coating of light sensitive material such as selenium. All elements in chamber 1 are connected electrically by battery 6. The photosensitive screen 4 is negative with respect to electron source 2; the focusing screen 5 is positive to the electron source 2; and electron collecting plate 3 is positive with respect to focusing screen 5. The electrical action is carried on for a predetermined time after which the electron collecting plate 3 is removed and a charged charcoal powder or similar substance is impressed on its surface to enable the electron image on the electron collecting plate 3 to be developed to a visible image. Non-conductive substance 11, in the same manner as light sensitive coating 12, firmly retains the electrostatic charge impressed thereon for an appreciable period permitting

the removal of electron collecting means 3 from chamber 1 for development within a reasonable period.

To form an original photoelectrostatic image, light is impressed upon the non-exposed negatively charged photosensitive screen 4, thus causing a decrease in the number of electrostatic charges on the individual particles of said screen which is proportional to the quantum of light falling upon the individual light sensitive particles comprising the screen.

After exposing photosensitive screen 4 to a light image, it is placed within chamber 1 which is then evacuated. Electron emissive source 2 is activated to produce a cloud of electrons within the chamber. The electron cloud emitted is attracted to the positive electrodes in chamber 1; namely the focusing screen 5 and the electron collecting plate 3. Photosensitive screen 4, since it is negatively charged, will retard the passage of electrons. The amount of retardation is proportional to the number of electrostatic charges present on the photosensitive screen. This action is similar to the action of a control grid in a triode type vacuum tube. Electrons which have passed through the openings of the meshed photosensitive screen 4 are accelerated and directed by the focusing screen 5 so that they impinge on collecting plate 3. Stray electrons will be collected by focusing screen 5 while electrons traveling parallel to photosensitive screen 4 and focusing screen 5 mesh openings will not be collected by said focusing screen and will pass therethrough to impinge on electron collecting plate 3. Discrete sections of plate 3 will be charged negatively; the amount of charge being proportional to (1) the amount of electrons impinging thereon, (2) the length of time the electrical action takes place, (3) the electron cloud density, and (4) the charge present on exposed photosensitive screen 4. Thus, within a given time and given electron cloud density, there will be a charge impressed on any given point on electron collecting plate 3 which is proportional to a corresponding point on photosensitive screen 4. Since the charges on said photosensitive screen have a great influence on the number of electrons that can pass through its screen openings after a predetermined period of time has elapsed, the amount of charges impressed between any two points on electron collecting plate 3 is greater than the corresponding charge on photosensitive screen 4.

In effect, what has been accomplished is the impressing of a greater electrostatic charge on the electron collecting plate resulting in a stronger electrostatic image corresponding to the relatively weak image on the negatively charged photosensitive screen. The electron collecting plate acquires a latent photoelectrostatic image negative

to that on the photosensitive screen. If desired, a positive latent image may be obtained by first charging electron collecting plate 3 positively and then allowing the electrons passing through focusing screen 5 to discharge discrete positively charged sections on electron collecting plate 3.

While there has been described what is at present considered to be the preferred embodiment of this invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and it is, therefore, aimed in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. A device for intensifying a photoelectrostatic image comprising an evacuable chamber, an emissive electron source within said chamber at one end thereof, electron collecting means at the other end thereof, means for focusing said emitted electrons to impinge on said collecting means, means intermediate said electron source and said focusing means for controlling the amount of electrons impinging on said collecting means comprising a screen having a photoelectrostatic image thereon, removable means for permitting ingress to and egress from said chamber, and means for evacuating said chamber.

2. A device for intensifying a photoelectrostatic image as in claim 1 wherein said electron source is a screen cathode of small mesh adapted to emit electrons under vacuum conditions at moderately warm temperatures.

3. A device for intensifying a photoelectrostatic image as in claim 1 wherein said electron collecting means comprises a conducting plate coated on one side with a non-conductive material for retaining an electrostatic charge.

4. A device for intensifying a photoelectrostatic image as in claim 1 wherein said controlling means comprises a negatively charged conducting screen of small mesh, a photosensitive coating on one side, said photosensitive coating having a photoelectrostatic image thereon.

5. A device for intensifying a photoelectrostatic image as in claim 1 wherein said focusing means comprises a screen of small mesh.

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