

[54] ION LENS RECORDING SYSTEM

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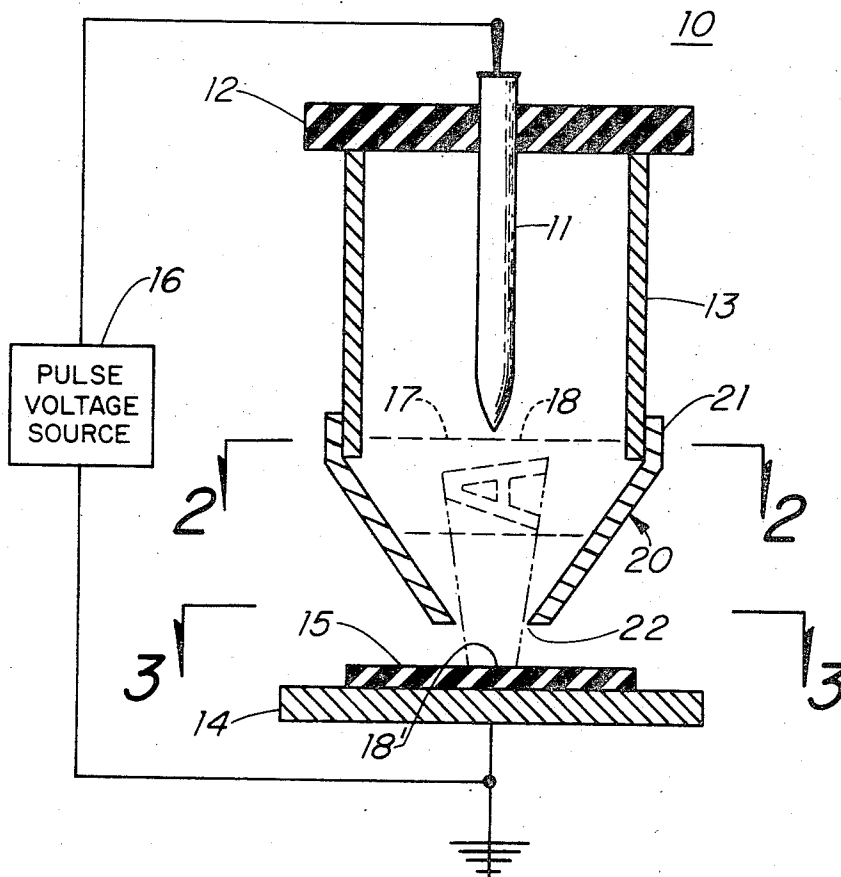
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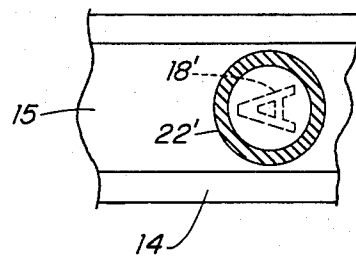
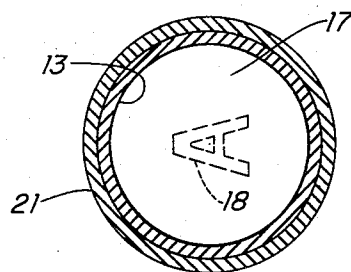
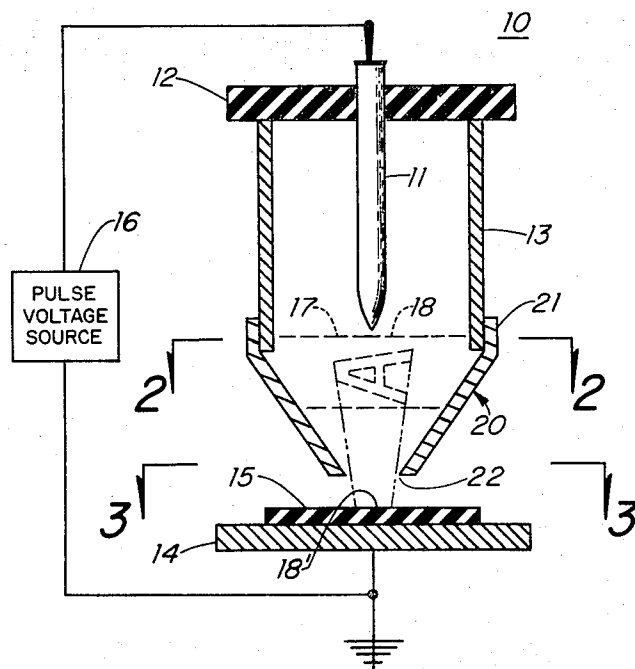
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ABSTRACT

An ion beam imaging apparatus for uniformly reducing an ion beam of a preselected shape. An ion beam is generated by supplying a suitable electrical voltage to a needle-like electrode with the ion sensitive surface of an insulating member being disposed on a conductive member and spaced away from the discharge end of the needle-like electrode. A suitable stencil having an aperture therein defining a preselected shape is positioned below and in proximity to the discharge end of the needle-like electrode and a tapered member of decreasing cross-sectional area is disposed above the ion sensitive surface in a substantially surrounding relationship to the ion beam defined by the stencil aperture. The aperture of the tapered member at the lower end thereof is disposed in proximity to the ion sensitive surface and remote from the stencil with the ion beam being converged and correspondingly reduced in cross-section at the aperture of the tapered member. The tapered member constitutes an ion imaging system as a uniformly reduced or minified latent image is defined on the ion sensitive surface of the insulating member.

5 Claims, 3 Drawing Figures





ION LENS RECORDING SYSTEM

This invention relates to ion beam discharge apparatus used with a stencil character for producing an ion-charged image thereof on a support surface, and more specifically, to such apparatus embodying a device for decreasing a cross section of the ion-charged image between the stencil character and the surface to minify the ion-charged image to a preselected size as recorded on the surface.

The prior art teaches the use of ion beam apparatus for recording an ion-charged image of a preselected stencil character on an ion sensitive surface. According to such teaching, the size of the ion-charged image corresponds to that of the stencil character.

The present invention is concerned with a device embodied in the ion beam apparatus between the stencil character and the ion sensitive surface for reducing a cross section of the ion beam therebetween to minify the ion-charged image representing the stencil character to a preselected size as recorded on the ion sensitive surface.

A principal object of the invention is to reduce the size of an ion-charged image derived from a preselected stencil character in ion beam discharge apparatus.

Another object is to reduce the size of an ion-charged image of a preselected stencil character in ion beam discharge apparatus to a preselected size.

Additional advantages and objects of the invention are contained in the description hereinafter detailed.

The invention is readily understood from the following description taken together with the accompanying drawing in which:

FIG. 1 is a front elevational cross section of an ion beam apparatus adapted with a specific embodiment of the invention;

FIG. 2 is a plan view taken along line 2—2 in FIG. 1; and

FIG. 3 is a plan view taken along line 3—3 in FIG. 1.

FIG. 1 delineates ion beam apparatus 10 comprising a suitable source of ions 11 such as, for example, a conducting electrode, formed as a needle having one end tapered and an opposite end firmly secured in an electric insulator 12 for disposing the needle in a direction normal to the insulator on an under surface of maximum dimension thereof. It is appreciated that any other conventional ion source may be employed if so desired. A housing 13, which may, for example, be cylindrical, has one open end attached to the insulator under surface and positioned in a direction normal thereto for so enclosing the free end of the needle as to locate the needle tapered end within the housing at an area proximate to an opposite open end of the housing. This positions a peripheral surface of the needle equidistantly from an inner surface of the housing, whereby the needle and housing are coaxially aligned.

An electric conductive member 14 is disposed oppositely to the needle tapered end in spaced relation therewith in a plane normal to a lengthwise axis of the needle. A suitable insulating surface 15, such as, for example, electrographic paper, is so positioned on the conductive member that an ion sensitive surface thereof faces the needle tapered end. It is understood the insulating surface 15 makes satisfactory electric contact with the conductive member. A source 16 of suitable voltage has a positive terminal connected to

the needle opposite end and a negative terminal (ground) connected to the conductive member 14, supporting the insulating surface 15. It is understood that the source may provide voltage pulses having a preassigned magnitude, time and duration and frequency as required for a particular ion beam apparatus.

The voltage pulses activate the needle 11 and conductive member 14 to institute an ion beam discharge therebetween and thereby onto the sensitive surface of the insulating surface 15. A shaped aperture such as a character "A" 18 of preselected shape as shown in FIGS. 1 and 2 is interposed between the tapered end of needle and the sensitive surface of the insulating surface for restricting the ion beam to a shape coincident with that of the stencil character to ion-charge to latter sensitive surface to record thereon an ion-charge shape 18' shown in FIG. 3 and corresponding to that of the stencil character shape "A" 18. It is understood that tapered end of needle 11, conductive member 14, insulating surface 15 and stencil character 18 are positioned in an ambient atmosphere.

In accordance with a specific embodiment of the present invention, the restricted shape of the ion beam effective between the stencil character "A" 18 in FIG. 2 and the sensitive surface of the insulating surface 15 is reduced in cross section to minify the recorded ion charge shape in a manner that is presently explained. A tapered member 20 having a decreasing cross-sectional area is provided and may comprise a funnel that includes a cylindrical open end 21 accommodated on the opposite open end of housing 13 and formed on its opposite end with an aperture 22 provided with a preselected diameter and positioned proximate to the ion sensitive surface of the insulating surface 15. It is noted that the funnel is coaxially aligned with the needle 11 and housing 13. The preselected diameter of aperture 22 serves a purpose that is presently explained.

In the operation of the specific embodiment of the invention, the restricted ion beam upon leaving the stencil character is converged by the aperture 22 to reduce the cross section of the restricted ion beam by an amount related to the diameter of the latter aperture. This reduction records on the ion sensitive surface of the insulating surface 15 an ion-charge shape 18', illustrated in FIG. 3, as determined by the preselected diameter of aperture 22 in relation to the distance of the aperture 22 from the ion sensitive surface, whereby the stencil character "A" 18 is minified on the ion sensitive surface of the insulating surface 15. It is thus seen that if the aperture 22 were spaced a fixed distance from the ion sensitive surface of member 15, then the size of the ion-charge shape 18' in FIG. 3 recorded thereon is determined by the diameter of aperture 22. It is obvious that the single character "A" 18 in FIG. 2 may be replaced with a character wheel stencil including a plurality of single or groups of characters of preselected shapes. It is accordingly evident that when aperture 22 is provided with one of a preassigned range of different diameters at a given time, then the stencil character 18 in FIG. 2 can be minified to ion-charge shape 18' in FIG. 3 in proportion to each of the respective aperture diameters as illustrated in FIG. 3.

Results achieved with the arrangement of FIG. 1 having indicated parameters for minifying character "A" 18 in FIGS. 1 and 2 are illustrated in the following table. These assume that aperture 22 is spaced approximately five-sixteenths inches from the ion sensitive in-

insulating surface 15 and the pulse voltage of source 16 is of the order of 8 kilovolts.

Size of Aperture 22 in inches	Projected Aperture 22' in mm.	Size of Image 18' in mm.	Ratio of Size of Image 18' to Projected Aperture Size 22'
1.0	27.0	5.5	0.204
0.5	8.5	1.5	0.177
0.312	5.0	0.8	0.160
0.250	3.9	0.6	0.156

It is understood that the invention herein is described in specific respects for the purpose of this description. It is also understood that such respects are merely illustrative of an application of the invention. It is obvious that the tapered member 20 of the invention which is described as a funnel may be replaced by other tapered-shaped devices to reduce a cross section of the ion-charge shape to a preselected size as recorded on the ion sensitive surface of the insulating surface. Numerous other arrangements may be derived by those skilled in the art without departing from the spirit and scope of the invention.

What is claimed is:

1. An ion imaging system, comprising:

an ion source;

an electrically conductive member spaced away from said ion source;

means for receiving and positioning an insulating surface on said electrically conductive member and having an ion sensitive surface facing said ion source;

means for supplying an electric voltage to said ion source to institute an ion beam discharge between said ion source and said ion sensitive surface;

means for receiving a stencil member defining an aperture of preselected shape interposed between said ion source and ion sensitive surface for defining said ion beam as a shape coinciding with the preselected shape of said aperture; and

tapered means disposed intermediate said aperture of preselected shape and said ion sensitive surface and spacially positioned so as to uniformly reduce said defined ion beam shape incident upon said ion sensitive surface relative to said preselected shape.

2. The system defined in claim 1 in which said tapered means comprises a tapered structure having at a narrow end thereof an aperture proximate to said ion sensitive surface for converging said defined ion beam shape at said aperture to uniformly reduce said defined shape thereat.

3. The system defined in claim 2 in which said aperture of said tapered structure is provided with a preassigned diameter for minifying said defined ion-charged

shape in proportion to the preassigned diameter of said aperture.

4. The system defined in claim 1 further comprising a housing and in which said ion source comprises a needle having a tapered end disposed proximate to said stencil with said needle being substantially enclosed by said housing.

5. An ion imaging system, comprising:

a conducting electrode consisting of a needle having a tapered end;

an electric insulator supporting an end of said needle opposite to said tapered end thereof for disposing said needle in a direction normal to said insulator;

a cylindrical housing having one open end attached to said insulator and disposed in a direction normal thereto for so enclosing said needle tapered end within said housing as to locate said needle tapered end within said housing at an area proximate to an opposite end of said housing, whereby said needle and housing are coaxially aligned;

an electrically conductive member disposed oppositely to said needle tapered end in spaced relation therewith in a plane normal to a lengthwise axis of said needle;

means for receiving and positioning an insulating surface on said member and having an ion sensitive surface disposed to face said needle tapered end;

means for supplying an electric voltage to said needle and to said member to institute an ion beam discharge therebetween and thereby onto said ion sensitive surface;

means for receiving a stencil character of preselected shape interposed between said needle tapered end and said ion sensitive surface for defining said ion beam to a shape coincident with that of said character to ion-charge said ion sensitive surface to record thereon an ion-charge shape corresponding to said stencil character shape; and

tapered means disposed intermediate said stencil character and ion sensitive surface and spacially positioned so as to uniformly reduce said defined ion beam shape to minify said ion charge shape recorded on said ion sensitive surface relative to said stencil character shape; said tapered means including a funnel having an end of large diameter contiguous with said housing opposite end and an opposite end of small diameter proximate to said ion sensitive surface; said funnel opposite end formed with an aperture of preselected diameter for converging said defined ion beam shape thereat to minify said ion charge shape recorded on said ion sensitive surface in proportion to the preselected diameter of said funnel aperture.

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