July 14, 1959 H. J. McCREARY 2,894,799

HIGH SPEED RECORDER SYSTEM

Filed Aug. 23, 1956 2 Sheets-Sheet 1

FIG. 1

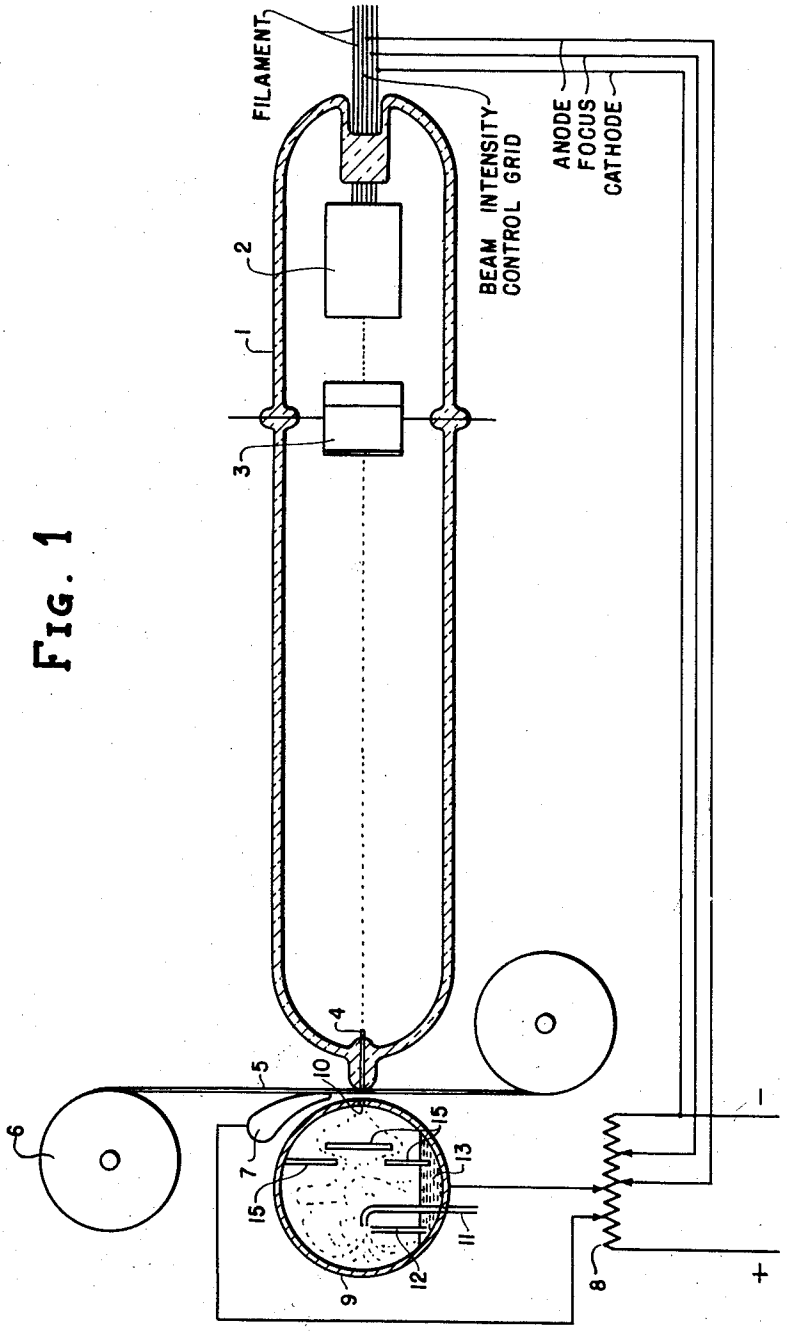

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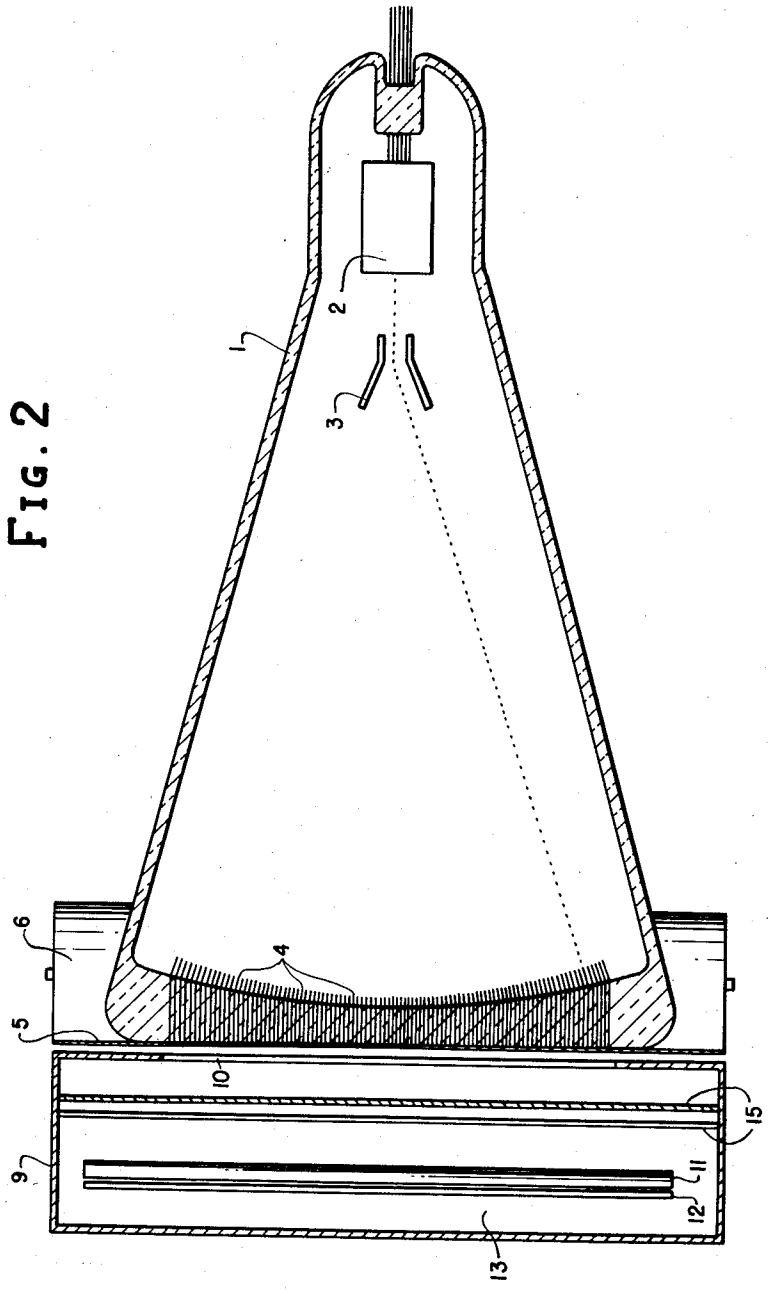
FIG. 2



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HIGH SPEED RECORDER SYSTEM

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2 Claims. (Cl. 346—74)

This invention relates to a recording system in general and, more particularly, to a high speed recorder system.

An object of this invention is to print pictures or facsimiles at a high rate of speed with printing ink or carbon dust or pigment of almost any form without the use of mechanical moving parts or impression plates with the exception of a moving printing surface such as paper.

Another object of this invention is to provide a high speed recorder which will produce an immediately available record without photographic development.

Another object of this invention is to provide a high speed recorder which may record at speeds approximately as high as the speed of television broadcast.

It is yet another object of this invention to electronically produce an electrostatic image, upon a printing surface, upon which an oppositely charged aerosol such as ink is deposited in a pattern corresponding to the electrostatic image.

Another object of this invention is to produce a high speed recorder which will produce an electrostatic image upon a printing surface in response to a received electrical signal upon which image an oppositely charged aerosol such as ink is deposited in a pattern corresponding to the electrostatic image.

Another object of this invention is to produce an inertialess recorder limited in frequency response only by the speed that the paper can be moved.

Figure 1 is a horizontal sectional view of a device embodying the invention shown in typical configuration.

Figure 2 is a top sectional view of the device.

Figure 1 contains a cathode ray tube **1** which includes a conventional electron gun **2** which is composed of an electron source, that is a filament and a cathode, an electron beam grouper called a focus, a beam intensity control grid and an accelerating anode all of which are well known in the art but which are not individually shown. Also included in the cathode ray tube **1** are the horizontal deflecting plates **3** and a horizontal row of conductive pins **4**. The horizontal row of conductive pins **4** are targets for the electron beam and these targets extend through and terminate flush with the outer surface of the tube.

A dielectric suitable for printing such as paper **5** is moved over the outer surface of the tube **1** by a conventional drive mechanism **6**.

On the opposite side of the moving paper **5** is an electrode **7** which charges the paper positively as is indicated in the drawing in a manner well known in the art.

Also on the opposite side of the moving paper **5** is a hollow metal cylindrical electrode **9** closed at both ends, which is at a positive potential as is indicated in the drawing. The cylinder **9** has a slit or aperture **10** which is opposite the row of target pins **4**. The slit or aperture **10** is just as long as the row of target pins **4**.

In the cylinder **9** there is a source of a printing medium **13** such as ink. Also within the cylinder **9** are two tubes **11** and **12**. Tube **11** has air at a pressure pushed through it and **12** is a hollow tube extending into the ink supply **13**. Also in the cylinder **9** there is a series of baffles **15** fastened to the ends of the cylinder.

A source of potential not shown energizes the system through resistor **8**.

An electron beam is formed and directed at the horizontal row of target pins **4** by the conventional electron gun **2** in a manner well known in the art.

The beam is swept over the row of target pins **4** by a sweep circuit, not shown but well known in the art, through the horizontal deflection plates **3**.

The electron beam strikes the target pins **4** and charges them negatively. The intensity of the charge will vary directly with the intensity of the beam. The intensity of the beam varies with the potential on the beam intensity control grid. The beam intensity control grid is part of the conventional electron gun **2** and is not shown individually. The control of the intensity of an electron beam by a potential on a beam intensity control grid is well known in the art.

The paper **5** is charged positively at the electrode **7** in a well known manner as is indicated in the drawing.

As the positively charged paper **5** moves over the outer surface of the row of variably charged target pins **4** a negative charge is induced on the opposite side of the paper proportional to the intensity of the electron beam which is proportional to the potential on the beam intensity control grid. The negative charge is induced on the opposite side of the paper in the same manner as a condenser induces a like charge on the other side of its dielectric as is well known in the art.

The signal on the beam intensity control grid which determines the intensity of the negative charge on the paper's surface could be received from almost any kind of transducer. It could come from a spot scanning system similar to a television camera so as to reproduce pictures or facsimile. The horizontal sweep frequency would necessarily have to be synchronized with the horizontal sweep frequency of the transducer in this mentioned example.

By using the proper sweep frequency an electrostatic, negatively charged, image is induced on the moving paper similar to the image desired to be reproduced.

Inside the cylinder **9**, which is located close to the moving paper **5** opposite the horizontal row of target pins **4**, air at a pressure above atmospheric is admitted to the cylinder **9** through tube **11**. This produces a fine stream of air at high speed over the top of the suction tube **12**. One end of tube **12** is immersed in a printing medium such as ink, the nature of the printing medium being not necessary to the operation of the invention. The air flowing over the top of suction tube **12** creates a partial vacuum whereby the ink **13** is forced up through tube **12** and blown into a fine vapor. The vaporized ink is charged positively being that it is in a positively charged container. The vaporized particles of ink drift through the baffle system **15** and the coarser droplets settle to the bottom such that only the finer particles reach the aperture **10**.

The particles of ink which reach the aperture **10** are positively charged and since the paper **5** is positively charged by electrode **7**, the particles of ink will not be deposited upon the paper **5** except where a negative charge appears on the paper surface.

Negative charges are induced on the paper **5** at the horizontal row of target pins **4** as has been described in the aforegoing.

The positively charged particles of ink which are suspended in the chamber near the aperture **10** are electrostatically attracted to the negatively charged portions of the paper **5** in various densities proportional to the negative charge on the paper.

The aperture 10 can be increased in width so as to enable speeding up of the process without affecting the operation of the invention.

The speed of the fine particles of ink is high because the mass is relatively low and the electrostatic force is high because of the small distance of travel thus making the speed at which the paper can be moved past the horizontal row of target pins the limiting factor in the speed of recording.

This same system as described could be used as an inertialess recorder by keeping the electron beam intensity constant and placing the received signal on the horizontal deflecting plates. The limiting factor in the frequency response of such a system would again be the speed at which the paper 5 could be moved over the surface of the horizontal row of target pins.

What has been described is considered to be the preferred embodiment of my invention and it is to be further understood that other modifications in addition to those suggested in the preceeding paragraph, both in structure and manner of operation, may be made without departing from the scope of my invention as defined in the claims which follow.

What is claimed is:

1. A high speed printing device comprising a web of dielectric material electrostatically charged in one polarity, means for periodically sweeping a modulated electron beam along a predetermined path on one side of said web to reverse said polarity of charge in accordance with the modulations of said beam, means for dispensing a finely dispersed printing medium, electrostatically charged in the same polarity as said web, through an elongated orifice adjacent to said web on the other side thereof, said orifice positioned opposite said electron beam and having its long dimension lying in the same plane as said predetermined path, and means for moving

said web transversely to said orifice and said predetermined path at a speed synchronized with the sweep frequency of said beam, whereby said printing medium is deposited on the last-mentioned side of said web in a two-dimensional pattern corresponding to the modulations of said beam as said web moves past said orifice.

2. The device set forth in claim 1, wherein said means for periodically sweeping a modulated electron beam along a predetermined path include, a cathode ray tube having an elongated, narrow, rectangular shaped screen, a plurality of insulated target pins extending through said screen, along a line parallel to its longer sides, said target pins defining said predetermined path, an electron beam forming gun for directing a beam of electrons at said target pins, deflecting means for periodically deflecting said beam across said target pins, and a beam intensity control grid on said gun for modulating said electron beam in accordance with a received electrical signal.

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