

Nov. 15, 1955

M. L. GOEPPINGER ET AL

2,724,021

CATHODE RAY TUBE

Filed Oct. 6, 1952

3 Sheets-Sheet 1

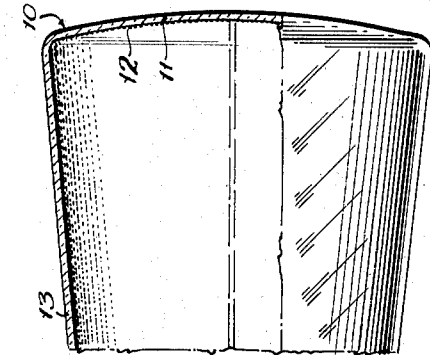
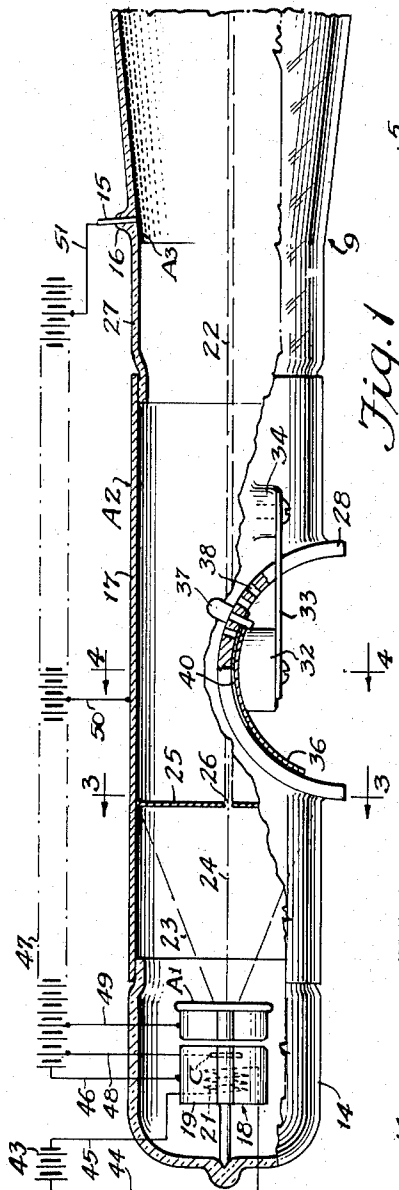


Fig. 1

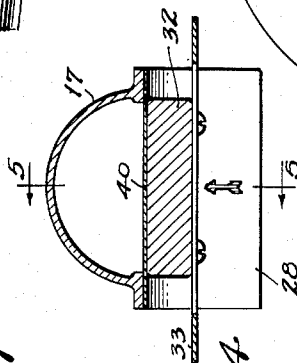


Fig. 3

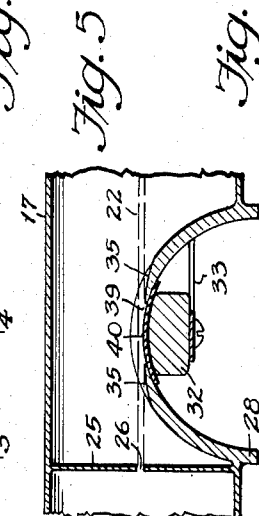


Fig. 4

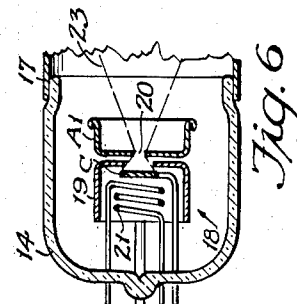


Fig. 5

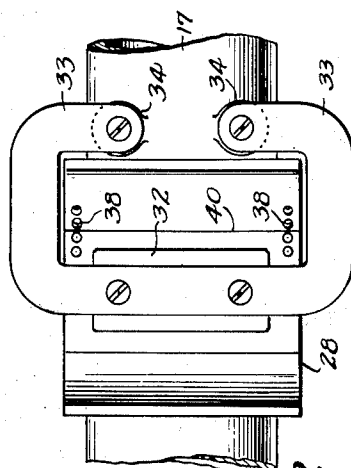


Fig. 6

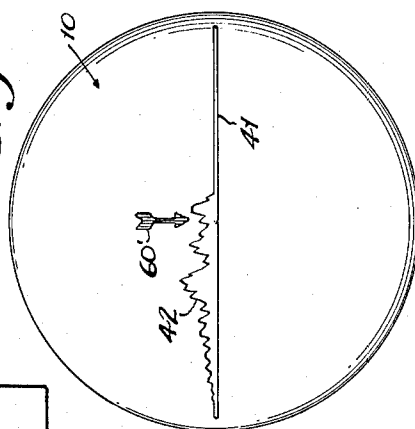


Fig. 7

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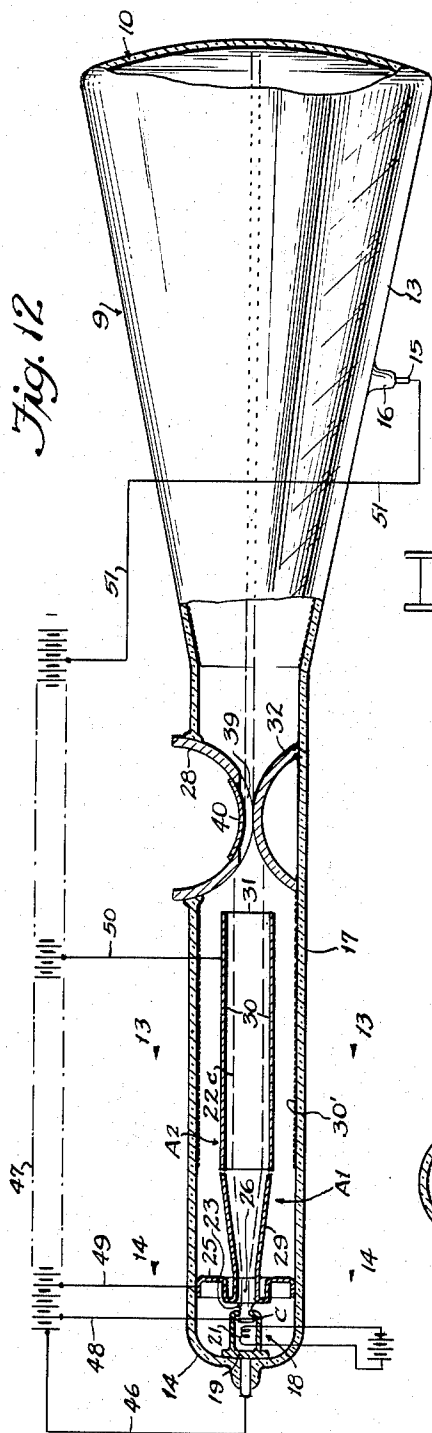
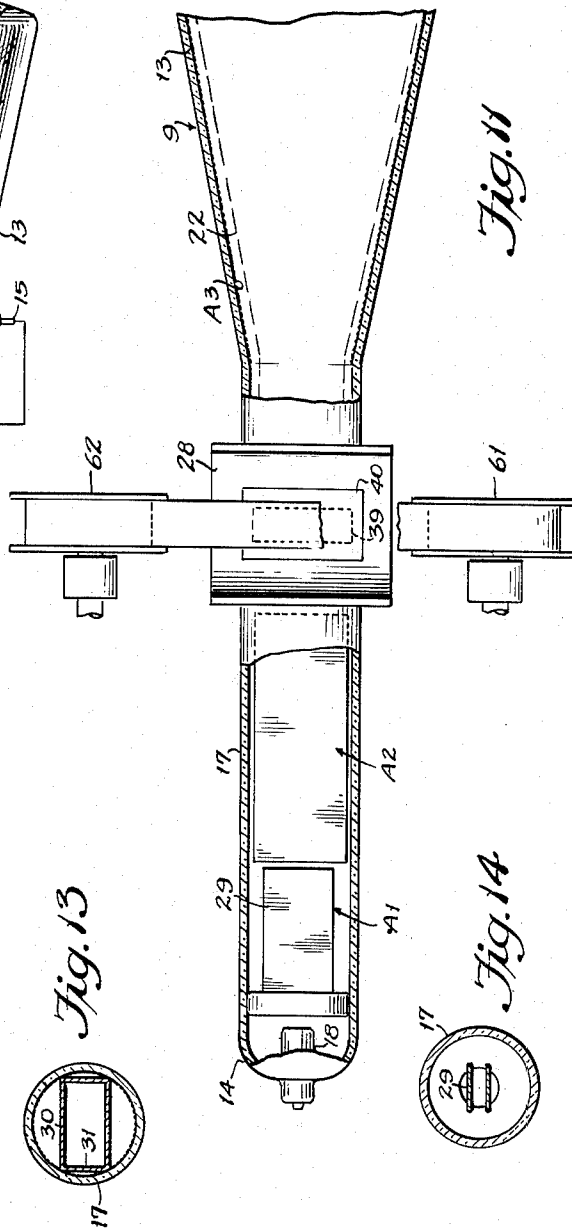
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CATHODE RAY TUBE

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Application October 6, 1952, Serial No. 313,312

15 Claims. (Cl. 179—100.2)

This invention relates generally to cathode ray tubes. In a specific aspect, it relates to machines for editing magnetic sound record wire, tape or film. It relates, more broadly, to apparatus for determining the electromagnetic or electrostatic pattern of a magnetized or charged body, utilizing a unique cathode ray tube as the principal component of the apparatus.

A particular object is to provide an apparatus for producing a visual image of the pattern of magnetization stored on a magnetic medium.

A further object is to provide an improved cathode ray tube adapted to produce an optical image of an elongated section of a sound record, whether stationary or in motion.

Another object is to provide a cathode ray tube adapted to produce a thin, flat fan shaped cathode ray beam, and to correspondingly produce a narrow straight line image on the picture screen of the tube; and having means whereby said straight line image may be distorted on one side thereof to indicate the characteristics of a sound record or other magnetized body being passed over the tube.

As a specific embodiment, the invention contemplates an improved and simplified machine for editing a magnetic sound record tape, wire or film, in such a manner that any particular section of the record, requiring observation, may be located on the tape more rapidly than heretofore possible.

Other objects will become apparent in the ensuing specification and appended drawings in which:

Fig. 1 is a view, partially in side elevation and partially in section, of a cathode ray tube embodying the invention;

Fig. 2 is a fragmentary plan view of the same;

Fig. 3 is a transverse sectional view taken on the line 3—3 of Fig. 1;

Fig. 4 is a transverse sectional view of the same taken on the line 4—4 of Fig. 1;

Fig. 5 is an axial sectional view of the same taken on the line 5—5 of Fig. 4;

Fig. 6 is an axial sectional view of the rear end portion of the tube;

Fig. 7 is a front view of the tube illustrating the picture screen and a sound track image thereon;

Fig. 8 is an axial sectional view of a cathode ray tube embodying a modified form of the invention;

Fig. 9 is a fragmentary perspective sectional view of a cathode ray tube embodying another form of the invention;

Fig. 9a is fragmentary perspective view of another embodiment of the invention;

Fig. 9b illustrates the image obtained on the screen of the tube embodied in Figure 9a;

Fig. 10 is a transverse sectional view of a cathode ray tube embodying a further modified form of the invention, as embodied in an editing machine;

Fig. 11 is a fragmentary plan view of the same;

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Fig. 12 is a view of the same, partially in elevation and partially in axial section;

Fig. 13 is a transverse sectional view of the same, taken on the line 13—13 of Fig. 12; and

Fig. 14 is a transverse sectional view of the same, taken on the line 14—14 of Fig. 12.

Description of the cathode ray tube

Referring now to the drawings in detail, we have shown, as an example of one form in which the invention may be embodied, a cathode ray tube forming part of an editing machine for magnetic tape such as that used for the sound record of sound movies. The cathode ray tube has an evacuated envelope 9 including a skirt 13 of conventional frusto-conical form, closed at its forward end by a screen 10. The screen 10 may consist in a dished end member 11 and a luminescent coating 12 of suitable phosphors on the inner surface thereof. End member 11 is of transparent or translucent material, and may be of glass, as may also the skirt 13. The frusto-conical skirt portion 13 of envelope 9 is interiorly coated with a conductive anode coating A3 (e. g. graphite) to which is connected an electric terminal 15 embedded in a suitable protuberance 16 on the skirt 13.

Envelope 9 includes a barrel 17 interiorly communicating with the skirt 13 and projecting rearwardly therefrom. The rear end of barrel 17 is hermetically closed by a cap 14 of insulating material in which is mounted an electron gun 18. Gun 18 comprises a cathode C confined within a collar shaped grid 19. A heater 21, which may be in the form of a coiled filament, is disposed within grid 19 immediately behind cathode C, for activating the same.

Forwardly of electron gun 18 is a primary anode A1 of conventional annular cup form, having a central aperture 20. Anode A1 functions in a conventional manner to accelerate the flow of electrons from cathode C through aperture 20 to produce a cone-shaped cathode ray beam 23 of spreading cathode rays, projected forwardly into barrel 17, centered about the longitudinal axis 24 of the tube. In a plane at right angles to axis 24, approximately where beam 23 would intersect the wall of barrel 17, is mounted a gate 25 in the form of a thin disc of sheet material (e. g. non-magnetic sheet metal), having an aperture 26 in the form of a narrow diametrical slot which passes a thin flat band 22 of rays from beam 23. Beam 22 is fan shaped, its side margins spreading as it passes through skirt 13, so that the beam is the full width of screen 10 when it strikes the latter.

From its rear extremity, where it joins cap 14, barrel 17 provides an annular interior wall of conductive material which constitutes an anode A2. Anode A2 may be either of nonmagnetic sheet metal or nonmetallic sheet material, interiorly coated with a metallic film. As a preferred form of construction, anode A2 comprises a length of metallic tubing, joined at its rear end to glass end cap 14 and at its forward end joined to a nonmetallic collar 27 which may constitute an integral extension of skirt 13.

Inset into secondary anode A2 is a saddle 28, which may consist in a short semi-cylindric section of metal tubing or formed sheet metal. It is electrically connected to anode A2 and forms a part thereof. In its preferred form, it may be of copper or brass sheet material, brazed or soldered to the wall of the metal tube portion of barrel 17, just forwardly of gate 25.

The central portion of saddle 28 on its inner side is flattened as at 35 so as to be of paper thinness, and is provided with a window aperture 39 in the form of a narrow slot extending transversely of the tube, parallel

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to the plane of beam 22. Aperture 39 is covered by a window 40 which consists in a strip of very thin non-metallic sheet material or nonmagnetic sheet metal suitably cemented, brazed or welded to the outer wall of saddle 28 around the margins of aperture 39. Window 40 is of minimum thickness consistent with the ability to withstand atmospheric pressure over the aperture 39 without deforming. For example, it may fall within a range of .001-.010 inch thickness, i. e., may approach the thickness of what is usually referred to as "foil." It should also be pervious to lines of magnetic flux. An example of a material that has been found suitable is nonmagnetic stainless steel.

Window 40 provides a bearing seat for a magnetic tape 36 carrying a sound record, and provides for the movement of tape 36 in a plane parallel to and immediately adjacent the cathode ray beam 22 and in a path extending transversely of the tube.

The flattened faces 35 of saddle 28 are positioned with reference to gate aperture 26 so that beam 22 will substantially graze the edges of the faces 35 bordering the aperture 39. The faces 35, instead of being disposed in a common flat plane parallel to beam 22, are preferably slanted away from said plane, and for this purpose may be slightly curved as shown in Fig. 5. Thus the invention provides for operation of tape 36 at maximum closeness to the beam 22, and the magnetic field of the sound record on tape 36 may readily pierce the window 40 which is proximate to the beam to act upon the beam 22. The function of window aperture 39 and window 40, therefore, is to allow the varying magnetic field of tape 36 (which may be considered as being a relatively straight line with varying degrees of magnetization along the length thereof) to act upon the extremely thin cathode ray beam 22 in a manner to distort the same by widening it into aperture 39. The result is that the image of the beam on screen 10 which, in the absence of excitation is a thin straight line as indicated at 41 in Fig. 7, becomes distorted on its upper side into a jagged contour as indicated at 42 in Fig. 7.

For holding the tape 36 snugly against window 40, we provide a pad 32, carried by spring arms 33 suitably mounted on barrel 17 as by being secured to lugs 34 thereon.

To position the tape 36 so that its sound track is properly centered over window aperture 39, there is provided suitable positioning means such as the abutment pins 37, selectively mounted in any one of a series of pairs of small openings 38 in the respective end portions of saddle 28. The openings 38 are arranged on one side only of the window aperture 39, since the usual method of moving the tape through saddle 28 will be to pull it through by hand, keeping one edge thereof bearing against the abutment pins 37.

It may now be noted that the window 40 provides a seat or guide for positioning the magnetic tape in substantial tangency to the cathode ray beam 22. The term "substantial tangency" is herein used in a somewhat broad sense of immediate adjacency, face to face, of the magnetic tape and the plane of beam 22. Actually, where the window 40 is of cylindrical curvature as shown, so as to impart a corresponding curvature to the tape, there will be substantial tangency in the technical sense of tangency between a flat plane and a cylindrical surface. Should it be considered desirable, however, to utilize a window that is flat or substantially flat (in which case there would be substantially parallel, flat face to face association of the tape with the beam 22), the term "tangency" would be applicable in the broad sense of tangency between a flat plane and a cylindrical surface of infinite or substantially infinite radius.

Electrical circuit

Our improved cathode ray tube, as embodied in any selected apparatus, is combined with other electrical com-

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ponents for energization to produce the cathode ray beam. Heater 21 is energized by an A battery 43, connected to its respective terminals by conductors 44, 45. Grid 19 is connected, by a conductor 46, to the negative side of a B battery 47. Cathode C is connected, by a conductor 48, to a cell of B battery 47 closely adjacent to the negative side thereof. Primary anode A1 is connected by a conductor 49 to B battery 47 somewhat farther toward the positive side thereof. The third and final anode A3, consisting in the interior conductive coating of skirt 13, is connected through a conductor 51 to the positive side of B battery 47 (or at a point near the positive side, selected in accordance with the exact potential to be impressed upon coating A3).

It will now be apparent that, with respect to cathode C, grid 19 is slightly negative, whereas anodes A1, A2 and A3 are all positive with progressively increasing potentials, whereby each of these anodes, in succession, exert a pull against the negatively charged electrons streaming from cathode C, to drive the cathode ray beam 22 against the screen 10.

Operation of the tube

We will first describe the general operation of the tube as a cathode ray tube. Cathode C, heated by the heater 21, will discharge electrons in all directions through opening 20, these electrons being repelled by the negative charge on grid 19 so as to be accelerated toward the narrow slot aperture 26 of gate 25 in the form of conical spray. This spray of electrons is drawn through the narrow gate aperture 26 by the attraction of the positive electrostatic charge on anode A2.

As the cathode ray spray 23 meets the gate 25, a large number of the electrons at the upper and lower sides of the spray respectively, are intercepted by the gate 25 and are drained off through conductor 50 to the B battery 47. Thus only the central portion of the spray 23, in which the electrons are highly concentrated because of the repulsive action of the outer layers of the electrons in the beam, is allowed to travel through the aperture 26, and the extremely thin flat beam 22, emitted from the aperture 26 consists in this concentrated central portion of the spray 23.

The anode A3, the conductive coating within envelope 9, produces an electrostatic attractive field which draws the electrons of the beam 22 past window 40 and accelerates them in the travel toward the screen 10.

Referring now to Fig. 1, the thin flat beam 22 is fan shaped as indicated by the broken lines indicating the lateral margins thereof in Fig. 1. This fan shaped beam 22 produces an image on screen 10 in the form of a relatively thin line extending diametrically across the screen from side to side thereof.

The magnetic fields produced by the recording on tape 36 penetrate the window 40. Thus the electrons in the cathode-ray beam pass through these fields in their path by the window. These electrons are deflected toward the tape or away from it, depending upon the direction of the magnetic field. The amplitude of each of these deflections depends upon the strength of the field causing it. Thus there is produced the distorted image 42, comprising a visual image of the sound track on tape 36, with each variation in intensity in the sound being indicated by a peak on the upper side of image 42.

The above mentioned tangent relation between the sound record tape and the cathode ray beam 22 provides for maximum modulating action by the magnetic record upon the cathode ray beam, in that it disposes the general plane of the magnetic record substantially in the plane of a flattened side of the beam so that all portions of the width of the sound record are of substantially equal effectiveness which would be obtained if the ribbon were disposed in a plane at right angles to the plane of the beam.

Fig. 10. Application of invention to an editing machine

As an example of one class of apparatus in which the

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invention is particularly useful, the illustration of the tape 36 and reels 61, 62 in connection with the cathode ray tube, may be viewed as a schematic illustration of components of an editing machine of which the cathode ray tube constitutes the major component. Any suitable means may be utilized for driving one of the reels (e. g. the reel 62), to cause the tape 36 to move as indicated by the arrow in Fig. 10, transversely of the tube and directly above the thin flat cathode ray beam 22 and the window aperture 39. Such drive may, for example, be transmitted to reel 62 through a shaft 91 from an electric motor 52 suitably energized from a current source 53 under the control of the operator through a manual switch 54. Motor 52 is preferably a reversible motor, and switch 54 a two-way switch, for controlling the operation of the motor selectively in either forward or reverse directions through respective circuits 55, 56. Thus the tape may be "backed up" when desired.

The editing apparatus may also include a sound reproducing unit including an electromagnetic pick-up 57 associated with sound tape 36 for excitation by the sound track thereon, a suitable amplifying unit 58 of any satisfactorily conventional design, and a dynamic speaker 59, energized through the amplifier 58.

Operation of editing apparatus

In the operation of the editing apparatus schematically indicated in Fig. 10 and Fig. 11, the operator, seated in front of the screen 10 and viewing the image 42 thereon, causes the tape 36 to travel across the window 40 and aperture 39, controlling the movement of the tape by the manual switch 54. Allowing the tape to normally have a continuous forward full speed travel as indicated by the arrow, he listens to the sound issuing from the speaker 59, and simultaneously watches the fluctuations of image 42, relating them to the fluctuations in sound. If the pick-up 57 is located at one side of the tube, as shown, the visual image of an instantaneous sound will occur at the corresponding side of screen 10 at the instant it is being delivered in audible form from speaker 59. When the operator hears a note or any other sound which in his opinion should be located on the sound record, he opens the switch 54 to arrest the travel of tape 36, and, if necessary, momentarily reverses the drive to "back up" the tape to a position where the visual image of the unwanted sound reappears on the screen (assuming it has travelled off the screen in the meantime). The image 42 may then be "frozen" upon screen 10 in a stationary condition. By manually shifting the tape 36, the operator can bring the image of the selected sound to the center of screen 10, thus bringing the corresponding point on the sound tape 36 to the center of saddle 28. This point can be accurately indicated in any suitable manner, using the indicator mark 60 as a guide for accurate location of the mark, so that subsequently the tape may be severed at the indicating mark thereon, for editing purposes. Actually, the severed portion of the tape will ordinarily be embraced between a pair of marks on the tape showing the respective limits of the section of tape that is to be removed.

During this process of arresting the movement of the tape and placing indicating marks thereon, the operation of the cathode ray tube is continued, so that the visual image 42 will remain on the screen 10. As the tape is shifted manually in one direction or the other, to bring, in succession, the respective limits of the undesirable sound opposite the indicator mark 60, the visual image of the sound will move, in step with the movement of the tape, so that the limits thereof may be accurately determined by registration with the center of screen 10, or with an indicator mark 60' on the screen 10, properly related to indicator mark 60 on seat 33. It will be understood that, before shifting the tape over to the marking point, the limits of the selected sound on the record will be determined by reference to the limits of the same sound in its visual image 42.

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It will now be apparent that the invention provides an apparatus whereby a visual image of a selected sound on a sound track can be manipulated manually by "slow motion" to a predetermined position where, by reference to said visual image, the respective limits of the corresponding portion of the sound record can be accurately marked upon the sound tape, whereas the corresponding audible sound cannot be maintained through such "slow motion" manipulation of the tape, for the reason that the reproduction of the audible sound depends upon the rapid and continued movement of the tape at a predetermined, uniform speed, past the pick-up 57. This movement of the tape is so rapid as to make it impossible to pinpoint the limit of the particular section of the sound track which correspond to the selected sound heard in the loud speaker 59. Accordingly, after having first located the limits of the selected sound upon the visual image 42, the operator then dispenses with the audible sound and utilizes simply the visual image 42 in order to fix the location of the selected section of the sound record by means of markings on the tape 36.

One of the important uses of an editing machine of this type is in locating certain accent sounds in a sound record, such as for example the impact of the toe of a tap dancer doing a tap dance routine, or the sound of a gunshot. Obviously it is quite important that such sounds be synchronized exactly with the visual image of the dancer's toe contacting the stage or of the gun firing the shot, in the assembling of the sound track on the film, and the invention provides a very easy method of doing this. Another possible use of the apparatus is in detecting and deleting undesirable sounds from a sound record.

Other applications of the invention

Other useful applications of the invention will suggest themselves to those skilled in the art, and it is my intention to cover various applications of the invention to uses other than sound record editing apparatus. For example, it is possible to test the crystalline structure of wires, rods, cables, etc., by passing them longitudinally through the saddle 28, in contact with or close proximity to window 40. By suitably causing an alternating electric current to flow through the wire, rod or the like, magnetic field, varying in accordance with variations in the crystalline structure of the wire, rod or the like, may be produced, and this varying field, penetrating window 40, will produce a distortion of the image 41 on screen 10, having recognizable characteristics such as to indicate flaws, etc., in the wire, rod, cable or the like. In the event it is desired to determine the state of magnetization or a lack of magnetization of an object, the object may simply be passed over window 40 without being subjected to an electric current, resulting in a visual image on screen 10 disclosing the variations in magnetization. By varying the shape of saddle 28 to receive a physical object such as a casting or the like, the magnetic characteristics thereof may be determined by moving the object in close proximity to window 40 so as to successively present different portions of the surface area of the object thereto.

Fig. 8 illustrates a modified form of the invention wherein, instead of the means for reshaping a round beam into a thin flat beam, there is provided means for producing a thin, needle-like beam 22a, together with means to cause said beam 22a to sweep back and forth across the tube in an axial plane 24 so as to produce an image on screen 10 in the form of a diametral line 41 which is distorted to produce an image 42 corresponding to the variations in a sound record track on tape 36.

For producing the sweep of beam 22a, there is provided a conventional control set of deflection coils in ring 70 encircling the barrel 17 and energized by a conventional sweep circuit component, indicated schematically at 71, operable to alternately deflect the beam first to one side and then the other. The control ring 70 is so placed as to cause the sweep to occur in the axial plane 24', par-

allel to and immediately adjacent the window 40. As the beam sweeps back and forth, it is widened in a direction at right angles to plane 24', with the widening action varying throughout the path of sweep, in accordance with the variations in intensity in the electromagnetic or electrostatic field of the tape 36 or other object passing across window 40. A suitable anode A1, of conventional form, for shaping the cathode ray beam into a slender needle form, is utilized instead of the anode A1 of the above described form of the invention.

Fig. 9 illustrates a further modification wherein a cathode ray beam issuing from a gun 18b passes through a primary anode Ab, thence between a pair of variable potential electrostatic sweep-control plates 75 for causing the beam to sweep from side to side in a plane parallel to and midway between a pair of fixed-potential anode plates A2, thus producing a diametral line image on screen 10 which is varied in texture by the control parts 28, 38, 40, etc., all corresponding to the same parts in Fig. 1.

Fig. 9a illustrates an arrangement in which saddle 28 blocks only one-half of the beam 23'', allowing the other half to spread in the shape of a half cone, producing an image 41'' on screen 10 (Fig. 9b) in the shape of a 180° segment of a circular disc of light. Image 41 has its normally straight upper margin modified by response to a sound tape, as indicated at 42''.

Fig. 12 illustrates a further modified form of the invention. A conventional electron gun 18 is utilized, as in Fig. 1. Forwardly of electron gun 18 is a primary anode A1 which comprises a pair of plates 29 the rear portions of which are spaced relatively close to and disposed on opposite sides of the transverse axial plane of the tube. Plates 29 extend to the full width of the barrel 17 from the width indicated in the cross sectional view shown in Fig. 14. The rear extremities of plates 29 are attached to a gate 25, which has a narrow aperture 26 in the form of a transverse slot bisected by the axial plane. The cathode ray beam issuing from cathode aperture 20 in the form of a spreading cone 23 of cathode rays, is reshaped by gate 25, as they pass through aperture 26, into a beam of flat ribbon form, indicated by the broken lines 22c in Fig. 12.

Forwardly of primary anode A1 is a secondary anode A2 which includes an anode duct in the form of a tube of shallow rectangular cross section including transverse wall portions 30, extending transversely of barrel 17, parallel to axial plane and equally spaced above and below the same, and including relatively narrow side walls 31 joining the transverse walls 30. Tube 30, 31 is of electrically conductive material, such as metal (e. g., copper, stainless steel, etc.). The secondary anode A2 also includes the barrel 17, which is constructed of metal tubing or of glass tubing with a conductive coating 30' on its inner face. The secondary anode A2 also includes a pair of shields 32 and 28 which extend transversely of barrel 17 in symmetrical relation to the axial plane and are equally spaced above and below said plane, with their central portions closely spaced to define a flat shallow pass 39 extending the full width of barrel 17 as indicated in the cross sectional view in Figure 14. Shields 32 and 28 are of channel section in an axial plane of the tube at right angles to the axial plane. In a transverse section of barrel 17 (in a plane normal to the tube axis) they define parallel straight lines.

Shields 32, 28 may be of non-magnetic sheet metal or of non-metallic sheet material, interiorly coated with a metallic film. They function to intercept all portions of beam 22c except the thin flat central portion 22 which passes on to the screen. The electrons which strike shields 28, 32 are drained off through return circuit 50, back to potential source 47.

In other respects, the tube of Fig. 12 is like that of Fig. 1, and corresponding reference numerals are used to designate the same.

While the descriptions of the embodiments of the invention all show magnetic tape brought into contact with and being moved with the tape extending transversely to the path of the cathode-ray beam in the tube, it should be appreciated that this is not to be construed as a limitation. The magnetic tape may also be brought, for example, into and out of contact with the window 40 with the tape extending in the same direction as the cathode-ray beam to effectively display the magnetic pattern recorded on the tape. This type of operation may be employed where information is recorded in the form of binary coded pulses on several parallel longitudinally extending tracks on the tape. The tape may be brought into and out of contact with the window, for example, over a fairly narrow rod or roller, in order that only one set of aligned pulses may be seen at a time. In effect, the present invention may be used with magnetic tape as a visual reading head for magnetically recorded information, regardless of the direction of recording, to display the information recorded in any desired portion of the recording medium, whether it is moving or stationary, by bringing the recording medium into such proximity with the cathode-ray beam of the invention that no guiding structure for lines of flux emanating from the recording medium is required to cause them to deflect the cathode-ray beam.

Accordingly, there has been shown and described herein a novel and useful cathode-ray tube which can provide a visual display of the information recorded on a section of a magnetic medium brought into proximity with the tube without employing any auxiliary equipment. Such display is provided whether the magnetic medium is stationary or in motion.

We claim:

1. The combination with a magnetic recording medium on which signals have been recorded on a cathode-ray tube including an evacuated envelope, a screen at one end of said envelope, means at the other end of said envelope for generating a cathode-ray beam having a substantially elongated rectangular cross-sectional area, means for directing said beam toward said screen and means to which said recording medium is applied to act upon said cathode-ray beam with the magnetic field from signals recorded thereon, said means comprising a surface in said evacuated envelope wall made of sheet material substantially pervious to lines of magnetic flux and which maintains said evacuated envelope sealed, said sheet material being positioned in said tube to be along the path of said beam toward said screen, and to separate said beam from said storage medium.

2. In apparatus for displaying signals recorded on a magnetic storage medium a cathode-ray tube having an evacuated envelope, a screen at one end of said envelope, means at the other end of said envelope for generating a cathode-ray beam, means for shaping said beam to have a substantially elongated cross-sectional area, means for directing said beam in a path toward said screen and means to which said medium is applied to act upon said cathode-ray beam with the magnetic field from signals recorded thereon, said means comprising a surface in said evacuated envelope wall made of sheet material substantially pervious to lines of magnetic flux and which maintains said evacuated envelope sealed, said sheet material being positioned in said tube to be along the path of said beam toward said screen and to have one of its surfaces substantially touching the long side of said beam and its opposite surface substantially in contact with said storage medium.

3. Apparatus as recited in claim 2 wherein said sheet material is made of non-magnetic stainless steel.

4. Apparatus as recited in claim 3 wherein said means for acting on said cathode-ray beam includes two sheet material surfaces in said envelope wall which are located opposite one another.

5. In apparatus for displaying information recorded on

magnetic tape a cathode-ray tube having an evacuated envelope, a screen at one end of said envelope, means at the other end for generating a cathode-ray beam, means for shaping said beam to have an elongated substantially rectangular cross-sectional area, means for directing said beam in a path toward said screen, and means, including means in said tube against which said tape is applied, to produce a visible pattern on said screen representative of the information recorded on the portion of the tape being applied, said last-named means comprising an aperture in said envelope, a thin sheet of material sealing said aperture, said material being pervious to lines of magnetic flux and being positioned in the path of and having one surface proximate to said rectangular beam, said tape being applied to said opposite surface.

6. In apparatus for displaying signals recorded on a magnetic storage medium a cathode ray tube comprising an evacuated envelope including a barrel, a skirt, and a screen at the outer end of said skirt; an electron gun in said barrel, arranged to project a bundle of cathode rays toward said screen; a primary anode; means for reshaping said bundle into a thin, flat beam impinging on said screen to produce a visual image of linear form; a secondary anode including a saddle member projecting inwardly from the wall of said barrel and having an elongated window aperture extending chordally with reference to said barrel wall and parallel and close to the plane of said flat beam; and a window of thin, non-magnetic sheet material covering and sealing said window aperture and forming part of said envelope, said window providing a seat for guiding the movement of said magnetic medium past said window aperture, and being permeable to the magnetic fields of the signals on said medium whereby said signals are visually reproduced by distortion of said image.

7. Apparatus as defined in claim 6 wherein said flat beam plane is disposed closely adjacent an axial plane of said tube, whereby said image line is positioned substantially as a diameter of said screen, and wherein said window is substantially tangent to said plane so as to support said tape in a plane substantially coincident with said beam plane.

8. Apparatus as defined in claim 6, wherein said skirt is provided on its inner surface with a conductive coating constituting a third anode of higher potential than said secondary anode, for further accelerating said beam.

9. In apparatus for displaying signals recorded on magnetic tape a cathode-ray tube having an evacuated envelope including a barrel, a skirt, and a screen at the outer end of said skirt; an electron gun in said barrel, arranged to project a bundle of cathode rays toward said screen; a primary anode; means for reshaping said bundle into a thin, flat beam impinging on said screen to produce a visual image of linear form; a secondary anode including a saddle member of semi-cylindrically arched form, arranged in reentrant relation to the barrel, with its axis transverse to the tube axis and with its central portion substantially tangent to a plane of said tube axis and having a window aperture of slot form extending substantially diametrically of said barrel; and a window of thin, non-magnetic sheet material covering and sealing said window aperture, arched inwardly across the plane of said aperture and tangent to the plane of said flat beam, said window providing a seat for facilitating movement of a magnetized tape past said window aperture, and being permeable to the magnetic fields of the signals recorded on said tape whereby said fields are visually reproduced by distortion of said image.

10. Apparatus for displaying signals as recited in claim 9 wherein said means for reshaping said bundle into a thin, flat beam impinging on said screen to produce a visual image of linear form includes a pair of gate members disposed within and transversely of said barrel a substantial distance forwardly of said primary anode, said

gate members being spaced to define a narrow pass disposed diametrically of said barrel and functioning to reshape said cone into a thin, flat beam impinging upon said screen to produce a visual image of linear form, said saddle member being disposed slightly forwardly of said gate members.

11. In apparatus as recited in claim 9 wherein said primary anode includes a conductive coating on the inner wall of said barrel and further includes a pair of shield members defining a pass of restricted depth for passage of a central layer of said beam while intercepting outer layers of said beam, whereby to reduce said beam in thickness so that the beam as it strikes said screen will be thin and broad, producing a visual image in the form of a straight line on the screen.

12. In apparatus for displaying signals recorded on magnetic tape a cathode ray tube having an evacuated envelope including a skirt, a barrel, and a screen at the forward end of the skirt; an electron gun in said barrel, arranged to project cathode rays toward said screen; a primary anode interposed between said gun and said screen slightly forwardly of said gun, adapted to bend said rays into a cone of spreading cathode rays; a gate comprising a disc disposed in a plane at right angles to the longitudinal axis of the barrel, a substantial distance forwardly of said primary anode, said barrel being a sheet metal tube, electrically connected to said gate members and cooperating therewith to constitute a second anode, said disc having a diametrically disposed narrow slot constituting a pass for reshaping said cone of rays into a thin, flat beam impinging upon said screen to produce a visual image of linear form; a saddle member of semi-cylindrical arched form disposed slightly forwardly of said gate and constituting a reentrant portion of the exterior wall of the tube and having therein a window aperture of slot form extending substantially diametrically of said barrel and parallel and immediately adjacent to the axial plane of said pass; and a window of thin, non-magnetic sheet material having a cylindrical curvature corresponding to that of said saddle member covering and sealing said window aperture and forming part of said envelope, said window providing a seat for guiding the movement of said tape past said window aperture, and being permeable to the magnetic fields from signals recorded on said tape whereby said fields are visually reproduced by distortion of said image.

13. In apparatus as defined in claim 12 wherein said saddle member has end portions projecting beyond the sides of the tube, and positioning stops adjustably carried by said end portions for adjustment laterally of the axis of the saddle, said saddle axis extending transversely with reference to the longitudinal axis of the tube.

14. In a magnetic sound tape editing machine, an evacuated envelope including a barrel, a skirt, and a luminescent screen at the outer end of said skirt; an electron gun in said barrel arranged to project a bundle of cathode rays toward said screen; a primary anode; means for reshaping said bundle into a thin, flat beam impinging on said screen to produce a visual image of linear form; an arched saddle member constituting a reentrant portion of the wall of said barrel and having a window aperture of slot form extending chordally with reference to said barrel wall; a window of thin non-magnetic sheet material covering and sealing said window aperture and forming part of said envelope, said window providing a seat for guiding the movement of a magnetic sound tape past said window aperture, and being permeable to the magnetic field of said tape whereby said field will be visually reproduced by distortion of said image; and tape reels for supporting a sound tape so that a web thereof, extending between said reels, may travel past and upon said window, transversely of the tube axis.

15. In an apparatus for producing a visual image of a substantial length of a magnetized record on an elon-

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gated recording medium, a cathode ray tube comprising an evacuated envelope including a skirt, a barrel, and a screen at the forward end of said skirt; an electron gun in said barrel, arranged to project a bundle of cathode rays toward said screen; means for reshaping said bundle into a thin, flat beam impinging on said screen to produce a visual image of linear form; said barrel having a reentrant wall portion providing an elongated space extending transversely of the barrel and open to the exterior thereof, whereby said magnetized recording medium can be inserted into and passed through said space, said reentrant wall portion having a bottom portion, and of such thinness as to be permeable to the magnetic field of said tape, and of elongated form, disposed chord-

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ally with reference to the barrel and substantially tangent to said beam, whereby the magnetic sound record upon said tape can be disposed in substantial tangency so as to be visually reproduced by distortion of said screen image.

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