May 13, 1941. J. F. DREYER, JR 2,241,544

VISUAL SIGNAL RECORDER

Filed May 18, 1938 2 Sheets-Sheet 1

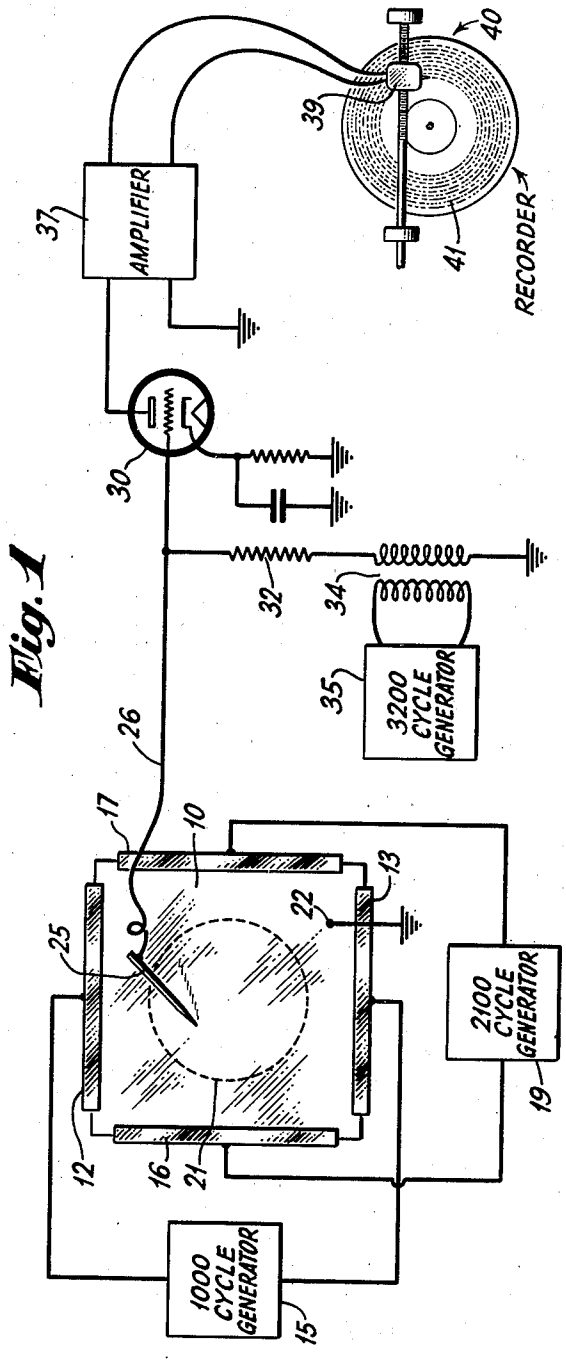


Fig. 1

INVENTOR.
JOHN F. DREYER, JR.

BY H. S. Grover

ATTORNEY.

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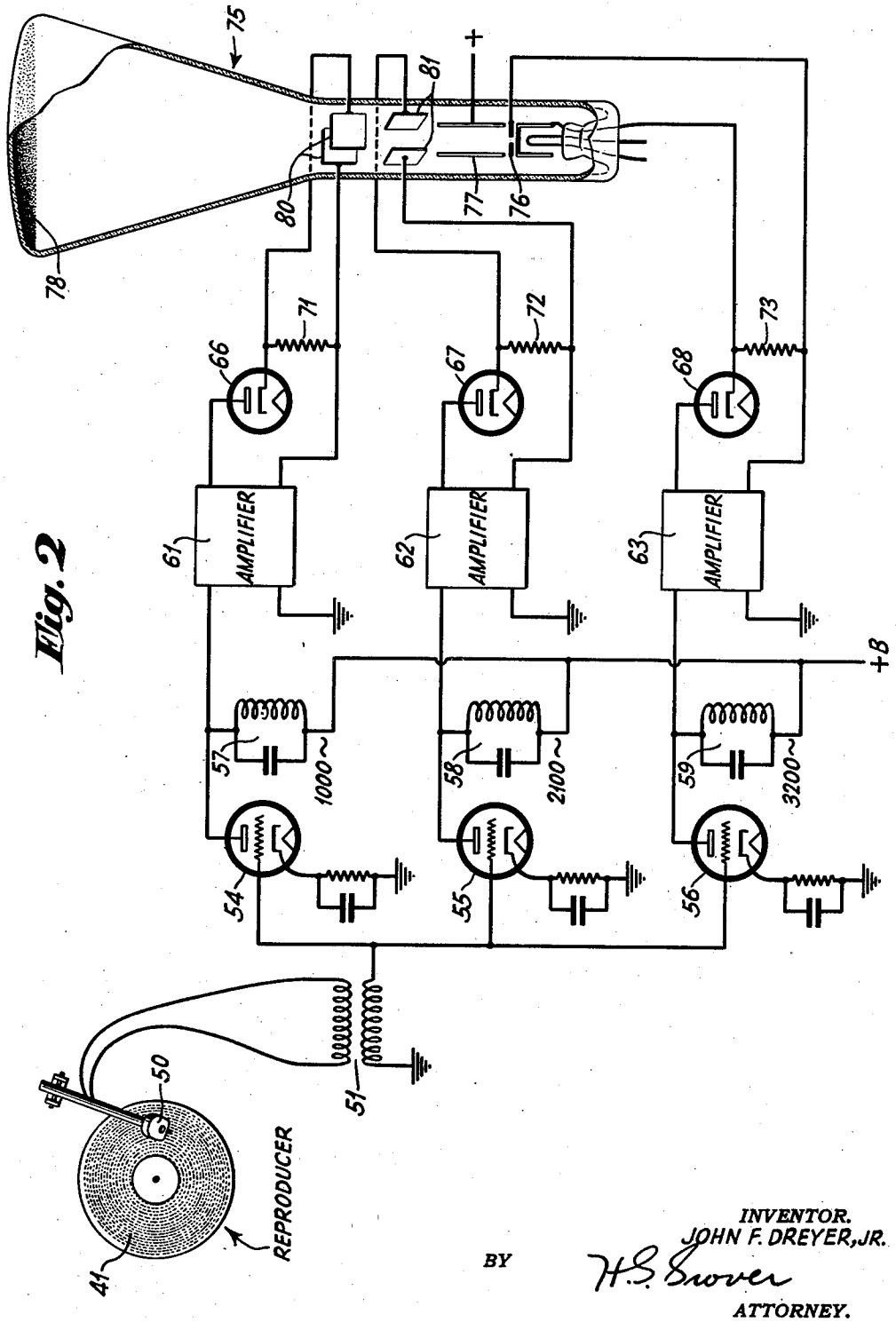


Fig. 2

INVENTOR.
JOHN F. DREYER, JR.

BY H. S. Grover

ATTORNEY.

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UNITED STATES PATENT OFFICE

2,241,544

VISUAL SIGNAL RECORDER

John F. Dreyer, Jr., Brooklyn, N. Y., assignor to Radio Corporation of America, a corporation of Delaware

Application May 18, 1938, Serial No. 208,726

6 Claims. (Cl. 178—6.6)

This invention relates to the means of and method for recording visual signals in such a manner that they may be subsequently reproduced and caused to appear upon a fluorescent or phosphorescent screen of a cathode ray tube.

More specifically, the present invention relates to a method of and means whereby movements of a stylus over a metallic sheet or foil may be recorded in record form similar to a phonograph record. The record may later be placed in a reproducer and the signals derived therefrom utilized to control the deflection of a cathode ray beam in a cathode ray tube for reproducing the movements of the stylus upon the fluorescent end wall of the cathode ray tube. Such a device is, of course, capable of reproducing drawings, sketches, written matter, or the like, and is particularly useful for instruction work or for advertising or the like in which case the cathode ray tube upon which the configurations are to be caused to appear could be placed before a class or an audience or in a display window.

Various telautograph systems are known in the art and in such systems no storage of the signals generated at the transmitter is possible, the signals being utilized to immediately reproduce the message at the receiving apparatus. In the present device, permanent recordings of the signal variations as produced by the transmitting mechanism may be stored in record form and may be used at any subsequent time. Furthermore, from a master recording a great number of reproductions or copies may be made in a manner similar to the reproduction of phonograph recordings.

One purpose of the present invention, therefore, resides in the provision of means for permanently recording the movement of a stylus.

A further purpose of the present invention resides in the provision of means whereby the movement of a stylus may be permanently recorded so that the recording may be used subsequently to reproduce the original movements of the stylus.

Still another purpose of the present invention resides in the provision of means whereby a stylus similar to a pencil may be manipulated in a conventional manner over a foil of conducting material to produce a recording of such manipulations or movements of the stylus.

Still another purpose of the present invention resides in the provision of means whereby the reproduction of the movement of the stylus may be presented on the fluorescent or luminescent screen of a cathode ray tube, the fluorescent coating having a degree of light persistency such that successive tracings of the stylus may be reproduced successively on the same screen area.

A still further purpose of the present invention resides in the provision of means whereby the movements of a stylus may be reproduced upon a relatively small area without the necessity of providing a recording paper upon which the movements of the stylus are to appear.

Still further purposes and advantages of the present invention will become more apparent to those skilled in the art from a reading of the following specification and claims, particularly in connection with the drawings, wherein:

Figure 1 represents one form of a means for recording the movements of a stylus and,

Figure 2 represents a system for reproducing the recorded movements of the stylus in accordance with the present invention.

Referring now to the drawings, and particularly to Figure 1 which shows the system for recording the movements of the stylus, a sheet of metallic foil 10 is provided. The metallic foil is preferably square or rectangular and opposite edges of the foil are provided with contact strips such as 12 and 13 by means of which a source of alternating potential may be impressed across the foil in one direction. An alternating current generator 15 capable of generating, for instance, 1000 cycles per second, is provided, the output of the generator being connected to the terminal strips 12 and 13. Two other terminal strips 16 and 17 are attached to the remaining two edges of the metallic foil and upon these terminal strips is impressed an alternating potential of a different frequency. A second generator 19 capable of generating, for example, 2100 cycles per second, is therefore provided and the output of this generator is connected to the terminal strips 16 and 17.

Shown on the metallic foil is a dotted circle 21 corresponding to the limits within which a stylus is to be moved. A point outside the confines of the circle 21, such as point 22, is connected to ground so that when one frequency is applied vertically across the metallic foil and a second frequency applied horizontally across the metallic foil, varying potentials will be present at different points on the foil with respect to ground. The amplitudes of these potentials of the one frequency or the other, appearing between a predetermined point within the confines of the circle 21 and the grounded point 22, depend upon the coordinates of the point, that is, the displacement of the particular point hori-

zontally with respect to the ground point 22, and the displacement of the point vertically with respect to the ground point 22. A stylus 25 which is made of conducting material, is provided, the stylus being preferably in the form of a pencil. As the stylus 25 is moved over the surface of the foil 10 and within the confines of the circle 21, the frequencies which are impressed vertically and horizontally across the foil will be present between the conductor 26 (which is attached to the stylus 25) and ground, the intensity or voltage of the different frequencies depending upon horizontal and vertical displacement of the point of the stylus on the foil 10 with respect to the grounded point 22.

The intensities of the two frequencies which are present between the stylus and ground vary in accordance with the position of the stylus on the foil 10 and it is these variable intensity frequencies that are recorded, but in view of the fact that the intensities are relatively small (the voltage of the generator sources 15 and 19 being of the order of only a few volts) amplifying means are necessary. The amplifying means includes an electron discharge device 30, including a cathode, a control electrode and an anode. The cathode of the discharge device 30 is connected to ground whereas the control electrode of the discharge tube is connected to the conductor 26. Introduced between the control electrode and ground is a resistance 32 and the secondary of the transformer 34. Connected to the primary of the transformer 34 is a third voltage generator 35 capable of generating, for instance, 3200 cycles per second, the purpose of which will be explained later. The output of the discharge tube 30 is connected to additional amplifier 37, the output from which is connected to the recording head 39 of a recording mechanism 40.

It may be seen, therefore, that as the stylus 25 is moved over the metallic foil 10, the 1000 cycle and the 2100 cycle frequencies which are impressed across the foil will appear in the conductor 26, the intensities of these frequencies being dependent upon the position of the stylus with respect to the ground point 22. When these signals are amplified and applied to the recording head 39, a record of the variations in the intensities of the two frequencies will be produced upon the record 41 by the recording mechanism 40. If the stylus is completely removed from the foil 10, then the frequency generator 35 becomes effective to supply a frequency of 3200 cycles, for example, to the amplifier 37, and, under this condition, there is a frequency of constant amplitude of the frequency supplied by the generator 35 recorded upon the record 41, the other frequencies being entirely absent.

After the record has been made, recording the signals resulting from a movement of the stylus over the metallic foil, the record may then be played back to reproduce such movements or the record may be used as a master from which a plurality of reproductions or copies may be made.

The reproducing system is shown in Figure 2 and includes a pick-up device 50 which operates to transform the physical variations which are present on the record 41 into electrical voltage variations. The output of the pick-up device 50 is connected to the primary of the transformer 51, the secondary of which is connected to the control electrodes of a plurality of amplifying tubes 54, 55 and 56. Associated with the anode circuit of each amplifier tube are filter circuits 57, 58 and 59. The filter circuit 57, which is associated with amplifier tube 54, is in the form of a parallel resonant circuit and is tuned to the frequency of the generator 15 (1000 cycles). Additional amplifying means 61 is provided for amplifying the frequencies which are not absorbed by the filter circuit 57. The filter circuit 58, which is associated with the amplifier tube 55, is tuned to the frequency of the generator 19 (2100 cycles), whereas the frequency of the filter circuit 59, which is associated with the amplifier tube 56 is tuned to the frequency of the generator 35, which, as assumed above, may be 3200 cycles. Additional amplifying means 62 and 63 are also provided for amplifying the signals which are not absorbed by the filters 58 and 59, respectively.

Connected to the outputs of the amplifiers 61, 62 and 63, are separate rectifier tubes 66, 67 and 68. The amplified variable intensity signals of 1000 cycles and 2100 cycles, and the amplified 3200 cycle signal when present, are impressed upon these rectified tubes. Separate direct current voltages then appear across the cathode resistors of these tubes in an amount depending upon the intensities of the recorded frequencies. The voltage appearing across the resistance 71, therefore, depends upon the intensity of the 1000 cycle frequency recorded upon the record 41; the voltage appearing across the resistance 72 depends upon the intensity of the 2100 cycle frequency recorded upon the record 41, and the voltage which appears across the resistance 73 depends upon the intensity and presence of the frequency of 3200 cycles recorded upon the record. For reproducing the movements of the stylus, a cathode ray tube 75 is provided which includes an electron gun structure in one end of the tube and a fluorescent or luminescent screen in the other end of the tube. The gun structure may be of conventional design and may include, for instance, a cathode from which a supply of electrons may be derived, a control electrode 76 for regulating the intensity of the electrons, and an accelerating electrode 77 for directing the electrons toward and for focusing the same upon the fluorescent screen 78 which is deposited upon the inside surface of the end wall of the cathode ray tube. When appropriate potentials are applied to the electrodes which constitute the electron gun, a stream of electrons commonly known as a cathode ray beam will be generated and direct against the fluorescent screen, the fluorescent screen becoming luminescent or fluorescent upon bombardment by the cathode ray beam.

For deflecting the cathode ray beam across the fluorescent screen, two pairs of deflecting plates 80 and 81 may be provided, the plates 80 operating to deflect the cathode ray beam in a vertical direction and the plates 81 operating to deflect the beam in a horizontal direction.

Since the 1000 cycle generator 15 is applied across the top and bottom edges of the metallic foil, variations in the intensity of the 1000 cycle oscillations as recorded upon the record 41 are used to control the vertical deflection of the cathode ray beam. Inasmuch as the voltage appearing across the resistance 71 is a function of the intensity of these oscillations, the vertical deflecting plates 80 are connected to the terminals of the resistance 71. Accordingly, since the 2100 cycle generator is connected to the sides of the metallic foil, in order that the cathode ray beam may be deflected horizontally in ac-

cordance with the horizontal position of the stylus 25, the voltages which appear across the resistance 72 are impressed upon the horizontal deflecting plates 31. It may be seen, therefore, that the horizontal and vertical positioning of the cathode ray beam and its point of contact with the fluorescent screen may be determined by the intensity of the 1000 and the 2100 oscillations as they appear on the record 41.

In view of the fact that it is desirable to interrupt or eliminate the cathode ray beam during periods corresponding to the time when the stylus was not in contact with the foil 10, the 3200 cycle oscillation is used to control the intensity of the cathode ray beam. Accordingly, the voltage which appears across the resistance 73 is impressed between the control electrode 76 and the cathode of the electron gun structure so that when the 3200 cycle oscillation is present and the 1000 and 2100 cycle oscillations are not present (which corresponds to a time when the stylus is lifted from the metallic foil) the cathode ray beam is intercepted and no trace appears on the fluorescent screen.

In order that the reproduced movements of the stylus on the fluorescent screen of the cathode ray beam may persist sufficiently long to be readily seen, it is desirable to provide a fluorescent screen of relatively long persistency yet of a persistency not so long but that retraces over the same portion of the screen may be possible especially when written messages, for instance, are to be reproduced. The degree of persistency of the screen of the cathode ray tube may, of course, be chosen in accordance with the subject matter of the material being displayed upon the end of the cathode ray tube. If sketches are to be drawn, the persistency of the screen may be increased so that the first portion of the sketch will not become invisible before the sketch is completed. If, however, messages are to be reproduced on the end of the cathode ray tube it is desirable that the persistency be such that the entire available area may be repeatedly used without interference.

It is to be understood that different types of means may be used for storing the signal variations and, although a disc record such as used in phonograph recordings is shown and described, any other suitable and convenient medium may be employed. For instance, lengths of wire may be magnetized by the varying signals as in a Poulsen recorder or the record may be placed on a photographic film in a manner well known in the art.

Furthermore, it is not necessary that a cathode ray tube be used specifically to reproduce the movements of the stylus since other means could as well be used. For instance, the current or voltage variations which represent the movements of the stylus could be used to energize the magnets or solenoids of a conventional telautograph. When such a responsive means is used the arm of the telautograph could be used to write directly on a strip of paper or the movements of the arm could be used to control the selective energization of a group of lamps on a remotely positioned lamp bank.

Various other modifications in the invention may be made without departing from the spirit and scope thereof, and it is desired that any and all such modifications be considered within the purview of the present invention, except as limited by the hereinafter appended claims.

I claim:

1. A system for recording and reproducing movements of a stylus comprising a foil of conducting material, means for impressing a first alternating current frequency across said foil, means for impressing a second alternating current frequency across said foil in a direction normal to the direction in which the first frequency is impressed, a movable and a fixed contact associated with said foil whereby the potentials of the two frequencies present at said contacts will depend upon the position of said movable contact on said foil, a third alternating current frequency, means for suppressing said third frequency when said first and second frequencies are present, means for permanently recording all of said frequencies on a record medium, a cathode ray tube including means for developing a cathode ray beam, means for controlling the intensity of the developed beam and a fluorescent screen responsive to the presence of the beam, means for deflecting the cathode ray beam in mutually perpendicular directions, and means responsive to the intensities of the recorded frequencies on the record medium for controlling the deflections and intensity of the cathode ray beam to reproduce on the fluorescent screen the movements of the movable contact over the foil.

2. A system for recording and reproducing movements of a stylus comprising a foil of conducting material, means for impressing a first alternating current frequency across said foil, means for impressing a second alternating current frequency across said foil in a direction normal to the direction in which the first frequency is impressed, a movable stylus and a fixed contact associated with said foil whereby the potentials of the two frequencies present between said stylus and contact will depend upon the position of said stylus on said foil, means for permanently recording the variations in potentials of the two frequencies on a record medium, a cathode ray tube including means for developing a cathode ray beam and a fluorescent screen responsive to the presence of the beam, means for deflecting the cathode ray beam in mutually perpendicular directions, and means responsive to the intensities of the recorded frequencies on the record medium for controlling the deflections of the cathode ray beam in order to reproduce on the fluorescent screen the movements of the stylus over the foil.

3. A system for recording and reproducing movements of a stylus comprising a layer of conducting material, means for impressing two different alternating current frequencies across said layer in mutually perpendicular directions, a stylus and a fixed contact associated with said layer whereby the potentials of the two frequencies present at said stylus and fixed contact will depend upon the position of said stylus on said layer, means for permanently recording the variations in potentials of the two frequencies on a record medium, a cathode ray tube including means for developing a cathode ray beam and means responsive to the presence of the developed cathode ray beam for producing visual sensations, means for deflecting the cathode ray beam in mutually perpendicular directions, and means responsive to the intensities of the recorded frequencies on the record medium for controlling the deflection of the cathode ray beam in order to visually reproduce movements of the stylus over the layer.

4. In a system for recording movements of a stylus comprising a film of conducting material,

means for impressing an alternating current oscillation of one frequency across said film in one direction, means for impressing an alternating current oscillation of another frequency across said film in a direction normal to the direction in which the first frequency is impressed, a movable stylus and a fixed contact associated with said film whereby the potentials of the two frequencies present across said stylus and said fixed contact depend upon the position of the stylus with respect to said fixed contact, means for amplifying said potential variations of the two frequencies including an electron discharge tube having a cathode, a control electrode and an anode, means for impressing said potential variations of the two frequencies between said cathode and control electrode, means for impressing a third frequency between said control electrode and cathode, said last named means including means whereby said third frequency is materially suppressed when the stylus is in contact with said film, and means associated with the anode of said amplifier tube for permanently recording all of said frequencies on a record medium.

5. In a system for recording movements of a stylus comprising a film of conducting material, means for impressing an alternating current oscillation of one frequency across said film in one direction, means for impressing an alternating current oscillation of another frequency across said film in a direction normal to the direction in which the first frequency is impressed, a movable stylus and a fixed contact associated with said film whereby the potentials of the two frequencies present across said stylus and said fixed contact depend upon the position of the stylus on the conducting film with respect to said fixed contact, means for amplifying said potential variations of the two frequencies including an electron discharge tube having a cathode, a control electrode and an anode, means for impressing said potential variations of the two frequencies between said cathode and control electrode, and means associated with the anode of said discharge tube for permanently recording the potential variations of said frequencies on a record medium.

6. In a system for recording movements of a stylus comprising a film of conducting material, means for impressing an alternating current oscillation of one frequency across said film in one direction, means for impressing an alternating current oscillation of another frequency across said film in a direction normal to the direction in which the first frequency is impressed, a movable stylus and a fixed contact associated with said film whereby the intensities of the two frequencies present across said stylus and said fixed contact will be modulated in accordance with the position of the stylus on the film with respect to said fixed contact, and means for permanently recording the modulated frequencies on a record medium.

JOHN F. DREYER, JR.