May 7, 1935. A. B. DU MONT 2,000,014

TELAUTOGRAPH

Filed May 31, 1932

Fig. 1

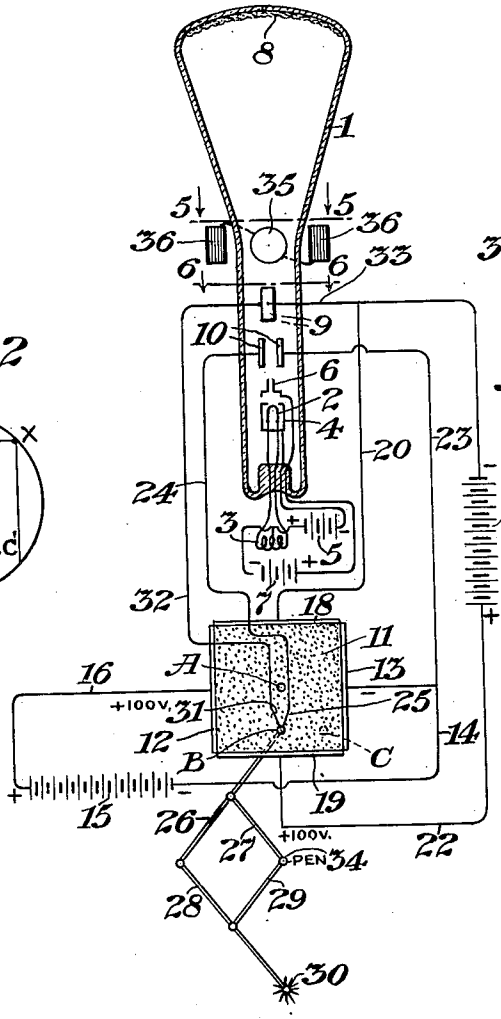


Fig. 2

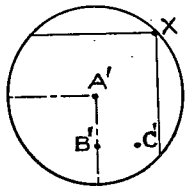


Fig. 5

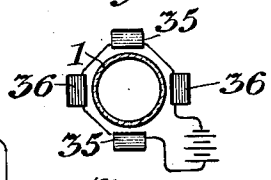


Fig. 6

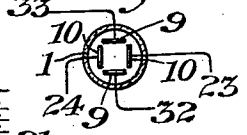


Fig. 3

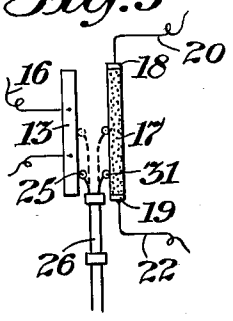
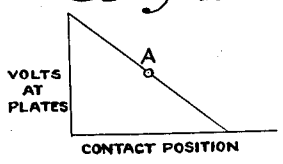


Fig. 4



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TELAUTOGRAPH

Allen B. Du Mont, Upper Montclair, N. J.

Application May 31, 1932, Serial No. 614,347

7 Claims. (Cl. 178—18)

This invention relates to improved means whereby the movements of a body such as a pen, pencil or the like, in tracing a picture, writing or in other uses, may be reproduced. This is now done by an instrument known as the telautograph wherein the movements of a stylus such as a pen, pencil or the like is moved to trace the desired writing or characters and this is reproduced at a distant station by means of a pantograph operated pencil marking upon a sheet of paper which is slowly moved beneath the pencil.

It is the main object of the present invention to provide improved means for transmitting writing, pictures and the like which shall be simple and efficient and require few, if any, moving parts in the receiver.

To the end as stated, it is a further object of the invention to provide a system of the character referred to wherein the reproduction is effected by the shifting of cathode rays in response to the movements of the stylus at the transmitter and rendering the said rays manifest in their various positions.

A further object of the invention is to provide a telautograph system which is well adapted to have communication between the transmitter and receiver accomplished by radio which would be particularly valuable for aeroplane scouting in time of war.

It is a further object of the invention to provide a telautographic system wherein a photographic record of the message may be readily made.

Other and ancillary objects of the invention will appear hereinafter.

In the accompanying drawing which illustrates the invention—

Fig. 1 is a diagrammatic view showing a telautographic system embodying the invention, the cathode ray tube at the receiving end being shown in section;

Fig. 2 is a diagrammatic view of the screen end of the cathode ray tube illustrating in diagram the positions assumed by the light spots on the cathode ray screen occasioned by the transmission of a character;

Fig. 3 is an edge view of the resistance blocks of the transmitter;

Fig. 4 is a graphical representation of the variation in potential across the resistance of the transmitter;

Fig. 5 is a section on the line 5—5 of Fig. 1; and

Fig. 6 is a section on the line 6—6 of Fig. 1;

Referring to the drawing, the apparatus at the receiving end of the system comprises a cathode ray tube including a suitably evacuated glass envelope 1, provided with a suitable electron emitting filament 2 energized from a transformer secondary 3, a focusing electrode 4 which is preferably kept at a slightly negative potential with relation to the filament as by means of a battery 5 having its negative terminal connected with the electrode 4 and its positive terminal connected with the center of the transformer secondary 3. The reason for maintaining the electrode at a slightly negative potential as stated is to prevent positive ion bombardment of the filament and to focus the rays.

The cathode ray tube is also provided with the tubular accelerating electrode 6 which is maintained positive by direct current source illustrated by the battery 7. This source may be from 200 to 400 volts and has its negative terminal connected with the central point of the secondary 3 of the transformer and its positive terminal with the accelerating electrode 6. The beam of cathode rays thus projected impinges upon a fluorescent and phosporescent screen 8 of calcium fluoride which is supported upon the interior of the end of the glass envelope 1.

About the path of the cathode rays are arranged two pairs of deflection plates 9 and 10 for the rays, the plates of the pair 9 being on opposite sides of the ray path and the pair of plates 10 are below and at substantially 90° from the pair 9, and the plates of the pair 10 are also on opposite sides of the path of the rays.

In receiving the message the rays are shifted in response to the transmitting apparatus which will now be described, and which may be located at any desired distance from the receiving apparatus and related thereto in any suitable way as by electric conductors, radio, etc.

A block or plate of carbon 11 or other suitable resistance material has secured to its edges copper strips 12 and 13 which are substantially coextensive with the carbon plate. One side of the carbon plate is connected through the copper strip 13 and conductor 14 with the negative terminal of a suitable source of current 15 represented as a battery, the plus terminal of the battery being connected through the conductor 16 and the copper strip 12 with the opposite edge of the carbon plate 11. The carbon plate 11 thus acts as a potentiometer resistance for varying the potential applied to the deflection plates 10 by connection as will be hereinafter referred to.

Lying alongside the carbon plate 11 is a similar

carbon plate 17 having secured to its edges and co-extensive therewith the copper strips 18 and 19, these strips being at the top and bottom of the plate 17, while the strips 12 and 13 are at the sides of the plate 11, in other words are 90° removed from the strips 18 and 19. The plate 17 has the strip 18 on one side connected by a conductor 20 with the negative terminal of a suitable source of electro-motive force shown as the battery 21, the other terminal of the battery being connected by the conductor 22 with the copper strip 19 at the opposite edge of the carbon plate 17. The carbon plate 17 therefore acts as a potentiometer resistance across the source 21 whereby the potential between the plates 9 may be varied, the connections for accomplishing which will be presently set forth.

The strip 13 is connected by a conductor 23 with one of the cathode ray deflection plates 10. The other one of the deflection plates 10 is connected by a conductor 24 with a contact 25 engaging with the surface of the carbon plate 11 and adapted to have its contact therewith shifted to various portions thereof. This contact is mounted upon the end of an arm 26 of a well known pantograph arrangement comprising the pivoted arms 27, 28 and 29, the arm 28 having the fixed pivot 30. The link 27 is pivoted to the arms 26 and 29, the arm 29 being pivoted at its other end to the link 28 which is pivoted at one end to the extremity of the arm 26 and at its other end to the stationary pivot 30. At the pivoted junction of the arms 27 and 29 is a holder for a stylus such as a pen or pencil.

Also mounted upon the extremity of the arm 26 is another contact 31 contacting the plate 17, at any instant, at a point directly opposite the engagement of the contact 25 with the plate 11. The contacts 25 and 31 and other conductors are insulated from each other and the contact 31 is connected by a conductor 32 with one of the plates of the pair 9, the other plate of that pair being connected by the conductor 33 with the conductor 20 leading to the copper strip 18 at the edge of the carbon plate 17.

It will now be seen that when the stylus or pen 34 is moved, the upper extremity of the arm 26 carrying the contacts 25 and 31 will be correspondingly moved. It will further be apparent that when the pen is moved in a line parallel to the strips 12 and 13, the amount of resistance in the plate 11 which is included between the strip 13 and the contact 25 will not be changed and hence the potential between the plates 10 will not be changed. Movement of the contact 25 in a direction perpendicular to that just stated will, however, cause a change in the amount of resistance of the plate 11 included between the strip 13 and contact 25 and therefore a change in the potential between the plates 10. This potential will depend upon the position of the contact 25, the potential or volts being illustrated in the graph of Fig. 4 from which it clearly appears that the maximum potential of voltage impressed upon the plates 10 will be when the contact 25 is substantially at the side of the plate 11 at which is located the strip 12, and that this impressed potential will decrease proportionately as the contact 25 is moved across the plate 11 between the strips 12 and 13 and will be zero when the contact 25 is substantially at the side of the plate where is located the strip 13.

Similarly the graph of Fig. 4 indicates the gradient of potential impressed upon the plates 9 as the contact 31 is moved parallel to the strips 12 and 13, being a maximum when the contact 31 is substantially in engagement with the strip 19 and a minimum when the contact 31 is at the opposite edge of the plate 17. There is no change in the potential impressed upon the plates 9 as the contact 31 is moved in a direction parallel to the strips 18 and 19.

It will now be apparent that movement of the pen 34 in a vertical direction parallel to the strips 12 and 13 will cause a variation in the potential difference between the plates 9 but will not vary the potential between the plates 10 whereupon the cathode ray will be deflected in one plane. Similarly movement of the pen horizontally will cause a similar movement of the contact end of the arm 26 which will result in variation of the potential between the plates 10 while the potential across the plates 9 will not be changed. The cathode ray beam will therefore be deflected or shifted in a plane at right angles to the aforementioned plane of shifting. Should the pen be moved in any intermediate direction, that is in a direction having both a horizontal and vertical component the potential between the plates 9 will be varied according to the vertical component and the potential across the plates 10 will be varied according to the horizontal component of the movement, and the cathode ray beam will be deflected accordingly.

It will now be apparent that the cathode beam will be deflected according to the movement of the pen so that the spot of light produced on the screen 8 by bombardment of the electrons of the beam will be moved in a path corresponding to the path in which the pen 34 is moved so that when the pen is moved to outline letters, writing, pictures or the like, the spot will be moved correspondingly to trace the writing, letters, or pictures by means of the spot of light upon the screen.

The calcium fluoride of the screen has the property that after having been caused to fluoresce by bombardment of the cathode ray beam, which will take place promptly upon the application of the beam, the luminosity will remain for a considerable time after the removal of the beam from the spot, say thirty seconds. This retention or persistence of the luminosity after withdrawal of the beam is commonly referred to as phosphorescence and it is in this sense that the term phosphorescence is used herein.

In order that a larger portion of the screen may be available for the writing, picture or the like, two pairs of coils 35 and 36 are placed at right angles to each other and about the path of the cathode beam, which are constantly excited so that the beam is shifted from the central axis of the tube (A', Fig. 2) to a point X which represents the position of the axis of the beam i. e. the spot of light on the screen when the deflecting plates 9 and 10 are exercising no deflection. When the beam is not thus shifted but its axis is at A', but one fourth of the area of the screen is available for the writing.

If now the contact end of the arm 26 is at the point A (at which point there is a potential of approximately 50 volts applied to each pair of plates 9 and 10) the cathode beam will be deflected and the light spot caused thereby upon the fluorescent screen 8 will appear at A', the center of the screen (see Fig. 2). If the pen 34 is moved in a vertical line so that the contact end of the arm 26 is moved from the position A to the position B, the potential across the deflection plates 9 will be changed to say 80 volts,

while the potential across the deflection plates **10** remains as before. The cathode beam will therefore be deflected so that the fluorescent spot on the screen will move from A' to B' (see Fig. 2).

If now the pen **34** is moved laterally so that the contacts **25** and **31** move to the position C, the potential across the plates **9** remains as before while that across the plates **10** is reduced to say **20** volts which causes a deflection of the cathode beam in a plane at right angles to its previous deflection and its spot of light on the fluorescent screen will move at right angles to the line A' and B', to the spot C'.

It will now be seen that the light spot in moving from A' to B' and from B' to C' has traced the letter L and as the luminosity persists for some time after the passage of the cathode beam, the entire letter L will appear in lines of light which will remain visible until the luminosity fades away. Similarly other letters, words or pictures might be traced upon a fluorescent screen in obedience to the movements of the pen **34**. The persistence of vision of the human eye is not for a sufficient length of time to provide a character outline as indicated. It will be observed that the phosphorescence is for a much longer period than the persistence of vision of the human eye, so that the outlining of the letters, words of pictures may be accomplished as described.

It will be apparent that the figure or letter traced upon the screen may be permanently recorded by photographing it upon a photographic film in a manner as is well understood in connection with the photographing of similar outlines in oscillographs.

While the invention has been illustrated in what is considered its best application it may have other embodiments without departing from its spirit and is not therefore limited to the structure shown in the drawing.

What I claim is:

1. The combination with means for generating cathode rays, of a fluorescent and phosphorescent screen and means angularly displaced about the path of said rays for relatively deflecting said rays and screen, a pair of plates of resistance material respectively controlling angularly displaced ray deflecting means by respectively varying the potentials applied thereto, contacts between said plates and respectively bearing against the same and adapted to be moved in any direction between said plates, said contacts being mechanically secured together but insulated from each other and means for electrically connecting said contacts with ray deflecting means angularly displaced about the ray path and means for impressing potentials respectively upon the angularly displaced ray deflecting means.

2. The combination with means for generating cathode rays, of a fluorescent and phosphorescent screen and means angularly displaced about the path of said rays for relatively deflecting said rays and screen, a pair of plates of resistance material respectively controlling angularly displaced ray deflecting means by respectively varying the potentials applied thereto, contacts between said plates and respectively bearing against the same and adapted to be moved in any direction between said plates, said contacts being mechanically secured together but insulated from each other and means for electrically connecting said contacts with ray deflecting means angularly displaced about the ray path and means for impressing potentials respectively upon the angularly displaced ray deflecting means, a stylus and a pantograph connection between said contacts and said stylus.

3. The combination with means for generating cathode rays, of means for rendering said rays manifest comprising a screen of calcium fluoride.

4. The combination with means for generating cathode rays, of means for rendering said rays manifest comprising a fluorescent and phosphorescent material retaining phosphorescence after the removal of the cathode rays from action upon it, for a greater time than that of the persistance of vision of the human eye and means for relatively deflecting said rays and manifesting means.

5. The combination with means for generating cathode rays, of means for rendering said rays manifest comprising a screen of calcium fluoride and means for relatively deflecting said rays and manifesting means at will.

6. The combination with means for generating cathode rays, of means for rendering said rays manifest comprising a screen of calcium fluoride, a movable body and means for relatively deflecting said rays and manifesting means responsive to the movement of said body.

7. In a telautograph the combination with means for producing a beam of cathode rays, of a fluorescent and phosphorescent screen for receiving said beam and means for shifting said beam with relation to said screen in a plurality of directions at angles with each other, a stylus, and means operatively relating said stylus to said beam shifting means whereby the spot of impingement of said beam on said screen follows the movement of said stylus, the material of said screen being adapted to retain phosphorescence during successive shifted positions of said impingement spot sufficient to form a luminous line outlining a predetermined character or symbol.

ALLEN B. DU MONT.