Jan. 2, 1940. A. B. DU MONT 2,185,705

CATHAUTOGRAPH

Filed Nov. 30, 1935 3 Sheets-Sheet 1

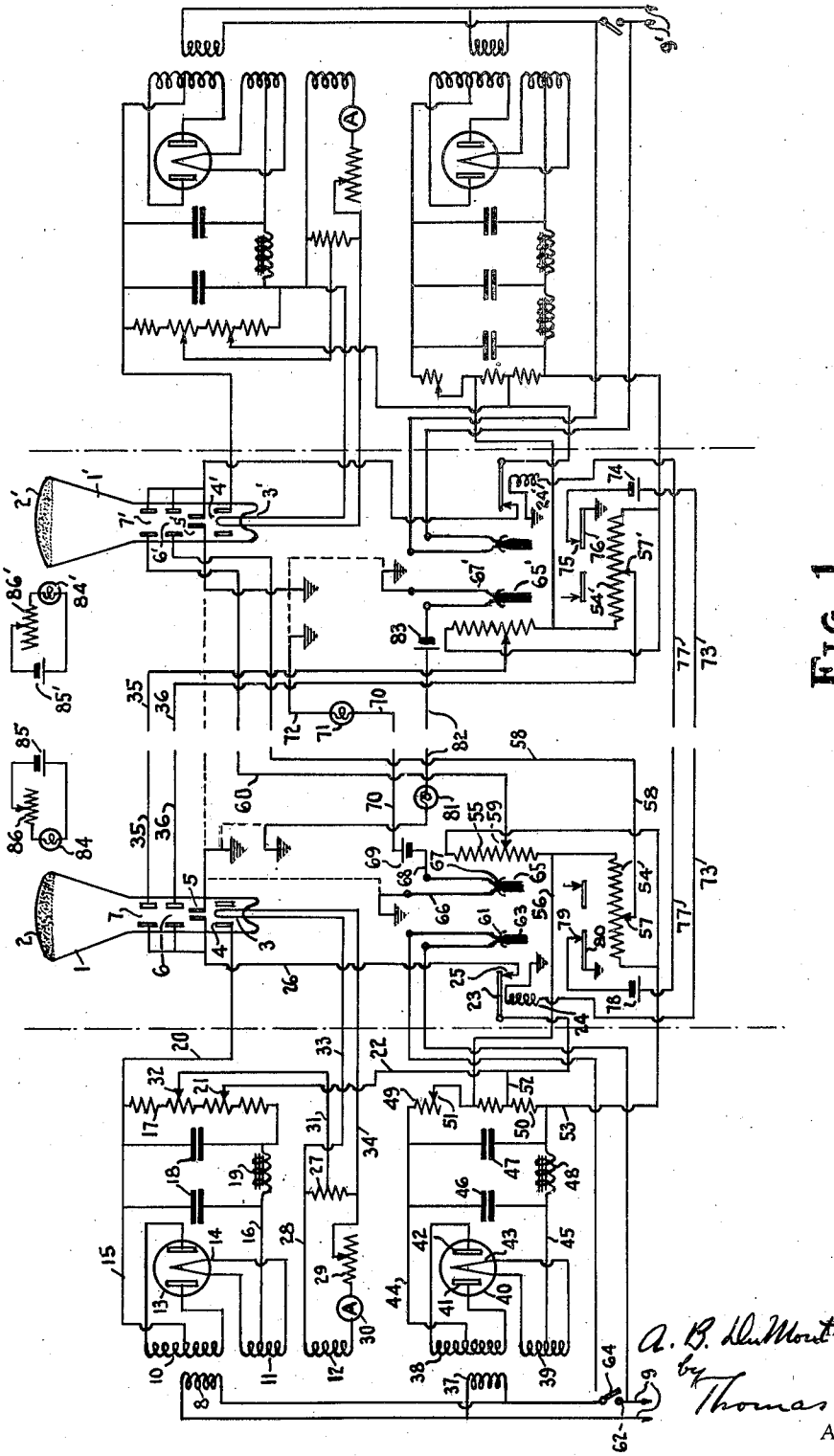


FIG. 1

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CATHAUTOGRAPH

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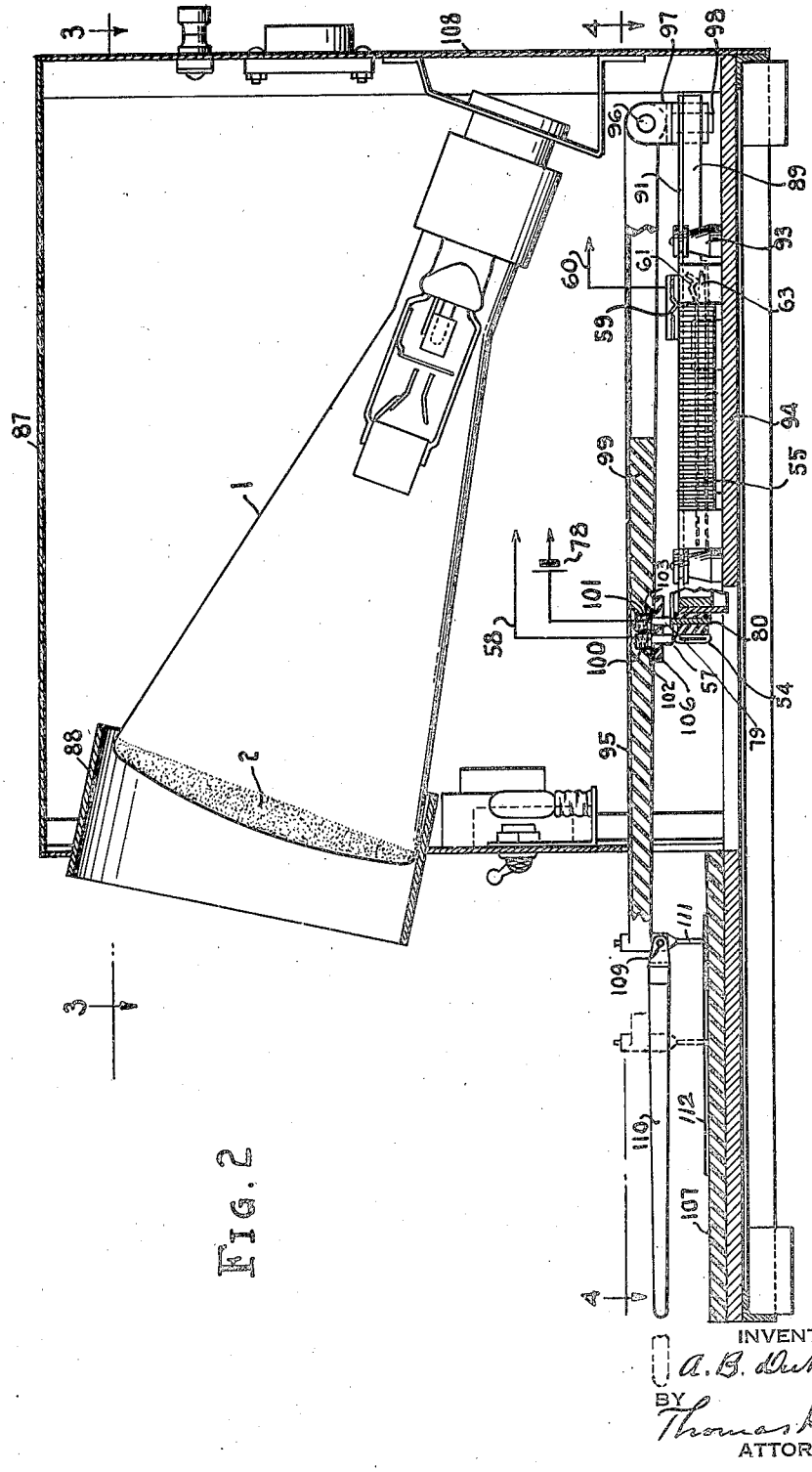


FIG. 2

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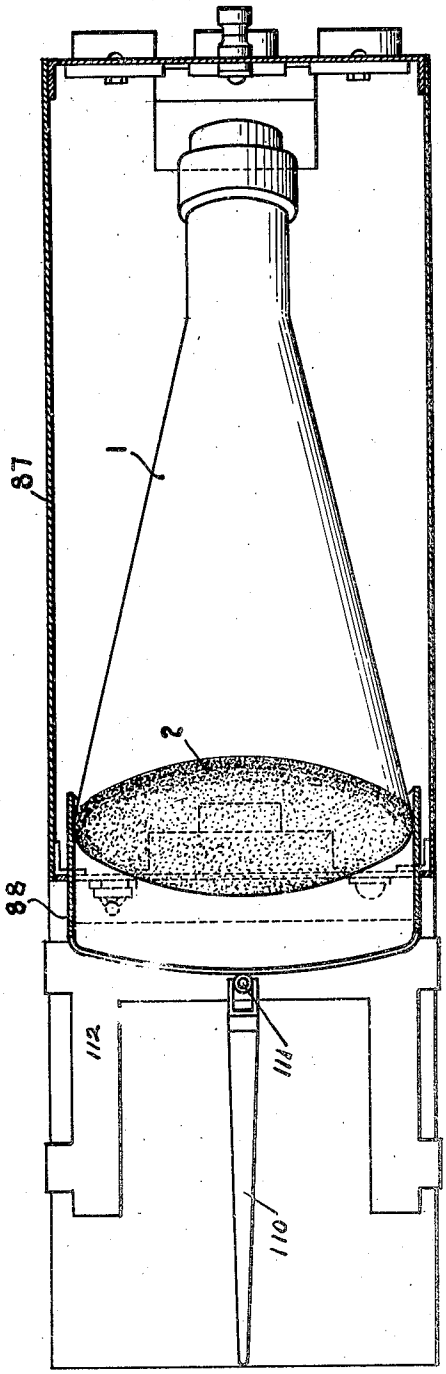


Fig. 3

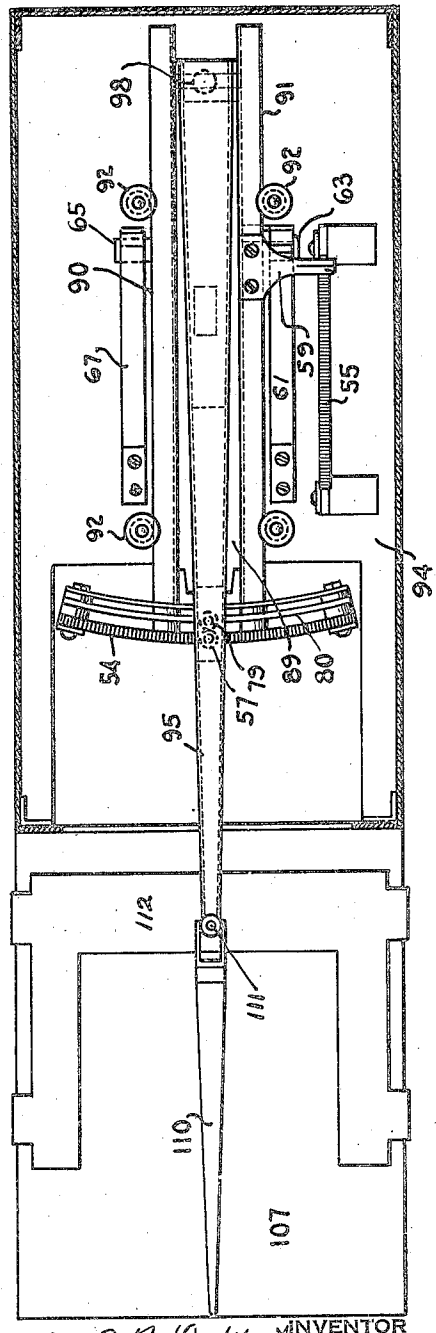


Fig. 4

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UNITED STATES PATENT OFFICE

2,185,705

CATHAUTOGRAPH

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Application November 30, 1935, Serial No. 52,329

5 Claims. (Cl. 178—18)

This invention relates to telautograph apparatus employing cathode ray tubes whereby the simulated writing at the sending station appears in luminous writing upon the cathode ray screen at the receiving station. Such an apparatus I have named a "cathautograph." Devices of this character are shown in my Patent No. 2,000,014.

The main object of the invention is to provide apparatus of the character as indicated which may be employed for the efficient transmission and reception in both directions between two stations.

A further object of the invention is to provide apparatus of the character indicated which shall require only the simplest and most natural operations on the part of the operator, necessary, ancillary operations being automatically performed.

Other and ancillary objects of the invention will appear hereinafter.

In the accompanying drawings which illustrate the invention—

Fig. 1 is a diagram of apparatus and electrical connections therefor;

Fig. 2 is a central, longitudinal section of sending and receiving apparatus for a station;

Fig. 3 is a section of the apparatus of Fig. 2 on the line 3—3 of Fig. 2; and

Fig. 4 is a section on the line 4—4 of Fig. 2.

Referring to the drawings there is therein shown a telautograph system comprising transmitting and receiving apparatus at each of the two stations whereby a message can be sent in either direction between the stations, the stations being operatively connected by wire, radio or in other suitable ways. At each of the stations is a cathode ray tube having means for making the cathode beam manifest and which has the beam shifted in accordance with transmitting apparatus at the other station controlled in accordance with the movement of a pencil or stylus, there being such transmitting apparatus located at each station. Also at each station is provided a suitable and suitably controlled means for applying desired voltages to the parts. Each station may also be provided with a signal operable by means at the other station to call up the operator when a message is about to be sent and means for placing the apparatus at the called station in proper condition to receive the message as well as other appurtenant apparatus.

Referring to the apparatus more in detail, at the station at the left-hand in Fig. 1 the cathode ray tube comprises a well known form of glass receptacle 1 upon which is mounted a screen of suitable phosphorescent material for instance zinc sulphide 2 which becomes phosphorescent upon impingement of the cathode ray upon it. Also the tube has the electrically heated filament 3, the focussing electrode 4, the tubular accelerating electrode 5 and the pairs 6 and 7 of deflection plates for the cathode beam. The plate pairs 6 and 7 are located at right angles to each other as is well known in such tubes. The pairs of deflection plates thus tend to deflect the beam of cathode rays respectively in planes at right angles to each other.

The energy for the filament focussing and accelerating electrodes is obtained from a transformer having its primary 8 connected across two alternating current supply lines 9. This transformer has three secondaries 10, 11 and 12 in inductive relation to the primary. To the terminals of the secondary 10 are connected the plates of a vacuum tube rectifier 13, the heating filament 14 of the rectifier being connected to the terminals of the secondary 11. From the centers of the secondaries 10 and 11, conductors 15 and 16 lead through a current filter to a bleeder resistance 17. The filter comprises the condensers 18 connected across the lines 15 and 16 and the reactance 19 connected in series in the line 16. This relative connection of condensers and reactance for current filtering purposes is well known.

One end of the resistance 17 is connected by a conductor 20 with the focussing electrode 4 and a variable contact 21 movable along the resistance 17 is connected by a conductor 22 with the movable contact 23 of a relay 2 having the coil 24 and stationary contact 25. This relay is normally open but is closed upon the energization of the coil which is controlled by the position of the stylus at the distant station. The stationary contact 25 is connected by the conductor 26 with the accelerating electrode 5 and one of each of the pairs of plates 6 and 7. When the relay contacts 23 and 25 are open voltage will be removed from the accelerating electrode and the cathode beam will no longer impinge on the screen so that the luminous spot will disappear as is desired between words or at the ends of lines.

The filament 3 of the cathode tube is energized from the secondary 12. This secondary has one terminal connected with one end of a resistance 27 by a conductor 28, the other end of the resistance being connected with the other terminal of the transformer through the variable resistance 29 and the ammeter 30. The center of the resistance 27 is connected by a conductor 31 with

the movable contact 32 contacting with the resistance 17.

The terminals of the resistance 27 are connected by conductors 33 and 34 with the terminals of the filament 3. The voltages on the deflection plates and thus the shift of the cathode beam is controlled through the conductors 35 and 36 connected respectively with the deflection plates of the pairs 7 and 6 which are not connected with the conductor 26 and passing to the control apparatus at the distant station as will be hereinafter referred to.

The control means at the left-hand station of Fig. 1 which is now under consideration, for supplying and controlling the voltages on the deflection plates for the cathode ray, of a tube the same as that already described but at the distant station, comprises the transformer primary 37 having its terminals connected across the alternating current supply mains 9, the transformer having the secondaries 38 and 39 in inductive relation to the primary 37. The alternating current generated in the secondaries is rectified by means of a vacuum tube rectifier 40, the plates 41 and 42 of which are respectively connected with the end of the secondary 38, while the terminals of the secondary 39 are connected with the heated filament 43 of the rectifier, the rectified current being led off from the center points of the secondaries 38 and 39 by the conductors 44 and 45. The current thus passes through a filter for smoothing out variations in the current, such filter comprising a well known combination of capacity and reactance comprising condensers 46 and 47 connected in parallel between the conductors 44 and 45 and a reactance coil 48 in series in the line 45 and between the connections of the condensers 46 and 47 therewith.

Passing beyond the filter the conductor 44 is connected with one end of a resistance 49, while the conductor 45 is connected through reactance 48 with one end of the resistance 50. The other end of the resistance 50 is connected by means of a variable contact 51 with the resistance 49. The variable contact permits the variation of the amount of resistance 49 which is included in series with the resistance 50 between the lines 44 and 45, and therefore controls the drop of potential between the terminals of the resistance 50 and thus controls the amount of deflection of the cathode beam at the distant station for a given movement of the stylus or other controlling means at the sending station. The potential applied to the deflection plates being thus enlarged or reduced, the amounts of deflections of the cathode beam will be accordingly governed and the size of the writing appearing upon the phosphorescent screen may be thus enlarged or reduced.

The center of the resistance 50 is connected by the conductor 52 with the conductor 22. One terminal of the resistance 50 is connected by a conductor 53 with a terminal of each of the deflection resistances 54 and 55, these resistances being arranged at right angles to each other, and variation of the resistance 55 being adapted to vary the deflection of the cathode beam at the distant station, vertically, while variation of the resistance 54 varies the deflection of the said cathode ray horizontally. The other ends of the resistances 54 and 55 are connected together and through the conductor 56 are connected with the other end of the resistance 50.

The connection to the midpoint of resistance 50 of the deflection plates of the pairs 6 and 7 which are connected together and at a constant potential permits the potentials of the other (free or unconnected) plates of the pairs to have their potentials varied on both sides of that of the connected plates whereby the cathode beam may be shifted on both sides of its normal or unshifted position and the whole width of the screen may be availed of for writing.

It will be seen that the voltage across the resistance 50 will be impressed upon each of the resistances 54 and 55. A contact 57 movable along the resistance 54 is connected by a conductor 58 with the isolated one of the deflection plates of the pair 6' of the cathode ray tube at the distant station, while the adjustable contact 59 movable along the resistance 55 is connected by means of a conductor 60 with the isolated one of the pair of deflection plates 7' at the distant station.

A movement of the contact 57 in one direction or other along the resistance 54 will operate to vary the horizontal deflection of the cathode ray beam in the tube 1' at the distant station. Also the sliding of the movable contact 59 in one way or the other along the resistance 55 will operate to vary the vertical deflection of the said cathode beam.

The power to the transformers 8 and 37 is controlled by a switch 61 comprising spring contacts tending to normally spring into engagement and thereby bridge a gap 62 in one of the supply lines 9. This switch is opened when the parts are in inoperative position by means of an insulating wedge 63 inserted between and separating the contacts 61, such wedge being removed, the contacts coming together and the power circuit being closed when the parts, such as the stylus etc., are moved into operative position. A switch 64 is also provided for closing the gap 62 for the purposes of testing the power circuit.

To automatically signal the distant station a switch is provided which is open when the operating parts of the transmitter are in inoperative position and which is closed when the parts, such as the stylus, are moved into operative position. Such switch comprises the normally closed spring contacts 67 and the member 65 of insulation for forcing the contacts apart, one of the contacts being connected by a conductor 66 with ground, and the other contact 67 being connected by the conductor 68 with one terminal of a suitable source of electricity 69 such as a battery, the other terminal being connected through the conductor 70 with one terminal of the signal lamp 71 at the distant station, the other terminal of the lamp being connected with the ground by conductor 72.

The coil 24 which controls the application of voltage to the accelerating electrode 5, has one terminal connected with the ground and the other terminal connected through a wire 73 with one terminal of a battery 74 or other suitable source of electromotive force at the other station, the other terminal of the battery being connected through the switch contacts 75 and 76 with the ground whereby the circuit of the coil is energized whenever the switch contacts 75 and 76 are closed. This takes place whenever the stylus is in writing position, these contacts being opened when the stylus is raised from the writing position (as at the end of a word).

The corresponding coil 24' at the distant station in a similar manner controls the application of potential to the accelerating electrode 5' of the cathode ray tube at the distant station, and such

coil, similar to the coil 24, has one terminal connected with the ground and the other terminal connected through a conductor 77, the battery 78 and the switch contacts being closed when the stylus of the left-hand transmitter (Fig. 1) is in operative position and being open when the said stylus is raised into inoperative position. In a manner similar to the control of the isolated deflection plates 6' and 7' by the movement of the contacts 57 and 59 along the resistances 54 and 55, the isolated deflection plates of the pairs 6 and 7 are controlled through the conductors 35 and 36 by the movement of the movable contacts 57' and 59' along the resistances 54' and 55' Also the signal lamp 81 at the left-hand station is in a circuit from the ground through a conductor 82 to the distant station, through the battery 83 and switch contacts 65' and 67' to the ground, the contacts 65' being controlled according to the position of their associated stylus in a manner similar to the control of the contacts 65 at the left-hand station.

It will be seen from the drawings of Fig. 1 that each of the stations has identical cathode ray tubes and at each of the stations is apparatus for controlling the tube at the other station, such controlling apparatus being operated and electrically connected in the same manner at each of the stations. The apparatus at the right-hand station derives its power from the alternating current mains 9' in a similar manner to that in which the left-hand station derives its energy from the mains 9.

The time of visibility of the cathode ray generated phosphorescence in the screen 8, and consequently the time during which the writing appearing upon the screen is visible, may be regulated by means of an electric lamp 84 mounted adjacent the screen 2 so as to illuminate the same. The lamp 84 is connected in circuit with a battery 85 or other suitable source of electromotive force, and a variable resistance 86. The intensity of the illumination of the lamp 84 determines the duration of visibility of the cathode ray generated phosphorescence, the greater the intensity of the illumination by the lamp the shorter being the duration of the visibility of the phosphorescence. Inasmuch as the lamp intensity may be controlled by the resistance 86 the time of duration of visibility of the phosphorescence may be varied. The phosphorescence is visible because its luminosity is greater than other portions of the screen. If the screen is illuminated, as by a lamp as just described, the luminosity of the phosphorescence will have to be above the general illumination of the screen by the lamp in order to be visible. The phosphorescence and luminosity of a portion of the screen is greatest while the cathode ray is impinging thereon. When this ray has been moved from the spot, as takes place in shifting the ray to trace writing on the screen, the phosphorescence immediately begins to fade or decay and when it has reached a value such that it is no greater than the general illumination of the screen it is no longer visible, consequently the duration of visibility of the phosphorescent trace of a writing on the screen by the cathode beam will be shorter as the general illumination of the screen (as by an extraneous lamp) is higher. The duration of the visibility of the cathode writing upon the screen may therefore be varied by varying the resistance 86.

Similarly, at the other station, a lamp 84' may be provided adjacent the phosphorescent screen 2', the lamp 84' being in circuit with a battery 85' and a variable resistance 86'.

At each station may be identical apparatus as shown in Figs. 2, 3 and 4, and hence a description of it with reference to the left-hand station of Fig. 1 will apply to both. The apparatus as shown in Figs. 2, 3 and 4 comprises a casing or housing 87 in which is mounted the cathode ray tube 1 with the phosphorescent screen 2, surrounded by the hood 88 serving as a light shield or shadow box. A carriage 89 is mounted to slide longitudinally by having lateral edges 90 and 91 supported in grooves in rollers 92 rotatably mounted on pedestals 93 secured to the bottom 94 of the housing. The stylus arm 95 is carried by the said carriage, being pivoted at 96 to swing vertically in a stud 97 which in turn is pivoted at 98 in the carriage so that the arm 95 can swing horizontally.

The coil 55 of resistance wire is mounted upon the bottom 94 of the casing so as to be insulated, the contact 59 being mounted upon the carriage 89 and insulated therefrom, being moved back and forth over the length of the resistance coil as the carriage is slid longitudinally in the rollers 92.

The arm 95 is a metal bar of U-shaped cross section. Within the bar is mounted an insulating piece 99 having a recess within which are the springs 100 and 101 bearing upon the heads 102 and 103 of contact plungers 57 and 79 sliding in the insulating plate 106 secured to the bottom of the block 99, the heads of the plungers being above the plate 106 so as to limit their downward movement. These plungers are insulated from each other.

Mounted upon the end of the carriage 89 in an insulated manner is the resistance coil 54 against which the plunger 57 is spring-pressed when the arm 95 is in its lower or writing position. Also mounted upon the carriage in an insulated manner is the metal contact strip 80 against which the plunger contact 79 is spring-pressed when the arm 95 is in its lower position. When the arm is raised vertically about its pivot 96 contact between the plunger 79 and the strip 80 will be broken whereby the circuit of the accelerating electrode in the receiving cathode ray tube will be broken and the impingement of the cathode beam upon the phosphorescent screen will cease.

It will be apparent that the contact 57 may be moved along the resistance coil 54 by swinging the arm 95 horizontally on the pivot 98. In the end of the metal arm 95 is secured a stylus or pencil 111 adapted, when the carriage is in inoperative position where it is retracted into a position adjacent the contact 108 to the casing as appears in full lines in Fig. 2, to rest upon the metal plate 112 secured upon the insulating platen 107. The metal plate 65 serves to delimit at its inner edge the margin of the writing area of the stylus and prevents the stylus from being inadvertently moved out of that area while a writing or message-transmitting operation is being performed. Pivoted at 109 to the end of the arm 95 is an operating handle 110 which may swing vertically on the pivot 109 and be grasped in the hand of the operator similar to the grasping of a pen or pencil when the stylus 111 may be moved to trace the desired writing or character.

Mounted in an insulated manner, upon the base 94 are the normally closed spring contacts 61 controlling the application of power to the transformer primaries 8 and 37 as noted in connection

with the foregoing description of Fig. 1. The lug 63 of insulation for separating its contacts is mounted upon the side of the carriage 89 and in the retracted or inoperative positions of the carriage this insulating block enters between and separates the contacts 61. When the carriage is drawn forward into operating position the block 63 is removed from between the contacts so that they come together and close the power circuit during all of the operative positions of the parts, the contacts being opened and the power cut off when the carriage is moved into retracted or inoperative position (see full lines Fig. 2) and the block 63 is then interposed between and separates the contacts to break the power circuit.

Mounted in an insulated manner upon the base 94 and upon the opposite side of the carriage 89 from the contacts 61, are the similar normally closed spring contacts 67 controlling the circuit of the signal at the distant station. The mounting and construction of contacts 67 are precisely the same as the contacts 61 and in a similar manner they are separated to break the signal circuit when a projection 65 of insulation fixed upon the carriage 89 forces the contacts apart. This projection 65 operates upon the contacts 67 in a manner similar to the operation of projection 63 upon the contacts 61, namely that the projection 65 is inserted between the contacts 67 and holds them out of contact when the carriage 89 (and the stylus 111) are in inoperative or retracted position, and the projection 65 moving forward with the carriage and stylus as they are moved into operative position, such movement permitting the contacts 67 to spring together and close the signal circuit.

In the use of the apparatus, the carriage being in its retracted or inoperative position, the power circuit and that of the signal at the distant station are open. The party desiring to send the message grasps the handle 110 and pulling the stylus outwardly draws the carriage forward thereby closing the power circuit and also the circuit of the signal lamp at the receiving station which becomes lit. The operator at the receiving station observing this, grasps the handle of his stylus and drawing his carriage forward establishes circuit for the signal lamp at the sending station thereby indicating his readiness to receive. The circuits of the signal lamps remain closed during all the times that the styluses are in operative position. The operator at the sending station then grasps the handle 110 and proceeds to write as with a pen or pencil, the stylus resting upon the platen and tracing the words or characters, his carriage moving back and forth and shifting the variable contact 59 along the resistance 55 and also the arm 95 swings from side to side moving the varying contact along the resistance 54 whereby the voltages on the deflection plates are varied in accordance with the movements of the stylus occasioned by the writing movement of the operator, and the light spot upon the phosphorescent screen at the receiving station will move correspondingly to the movement of the stylus at the sending station in tracing the writing of the message. The material of the screen is of such a character that the phosphorescence will persist for a sufficient length of time so that the desired writing or character may appear rather than having the appearance of a spot moving over the screen. After having finished a word, or a line, the operator would, as in ordinary writing, raise the stylus 67 with the handle 110 and in so doing would turn the arm 95 about its pivot 96 thereby separating the contacts 79 and 80, thereby breaking the circuit to the accelerating electrode of the tube at the receiving station and thereby preventing the formation of the luminous spot on the screen. By this means the usual blank spaces between words are obtained and also the spot is discontinued at the end of a line to reappear again when the stylus is again pressed down into its downward position against the platen in beginning another word or another line. This control is therefore effected by the operator simulating with the stylus handle the usual operations of writing with a pencil or a pen. When the message has been finished the operator pushes the carriage inwardly into retracted or inoperative position whereby the power and signal circuits are opened and the parts are in readiness to be again drawn forward to transmit another message.

While the invention has been illustrated in what are considered its best applications, it may have other embodiments without departing from its spirit and is not therefore limited to the structures shown in the drawings.

What I claim is:

1. In apparatus of the character described, the combination with a cathode ray tube having a screen and pairs of deflecting electrodes, of means at a distance for controlling the action of said deflection electrodes upon the cathode ray beam, means for causing the cessation of production of luminosity on the said screen by the cathode rays and a common operating means for the last mentioned means and the said deflection electrode-controlling means, said last-named operating means including a pantograph device and resistances operated thereby to modulate the operating circuit for said deflection electrodes, and a contact breaker operable manually by a contact making or breaking movement of said pantograph device independently of the deflection-modulating movements thereof.

2. In apparatus of the character described, the combination with a cathode ray tube having a screen and pairs of deflecting electrodes, of means at a distance for controlling the action of said deflection electrodes upon the cathode ray beam, means for controlling the electric supply to the transmitting apparatus for operating said tube and a common operating means for controlling the last mentioned means and said deflection electrode-controlling means, said last-named operating means including a sliding carriage member provided with an arm swinging in both horizontal and vertical planes, resistances disposed in proximity to the sliding and arcuate paths respectively of said arm, and electrical circuits, including contacts on said carriage and arm, constituting part of said means for controlling the action of the deflection electrodes; and a contact breaker operable by a swinging movement of said arm in its vertical path to incapacitate and rehabilitate the deflecting circuits at will.

3. The combination with a cathode ray tube having pairs of deflection plates for deflecting the cathode ray in different directions, of means for applying voltage to said deflection plates comprising a source of electro-motive force, resistances connected in parallel across the terminals of said source, one of the deflection plates of each pair being connected together, to the accelerating electrode of the cathode ray tube and the mid point of one of said resistances, and contacts respectively connected with the free de-

flecting plates of the said pairs, said contacts being slidable along other of said resistances.

4. The combination with a cathode ray tube having a screen, a pair of deflecting electrodes and an accelerating electrode, one deflecting electrode of said pair and said accelerating electrode being connected directly together, the other one of said pair of deflecting electrodes being unconnected with said accelerating electrode, and manually operable means for applying varying potentials at will to said pair of deflecting electrodes the potentials applied to said unconnected electrode being both plus and minus with relation to the other deflecting electrode, whereby the cathode ray beam may be shifted on either side of the normal position or position of no deflection of said cathode ray beam.

5. The combination with a cathode ray tube having a screen, a plurality of pairs of deflecting electrodes and an accelerating electrode, one deflecting electrode of each of said pairs and said accelerating electrode being directly connected together, the other one of each of said pairs of deflecting electrodes being unconnected with said accelerating electrode, and manually operable means for applying varying potentials at will to said pairs of deflecting electrodes, the potentials applied to said unconnected electrodes being both plus and minus with relation to the said connected electrodes whereby the cathode ray beam may be shifted by each pair of deflecting electrodes on either side of the normal position or position of no deflection of said cathode ray beam.

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