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2,097,392

ELECTRONIC DISTRIBUTOR

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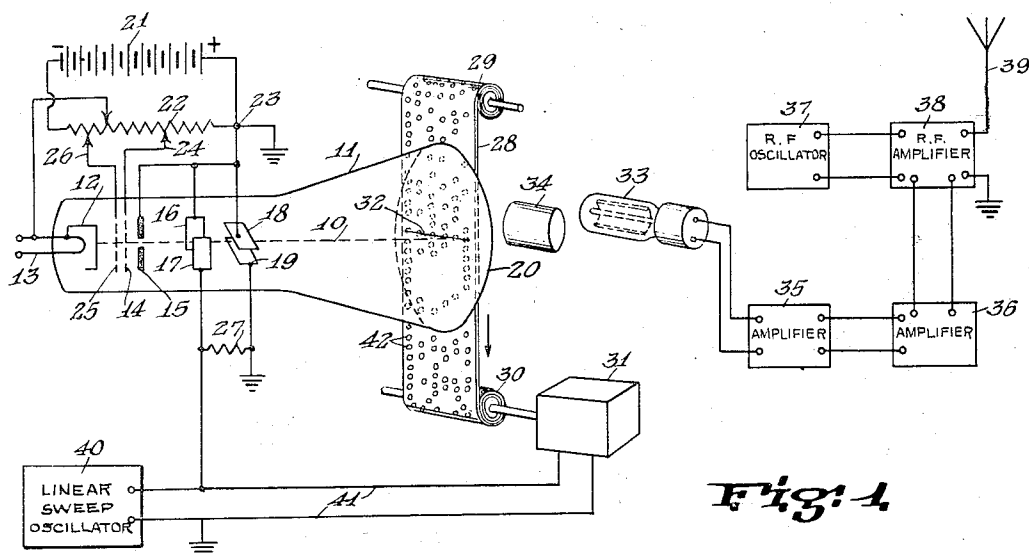


Fig: 1

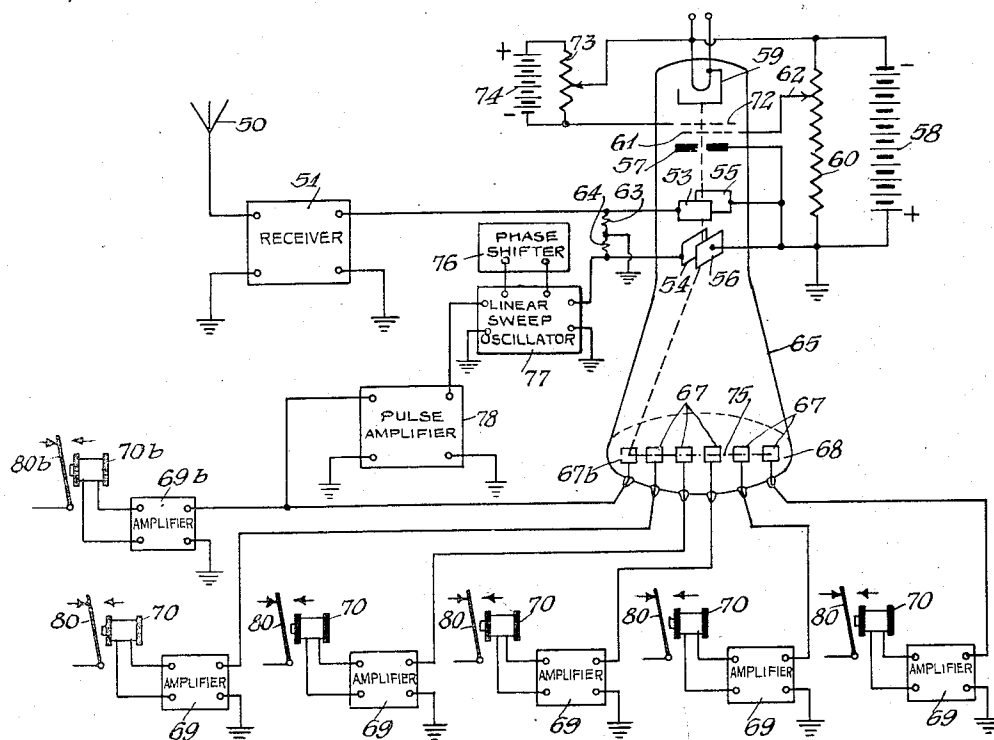


Fig. 2

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ELECTRONIC DISTRIBUTOR

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Original application December 4, 1935, Serial No. 52,871, now Patent No. 2,057,773, dated October 20, 1936. Divided and this application: October 19, 1936, Serial No. 106,413

9. Claims. (Cl. 178—3)

My invention relates to electronic distributors useful in signalling systems, and more particularly relates to the application of an electron beam distributor to high speed printing telegraphy.

This invention is a division of the parent application Serial No. 52,871 filed December 4, 1935 which matured into Patent No. 2,057,773 on October 20, 1936.

Modern high speed printing telegraph systems operate with a Baudot or five unit code. A continuous tape is successively punched with a predetermined combination of holes for each character. It is the practice to pass the tape through apparatus having five mechanical feelers which in turn operate contactors connected to contact plates on a mechanical distributor. The mechanical distributor, as is well known in the telegraphy art, comprises a rotating arm for successively contacting the contact plates to transmit coded impulses in succession. The operation of mechanical distributors materially limits the speed of transmission of printing telegraph signals.

It is the main object of my present invention to eliminate the mechanical distributor and substitute electronic means therefor. The electron beam of a cathode ray tube is made to scan over the fluorescent screen to generate a moving light spot. A perforated message tape controls the light spot action upon a photo-electric cell to generate signals transmitted as successive coded impulses. The substitution of an inertialess scanner for the mechanical selector in a distributor makes possible accurate transmission of telegraphy signals at much higher speeds than heretofore possible. A receiver is arranged having an electronic distributor comprising a cathode ray stream acting upon a plurality of conductive targets to select the transmitted code signals, and to operate standard telegraph printing apparatus.

It is accordingly an object of my invention to provide a novel high speed signalling system.

Another object of my invention is to provide a novel electronic distributor to replace the mechanical distributor in printing telegraphy systems.

Still another object of my invention is to provide a novel means for synchronizing the operation of transmitter and receiver electronic distributors in signalling systems.

A further object of my invention is to provide novel methods of and means for high speed transmission and translation of coded signals successively punched in a perforated message tape.

These and other objects of my invention will become apparent in the following description

taken in connection with the drawing, in which:

Figure 1 is a schematic illustration of a preferred embodiment for electrooptically transmitting printing telegraphy signals from a perforated tape.

Figure 2 is a schematic illustration of a receiver using an electronic distributor for translating the printing telegraphy signals transmitted according to Figure 1.

In carrying out my invention, I employ an electron beam 10 produced in a highly evacuated vessel 11. The generation of the electron beam is familiar to those skilled in the electronic art and schematically shown in Figure 1. The cathode 12 is heated by the heater 13 which is connected to suitable battery supply. The first anode 14 concentrates the emitted electrons into an electron beam. The high voltage anode 15 accelerates the electrons of the beam 10 which passes between the electrostatic deflecting plates 16, 17, 18, and 19 and on to the opposite end 20 of the vessel 11.

A high voltage direct current potential source 21 supplies the operating potentials for the electrodes of the cathode ray tube 11. A potentiometer 22 is connected across the battery 21. The second or high voltage anode 15 is connected to the positive side 23 of the potentiometer 22 which point is connected to ground in my preferred embodiment. The first anode 14 is connected to a suitable intermediate potential by tap 24. The control grid 25 is negatively biased with respect to the cathode 12 by a suitable tap 26 of the potentiometer 22. Deflecting plates 16, 18 and 19 are connected to the grounded high potential point 23 to assume the same potential as the anode 15. Deflecting plate 17 is connected to ground through high resistance 27 so that the electrostatic deflecting plates and the anode 15 have a common static potential which is at ground potential, an operating expedient commonly employed.

The electron beam 10 is focussed upon the fluorescent screen 20 causing a spot of light to appear on the external side thereof. The brilliance and intensity of the light spot is controlled by principles well known to those skilled in the art. A linear sweep oscillator 40 connected between deflecting plates 16 and 17 is used to scan the electron beam 10 horizontally across fluorescent screen 20 along path 32. The printing telegraphy signals to be transmitted are impressed in successive perforated coded groups along a message tape 28. The perforated tape 28 is moved

adjacent the preferably flat fluorescent screen 20 as illustrated in Figure 1.

The perforated message tape 28 is arranged on rollers 29 and 30. One of the rollers 30 is connected to an electrically operated mechanical stepping mechanism 31. The mechanism 31 may be a simple electro-magnetic pawl and ratchet arrangement actuated directly from the local linear oscillator 40 and connected thereto by leads 41. The electro-mechanical stepping means 31 is actuated once per cycle of the scanning frequency, and is accordingly arranged to advance the tape 28 one notch or code group at the end of each scanning operation by electron beam 10. The electron beam 10 is impinged upon the fluorescent screen 20 along the linear path 32 directly in line with the code group being scanned.

The illustration of Figure 1 shows six perforations being scanned corresponding to a predetermined symbol to be transmitted. Each perforation permits the moving light spot to impinge therethrough upon a photo-electric cell 33. A suitable lens 34 may be used to direct the light pulses passing through the perforations to the photo-electric cell 33. There is, accordingly, in the illustrated code group being scanned, a series of six consecutive light impulses impressed upon the photo-electric cell 33. The photo-electric cell 33 is connected to a suitable amplifier 35 which in turn is connected to the modulator 36 for modulating the radio transmitter system composed of the radio frequency oscillator 37, radio frequency amplifier 38 and antenna system 39. The perforations 42 illustrated at the left edge of the tape 28 correspond to the synchronizing impulses to be transmitted. Accordingly, at the end of each code group of combinations of five units transmitted, there is always a corresponding synchronizing impulse also transmitted for interlocking or synchronizing the oscillator at the receiving station in a manner already described.

The linear sweep oscillator scans the fluorescent light spot in a straight line across screen 20 directly behind the parallel code groups to be transmitted. The electro-optical system 33-34 is adjusted close to the horizontal scanning line 32 so as to translate the light impulses visible through the perforations to corresponding photo-electric currents at photo-electric cell 33 for transmission. Each light spot visible through a perforation is translated into a corresponding electrical impulse at the transmitter. The time lag or persistence of the fluorescent screen 20 is designed sufficiently small so as to avoid interference of the light spot between successive vertical rows of perforations of the successive horizontal code groups. The width of the path 32 is controlled by the voltage output of the linear sweep oscillator 40 and is made equal to the distance between the outer perforation rows. The electromagnet stepping mechanism 31 is preferably operated by marginal relays to respond to the peak voltage output of the oscillator 40 for returning the electron beam 10 to the next scanning line at the time the end vertical row of perforations is reached. The advancing impulse preferably occurs during the transmission of the synchronizing impulse corresponding to the vertical row of perforations 42.

The frequency of the linear sweep oscillator 40 determines the rate of code group transmission, one code group of scanning line occurring for each cycle of the oscillator output. The advancing operation of the tape is automatically performed and does not interfere with the speed of

operation of the code transmission. Although I have illustrated the synchronizing signals as being generated by a sixth vertical row of perforations 42, it is to be understood that by eliminating this row of perforations a similar result may be obtained. Another method for generating the synchronizing signals is to permit the electron beam 10 to traverse somewhat beyond the message tape 28 so that the moving light spot may cause a synchronizing signal impulse to be generated at photo-electric cell 33 at the end of each scanning cycle. The transmitted signals are coded combinations of five impulses (on or off signals) corresponding to the perforated code group, separated by a synchronizing impulse signal which is used at the receiver as will be hereinafter described for maintaining synchronous operation and providing the printing impulses therefor.

In Figure 2 I have illustrated electronic receiving apparatus for use in conjunction with the transmitter. The receiving antenna 50 is connected to the radio receiver 51 which detects and amplifies the telegraphy signals. The deflecting plates 55 and 56 are directly connected to ground potential. The second anode 57 is also connected to ground potential as is the positive terminal of the high voltage direct current source 58. The operating potential of the first anode 61 is adjusted with the tap 62 of the potentiometer 60. Resistors 63 and 64 having high resistance, connect the deflecting plates 53 and 54 to ground static potential.

The receiver electronic distributor comprises essentially a cathode ray tube 65. An electron beam 66 is produced and caused to scan a plurality of metallic electrodes or targets 67 arranged in a linear path on the back interior of the face 58 of the evacuated envelope. The targets 67 are individually connected to the input of amplifiers 69 at the outputs of which are connected relays 70. There are six relays 70 which are used to operate a local printing telegraph. The output of the receiver 49 controls the operation of the electronic distributor 65. The grid 72 bias potential is adjusted to a suitable negative value by the potentiometer 73 connected across the grid biasing battery 74.

The targets 67 at the receiver are arranged in a linear path. The scanning of the electron beam 66 is produced by a linear or sweep circuit oscillator 77 in a straight line. At one end of the linearly arranged electrodes 67 there is the synchronizing electrode 67b connected directly to a pulse amplifier 78. The output of amplifier 78 is connected to the sweep circuit oscillator 77 to interlock or synchronize its frequency with that at the transmitter. The output of the sweep oscillator 77 is connected directly to the electrostatic deflecting plate 54 to cause the beam to normally travel in a linear path parallel to the targets 67. The electron beam 66 does not pass over any of the targets 67 except in response to a received signal which deflects it thereto as will be herein described.

The signals received by receiver 51 are detected, amplified and directly impressed upon the deflecting plate 53. The output of the receiver 51 is polarized and of sufficient magnitude so that when a signal impulse is impressed upon it, the action of the deflecting plates 53-55 is to deflect the beam to the path 75 to impinge upon a predetermined target 67.

The beam 66 impinges upon the targets 67 in accordance with the signal impulses. Synchronous action causes the beam to impinge upon

predetermined targets 67 which are directly connected to corresponding amplifiers 69. The beam 66 accordingly produces an impulse at the input of the associated amplifier 69 to actuate a printing relay 70. There are five such printing relays 70 illustrated. These relays operate local selector mechanisms 80 for printing telegraphy operation.

The cyclic pulse output of amplifier 78 is controlled by the actuation of target 67b by beam 66 in response to the transmitted synchronizing signal impulse. The output of pulse amplifier 78 is connected to the linear sweep oscillator 77 to impulse-excite its circuit to maintain its frequency interlocked with that of oscillator 40 at the transmitter. The phase of the scanning signal of the impulse-excited interlocked oscillator 77 is adjusted by well known phase shifting means, schematically indicated at 76, to cause the electron beam 66 to pass over predetermined targets 67 in synchronization with the corresponding transmitted impulses in order to maintain the code combinations for the printing mechanism. Once the beam 66 is adjusted in proper phase relation with the transmitted impulses, the electronic distributor according to my invention will continue to be in synchronism with the transmitter and operate to selectively print the letters or symbols according to the coded punchings in the perforated tape 28 passing the screen 20.

The synchronizing impulse is also used as a "printing impulse" at the receiver to actuate the automatic printing telegraphy mechanism. The "printing impulse" corresponds to the position and electrical action of target 67b. Accordingly, an impulse will be impressed through target 67b upon the amplifier 69b to actuate a "printing impulse" relay 70b. The printer relay 70b may be employed to directly print the character selected by the other five relays 70, or may function to transfer the code group set up to another group of magnets or selectors provided in a manner well known in the art. The relays 70 will thereafter be automatically reset in readiness for the next code group transmitted.

The scanning frequency in cycles per second is equal to the rate of transmission of code groups per second. There is no inertia, mechanical wear, sparking or dust troubles with the electronic distributor of my invention. A greatly increased speed of operation is possible with this system as compared to existing printing telegraphy systems employing mechanical distributors.

I claim:

1. In a signalling system operable with a tape perforated in accordance with coded combinations of characters to be transmitted: electronic means for generating a transversely oscillating spot of light across said tape comprising an electron beam generator, means for deflecting said beam, a sweep oscillator connected to said deflecting means for oscillating said beam in a predetermined manner, and a fluorescent screen located in the path of said beam for producing a spot of light moving in accordance with said beam; means for moving said tape step by step past said spot of light for producing impulses of light corresponding to the perforations of the tape including means actuated by said sweep oscillator for advancing said tape once per code group during each cycle of said oscillator; means for transmitting signals in accordance with said light impulses and for transmitting a cyclic synchronizing signal impulse for each oscillation of said beam across said tape; and means for receiving and distributing said signals comprising an

electronic distributor having a corresponding electron beam oscillated in the predetermined manner of the transmitter beam.

2. In a signalling system operable with a perforated tape: electronic means for generating a transversely oscillating spot of light across said tape comprising an electron beam generator, means for deflecting said beam, a sweep oscillator connected to said deflecting means for oscillating said beam in a predetermined manner, and a fluorescent screen located in the path of said beam for producing a spot of light moving in accordance with said beam; means for moving said tape step by step past said spot of light for producing impulses of light corresponding to the perforations of the tape including means actuated by said sweep oscillator for advancing said tape once per code group during each cycle of said oscillator; means for transmitting signals in accordance with said light impulses comprising a photoelectric cell and means for focusing said light impulses upon said cell, and means for transmitting a cyclic synchronizing signal impulse for each oscillation of said beam across said tape; means for receiving and distributing said signals comprising an electronic distributor having means for generating an electron beam, means for oscillating the receiver beam in a linear path including a second sweep oscillator; and means for synchronizing the output of said second sweep oscillator with the transmitter oscillator.

3. In a signalling system operable with a perforated tape: electronic means for generating a transversely oscillating spot of light comprising an electron beam generator, means for deflecting said beam, a linear sweep oscillator connected to said deflecting means for oscillating said beam in a predetermined manner, and a fluorescent screen located in the path of said beam for producing a spot of light moving in accordance with said beam; means for moving said tape past said spot of light for producing impulses of light corresponding to the perforations of the tape including an electromagnetic stepping mechanism actuated by said linear sweep oscillator for advancing said tape once per code group during each cycle of said oscillator; means for transmitting signals in accordance with said light impulses comprising a photoelectric cell and means for focusing said light impulses upon said cell, and means for transmitting a cyclic synchronizing signal impulse for each oscillation of said beam across said tape; means for receiving and distributing said signals comprising an electronic distributor having means for generating an electron beam, means for oscillating the receiver beam in a linear path including a linear sweep oscillator, and a plurality of target electrodes linearly spaced in the path of said receiver beam; and means for synchronizing the output of the receiver linear sweep oscillator comprising a pulse amplifier connected to one of said targets, the output of said amplifier being interconnected with said receiver oscillator to impulse excite and control its frequency.

4. In a signalling system operable with a perforated tape: means for generating a transversely oscillating spot of light comprising an electron beam generator, means for deflecting said beam, a linear sweep oscillator connected to said deflecting means for oscillating said beam in a predetermined manner, and a fluorescent screen located in the path of said beam for producing a spot of light moving in accordance with said

beam; means for moving said tape past said spot of light for producing impulses of light corresponding to the perforations of the tape including an electromagnetic stepping mechanism actuated by said linear sweep oscillator for advancing said tape once per code group during each cycle of said oscillator; means for transmitting signals in accordance with said light impulses comprising a photoelectric cell and means for focusing said light impulses upon said cell, and means for transmitting a cyclic synchronizing signal impulse for each oscillation of said beam across said tape; means for receiving and distributing said signals comprising an electronic distributor having means for generating an electron beam, means for oscillating the receiver beam in a linear path including a linear sweep oscillator, and a plurality of target electrodes linearly spaced in the path of said receiver beam, and means for impinging said receiver beam upon said targets in response to the received signal impulses comprising a pair of deflecting plates controlled by said received signals; means for synchronizing the output of the receiver linear sweep oscillator comprising a pulse amplifier connected to an end one of said targets, the output of said amplifier being interconnected with said receiver oscillator to impulse-excite and control its frequency, and means for controlling the electrical phase of said receiver oscillator output, whereby said receiver beam is impinged upon said targets in a predetermined synchronous relation with the transmitted signals; and means for translating the received signals.

5. In a signalling system operable with a perforated tape: means for generating a transversely oscillating spot of light comprising an electron beam generator, means for deflecting said beam, a linear sweep oscillator connected to said deflecting means for oscillating said beam in a predetermined manner, and a fluorescent screen located in the path of said beam for producing a spot of light moving in accordance with said beam; means for moving said tape past said spot of light for producing impulses of light corresponding to the perforations of the tape including an electromagnetic stepping mechanism actuated by said linear sweep oscillator for advancing said tape once per code group during each cycle of said oscillator; means for transmitting signals in accordance with said light impulses comprising a photo-electric cell and means for focusing said light impulses upon said cell, and means for transmitting a cyclic synchronizing signal impulse for each oscillation of said beam across said tape; means for receiving and distributing said signals comprising an electronic distributor having means for generating an electron beam, means for oscillating the receiver beam in a linear path including a linear sweep oscillator, and a plurality of target electrodes linearly spaced in the path of said receiver beam, and means for impinging said receiver beam upon said targets in response to the received signal impulses comprising a pair of deflecting plates controlled by said received signals; means for synchronizing the output of the receiver linear sweep oscillator comprising a pulse amplifier connected to an end one of said targets, the output of said amplifier being interconnected with said receiver oscillator to impulse excite and control its frequency, and means for controlling the electrical phase of said receiver oscillator output, whereby said receiver beam is impinged upon said targets in a predetermined synchronous relation with the

transmitted signals; and means for translating the received signals comprising an amplifier unit individual to and controlled by each of said targets, relay means connected to said amplifier units for selecting characters corresponding to the transmitted characters.

6. In a signalling system operable with a perforated tape: means for generating a transversely oscillating spot of light comprising an electron beam generator, means for deflecting said beam, a linear sweep oscillator connected to said deflecting means for oscillating said beam in a predetermined manner, and a fluorescent screen located in the path of said beam for producing a spot of light moving in accordance with said beam; means for moving said tape past said spot of light for producing impulses of light corresponding to the perforations of the tape including an electromagnetic stepping mechanism actuated by said linear sweep oscillator for advancing said tape once per code group during each cycle of said oscillator; means for transmitting signals in accordance with said light impulses comprising a photo-electric cell and means for focusing said light impulses upon said cell, and means for transmitting a cyclic synchronizing signal impulse for each oscillation of said beam across said tape; means for receiving and distributing said signals comprising an electronic distributor having means for generating an electron beam, means for oscillating the receiver beam in a linear path including a linear sweep oscillator, and a plurality of target electrodes linearly spaced in the path of said receiver beam, and means for impinging said receiver beam upon said targets in response to the received signal impulses comprising a pair of deflecting plates controlled by said received signals; means for synchronizing the output of the receiver linear sweep oscillator comprising a pulse amplifier connected to an end one of said targets, the output of said amplifier being interconnected with said receiver oscillator to impulse excite and control its frequency, and means for controlling the electrical phase of said receiver oscillator output, whereby said receiver beam is impinged upon said targets in a predetermined synchronous relation with the transmitted signals; and means for translating the received signals comprising an amplifier unit individual to and controlled by each of said targets, and relay means connected to said amplifier units for selecting characters corresponding to the transmitted characters, one of said relay means being controlled by said one target to provide a cyclic printing impulse for said translating means, said relay means being individually responsive to impulses generated as said receiver beam impinges upon said targets.

7. In a signalling system, operable with a tape perforated in accordance with coded combinations of characters to be transmitted: means for generating a transversely oscillating spot of light; means for moving said tape past said spot of light for producing impulses of light corresponding to the perforations of the tape; means for transmitting signals in accordance with said light impulses and means for transmitting a cyclic synchronizing signal impulse for each oscillation of said beam across said tape; means for receiving and distributing said signals comprising an electronic distributor having means for generating an electron beam, means for oscillating the receiver beam in a linear path including a linear sweep oscillator and a plurality of target electrodes linearly spaced in the path of said

receiver beam, and means for impinging said receiver beam upon said targets in response to the received signal impulses comprising a pair of deflecting plates controlled by said received signals; and means for synchronizing the output of the receiver linear sweep oscillator comprising a pulse amplifier connected to one of said targets, the output of said amplifier being interconnected with said oscillator to impulse excite and control its frequency.

8. In a signalling system operable with a tape perforated in accordance with coded combinations of characters to be transmitted: means for generating a transversely oscillating spot of light; means for moving said tape past said spot of light for producing impulses of light corresponding to the perforations of the tape; means for transmitting signals in accordance with said light impulses and means for transmitting a cyclic synchronizing signal impulse for each oscillation of said beam across said tape; means for receiving and distributing said signals comprising an electronic distributor having means for generating an electron beam, means for oscillating the receiver beam in a linear path including a linear sweep oscillator and a plurality of target electrodes linearly spaced in the path of said receiver beam, and means for impinging said receiver beam upon said targets in response to the received signal impulses comprising a pair of deflecting plates controlled by said received signals; and means for synchronizing the output of the receiver linear sweep oscillator comprising a pulse amplifier connected to an end one of said targets, the output of said amplifier being interconnected with said receiver oscillator to impulse excite and control its frequency, and means for controlling the electrical phase of said receiver oscillator output, whereby said receiver beam is impinged upon said targets in a predetermined synchronous relation with the transmitted signals; and means for translating the received signals comprising an amplifier unit

individual to and controlled by each of said targets.

9. In a signalling system operable with a tape perforated in accordance with coded combinations of characters to be transmitted: means for generating a transversely oscillating spot of light; means for moving said tape past said spot of light for producing impulses of light corresponding to the perforations of the tape; means for transmitting signals in accordance with said light impulses and means for transmitting a cyclic synchronizing signal impulse for each oscillation of said beam across said tape; means for receiving and distributing said signals comprising an electronic distributor having means for generating an electron beam, means for oscillating the receiver beam in a linear path including a linear sweep oscillator and a plurality of target electrodes linearly spaced in the path of said receiver beam, and means for impinging said receiver beam upon said targets in response to the received signal impulses comprising a pair of deflecting plates controlled by said received signals; means for synchronizing the output of the receiver linear sweep oscillator comprising a pulse amplifier connected to an end one of said targets, the output of said amplifier being interconnected with said receiver oscillator to impulse excite and control its frequency, and means for controlling the electrical phase of said receiver oscillator output, whereby said receiver beam is impinged upon said targets in a predetermined synchronous relation with the transmitted signals; and means for translating the received signals comprising an amplifier unit individual to and controlled by each of said targets, and relay means connected to said amplifier units, one of said relay means being controlled by said one target to provide a cyclic printing impulse for said translating means, said relay means being individually responsive to impulses generated as said receiver beam impinges upon said targets.

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